June 24, 1958 P. L. SANDERS ET AL 2,839,792

SLAB DOOR

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Fig. 2

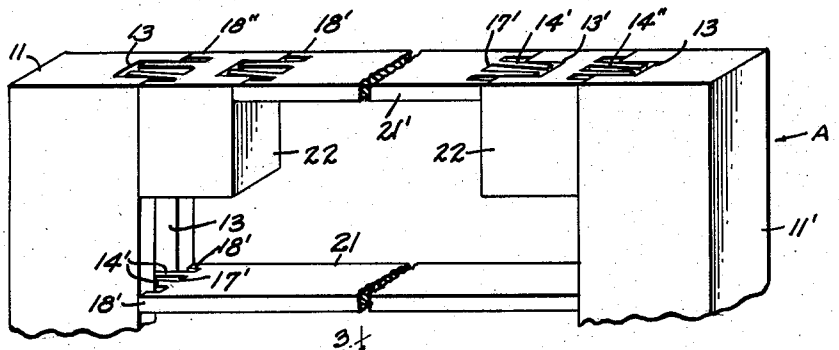


Fig. 1

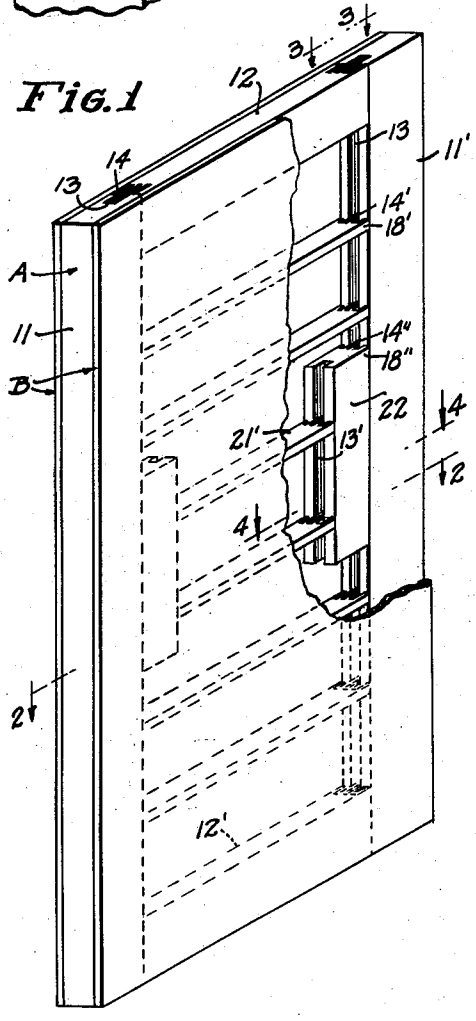
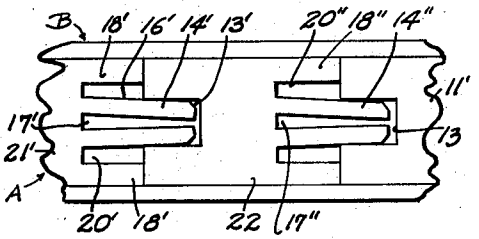


Fig. 4



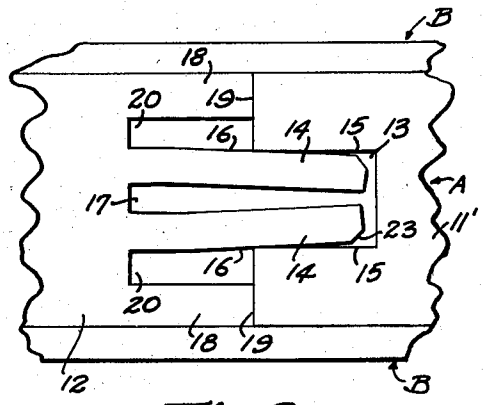


Fig. 3

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SLAB DOOR

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Fig. 5

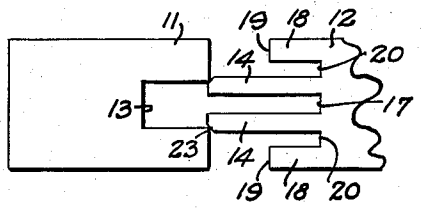
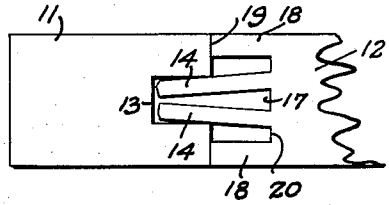


Fig. 6



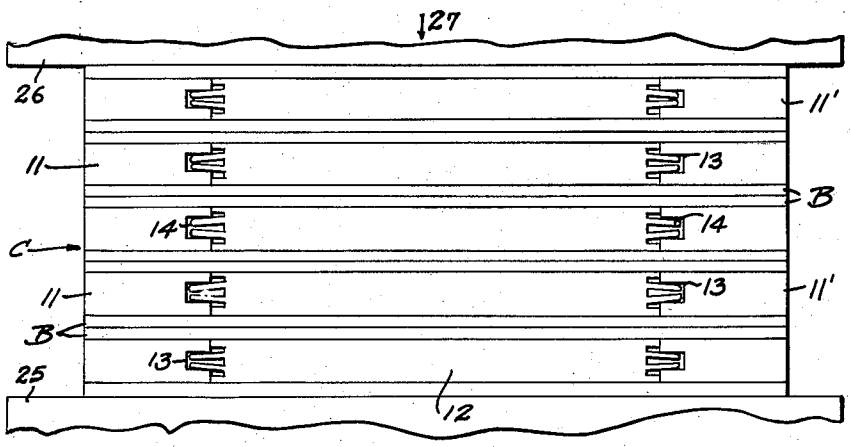


Fig. 7

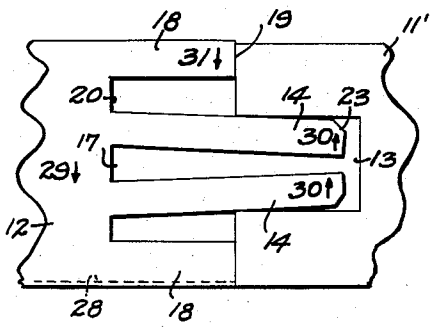


Fig. 8

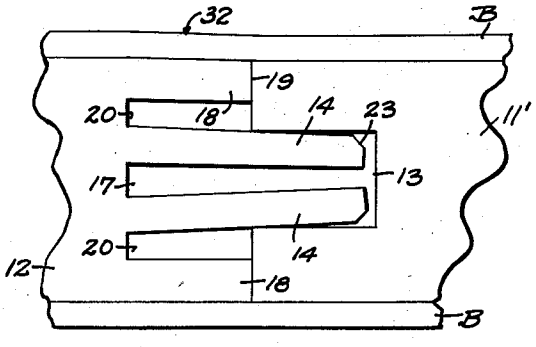


Fig. 9

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2,839,792

SLAB DOOR

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Application September 13, 1954, Serial No. 455,484

3 Claims. (Cl. 20—35)

This invention relates to the construction of doors of the type generally known as "slab door," wherein an open frame structure is faced on respective sides by facings of sheet material such as "Masonite" or thin plywood, the marginal faces of the frame constituting the main area of the marginal faces of the door. Such a door gives the general appearance of a solid slab with plain flat faces, although actually its interior is largely hollow, whereby the door is of relatively lightweight construction though exceedingly sturdy.

The facings of the door are adhesively attached to the faces of the frame by a suitable glue or cement. When the facings are thus bonded to the frame, they permanently secure the various components of the frame together in the selected door form. In the process of fabricating the door, however, the frame components, after being assembled, must be temporarily attached together in their proper positions, so that the frame structure may retain its shape until the facings have been bonded thereto. A number of expedients for thus temporarily attaching the frame components together have been utilized, a common one being that of driving staples into adjoining frame components across a joint line. Corrugated fasteners also can be used. However, in all cases where metal fasteners are used, there is created a hazard for the cutting tools of the carpenter or cabinet maker who subsequently fits and hangs the doors and cuts recesses therein for the reception of hardware such as locks, latches and hinges. This is a very serious objection to all slab doors having metal fasteners in the joints between sections of a frame, completely covered and hidden by the wood veneer or "Masonite" facings of the door. Accordingly, a primary object of the invention is to provide a slab door which contains no metal fasteners of any kind and is therefore completely free of this objection.

Where metal fasteners are driven into the joints of a slab door frame, in order that the facings may thereafter lie flatly against the faces of the components in the areas of attachment, the fasteners must be completely embedded in the surfaces of the frame components. However, we have found that in actual practice, in the production of slab doors in this manner, the staple has often been left protruding above the surfaces of the same components and will slightly raise the overlying portions of the facings when the latter is attached, leaving a fully visible "hump" in the finished door. Furthermore, the facings will be imperfectly bonded to the frame structure in the areas where it is thus held away from the surface of the frame.

One of the objects of this invention is to provide a slab door construction which is devoid of staples or other metal fastener elements and which provides in all cases a smooth flat intimate face to face contact between the facings and the frame surfaces throughout the entire areas of the frame.

A further object is to provide an improved method of fabricating such a slab door.

In the milling of components for frame structures such as that of a wooden door, using, as the basic construction, the common tongue and groove structure wherein a tongue, milled on the end of one component, is inserted into a groove milled in an adjoining component, the slight deviations from flatness, i. e. warpage or twisted conditions which is constantly encountered in components fabricated from wood, together with the fairly loose tolerances which are inherent in woodworking machinery, inevitably results in slight dimensional variations in the grooves and tongue structures (e. g. the thickness of the tongue, the width of the shoulders on either side of a tongue, the width of the groove or the width of the thickness of the cheeks which define a groove). Occasionally, these departures from the intended dimensions become sufficiently great so that the part is discarded as waste. Careful manufacturing practices make it possible to reduce the inaccuracies to a tolerable minimum, and yet even in the case of many parts which are actually used, the dimensional deviations are such as to preclude the attainment of a flush relation between adjoining areas of the frame component surfaces, and there will occur slight offsets in the frame where the facing does not lie smoothly and flatly against these adjoining areas of the frame surface. Even under the relatively high pressures that are applied in the gluing press, it is impossible to sufficiently compress the projecting areas so as to force the parts into a flush relation, and noticeable high spots will occur in the surface of the spacing over such irregular areas.

A further object of this invention is to provide a slab door construction which is such as to automatically provide a self aligning action between adjoining frame components in the surface areas thereof, when subjected to the pressure of an assembling press. Consonant with this object, a further object is to provide an improved method of fabricating a slab door so as to attain this self aligning action in the press.

Other objects will become apparent in the ensuing specifications and appended drawings in which:

Fig. 1 is a perspective view of a slab door embodying our invention, with a portion of the facing thereof broken away to illustrate the internal structure;

Fig. 2 is a fragmentary detail sectional perspective view of the frame structure, taken as indicated by the line 2—2 of Fig. 1;

Fig. 3 is a detail sectional view taken on the line 3—3 of Fig. 1;

Fig. 4 is a detail sectional view taken on the line 4—4 of Fig. 1;

Fig. 5 is a schematic view illustrating an initial stage of the process of assembling a slab door in accordance with the invention;

Fig. 6 is a schematic view showing another stage in the assembly;

Fig. 7 is a schematic view showing a later step in the assembly operation.

Fig. 8 is a schematic view illustrating a dimensional deviation occuring in adjoining parts of a slab door in the process of fabrication according to the invention; and

Fig. 9 is a schematic view showing how the invention adapts the door to such deviation.

The slab door article

Referring now in detail to sheet 1 of the drawings, and to Figs. 1–4 inclusive shown thereon, we have shown in these figures, as an example of one form in which the invention may be embodied, a slab door which comprises a frame structure indicated generally by the reference character A and facings indicated generally by the reference character B. In accordance with conventional practice,

the facings B may be of a hard, bonded and calendered fiber sheet such as that commonly known by the trade name "Masonite"; whereas the frame A may be of soft wood, with the facings B bonded or cemented thereto by a suitable cement or glue.

Referring now to the frame structure A in detail, it comprises four peripheral frame bars including the pair of opposed parallel upright bars **11** and **11'** and a pair of opposed parallel horizontal members, i. e. the top and bottom frame members **12** and **12'**. The members of one pair of such peripheral frame members is provided with a groove; the members of the other pair of spaced parallel members are provided with tongue means for insertion into such grooves. In the particular example shown, the grooves are the longitudinal grooves **13** in upright frame members **11** and **11'**; and the tongues are a pair of laterally spaced tongues **14** provided at each end of each of the horizontal bars **12, 12'**.

The tongues **14** when received in grooves **13** are adapted to maintain yielding spreading pressure against the side walls **15** of the groove **13**. Accordingly, the tongues **14** are initially fabricated with their outer side walls **16** spaced somewhat farther apart than the side walls **15** of the groove **13**, whereby the tongues are received in the groove **13** with an interference fit, and must be sprung toward one another in order to be so received. In the drawings, the dimensional difference between the original spacing of tongue walls **16** and that of groove walls **15** is shown in exaggerated contrast, for the purpose of making said dimensional difference readily apparent from an inspection of the drawings. In actual practice, the dimensional difference is considerably less and the tongues **14** do not attain the degree of convergence which is shown for example in Fig. 3. As indicated in Fig. 3, the tongues will, when received in the groove **13**, be flexed toward one another, the portions thereof between their roots and their areas of engagement with walls **15** being curved, and the outward pressure against walls **15** being largely concentrated at the areas adjacent the outer corners thereof, where some compression will take place between the said outer corners and the tongue side walls **16**. Thus the tongues will be frictionally locked or latched to the upright members **11, 11'**, whereby the frame structure is held in assembly temporarily during the steps of handling the frame, applying the facings B thereto and assembling the doors in suitable clamp means for applying pressure that is utilized in effecting a close bond between the facings and the faces of the frame.

The tongues **14** are separated by a slot **17** which is at all times unobstructed, the groove **13** being a plain rectangular groove and the tips of the tongues being free to flex toward one another during the various stages of fabrication of the door, whereby to provide a resilent joint between the adjoining frame bars. To be more specific, the joints between the bars, provided by tongues **14**, is of a resiliency such as to provide for yield between the adjoining frame members in a direction transverse to the general plane of the door. This yielding quality is made use of in a self aligning operation which characterizes the assembling method described hereinafter. In addition, it reduces to a substantially constant minimum the loads which may be set up between the facings and the frame members when a facing is bonded, under clamping pressure, to adjoining frame surfaces which initially are not flush. Thus, in the fabricated door, the tendency of the facing to pull away from one of the frame surfaces under the differential loads established in this manner, is eliminated because of reduction of the residual loads to a safe minimum, well within the capacity of the bonded joint to resist.

Each of the end portions of bars **12** and **12'** includes, in addition to the tongues **14**, a pair of abutment wings **18**, each terminating at its outer end in an abutment shoulder **19** and each spaced from a respective tongue **14** by a lateral slot **20**. Shoulders **19** are offset rearwardly from the tips of tongues **14** a distance slightly less than the depth of groove **13**, whereby the shoulders **19** may engage the inner lateral margins of frame bars **11, 11'** on respective sides of grooves **13**, to provide the spacing between vertical bars **11, 11'**, with the tips of tongues **14** clearing the bottoms of grooves **13** as indicated in Fig. 3.

The lateral slots **20** are of sufficient depth to provide in the abutment wings **18** adequate lengths to embody a lateral resiliency which is utilized in compensating for thickness variations between adjoining frame members, in a manner which will be more fully pointed out in the ensuing description of the fabrication method. Furthermore, this resiliency of the abutment wings **18** is such as to reduce to a tolerable minimum the residual loads set up between a facing and one of two adjoining frame members of initially greater thickness than the other, in being placed under compression in the bonding operation. This eliminates the tendency for the facing to be forced away from the thinner frame member as the result of such residual loading.

In addition to the peripheral frame bars described above, the frame A includes a series of intermediate stringers **21** and **21'** and a pair of lock-casing slabs **22**. Each of the stringers **21** and **21'** has at each end thereof, tongues **14**, abutment wings **18'**, and lateral slots **20'**, tongues **14'** having outer walls **16'** and being spaced by slots **17'**, all of the same cross sectional dimensions as the tongues **14**, abutment wings **18**, lateral slots **20** and slot **17** of peripheral frame bars **12** and **12'**. (See Figs. 2 and 4.)

Lock casing slabs **22** are each provided on one side with a longitudinal groove **13'** of the same dimensions as grooves **13** and on the other side with longitudinally extending flanges **14''** (Fig. 4) spaced by central slots **17''**, together with abutment wings **18''** spaced from inner flanges **14''** by lateral grooves **20''**, each of these parts and grooves having the same cross sectional dimensions as the parts and grooves **14, 17, 18** and **20** of the ends of horizontal bars **12, 12'**. The flanges **14''** are received in grooves **13** in the same manner as tongues **14**, and the abutment wings **18''** abut against frame members **11, 11'** in the same manner as shoulder members **18**.

Tongues **14'** of stringers **21'** are received in grooves **13'** of lock casing slabs **22**, in the same manner as tongues **14** of frame bars **12** and **12'**.

In each case, the tongues **14, 14', 14''** and the shoulder members **18, 18', 18''** extend the full vertical dimension of the respective parts **12, 21** and **22** (the width of bars **12** and **21** and the length of slabs **22**).

The lock casing slabs **22** provide, intermediate the bottom and top of the door, added width to the vertical frame members **11, 11'**, such that there is plenty of area for the lock cavities which are conventionally provided in door structures. The short length stringers **21'** serve to brace the slabs **22** apart so as to eliminate any possibility of them coming loose from the facings during the cutting operations in which the lock cavities are formed. Stringers **21** and **21'** are evenly spaced from top to bottom of the door, for a maximum distribution of support to the facings.

Facings B are attached to the forward and rear faces respectively of frame members **11, 11', 12, 12', 21, 21'** and **22** by films of waterproof glue or cement, to provide the sole means for permanent fastening of the parts together in the form of a slab door. The tongues **14, 14', 14''** provide lateral support resisting any loads that might be applied to the door in shear between the adjoining surfaces of frame members such as members **11, 12**, etc., tending to shift these members into offset relation in the direction transversely of the general plane of the door. This resistance to such offset shifting is a yielding one, but adequate to support the relatively thin facings B against the tendency to be ruptured in shear as the result of any such loads.

The method of fabricating the slab door

Referring now to Figs. 5 to 9 inclusive, on sheet 2

of the drawings, and with specific reference first to Fig. 5, there is shown in that figure the step of initially assembling a pair of adjoining frame sections such as the vertical peripheral frame bar **11** and the upper horizontal bar **12**. The grooves **13** of upright bar **11** are formed by a conventional rabbeting operation and the tongues **14**, abutment wings **18** and slots **17** and **20** are, in the initial milling operation, fabricated by a suitable gang of dado cutters in an end milling operation. The same gang of cutters is employed for milling the parts **14'**, **18'** etc., of the stringers **21** and **21'**, and for rabbeting the flanges **14''**, **18''** and grooves **17''** and **20''** of lock casing slabs **22**. Subsequently the outer tip corners of tongues **14**, **14'** and flanges **14''** respectively are mitered at **23** so as to facilitate entry of the tongues and flanges into the grooves **13**, **13'** etc.

The parts having been fabricated in the manner indicated above, a set of parts shown in Fig. 1 are arranged on a suitable supporting surface, preferably horizontal, with the transverse members **12**, **21**, **21'** and **12'** being arranged in properly spaced relation and the vertical members **11**, **11'** and **22** being then brought into place from respective sides until the various tongues, flanges and grooves are in the entry relation shown in Fig. 5. If desired, the lock casing slab **22** may be attached to stringers **21'** to provide preassembled central units which may then be arranged as units between the stringers **21** and vertical bars **11**, **11'** prior to bringing the bars **11**, **11'** together.

A satisfactory and desirable method of quickly determining the relative positions of the various parts of the door frame is to utilize an assembly jig having various projecting parts corresponding to the spaces between the door frame parts, the latter being simply fitted against the projecting parts of the jig. After the frame is assembled it can be lifted away from the jig.

With the parts properly positioned as indicated above, the side frame bars **11**, **11'** are pushed toward one another, forcing the tongues **14**, **14'** and flanges **14''** to enter the grooves **13** of the bars **11**, **11'**, until the various abutment wings **18**, **18'**, **18''** are in snug bearing engagement with the respective frame bars **11**, **11'**.

With the frame thus fully assembled, the yielding outward pressure of tongues **14**, **14'** and flanges **14''** against the walls **15** of grooves **13** is adequate to hold the frame in assembled relation while it is handled (e. g. is lifted away from the assembly slab and placed on top of a facing B lying upon a suitable horizontal support).

Before applying the frame to the facings, the respective forward and rear faces of the frame members are coated with a suitable bonding adhesive. To this end, the frame is passed over or between the adhesive applying rollers of a suitable adhesive applying apparatus so that both faces of the frame are coated at substantially the same time. The frame is then laid upon one of the facings B as previously indicated.

A preferable method of applying the frames to the casing is to build up a stack of alternating facings and frames as indicated in Fig. 7. The facings for the lowermost door of the stack may be made for example upon a horizontal supporting surface **25**. The first frame after being duly coated with adhesive is then laid carefully upon the first facing in a manner to bring the edges of the frame and the edges of the facing into satisfactory registry.

Another facing is then laid over the frame and the edges are properly fitted to the margins of the frame. The lower facing for the next door is then laid on top of the door which has just been assembled, and another door frame, after being coated, is laid in the stack. Thus the stack is built up to a pre-determined height. The completed stack of assembled doors is indicated at C in Fig. 7. A pressure applying platen **26** is then brought to bear against the uppermost door of the stack, and downward pressure is applied as indicated by arrow **27**. A suitable press, adequate for applying fairly high pressure to the stack of doors, is employed.

The stack of doors is left in the press an adequate time to provide for thorough setting or curing of the bonding agent. Finally, the doors are removed from the press and are then in completed form, ready for finish trimming and sanding operations which may be applied to complete the doors ready for painting.

While it is preferable in quantity production of slab doors to arrange them in stacks for the application of pressure, it is to be understood that the invention is not restricted to the stack type of operation. As an alternative, the invention contemplates the pressing of a single door at a time in a heated platen press wherein each individual door is inserted in a respective opening between separating platens; or it would be entirely possible to utilize the invention in a single simple clamp or press having a capacity for receiving only one door at a time.

During the assembling operations, the invention provides for an automatic self aligning action for the following occasional occurrences:

(*a*) Misplacement of groove or tongue laterally from its proper position. Through the tolerances existent in milling machinery, the fabricator of tongue and groove mill work is constantly faced with appreciable variations in the location of grooves and tongues with reference to the thickness of the milled parts. Such variations are commonly caused by warped conditions in the milled parts, and cannot be completely avoided. Where the warpage is too severe the parts may have to be discarded. However, it is highly desirable that the majority of milled parts which are thus produced with dimensional deviations from the designed dimensions, be rendered usable. The present invention provides for this in the following respects: by reference to Fig. 8 it will be assumed that the thickness of the respective parts **11'** and **12** is reasonably equal so that the tongues **14** are displaced upwardly, as viewed in Fig. 8, with reference to their designed positions. It may also be assumed, in this example, that the uppermost slot **20** is wider than it should be and that the lowermost slot **20** is narrower than it should be. In this assumed example, the dotted line **28** will be taken as the outer face of the lower side of bar **12** and lowermost wing **18**. It will now be apparent that, as initially assembled, frame parts **11** and **12** will be slightly misaligned in that upper abutment wing **18** will project slightly above the adjoining surface of vertical bar **11'** whereas lower abutment wing **18** will be recessed slightly upwardly from the lower surface of bar **11'** as indicated by dotted line **28**.

This condition will remain during the assembling of the frame between the facings B, but when pressure is applied to the doors in the stack C, it will force frame bar **12** downwardly with respect to bar **11'** as indicated by arrow **29**, the tongues **14** yielding in order to allow this self-aligning action wherein the faces of bar **12** become flush with the faces of bar **11'**.

Another condition which frequently occurs is a dimensional variation in thickness between adjoining frame bars. This is illustrated in the full line showing of Fig. 8, bar **12** being shown as being somewhat thicker than frame bar **11'**. In this case, a conforming action is provided for by the yielding quality of the upper abutment wing **18**, the downward pressure against the same causing it to flex downwardly as indicated by arrow **31** in Fig. 8 until it assumes the position shown in Fig. 9. Correspondingly, the upper facing B will bend slightly in the area indicated at **32**, to cause the facing to lie flatly against the adjacent faces of both frame members **11** and **12** and to conform to the revised contour of the upper wing **18**.

In this shifting movement of tongues **14**, the flexure of the lower tongue will be increased and that of the upper tongue will be relieved, the tips of the tongues shifting slightly upwardly as indicated by arrows **30**, while the

roots of the tongues move slightly downwardly with the bodily downward shift of frame bar 12. During this conforming operation, it is not necessary for the tongues 14 to shift position, the lower wing 18 being initially flush with the lower side of bar 11' in this second assumed example.

While the foregoing description relates specifically to the manufacture of slab doors, it is to be understood that the invention can be extended to the manufacture of other hollow articles such as table tops, wall panels, or sections, and partitions for pre-fabricated building structures, or any other type of panel structure or hollow wall structure, where high precision finish is required.

We claim:

1. A joint for a slab door core, comprising: a frame bar having a longitudinal groove defined between spaced flanges having substantially parallel, opposed inner walls and having marginal walls disposed in a common plane normal to said inner walls; and a joining bar having at its end a central slot, tenon tongues on respective sides of said slot, projecting into said groove, and a pair of resilient abutment wings on respective sides of said tongues, in opposed embracing relation to the roots of the respective tongues, said wings at their tips having squared abutment shoulders set back from the tips of said tongues and in closed-joint abutting engagement with the said marginal walls of the respective flanges of said frame bar; said joining bar having lateral slots between said tongues and the inner faces of said wings whereby said inner faces are spaced outwardly from the outer faces of said tongues and from the planes of said inner walls of the groove, said outer tongue faces being substantially parallel, and said tongues being sprung toward one another by the embracing action of said flanges so as to exert yielding outward pressure against said inner walls of the groove such that said tongues are frictionally gripped by said flanges to secure said joint in assembled condition without the aid of fastening elements; said abutment shoulders of said wings being in freely shiftable association with said marginal faces of the frame bar against which they are abutted, whereby said wings are freely yieldable inwardly against the pressure of facing sheets covering the outer faces of said bars, whereby to achieve a flush relation between the respective outer faces of said wings and said flanges.

2. In a slab door: a frame bar having a longitudinal groove defined between spaced flanges having substantially parallel opposed inner walls; a joining bar having at its end a central slot, tenon tongues on respective sides of said slot, projecting into said groove, and a pair of resilient abutment wings on respective sides of said tongues, in opposed, embracing relation to the roots of the respective tongues, said joining bar having lateral slots between said tongues and the inner faces of said wings whereby said inner faces are spaced outwardly from the outer faces of said tongues for yielding movement toward the same, said wings having at their tips abutment shoulders in abutting engagement with the marginal faces of the respective flanges of said frame bar; said tongues exerting yielding outward pressure against said inner walls of said groove whereby said tongues are frictionally gripped by said flanges; and facing sheets attached to the outer faces of said bar and bridging across the joints between said abutment wings and said flanges; said abutment shoulders and marginal flange faces being in closed-joint contact with one another in a plane substantially at right angles to said tongues and wings, and being freely shiftable in said plane relative to one another so as to accommodate inward yielding of said wings to achieve flush relation between said outer faces of the wings and the flanges in the adjoining areas thereof, whereby said facing sheets lie smoothly across the joint between said wings and flanges.

3. In a slab door: a frame bar having a longitudinal groove defined between spaced flanges having substantially parallel opposed inner walls; a joining bar having, at its end, tenon tongue means projecting into said groove, and a pair of resilient abutment wings on respective sides of said tongue means, in opposed, embracing relation to the root areas of the outer walls of said tongue means, said wings at their tips having abutment shoulders set back from a tip area of said tongue means; said joining bar having lateral slots between said tongue means and the inner faces of said wings whereby said inner faces are spaced outwardly from the outer faces of said tongue means for inward yielding movement of said wings relative to said tongue means; said outer walls of said tongue means exerting outward pressure against said inner walls of the grooves whereby said tongue means is frictionally gripped by said flanges; and facing sheets attached to the outer faces of said bar and bridging across the joints between said abutment wings and said flanges; said abutment shoulders and marginal flange faces being in closed-joint contact with one another in a plane substantially at right angles to said tongue means and said wings, and being freely shiftable in said plane relative to one another so as to accommodate inward yielding of said wings to achieve flush relation between said outer faces of the wings and the flanges in the adjoining areas thereof, whereby said facing sheets lie smoothly across the joints between said wings and flanges.

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