May 19, 1942. H. G. PILLSBURY 2,283,574

PANEL SECURING MEANS

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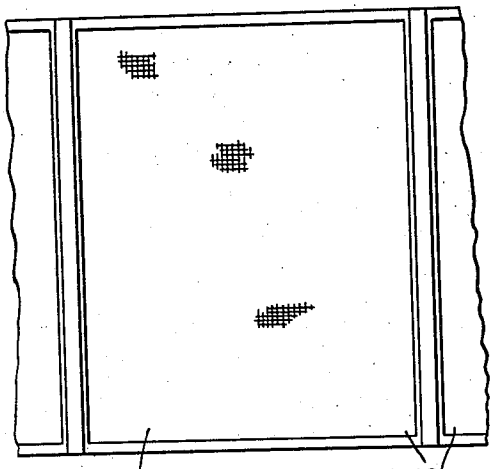


FIG.-1

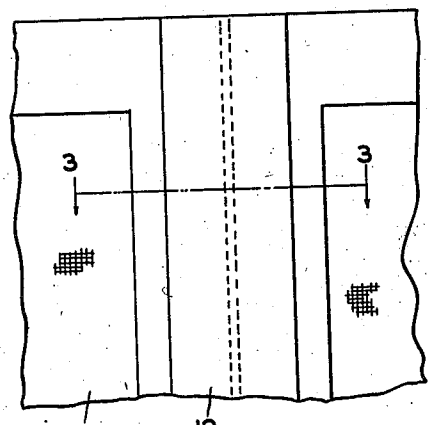


FIG.-2

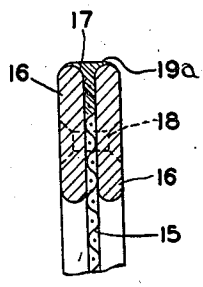


FIG.-4

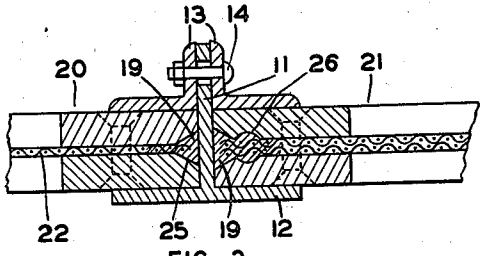


FIG.-3

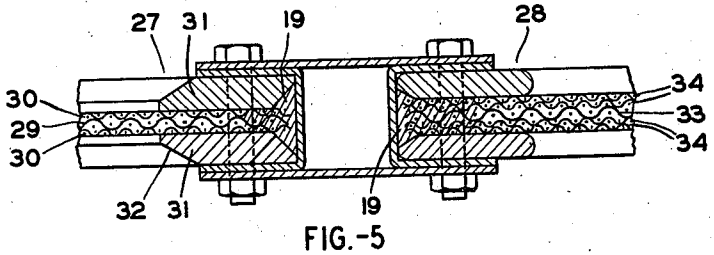


FIG.-5

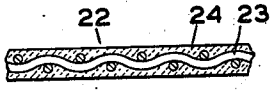


FIG.-6

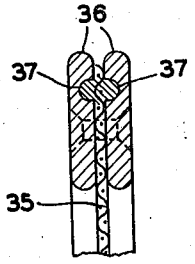


FIG.-7

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PANEL SECURING MEANS

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Application April 19, 1941, Serial No. 389,275

6 Claims. (Cl. 189—84)

This invention relates to an improved panel securing means and method, its object being to provide unusually effective securement for a foraminous sheet or panel in a holding frame therefor, together with an improved method of manufacture of the unit, all enabling any foraminous sheet or panel, such as wire screen, to be firmly, rigidly and securely fastened in its frame.

The invention is capable of use in connection with and for a variety of devices, such as ordinary screens for windows, doors or other openings of buildings, for detention screens such as are used for the windows and doors of psychiatric or other institutions of confinement, for guard panels for booths or cages, such as the protecting cages of bank officers, or for panels used for fire-proof, explosion-proof, or other forms of walls, ceilings, partitions or other parts of buildings. While it is not limited to such use, for convenience, and in no sense of limitation, the description will first refer to a wall structure where wire mesh screen is used, in the construction of fireproof or explosion-proof units for walls, partitions, and ceilings in buildings devoted to the manufacture, storage, or handling of materials which constitute an explosion or fire hazard. As the description proceeds it will be apparent, however, that the method and means herein disclosed are applicable wherever an indented or perforated sheet is fixedly held between retaining members.

In a copending joint application filed by me and one Elton B. Ingersoll, U. S. Serial No. 385,403, filed March 27, 1941, there is disclosed a wall structure which, to a high degree, is fireproof and at the same time offers a yieldable yet impermeable barrier to all but the most severe explosions. It has heretofore been recognized that a rigid wall structure affords little or no protection in case of an explosion in close proximity thereto, unless of course the wall is made so thick and strong that its cost is likely to be prohibitive. A preferred structure, as disclosed in the aforesaid copending application, involves a structural unit which is not entirely rigid and which not only conserves space, but also yields sufficiently on first impact of expanding gases, or flying debris or bomb fragments, to prevent shattering, thereby permitting the explosion forces to find outlet in a predetermined direction through a relatively more yieldable wall portion. Preferably this structural unit is composed of at least two superposed sheets of foraminous metallic screen material, said sheets having thereon a coating of fireproof plaster, the superposed sheets being gripped along their peripheral edges in frame members to provide a laminated panel which is relatively highly resistant to the destructive effects of fires and explosions, and which is sufficiently yieldable to cushion initial impact, either solid or gaseous.

While in the aforesaid copending application entirely adequate means was disclosed for holding the described yieldable fireproof panels in a retaining structure, I have discovered, as a result of actual tests in explosion testing chambers and under the impact of severe explosions, that the method and structure herein to be described and claimed are superior to any other so far developed, since they furnish a positive, continuous, wedge grip of the sheet or panel along the peripheral edge portion of the panel assembly, and sudden impact or increasing tension merely increases this gripping effect.

Before the present invention is described in detail, it is to be understood that such invention is not limited to the details of construction and/or the specific arrangement of parts herein illustrated and/or described, as the invention obviously may take other forms. It also is to be understood that the phraseology or terminology herein employed is for the purpose of description, and not of limitation.

Fig. 1 is a fragmentary front elevation of one form of wall unit mounted in accordance with my invention.

Fig. 2 is a somewhat enlarged view of a portion of Fig. 1.

Fig. 3 is a section, somewhat enlarged, taken on the line 3—3 of Fig. 2.

Fig. 4 is a fragmentary sectional view showing my method of gripping a single screen panel between frame members.

Fig. 5 is a view, somewhat similar to Fig. 3, showing another method of assembly of adjacent structural units; and

Fig. 6 is a fragmentary section, somewhat enlarged, showing a single sheet, of fireproof characteristics, as used in assembling a wall panel.

Fig. 7 is a view in section, similar to Fig. 4, but showing yet another method of securing a screen panel in a frame assembly.

As described in the aforesaid copending application, wherein novel and improved wall structures for resisting the injurious effects of fire and explosion are fully disclosed, said structures are preferably assembled by abutting, in edge-contacting relationship, a series of panels, each panel having as its basic element a layer or sheet of screen wire, or metallic mesh fabric, used as

a resilient supporting framework or skeleton for a layer of fireproof plaster material. The strengthening and supporting element is a metallic screen which may vary in mesh size and wire diameter depending on particular circumstances. A panel composed of a single sheet of this fireproof material affords material protection but the general strength, shock resistance, and heat resistance of the structural unit are materially improved by forming the panel of a plurality of superposed layers of the above character united at their peripheral edges in a retaining frame. Since very severe explosions, or the impact of debris or shell fragments propelled at high velocity, may tend to pull the screen edges from the retaining frame I have devised the following method and means of securely anchoring the screen.

In the drawing, Fig. 1 shows a portion of a wall constructed by assembling a plurality of adjacent panels **10**, retained in edge abutment by any suitable means. In the embodiment shown in Figs. 1 to 3, adjoining units are clamped in assembled relationship by inserting between their adjacent edges the web **11** of a T-bar **12**, and suitable angle members **13** are fitted to the exposed portion of the T-bar web, the assembly being held in permanent attachment by bolts **14**. An alternative method of assembly is shown in Fig. 5, the drawing being so clear to anyone mechanically skilled that detailed explanation is unnecessary.

In accordance with the present invention I place the peripheral edge portions of the screen or other suitable foraminous panel material **15** between two superposed open rectangular frames **16** (Fig. 4). The outwardly disposed edge faces of frame members **16** are curved or contoured to provide therebetween an outwardly opening and flaring channel **17** for a purpose to be hereinafter described. The frames, so assembled, are united in firm screen gripping relationship by any suitable retaining means, such as rivets **18**, screws, bolts, spot welds, or otherwise.

Having assembled a single structural unit, such as described, comprising the foraminous sheet or panel and its frame, together with the securing or retaining means **18**, I next permanently anchor the edges of the sheet in the flared groove or space in which they lie. This I accomplish by employing any suitable material which can be applied in a soft or fluent state, either molten or plastic, and which will harden in situ so as to become substantially an integral part of the wire screen, penetrating and filling all of its openings or interstices which are covered by the frame members and also the outwardly flared portion of the groove exposed along the edges of the frame, and which, when hard, is sufficiently strong for the purpose and not likely to crumble, shear or break away, all to provide the necessary more or less permanent anchor. All such materials, whatever their composition, which can be applied in a soft or fluent condition and which subsequently solidify or harden and are sufficiently strong, I here refer to, for convenience, as "hardening" materials.

Any of the usual or well known modern thermo-setting or thermo-plastic materials capable of hardening either by heating or by cooling, such as the phenolic or other synthetic resins, or certain plastic hardening cements, such as are used for the joints of furnace settings, may be employed for the purpose, or even a low melting point metal, such as lead, or low melting point alloys of lead, bismuth, cadmium and tin or other metals are suitable.

When a plastic material is used it is squeezed or forced, in a plastic condition, usually under pressure, as from a caulking gun, into the groove which opens outwardly along the outer edges of the frame members, with pressure sufficient to cause it to flow into and around the wires or material and through the openings of the foraminous panel along its edges where covered by the frame members. Then the plastic material is allowed or caused to harden, either by standing, as the result of drying, oxidation, or other chemical action, or by the application of heat or a cooling agent to produce similar hardening action, as may be necessary.

When a low melting point metal or alloy is used for the purpose the molten metal may be cast or poured directly into the groove, in the presence of a suitable flux, and thus be permitted to flow into interlocking engagement with the wires and interstices of the foraminous panel. A more convenient method, however, is to apply the metal to the open groove or crevice in the form of a rod or wire of suitable size, whereupon, by local application of heat, as by a blow torch, the lead or alloy rod or wire may be caused to melt locally and run down into the groove, a quasi casting step quite analogous to ordinary "lead-burning." Sufficient lead or alloy is applied to at least fill the flared groove level, but preferably a slight excess is employed so that when rough spots are filed off or otherwise removed, the filling lead or soft metal projects slightly from the groove, as indicated at **19***a*, Fig. 4. This excess, if continuous or substantially so, around the entire frame, provides a cushion to engage any adjoining steel or iron of the window or wall frame in which the panel is secured and not only takes up unevenness in the joint, but cushions the panel against injury.

Temperatures are employed, during the fusing or casting operation, sufficient to cause the metal to melt and flow freely into the joint and thereby completely surround and interpenetrate the wires and interstices of the metallic screen, so that when the metal solidifies upon cooling the screen or foraminous panel and the surrounding soft metal are substantially integral and therefore are inseparable.

Whichever material is employed, plastic or metal, it becomes so hard and tough that strain on the panel or sheet, which might pull it out from between the frame parts, is strongly resisted, without shearing, crumbling or breaking of the anchoring material, and the holding action is secure enough to bridge the gaps between rivets or bolts and prevent any separation whatsoever.

If the frame members **16** are affixed in a building structure, for instance such as shown in section in Figs. 3 and 5, and any deforming force is applied in a direction normal or parallel to the plane of the screen layer, such force will ordinarily be successfully resisted by the gripping effect of the frames **16** and rivets **18**. If the force is so great that the screen edge might normally be inclined to tear away around the edges, the wedge-shaped mass of anchoring material greatly increases the resistance of the screen material to forcible withdrawal against the wedge locking tendency.

Figs. 3 and 5 illustrate, for convenience and simplicity, four separate embodiments of the invention differing in certain details of assembly.

In Fig. 3 there are shown two structural units, indicated generally by reference numerals **20** and **21**. Unit **20** comprises a single screen panel **22**, shown in greater details in Fig. 6, and comprising a metallic screen **23** imbedded in a fireproof plaster material **24**, which preferably may be made up from a mixture of desiccated rock wool and asbestos fibre. The frame members of unit **20** are substantially rectangular in cross section except for the portions cut away at **25**, Fig. 3, to provide the outwardly opening flare. In unit **21** the flare effect is increased over that shown in Fig. 4, and is further supplemented by grooves **26** which accentuate the keying effect by providing an anchoring tendency against motion of the screen panel in both directions. In this unit also the unit has a laminated panel built up from two superposed fireproof layers. In either case, the anchoring material **19** may be a suitable hardening plastic material, or a low fusing point metal or alloy, as before.

In Fig. 5 two additional structural units are shown, and indicated generally by reference numerals **27** and **28**. The fireproof panel of unit **27** is a laminated construction comprising a layer of relatively coarse mesh screen **29**, between two layers of relatively finer mesh screens **30**. One or more of these layers carries a fireproof plaster layer or coating. The frame members **31** have a tapered exposed face **32** to provide a surface which retains no substantial dust particles and which may be readily cleaned. The panel of unit **28** is a laminated construction comprising a central sheet **33** of relatively coarse mesh, having on each face two superposed layers of relatively finer mesh screen, one or more of the layers carrying, or being impregnated with, a layer of fireproof material as described. As indicated by the drawing, the amount of taper or flare to the outer edge of the groove between the frame edges may be varied to suit the anticipated strain as determined by the specific application.

The retaining frame members are preferably of metal, especially when the anchoring material is a soft fusible metal, and also to secure the greatest possible strength in the structure generally. Since, however, the present invention may be found useful in various general applications, the frame members might be formed from wood, in which case the anchoring material may be a hardening plastic substance, or a hardening cement, or a low melting point metal or alloy might be used as an anchoring means, such alloys being available which have a melting point below the ignition point of wood. Alloys of lead, bismuth, cadmium and tin are available for this purpose, although I prefer to use molten lead in conjunction with metal frames.

Fig. 7 shows another embodiment of the inventive concept herein involved. In this embodiment I have used the grooved locking construction, such as is shown at **26** in Fig. 3, without the additional wedge lock of Fig. 3. Fig. 7 shows a panel **35** retained between frame members **36**. The gripping faces of the frame members are provided with longitudinal, opposed, grooves **37**. Molten solder, lead, cement, or other suitable material is injected into said grooves after the foraminous panel is gripped in the position shown in Fig. 7, and prior to solidification the locking material interpenetrates the perforations of the panel and the undercut grooves, freezing and hardening therein. Suitable gating apertures for the introduction of the locking material may be provided at locations spaced in accordance with the length of the frame members and other material factors as will be understood by those skilled in the art.

The invention described provides a panel structure or unit, including the foraminous sheet and the frame in which it is mounted, suitable for use either as a screen for window, door or other building openings, or for a portion of a wall or partition thereof, or even for use as a separating screen in screening machines, such as are used for sifting or separating pulverulent material. In all cases the screen or foraminous sheet is firmly, rigidly and more or less permanently anchored in the frame by simple means capable of application at low cost and providing a very durable screen for the purpose.

What I claim is:

1. A structural unit including two open frame members, a foraminous panel extending across the opening in said unit and having foraminous edge portions, and affixed, at said edge portions, between said members, the adjacent faces of said members having outwardly flaring edges defining a peripherally extending channel surrounding the said panel edge portions and opening outwardly, and retaining means for holding said panel edge between said frames comprising a low melting point metal filling strip fused into said channel and interpenetrating the foraminous edge portions of said panel.

2. The method of anchoring a foraminous panel in a supporting frame structure, comprising disposing an edge portion of said panel between two superposed rigid frame members having outwardly flared facing portions to provide therebetween a tapered channel surrounding the edge of said panel, securely fastening said frame members in fixed relationship, applying relatively soft fluent self-hardening filling material to said channel, and permitting said filling material to interpenetrate the foraminous edge portions of said panel and to harden in situ.

3. The method of anchoring a foraminous panel in a supporting frame structure, comprising disposing an edge portion of said panel between two superposed rigid frame members having outwardly flared facing portions to provide therebetween a tapered channel surrounding the edge of said panel, securely fastening said frame members in fixed relationship, and flowing molten metal into said channel so as to cause it to interpenetrate the apertures in said panel edge portion, and permitting said metal to solidify and thereby permanently anchor said panel edge in said frame structure.

4. In a building structure wherein the foraminous edge portions of a foraminous panel are firmly retained between juxtaposed rigid frame members, a method of increasing the gripping effect of said frame members on said panel edge portions comprising forming the adjacent gripping faces of said frame members to provide therebetween an outwardly flaring channel surrounding said panel edge portions, and filling said channel with molten metal at a temperature high enough so that said molten metal interpenetrates the foraminous panel edge, and, upon solidification, anchors said panel edge in said channel.

5. In a building structure wherein the foraminous edge portions of a foraminous panel are firmly retained between juxtaposed rigid frame members, a method of increasing the gripping effect of said frame members on said panel edge

portions comprising providing the adjacent gripping faces with undercut grooved portions, and introducing molten metal into the interstitial space between said frame members and into said undercut grooves in such a manner as to cause said molten metal to interpenetrate the foraminous edge portions of said panel and solidify therein and in said interstitial space and in said undercut grooves and thereby permanently anchor the panel in place.

6. A structural unit including two open frame members, a foraminous panel extending across the opening in said unit and having foraminous edge portions, and affixed, at said edge portions, between said frame members, the adjacent faces of said members having outwardly flaring edges defining a peripherally extending channel surrounding the said panel edge portions and opening outwardly, and relatively soft self-hardening filling material lying in the outwardly flaring portion of said channel and interpenetrating the foraminous edge portions of said panel.

HOWARD G. PILLSBURY.