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(54) **An edgewise profile plate member for use as a wall member in a hollow-shaped profile and a damper blade for a ventilation damper assembly composed of one or two such plate members.**

(57) A hollow wing-shaped profile for use as a damper blade in a ventilation damper assembly, a guide blade or a fan vane is composed by means of an edgewise profiled plate member (17) having along one longitudinal edge a first edge portion comprising an edge flange (19) bent into a substantially U-shaped cross-section and at the opposite longitudinal edge a second edge portion comprising an edge flange (21) bent by two successive bendings into a substantially S-shaped cross-section for engagement with the first edge portion by pressing the extreme portion (21a) of the S-shaped edge flange (21) into the opening behind the U-shaped edge flange (19), the edge flanges being locked in said engagement by end members fitting into the internal cross-section of the hollow profile.

Thereby, separate connecting means between a number of wall elements for such a profile is avoided. The production may be performed by a single rolling operation, and by means of one and the same plate member there may be obtained a damper blade consisting of a single element as well as a damper blade composed of two elements and having the double width.

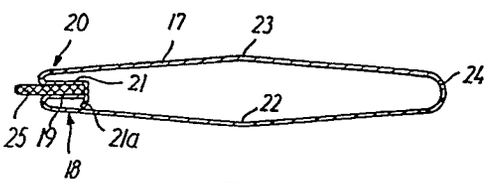

FIG. 3

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An edgewise Profile Plate Member for Use as a Wall Member in a Hollow-Shaped Profile and a Damper Blade for a Ventilation Damper Assembly Composed of One or Two such Plate Members.

This invention generally relates to an edgewise profiled, quadrilateral plate member to be used as a wall member in a hollow wing-shaped profile, in particular a damper blade, a guide blade or a vane.

In particular, the invention relates to the use of such a hollow profile as a damper blade for a ventilation damper assembly of the type in which a number of substantially rectangular damper blades of wing-shaped cross-sectional profile is pivotally suspended with parallel axes of rotation between opposite frame members in a substantially rectangular damper frame for mounting in an apparatus cabinet, in a ventilation duct or in a wall opening, so that the damper blades can be moved between a closing position and an opening position by rotation about said axes.

Ventilation damper assemblies of this kind are mainly used as air volume control and damping means as well as mixing dampers when mounted in ventilation ducts of rectangular cross-section, in wall openings or in apparatus cabinets, for instance for an air conditioning central unit in an air conditioning system. Beyond a reliable closing function with respect to sealing and a movement of the damper blades, which as far as possible is free from noise and play, importance is attached to a simple and sturdy design of the damper construction with the lowest possible costs of production for the individual components thereof.

In a damper assembly disclosed in German Offenlegungsschrift No. 2,342,531 each damper blade is com-

posed of two opposite, plate members profiled into a wing-shaped cross-section and being held together by longitudinal nose strips carrying longitudinal lobe seals at the edges of the damper blade, together with an internal clamping thread.

For a similar construction of a damper blade composed of two plate members it is moreover known from German Offenlegungsschrift No. 2,208,259 to join plate members together by folding along the lateral edges without any need for additional connection means for keeping the plate members together. The folding used in this case does not allow any arrangement of sealing strips.

By the present invention a simple design of a hollow wing-shaped profile of the kind used in such damper blades is obtained together with the possibility of arranging and fastening a lobe seal directly in the joint between the lateral edges, by forming the plate member into a wing-shaped cross-sectional profile by longitudinal rolling and/or bending, and by forming along one of its opposite longitudinal edges of the plate member a first edge portion having an edge flange bent once into substantially U-shaped cross-section and at the other of said longitudinal edges a second edge portion having an edge flange bent by two successive, oppositely directed bendings into a substantially S-shaped cross-section for engagement with said first edge portion of the same plate member or of another opposed plate member by pressing the extreme portion of the edge flange of said second edge portion into the opening behind the edge flange of the first edge portion, said edge flanges being locked in said engagement by end members fitting into the internal cross-section of said hollow profile.

In accordance therewith, according to the invention, a damper blade of the above mentioned kind

is characterized in that a wall member of the damper blade is made from a rectangular plate member by longitudinal rolling and/or bending into said wing-shaped cross-sectional profile, said plate member being formed along one of its opposite longitudinal edges with a first edge portion having an edge flange bent once into a substantially U-shaped cross-section and at the other of said longitudinal edges a second edge portion with an edge flange bent by two successive, oppositely directed bendings into a substantially S-shaped cross-section, said first and second edge portions of the same wall member or of two different, opposed wall members being put into engagement with each other by pressing the extreme portion of the edge flange of said second edge portion into the opening behind the edge flange of said first edge portion and being locked in said engagement by end members fitting into the internal cross-section of the damper blade to receive the rotational shaft or journals of the damper blade.

Thereby, by one and the same design of said edge portions of the plate member a damper blade may be produced consisting either of a single wall member or being made into double width by joining together two opposed wall members, each of the two edge portions of one wall member being in engagement with the respective opposite edge portion of the other wall member.

In a damper blade according to the invention a sealing strip may be fastened without the use of particular connection means, in that a sealing member is arranged as a lobe seal between the sides of said first and second edge portions facing each other and is clamped by their mutual engagement. A simple ribbon- or strip-shaped member may be used for sealing members, for instance made from rubber with a mainly flat rectangular cross-sectional profile, so that there is no

need for an expensive special design of the sealing member. In a damper blade composed of two wall members sealing strips may be arranged optionally at one or both longitudinal edges of the damper blade.

However, the invention is not restricted to the production of damper blades of the above mentioned kind, but it may generally find application in the production of hollow profiles having walls made from sheet metal, for instance plate wings for axial flow fans or profiled guide vanes or blades for centrifugal fans.

In the following the invention is explained in more detail with reference to the schematical drawings, in which

Figs 1 and 2 illustrate a damper of the above mentioned type as an embodiment of the invention, in a view perpendicular to the flow passage area and a perspective view, resp.,

Fig. 3 is a cross-sectional view of a first embodiment of a damper blade according to the invention,

Figs 4 and 5 illustrate two longitudinal sectional views at right angles to each other of the portion of the damper blade engaging a frame member in the damper frame, and

Fig. 6 a cross-sectional view of another embodiment of the damper blade.

The damper assembly shown in Figs 1 and 2 is mounted in a rectangular, in the present case almost quadrilateral damper frame comprising frame members 1 to 4 made from bent sheet profiles of a substantially flat, U-shaped cross-section, so that either frame member as shown at 5 and 6 for the frame member 1 is provided with edge flanges to secure the damper frame either to a ventilation duct having the same flow passage area and cross-sectional shape or to a wall open-

ing or an opening in the side or end wall of an apparatus cabinet, for instance for a central unit in an air conditioning system in which one or more fans, air humidifiers, filters and/or heating members may be arranged.

In the illustrated embodiment four damper blades 7 to 10 of wing-shaped cross-sectional profile are rotatably suspended in the damper frame with parallel axes of rotation between two opposite lateral frame members 1 and 3, an end member 11 being provided at either end of each damper blade as shown in Figs 4 and 5 and comprising a journal 12 positioned with sliding fit in a bushing 13 drawn up in the sheet member of the frame member.

In Figs 1 and 2 the damper blades 7 to 10 are shown in a central position between a closing position in which the damper blades extend transverse to the flow direction and block the flow passage area, and an opening position in which the damper blades 7 to 10 are substantially parallel to the flow direction.

The operation of the damper blades is effected by means of an arm 14 secured to the journal 12 for one of the damper blades 7, and the damper blades 7 to 10 are interconnected with respect to movability through a drive mechanism including a coupling bar 15, a pivot arm 16 positioned behind the coupling bar 15 being rotatably connected with the coupling bar 15 and secured to one of the journals for each damper blade.

In Fig. 3 the cross-sectional profile of a first embodiment of a damper blade according to the invention is shown. In this embodiment the damper blade is made up of a single wall member 17 from sheet metal, said member having been formed into the wing-shaped cross-sectional profile illustrated in the figure by longitudinal rolling through a series of roller stations. As explained in the following the profile shape may

further be performed by a combination of longitudinal rolling and subsequent bending.

In accordance with the invention the wall member 17 is formed at one longitudinal edge with a first edge portion 18 having an edge flange 19 bent once towards the interior of the damper blade, so that the edge portion 18 obtains a substantially U-shaped cross-section with its opening facing the interior of the damper blade.

For engagement with the first edge portion 18 the damper blade is formed at its other longitudinal edge with a second edge portion 20 having an edge flange 21 bent towards the interior of the damper blade so as to obtain a substantially S-shaped cross-section.

The shaping of the edge portions 18 and 20 with the flanges 19 and 21 into the illustrated cross-sectional shape and the forming of slight, longitudinal bendings in the wall member as shown at 22 and 23 to obtain the desired wing-shaped cross-sectional profile as well as bending or folding as shown at 24 can be carried out in one and the same rolling operation so that the edge portions 18 and 20 will be positioned opposite each other. After the arrangement of a sealing member 25, which may be made, for instance as shown by a ribbon- or strip-shaped member of rubber of substantially flat or rectangular cross-sectional profile as a lobe seal between two sides of the edge flanges 19 and 21 facing each other, the edge portions 18 and 20 are put into engagement with each other by squeezing them together by an external pressure against the sides of the profile. As the plate member having edge flanges due to the profile shape produced as mentioned has a certain spring action, the said squeezing causes the extreme portion 21a of the edge flange 21 to be pressed over the free edge of the edge flange 19. By subsequent-

ly releasing the external pressure the extreme portion 21a of the edge flange 21 will be pressed against the bottom of the U-shaped cross-section of the edge portion 18 due to the spring action with its free edge in engagement with the wall member opposite the edge flange 19.

In order to maintain the locking engagement between the two edge portions 18 and 20 the damper blade is finished by inserting at either end, subsequent to the release of the external pressure, an end member 26 as shown in Figs 4 and 5 having a form fitting into the internal cross-sectional profile of the damper blade. In its outermost portion the end member 26 has a bottom part 26a covering the edge of the wall member 17 and in which a slit, not shown, is provided for the sealing strip 25. As shown in Fig. 5 the bottom part 26a has a curved external surface the function of which forms the subject matter of Applicant's copending application No. 1034/81. Inside the bottom part 26a the end member 26 has a fitting part 26b corresponding to the internal cross-sectional profile of the damper blade and having lateral surfaces in engagement with the internal surfaces of the wall member 17 and with the valley of the S-shaped edge flange 21 located at the extreme part 21a and facing the interior of the damper blade. As a consequence of said engagement the edge portions 18 and 20 are kept firmly in mutually locking engagement. Said locking engagement further provides for obtaining a firm squeezing of the sealing strip 25 which by virtue of its elasticity further keeps the edge flange 19 pressed outwardly towards the opposed part of the wall member 17, thereby contributing to firmly damp the extreme part 21a of the edge flange 21 in the opening of the U-shaped cross-section of the edge portion 18.

However, as shown in Fig. 6 the arrangement of a sealing strip is not mandatory to secure the engagement between edge portions having the illustrated shape. The damper blade shown in Fig. 6 is composed of two wall members 30 and 31 which may be formed in a rolling operation in the same manner as the wall member 17 in Fig. 3 but without being subjected to any bending or folding as shown at 24 in Fig. 3. Each of the wall members 30 and 31 comprises a first edge portion 32 and 33, resp., having the same shape as the edge portion 18 in the embodiment shown in Fig. 3 and a second edge portion 34 and 35, resp., shaped mainly as the edge portion 20 in the embodiment shown in Fig. 3, the extreme part 35a of the second edge portion 35 for the wall member 31 showing, however, a more pronounced bending than the extreme part 34a of the second edge portion 34 of the wall member 30.

The wall members 30 and 31 are connected by initially providing engagement between the edge portions 32 and 35 by locating and fastening the extreme part 35a of the edge portion 35 in the opening of the U-shaped cross-section of the edge portion 32. After the arrangement of a sealing strip 36 having the same shape as the sealing strip 25 in Fig. 3, engagement is effected between the edge portions 32 and 35 as well as the opposite edge portions 33 and 34 by the same operation as described above, during which end members, not shown, are simultaneously inserted in the same manner as for the embodiment shown in Fig. 3. to hold the edge portions in place in mutual engagement.

Thus, by means of the invention a damper blade is formed by a simple construction without the use of any particular connecting means, which is composed solely of one or two wall members, two end members matching thereto and, possibly, one or two longitudinal sealing strips. A particular advantage is the possibility of forming a damper blade by folding a single wall member

or a damper blade having double width by using two wall members without changing the form of the wall members.

In addition, the invention may generally be applied to the design of hollow wing-shaped profiles having walls consisting of quadrilateral plate members, particularly for plate wings for use in axial flow fans whereby the plate members may have an oblong trapezoidal form or for guide vanes and blades for centrifugal fans.

PATENT CLAIMS

1. An edgewise profiled, quadrilateral plate member to be used as a wall member in a hollow wing-shaped profile, in particular a damper blade, a guide nlade or a vane, characterized by forming the plate member into a wing-shaped cross-sectional profile by lomgitudinal rolling and/or bending, and by forming along one of its opposite longitudinal edges of the plate member a first edge portion (18, 32, 33) having an edge flange (19) bent once into substantially U-shaped cross-section and at the other of said longitudinal edges a second edge portion (20, 34, 35) having an edge flange (21) bent by two successive, oppositely directed bendings into a substantially S-shaped cross-section for engagement with said first edge portion of the same plate member or of another opposed plate member by pressing the extreme portion (21a, 34a, 35a) of the edge flange (21) of said second edge portion (20, 34, 35) into the opening behind the edge flange of the first edge portion (18, 32, 33), said edge flanges being locked in said engagement by end members fitting into the internal cross-section of said hollow profile.

2. A damper blade for a ventilation damper assembly of the type in which a number of substantially rectangular damper blades (7-10) of wing-shaped cross-sectional profile is pivotally suspended with parallel axes of rotation between opposite frame members (1,3) in a substantially rectangular damper frame for mounting in an apparatus cabinet, in a ventilation duct or in a wall opening, so that the damper blades (7-10) can be moved between a closing position and an opening position by rotation about said axes, characterized in that a wall member (17, 30, 31) of the damper blade is made from a rectangular plate member by longitudinal rolling and/or bending into said wing-shaped cross-sectional profile, said plate member being formed along one of its opposite

longitudinal edges with a first edge portion (18, 32, 33) having an edge flange (19) bent once into a substantially U-shaped cross-section and at the other of said longitudinal edges a second edge portion (20, 34, 35) with an edge flange (21) bent by two successive, oppositely directed bendings into a substantially S-shaped cross-section, said first and second edge portions (18, 20; 32-35) of the same wall member (17) or of two different, opposed wall members (30, 31) being put into engagement with each other by pressing the extreme portion (21a, 34a, 35a) of the edge flange (21) of said second edge portion (20, 34, 35) into the opening behind the edge flange of said first edge portion (18, 32, 33) and being locked in said engagement by end members (26) fitting into the internal cross-section of the damper blade to receive the rotational shaft or journals of the damper blade.

3. A damper blade according to claim 2, characterized in that a sealing member (25, 36) is arranged as a lobe seal between opposite sides of the edge flanges of said first and second edge portion (18, 20; 32, 34) and is clamped by their mutual engagement.

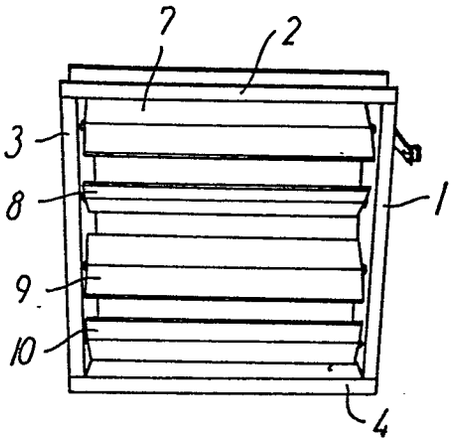

FIG. 1

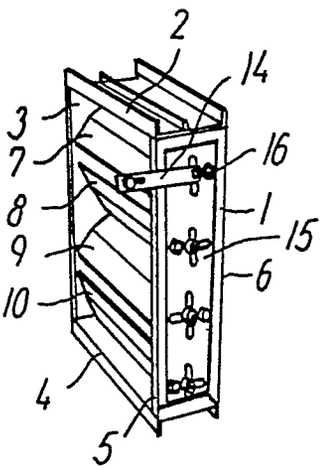

FIG. 2

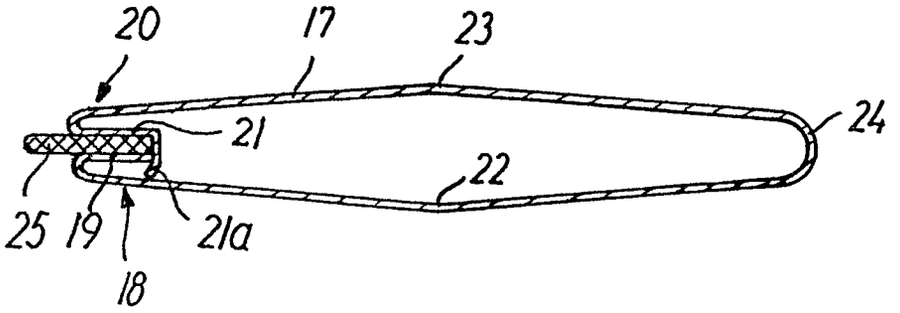

FIG. 3

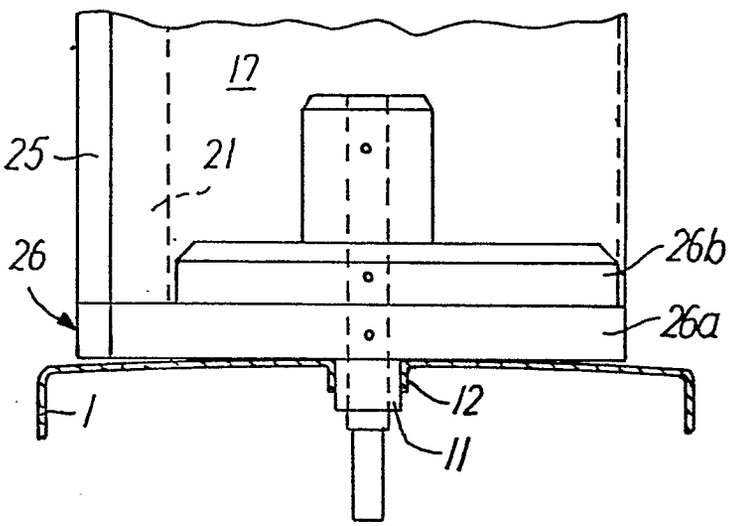

FIG. 4

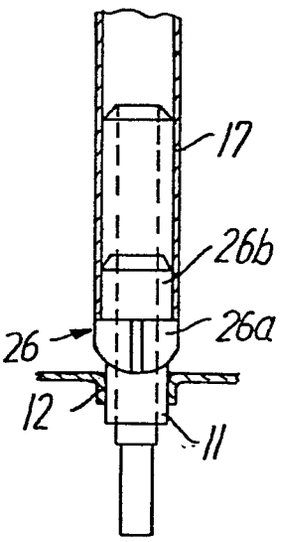

FIG. 5

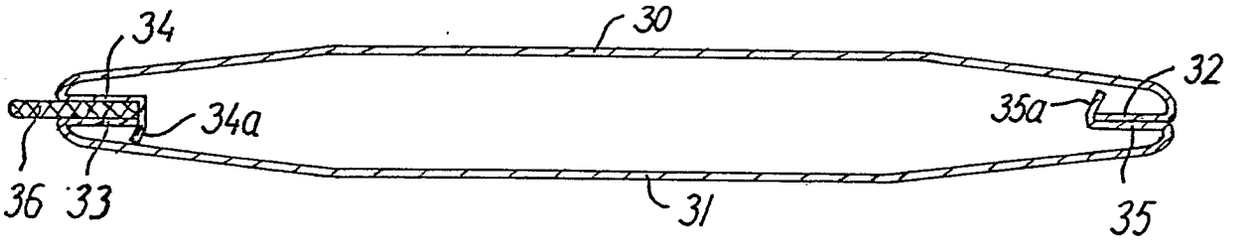

FIG. 6