

TITLE: TRANSPORT PIPE

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TECHNICAL FIELD

The present invention relates generally to pneumatic transport systems, and more specifically relates to a transport pipe for a pneumatic transport system, in accordance with the preamble of the accompanying claim 1, to a method of increasing the useful life of such a transport pipe, according to the preamble of the accompanying claim 9, to a means for reducing the wear at a bend of such a transport pipe, according to the preamble of the accompanying claim 14 and to a use of an inventive transport pipe, according to claim 19.

BACKGROUND

In the type of pneumatic transport systems that are intended above all for domestic waste and that are described in for instance our U.S. Patent Specifications 3 687 503 and 3 813 128, the waste is transported from the different insertion chutes in transport pipes that are laid substantially horizontally in the ground. The pipe diameter of such transport pipes is usually 300mm, 400mm or 500mm. The waste is transported at a relatively high velocity – the velocity may usually be approximately 18-24 m/s – and often contains hard and/or sharp fractions such as glass, pottery, metal, sand and soil. Such fractions will generally cause erosion, that is they will wear the pipe material. Such abrasion occurs to a less serious degree at the bottom of straight pipe sections, but becomes particularly serious at the bends and curves that are always present in such a transport system. At such positions the hard and sharp fractions will hit the wall of the bend with a substantial force. In principle such abrasion will occur distributed over the surface of the bend, but it will become particularly serious, that is deep, within a restricted area that, due to the influence of the centrifugal force, will be moved from the bottom of the pipe and up to its outer, with regard to the bend, side wall.

This restricted “waste impact area” where the wear of the pipe wall will be greatest is illustrated in the enclosed drawing figures 1 and 2, where a bend 2 of a conventional transport pipe 1 is illustrated from one side and in a plan view from above, respectively. The waste is transported in the direction B in a straight section that is preferably extended horizontally, but that may possibly also be inclined relative to the horizontal plane and may even be vertical.



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Experience has shown that when the portions of the waste that contain the hard and sharp fractions enter a bend 2, they are moved up towards the outer side wall 5 by the centrifugal force, after having been transported or conveyed horizontally in contact substantially with the bottom wall 4. Thereby they hit the side wall 5 substantially within the indicated, restricted area that is designated by the reference number 6 in the drawings. This area refers to the illustrated situation where the radius of the bend is approximately three times the pipe diameter. Accordingly, the hard and sharp fractions will cause a relatively severe and deep erosion or abrasion within such a restricted area. Obviously the "impact area" could be extended or enlarged by increasing the radius of the bend, but many times this is not possible for design reasons. Moreover, such an increase of the radius leads to a significant increase of the costs, since the size of the bend increases correspondingly.

In particular, the wear caused by such erosion may become up to 20 times greater in a 90° bend than in a straight section of the pipe. Buyers of such so-called "refuse suction systems" make great demands, in particular on the useful life of the transport pipe laid down in the ground. Normally the requirement is a useful life of at least 30 years but requirements for a useful life of up to 60 years may be made especially where the pipe is laid under a building. In view of the above and with regard to the wear, the bends and curves of the pipe will be the critical points of the system.

Up to the present day, attempts to solve or at least minimize the above discussed problems within this technical field have predominantly aimed at providing the desired useful life through special manufacturing of the bends. Thereby, one alternative has been to manufacture the bends from the same material as the rest of the pipe, but with a much thicker wall. Another alternative has been to manufacture the bends from a specifically wear resistant material, such as a Ni-Hard-alloy. Both said solutions result in a substantial cost increase, especially in systems containing a large number of bends. Another way of solving said problem is suggested in our own Swedish Patent no. 409 019. This alternative method is likewise based upon a strengthening of the bend for the purpose of increasing the useful life thereof, but suggests a slightly different approach. According to said patent overlapping wear resistant inserts are provided over at least the portion of a bend of the pipe, which is subjected to the erosive action of the hard and sharp fractions of the material. The inserts are preferably

welded to the pipe wall and cause a considerable increase in costs, both with regard to material and work. Moreover, in most cases the last mentioned solution causes an undesirable reduction of the cross section area.

To sum up, it can therefore be established that the conventional solutions in themselves have performed their function in a satisfactory manner, but that they are all based on the principle of increasing the useful life of the bend by strengthening it. As has been discussed above, such a solution in all cases results in a substantially increased cost of the strengthened or reinforced bend, and this is a serious problem, not least in larger suction operated refuse systems containing a large number of bends.

SUMMARY OF THE INVENTION

A basic object of the invention is therefore to provide a simple and yet appropriate way of combining a desired useful life of a bend in a transport pipe of the above indicated kind and a reasonable cost thereof. To be more precise, the object is to achieve this by permitting the use of a pipe bend having a wall thickness that is significantly reduced as compared to the prior art, and/or that is manufactured from a comparatively inexpensive material, for instance the same material as that of the remaining transport pipe.

The invention is based on the understanding that the need for the traditional reinforced pipe bend may be reduced by accomplishing a distribution of the wear or abrasion over a larger surface, that is by spreading or expanding the "impact area" of the heavily eroding material transported in the pipe. In other words, this means that the area of the bend that is exposed to the abrasive and eroding action of the transported hard and sharp material is in itself enlarged. Simultaneously, or as a result thereof, the depth of the wear or abrasion in each point of the wear surface, which is in itself expanded, will become significantly smaller than in the wear surface indicated in figs 1 and 2, where the most severe abrasion occurs when the conventional technique is employed. This will correspondingly increase the useful life of the transport pipe.

According to one aspect of the invention these basic objects are achieved by fixing at least one impact plate to the inner surface of the pipe, said impact plate extending into the transport

path of the material transported in the pipe. Said impact plate is provided at a position just before, at or just after the junction between or transition from a substantially straight section and/to a bend of the transport pipe. In view of the fact that the plate serves as an impact surface for at least those portions of the arriving, transported material that contain the hard and sharp fractions and that from experience are also known to be heaviest, this material will change direction in what may be called an unpredictable or random manner since separate units of the material will hit the plate at different angles and with different force. Through this spreading effect the different material units will hit the pipe bend distributed over an essentially larger area than in a traditional system, which in turn means that the useful life of the bend will be correspondingly extended.

In an appropriate embodiment of the invention the impact plate or plates are provided with a rear edge, as seen in the transport direction. Said rear edge is preferably attached to the inner circumferential surface of the transport pipe, at a level therewith. Furthermore the impact plate or plates are provided with side edges closely adjoining and preferably being attached to the inner circumferential surface of the transport pipe, as well as with a forward edge positioned at a distance from said inner circumferential surface of the transport pipe. Hereby, the upper surface of the of the impact plate or plates will slope generally outwardly from the inner circumferential surface of the transport pipe, as seen in the transport direction, for providing the impact surface extending into the transport pipe. With such a design the plate may easily be welded to the inner circumferential surface of the transport pipe.

According to another embodiment of the invention two or more plates are provided after each other in the transport direction, whereby these plates may be provided in the same or in mutually different positions around the inner circumference of the transport pipe. With this design the useful life of the pipe bend may be extended even further since the forward plate or plates, as seen in the transport direction, are put into action as a rear plate becomes worn and loses its impact function.

Other advantageous embodiments of this aspect of the invention are specified in the respective dependent claims.

According to another aspect of the invention a method is provided for extending or increasing the useful life of a transport pipe of a pneumatic transport system containing at least one pipe bend. This is achieved by changing the transport direction of at least portions of the material transported in the pipe in an area extending from just before to just after the entry of the material into the bend. Thereby, the above mentioned favorable effect is achieved of increasing the spreading of the impacts of the material portions or units, that is their "impact area", on the inner circumferential surface of the pipe bend, namely the extension of the useful life of the pipe bend.

In a favorable embodiment of this method at least one impact plate is attached to the inner circumferential surface of the transport pipe, whereby the plate or plates are arranged such that an upper surface thereof extends into the transport path of the material transported in the pipe. The plate or plates are provided just before, at or just after the junction or transitional region between a substantially straight section and a bend of the transport pipe.

In one embodiment of the method the plate or plates are fixed to the inner circumferential surface of the transport pipe before the transport pipe is taken into operation, and then said plate or plates are allowed to wear down, thereby obtaining the desired useful life. When several plates are attached one after another the useful life is correspondingly further extended.

In an alternative embodiment of the method the plate or plates are retrofitted in an existing transport pipe after it has been put into operation, either for the purpose of supplementing existing systems or as a replacement for a previously mounted, worn out plate. When employing this method the pipe bend could also from the beginning be dimensioned for substantially half the desired useful life, whereby one or several plates are attached once the pipe bend has become worn to a certain, predetermined degree. In all of these cases the point of time for attaching the plate or plates to the transport pipe can be determined based on a preset operating time of the pipe or subsequent to the detection of a specific, maximum permissible wear in the bend.

According to a further aspect of the invention an apparatus is provided that serves to minimize the wear at a bend of a transport pipe being part of a pneumatic transport system.

Yet another aspect of the invention relates to the use of a transport pipe designed in accordance with the basic principles of the invention in a pneumatic transport system intended substantially for domestic waste.

Further objects, features and advantages of the invention will appear from the dependent patent claims and from the following description of exemplifying embodiments.

BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be described more closely in connection with the accompanying drawings, in which:

- Fig. 1 is a partial side view illustrating an area of wear in a bend for material transported in a conventional pneumatic transport pipe,
- Fig. 2 is a plan view from above of the transport pipe, illustrating the area of wear corresponding to fig. 1,
- Fig. 3a in a view corresponding to that of fig. 1 illustrates the area of wear obtained when using a first embodiment of the invention,
- Fig. 3b is a view of the transport pipe as seen from an open end thereof and in the embodiment of the invention illustrated in fig. 3a,
- Fig. 4a in a view corresponding to that of fig. 2 illustrates the area of wear obtained when using the embodiment of the invention that is illustrated in figs. 3a and 3b,
- Figs. 4b-c show a detailed view from above and a longitudinal section along line C-C, respectively of an impact plate used in the first embodiment of the invention, and

Figs. 5a-d illustrate alternative embodiments of the impact plate of the invention, as seen in views corresponding to that of fig. 3b.

DESCRIPTION OF EMBODIMENTS

With reference to drawing figures 3a-b and 4a-c the basic principles of the invention shall now be described with the aid of a presently preferred embodiment thereof. At the same time the differences in comparison with conventionally designed pipe systems (Figs. 1-2) shall be explained. In all of these drawing figures, as well as in Figs. 5a-d the invention is clarified by means of very schematical illustrations. It shall be emphasized that the practical design of details may differ from those illustrated, and that such modifications fall within the scope of the invention.

As was stated above, drawing figures 1 and 2 illustrate a portion of a conventional transport pipe 1 of the type normally employed in pneumatic transport systems, for instance in so called "refuse suction systems", for connecting not shown insertion chutes to a central collecting station. The illustrated portion of the transport pipe 1 consists of a first, as seen in the transport direction B of the material, straight section 3, a pipe bend 2 and a second straight section 3. In the illustrated example, as well as in the later discussed embodiments of the present invention, the transport pipe 1 in its entirety is considered being extended horizontally so that the pipe for explanatory purposes may be said to have a general bottom wall 4 and side walls 5, although actually having a circular cross section. It shall be emphasized though, that the conditions discussed herein apply also to a transport pipe extending vertically or inclined relative to the horizontal plane before and after the bend. However, in such a case the later discussed wear areas or "impact areas" will differ from the ones illustrated. This applies also to other situations where a material transport is deflected from its main direction, such as by a branch, where a transport pipe meets another pipe at an angle of for instance 30-50°. The invention may be applied to this kind of branches and therefore also comprises such applications.

It will be experienced that in this kind of transport pipe 1 the transported material, which in the case of domestic waste often contains hard and sharp, sharp-edged fractions, such as pottery, metal, glass, sand and rocks, provides a very restricted area of wear 6 where the most

severe and therefore deep abrasion occurs. Expressed otherwise, the material portions provide a very concentrated impact area 6 as they with full force hit the inner circumferential surface of the pipe bend 2, in the outer region of the bend 2. One reason for this concentrated impact area is that the hard and sharp fractions of the material almost always are the heaviest portions of the material and are accordingly transported at the bottom of the pipe, whereas the lighter fractions may take different paths in the pipe.

Naturally, the appearance of the most severe impact area or impact surface will vary depending upon a number of parameters, such as the sharpness of the bend - in the illustrated case the radius of the bend 2 is approximately equal to three times the diameter of the transport pipe - the transport velocity and the type of transported material, but under all conditions the pipe bend is subjected to wear or abrasion over a very restricted surface that in practical operation has been found to be situated in the outer side wall 5 of the pipe bend 2. Where none of the initially discussed and presently employed costly measures are taken this concentrated wear seriously reduces the useful life of the pipe bend 2.

As was stated initially, a basic object of the invention is to provide a simple and appropriate method of combining a desired useful life of the pipe bend with a low cost therefore. To be more precise the object is to achieve this by permitting the use of a pipe bend having a wall thickness that is significantly reduced as compared to the prior art, and/or that is manufactured from a comparatively inexpensive material, for instance the same material as that of the remaining transport pipe. In accordance with the embodiment of the present invention illustrated in Figs. 3a-b and 4a-c this is achieved by means of an enlargement and successive variation of the surface of the pipe bend over which the abrasive or eroding action of the transported material is distributed. This results in a corresponding reduction of the depth of the wear in the area where the maximum wear occurs.

Starting from the conventional transport pipe 1 illustrated in figures 1 and 2 the intended effect of the invention is achieved by providing an impact plate 7 illustrated in drawing figures 3a-b and 4a-c. The impact plate 7 is here illustrated when attached to a forward, with regard to the transport direction B, area of the first straight section 3, and accordingly immediately before the pipe bend 2. It shall be emphasized though, that the invention likewise comprises an

attachment of the impact plate in the junction or transitional region between the straight section and the bend or in an entrance area of the actual pipe bend 3.

In the illustrated embodiment the impact plate is attached to the bottom wall 4 of the horizontally extended transport pipe 1, centered in relation to a vertical plane passing through the centre axis A of the transport pipe 1. As will be mentioned further below in connection with an embodiment of the impact plate 17' illustrated in Fig. 5a, this plate may in other applications be provided in other positions around the inner circumferential surface of the transport pipe 1.

The impact plate 7 has an upper impact surface 8 that in the illustrated embodiment is planar, but that for other applications may be given a different shape. This will be described more closely below in connection with drawing figures 5a-d. The plate is attached to the interior of the transport pipe 1 by being fixed, for instance through welding, with its rear edge 7a and side edges 7b, 7c to the interior surface of the pipe 1. Thereby the plate 7 is positioned with its upper impact surface 8 extended at an angle to the center axis of the pipe 1, and more specifically so that this upper surface 8 slopes generally outwardly from the inner circumferential surface of the transport pipe 1, as seen in the transport direction. In the illustrated embodiment an imaginary extension of the impact surface 8 forms an angle of 30° (not specifically illustrated) with the center axis A. However, it shall be emphasized that this angle of inclination may also be varied depending upon the specific circumstances for different applications. Generally, a reduction of the angle reduces the spreading effect and reduces the wear surface 16 to a corresponding degree, whereas an increase of the angle results in an increased wear of the impact plate 7 and finally once more in a reduced spreading effect and in most cases in an undesirable deceleration of the material or even a risk of blocking the pipe. The optimum angle as well as the length of the impact surface 8 must therefore be calculated for each specific case, considering different parameters, such as the expected composition of the transported material, its transport velocity and the radius of the bend 2.

For the purpose of preventing transported material from getting stuck at the impact plate 7, it is important that its rear edge 7a and side edges 7b, 7c are formed so as to closely adjoin or

connect to the inner surface of the pipe 1. When used in a circular pipe 1 and in the illustrated angular position they will thereby have the shape illustrated most clearly in fig. 4c. In order to bring the edges of the impact plate 7 to connect to the inner surface of the pipe 1 without any gap therebetween, it may be suitable to chamfer the plate 7 at its rear edge 7a and side edges 7b, 7c, in the manner that with regard to the rear edge is likewise illustrated in fig. 4c. This drawing figure also illustrates that in connection with its forward edge 7d the impact plate 7 may be provided with a support 9 extending down at an angle from the plane of the impact surface 8. This support 9 is intended for attachment to the inner circumferential surface of the transport pipe 1 for supporting the forward edge 7d that through the inclination of the plate will be positioned at a distance above the bottom wall 4 of the transport pipe 1.

In a transport pipe 1 equipped in the manner suggested according to the invention, above all the very erosive portions of the transported material will hit the upper surface 8 of the impact plate 7. Accordingly, the transport direction of at least these portions of the material transported in the pipe 1 will change just before the entrance of the material into the bend 2, or, as mentioned above, in connection with or shortly after its entrance into the bend. The result is that at least these portions of the material will hit the surface of the pipe bend 2 at another position in the bend 2, with regard to the transport direction, than without the contact with the plate 7. As a result of this the surface 16 that is subjected to wear is extended and in each point of the of the wear surface 16 the wear is reduced compared to the conventional maximum wear surface 6, that is the wear or abrasion will be correspondingly shallower. In practice, the wear in each individual point will be reduced even further, since said portions of the material will in most cases hit the inner wall of the bend 2 at a sharper angle, so that the erosive action of the hard and sharp fractions will be reduced in itself. The drawing figures illustrate that the wear surface 16 at the side wall 5 is extended or enlarged both in the circumferential and particularly in the longitudinal direction of the pipe.

The wear surface 16 illustrated in Figs. 3a and 4a refers to a calculated spreading effect with a planar impact plate 7 in the illustrated angular position and when transporting domestic waste at a velocity of approximately 18m/s in a transport pipe 1 having a diameter of 500mm and a bend 2 having a radius corresponding to approximately three times the pipe diameter. It is obvious that the wear surface will have a slightly different appearance when either of these

parameters are changed, and especially so in a transport pipe that is extended vertically or is inclined before or after the bend, or at a branch. However, the basic principles of the enlargement or extension of the wear surface will remain the same.

5 When using the invention it is possible to proceed in different manners in order to obtain the desired effect. According to a first basic alternative, the transport pipe 1 is provided with an impact plate 7 from the start, prior to being put into operation. Where possible, the impact plate is in this case preferably dimensioned so as to have approximately the same useful life as the pipe bend 2. However, as was mentioned above, when required it is possible to provide
10 two or even more impact plates 7 after each other, such that a new plate 7 becomes active when the immediately preceding plate becomes worn down. This is an alternative to the later described retrofitting of new replacement plates in cases where it is not possible to dimension the impact plate for the same useful life as the actual pipe bend.

15 In another embodiment one or several impact plates 7 are retrofitted in an existing transport pipe 1 being in operation. This alternative may be used either in order to supplement an old system, in order to thereby afterwards extend its useful life beyond the one that was once planned, or to replace a worn out plate in a system that was from the beginning provided with an impact plate 7. This may become necessary where it has not been possible to dimension the
20 originally attached impact plate for the required useful life or in case the wear for some reason, such as a changed composition or nature of the transported material, has been more severe than expected. In this connection it may also be noted that in one respect the wear of the impact plate may also have a positive effect. Through the successive wear of the plate its altered impact surface will result in a changed influence upon particularly the hard and sharp
25 material fractions, and accordingly in a successively changed "impact area" that in time further increases the distribution or spreading of the impacts of the material with the bend.

Figs. 5a and 5b illustrate alternative embodiments of the impact plate 17, 17' and 27
30 respectively, suggested in accordance with the invention. In this case the upper impact surface 18 and 28 respectively of the plate is angled, either in a direction upwardly from – the surface 18 – or downwardly towards – the surface 28 – the bottom wall 4. With such a design it is possible under certain circumstances, that is depending upon the transport velocity and the

material composition, to favorably influence the spreading action. The same applies to the embodiment indicated with a dash-dot line in Fig. 5a, where the position of the impact plate 17' has been moved upwardly towards the side wall 5 of the pipe 1. With regard to the angle of the upper surface 18, 28 and to the positioning of the plate 17' around the circumference, the exact values providing the optimum result must be calculated for each separate case, for instance based on the above stated parameters.

Fig. 5c and 5d illustrate further alternative designs of the impact plates 37 and 47 respectively, according to the invention. In these cases the impact plates are formed with an upper impact surface having a downwardly – the surface 38 – or upwardly – the surface 48 – curved shape. In principle the same considerations apply to these embodiments as to the variants of Figs. 5a and 5b, whereby the position of the plate around the circumference may be changed in this case too. Other, not illustrated, shapes of the impact plate may likewise be used within the scope of the invention, provided that they produce the effects suggested in accordance with the invention, namely the change of transport direction for at least portions of the transported material, and thereby the desired spreading of its “impact area” on the inner wall of the pipe bend.

Figures 5a-d illustrate an impact plate that is angled and curved respectively, generally in the longitudinal direction of the plate. It shall be emphasized though, that within the scope of the invention the impact plate may also be designed so that it is angled and curved respectively, in a transversal direction for providing an angle of inclination for the upper impact surface that varies along the length of the plate.

The invention is presently regarded as having its major field of application in connection with so-called refuse suction systems, that is pneumatic transport systems for domestic waste. The invention likewise covers an application of its basic principles to pneumatic transport systems used within other areas, such as for industrial waste, waste from restaurants and hospital waste.

In all such cases the use of every one of the embodiments discussed herein basically provides for an extended useful life of the pipe system, and at a relatively low cost.

It will be understood by those skilled in the art that various modifications and changes may be made to the present invention without departure from the scope thereof, which is defined by the appended claims.

CLAIMS

1. A transport pipe (1) of a pneumatic refuse suction system comprising at least one bend (2) and means fixed to the inner circumferential surface of the transport pipe (1) and extended into the transport path of the material transported in the transport pipe (1) for the purpose of reducing the wear of the pipe bend, **characterized by** an impact plate (7; 17; 17'; 27; 37; 47) provided in an area that, seen in the transport direction, lies just before, at or just after the junction between a substantially straight section (3) and a bend (2) of the transport pipe (1).

2. A transport pipe (1) according to claim 1, which before the pipe bend (2) is extended substantially horizontally, **characterized in that** the impact plate (7; 17; 27; 37; 47) is provided at a position around the inner circumference of the transport pipe (1) that, with regard to the material transport, corresponds to a bottom surface (4) thereof.

3. A transport pipe (1) according to claim 1 which before the pipe bend (2) is extended substantially horizontally, **characterized in that** the impact plate (17') is provided at a position around the inner circumference of the transport pipe (1) that, with regard to the material transport, corresponds to a side surface (5) of the transport pipe (1).

4. A transport pipe (1) according to any of claims 1-3, **characterized in that** the impact plate (7; 17; 17'; 27; 37; 47) has a rear, as seen in the transport direction, edge (7a) that is provided substantially on a level with and is preferably fixed to the inner circumferential surface of the transport pipe (1), side edges (7b, 7c) closely adjoining and preferably fixed to the inner circumferential surface of the transport pipe (1) and a forward edge (7d) provided at a distance from the inner circumferential surface of the transport pipe (1), whereby the upper surface (8; 18; 28; 38; 48) of the plate slopes generally outwardly from the inner circumferential surface of the transport pipe (1), as seen in the transport direction.

5. A transport pipe (1) according to any of claims 1-4, **characterized in that** the impact plate (7) is formed having a planar upper surface (8).

6. A transport pipe (1) according to any of claims 1-4, **characterized in that** the impact plate (17; 17'; 27) is formed having an angled upper surface (18; 28).

7. A transport pipe (1) according to any of claims 1-4, **characterized in that** the impact plate (37; 47) is formed having a curved upper surface (48).

8. A transport pipe (1) according to any of claims 1-7, **characterized by** at least one further impact plate (7; 17; 27; 37; 47) provided after the first impact plate, as seen in the transport direction, in the same position around the inner circumference of the transport pipe (1) and intended to be put into operation as the first plate becomes worn.

9. A method of extending the useful life of a transport pipe (1) of a pneumatic refuse suction system containing at least one bend (2), whereby means are fixed to the inner circumferential surface of the transport pipe (1) and are provided so as to extend into the transport path of the material transported in the transport pipe (1) for the purpose of reducing the wear of the pipe bend, **characterized in that** an impact plate (7; 17; 17'; 27; 37; 47) is provided in an area that, seen in the transport direction, lies just before, at or just after the junction between a substantially straight section (3) and a bend (2) of the transport pipe.

10. A method according to claim 9, by a transport pipe (1) that before the pipe bend (2) is extended substantially horizontally, **characterized in that** the impact plate (7; 17; 17'; 27; 37; 47) is provided at a position around the inner circumference of the transport pipe (1) that, with regard to the material transport, corresponds to a bottom surface (4) thereof.

11. A method according to claim 9, by a transport pipe (1) that before the pipe bend (2) is extended substantially horizontally, **characterized in that** the impact plate (7; 17; 17'; 27; 37; 47) is provided at a position around the inner circumference of the transport pipe (1) that, with regard to the material transport, corresponds to a side surface (5) thereof.

12. A method according to any of claims 9-11, **characterized in that** at least one further impact plate (7; 17; 27; 37; 47) is provided after the first impact plate, as seen in the transport direction, in the same position around the inner circumference of the transport pipe (1).

13. A method according to any of claims 9-12, **characterized in that** the impact plate or plates (7; 17; 17'; 27; 37; 47) is (are) fixed to the inner circumferential surface of the transport pipe (10) before the transport pipe is put into operation.

5 14. A method according to any of claims 9-12, **characterized in that** the impact plate or plates (7; 17; 17'; 27; 37; 47) is (are) retrofitted in an existing transport pipe (1) after it has been put into operation.

10 15. A method according to claim 14, **characterized in that** the impact plate or plates (7; 17; 17'; 27; 37; 47) is (are) fixed to the inner circumferential surface of the transport pipe (1) after the pipe has been in operation for a predetermined period of time or after a specified, maximum allowed wear has been measured in a bend (2).

15 16. An apparatus for extending the useful life of a bend (2) in a transport pipe (1) being part of a pneumatic refuse suction system, **characterized by** a plate (7; 17; 17'; 27; 37; 47) for attachment in the transport pipe (1) and having a rear edge (7a) and side edges (7b, 7c) intended to be fixed to the inner circumferential surface of the transport pipe (1) and a forward edge (7d) intended to be positioned at a distance from said circumferential surface and a planar upper impact surface (8; 18; 28; 38; 48) for the material transported in the pipe.

20 17. An apparatus according to claim 16, **characterized in that** in connection with its forward edge (7d) the impact plate (7; 17; 17'; 27; 37; 47) has a support (9) extending down at an angle from the plane of the impact surface (8; 18; 28; 38; 48) and intended to be fixed to the inner circumferential surface of the transport pipe (1), for supporting the forward edge (7d).