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FRAME STRUCTURE

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2 Sheets-Sheet 1

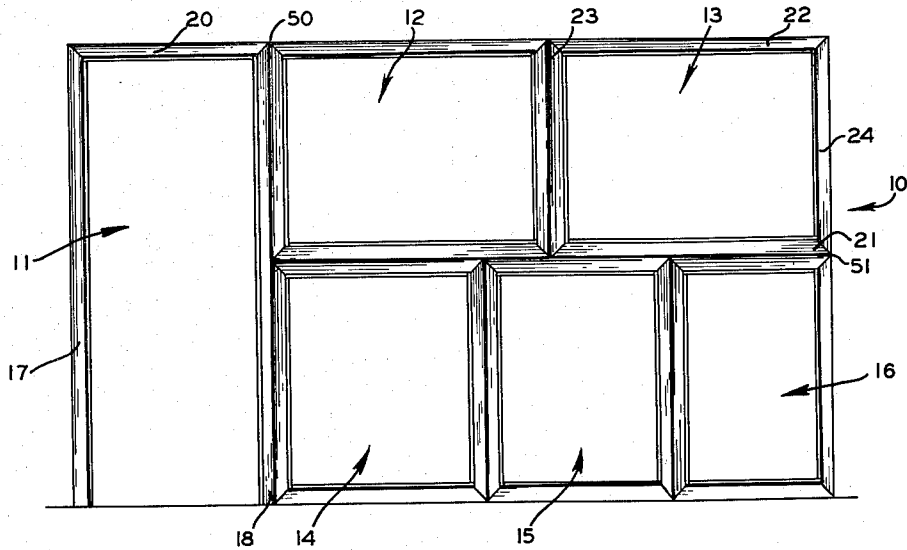


Fig. 1.

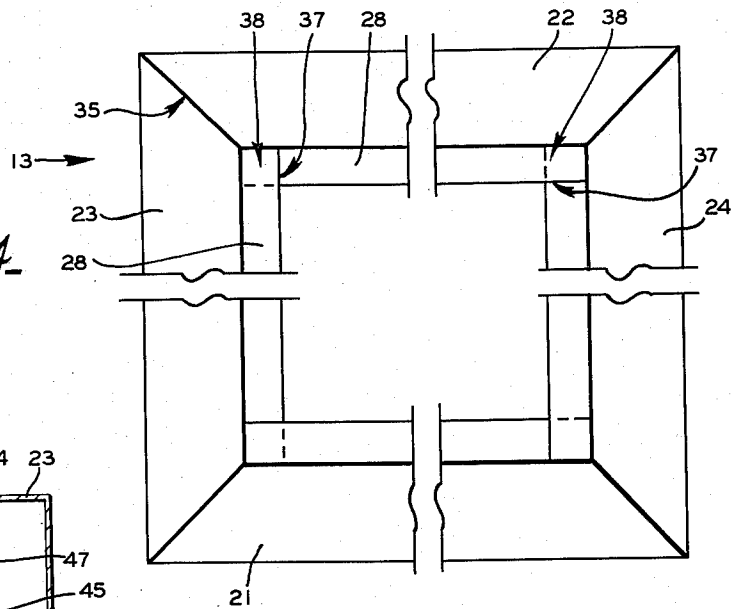


Fig. 4.

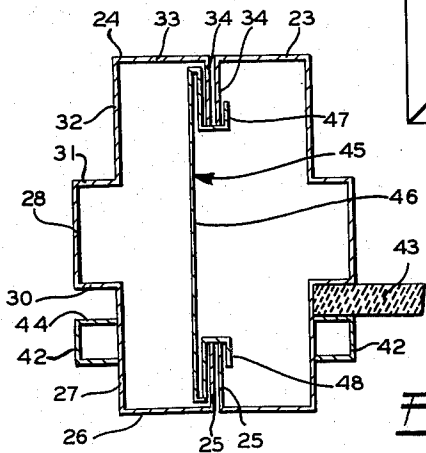


Fig. 3.

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2,990,922

FRAME STRUCTURE

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The present invention relates generally to metallic frames for doors, windows, and the like and more particularly to interchangeable frame sections enabling assembly of custom frames for doors and windows from a minimum of standard length components.

Hollow metallic frames are used extensively for enclosing doors, windows, etc., in the construction of institutional, commercial, industrial and other buildings. Each particular building utilizes not only a different arrangement but in a number of instances different sizes of doors and windows in order to satisfy the special requirements of the architect involved. Standard metallic sections or pieces from which these frames are assembled have been available heretofore in very limited ranges only, and such generally was the exception rather than the rule.

Consequently, it has been necessary in the past, if variety of composition were desired, to specifically design and fabricate each section, each sub-assembly and each assembly. For example, the present method of handling the design and fabrication of custom built hollow metal frames involves at least the following steps. After completion, the building plans, including information relating to the hollow metal frame requirements, are sent to a manufacturer of such hollow metal products. The frame manufacturer prepares "shop drawings" in keeping with the requirements of the building designer. These drawings are submitted to the designer for checking and approval. After approval, the "shop drawings" are returned to the frame manufacturer who utilizes them in preparing more complete "factory drawings" illustrating details including the shape and design of each section, each sub-assembly, and each assembly. From these "factory drawings" the frame assemblies are fabricated and delivered in completed form. It will be evident that a considerable amount of time, labor and expense is involved in custom fabrication such as that described above.

One of the objects of this invention is to provide a frame structure and method of assembly not having the aforesaid disadvantages of known constructions.

Another object of the present invention is to provide a frame section which may be joined or interchanged with a frame section of like construction, regardless of length.

A further object of this invention is to provide a hollow metallic frame section which simplifies the joining of door and window frame sub-assemblies with other door and window frame sub-assemblies of the same or different lengths.

Still another object of the present invention is to provide directly interlocking and interchangeable frame sections which will permit an inventory of standard length sections in a variety of standard widths for fabrication into standard sub-assemblies.

Another object of this invention is to provide a novel method of and apparatus for locking and sealing adjacent frame sub-assemblies.

Still another object of the present invention is to provide novel frame sections for the fabrication of sub-assemblies having greater strength and rigidity than heretofore possible.

A further object of this invention is to provide frame sections requiring very little time and labor for fabrication into hollow metal door and window frame constructions.

Still another object of the present invention is to pro-

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vide door and window frame sub-assemblies which are easy to assemble from economically manufactured frame sections of uncomplicated design.

In accordance with this invention, a single hollow metal frame piece or section having a generally channel-shaped cross-section with a door or window stop formed integral with one face thereof is provided with one male and one female end. In other words, the integral stop on each frame section is rabbeted at one end to receive the unrabbeted end of a complementary section and unrabbeted at the opposite end to interlock with the rabbeted end of still another frame section, thereby forming a frame sub-assembly. Moreover, if it is desired to join adjacent sub-assemblies, this invention contemplates the sealing and locking of legs on adjoining sub-assemblies in one operation, and where removable stops are utilized for securing window pieces in position, it is preferred that these stops be rabbeted in the same manner as the integral stops, but reversed longitudinally in the final assembly to provide added strength and rigidity. It is also preferred that each frame section include a projecting tab at one end and an interlocking slot at the opposite end in order to facilitate alignment and temporary placement of sections constituting a frame sub-assembly.

Other objects and advantages of this invention will become apparent to those skilled in this art upon study of the following detailed disclosure taken in conjunction with the accompanying drawings, wherein:

FIGURE 1 is a front elevational view illustrating an assortment of door and window frame sub-assemblies forming one compound or composite frame assembly fabricated from hollow metal sections of the type herein under consideration;

FIGURE 2 is an enlarged view illustrating in detail a portion of the joints appearing in the assembly of FIGURE 1;

FIGURE 3 is a sectional view, taken along the lines 3-3 of FIGURE 2, showing the manner in which two abutting sub-assemblies may be joined together, and also illustrating removable stops for securing a window pane or other rigid material in position;

FIGURE 4 is an enlarged elevational view of the joints necessary for fabricating a frame sub-assembly from the interchangeable sections forming a part of this invention; and

FIGURE 5 is a plan view, prior to bending, of sheet metal stock cut to the necessary shape for forming a single interchangeable frame piece or section, and showing in dashed lines the edges resulting from bending into final form.

Referring now to FIGURE 1 of the drawings, reference numeral 10 designates generally one compound frame assembly. This assembly 10 is formed from one door sub-assembly 11 and five different window sub-assemblies 12, 13, 14, 15 and 16, all of different lengths. This invention of course is not limited to the specific assembly shown, and a compound assembly could consist of any desired combination of sub-assemblies.

The door sub-assembly 11 is constructed from door jambs 17, 18 and door head 20, and each window sub-assembly is fabricated from one window sill 21, one window head 22, and two window jambs 23, 24. As will be pointed out more specifically hereinafter, the jambs, heads, and sills are of identical construction but, in some instances, of different lengths. Consequently, all of the window jambs, heads and sills for each window sub-assembly will be identified by like reference numerals. In FIGURES 1 and 2, for example, two vertically aligned window jambs 23, 23 abut the door jamb 18. Moreover, one window jamb 23 may abut another jamb 24, and a window sill 21 may abut one or more window heads

22, depending on the size, number and arrangement of sub-assemblies.

As mentioned briefly above, the interchangeability feature of this invention is produced by forming the two ends of each metal section of opposite hand. In other words, each section when formed is provided with one male and one female end. For a more detailed explanation of this, attention is directed to FIGURES 3, 4 and 5. Although the flat elongated sheet stock shown in FIGURE 5 has been given reference numeral 24 to associate the same with one of the window jambs in FIGURES 3 and 4, the following discussion will of course be equally applicable to the other jambs, sills and heads, since all of these sections are constructed in the same manner.

The section 24 may be cut, punched, or otherwise formed from a web of sheet material having sufficient width to provide the generally channel-shaped final construction shown in FIGURE 3, which shape may be obtained in one or more bending operations indicated by dashed lines, as mentioned earlier. Preferably, the trailing end of one section would be punched simultaneously with the leading end of another section in order to reduce the time required for producing a given number of pieces. Each section, such as 24, consists broadly of parallel side panels, a central panel disposed therebetween, and an intermediate panel disposed between the central panel and each side panel. More specifically, the panels may be divided further into a front leg 25, a front flange 26, a front face 27, an integral stop 28 having front and rear sides 30, 31, respectively, a rear face 32, a rear flange 33, and a rear leg 34. (Compare FIGURES 3 and 5, for example.) Each end of each flange 26, 33 terminates in an edge 35 extending at an angle of 45 degrees with the longitudinal axis of the section. Each mitered edge 35 of each section abuts against, or is joined with, a similar edge of a mating section to form the right angle construction necessary for each sub-assembly, as shown in each of FIGURES 1, 2 and 4. Moreover, each diagonal edge 35 terminates in a tip 36 extending outwardly from the ends of legs 25, 34 to permit or facilitate interlocking of adjoining sub-assemblies.

One end of section 24 is recessed or rabbeted, as indicated by numeral 37, so that the integral stop 28 and sides thereof does not extend flush with this end of the section. The opposite end of section 24 is unrabbeted, as indicated by numeral 38, and the portion of this stock which ultimately will form the stop 28 is flush with the remainder thereof at this end. It can be seen from this construction that each metal section is provided with a rabbeted or female end 37 and an unrabbeted or male end 38. The amount of rabbeting at 37 corresponds to the projection of stop 28 from the plane of front and rear faces 27, 32 (see FIGURE 3), or the approximate dimension of a side 30 or 31, and is sufficient to permit insertion therein of the integral stop on another metal section. For example, see FIGURE 4.

One end of each front face 27 and rear face 32 is provided with a projecting interlocking tab 40. This tab cooperates with an interlocking slot 41 formed in the opposite end on a mating section and functions to align and temporarily hold the two adjoining sections in position until more permanent securing means can be provided. It will be seen from FIGURE 5 that each metal section is initially formed not only with male and female ends insofar as concerns the integral stop portion, but similar male and female portions for facilitating fabrication into sub-assemblies. It should be understood that the tabs and slots on the section 24, which of course do not cooperate with each other but with similar slots and tabs, respectively, on other sections, could be formed in any shape desired. Although the tapered tabs 40 shown in FIGURE 5 are more easily inserted into cooperating slots 41, any configuration which expedites initial alignment and securing of two mating sections would suffice.

The sheet stock shown in FIGURE 5 may be bent into

the desired cross-sectional shape by any suitable means. In the shape chosen for illustration of one embodiment of this invention, shown particularly in FIGURE 3, the front and rear faces, or panels, 27, 32 lie in a common plane and the integral stop 28 projects laterally therefrom. The projection of stop 28 is of course equal to the short dimension of the recess 37 since it is the latter opening which must receive the integral stop on an adjoining section, as explained earlier. Front and rear flanges 26, 33 lie in parallel planes extending normal to the planar faces 27, 32, and front and rear legs 25, 34 are substantially planar. Although this cross-sectional shape is preferred because of ease in assembly, other shapes embodying the principles of this invention obviously could be selected.

With attention now directed to FIGURE 4, note that each of the four sections 21, 22, 23, 24 is provided with a rabbeted end 37 and an unrabbeted end 38. Consequently, each section receives the male end of one other section and provides an unrabbeted portion which projects into the rabbeted portion of still another section. For example, the left end of window head or section 22 in this figure is rabbeted at 37 and receives the male end 38 of window jamb or section 23. Moreover, the cooperating end of section 24 is rabbeted at 37 to receive the male portion 38 of section 22. The same construction exists with regard to all four sections, which offers many advantages over the heretofore conventional sections having, for example, two unrabbeted ends on the heads and sills, with both ends of the jambs being rabbeted, or vice versa. For example, it is possible with the present invention to construct a square sub-assembly from four substantially identical sections of equal length, and to construct a rectangular sub-assembly from two different lengths of substantially identical sections.

When the sections described herein are to be used as window frames, it is desirable that a removable stop be provided for securing the glass snugly in position against the integral stop 28. A U-shaped channel member 42 (see FIGURE 3) preferably is used for this purpose, although other cross-sectional shapes would suffice. The glass 43 may be forced or clamped between front side 30 of stop 28 and the internal face 44 of removable stop 42, as shown, and the stop may then be detachably secured to the front face 27 by any known means, such as metal screws (not shown). Any solid and/or meshed sheet material of course could be used in lieu of the glass 43.

The means by which removable stops 42 are staggered with respect to integral stops 28 may be explained best in connection with FIGURE 4. With attention directed to the upper left corner of window sub-assembly 13, note that the integral stop 28 of window head 22 is rabbeted at 37 to receive the male or unrabbeted end 38 of integral stop 28 on jamb 23, as explained earlier. The removable stop 42 corresponding to the horizontal integral stop 28, not visible in this view because it lies on the back side of this sub-assembly 13, is unrabbeted, as indicated by the dotted line extension of this member, and the removable stop which corresponds to the vertical integral stop 28, also not visible, is rabbeted. Although the term "rabbet" has been used to describe the corner joining of removable stops, it of course should be understood that these stops actually are uniformly constructed throughout and are cut to a dimension equal to that of the integral stops, or less than the length of a frame section by an amount equal to the thickness of a cooperating removable stop on another section. When placed in position, an opening therefore remains at one end of the frame section. This opening, however, preferably occurs at the unrabbeted or male end of each section. Consequently, added strength and rigidity result because of the staggered relationship between the rabbeted ends of the integral and removable stops at each joint.

More frequently than not, it is desired that a number

of frame sub-assemblies be joined together somewhat as shown in FIGURE 1. Since this composite assembly is formed from metal components, it is obvious that welding along all joints would provide a very rigid unit. Welding, however, is an expensive operation requiring the time and effort of highly skilled personnel as well as elaborate equipment. Other methods of unitizing the sub-assemblies are preferred, especially when cost is an important factor in the building construction and when an over-abundance of strength is not required. Moreover, even if the sub-assemblies are to be spot-welded subsequently, it is desired that some means be provided for at least maintaining temporary alignment and especially for sealing the joints between sub-assemblies. A very effective method of accomplishing this end will next be described as a part of the present invention.

With attention directed to FIGURE 3, it can be seen that two frame sections 23, 24 have been placed back to back, so to speak, with corresponding front and rear legs 25, 25 and 34, 34 lying in contact. An elongated locking and sealing strip indicated generally at 45 has been provided to lock the aforesaid legs in the position shown. This elongated strip consists of a main web or spanner portion 46 terminating at the lateral edges thereof in U-shaped clamps 47, 48. The transverse width of the strip 45, or the distance between the base of each clamp 47, 48 corresponds to the spacing between the inner edges of front and rear legs 25, 34 on each section in order to prevent relative lateral movement between adjacent sections. The gripping surfaces of the U-shaped clamps may be bent together so as to resiliently urge the adjacent legs 25, 25 and 34, 34 into contact. It is desired that the clamping means be resilient so that this function can be accomplished.

The outside of each joint between sub-assemblies, such as those indicated at 50, 51 in FIGURE 1, is open and accessible upon initial assembly. As mentioned in connection with the discussion of FIGURE 5, tips 36 project longitudinally beyond the ends of legs 25, 34. The reason for having these legs recessed with respect to the tips is to permit installation of locking and sealing strip 45. The legs 25, 34 on section 20, for example, do not extend to the joint 50, and similarly the legs 25, 34 on section 24 do not extend to the joint 51. Consequently, the strips 45 may be inserted at joints 50, 51, for example, and forced longitudinally along the interior of adjoining sections of the adjacent sub-assemblies. The locking and sealing strips 45 may be provided in lengths corresponding to that of the frame sections and removable stops and may be quickly and easily inserted and detached when desired. If necessary, the joints between sub-assemblies of course may be sealed permanently by welding, clips, or other known means.

Summary

In the fabrication of a composite frame assembly such as shown in FIGURE 1, each of the sub-assemblies is first formed by interlocking frame sections of the desired length. The male end of one section is aligned with and joined to the female end of another section through the use of projecting tabs 40 and slots 41. If desired, these tabs may be bent down after insertion in order to hold the sections temporarily together. Also, the aligned mitered edges 35 of adjacent sections may be spot welded or clipped in known manner.

After each sub-assembly has been fabricated, they may be arranged in the desired order and secured by use of the locking and sealing strips mentioned. Thereafter, if necessary or desirable, the joints may be further secured by any of the methods presently available and the doors and/or windows may be placed in position. The removable stops next may be added, in the staggered manner described, and secured in position.

The frame sections, removable stops and sealing strip may be formed from any suitable material, such as metals, alloys, or plastics. The spanner portion 46 of

the locking and sealing strip 45 may be formed as the integral rigid web shown, as a separate piece secured to the clamps, or as a suitable toggle linkage to be clamped into position after insertion.

Moreover, the frame sections, strips and removable stops may be cut to any desired length. It is an important object of this invention, however, to reduce the total number of sections required for fabricating substantially any desired composite frame assembly. This reduction in total pieces required will be accomplished by elimination of the need for both right and left hand frame sections. Inasmuch as the sections described herein interlock one with another regardless of longitudinal dimensions, it is possible to provide customer selection from standard but carefully chosen lengths, and still permit substantially custom frame construction. This is a distinct advantage over the frames presently available.

The cross-sectional shape described herein was chosen for purposes of illustration only and is not to be taken as a limitation. It is not necessary, for example, that the integral stop be rectangular in cross-section or symmetrical with respect to the frame section faces. In the practice of this invention it is necessary for the frame manufacturer to stock only one type section for each desired length and cross-sectional shape.

The term length as used herein is intended to signify that distance between tip 36 on the male end of a section and the corresponding tip 36 on the opposite or female end of that section, as shown in FIGURE 5. Width of a formed section, as used herein, is intended to denote that distance between the outer surfaces of front and rear flanges 26, 33, respectively, while thickness of a formed section is that distance between the external surface of a front face 27 and the external surface of a front leg 25, all as shown in FIGURE 3.

If it is desired that the sills, heads and jambs surrounding a completed assembly be uniform in thickness with the internal sills, heads and jambs thereof, for example to provide a more balanced appearance, filler strips may be added to the assembly. For instance, note in FIGURE 1 that the thickness of head 20 is only half the thickness of the sill on sub-assembly 12 coupled with the head on sub-assembly 14. Filler strips of course also could be used purely for edging a single sub-assembly. The filler strips may be of any desired thickness and cross-sectional shape. Moreover, the aforesaid strips 45 may be used to seal the joint between a filler strip and the adjoining frame section.

Inasmuch as other modifications will become apparent upon study of this disclosure, it is intended that the scope of the present invention be limited only to the extent set forth in the following claims.

What is claimed is:

1. A closed frame sub-assembly formed from four: elongated metal frame sections extending at right angles: one with respect to the other, each frame section having: leading and trailing ends with the leading end of one: frame section being adapted for joining to the trailing end: of the adjacent section, the frame sections being sub-: stantially identical in configuration and at least opposed: pairs being of equal length, each frame section compris-: ing at least one face panel extending longitudinally there-: of, a flange panel secured to said face panel and extend-: ing longitudinally of said section in a plane substantially: normal to the plane of said face panel, means defining a: mitred edge on each end of said flange panel, and an: integral stop projecting laterally from the plane of said: face panel and also extending longitudinally of said frame: section, the leading end of said integral stop being rec-: essed from the corresponding leading end of said face: panel by an amount substantially equal to the projection: thereof from said face panel, the trailing end of said: integral stop being substantially flush with the trailing: end of said face panel, said frame sections being disposed: in a closed path with respective mitred edges on ad-

adjacent frame sections engaging and with the flush end of one integral stop on one frame section projecting into the recessed end of the integral stop on the adjacent frame section, whereby four identical joints are formed at the points of engagement between leading and trailing ends of adjacent frame sections.

2. A closed frame sub-assembly as set forth in claim 1 and further comprising a removable stop secured to each of said face panels in parallel but spaced relationship with respect to and having a length equal to that of the corresponding integral stop, said removable stops having one end recessed and one end flush with respect to said face panel thereby forming interlocking joints, the interlocking joints of said removable stops being reversed with respect to the recessed and flush ends of said integral stops.

3. A composite frame assembly including at least two closed frame sub-assemblies, each of said sub-assemblies being formed from four elongated and channel-shaped metal frame sections extending at right angles one with respect to the other, each frame section having leading and trailing ends with the leading end of one frame section being adapted for joining to the trailing end of the adjacent section, the frame sections of each sub-assembly being substantially identical in configuration and at least opposed pairs of frame sections in each sub-assembly being of equal length, each frame section comprising a face panel extending longitudinally thereof, a flange panel extending longitudinally of said section in a plane substantially normal to the plane of the face panel and secured to said face panel at each side thereof to form a channel, means defining a mitered edge on each end of each flange panel, an integral stop projecting laterally from said face panel and also extending longitudinally of said frame section, the leading end of said integral stop being recessed from the corresponding leading end of said face panel by an amount substantially equal to the projection thereof from said face panel, the trailing end of said integral stop being substantially flush with the trailing end of said face panel, the four frame sections of each sub-assembly being disposed in the closed path with respective mitered edges on adjacent frame sections engaging and with the flush end of one integral stop on one frame section projecting into the recessed end of the adjacent frame section, whereby four identical joints are formed at the points of engagement between leading and trailing ends of adjacent frame sections, at least one open side of the channel-shaped section from one sub-assembly facing an open side of a channel-shaped section on another sub-assembly, and means for quick-detachably securing said sub-assemblies into a composite frame assembly with said open sides juxtaposed one with respect to the other.

4. A composite frame assembly as set forth in claim 3 and further comprising legs extending inwardly from each edge of each of said flange panels, and wherein said quick-detachable securing means comprises opposed U-shaped clamping members of substantially the same length as corresponding frame sections for resiliently urging corresponding legs of adjacent frame sections into contact to seal the joint between adjacent, cooperating legs while simultaneously locking said corresponding legs against relative lateral movement, and a spanner for simultaneously positioning said clamping members over respective pairs of legs.

5. A composite frame assembly as set forth in claim 4 and further comprising means defining a tip projecting

from one extremity of each mitered edge in order to provide an additional recess to facilitate interlocking of adjoining sub-assemblies.

6. A door frame sub-assembly including first, second and third elongated metal frame sections extending at right angles one with respect to the other, each frame section having at least one end adapted for joining to a complementary end on an adjacent frame section and at least said first and third frame sections being of substantially the same length; the first frame section serving as a door jamb and comprising at least one face panel extending longitudinally thereof, a flange panel secured to said face panel and extending longitudinally of said first frame section in a plane substantially normal to the plane of said face panel, means defining a mitered edge at a leading end of said first frame section, and a first integral stop projecting laterally from the plane of said face panel and also extending longitudinally of said first frame section, the leading end of said first integral stop being recessed from the corresponding leading end of said face panel by an amount substantially equal to the projection thereof from said face panel; the second frame section serving as a door header and comprising at least one face panel extending longitudinally thereof, a flange panel secured to said face panel and extending longitudinally of said second frame section in a plane substantially normal to the plane of said face panel, means defining a mitered edge at leading and trailing ends of said second frame section, and a second integral stop projecting laterally from the plane of said face panel and also extending longitudinally of said second frame section, the leading end of said second integral stop being recessed from the corresponding leading end of said face panel by an amount equal to the projection thereof from said face panel, and the trailing end of said second integral stop being flush with the corresponding trailing end of said face panel in order to project into the recessed portion on the leading end of said first frame section; the third frame section also serving as a door jamb and comprising at least one face panel extending longitudinally thereof, a flange panel secured to said face panel and extending longitudinally of said third frame section in a plane substantially normal to the plane of said face panel, means defining a mitered edge at a trailing end of said third frame section, and a third integral stop projecting laterally from the plane of said face panel and also extending longitudinally of said third frame section, the trailing end of said third integral stop being flush with the corresponding trailing end of said face panel in order to project into the recessed portion on the leading end of said second frame section; and means securing said first, second and third frame sections in assembled condition with mitered edges on adjacent frame sections abutting and with the flush ends of the second and third integral stops projected into the recessed ends of the first and second frame sections, respectively.

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