Aug. 23, 1949. W. H. RUNDQUIST 2,479,870

HOLLOW-CORE PANEL

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Fig. 1

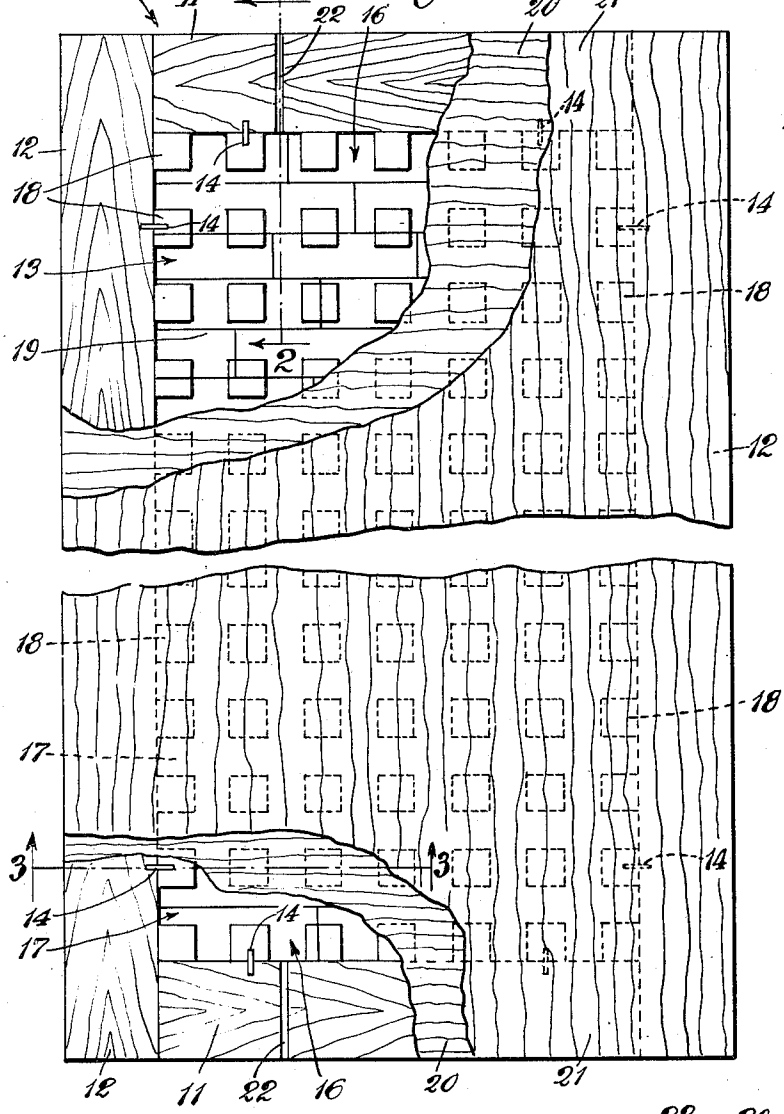
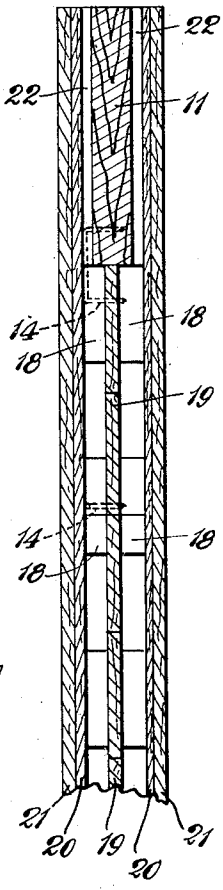


Fig. 2



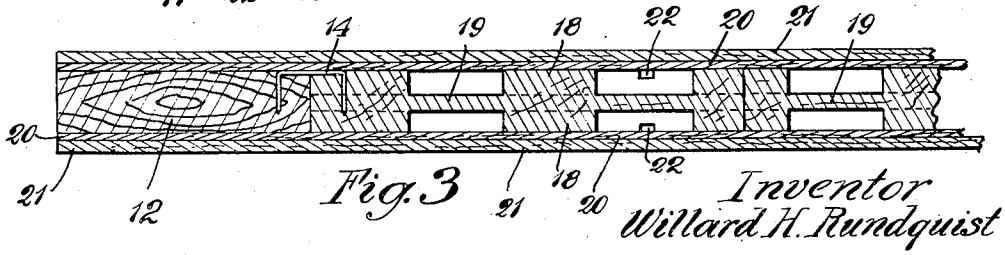


Fig. 3

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Fig. 6

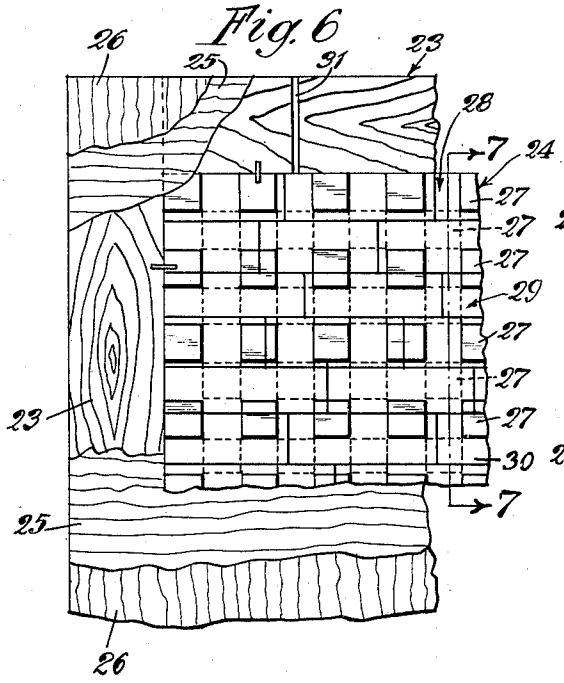


Fig. 7

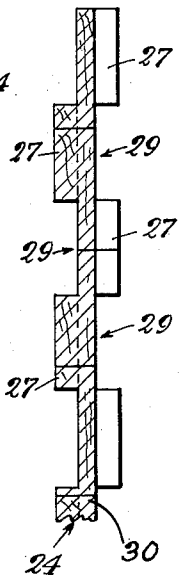


Fig. 8

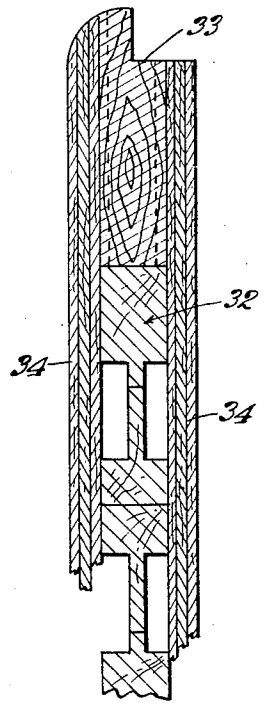


Fig. 4

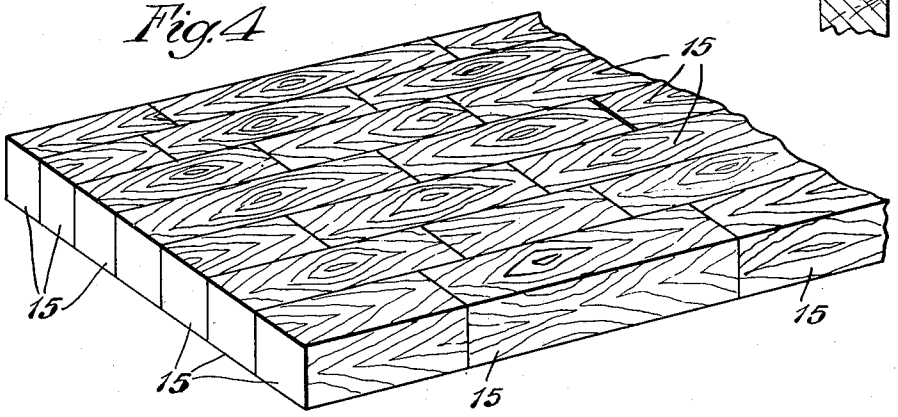
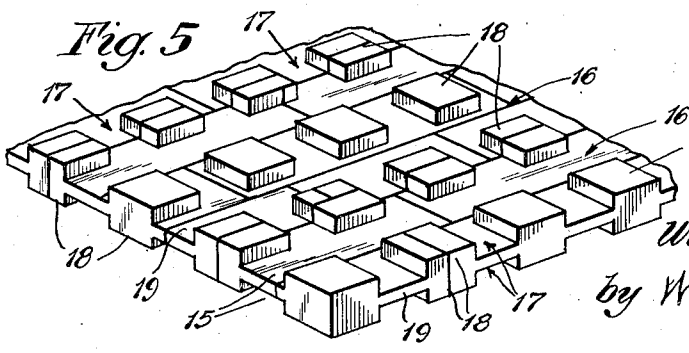


Fig. 5



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HOLLOW-CORE PANEL

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5 Claims. (Cl. 20—91)

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This invention relates generally to improvements in panels, and in particular to hollow-core door constructions.

Flush solid-core doors as generally made heretofore are relatively heavy, as compared with paneled doors or the like of equal size, due to the greater quantity of material employed in their manufacture. In addition, solid-core flush doors as heretofore made have rendered them subject to warpage under varying climatic and atmospheric conditions.

It is an object of the present invention to provide a flush hollow-core door or like structure so constructed that it not only is lighter in weight, as compared with a solid structure, such as a flush solid-core door of conventional construction, but one that is stabilized to a substantial degree against distortion resulting from varying conditions of humidity.

In all or most wood working mills, such as sash and door plants, there are left-over pieces of wood that are classed as core blocks. The core blocks from certain operations may be made up of pieces more or less uniform as to width and thickness, but varying in length. It is another object of the present invention to provide an improved flush door or other panel-like structure having a core that may be made up of such heretofore short and narrow pieces of lumber, and which door, while of sturdy construction, also is substantially less in weight than conventional solid flush doors of like dimensions. Reduction in weight of such doors is important, not only from the standpoint of the reduction of stresses on hinges and frames and of the reduction of effort required in swinging them in use, but also from the standpoint of the reduction in handling and shipping costs from the point of origin to jobbers and users.

Another object of the invention is to provide a flush door having a core that provides internal ventilation substantially throughout the width and length of the door, not only for facilitating the drying and setting of the glue employed in the manufacture of the door, but for the purpose of subjecting internal surfaces of the door structure to conditions of humidity similar to those that affect the outer surfaces for thereby neutralizing, in substantial degree, the forces that generally produce distortion of large wood panels.

Other objects of the invention relate to various features of construction and arrangement of parts that will be apparent from a consideration

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of the following specification and accompanying drawings, wherein:

Fig. 1 is a broken front elevation of a panel construction such as a flush hollow-core door that is illustrative of the present invention.

Fig. 2 is an enlarged sectional view taken on line 2—2 of Fig. 1.

Fig. 3 is an enlarged sectional view taken on line 3—3 of Fig. 1.

Fig. 4 is a broken perspective view illustrating a core structure in an initial state of manufacture.

Fig. 5 is a broken perspective view of a detached core structure.

Fig. 6 is a broken side elevation of a door showing in position therein a modified core structure.

Fig. 7 is an enlarged sectional view taken on line 7—7 of Fig. 6 and illustrating the modified core structure.

Fig. 8 is a broken vertical longitudinal sectional view of a flush-type cupboard door, taken on a line intermediate horizontal stiles, and illustrative of the present invention.

In the drawing, the door shown in Fig. 1, for the purpose of illustrating the preferred use of the invention, is provided with a surface-covered structure comprising edge strips, preferably arranged to form a frame 10, with or without joined corners, including upper and lower rails 11, stiles 12 and a core structure 13. As shown, the dimensions of the frame correspond to the width and length of the door. The rails and stiles may be united at the corners of the frame by dowels, by mortise and tenon joints, or by any other suitable means, not shown.

The core structure 13 is of the required lengthwise and crosswise dimensions to fit within the frame 10, and in the particular structure illustrated, the core is attached to the frame by staples 14. The fit of the core within the frame need not be precise nor need the staples afford any substantial rigidity to the structure inasmuch as they are employed in the initial assembly primarily for retaining the parts together during the subsequent manufacturing stages.

The core structure 13 may be made, and for the purpose of economy preferably is made, of available material that might otherwise be classed as scrap. As indicated in Fig. 4, the core initially is assembled in slab form by gluing together at the edges a number of relatively short pieces of lumber 15 which preferably are substantially uniform in width and thickness or which can be made so by economical mill operations. Such

pieces of lumber indicated in Fig. 4, generally are of random or non-uniform length whereby the end joints of the pieces in the assembled slab are staggered. It is not necessary that the blocks in the assembly provide two planar surfaces as blocks of different heights from an assembly table top are permitted. Lengths also may vary. After removal from the glue-up clamps, the composite slab is run through a resaw then run through a moulder which reduces it to a uniform or other condition of desired thickness corresponding to the thickness of the frame 10. At the same operation, one set of longitudinal grooves or channels is formed in each of the opposite faces, preferably all in one direction as illustrated by grooves 16. The slab is then grooved on each face by a new set crossing the first set, as by passing it through a gang grooving machine which cuts transverse grooves in each face of the slab as shown at 17 in Fig. 5. The two sets of grooves 16 and 17 of each face are preferably uniformly spaced to provide regularly distributed studs or blocks 18 that are integral with a medial web 19, preferably centered between the faces of the cut slab.

In the structure shown in Figs. 1, 2 and 3, sheets are secured to opposite sides of the frame and core structures which impart to the door its flush character. Where a wood grain at the surface is desired, veneer is suitable and it is preferably cross-banded by an inner ply of wood to provide relatively crossing grains. As illustrated in said figure, there are glued to the respective co-planar end-surfaces of the studs 18 and to the corresponding faces of the frame 10, on each side of the door, a cross-banding wooden sheet 20 that may be a ply of wood veneer approximately $\frac{1}{16}$'' in thickness and having the grain extending crosswise of the frame. Such cross band having the grain extending crosswise of the door, offers substantial resistance to dimensional changes in the door in a transverse direction. To the outer surface of each crossband 20, in the form of the door shown in Fig. 1, there is glued a finishing or facing sheet of veneer 21 with grain lengthwise of the door. The facing sheets, which may be of a selected wood, such as hard wood, give the door the desired surface appearance and may be finished as desired. Any wood ply covering may be one or more pieces arranged as desired.

In gluing the crossbands, with or without the outer veneer sheets, to the frame and core as mentioned above, the coplanar surfaces of the studs and the faces of the frame receive the glue. As will be noted, each of the studs 18 at one side of the web 19 is arranged directly opposite a stud on the other side, and hence substantial pressure may be exerted on the assembly by the press during the gluing of the crossbands to the frame and core or of the veneer to the already glued-on crossband, without producing distortion of the web 19 or the sheets carried by its studs 18. The crossbands 20 thus are secured along the margins to the frame 10 and are attached at numerous intermediate, and preferably regularly disposed, areas or spots to the studs 18.

It will be understood that the core structure 13 of a particular door need not be composed of a single slab, but may consist of two or more preformed slabs, each preferably extending across the opening of the frame and initially secured to the frame by staples.

Preferably, ventilation passages are provided in the frame 10, which communicate with the core channels 16 and 17 on each side of the medially disposed web 19, as shown at 22 in Figs. 1, 2 and 3. The passages 22 may be in the form of transverse grooves formed in the surfaces of the upper and lower frame rails 11. These ventilation passages are visible only at the ends of the door and are not, therefore, objectionable from the standpoint of appearance, but they facilitate the drying or setting of the glue used in attaching the crossband to the core, and thereby shorten the conditioning period that is usually required between completion of the manufacture of the doors and the shipping of the same. Likewise, the passages 22 permit the inner door structures to breathe with temperature changes, and to take on or give up moisture under varying conditions of humidity that affect the outer surfaces of the door and they thus tend to effect equalization of those forces which produce warpage of wood structures. As many ventilation passages may be provided in the frame rails as desired. In spite of the fact that the structure is one to minimize or prevent warping, the minimizing of warp-inducing forces lessens the stresses imposed within the structure.

The web 19, being relatively thin, exerts but small warpage forces, even should conditions obtain wherein one side of the web contains much more moisture than the other. The studs 18 themselves, being of relatively small crossgrain dimensions, expand or contract inappreciably under the influence of humidity changes. Because the core is formed by numerous pieces 15 of wood glued edge-to-edge and has random disposition of annular rings, the tendency of some pieces to warp in one direction is substantially resisted by the opposite tendencies of other pieces, and hence the core itself is substantially stabilized against distortion, due to differences in the humidity affecting opposite sides of the core. The crosswise forces exerted by the web 19 in tending to expand or contract transversely are of low degree, due to the relative thinness of the web. Such forces are resisted by the crossbands or other surfacing sheets, and hence the improved door not only is relatively light in weight, as compared with a solid type flush door of similar dimension, but it is substantially more stable with respect to dimensional changes when subjected to variations in humidity or climate conditions. In the core, the ends of blocks 15 (Fig. 4) exhibiting ends of grain, are not effectively glueable, and hence, commonly no glue is applied. Thus, there are formed unglued joints in the midweb 19 at these locations. Moisture vapor inside the core channels can thus readily penetrate the midweb through these unglued joints, thus further to minimize humidity differences.

In Fig. 6 a door is illustrated which may be manufactured as above described and comprises a frame 23, a core 24, crossbands 25, and facing sheets 26. The core 24 has studs 27, as shown more clearly in Fig. 7, which are not oppositely arranged as in Fig. 1, but are staggered, that is, the studs on the reverse side of the core in Fig. 6 are arranged opposite the areas of intersection of the channels on the obverse side of the core. In this arrangement, it is preferred that the channel spacing be at least equal to or greater than the channel width, so that assembly pressure on a stud is not born by a span of the medial web. The staggered arrangement provides parallel longitudinal channels 28 and transverse circulation channels 29 on each side of the web 30. While this construction does not possess the resistance to compression while in the glue presses that is afforded by the arrangement of Fig. 1, the

staggered relation of the studs improves the insulating value of the construction to some extent by interrupting direct heat-flow paths from one face of the door to the other, which are present where the studs are oppositely arranged. Ventilation passages 31 in the frame rails preferably are provided as in the above described structure.

In Fig. 8 a door, commonly designated a cupboard door, is shown in broken longitudinal section. The core 32 is similar to the core 13 above described with respect to Fig. 1, but to each face of the core and a flange-forming frame 33 is attached a sheet of pre-formed 3-ply-plywood 34, in lieu of the two pieces of crossbands and veneer sheets above described. The plywood sheets rigidify the structure and are attached to the core and frame by glue, with suitable compression. The crossband and veneer sheets may of course be used in making flush cupboard or other doors, or panels, if desired, while pre-formed plywood sheets of suitable wood may be substituted for the use of separate crossband and veneer sheets, as described for the larger flush doors of Fig. 1.

In utilizing the present improvements in small doors, such as cupboard doors, I have found that the web of a ¾-inch-thick core need not be thicker than ⅛ inch and if the studs are ¾ inch square and the channels ¾ inch wide, with a crossband $\frac{1}{16}$ inch thick and facing veneer ⅛ inch thick, the structure is suitably rigid. In doors of larger sizes such as room doors, the thickness of the core and other dimensions of the parts are greater. Soft wood, as pine for example, is suitable for the core, and waterproof or water-resistant glue preferably is employed in the gluing operations mentioned. However, any glue may be used, and hot pressing of resin glues may be practiced.

The wood ply coverings, or the plywood surface, are examples of a reinforcing sheet material attached to and rigidifying the otherwise flexible core structure. Such a sheet secured to two spaced studs, for example, acts as a rigidifying bridge, and although the sheet-bridge itself may be of flexible material, such as wood veneer, the medial web of the core and the sheet act mutually to resist flexure of each other, and hence to prevent warping. Thus, for a non-warping panel, the core structure and the surfacing sheets are sufficient in the combination described, and the perimetrical frame among other uses, provides finished edge structures where the margins of the covering sheets are secured to the frame.

Although the doors or panels have been illustrated as each of uniform thickness, it is to be understood that there is no essentiality in the two planar sides being parallel.

While I have shown and described door structures which are illustrative of the improvements, the invention may be utilized in other panel structures, and changes in the details shown may be resorted to within the scope and spirit of the invention, as set forth in the appended claims.

I claim:

1. A panel suitable for use as a door comprising in combination a rectangular perimetric frame of wood, a core structure disposed within the frame and fitting closely in the frame opening, said core structure having its bounding faces co-extensive with the faces of said frame, said core structure consisting of multitudinous pieces of wood placed together endwise and sidewise and glued into a unitary body, said pieces having their grains running generally in the same direction and in the plane of the extent of the core structure, said pieces being in random arrangement of the annular rings of the individual pieces, said structure being provided with series of crossing channels in each face to a limited depth whereby to provide a relatively thin planar midweb in the core structure, and to provide on each face a plurality of columnar studs projecting from said midweb to the respective bounding faces of the core structure, and sheet material secured to each of the faces of the frame and to the corresponding end-faces of the studs.

2. A panel suitable for use as a door comprising in combination a rectangular perimetric frame of wood, a core structure disposed within the frame and fitting closely in the frame opening, said core structure having its bounding faces co-extensive with the faces of said frame, said core structure consisting of multitudinous pieces of wood placed together endwise and sidewise and glued into a unitary body, said pieces having their grains running generally in the same direction and in the plane of the extent of the core structure, said pieces being in random arrangement of the annular rings of the individual pieces, said structure being provided with longitudinal and transverse channels in each face to a limited depth whereby to provide a relatively thin planar midweb in the core structure, and to provide on each face a plurality of columnar studs of rectangular cross-section projecting from said midweb to the respective bounding faces of the core structure, and sheet material secured to each of the faces of the frame and to the corresponding end-faces of the studs.

3. A wooden panel suitable for use as a door comprising in combination a rectangular perimetric frame of wood, a core structure disposed within the frame and fitting closely in the frame opening, said core structure having its bounding faces co-extensive with the faces of said frame, said core structure consisting of multitudinous pieces of wood placed together endwise and sidewise and glued into a unitary body, said pieces having their grains running generally in the same direction and in the plane of the extent of the core structure, said pieces being in random arrangement of the annular rings of the individual pieces, said structure being provided with longitudinal and transverse channels in each face to a limited depth whereby to provide a relatively thin planar midweb in the core structure, and to provide on each face a plurality of columnar studs of rectangular cross-section projecting from said midweb to the respective bounding faces of the core structure, and at least two layers of cross-banded wood veneer secured to each of the faces of the frame and to the corresponding end-faces of the studs.

4. A panel suitable for use as a door comprising in combination a rectangular perimetric frame of wood, a core structure disposed within the frame and fitting closely in the frame opening, said core structure having its bounding faces co-extensive with the faces of said frame, said core structure consisting of multitudinous pieces of wood placed together endwise and sidewise and glued into a unitary body, said pieces having their grains running generally in the same direction and in the plane of the extent of the core structure, said pieces being in random arrangement of the annular rings of the individual pieces, said structure being provided with longitudinal and transverse channels in each face to a limited

depth whereby to provide a relatively thin planar midweb in the core structure, said channels being opposite each other on the two faces whereby to provide on the two faces a plurality of opposed columnar studs of rectangular cross-section projecting from said midweb to the respective bounding faces of the core structure, and sheet material secured to each of the faces of the frame and to the corresponding end-faces of the studs.

5. A wooden panel suitable for use as a door comprising in combination a rectangular perimetric frame of wood, a core structure disposed within the frame and fitting closely in the frame opening, said core structure having its bounding faces co-extensive with the faces of said frame, said core structure consisting of multitudinous pieces of wood placed together endwise and sidewise and glued into a unitary body, said pieces having their grains running generally in the same direction and in the plane of the extent of the core structure, said pieces being in random arrangement of the annular rings of the individual pieces, said structure being provided with longitudinal and transverse channels in each face to a limited depth whereby to provide a relatively thin planar midweb in the core structure said channels being opposite each other on

the two faces whereby to provide on the two faces a plurality of opposed columnar studs of rectangular cross-section projecting from said midweb to the respective bounding faces of the core structure, and at least two layers of cross-banded wood veneer secured to each of the faces of the frame and to the corresponding end-faces of the studs.

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