

TITLE: DUCT AND FLANGE ASSEMBLY

The invention relates to an assembly comprising a flange connection and rectangular air conditioning duct.

A flange connection of this type is known, for example, from German Offenlegungsschrift No. 22 21 312. In the case of this known flange profile there is fitted between the second web of the bead and the first longitudinal arm a seal which is intended to prevent air passing through the gap between the first longitudinal arm and the inside of the duct wall and then over the end face of the duct wall and to the outside. Such a seal which is located inside the hollow profile cannot however be sufficiently reliable in use. In fact, the only feasible solution is an injected sealing composition. As the flange profiles are sometimes of quite considerable length, however, it is impossible to ensure a sufficient quantity of sealing composition being present everywhere along this cavity. Therefore, it is not possible adequately to ensure the intended sealing effect. In addition, even with permanently elastic seals, their elasticity can only be retained for a limited time, particularly in elevated working temperatures which, in the case of air conditioning ducts, may be as much as 60°C, so that they rapidly lose their sealing effect.

German Auslegeschrift No. 23 13 425 likewise discloses a flange connection of the type mentioned at the outset. In the case of the flange profile shown therein, the second web of the bead forms together with the first longitudinal arm a wedge-shaped slot into which it is intended that the end face of the duct wall should be clampingly inserted. Accordingly, the sealing action is intended to be established along the

end edge of the duct wall. In practice, however, this causes considerable difficulties because above all these end edges of the duct walls diverge greatly from what is the ideal straight line. Thus they exhibit varying degrees of burr formation and in addition have become
5 misshapen due to relatively rough handling in transport and at the assembly site. Furthermore, the construction of profile illustrated is extremely unfavourable from the manufacturing point of view. This narrow wedge-shaped groove calls for correspondingly narrow rolling and the rollers are subjected to an enormous loading. The sheet metal
10 undergoes extreme deformation particularly in the region of the bead, which on the one hand denotes considerable wear and tear on the rolling tools and on the other considerable likelihood of fracture in the overstressed material. This is disadvantageous in that air conditioning ducts are caused to undergo considerable oscillation due to currents
15 of air in the low frequency and high frequency vibration range. In order to avoid damage resulting therefrom, it is necessary to follow the rolling operation on the flange profile with either some annealing process or a heavily stressable and thus more expensive material must be used in its manufacture. The wedge-shaped surface cannot be pro-
20 duced in any technologically feasible arrangement.

The object of the invention, therefore, is so further to develop a flange connection of the type indicated that as little air as possible can escape between the duct wall and the flange profiles. In particular, it is intended that the sealing effect should be permanent,
25 easily achieved and capable of being perfectly predetermined during manufacture. The sealing effect should also be substantially unaffected by damage to the end edge of the duct wall. It should be possible for the flange profile to be manufactured with less heavily loaded

rolls, the material stresses being reduced at the same time. In order to produce the flange profiles, inexpensive material should be used and require no secondary treatment.

5 According to the invention there is provided an assembly comprising a rectangular air conditioning duct having four walls, and at least one flange connection having four flange profiles each of substantially L-shaped hollow profile and made from sheet metal and
10 four angle-pieces, said flange profiles each having a first longitudinal member which is parallel with a geometric longitudinal axis of the air conditioning duct and bears on the inside face of the duct wall, a second longitudinal member in the form of a first
15 radial arm emanating from said first member at right angles thereto for location in front of the end face of the duct wall, a third longitudinal member in the form of an outer arm emanating from said second member and extending on assembly back to a position behind the
20 end face of the duct wall, a fourth longitudinal member in the form of a second radial arm emanating from said third member and extending at a distance from and parallel with the first radial arm, a fifth longitudinal member in the form of an oblique arm
25 extending from said fourth member and having a radial dimension approximately half the height of the first radial arm and a sixth longitudinal member emerging



from said fifth member which bears on the outside face of the duct wall, opposite the first longitudinal member, a bead shaped into the first radial arm and extending into the hollow profile of the flange, the
5 bead being formed with a first bent-over portion, a first web approximately at a right-angle to the first radial arm and situated opposite and at a distance from the outer arm, the ends of said angle pieces engaging with a close fit between the radial arms, the outer
10 arm and the first web and into the end zones of the flange profiles, said bead also being formed with a second web disposed between the first web and the first longitudinal member, said second web merging along one edge by means of a second bent-over portion into the
15 first longitudinal arm and connected at a second edge, via a substantially semi-circular first arc, to the first web, said second bent-over portion being constructed as a substantially semi-circular second arc which, from the second web merges directly into the
20 first longitudinal member, said bead being so formed that the first arc, when the flange profile is not applied against a duct wall, is spaced at a distance from the first longitudinal arm which is less than the thickness of the duct wall, whereby the bead can bear
25 with a clamping fit on the outside face of the duct wall.

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The advantage of the embodiment according to the invention lies particularly in the fact that the flange profile has no bending zones which are over-stressed, which means that it can be produced with less heavily loaded rolls and also formed with relatively wide rolls. Therefore, a normal quality metal sheet can be used and no secondary annealing is required. A good and lasting sealing effect results from the fact that the beaded edge presses the duct wall against the first longitudinal arm, in fact at a greater distance behind the end face of the duct wall. Any burrs or nicks or other deformation of the end face cannot have any effect, which means it is possible to achieve the seal in a manner which can be predetermined without difficulty during manufacture.

The feature according to Claim 2 enhances the clamping pressure.

The feature according to Claim 3 counteracts the propagation of air turbulence inside the air conditioning duct.

By reason of the feature according to Claim 4, it is possible to integrate into the flange connection an edge plate which, in known manner, serves to secure insulating panels which are located within the air

conditioning duct.

The features according to Claim 5 achieve a further increase in clamping pressure.

5 The invention will be explained in greater detail hereinafter with reference to examples of embodiment illustrated in the accompanying drawings, in which:

FIGURE 1 shows a particularly preferred embodiment of flange connection according to the invention, only part of a duct wall being illustrated;

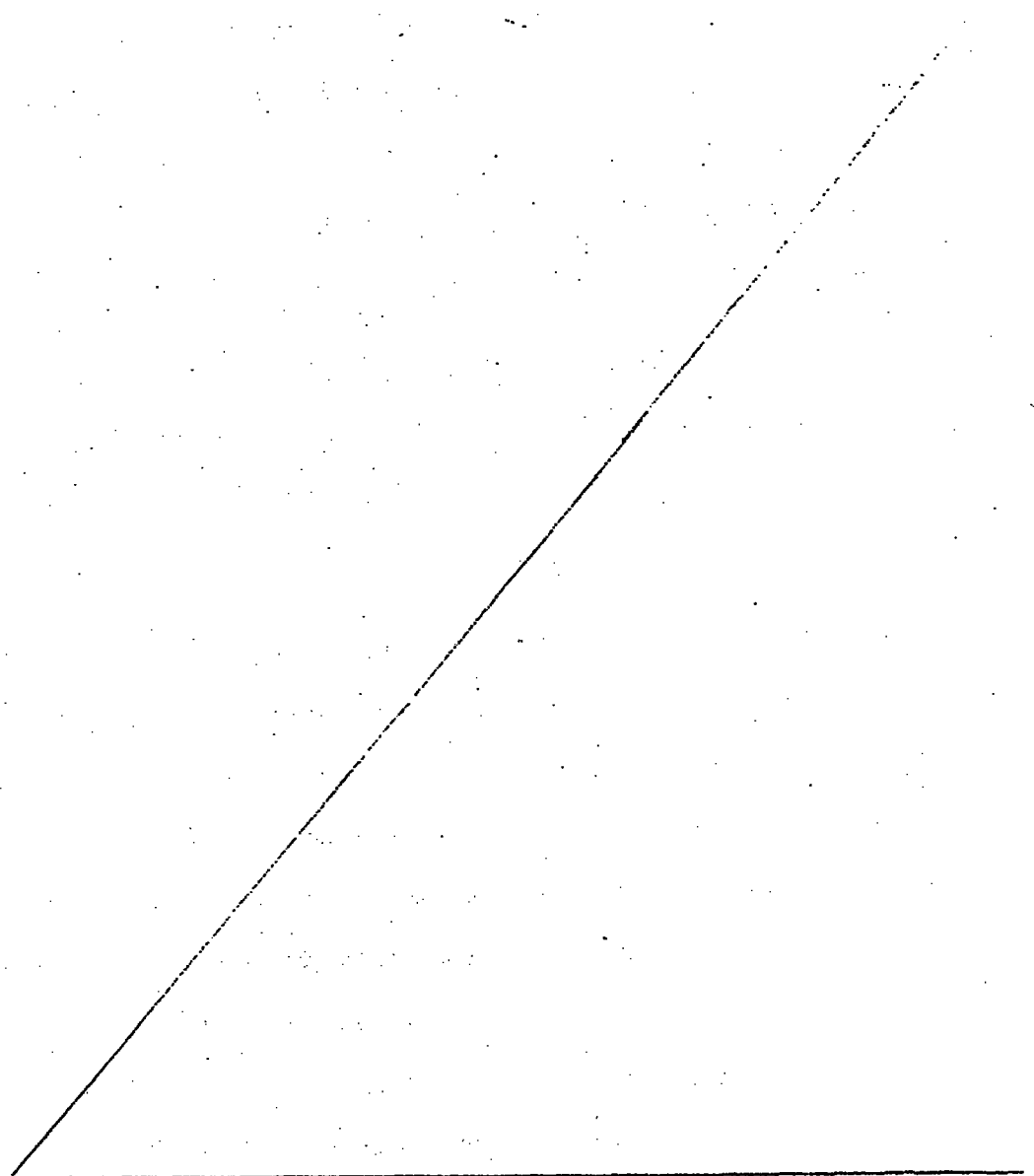
10 FIGURE 2 is a view in the direction of the arrow 2 according to Figure 1;

FIGURE 3 shows a view corresponding to that in Figure 2 but according to a second embodiment of the invention, and

15 FIGURE 4 shows a view corresponding to that in Figure 2 but of a third embodiment of the invention.

An air conditioning duct consists of four duct walls of which, for the sake of greater clarity, Figure 1 only shows an upper duct wall 11 while dash-
20 dotted lines indicate a lateral duct wall 12 adjacent thereto. Mounted on the ends of each duct wall is a flange profile 13, the four frame-wise disposed flange profiles being connected by angle pieces 14 inserted into their end zones and of which Figure 1 shows one in
25 dash-dotted lines. Air conditioning ducts, or more precisely partial ducts, are prefabricated in this manner and carry such flange profiles 13 at both ends.

A plurality of partial ducts are laid one against another on site and are connected to one another as air-tightly as possible by their abutting flange profiles. A geometrical longitudinal axis 16 can be
5 associated with the air conditioning duct. In relation to this geometrical longitudinal axis 16, it is possible to sub-divide the _____



flange profile 13 into the following zones, looking in the longitudinal direction of the profile, in other words in the direction of the arrow 2:

5 A first longitudinal arm 17 bearing on the inside face of the duct wall 11, a first radial arm 19 extending from the longitudinal arm 17 and disposed in front of the end face 18 of the duct wall 11 and oriented at a right-angle thereto, an outer arm 21 starting therefrom and extending back behind the end face 18 of the duct wall 11 and having in this example a convex shape 22, a second radial arm 23 extending
10 therefrom at a distance from and parallel with the first radial arm 19, an oblique arm 24 extending therefrom at about half the height of the first radial arm 19 and, starting therefrom, a second longitudinal arm 26 which bears on the outside face of the duct wall 11.

Adjacent the second longitudinal arm 26 is an oblique guide lip 27.

15 The first longitudinal arm 17, the duct wall 11 and the second longitudinal arm 26 are connected to one another by a series of spot welds 28 disposed one after another.

The profile views in the drawings are true-to-scale reproductions of the structural drawings. Fig. 2 once again shows the flange profile
20 13 described with reference to Fig. 1 but in a view according to the direction of the arrow 2, in order to show more clearly the details which are essential to the invention. Starting from the first radial arm 19, a rolled bead 29 is formed into the hollow profile and has a first web 32 extending from a first bent portion 31 on the first radial
25 arm 19 and approximately at a right-angle to this latter. After a first semi-circular arc 33, there follows a second web 34 which merges via a second arc 36 directly into the first longitudinal arm 17.

According to Fig. 1, the end of the angle piece 41 which has a cross-

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section 37 shown in the drawing as a shaded area is inserted with a close fit between the radial arms 19 and 23, the outer arm 21 and the first web 32 into the end zone of the flange profile 13. When a flange connection is made up, initially four such flange profiles 13 are connected by four angle pieces 14 into a frame which is then fitted onto the open end of the air conditioning duct and then secured by the spot welds 28 in the manner described. During this pushing-on process, the oblique guide lip 27 assists assembly. Pushing-on does not initially require much force until the end face 18 abuts against the first arc 33. Now this pressure point is overcome by the application of somewhat more force and the duct walls 11 force themselves between the first arc 33 and the longitudinal arm 17, the first arc 33 acting at the same time as an oblique guide lip. Once the fitter has overcome this pressure point, he can quite clearly feel that the flange profiles are correctly and completely fitted onto the duct walls. The clamping fit also ensures that the flange profiles cannot flip in the meantime, before the spot welds 28 have been applied. The configuration of the two arcs 33 and 36 in conjunction with the second web 34 acts as a clamping spring which is capable of accommodating duct walls 11 made from sheet metal ranging from 0.75 to 1.5 mm thickness. Here, therefore, considerable play is available both with regard to usage and tolerance. By reason of the fact that the first web 32 is, at least in the end zones of the flange profiles, supported by the inserted ends of the angle pieces 14, there is considerable contact pressure at the point of contact between the first arc 33 and the duct wall 11. The first arc 33 also reinforces the profile very effectively, so that even undulations in the duct wall 11 can be pressed flat.

As Fig. 2 shows, the two arcs 33 and 34 are preferably of the same

radius and in fact a radius of 2.5 mm in relation to the centre of the material. The bead can therefore be produced to a measure which is reasonable from the manufacturing point of view. When fitted, the flange profiles which bear on one another are clamped against one another substantially in the region of the curvature 22. So that the opening formed in the first radial arm 19 by the bead 29 does not result in that end of the flange profile which is opposite the clamping point and relatively and radially quite some distance inwards likewise clinging on the first radial arm 19 with a springing action and so tending to suffer vibrations, there is provision for the second arc 36 to bear on the first web preferably with some initial tension.

According to Fig. 2, the spot welds 28 are at a longitudinal distance 38 from the first radial arm 19. In the case of the example of embodiment, this longitudinal distance 38 amounts to some 30 mm. At a distance 39 of about one-quarter of the longitudinal distance 38 from the end face 18 of the duct wall 11, the first arc 33 presses against the outside wall of the duct wall 11. In the case of the example of embodiment illustrated, this gap 39 measures about 7 mm.

According to the preferred embodiment of Figs. 1 and 2, the outside face of the first radial arm 19 is aligned with a tangent which can be applied against the outside face of the second arc 36. A variation on the invention which differs from the embodiment only on this point is shown in Fig. 3. Therefore, since all the essential elements are the same, then in order to ensure better illustration, they are identified by the same reference numerals but in each case raised by 300. Here, between the outer web 332 and the second arc 336 there is inserted with a clamping fit an arm 41 of an edge plate 42. This edge plate 42 has a further arm 43 which projects radially into the air conditioning

duct. The second arc 336 is so far set back in relation to the first radial arm 319 that the outside face of the first radial arm 319 is aligned with the outside face of the further arm 43. Adjacent to the further arm 43 is a third arm 44 which extends parallel with the duct wall 311. Between this arm 44 and the duct wall 311, it is possible to secure an insulating panel in a manner not shown here in greater detail.

Fig. 4 shows a further alternative embodiment of the invention. Since the individual elements agree substantially with those already described in connection with Figs. 1 and 2, then in this case also, equivalent parts are identified by reference numerals which are the same except that they have been raised by 400. This flange profile 413 is distinguished in that, so long as it is not welded to the duct wall 411, it has between its longitudinal arms 417 and 426 a gap which is somewhat greater than the thickness of the duct wall 411. Furthermore, the first arc 433 in Fig. 4 is displaced so far rightwardly that it comes very close to and preferably lightly touches the oblique arm 424. Now, as soon as the spot welds 428 have been applied, the oblique arm 424 presses against the first arc 433 causing this now to be pressed against the duct wall 411 but with increased pressure. The spot welds 428 are at a longitudinal distance 438 from the first radial arm 419. The first arc 433 presses at a distance 439 on the outside face of the duct wall 411, which amounts to approximately half the longitudinal distance 438. The advantage of this developed embodiment lies in the increased pressure of application. In contrast, the particularly preferred embodiment according to Fig. 1 offers the advantage that the flange profile 13 can be shaped from a narrower strip of sheet metal and the rolling depth is less.

The example of embodiment shown in Fig. 4 can be modified in the same way as that in Fig. 3.

According to Fig. 2, the second web 34 is inclined by about 20° obliquely in relation to the duct wall 11. Accordingly, both arcs 33, 36 extend in each case over an angular segment of some 200° . According to Fig. 4, the second web 434 is inclined to the duct wall 411 by a somewhat flatter angle of about 10° . The arcs 433 and 436 therefore extend over an approximately 190° segment of angle.

In general, the sealing effect is based on surface pressure between the duct wall and the inner longitudinal arm of the flange profile.

The outer longitudinal rib pressing against it and the cross-section of which constitutes the first arc presses in turn more in the form of linear pressure and can straighten undulating distortions of the duct wall in order thus to increase the sealing action on the actual sealing surfaces. The sealing surfaces lie on the one hand sufficiently far behind the end edge of the duct wall in order not to be adversely influenced by its structure but on the other hand also near enough to fix the frame flanges in a stable fashion and also support the end edge.

The webs function as pressure springs. In the end zones of the frame flanges, the ends of the angle piece which extend over a part of the first web also produce an additional amplification of the applied pressure.

(12)

CLAIMS:

1. An assembly comprising a rectangular air conditioning duct having four walls, and at least one flange connection having four flange profiles each of substantially L-shaped hollow profile and made from sheet metal and four angle-pieces, said flange profiles each having a first longitudinal member (17) which is parallel with a geometric longitudinal axis of the air conditioning duct and bears on the inside face of the duct wall, a second longitudinal member in the form of a first radial arm (19) emanating from said first member at right-angles thereto for location in front of the end face of the duct wall, a third longitudinal member in the form of an outer arm (21) emanating from said second member and extending back to a position behind the end face of the duct wall, a fourth longitudinal member in the form of a second radial arm emanating from said third member and extending at a distance from and parallel with the first radial arm, a fifth longitudinal member in the form of an oblique arm (24) extending from said fourth member and having a radial dimension approximately half the height of the first radial arm and a sixth longitudinal member (26) emerging from said fifth member which bears on the outside face of the duct wall, opposite the first longitudinal member, a bead (29) shaped into the first radial arm and extending



* C L H S *



into the hollow profile of the flange, the bead being formed with a first bent-over portion (31), a first web (32) approximately at a right-angle to the first radial arm and situated opposite and at a distance from the outer arm (21), the ends of said angle pieces engaging with a close fit between the radial arms, the outer arm and the first web and into the end zones of the flange profiles, said bead also being formed with a second web (34) disposed between the first web and the first longitudinal member, said second web merging along one edge by means of a second bent-over portion (36) into the first longitudinal arm and connected at a second edge, via a substantially semi-circular first arc (33) to the first web, said second bent-over portion being constructed as a substantially semi-circular second arc (36, 336, 436) which, from the second web (34, 334, 434) merges directly into the first longitudinal member (17, 317, 417), said bead (29) being so formed that the first arc (33, 333, 433), when the flange profile (13, 313, 413) is not applied against a duct wall (11, 311, 411), is spaced at a distance from the first longitudinal arm (17, 317, 417) which is less than the thickness of the duct wall (11, 311, 411), whereby the bead can bear with a clamping fit on the outside face of the duct wall (11, 311, 411).

2. An assembly as claimed in Claim 1, wherein when the flange profile (13, 313, 413) is not applied



against a duct wall, the second arc (36, 336, 436) is constructed to bear, particularly to bear with initial tension, against the first web (32, 332, 432).

3. An assembly as claimed in Claim 1, wherein the
5 outside face of the first radial arm (19, 419) is in line with a tangent which can be applied against the outside face of the second arc (36, 436).

4. An assembly as claimed in Claims 1 or 2, wherein
an arm (41) of an edge plate (42) from which a further
10 arm (43) projects radially into the air conditioning duct is held with a clamping fit between the second arc (336) and the first web (332), the second arc (336) being set back in relation to the first radial arm (319) so that the outside face of the first radial arm
15 (319) is aligned with the outside face of the further arm (43).

5. An assembly as claimed in any one of the preceding Claims, wherein the flange profile (413) is not applied against a duct wall (411), the first arc
20 (433) extends quite close to and preferably is in light contact with the oblique arm (424).

6. An assembly as claimed in any one of Claims 1 to 5, wherein the first (17, 317) and sixth (26, 326) longitudinal members are connected to the duct wall
25 (11, 311) between them by a row of spot welds (28, 328) disposed serially in the longitudinal direction of the profile, and in that these spot welds are at a





longitudinal distance (38) from the first radial arm (19, 319), the first arc (33, 333) bearing on the outside of the duct wall (11, 311) at approximately one-quarter of the longitudinal distance from the end face thereof.

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7. An assembly as claimed in Claim 6, wherein the first (417) and sixth (426) longitudinal members are connected to the duct wall (411) between them by a row of spot welds (428) disposed serially in the longitudinal direction of the profile, said spot welds being at a longitudinal distance (438) from the first radial arm (419), the first arc (433) bearing on the outside face of the duct wall (411) at approximately half this longitudinal distance.

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8. An assembly as claimed in any one of Claims 1 - 6, wherein the first and second arcs (36, 336, 436) have the same radius.

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9. An assembly as claimed in Claim 9, wherein the first and second arcs extend in each case over an angular segment of about 190 to 200 degrees.

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10. An assembly substantially as described with reference to Figures 1 and 2, Figure 3 or Figure 4 of the accompanying drawings.



ERRATUM

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