Dec. 7, 1965 L. L. SMITH ETAL 3,221,636

LOUVERED VENTILATOR

Original Filed Jan. 26, 1961

Fig. 1

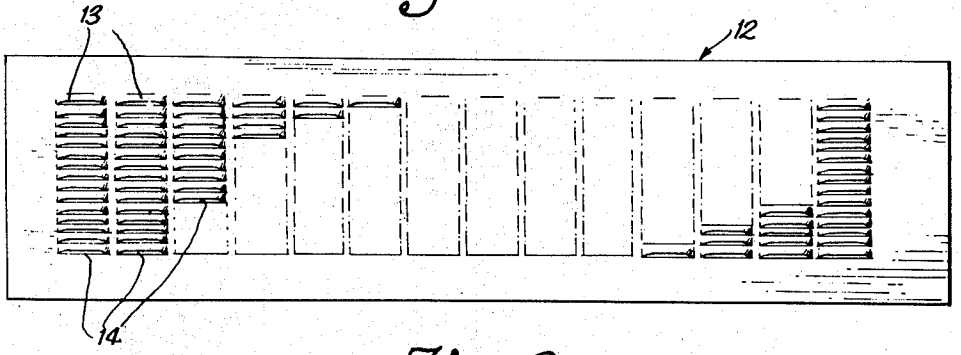


Fig. 2

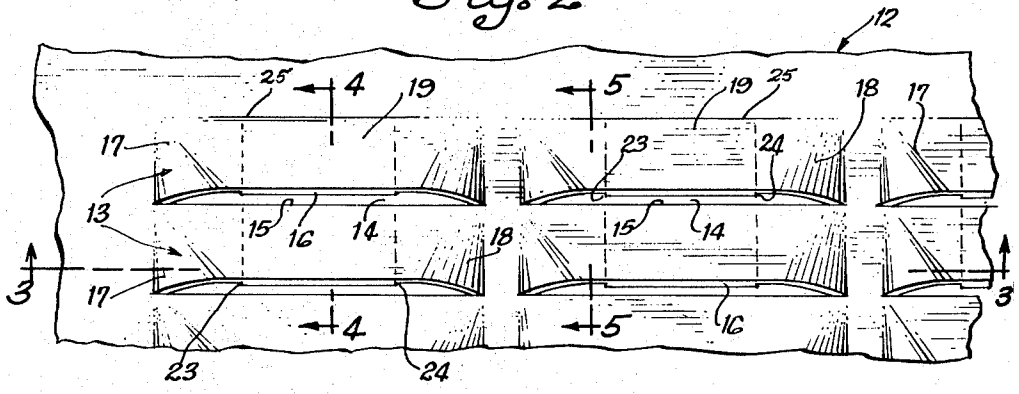


Fig. 3

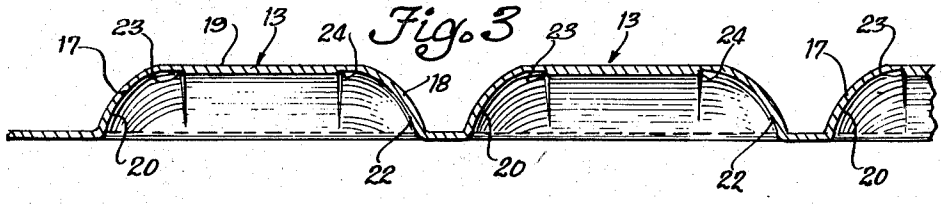


Fig. 4

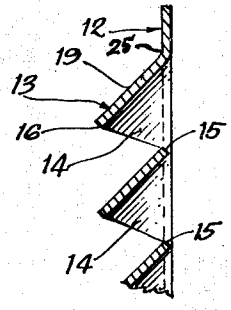
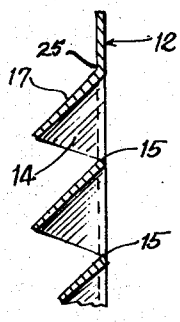


Fig. 5



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LOUVERED VENTILATOR

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9 Claims. (Cl. 98—121)

This application is a division of application Serial No. 85,108, filed January 26, 1961.

This invention relates to louvered ventilators, and more particularly the invention is concerned with ventilators integrally made from sheet stock to embody structure such that the louvered sheet does not warp or bend as a result of the formation of the louvers and openings therein.

The integral formation of louvered openings in sheet stock by usual methods and to embody customary structures sets up stresses in the sheet which cause the louvered sheet to bend or warp. This warping or bending of louvered sheets and strips is undesirable in practically any instance and makes it difficult to ship the structures in strip form and to secure a louvered ventilator in place relative to a flat surface. The stresses which cause the warping or bending result from the variations in the amount of deformation and the lack of symmetry of each louver in a direction lateral to the louver. Furthermore, the stresses occur even though the sheet stock is clamped and held flat during the punching and forming operation.

One of the general objects of this invention is to provide a louver structure made from sheet stock and wherein the structure is such that the resulting louvered sheet is normally flat.

As another object, this invention comprehends the provision of a louver structure, in which structure the material in each louver is coined in a direct relation to the amount of deformation and elongation to which the material is subjected during the forming operation, so as to relieve the stresses normally inherent as a result of such deformation and elongation.

The invention further has within its purview the provision of a louver structure produced from sheet stock and wherein the material of each louver is varied in thickness during the forming operation to effect a flow of such material which is related to the amount of deformation and elongation of the metal, thereby to relieve the stresses normally caused by variations of the deformation and elongation across each louver in comparison to the undeformed material.

As another object, this invention provides a louvered ventilator structure wherein each louver is prevented from delivering strain producing stresses to the rest of the ventilator structure without detriment to the strength, weather protection and such desirable characteristics of the ventilator.

Other objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawings in which:

FIG. 1 is a front elevational view of a louvered panel integrally formed from sheet stock and wherein the structure of the louvers is in accord with a preferred embodiment of this invention;

FIG. 2 is a fragmentary front elevational view of a portion of the louvered panel depicted in FIG. 1 and drawn to a scale larger than that of FIG. 1 to afford a better illustration of the structural details involved;

FIG. 3 is a longitudinal sectional view taken substantially as indicated by a line 3—3 and accompanying arrows in FIG. 2;

FIGS. 4 and 5 are end sectional views taken substantially at the positions indicated by lines 4—4 and 5—5 respectively, in FIG. 2, and in the directions indicated by the accompanying arrows.

In the exemplary embodiment of our invention which is disclosed herein for illustrative purposes, we have illustrated the adaptation of our invention to a louvered panel **12** having therein a plurality of louvers **13** which, in the disclosed form, are substantially alike in structure and which are arranged in rows extending both longitudinally and laterally of the panel. The panel is integrally made of sheet stock material, which may be either metal, such as sheet aluminum or sheet steel, or some types of plastics. It may be understood that although the structure disclosed herein for illustrative purposes embodies a considerable number of relatively small louvers, the disclosed principles, method steps and the structural details are similarly applicable to structures wherein the louvers are larger in proportion to the area of the panel and are differently arranged, or may even be applicable to an individually formed louver which is adapted to mounting in reference to a flat surface; it being understood that one of the problems solved by the disclosed structure and the use of our method is the relief of stresses in each three-dimensionally formed louver, in order to avoid the tendency of each louver to warp and thereby avoid the warping or bending of either an individual louver or a panel embodying any number of integrally formed louvers as a result of the cumulative stresses set up in the individual louvers.

As depicted, and as is usual, the louvers **13** project outwardly from one surface of the panel and are similarly disposed, so that each overlies a vent opening **14** in the panel, although it may be understood that our invention is not limited to louvers arranged in rows, as shown, or to those projecting from only one surface of a panel or sheet. In such structures, the material of the panel is pierced along a line which forms an edge **15** of the vent opening and longitudinal free edge **16** of the louver. Each louver comprises sheet material from the panel which is formed longitudinally and laterally of the longitudinal louver edge **16** to afford the desired longitudinal and lateral configuration of the louver. In the form herein illustrated, each louver has end portions **17** and **18** which are curved in reference to planes normal to the panel and which extend both longitudinally and laterally of the longitudinal louver edge **16**. Each louver also has an integral mid-portion **19** which, as shown in FIG. 4, is generally straight in a direction lateral to the edge **16**, and which is also generally straight in a direction parallel to the longitudinal edge **16**.

In the usual and previously known manners of forming louvers of the general type, and without precautions and steps being taken for the relief of stresses produced in the forming operation as a result of the non-symmetrical lateral configuration of each louver and the required deformation of the stock which is greatest at the curved end regions of each louver, as well as by virtue of the normal resilience and resistance to deformation of the material from which louvers are usually made, stresses have usually been encountered which tend to effect, and usually do effect, warping or bending of the louver or a panel from conformity to a plane flat surface. Such warping and bending is not only detrimental to the handling of the resultant product in production and shipment, but is particularly detrimental to appearance and the securement of the louvered panel in place in reference to a flat surface, particularly when the louvered panel is large or in the form of a long strip.

In the structure herein illustrated and described, there are distinct departures from the usual louver structure and from the forming method previously used which com-

pensate for factors, such as the resilience of the sheet material and its resistance to deformation and which are calculated to be substantially proportional to the amounts of deformation at various parts or regions of the louver, thereby to minimize the stresses in each formed louver, with a result that the tendency of louvered panel to warp or bend as a result of such stresses is virtually and practically eliminated. In the structure disclosed, the result is accomplished without material detriment to the strength or weather protection afforded by each louver.

As is apparent in the disclosed structure, and as previously mentioned, the end regions **17** and **18** of each louver, which are deformed in reference to transverse planes, are subjected to more drastic and greater deformation than the longitudinal mid-portion of the louver. Being formed both laterally and longitudinally of the free edge **16** of each louver, the end regions **17** and **18** develop stresses in directions both longitudinal and lateral to the free edge. It has been found that if sheet stock has slits put therein which will extend laterally of the free edge of each louver near the curved end regions thereof and then the louvers are formed in the usual and customary manner, or if formed louvers of the usual type are cut laterally across the free edge **16** and near the end regions thereof, the cut slits will open longitudinally of the louver edge to form a V-shaped notch indicating the presence of longitudinal stresses in the louver and showing the desirability of greater longitudinal deformation toward the free edge to relieve such stresses.

While the desired longitudinal elongation may be provided at various positions along the louver and may be effected at various times in respect to the forming of the louvers for relieving the aforementioned stresses in each louver, this elongation is effected in the disclosed louvers by coining the end regions **17** and **18** of each louver in a manner to effect a flow of the formed sheet material of the louver longitudinally thereof, and in amounts related to the amount of deformation of each increment of the louver from its preformed dimensions. This coining may be done at the end of the forming stroke of the louver punch. As shown in FIG. 3, the coining which is effected in our preferred structure effects a gradual reduction of the thickness of the louver material from positions **20** and **22** near the juncture of the formed louver section with the unformed sheet stock and toward inner portions of the end regions, which are indicated as positions **23** and **24**, at which the curved end portions **17** and **18** are adjoined to the relatively straight mid-portion **19** of the louver. Also, as shown in FIG. 5, the thickness of each of the louver end regions **17** and **18**, as a result of the coining, diminishes outwardly toward the free edge **16** from a position **25** at which the formed section of the louver adjoins the unformed sheet stock. This coining relieves the stresses laterally of the free edge of the louver and in proportion to the variations of the amount of deformation of the louver section in a direction lateral to the free edge. It may be understood that the coining may be restricted to more localized areas longitudinally of the louvers, but is most effective when closely associated with the curved end regions of the louver.

As may be observed in FIG. 4, the thickness of the louver material laterally of the mid-portion **19** of each louver remains substantially uniform when sufficient elongation of the material is produced by the coining of the end regions **17** and **18**. The coining of the material in or adjacent the end regions **17** and **18** of each louver effects variations of the louver thickness between end regions **17** and **18** of each louver and the opposite ends of the mid-portion **19** thereof, which variations of thickness increase toward and lateral to the free edge. By confining the thinned material to the curved end regions, the rigidifying effect of the curvatures of the formed end regions compensates for the weakening of the material section.

It has been found that the reduction of the material thickness in a direction inwardly from the opposite ends

of the louver and laterally toward the free edge of the louver provides the desired elongation in proportion to the deformation of the louver and effects a flow of the material inwardly from the louver ends and toward the free edge which is desirable for relief of the stresses which otherwise tend to cause the louvers and their adjoining material to warp or bend.

From the foregoing description and by reference to the accompanying drawings, it may be readily understood that we have produced a louver structure which provides for the relief of stress in the formed material and thereby results in the production of louvers or louvered panels which are adapted to conform to a flat surface without being warped or bent to effect such conformity. It is noteworthy that our disclosed structure provides normal rigidity and has normal weather protective characteristics.

It is further to be understood in connection with this invention that the structural advantages are applicable, even though various kinds of cutting and forming tools may be utilized in the production thereof.

Having thus described our invention, what is claimed is:

1. A louvered ventilator integrally formed from sheet stock and comprising, in combination, a panel of sheet stock having therein a plurality of integrally formed louvers projecting from one face of the sheet stock and each overlying a vent opening and having a free longitudinal edge, said louvers each having end portions curved in respect to planes which are transverse to one another and normal to the panel, said louvers also having mid-portions which are substantially straight longitudinally, and said end portions of each louver including coined regions which embody preestablished variations in material thickness in addition to those normally effected by louver formation and which variations extend both laterally and longitudinally of said longitudinal edge.

2. A louvered ventilator as defined in claim **1**, and wherein said coined regions of the end portions of each louver diminish in thickness longitudinally of the louver toward said mid-portion thereof and laterally of the louver toward said longitudinal edge thereof.

3. A louvered ventilator as defined in claim **1**, and wherein said coined regions of each louver are adjacent and intersect said longitudinal edge thereof to effect elongation of the louver longitudinally of said edge.

4. A louvered ventilator integrally formed from sheet stock and comprising, in combination, a panel of sheet stock having therein an integrally formed louver projecting from one face of the panel and overlying a vent opening, said louver having a free longitudinal edge and end portions curved in respect to planes which are transverse to one another and normal to the panel, said louver also having a mid-portion which is substantially straight longitudinally of said longitudinal edge, and regions of said end portions of the louver being coined to effect an elongation thereof along and adjacent said longitudinal edge.

5. A louvered ventilator as defined in claim **4**, and wherein regions of said end portions of the louver vary in thickness inwardly from opposite ends of said longitudinal edge and laterally toward said longitudinal edge.

6. A louvered ventilator as defined in claim **4**, and wherein said mid-portion of the louver has a surface offset from adjacent surface regions of said end portions thereof.

7. A louvered panel integrally formed from sheet stock and comprising, in combination, a panel of sheet stock having therein an integrally formed louver projecting from one face of the panel and overlying a vent opening, said louver having integrally adjoined end portions and a mid-portion which each adjoin the panel and which together define a free longitudinal edge of the louver, and said louver having a coined region intermediate the ends of said longitudinal edge and which extends along and adjacent said longitudinal edge for effectively producing an elongation of the louver stock at said edge.

8. A louvered panel as defined in claim 7, and wherein the thickness of the louver in said coined region varies and becomes thinner in a direction laterally of and toward said longitudinal edge.

9. An integrally formed louver in which internal stresses have been minimized, and which louver has a free edge having curved end portions, said louver comprising formed sheet material, and a portion of said formed sheet material being coined to effect variations in the thickness thereof in directions both longitudinally and laterally of said free edge and with the thinnest section at said free edge.

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