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A frame for a fire damper.

A four-sided fire damper frame for air ducts in ventilation systems, comprising a number of reciprocally connected frame elements (10, 11). These are provided with a substantially U-shaped cross section with a web (16, 21) and two side shanks (15, 19), wherein the duct section is formed by the web of connected frame elements (16, 21). Two opposite frame sides (11) are provided with bearings (14) for one or more blades (12) mounted on pivotal axes (13). Each of the other two frame elements (10) is provided with a sheet metal strip (18) which forms a tension joint, at a distance from the respective web (21), along the respective frame element (10).

TECHNICAL FIELD

The present invention concerns a four-sided fire damper frame for air ducts in ventilation systems, comprising a number of reciprocally connected frame elements, having a substantially U-shaped cross section with a web and two side shanks, wherein the duct section is formed by the web of connected frame elements, and wherein two opposite frame sides are provided with bearings for one or more blades mounted on pivotal axes.

BACKGROUND OF THE INVENTION

Fire dampers are for example used for air ducts in ventilation systems in marine structures for screening off different fire zones, so that a fire will not be able to spread itself via the duct system, from one room to another. Thus, at a passenger ferry, each location where a duct forms a passage through a fire protecting bulkhead or deck, must be provided with a fire damper which is equipped with thermal insulation at its outside.

Fire dampers must be approved according to international rules, requiring that the damper shall be able to withstand heating up to a temperature of 1000°C, without substantial deformation, so that a gap arises which exceeds certain standards, either between the blades screening off the damper opening, or between the frame of the damper and said blades, which is the normal case. The measurements and the presence of such gaps are controlled by means of a gauge.

Without special measures, a frame will bend outwards so that the webs will leave a large gap to the blade, especially if it has been designed with a rectangular section as seen in the direction of flow, which section is exposed to hot fire gases, so that the webs leave a large gap to the blade where the fire fumes/flames can penetrate. The problem often occurs at the two frame elements which are parallel to the blade shaft, because locking of the blade shaft to the two other frame elements prevent them from bending outwards.

So far, these requirements have been fulfilled by dimensioning those frame elements which form the damper frame comparatively large. Also, it is possible to choose to limit the cross flow area of the damper, in order to reduce the length of the webs. To be able to meet the ventilation requirements, it has then been necessary to make forked limbs in the duct system and to mount several dampers in parallel.

The use of large dimension frame elements will make production of fire dampers more expensive, at the same time as they will be heavier to handle and transport. The method to use several parallel forked duct limbs and fire dampers when making passage through a bulkhead or a deck rises costs considerably and is also space demanding.

The comparatively large frame elements used according to the state of the art, are usually complemented by welded profile elements, which serve as stop means for the damper blades, and also forms labyrinth seals between the duct wall and the edge of the nearby damper blade. These profile elements leads to an unfavourable reduction of the cross sectional area of the duct, forming pockets together with the duct wall to collect dirt, which can form fertile soil for bacteria. Said profile elements influences deformation of the damper, when it is subjected to high temperatures, because material with different thickness expands out of phase. It has occurred that profile elements have come loose, on account of heat induced tensions, which might have led to functional disorders.

TECHNICAL PROBLEM

One object of the present invention is to provide a frame design for a fire damper, which makes it possible to build wide, flat fire dampers having duct section measurements, example amounting to or exceeding 800 x 1200 mm, without problems with deformation in the long horizontal frame elements, owing to the heat. Another object is to be able to use the frame element with equal or with reduced material thickness, for example about 5 mm for such large dimensions. Still another object has been to provide an acoustically and technically flow efficient damper, which does not have inner pockets to collect bacteria growing dirt.

THE SOLUTION

Surprisingly to the professional in this field, all of the above mentioned objects have been accomplished in a single frame design, wherein according to the invention, each of the other two frame elements is provided with a sheet metal strip which forms a tension joint, at a distance from the respective web, along the respective frame element.

DESCRIPTION OF THE DRAWING

The invention will now be described here below with reference to a preferred embodiment, which is shown in the attached drawings, in which

- 5 Fig. 1 shows a fire damper according to the invention in a perspective view, and
 Fig. 2 is a section through the frame in Fig. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

- 10 Fig. 1 and 2 shows a fire damper which for example can be used as closeable ventilation aperture through bulkheads or decks which delimit fire zones within a vessel.

The fire damper comprises a frame with two horizontal frame elements 10 and two vertical frame elements 11, which together define a rectangular duct section. In the shown embodiment, two pivotal damper blades 12 are used, which are journaled by means of tubular or solid shafts 13 in bearings 14 at the two vertical frame elements 11 of the damper.

15 The vertical frame elements 11 comprise U-shaped sheet metal profiles with side shanks 15 and a central web 16. The material in these frame elements are preferably stainless steel with a thickness of for example 5 mm.

The horizontal frame elements 10 is composed, as is shown in Fig. 2, partly by U-shaped sheet metal profiles 17 and partly by a flat cover plate 18 which is connected to the side shanks 19 of the sheet metal profile 17, e.g. by means of spot welding 20. The cover plates 18 together with the sheet metal profiles 17 form box beams. The sheet metal profiles 17 are preferably made up of the same material and material thickness as the frame elements 11. The cover plates 18 are preferably manufactured from common steel plate, but with the same or thinner material thickness as the profiles 10, 17.

25 Because the cover plates 18 do not bind the side shanks 19 together, but lie upon the beam web, a box beam is foamed with especially favourable characteristics from the point of heat deformation, at the outside of the duct which is exposed to hot fire fumes. On account of this, the frame will be much less inclined to deformation under the heating phase, until heating eventually has resulted in that the entire frame has reached the same temperature, than a conventional frame to a fire damper, because the lower temperature of the cover plate as compared to the temperature of the web, creates a tension joint which forces the web to expand inwards and seal towards the damper blade instead of bending outwards. Also, and in a corresponding way, the fact that the cover plates are made from conventional steel with a thermal coefficient of expansion which is about 30% less than for stainless steel at high temperatures, means that the damper frame retains its resistance against deformation, even when the same temperature prevails on the outside and the inside of the damper duct.

30 In those cases when the damper is exposed to hot fire fumes, on its insulated outside, the temperature difference between the cover plate 18 and web (framing) to be considerably smaller than what is the case with hot fire fumes in the duct. The result of this is that the somewhat hotter cover plate with its smaller coefficient of expansion, expands at the same rate as the somewhat colder web with its higher coefficient of expansion, wherein the frame certainly expands at the same rate as the increase in temperature, but remains undeformed.

The sheet metal profiles 17 are provided with a longitudinally profiled web 21, which is provided with two symmetrical protrusions 22, on each side of a V-formed part 23 of the web 21 which is directed towards the inner of the duct.

45 The profiling of the web 21 contributes to make the horizontal frame elements 10 more rigid against deformation. However, the main object with the V-shaped parts 23 are to form abutments for the damper blades 12 in the closed position. The damper blades 12 are controlled by a not shown synchronised mechanism, in such a way that the upper blade in Fig. 2 is turned counter clockwise from the dashed to the unbroken position, while the lower blade in Fig. 2 is turned clockwise from the dashed to the unbroken position.

50 The cross sectional area of the duct can be maintained by means of the protrusions 22 in spite of the towards the inner of the duct directed V-formed parts 23. This is marked by the dash-dotted lines 24 in Fig. 2. Because the duct cross section is maintained substantially unchanged, very favourable flow characteristics are obtained by the fire damper. This means that the capacity requirements for the fans can be reduced. Smaller fans eventually leads to reduced power consumption.

55 The fire damper according to the invention has proven to function well from the acoustic point of view, because the even duct inside reduces turbulence to the air which passes the damper. The even inside lacks sharp folds and transitions with pockets that can accumulate dirt, and the even thickness contributes to an increased resistance against deformation. The number of details and therefore the manufacturing cost is reduced in relation to a conventional damper with welded seals/stops.

Further, an inclined transition from the inside of the web and the edge of the damper blade is favourable from the alignment point of view when the web moves in relation to the damper blade, because the damper blade is much more pliable in one direction than the other and can in this way spring away and adapt itself to a "movable" sealing surface. When the web is moving inwards towards the damper blade, the web will become tighter and tighter.

The invention is not limited to the above described embodiment, but several variations are possible within the scope of the accompanying claims. For example, the horizontal frame elements 10 can be designed differently than shown. Further, several types of mechanisms can be used for turning the damper blades from open to closed position.

Claims

1. A four-sided fire damper frame for air ducts in ventilation systems, comprising a number of reciprocally connected frame elements (10, 11), having a substantially U-shaped cross section with a web (16, 21) and two side shanks (15, 19), wherein the duct section is formed by the web of connected frame elements (16, 21), and wherein two opposite frame sides (11) are provided with bearings (14) for one or more blades (12) mounted on pivotal axes (13),
characterized in that each of the other two frame elements (10) is provided with a sheet metal strip (18) which forms a tension joint, at a distance from the respective web (21), along the respective frame element (10).
2. A frame according to claim 1,
characterized in that the frame elements (10) are manufactured from stainless steel, while the sheet metal strips (18) are manufactured from common sheet steel.
3. A frame according to claim 1,
characterized in that the webs (21) on the two opposite frame elements (10) are longitudinally profiled.
4. A frame according to claim 3,
characterized in that profiling is directed outwards, from the duct section of the damper.
5. A frame according to claim 4,
characterized in that the profiling forms a bulge (22) in the normal duct section (24).
6. A frame according to claim 5,
characterized in that one side of the bulge (22) is delimited by a V-shaped part (23) of the web (21) directed towards the inner of the duct.
7. A frame according to claim 6,
characterized in that the V-shaped parts (23) form declining stop abutments for one or more blades (12).
8. A frame according to claim 7,
characterized in that the profiling is symmetrical towards each duct section end.

FIG. 1

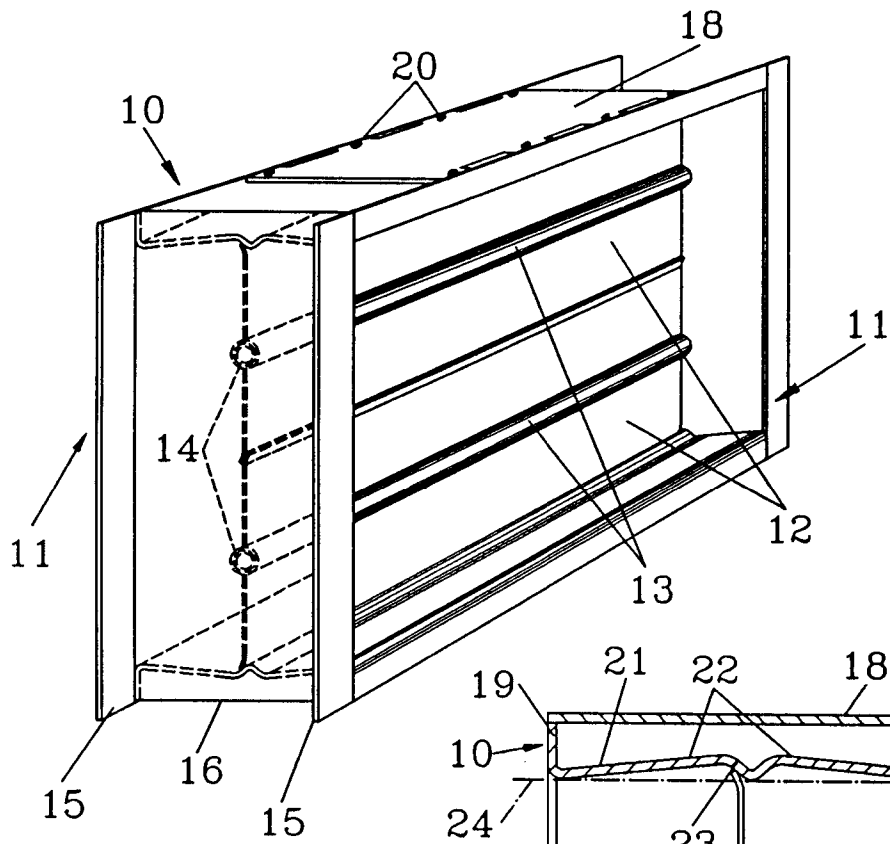


FIG. 2

