Oct. 8, 1946. F. A. GUTH 2,409,037

DOOR CONSTRUCTION

Filed Sept. 4, 1944 4 Sheets-Sheet 1

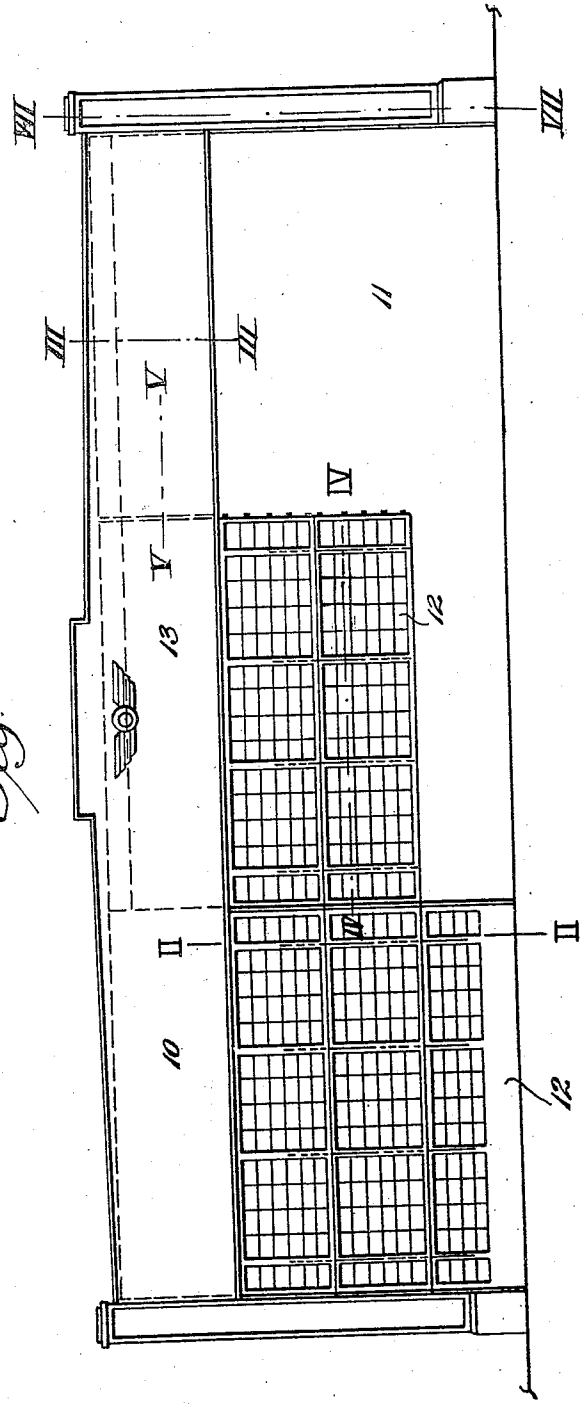


Fig. 1.

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Fig. 2.

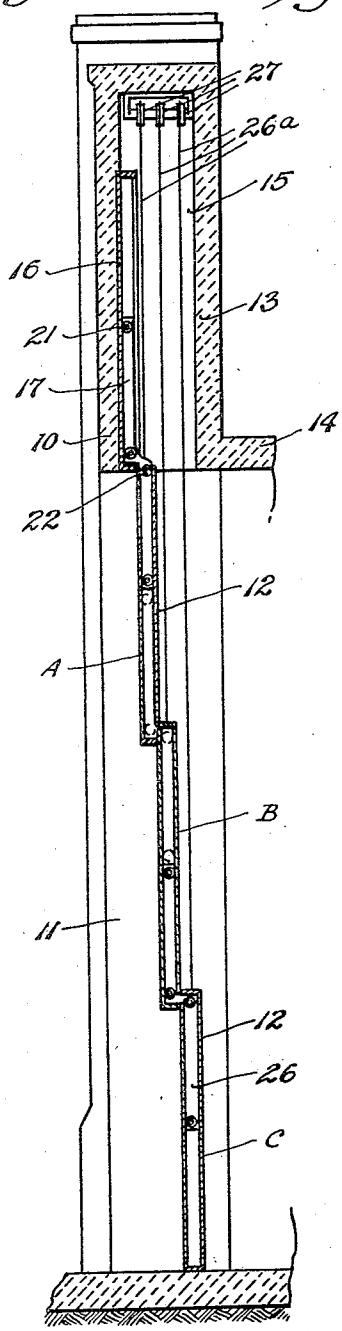
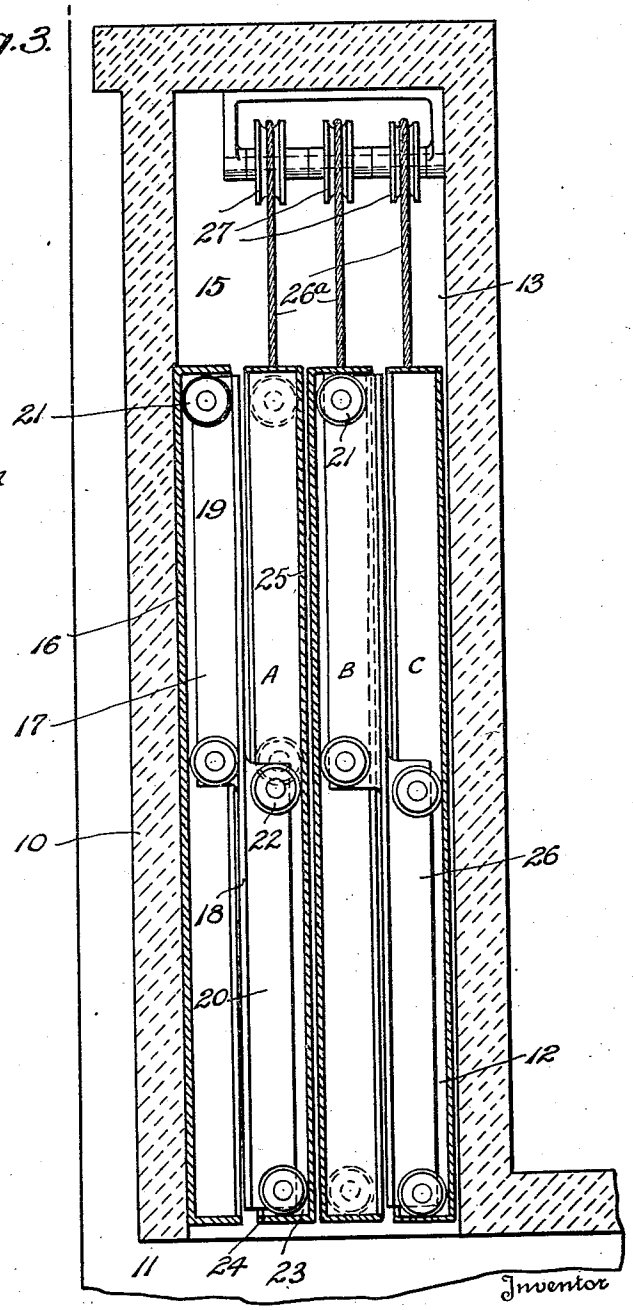


Fig. 3.



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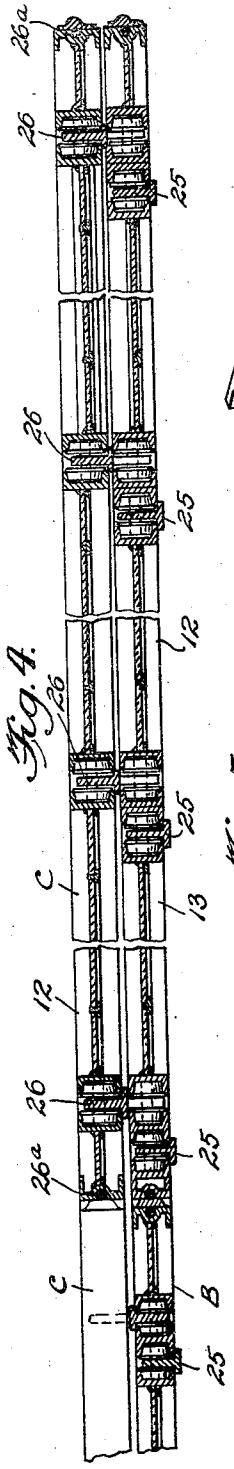


Fig. 4.

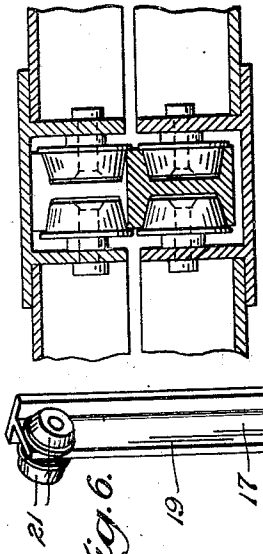


Fig. 6.

Fig. 9.

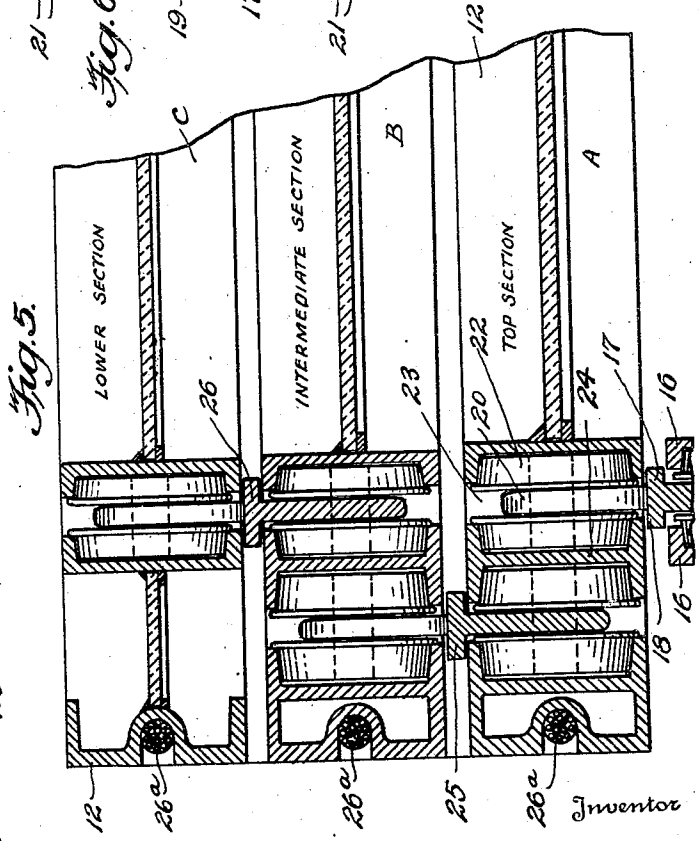


Fig. 5.

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Fig. 8.

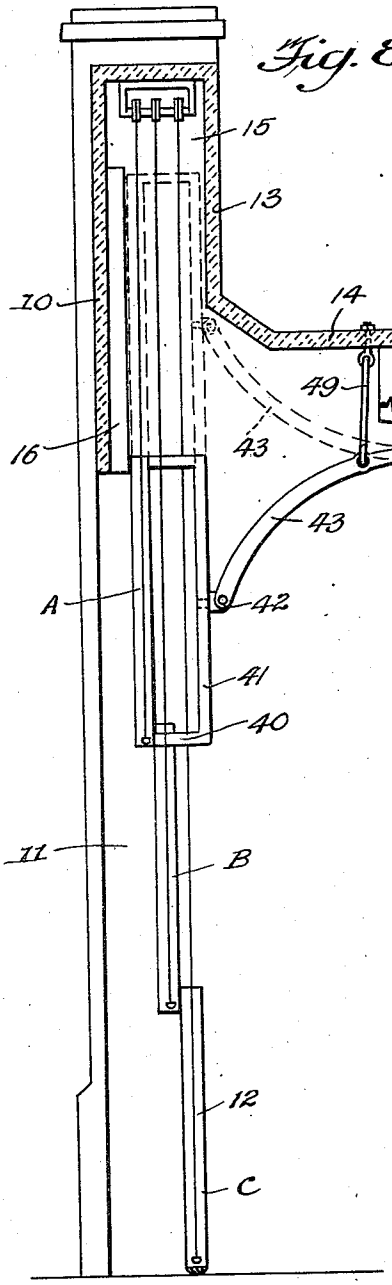
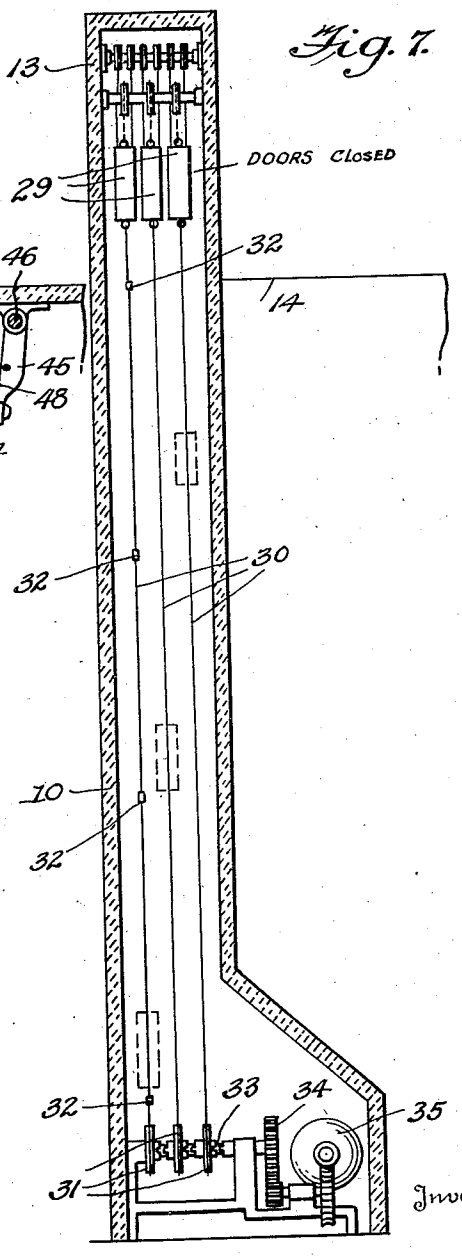


Fig. 7.



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UNITED STATES PATENT OFFICE

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DOOR CONSTRUCTION

Frederick A. Guth, Denver, Ohio

Application September 4, 1944, Serial No. 552,590

10 Claims. (Cl. 160—33)

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This invention relates to doors and mechanism for mounting and operating the same and, with reference to its more specific aspects, is concerned with doors of the multiple sectional type employed for opening and closing the doorways of airplane hangars and other industrial buildings.

In buildings used as airplane factories or hangars, doorways of unusual height and span are needed in affording unobstructed passage of airplanes of various proportions therethrough. Such doorways are necessarily devoid of vertical columns between the sides thereof which might be employed as guides for slidably movable doors, since the use of such columns would diminish the effective width of the door opening. In such constructions, architects and door designers face the problem of providing sectional doors which may be independently opened or closed as needed to admit of the passage of airplanes differing widely in wing span, and at the same time to guide and brace said doors, without using intermediate vertical columns in effecting their controlled opening and closing movements, and in holding the same relatively in stabilized positions of closure so as to resist the effects of wind pressures, or other laterally directed forces of a sway-producing nature.

Accordingly, it is an object of the present invention to provide a multiple section slidable door construction, suitable for door openings of wide span, wherein the sliding door sections are interunited through the provision of floating bar members, one of the latter being received within registering guide channels provided in each pair of complemental door sections, said bar members serving to unite the door sections in firm and substantial relationship but to permit said door sections to slide relatively to each other during doorway opening and closing movement thereof, eliminating the necessity of employing vertical door jambs or columns in obtaining guided movement and bracing of the door sections.

It is another object of the invention to provide a building having a wall structure provided with an open doorway uninterrupted by vertical members between the side jambs thereof, the said wall structure above the doorway being formed with a door-receiving chamber, the doorway being opened and closed by means of a plurality of vertically slidable relatively movable door sections of rectangular formation, the said door sections being cable suspended for independent and joint vertical movement and united in their proper relative order solely by means of a plurality of slidable bar members, each of said bar members engaging two of said door sections and retained in vertically aligned receiving channels provided therefor in the door sections.

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A further object of the invention is to provide a hangar door construction of the character set forth and wherein, in one form of my invention, the door sections when in position of doorway closure are reenforced and strengthened by means of an improved brace construction joined with the roof or ceiling of the associated building and with the upper of the sliding door sections.

For a further understanding of the invention, reference is to be had to the following description and the accompanying drawings, wherein:

Fig. 1 is a front elevational view of a building employed as an airplane hangar or the like and disclosing the doorway thereof provided with my improved sliding and self-bracing multiple door construction;

Fig. 2 is a vertical sectional view taken on the plane indicated by the line II—II of Fig. 1;

Fig. 3 is a similar view on the plane indicated by the line III—III of Fig. 1;

Fig. 4 is a horizontal sectional view taken through the door structure on the plane indicated by the line IV—IV of Fig. 1;

Fig. 5 is a similar view on the plane indicated by the line V—V of Fig. 1;

Fig. 6 is a detail perspective view of one of the roller bar members;

Fig. 7 is a vertical sectional view on the line VII—VII of Fig. 1 and disclosing the cable-operating means provided for the raising and lowering of the door sections;

Fig. 8 is a vertical sectional view disclosing a modified form of my improved door construction, wherein the upper door sections are provided with roof braces;

Fig. 9 is a detail horizontal sectional view disclosing a modified form of the floating bar member in which the rollers are carried by the flanges of the guide channels.

Referring more particularly to the drawings, the numeral 10 designates the front wall of an industrial building, such as an airplane hangar or factory. The wall is provided with a door opening 11, which extends across substantially the full width of the building and is of any appropriate height, the walls of the building being designed to produce a door span of the character indicated without the employment of intermediate door-supporting and guiding columns.

In accordance with the present invention, this uninterrupted doorway is opened or closed, par-

tially or fully, by a plurality of relatively slidable and vertically movable door sections 12. In a typical installation, these door sections comprise a plurality of vertical tiers, each tier being composed of an upper door section A, an intermediate door section B and a lower door section C and as many tiers of these door sections may be used as is required to completely span the doorway.

Each of these door sections may, to a limited extent, be independently actuated. For example, one or more of the lower door sections, indicated at C, may be raised until it is in horizontal registration with a complemental intermediate door section B, thus providing a door opening of sufficient area to admit of the passage of airplanes of small sizes, and without disturbing the closed position of the balance of the door sections. This is advantageous in connection with heated buildings, where it is desirable to minimize the area of the door opening in order to prevent loss of heat, and also, to provide for rapid operation of the doors in the opening and closing thereof. However, for extremely large airplanes, or in admitting a number of airplanes simultaneously, all the doors may be elevated and overlapped, that is, arranged side by side in the header region 13 of the wall 10.

Since the jambs of the doorway, or other vertical columns, are not used in the support, guidance and bracing of the door sections, for reasons above noted, I employ a novel construction by which the door sections of any one tier are self-bracing and slidably interlocked. Above each vertical tier of door sections, the front wall 10 of the building has formed therein, adjacent to the roof 14, a door-receiving header chamber 15. Secured at the front wall of this chamber are sets of vertically extending channel members 16. Each set of these members receives the upper end of a roller bar 17, each of the latter having the configuration conforming to that disclosed in Fig. 6 of the drawings. In Fig. 6, it will be observed that the roller bar is provided with an intermediate vertically extending flange 18 and with perpendicularly extending, oppositely disposed, upper and lower roller flanges 19 and 20, respectively. The upper flange 19 is received by the channel members 16 and carries vertically spaced sets of flanged rollers 21, which are movably confined within the limits of the channel members 16. Likewise, the roller flange 20 of each roller bar is equipped with flanged rollers 22, the latter being received within complemental and vertically registering guide channels 23 carried by the upper sections A of said doors. The channels 23 are formed by means of spaced opposed channel members 24 formed vertically and rigidly in the frame structures of each of the upper door sections.

Each of the roller bars 17 possesses a length substantially approximately that of either of the channel members 16 and 24, so that when the door sections occupy their positions of doorway closure, the upper half of each roller bar 17 will occupy the lower part of the associated channel member 16 and the upper part of the associated channels 23. When the door sections are lowered, the rollers on the bars 17 engage the lower ends of the channel members 16 and the upper ends of the channel members 24 to limit the descent of the upper door sections.

Likewise, the door sections A, B and C are united by means of roller bars 25 and 26, respectively. These bars correspond in construction and function to the roller bars 17 of the header

chamber, whereby to facilitate raising and lowering movement of said sections and yet to hold the same in firmly united and rigidly braced relationship in all their operating positions.

Any suitable mechanism may be employed for raising and lowering the individual door sections. As shown, however, this may be accomplished by means of flexible cables 26a which have their ends connected with the upper edges of said door sections, and extend upwardly, passing over sheaves 27 disposed in the header chamber 15. After passing over the sheaves 27, the cables are directed downwardly and have their other ends connected with counterbalancing weights 29. The lower ends of these weights are connected with chains 30, the latter extending downwardly in chambers provided in the side jambs of the doorway, and are trained over motor driven sprocket elements 31. These sprocket elements are selectively rotated in any suitable manner to, first, effect the raising of one or more of the lower door sections C. When the lower door section has been raised until it is immediately behind and in registration with the intermediate door section or sections, the cable mechanism is actuated to simultaneously elevate both the lower and intermediate door sections until they are located behind and in registration with the upper door section or sections A. At this time, all three sections are simultaneously elevated until the door sections substantially occupy the chamber 15, thus providing for the maximum area of door opening.

The chains 30 may be provided at intervals with control buttons 32, used for automatically clutching and declutching the sprocket elements 31 with a shaft 33 driven through speed-reducing gearing 34 by an electric motor 35. The counterweights approximately balance the weight of the door sections so that the working load on the motor 35 is quite light.

It will be noted that during the door raising operation, the door sections are guided for confined movement in vertical planes and through the provision of floating roller bars, such vertical planes are positively maintained without lateral movement or horizontal sway on the part of said door sections. The doors thus provide their own internal guiding and bracing mechanism and avoid the necessity, heretofore present, of employing doors of great width and heavy weight in providing maximum door span. Each of the door sections possesses dimensions and weight enabling it to be readily handled by the raising and lowering mechanism, and since each door section possesses comparatively small height and width dimensions, it is unnecessary to open a large portion of the doorway, as heretofore, when but a small doorway is needed.

It is within the scope of the invention to provide internal bracing for the door sections desired. For instance, as disclosed in Fig. 8, the upper door section A is provided with a rearwardly extending frame 40 having a vertical member 41 which will be arranged at the rear of the lower door section C when the latter is elevated into horizontal registration with the section A. Attached to the member 41 is a universal joint construction 42 with which construction there is also united the lower end of a rotating brace 43. This brace is curved and has its upper end united by means of the universal joint 44 with a crank arm 45 carried by a rock shaft 46. Connected with one or more of the crank arms 45 is a contractile spring or springs 47 which

forces the door sections forwardly and normally maintains the crank arm 45 in engagement with a fixed stop 48. In addition, each of the braces 43 may be supported by a swinging link 49. It will be seen that when the door section A is elevated, the link 49 will cause the brace 43 to make a one-half turn about its universal connections 42 and 44, in order that the brace will occupy but a minimum of head room when the doors are in their elevated positions. Other types of braces, of course, may be employed.

Likewise, various types of doors may be used, such as those which fold horizontally when the same reach the extreme upward positions of movement, or the door sections may be folded flatly against the side jambs of the doorway. In all of these conditions, however, the floating roller bars are utilized in providing guided movement between the door sections. In Fig. 9, a modification has been disclosed in which the roller elements are carried by the door channels, rather than by the floating bar members. It is obvious that other variations and modifications may be made in the construction without departing from the underlying principles of the invention or the scope of the annexed claims.

I claim:

1. Door construction comprising a plurality of relatively slidable rigid door sections effective when in extended positions to close an associated doorway and to occupy relatively overlapping positions of marginal registration when positioned to open said doorway, means for supporting and moving said door sections between positions of doorway opening and closure, each pair of said door sections being formed with registering channels, and a rigid bar member movably occupying said channels and confined for longitudinal movement therein, said bar members serving to unite the door sections associated therewith for guided relative movement.

2. Door construction comprising a plurality of relatively slidable rigid door sections effective when in relatively extended positions to close an associated doorway and to occupy relatively overlapping positions of marginal registration when moved to positions not obstructing said doorway, means for individually supporting and moving said door sections between positions of doorway opening and closure, each adjacent pair of said door sections being formed with registering channels, a rigid bar member movably occupying said channels and confined for longitudinal movement therein, said bar member serving to unite the door sections associated therewith against relative lateral displacement and to provide for guided sliding movement therebetween, antifriction means for facilitating relative movement between said door sections and bar member.

3. Door construction as specified in claim 2 and wherein said antifriction means comprises rollers carried by said bar member and mounted for rotation in the channels of said door sections.

4. Door construction as specified in claim 2 and wherein said antifriction means embodies rollers carried by said door sections and disposed in grooves provided in opposite faces of said bar member.

5. Door construction comprising a plurality of rigid door sections supported in a doorway for movement in vertical planes and disposed in relatively offset relationship with respect to each other, building-carried cable means connected with each of said door sections for moving the same vertically between positions of doorway opening and closure, said sections when positioned to open said doorway being disposed in registering order with one section behind the other, each adjacent pair of said door sections being formed with registering channels, and rigid bar members movably occupying the channels of each adjoining pair of door sections for confined longitudinal movement therein, said bar member serving to unite the door sections associated therewith against relative lateral displacement and provide for their guided sliding movement.

6. Building construction comprising a wall formed with a doorway, a plurality of relatively and vertically movable rigid door sections disposed in laterally offset relation with respect to each other and arranged in said doorway, means for moving said door sections vertically to open and close said doorway, each adjacent pair of said door sections being formed with registering vertically disposed complemental guide channels, a rigid bar member positioned in each pair of channels, said bar member being offset intermediately of its length to correspond with the offset relationship of the door sections associated therewith, and antifriction means cooperative with said bar members for facilitating relative movement between the same and the associated door sections.

7. In building construction, a wall formed with a doorway and a header chamber provided in the wall above the doorway, a plurality of vertically movable door sections effective when in extended positions to close said doorway and when in retracted positions to nest in said chamber in horizontally registering relatively offset order, cable means carried by said wall for raising and lowering said door sections, said door sections being provided with vertical edge channels at the respective lateral edges thereof, a guide member stationarily positioned in said chamber and formed with a channel aligned for registration with an edge channel of an upper door section, a bar member movably positioned in the channel of said guide member and the complemental channel of the upper door section, and corresponding bar members movably positioned in the channels of each contiguous pair of door sections.

8. In building construction, a wall having a doorway, a plurality of rigid door sections positioned in vertical planes in said doorway and movable to open and close said doorway, said sections being disposed in relatively offset relationship with respect to each other, building-carried cable and pulley means connected with each of said door sections, the cables running over pulleys above said doorway for moving said sections vertically between positions of doorway opening and closure, said sections when positioned to open said doorway being disposed above the latter and in horizontally registering order with one section behind the other, guide members mounted on the inner edge surface of said wall above said doorway, said guide members being formed with vertical channels, each of said door sections being formed with complemental vertical channels, a rigid bar member movably positioned in the channel of each of said guide members and in the associated channel of the adjacent upper door section, and additional bar members positioned in the channels of each adjoining pair of said door sections, said bar members serving to unite the door sections with each other and with the wall-carried guide members

to provide for guided vertical movement of said door sections between doorway opening and closing positions.

9. Building construction comprising a wall formed with a doorway having an unobstructed span, vertically movable lower, intermediate and upper door sections for opening and closing said doorway, said door sections being disposed in relatively offset relationship with respect to each other, building-carried cable means connected with each of said door sections for controlling their vertical movement and operative to raise the lower section to the plane of the intermediate section, to then raise the lower and intermediate section simultaneously to the plane of the upper door section and thereafter upon continuous operation to elevate simultaneously the three door sections to a horizontal plane above said doorway, said door sections being formed with vertically disposed edge channels, and rigid bar members movably occupying the channels of each adjoining pair of door sections for confined longitudinal movement therein, said bar members serving to unite the door sections associated therewith against relative lateral displacement and to provide for their guided raising and lowering movement independently of the jambs of said doorway.

10. Building construction comprising a wall formed with a doorway having an unobstructed span, vertically movable lower, intermediate and upper door sections for opening and closing said doorway, said door sections being disposed in relatively offset relationship with respect to each other, building-carried cable means connected with each of said door sections for controlling their vertical movement and operative to raise the lower section to the plane of the intermediate section, to then raise the lower and intermediate section simultaneously to the plane of the upper door section and thereafter upon continuous operation to elevate simultaneously the three door sections to a horizontal plane above said doorway, said door sections being formed with vertically disposed edge channels, rigid bar members movably occupying the channels of each adjoining pair of door sections for confined longitudinal movement therein, said bar members serving to unite the door sections associated therewith against relative lateral displacement and to provide for their guided raising and lowering movement independently of the jambs of said doorway, and building-carried brace means connected to the upper of said door sections.

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