Aug. 21, 1956 L. F. LONG 2,759,538

WINDOW SCREEN STRUCTURE

Filed Aug. 31, 1953 3 Sheets-Sheet 1

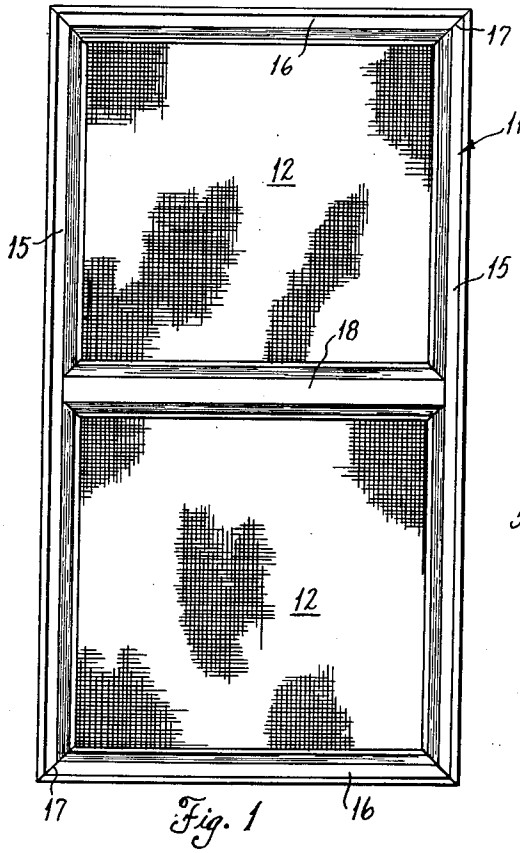
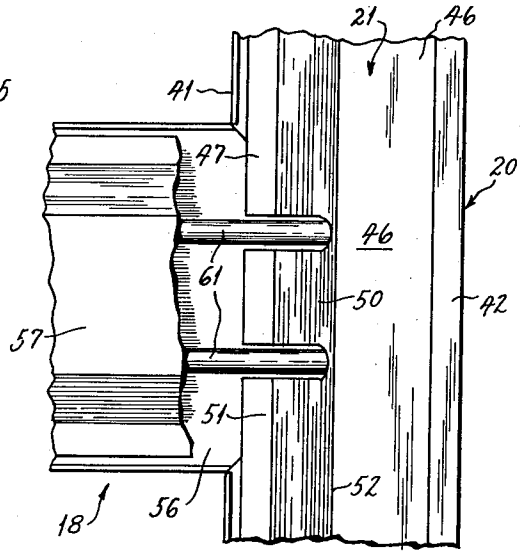


Fig. 1

Fig. 3



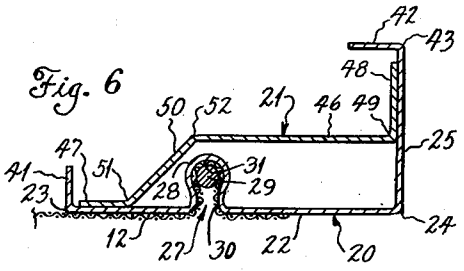


Fig. 6

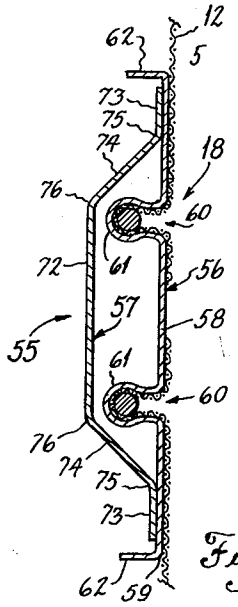


Fig. 8

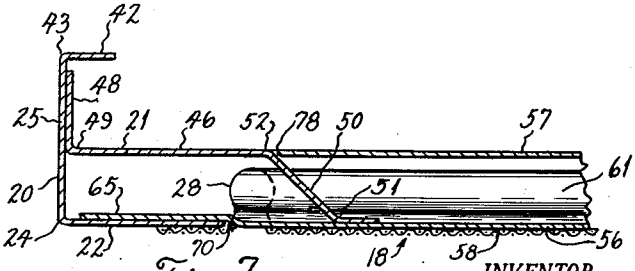


Fig. 7

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WINDOW SCREEN STRUCTURE

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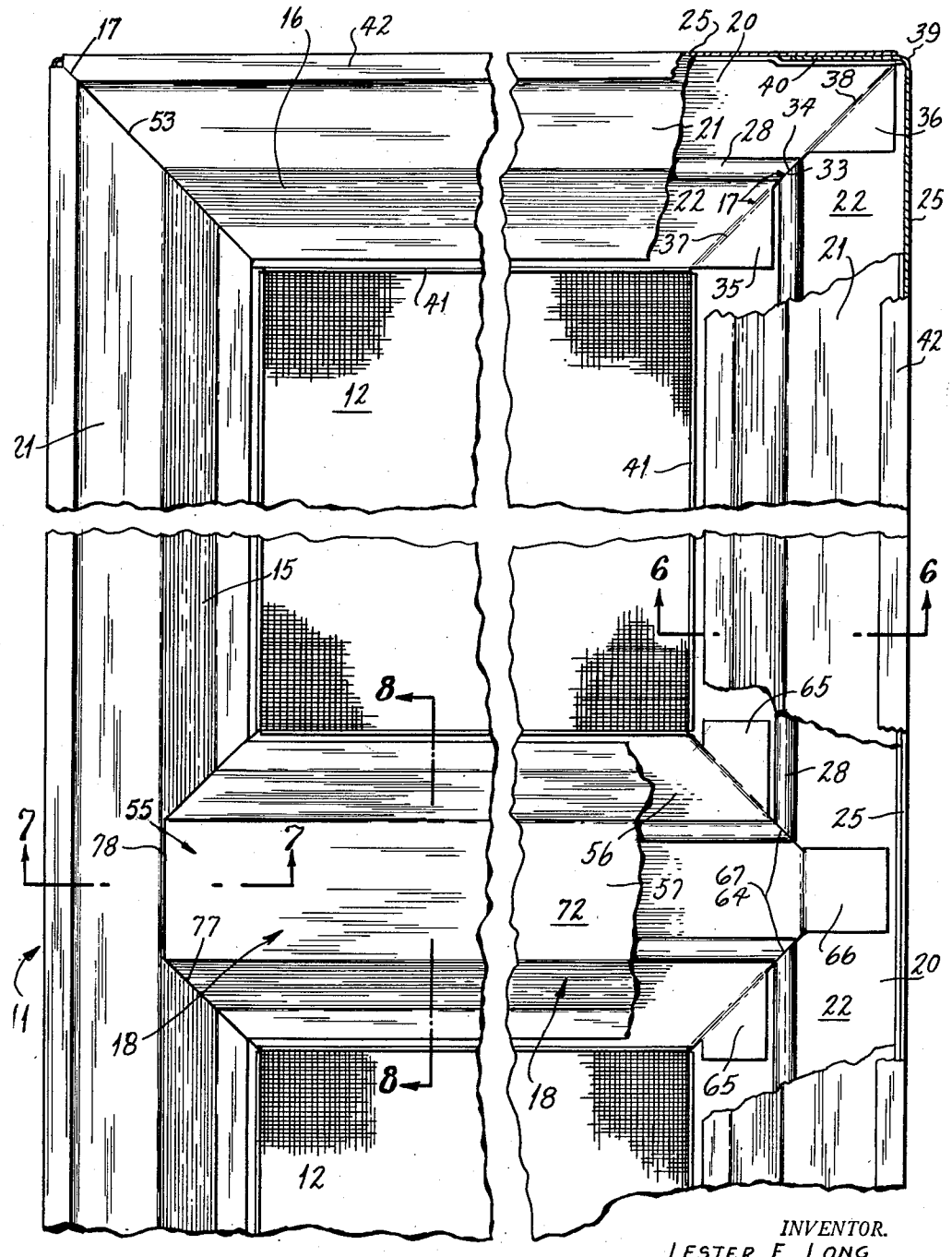


Fig. 2

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WINDOW SCREEN STRUCTURE

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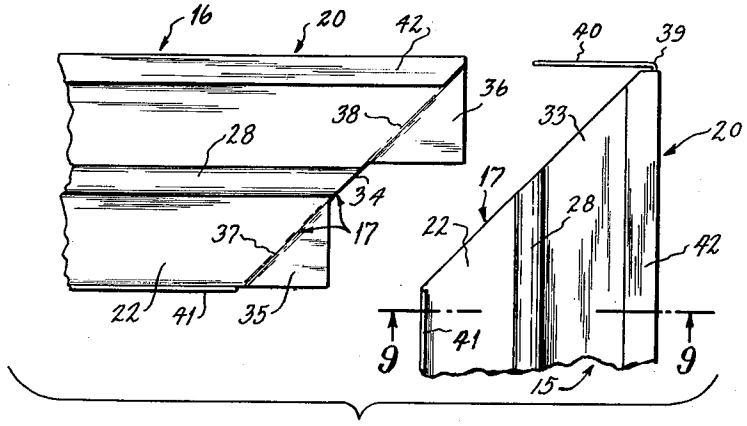


Fig. 4

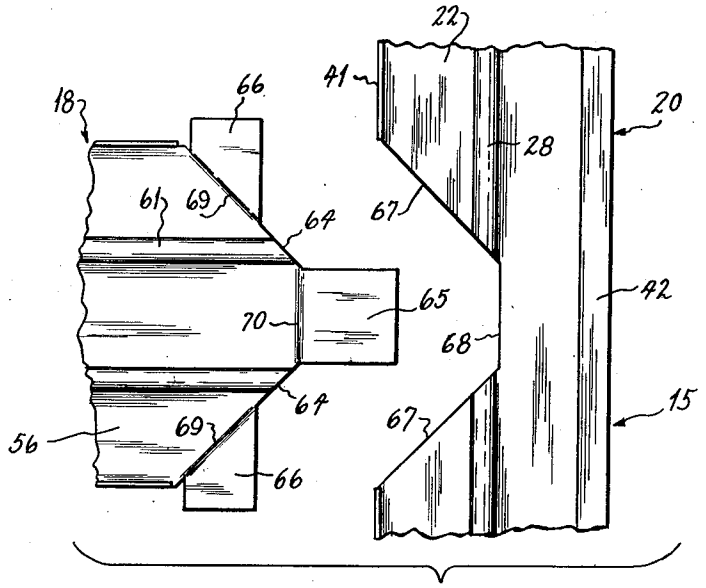


Fig. 5

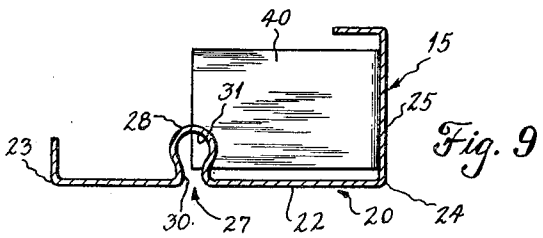


Fig. 9

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2,759,538

WINDOW SCREEN STRUCTURE

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Application August 31, 1953, Serial No. 377,737

4 Claims. (Cl. 160—379)

(Granted under Title 35, U. S. Code (1952), sec. 266)

The invention described herein may be manufactured and used by or for the Government of the United States of America for governmental purposes without the payment of any royalties thereon or therefor.

This invention pertains to the art of screens and the like for window openings that permit air passage through a window and prevent bugs and the like undesired things from entering, and in which a panel of screen fabric is secured at its edges to a frame that fits the window opening.

The present invention is directed to the structure of the screen, and particularly to structure of the frame and its means for securing the screen fabric to the frame.

Embodiment of the invention comprises side and end rails, and attachments between the several rails at their ends to form a rigid frame that borders the screen. Each rail comprises a body and a trim, both of sheet material, sheet metal being used which is formed by bending it to the desired contour. Each body and trim comprises a strip of the sheet material, which is formed to include several panels extending lengthwise and being arranged widthwise, the several panels being formed by bends between panels that extend throughout the length of the strip. Thus, no compound forming is required to form the material.

Each body comprises a face panel that extends widthwise to its edges constituting inside and outside edges of the frame border, the face panel of the body constituting a face of the screen frame. An edge panel projects laterally from the face panel along the outside frame edge thereof to the extent of the thickness of the screen frame, and constitutes the edge of the screen frame.

The means for securing the screen fabric to the frame is a holder included in each body, each holder also being formed by bends which extend continuously of the length of the strip. The holder of each body is contained in the face panel between inside and outside frame-edges, and comprises a trough extending throughout the length of the strip. The trough is depressed or projected into the surface of the face panel that forms the face surface of the screen frame, and projects out of the opposite surface of the body to constitute a ridge. The ridge projects away from the same side of the body as the edge panel, and thus becomes contained within the screen frame where it is covered and hidden by the trim.

The trim comprises a lengthwise face panel between opposite bordering or edge panels, which forms a face of the screen frame, the face panel being contoured in accordance with the desired contour of the corresponding face of the frame. The trim is adapted to be placed against the body of the ridge side thereof, with the bordering panels of the trim contacting the body continuously lengthwise face-to-face on respective opposite sides of the ridge. The bordering panels then are secured to the body along areas of contact by spot welding for example. The face panel of the trim is raised, whereby the trim bridges the fabric-holding ridge of the body which it covers, and which thereby is enclosed and hidden under the face panel

of the trim, it also adds stiffness to the rail and makes the frame more rigid.

The trough of the holder comprises a throat of predetermined width, and a base that is somewhat wider. An elongated insert fits into the throat of the trough, and is of a thickness which, including two thicknesses of the screen fabric, is a tight fit that must be forced through the throat. The insert, with a layer of screen fabric wrapped around it, fits snugly in the base of the trough. A piece of screen is applied to the frame on the trough side of the rail bodies, and with its edges along the troughs of the several rails. An insert is placed along the throat thereof to seat in the base. By means of this simple operation, the screen fabric is firmly secured along its edges to the frame, and the process of securing the screen fabric to the frame is quick and inexpensive.

The screen frame of the present invention is adapted to be assembled by the rapid and inexpensive process of spot welding.

Body and trim each of the several side and end rails are preferably made alike. Thus, a single set of dies for the body, and another set of dies for the trim, is sufficient to produce side and end rails. Body and trim strip are formed in suitable production lengths, and are cut to smaller lengths that are appropriate for side and end rails. The ends of side and end rail lengths of body and trim are cut on the bias to produce the frame with bevelled or angled corners. In the case of one or the other, or both, of the side and end rails, the ends are cut to include tabs that project beyond the line of bias cut, and these tabs overlap face-to-face onto companion surfaces of the next adjacent like side or end rail piece. Thus, with matched biased end-cuts of next-adjacent side and end rail pieces abutting, the tabs enable adjacent rails to be secured to each other at the corners of the frame by spot welds, which is preferred because of the quickness and low cost of the operation.

In the particular structure of the disclosure, the bodies of the several side and end rails are first attached to each other at the corners of the frame to complete the frame border. Thereafter, each side and end rail is completed by a corresponding trim being attached to its body. Trims of adjacent side and end rails are not secured directly to each other at the corners of the frame, and this lowers the cost of production.

The principles of the invention will be understood more fully from the accompanying drawings which show one practical embodiment thereof, and in which

Fig. 1 is an elevation facing a screen embodying the present invention,

Fig. 2 is an elevation of the screen of Fig. 1 on a greatly enlarged scale, and with parts broken away,

Fig. 3 is an elevation showing a detail of Fig. 2, with a break-away for clearness of illustration,

Fig. 4 is an exploded elevation, illustrating a step in the process of assembling the screen of Fig. 1,

Fig. 5 is an exploded elevation, illustrating another step in the process of assembling the screen of Fig. 1,

Fig. 6 is a cross-section, taken on line **6—6** of Fig. 2,

Fig. 7 is a cross-section, taken on line **7—7** of Fig. 2,

Fig. 8 is a cross-section, taken on line **8—8** of Fig. 2, and

Fig. 9 is a cross-section, taken on line **9—9** of Fig. 4.

A screen embodying the present invention comprises a frame, illustrated generally at **11**, Fig. 1, to which one or more areas **12** of screen fabric are attached at their edges.

Frame **11** consists of side rails **15** and end rails **16**, which are alike generally and are distinguished primarily by their respective positions in the frame. The side and end rails **15** and **16** are arranged to form the frame **11**, which borders the area of the screen, and are

attached to each other at their ends to constitute corners 17 of the frame.

Fig. 1 shows a full-length screen, so called, and comprises the additional cross rail 18, which extends from one to the other of the side rails 15, and is attached to each at its respective opposite ends. Two smaller areas of screen fabric 12 are secured to frame 11, respectively above and below the cross rail 18.

Each side rail 15 or end rail 16 consists of a body 20 and a trim 21, Figs. 2, 3, 6 and others. Frame 11 is made of sheet material, aluminum sheet being the material of the disclosed embodiment, and each body 20 and each trim 21 is made of a strip of the material and is formed to the desired contour by bending.

Each body 20 of either a side rail 15 or an end rail 16 comprises a lengthwise face panel 22, the surface on one side of which constitutes the face surface of one side of frame 11. Widthwise, the face panel 22 extends from the inner edge 23 to the outer edge 24, which edges correspond with the inner and outer edges of frame 11. In addition to face panel 22, the strip of body 20 comprises the edge panel 25, which extends, widthwise of the strip of body 20, beyond the outer edge 24 of face panel 22. Edge panel 25 extends continuously lengthwise of the strip, and it projects laterally away from face panel 22, by means of a bend along the line 24, to the extent of the thickness of frame 11, thereby constituting the outer edge of the frame.

A holder for the screen fabric 12 is embodied in the several bodies 20 of side and end rails 15 and 16 of frame 11. The holder comprises a trough 27 lengthwise of panel 22 between inner and outer edges 23 and 24. Trough 27 is projected into the face surface of face panel 22, and out of the opposite side to constitute the ridge 28. Edge panel 25 and ridge 28 project from the same side of the strip of face panel 22, and this structure positions the ridge 28 within the thickness of frame 11, where it is enclosed by the trim 21 in a manner to be described hereinafter.

As seen in Fig. 6, the trough 27 with its insert 29 constitutes a holder for screen fabric 12. Trough 27 comprises a throat 30, into which the insert 29 fits tightly, and a base 31, into which the insert seats snugly. Insert 29 constitutes a rod that extends along trough 27, and is cylindrical in the disclosed embodiment. The diameter of rod 29 plus two thicknesses of screen fabric 12 is slightly greater than the throat 20 of trough 27, and constitutes a force fit. Insert 29, with screen fabric 12 wrapped around it, is driven through the throat 30 into the base 31, where it fits tightly and holds the screen fabric 12 secured firmly in frame 11.

All the bodies 20 of the side and end rails 15 and 16 are alike. Body strip is made in convenient production lengths, and is cut into shorter lengths that are appropriate for side and end rails 15 and 16. The face and edge panels 20 and 25 are formed in a production length of body strip, by a bend at 24 that extends throughout the length of the production strip, and the trough 27 also is formed by lengthwise bends to extend throughout the length of the strip in a similar manner. Thus the bodies 20 of side and end rails 15 and 16 are made with a single set of dies, their structure also contributing to simple and low-cost assembly for reasons that will appear hereinafter. In addition, it will be observed that all the forming is done with simple, straight-line bends, thus eliminating the costly forming dies that are required for complex contours.

The side and end rail lengths of body strip 20 are cut on a 45° bias at their ends to form the bevelled or angled corners 17 seen in Figs. 1 and 2. The inner and outer edges 23 and 24 of adjacent bodies 20 of side and end rails 15 and 16 meet at the corners 17, as also the troughs 27. Thus, the complete holder for an area of screen fabric 12 is an endless trough 28 that extends all around the frame, and engages the fabric area along the edges of its four sides.

In the disclosed embodiment, body 20 of each side rail 15 is cut on the bias 33, as seen in Fig. 4, along each of its opposite end edges. Of end rails 16, the bodies 20 are cut on the bias 34, and the cut 34 abuts against the bias cut 33 of the adjacent side rail when the corner 17 is secured to assemble frame 11. The cut of each end edge of bodies 20 of end rails 16 also include the inner and outer tabs 35 and 36, which extend beyond the biased line 37, 38, of cut 34. Tabs 35 and 36 overlap corresponding surfaces of the adjacent side rail. The metal of tabs 35 and 36 is joggled along the line 37, 38, for close abutting relationship between cuts 34 and 33, and to position face panels 22 of side and end rails 15 and 16 in the same plane when tabs 35 and 36 engage in face-to-face relationship with corresponding surfaces of the face panel 22 of side rail 15. Spot welds in the areas of tabs 35 and 36 secure the corners 17, this method of assembly being preferred for its low cost and quick production.

Edge panels 25 in bodies 20 of side rails 15 are extended at their opposite ends, and are bent at 39 to form tabs 40, Figs. 4 and 9, which fit inside edge panels 25 of adjacent end rails 16, and in face-to-face engagement as seen in Fig. 2. Spot welds in the areas of tabs 40 completes the securing of side and end rails 15 and 16 to each other at the corners 17.

If greater rigidity of frame 11 is desired or required, additional inner and outer stiffener panels 41 and 42 may be added as shown.

Stiffener panel 41 is formed by a lengthwise bend along the inner edge 23 of face panel 22 and constitutes the inner edge of frame 11. Stiffener panel 42 is formed by a lengthwise bend along the edge 43 of edge panel 25. A production length of body strip is made with added width to provide added metal for the stiffener panels 41 and 42, which are formed by the bends along lines 23 and 43 as part of all the forming operations. Each stiffener panel 41 and 42 is projected laterally away from its next adjacent panel, 22 and 25 respectively, to the extent required for the desired stiffness.

It will be observed that stiffener panel 41, at the inner edge 23 of frame 11, provides added stiffness through the thickness of the frame, and stiffener panel 42, being at right angles to panel 41, provides stiffness to its rail in the direction face-wise of the frame. The result is added stiffness two-dimensionally.

By the method described hereinbefore, the entire border of frame 11 is completed by the proximate ends of bodies 20 of side and end rails 15 and 16 being secured to each other at corners 17 by means of spot welds in the areas of tabs 35, 36 and 40. Bodies 20 only complete the border of frame 11. Under preferred practice, trims 21 are secured to their respective bodies 20 later, in a manner that will be described hereinafter, and the trims 21 are not secured directly to each other at the corners 17, excepting by the bodies 20 being attached to each other by means of tabs 35, 36 and 40.

A trim piece 21 comprises a strip of the material formed to comprise a face panel 46 between opposite inner and outer securing panels 47 and 48 extending continuously widthwise of the strip, the securing panels 47 and 48 constituting bordering panels of the strips that form trims 21.

Trim 21 is secured to body 20 to form the face of frame 11 opposite the face that constitutes face panel 22 of the body. Each trim piece 21 comprises a face panel 46 between opposite securing panels 47 and 48 extending continuously widthwise.

Trim 21 also is formed in convenient production lengths, and is cut into shorter lengths that are appropriate for trim of side and end rails 15 and 16. The several panels 46, 47 and 48 are formed to extend throughout the production length of a strip of trim 21.

The face panel 46 of trim 21 forms the face of frame 11 that is opposite the face that constitutes the face panel 22 of body 20. Face panel 40 is raised to bridge the ridge 28 of body 20, which it covers and hides. Securing panels 47 and 48 are formed to engage each a companion panel of body 20, the several companion panels of the body being on respective opposite sides of ridge 28.

As seen in Fig. 6, outer securing panel 48 is formed to engage the inside surface of edge panel 25 of body 20, which it contacts face-to-face continuously along its length, the contact along edge panel 25 being along its length adjacent to the outer stiffener panel 42 of the body. Securing panel 48 is formed by the bend along the outer edge 49 of face panel 46, the bend being at right angles and sufficient to raise face panel 46 above the ridge 28 of body 20.

Inner securing panel 47 is formed to engage the side of body 20 opposite the face surface of frame 11 provided by the body 20, engagement being along the trim and face-to-face with a companion surface of face panel 22 adjacent to inner stiffener panel 41 as seen in Fig. 6. The inclined panel 50 between face panel 46 above the securing panel to be over ridge 28, and is formed by the reversely directed bends 51 and 52.

Trim 21, with its securing panels 47 and 48 positioned in face-to-face engagement with body 20 as seen in Fig. 6, is secured to the body by spot welds along the securing panels 47 and 48.

Trim pieces 21 are cut diagonally along both end edges at 53, Fig. 2, and are secured to their respective corresponding bodies 20 after the several bodies have been secured to each other at the corners 17 as hereinbefore described to border the frame. Diagonally cut 53 of proximate ends of adjacent side- and end-rail trims 21 abut against each other, and the trims are held in frame 11 by each being secured to its corresponding body 20. Adjacent trims 21 are not secured directly to each other.

The screen of the disclosure is full length, and comprises two areas of screen fabric 12, instead of a single panel to cover the entire area of the frame 11. Cross rail 55, Figs. 1 and 2, is positioned between opposite end rails 16, and is secured at its opposite ends to opposite side rails 15.

Cross rail 55, Fig. 8, also consists of a body 56 and a trim 57, respectively corresponding with the body 20 and trim 21 of the side and end rails 15 and 16. Body 56 and trim 57 are formed each of strip in convenient production lengths, and are cut to appropriate lengths for cross rail pieces 55.

Body 56, Fig. 8, is formed to comprise a face panel 58 extending widthwise to opposite edges 59. Face panel 58 is formed to comprise two troughs 60 adjacent each other and between the edges 59 of the panel. Both troughs 60 are projected into the surface of one side of body 56 that corresponds with a face of the screen frame 11, and project from the opposite side of body 56 to constitute ridges 61. Each trough 60 and its ridge 61 is formed the same as troughs and ridges 27 and 28 of side and end rail body 20, and form a matching fit as will be seen hereinafter.

The widthwise distance between each trough 60 and its adjacent edge 59 is the same as between a trough 27 and its adjacent inner edge 23 of body 20. The structure along each edge 59 of a body piece 56 of cross-rail 55 is the same as, and matches, the face panel 22 of body 20 of side and end rails 15 and 16 along an inner edge 23.

Accordingly, body 56 is formed with a stiffener panel 62 along each edge 59, which projects from the same side of the body as ridges 61, stiffener panels 62 each being the same as, and matching, inner stiffener panel 41 of body 20 for side and end rails 15 and 16.

As seen in Fig. 5, each end edge of a cross-rail body

56 is cut with 45° bias 64 on each side, with the tab 65 projecting from the end of the piece at its widthwise center. Additional tabs 66 project beyond the lines of the biases 64 with one along each. At the point where cross rail 55 is to be joined to a side rail 15, body 20 of the side rail is notched to comprise two bias cuts 67 that match the respective bias cuts 64 of cross-rail 55, and is provided with the lengthwise cut 68 between them. The metal is joggled along the lines of bias cuts 64, and similarly along the line 70 at the location of tab 65.

Tab 65 overlaps body 20 of side rail 15 on one side of ridge 28, and on the other side of the ridge the tabs 66 overlap the body, the tabs 65 and 66 bearing against body 20 face-to-face and being secured thereto by spot welds. In this manner, the cross-rail 55 is secured at its ends to the side-rails 15, as seen in Figs. 1 and 2. Joggles 69 and 70 permit bias cuts 64 of body 56 to abut against bias cuts 67 of body 20, and position the face panels 58 and 22 in a common plane to constitute one face of the frame 11.

It will be observed that each trough 60 meets a trough 27 of side panel 15 end to end, and forms two continuous troughs around respective frame areas above and below cross-rail 55, for securing the edges of two areas of screen fabric 12 to frame 11 as seen in Figs. 1, 2 and 8.

The trim 57 of cross-rail 55 is formed to comprise face panel 72 between securing panels 73 along respective opposite edges and distributed widthwise. Trim 57 is formed in both directions widthwise to match trim 21 along inner edges. The face panel 72 bridges both ridges 61 of body 56 on respective opposite sides of both ridges and adjacent to the respective stiffener panels 62, a seen in Fig. 8. The inclined panels 74, formed by oppositely directed bends 75 and 76, are disposed one between each securing panel 73 and the face panel 72, and raise the face panel 72 above ridges 61 as seen in Fig. 8.

Trim 57 of cross-rail 55 is not secured directly to trim 21 of side rail 15, but is attached thereto by being secured to its body 56 by spot welds along the securing panels 73. The end edges of trim 57 are cut to include the bias cuts 77, Fig. 2, that bear against the inclined panel 50 of side-rail trim 21, between the squared cut 78 that lies adjacent to the bend 52 as seen more clearly in Fig. 7.

As seen most clearly in Fig. 3, body 56 of cross-rail 55 is first secured at its ends to body 20 of side rail 15. Trim 21 is then secured to body 20 of side rail 15, and trim 57 is thereafter secured to body 56 of cross-rail 55 to complete assembly of the frame.

The finished structure is seen in Fig. 1, and more in detail in Fig. 2.

The disclosed structure is one practical embodiment only of the invention.

What is claimed is:

1. In a structure for screens, a frame and a panel of screen fabric held thereby, the frame comprising side and end rails bordering the area of the screen, each rail constituting a body and a trim both formed of sheet material, each body constituting a strip of the material formed continuously widthwise to comprise a face panel of the frame and an edge panel of the screen, each face panel of a body extending widthwise to the inner and outer edges of the frame border and comprising a holder for the screen fabric extending lengthwise of the face panel between its inner and outer frame edges, each holder comprising a trough projected into the side of the face panel that constitutes the face of the frame and projected as a ridge out of the opposite side of the face panel, the edge panel projecting laterally from the face panel on the ridge side thereof to the extent of the thickness of the frame, each trim being positioned on the ridge side of its corresponding body and being formed of a strip of the material continuously widthwise to comprise a securing panel along each of the edges of the strip and a face panel between the securing panels, the securing panels engaging the body face-to-face on respective opposite sides of the

ridge and being secured to the body along their lengths, the face panel of the trim being raised to bridge the ridge of the body, the several rails being positioned end-to-end to form the frame continuously along the border of the screen, and being secured to each other at their ends.

2. In a structure as defined in claim 1, each body comprising a stiffener panel extending lengthwise along each of the edges of its strip and projecting laterally away from its next adjacent panel.

3. In a structure for screens, a frame and a panel of screen fabric held thereby, the frame comprising side and end rails bordering the area of the screen, each rail constituting a body and a trim both formed of sheet material, each body constituting a strip of the material formed continuously widthwise to comprise a face panel of the frame and an edge panel of the screen, each face panel of a body extending widthwise to the inner and outer edges of the frame border and comprising a holder for the screen fabric extending lengthwise of the face panel between its inner and outer frame edges, each holder comprising a trough projected into the side of the face panel that constitutes the face of the frame and projected as a ridge out of the opposite side of the face panel, the edge panel projecting laterally from the face panel on the ridge side thereof to the extent of the thickness of the frame, the several bodies being positioned end-to-end to form the frame border continuously and being secured to each other at their ends, each trim being positioned on the ridge side of its corresponding body and being formed of a strip of the material continuously widthwise to comprise a securing panel along each of the edges of the strip and a face panel between the securing panel, the securing panels engaging the body face-to-face on respective opposite sides of the ridge and being secured to the body along their lengths, the face panel of the trim being raised to bridge the ridge of the body.

4. In a structure as defined in claim 3, a cross rail between the end rails and extending lengthwise from side rail to side rail, the cross rail comprising a body and a trim each formed of a strip of the sheet material, the body of the cross rail comprising a face panel and a holder for the screen fabric extending lengthwise of the face panel between the edges of the cross-rail body, the holder of the cross rail comprising a trough projected into the side of the face panel that constitutes the face of the frame and projected as a ridge out of the opposite side of the face panel, the cross-rail body being secured to the opposite side-rail bodies at its respective opposite ends, the cross-rail trim being positioned on the ridge side of the cross-rail body and being formed of a strip of the material continuously widthwise to comprise a securing panel along each of the edges of the strip and a face panel between the securing panels, the securing panels of the cross-rail trim engaging the cross-rail body face-to-face on respective opposite sides of the ridge and being secured to the body along their lengths, the face panel of the cross-rail trim being raised to bridge the ridge of the cross-rail body.

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