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GB 0886331 A **EP 0195528 A1** **US 4733889 A**
US 4606556 A

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(54) A right-angle bend for pneumatic conveyor lines

(57) A self-cleaning 90° bend which gives rise to minimal pressure loss and substantially avoids the formation of angels' hair consists of a tubular asymmetrical cross-sectional widening (2), a baffle plate (6) disposed on the outside of the bend and a tubular asymmetric cross-sectional narrowing (4) on the outlet side. The baffle plate (6) forms with the direction of flow on the inlet side an angle of between about 55° and 65°. The inside of the bend is formed by a quarter-circle shaped half shell (3) of pipe. The remaining surface areas are supplemented by filling segments (7) to form a closed cross-section.

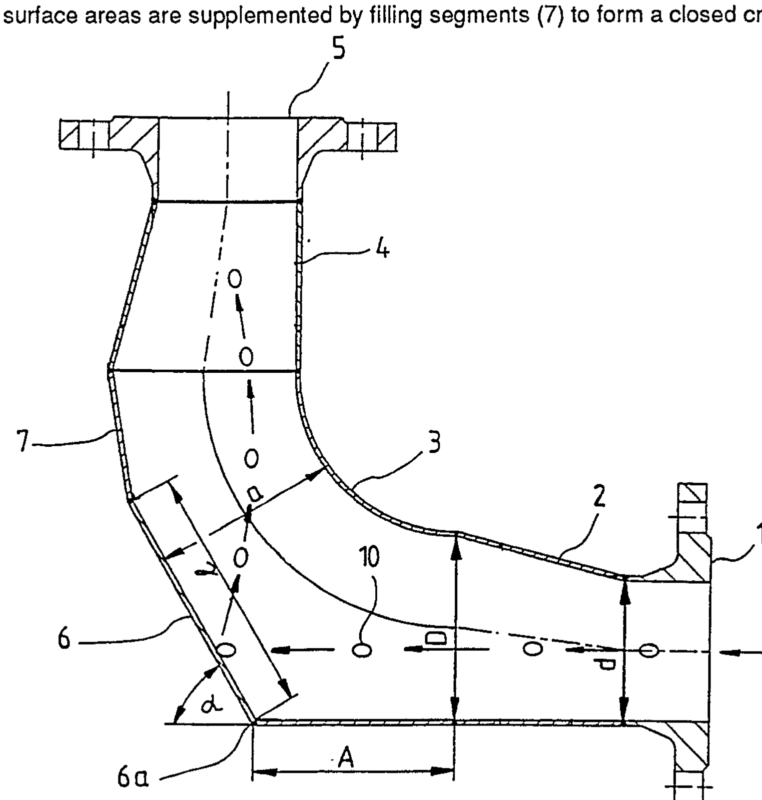

Fig. 3

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Fig. 1

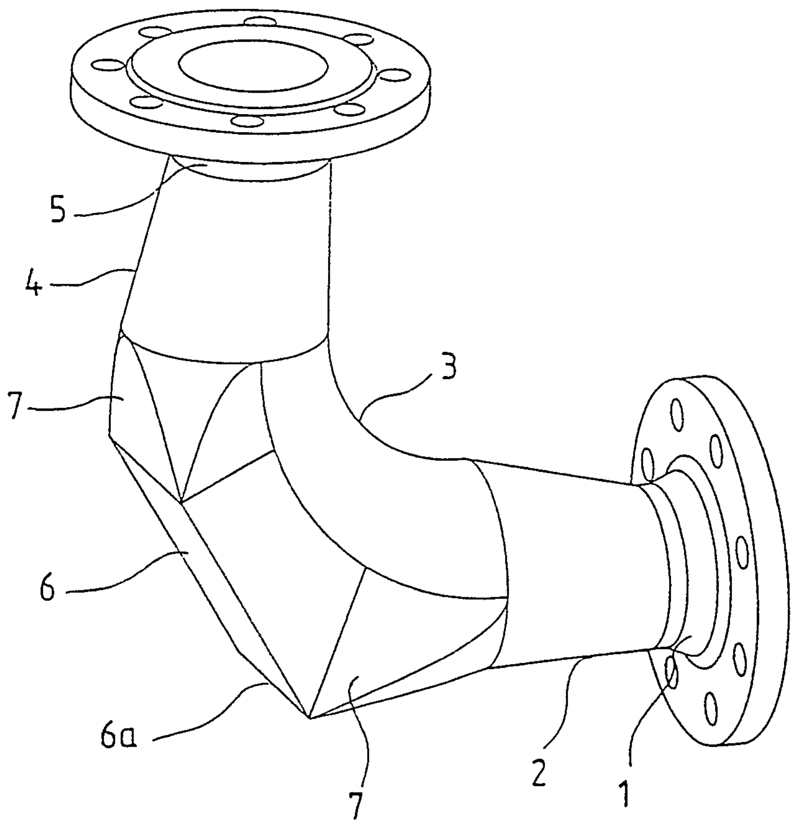


Fig. 2

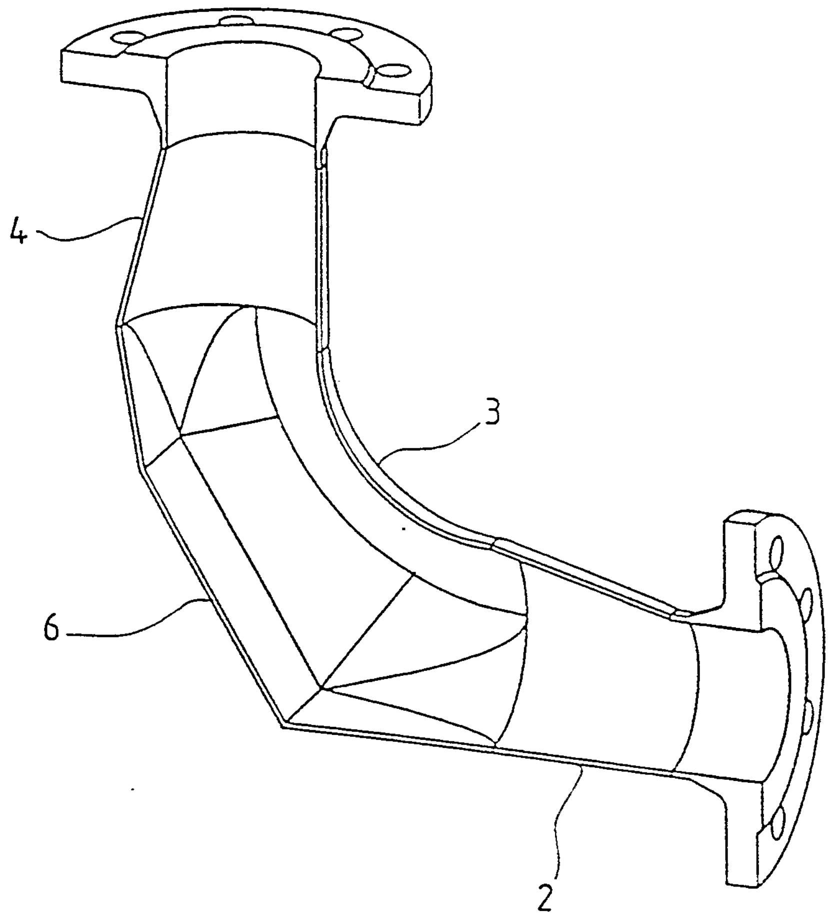
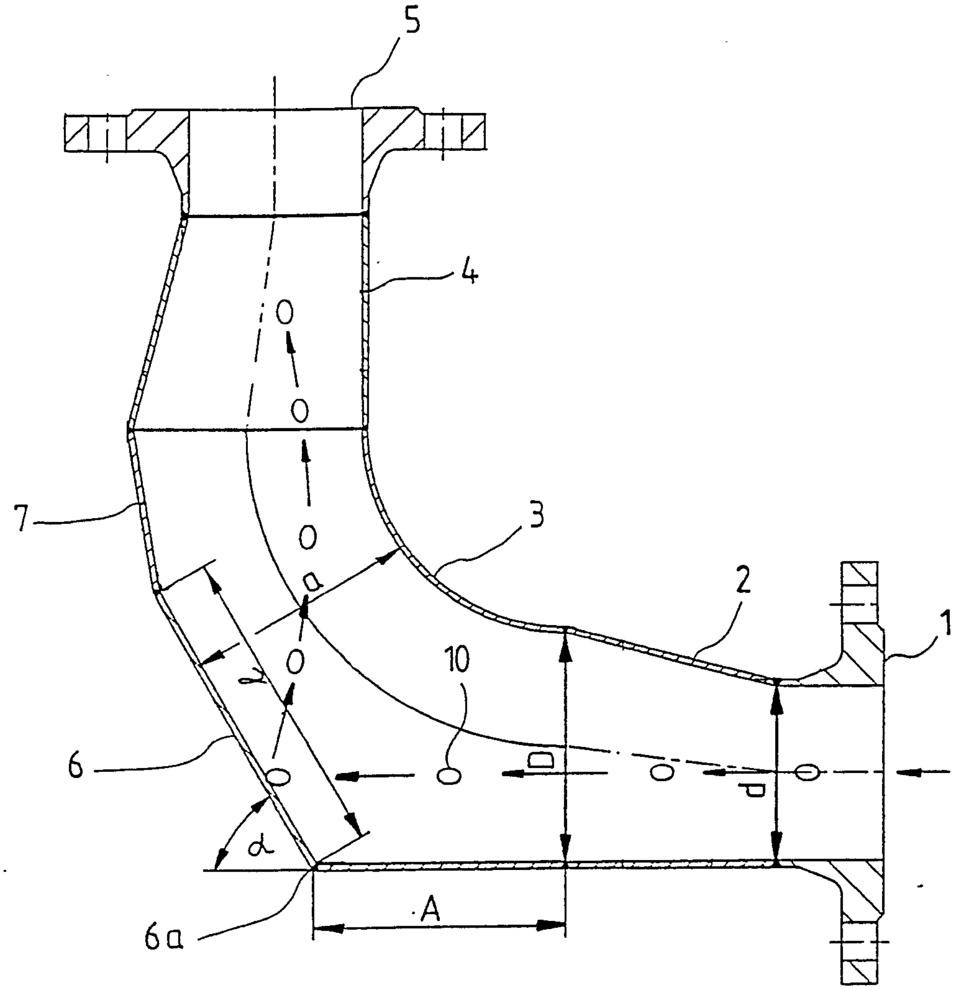


Fig. 3



A 90° bend for fluid conveyor lines

The invention relates to a 90° bend for pneumatic or other fluid lines, such as conveyor lines, with a first pipe connector portion opening into and a second pipe connector portion opening out of a widened cross-section.

Such a bend has become known from prior public use. It consists of a pipe bend shaped like a quarter of a circle, with a bag-like widening of the cross-section on the outside of the bend. The velocity of the inflowing stream of bulk material is slowed down by this bag-like widened out portion. Part of the bulk material collects in the space formed by the widened cross-section and so prevents direct impact of the particles of bulk material entering the bend from striking the wall on the outside of the bend. The correspondingly reduced wear and tear on this portion of wall results in a significantly longer effective life for the bend. A disadvantage, however, is the loss in pressure caused by the bag-like widening of the cross-section. Above all, however, the product collecting in the bag is virtually impossible to remove even by prolonged blasting, so that the bend has to be removed in order to be cleaned completely, as may be necessary for instance prior to a product change.

However, another 90° bend is known which takes the form of an arc of piping which has on the outside of the bend a cross-sectional widening in the form of a virtually spherical chamber. During operation, this chamber becomes filled with particles of bulk material intended to form a ball or eddy rotating in the opposite direction to that into which the flow is deflected and which imparts the desired deflection to the incoming flow without the particles of bulk material striking the wall on the outside of the bend. It is intended not only to reduce the wear and tear on the bend but also to prevent any change in the particle structure and the formation of product abrasion and so-called angels' hair. In actual fact, however, the separating edge which divides the incoming flow of bulk material into a deflected partial flow and a partial flow which enters the chamber and rotates therein, and also the rotating movement of the particles of bulk material in the spherical chamber encourage the formation of ultra-fine abraded material in particular. Furthermore, it has been found that at least with certain types of bulk materials, the desired suspension of bulk material particles in the conveying medium does not occur in the spherical chamber but instead, this chamber becomes filled with non-moving bulk material. Then, this construction of deflecting piece does not differ very much from the previously explained construction, also with regard to the problem of cleaning prior to a product change.

Of course, also known are conventional 90° pipe bends which have above all the advantage of low pressure loss and are self-cleaning but they quickly suffer from wear and tear on the outside of the bend and encourage the formation of angels' hair which occurs commonly when, inter alia, polyolefin granulate grains pass along the pipe wall, above all when high conveying speeds are involved. This can be avoided by using T-pieces instead of bends. With these T-pieces, the third connection has a blind ending so that it becomes filled with bulk material as far as the deflection point between the first and second connections, the boundary surface forming a kind of baffle plate for the incoming particles of bulk material. However, such T-pieces are not self-cleaning and they do create a high pressure loss.

According to the invention, there is provided a 90° bend for fluid conveyor lines having a first pipe connector opening into and and a second pipe connector opening out of a portion of widened cross-section, wherein the first pipe connector is connected to a first pipe portion of which the half shell on the inside of the bend widens out conically; said half shell is connected to a quarter-circle shaped half shell; the quarter-circle half shell is followed by the cylindrical half shell of a second pipe portion of which the half shell on the outside of the bend is conical; and the part of the pipe bend which is on the outside of the bend, between the first and second pipe portions, includes a baffle plate which subtends an angle of between about 55° and 65° relative to the axis of the first pipe connector.

Thus, there is provided a 90° bend of the type indicated at the outset, which avoids the formation of angels' hair, is self-cleaning and has a pressure loss which is not substantially greater than that of a conventional quarter-circle pipe bend of the same nominal diameter.

The nub of the present proposal resides in the eccentric but continuous widening of the cross-section, the baffle plate on the outside of the bend and an eccentric but continuous narrowing of the cross-section, avoiding pockets or similarly dead spaces. As a result of the widening of the cross-section, the individual particles of bulk material become detached from the inside wall of the pipe during pure volatile conveyance or turbulent flow (in other words, during reduced loading) and they strike the baffle surface. There, they rebound and are transported on by the flow. Therefore, in contrast to a conventional 90° pipe, hanks, skeins or eddies cannot form and therefore no angels' hair can be formed. Furthermore, the grain or other fluid material is accelerated again very quickly. Therefore, the pressure loss is minimal. With higher loading ("hank conveyance" which may correspond to smooth flow), on the other hand, a thin layer of bulk material forms on the baffle plate and in the adjacent part of the narrowed cross-section and this will slowly flow along the baffle plate and the adjacent pipe portion in the direction of flow. If the bulk material is a granulate, then the thickness of the layer is only a few times the grain diameter. The particles entering with the flow are therefore at least partially deflected in their resilient impact against the baffle plate so that the speed loss and correspondingly the pressure loss is on average less than with the 90° bend of the type mentioned at the outset and comparable constructions.

Preferably, from the production point of view, the second pipe portion has the same dimensions as the first pipe portion.

Preferably, the outlet diameter of the first pipe portion is substantially equal to between 1.2 and 1.5 times the inlet diameter.

If the bend is designed in accordance with these diameter proportions, it is equally suitable for conveyance with low as well as with high loading levels.

Preferably, the inlet edge of the baffle plate is spaced apart from the outlet cross-section of the first pipe portion by at least a diameter of this outlet cross-section. It is also preferable that the minimum distance between the baffle plate and the quarter-circle half shell, measured in the longitudinal plane of the bend, is substantially equal to an outlet diameter of the first pipe portion. Conveniently, measured in the direction of flow, the length of the baffle plate amounts to between 1.5 times and twice the diameter of the first pipe connector.

Keeping to these dimension minimises the pressure loss without the previously described function of the bend suffering. However, also other forms of cross-section are possible so long as the cross-sectional area in the deflection zone does not fall below the cross-sectional area of the first pipe connector.

There now follows a description of preferred embodiments of the invention, by way of example, with reference being made to the accompanying drawings in which:

Fig. 1 is a perspective view of a bend according to the invention;

Fig. 2 shows a longitudinal section through the bend in Fig. 1; and

Fig. 3 is a diagrammatic simplified view representing the same longitudinal section as in Fig. 2.

The 90° bend shown in the drawings consists of a first cylindrical pipe connector portion 1 comprising a connecting flange, a first pipe portion 2 which follows it, an adjacent half shell 3 in the shape of a quarter of a circle, a second pipe portion 4, a second cylindrical pipe connector 5 provided with a connecting flange, and a baffle plate 6 opposite the quarter-circle half shell and connected by a number of segments 7 of various shapes according to the geometry, for forming a closed cross-section with the quarter-circle half shell and also the first and second pipe portions. The direction of conveyance extends from the pipe connector 1 to the pipe connector 5.

The first pipe portion 2 and the second pipe portion 4 have the same outward form and do in fact each consist of a substantially cylindrical half shell and a conical half shell but they are disposed with varying orientation about their axes, in fact so that the cylindrical half shell of the first pipe portion 2 is disposed on the outside of the bend while the cylindrical half shell of the second pipe portion 4 is on the inside of the bend, as can be most clearly seen from Fig. 3. The cone angle and/or the length of the first pipe portion are so chosen that particles of bulk material which are conveyed along the inside wall of the bend of the cylindrical first pipe connector will become detached from the wall in any case in the region of the conical widening of the first pipe portion. In addition, the conveyance or flow velocity diminish due to the widening of the cross-section. A major part of the bulk goods particles being conveyed follows the path shown in Fig. 3 diagrammatically for a grain 10 of granulate. Depending on the loading, so a more or less high percentage of granulate grains 10 will be reflected directly by the baffle plate 6 in the direction of the outlet side of the bend or will be deflected on other precedent grains which are decelerated by the baffle plate 6 or which have already been reflected. The most favourable reflection or deflection pattern occurs when the baffle plate 6 encloses an angle α of between 55° and 65° with the axis of the first pipe connector 1.

The lower the flow or conveyance velocity of the grains 10 in this area, the greater the amount of deflection. Too marked a reduction in conveyance velocity must however be avoided not only because the pressure loss will be all the greater the more the conveyance velocity falls initially and correspondingly rises again at the output side but also in order to avoid accumulations of product which both trigger clogging and also are likely to jeopardise the self-cleaning properties. Therefore, a favourable compromise is to have a diameter D at the outlet cross-section of the first pipe portion 2, which amounts to 1.2 to 1.5 times the diameter d at the inlet cross-section which is at the same time the nominal diameter of the pipeline.

In order substantially to retain the increased cross-section, the edge 6a on the inlet side of the baffle plate 6 is at a distance A from the outlet cross-section of the first pipe portion which is at least equal to D. In order that the volume of the bend and also the angle of deflection are not excessively great, the baffle plate 6 ought to be at the very smallest distance a from the quarter-circle half shell 3 which at least is not substantially greater than D. Complying with this condition also establishes the maximum value of A.

The length l of the baffle plate 6 arises from the consideration that on the one hand virtually all the incoming grains 10 should strike the baffle plate 6 or the layer of grains forming thereon while on the other hand the variations in cross-section ought to be as steady as possible. The length l therefore amounts to about 1.5 times to twice the diameter d.

In the part of the bend which follows the baffle plate 6, the stream of bulk material is accelerated again due to the narrowing of the cross-section, principally in the region of the second pipe portion 4. Therefore, it is not a functionally necessary condition but only a production advantage if the second pipe portion 4 is of the same shape or the same dimensions as the first pipe portion 2.

CLAIMS

1. A 90° bend for fluid conveyor lines having a first pipe connector opening into and a second pipe connector opening out of a portion of widened cross-section, wherein

the first pipe connector is connected to a first pipe portion of which the half shell on the inside of the bend widens out conically;

said half shell is connected to the quarter-circle shaped half shell;

the quarter-circle half shell is followed by the cylindrical half shell of a second pipe portion of which the half shell on the outside of the bend is conical; and

the part of the pipe bend which is on the outside of the bend, between the first and second pipe portions, includes a baffle plate which subtends an angle of between about 55° and 65° relative to the axis of the first pipe connector.

2. A bend according to Claim 1, wherein the second pipe portion has the same dimensions as the first pipe portion.

3. A bend according to Claim 1 or Claim 2, wherein the outlet diameter of the first pipe portion is substantially equal to 1.2 to 1.5 times the inlet diameter.

4. A bend according to any of Claims 1 to 3, wherein the inlet edge of the baffle plate is spaced apart from the outlet cross-section of the first pipe portion by at least a diameter of this outlet cross-section.

5. A bend according to any of Claims 1 to 4, wherein the minimum distance between the baffle plate and the quarter-circle half shell, measured in the longitudinal sectional plane of the bend, is substantially equal to an outlet diameter of the first pipe portion.

6. A bend according to any of Claims 1 to 5, wherein measured in the direction of flow, the length of the baffle plate amounts to between 1.5 times and twice the diameter of the first pipe connector.

7. A bend generally as herein described, with reference to or as illustrated in the accompanying drawings.

8. Any novel combination or sub-combination disclosed and/or illustrated herein.

Examiner's report to the Comptroller under Section 17 (The Search Report)

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Relevant Technical fields

(i) UK Cl (Edition K) F2G (G1)
B8A

(ii) Int CL (Edition 5) F16L 43/00
B65G 53/52

Search Examiner

B J PROCTOR

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

12 MAY 1992

Documents considered relevant following a search in respect of claims 1-7

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
Y	GB 886331 A (SELLMEIER) eg Figures 4, 1	1, 2 at least
Y	EP 0195528 A1 (AKATAKE ENG) eg Figure 1	1, 2 at least
Y	US 4733889 A (GOODYEAR) eg Figure 2	1, 4, 5 at least
X Y	US 4606556 A (FULLER CO) eg Figures 1, 4 column 3 lines 27-30	1 at least

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

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