United States Patent [19]

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[45] **Oct. 30, 1973**

[54] **FIRE DAMPER FRAMES**

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[73] Assignee: **Advanced Air Inc.**, Philadelphia, Pa.

[22] Filed: **Aug. 20, 1971**

[21] Appl. No.: **173,596**

[52] **U.S. Cl.** **52/658**, 52/1, 160/381

[51] **Int. Cl.** **F23l 13/10**

[58] **Field of Search** ..... 160/381; 287/189.36 D, 20.92 J, 20.92 H, 20.92 D, 189.36 H; 52/317, 475, 656, 631, 658

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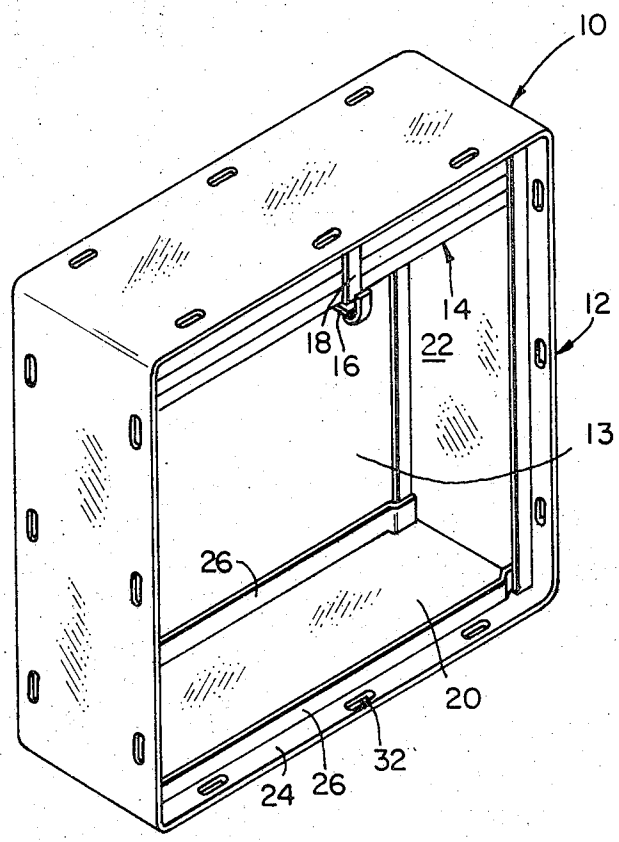
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Assistant Examiner—Carl D. Friedman
Attorney—Karl L. Spivak

[57] **ABSTRACT**

A fire damper frame of folded one piece construction having a centrally open transverse cross section formed from a unitary blank having cooperable interlocking means adjacent opposite ends for rigidly securing the fire damper frame in folded condition. The blank, in unfolded form, has a main planar central web portion disposed between parallel, longitudinally extending side peripheral mounting regions of substantially double blank thickness, and a pair of longitudinally extending, spaced, parallel upstanding flanges disposed at substantially right angles from an inner surface of the main planar central web portion and terminating at longitudinally extending outer edges. Each flange includes longitudinally spaced relief regions defining separate flange sections, each relief region in one flange being in transverse alignment with a corresponding region in the other flange. Each relief region comprises a slit extending from the outer edge of its respective flange in an inward direction for substantially the entire outward extent of the flange, and a portion of at least one of the flange sections adjacent each slit is disposed transversely out of the general plane of the longitudinally extending flange. Adjacent flange sections of each respective flange overlap to form frame corners when the frame is folded through the relief regions transverse to the elongate dimension of the blank to form a substantially continuous peripherally extending channel.

2 Claims, 8 Drawing Figures



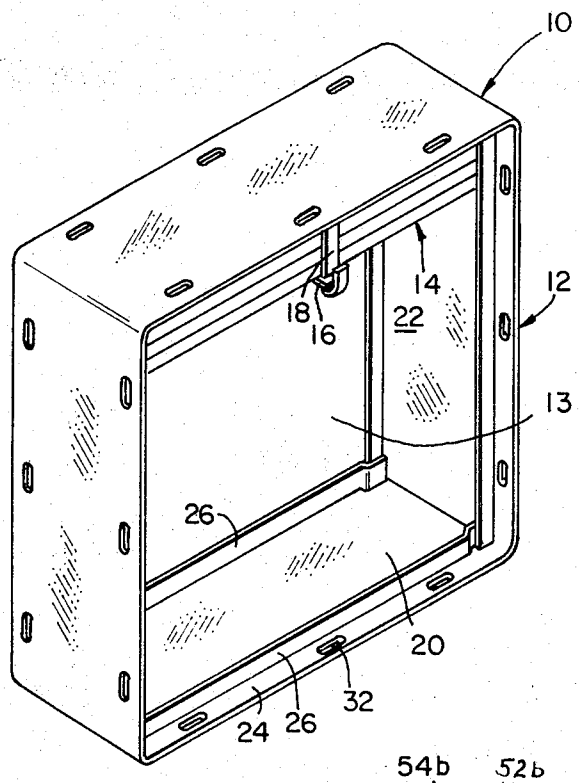


FIG. 1

FIG. 8

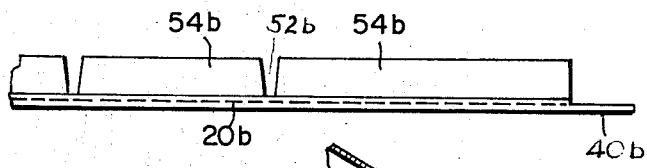
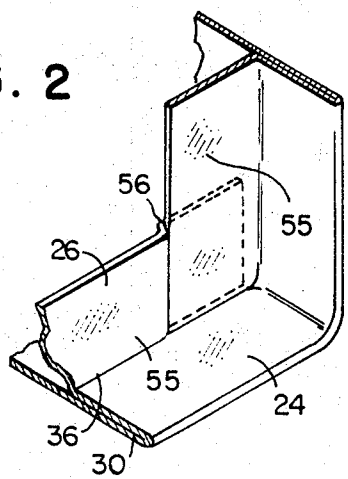


FIG. 2



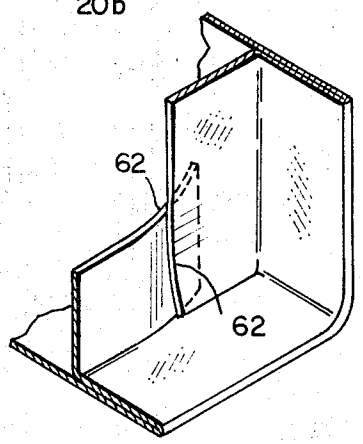


FIG. 3

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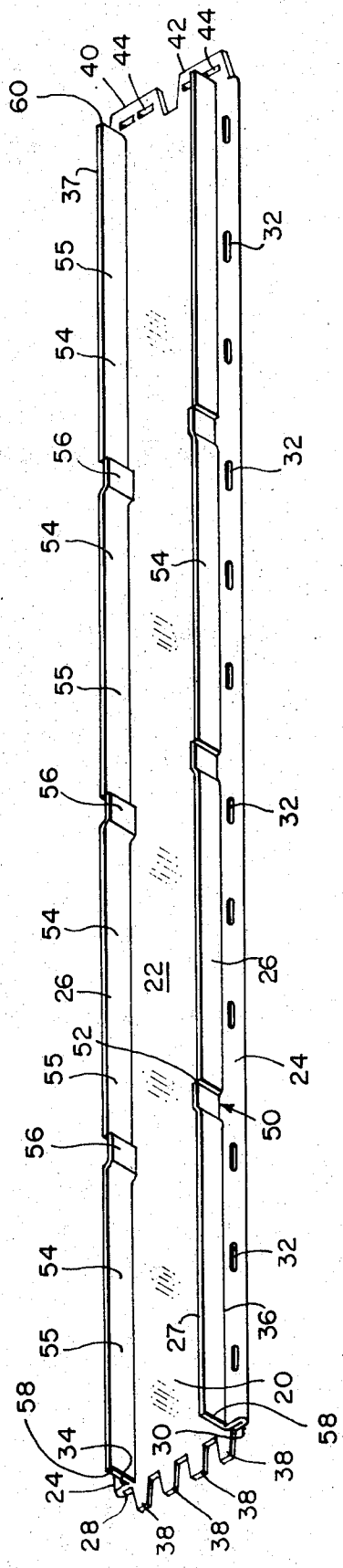


FIG. 4

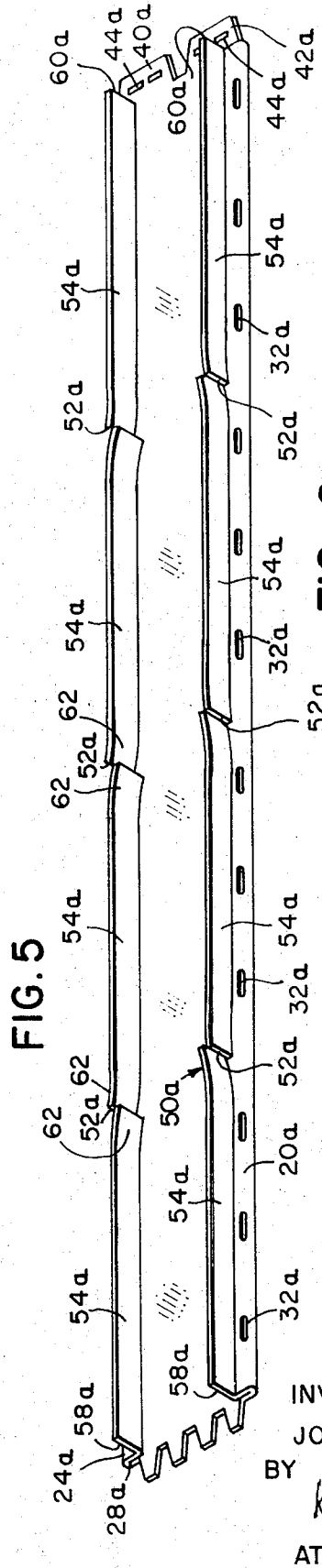


FIG. 5

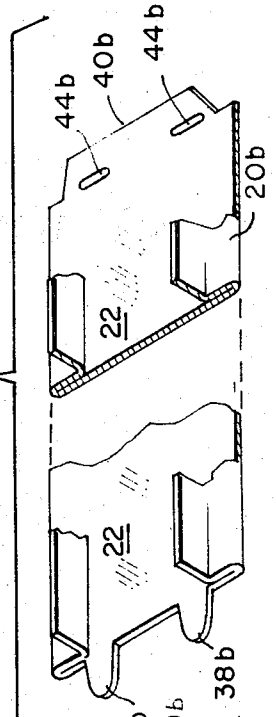


FIG. 6

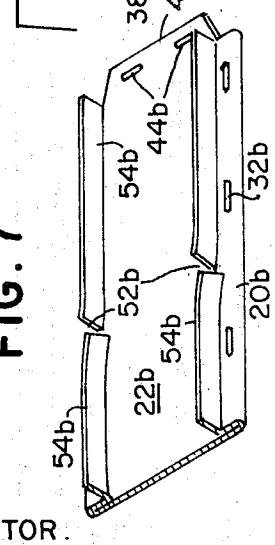


FIG. 7

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FIRE DAMPER FRAMES

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to fire damper structures and more particularly relates to a unique one piece fire damper frame in which a stack of reversely folded, interlocking blades is mounted to define a curtain for closing a central opening defined by the fire damper frame.

2. Description of the Prior Art

Fire damper frames of one piece construction are known in the prior art, as exemplified by U. S. Pat. No. 3,327,766. These frames are adapted for installation in air delivery systems, such as duct structures, and define a centrally open transverse cross section which is automatically closed by a plurality of hingedly interfitted metal blades upon occurrence of elevated temperatures within the duct. Fire dampers normally are employed as fire barriers within air ducts extending into adjacent fire separated areas and are required to close these air ducts in the event of a fire to prevent the fire from spreading into adjacent fire separations. Therefore, fire dampers must form a substantially air tight system to prevent the spread of fire, and must meet rigid specifications defined in appropriate Underwriters Laboratories publications and other similar standards.

The one piece fire damper frame disclosed in U.S. Pat. No. 3,327,766, is formed from a longitudinally extending blank having a central web disposed between transversely spaced, upstanding flanges, and a pair of peripheral mounting regions. The upstanding flanges are of substantially double blank thickness, and have longitudinally spaced V-shaped notches formed therein to form relief regions through which the blank is folded into its closed frame construction. Opposite ends of the longitudinally extending blank are provided with a plurality of transversely spaced, longitudinally extending fingers. The fingers at one end are disposed to interdigitate with the transverse space between the fingers at the other end so as to form an interlocking structure for maintaining the fire damper frame in its closed condition. In folded condition, inclined edges defined by each V-shaped notch abut each other such that the transversely spaced flanges, in conjunction with the central web, define inwardly directed channels which cooperate with the interlocking blades forming the curtain to close the opening defined by the fire damper frame in the event of a fire. The peripheral mounting regions are of single blank thickness, and have openings therein to permit attachment of the fire damper frame within an air delivery system, such as a duct structure.

The above described fire damper frame has several structural inadequacies. The butted inclined edges defined at each V-shaped notch forms a frame corner which does not aid in providing transverse, or lateral support for the fire damper frame. Furthermore, the interdigitated fingers which form the locking means for retaining the fire damper frame in closed condition may become loosened and thereby cause the frame to partially open and thereby fail to properly cooperate with the interlocking blades of the curtain to form a substantially air tight structure in the event of fire. The longitudinally extending peripheral mounting regions are of single stock thickness and are not of an optimum

rigid construction for attachment to the walls defining an air duct. In addition, the transversely spaced, upstanding flanges are of double stock thickness and are formed by an intricate folding operation which reduces the speed of manufacture of such fire damper frames, and thereby increased the cost of such manufacture.

SUMMARY OF THE INVENTION

The folded one piece fire damper frame of this invention has a centrally open transverse cross section formed from a longitudinally extending, unitary blank. The unitary blank, in unfolded form, is defined by a main planar central web portion disposed between transversely spaced apart longitudinally extending side peripheral mounting regions of substantially double blank thickness, and a pair transversely spaced apart longitudinally extending parallel flanges of single stock thickness disposed inwardly of the side peripheral mounting regions. Each flange extends outwardly at a substantially right angle to an inner surface of the main planar web portion and terminates at a longitudinally extending outer edge. Longitudinally spaced apart relief regions are formed in each flange to define separate flange sections, and each relief region in one flange is in substantial transverse alignment with a relief region in the other flange to define transverse fold lines about which the unitary blank is folded to form the fire damper frame. Each relief region is defined by a slit extending from the outer edge of its respective flange in an inward direction for substantially the entire outward extent of the flange. At least one of the flange sections adjacent each slit is disposed transversely out of the general plane of the longitudinally extending flange so that adjacent flange sections will overlap to define frame corners when the blank is folded into its fire damper frame configuration. The overlapping flange sections cooperate with the main planar central web portion to define a substantially continuous peripherally extending channel within the blank. One longitudinal end of the blank has transversely spaced fingers extending therefrom which cooperate with slits at the opposite longitudinal end to form an interlocking construction to maintain the fire damper frame in its folded condition.

The peripheral mounting regions of double blank thickness are extremely rigid, and can therefore be secured directly to the walls defining an air duct without any resulting distortion of the fire damper frame. The overlapping flange sections defining each frame corner add a high degree of lateral stability to the fire damper frame, and assures that a substantially continuous peripherally extending channel will be maintained in the fire damper frame. In the prior art unitary fire damper frame disclosed in U. S. Pat. No. 3,327,766, any transverse misalignment between flange sections at a frame corner caused a discontinuity in the peripherally extending channel to thereby create undesireable air gaps. The unique cooperation between the fingers at one longitudinal end of the blank with the slits formed at the longitudinal end of the blank provide a positive locking means for preventing the opening of the fire damper frame. In the event the fingers are slightly opened, i.e., bent out of engagement with the outer surface of the blank, the fingers will still be supported by marginal walls defining the slits to prevent the folded, fire damper frame of this invention from opening up in an undesirable manner.

It is therefore an object of this invention to provide an improved folded, one piece fire damper frame substantially as set forth above.

It is a further object of this invention to provide a folded, one piece fire damper frame having a rigid peripheral mounting region of substantially double blank thickness.

It is a further object of this invention to provide a folded, one piece fire damper frame having interlocking means for preventing said fire damper frame from partially opening during use.

It is a further object of this invention to provide a folded, one piece fire damper frame having overlapping adjacent flange sections defining each frame corner to enhance the lateral stability of said fire damper frame.

It is a further object of this invention to provide a folded, one piece fire damper frame which is inexpensive to manufacture, and reliable in operation.

Other objects and a fuller understanding of the invention will be had by referring to the following description and claims of the preferred embodiment thereof, taken in conjunction with the accompanying drawings wherein like reference characters refer to similar parts throughout the several views and in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric view of a fire damper employing a folded one piece fire damper frame according to this invention.

FIG. 2 is a fragmentary, isometric view showing details of a corner construction of the folded, one piece fire damper frame shown in FIG. 1.

FIG. 3 is a fragmentary, isometric view of a modified corner construction of a folded, one piece fire damper frame according to this invention.

FIG. 4 is an isometric view of a unitary blank from which the folded, one piece fire damper frame of FIG. 1 is constructed.

FIG. 5 is an isometric view of a unitary blank from which the folded, one piece fire damper frame having the modified corner construction shown in FIG. 3 is formed.

FIG. 6 is an isometric view of a unitary blank showing a modified locking arrangement for maintaining the fire damper frames according to this invention in folded condition.

FIG. 7 is a partial, isometric view of a unitary blank showing a second modified fire damper frame corner construction.

FIG. 8 is a partial, elevational view of the unitary blank of FIG. 7.

DESCRIPTION OF THE PREFERRED EMBODIMENTS OF THE INVENTION

Although specific terms are used in the following description for the sake of clarity, these terms are intended to refer only to the particular structures of my invention selected for illustration in the drawings, and are not intended to define or limit the scope of the invention.

Referring to FIG. 1, a fire damper unit 10 employing a folded, one piece fire damper frame 12 of this invention is shown. The fire damper frame 12 is adapted to be secured in air delivery systems, such as duct structures, and has a centrally open transverse cross section 13. A blade or slat assembly 14 is comprised of a stack reversely folded, continuous, interlocked blades which define a curtain for closing the open area 13 in the event of fire. The interlocked blades forming the blade assembly 14 do not form a part of the present invention, but preferably are of the type disclosed in U. S. Pat. No. 3,273,632, the subject of which is hereby incorporated by reference. A fusible link 16 is disposed in underlying relationship with the lower-most blade of the blade assembly 14, and is fixedly secured to a pair of cinch straps 18 (only one of which is shown in FIG. 1). The fusible link 16 is comprised of a low temperature fuse metal which melts when exposed to temperatures encountered when a fire occurs to thereby permit the blade assembly 14 to open by gravity or otherwise to close the open area 13. If desired, positive acting spring means can be secured to the blade assembly 14 to positively close the blade assembly to close the open area 13. This latter mentioned construction is particularly desirable when the fire damper unit 10 is disposed in a horizontal plane within a duct structure.

Referring now to FIGS. 1, 2, and 4, a fire damper frame 12 according to this invention will now be described. The fire damper frame 12 is formed from a longitudinally extending, unitary sheet metal blank 20. The blank 20 has a main planar central web portion 22 disposed between a pair of transversely spaced, longitudinally extending side peripheral mounting regions 24 and a pair of transversely spaced, longitudinally extending parallel upstanding flanges 26. The peripheral mounting regions 24 are of substantially double blank thickness and are formed by folding side regions of the sheet metal stock through substantially 180° along elongate fold lines 28 and 30 respectively. A plurality of mounting holes 32 are formed in the peripheral mounting regions 24 to permit attachment of the fire damper frame 12 to the walls defining air delivery systems, such as duct structures. Marginal sections of the folded side regions are provided with a reverse bend of substantially ninety degrees along elongate fold lines 34 and 36, respectively, to define the upstanding flanges 26. The upstanding flanges terminate in longitudinally extending outer edges 37.

One longitudinal end of the metal blank 20 is provided with a plurality of transversely spaced fingers 38 which are formed by any suitable operation such as punching or die cutting, and the outer fingers extend at least partially in longitudinal alignment with the peripheral mounting regions 24. The opposite longitudinal end of the metal blank 20 is provided with a pair of tab extensions 40, 42. Elongate transverse slits 44 are formed at the junction of the tab extensions 40 and 42 with the main planar central web portion 22. The slits 44 are in longitudinal alignment with the fingers 38, whereby the fingers will be disposed within the slits when the unitary sheet metal blank 20 is folded to form the fire damper frame 12, as shown in FIG. 1.

Referring to FIG. 4, each upstanding flange 26 is provided with longitudinally spaced, identical, relief regions 50 defined by a slit or die cut 52 which separates each upstanding flange 26 into separate flange sections 54. Each relief region 50 in one of the upstanding flanges 26 is in transverse alignment with a relief region 50 in the other flange 26 to define transverse fold regions along which the unitary sheet metal blank 20 is folded to form the fire damper frame 12. Each flange section 54 has a body region 55, and a lance region 56 which is disposed out of the general plane of the body region 55. Each lance region 56 is disposed adjacent a

body region 55 of an adjacent flange section 54 to permit overlapping of adjacent flange sections when the sheet metal blank 20 is bent through the relief regions to form the desired fire damper frame (FIG. 2). End margins 58 and 60 of each flange 26 are not provided with lance regions, but are sufficiently flexible to be forced out of their general plane to overlap when the fire damper frame 12 is formed.

Referring to FIG. 5, a modified unitary sheet metal blank 20*a* will be described. The blank 20*a* differs from the sheet metal blank 20 in the specific construction of relief regions 50*a*. In all other respects the blank 20*a* is identical to the blank 20 shown in FIG. 4. The relief regions 50*a* are defined by die cuts 52*a* which define individual flange sections 54*a*. The flange section 54*a* adjacent each die cut are curved out of the general plane of the initially formed continuous flange, as indicated at 62, in opposite directions from the elongate center line of the undeformed continuous flange, whereby adjacent flange sections overlap as shown in FIG. 3 to define the frame corners of a formed fire damper frame 12.

Referring to FIG. 6, a modified locking arrangement is shown for maintaining a formed fire damper frame in its formed condition. The interlocking structure shown in FIG. 6 includes two transversely spaced fingers 38*b* at one longitudinal end of the sheet metal blank and a single tab 40*b* at the opposite longitudinal end of said sheet metal blank. Transversely spaced elongate slits 44*b* are formed at the junction between the tab extensions 40*b* and the main planar central web portion 22 to cooperate with the transversely spaced fingers 38*b* in retaining the fire damper frame 12 in its formed condition. The fingers 38*b* are disposed through the elongate slits 44*b* and are then bent at substantially a 90° angle to overlie the outer exposed surface of the fire damper frame 12 in the manner shown in FIG. 1. The locking arrangement shown in FIG. 6 can be utilized with either a unitary sheet metal blank having relief regions 50 as shown in FIG. 4, or relief regions 50*a* as shown in FIG. 5.

The overlapping flange sections in the fire damper frames of this invention define frame corners which add lateral rigidity to said fire damper frames, and which provide substantially continuous peripherally extending channels for cooperating with the blade assembly 14 to adequately assure that a substantially air tight system is created in the event of fire. The peripheral mounting regions 24 of double thickness are extremely rigid and provide reliable means through which the fire damper frame 12 can be secured to the walls of a suitable duct structure without distorting said fire damper frame. The unique cooperation between the fingers at one end of the sheet metal blank and the elongate slits at the opposite end of said blank provides positive assurance that the fire damper frame will not open, even if the fingers tend to bend out of engagement with the outer exposed surface of said fire damper frame.

Referring now to FIGS. 7 and 8, I show a second modified unitary sheet metal blank 20*b*. The blank 20*b* differs from the sheet metal blank 20 in the specific construction of the V-shaped notches 52*b*. The V-shaped notches 52*b* cut entirely through the initially formed, continuous flanges to define adjacent flange sections 54*b*. The portions of the flange sections 54*b* immediately adjacent each V-shaped notch 52*b* bend respectively alternately slightly inwardly and outwardly from the general plane of the initially formed continuous flange, whereby adjacent flange sections overlap in the manner illustrated in FIG. 3 to define the frame corners of a formed fire damper frame 12.

I claim:

1. In a folded, one piece fire damper frame having a centrally open transverse cross section formed from a longitudinally extending unitary sheet metal blank, the combination of

A. a longitudinally extending, planar, central web portion,
   1. said web portion being of single blank thickness;
B. a pair of transversely spaced, longitudinally extending, peripheral mounting regions,
   1. said blank being longitudinally bent to define the mounting regions,
   2. said mounting regions being of double blank thickness to provide increased peripheral strength for fire damper mounting purposes;
C. a pair of transversely spaced, longitudinally extending, parallel flanges disposed inwardly of the side peripheral mounting regions,
   1. a plane through said flanges extending at right angles to a plane drawn through the web portion,
   2. said flanges being formed of single blank thickness;
D. a plurality of longitudinally spaced relief regions formed in each flange,
   1. each relief region in one flange being in transverse alignment with a relief region in the other flange,
   2. each relief region comprising a slit extending the entire height of the flange to define adjacent right and left flange sections,
   3. at least one of the right and left flange sections adjacent each slit being curved out of the general plane drawn through the flange to form right or left curved regions,
   4. each right curved region curving in a first direction from the plane through the flange and each left curved region curving in second direction from the said plane, said second direction being opposite the first direction,
   5. the said frame being folded through the relief regions transversely to the length of the blank to form frame corners.

2. The invention of claim 1 wherein the right and left curved regions curve away from the said plane a distance sufficient to permit the respective right and left curved regions to overlap when the frame is folded through the relief regions.

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