(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 106 481**
A2

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **83305077.6**

(22) Date of filing: **01.09.83**

(51) Int. Cl.³: **F 01 N 7/18**
F 01 N 1/24

(30) Priority: **10.09.82 GB 8225865**

(43) Date of publication of application:
25.04.84 Bulletin 84/17

(84) Designated Contracting States:
DE FR GB IT

(71) Applicant: **Unipart Group Limited**
Unipart House Garsington Road
Cowley Oxford OX4 2PG(GB)

(72) Inventor: **Robinson, Norman**
20 Arthray Road
Botley Oxford(GB)

(72) Inventor: **Grain, John Robert**
33 Cromwell Way
Kidlington Oxford(GB)

(72) Inventor: **Huggett, Ralph**
28 Harridge Avenue
Shawclough Rochdale Greater Manchester(GB)

(74) Representative: **Waters, Jeffrey et al,**
ARG Patent Department Cowley Body Plant
Cowley Oxford OX4 5NL(GB)

(54) Packing automobile exhaust silencers.

(57) An automobile exhaust silencer has a casing 1, a central perforated tube 6 and an end piece 5 at one end. A similar end piece is welded to the other end when the silencer has been packed. Vacuum producing apparatus 2 is brought into contact with the closed end of the silencer casing, aperture 7 registering with the perforated tube 6, and a similar sealing member 9 having an aperture 10 is brought into contact with the open end of the silencer casing, thereby blocking off the other end of the perforated tube 6.

A strand or roving consisting of a multitude, for example, two thousand continuous glass fibres of diameter, for example, less than twenty microns, is fed between two rollers, one of which is driven, in gun 4 where a further roller having a cutter cuts the roving into discrete lengths. An air blast assists in projecting the discrete lengths forwards, and they are sucked into the silencer casing by means of the vacuum to which the other end is subjected.

It is found that the individual fibres of each discrete length separate from each other in the silencer casing to form the desired fluffed-up wool-like consistency in the casing. Furthermore, with this method it is possible to accurately meter the quantity of material fed into each silencer.

As an alternative to the use of a vacuum, a jet of compressed air may be used to establish the required air flow through the casing.

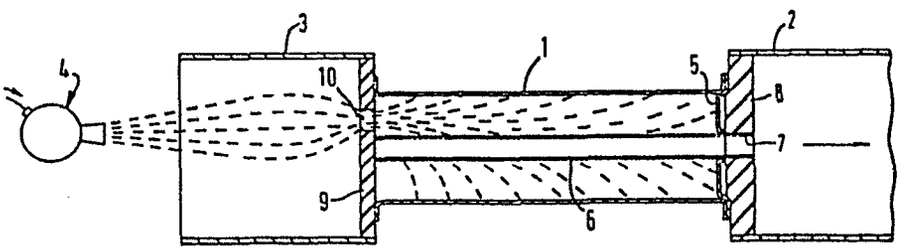

FIG.1

EP 0 106 481 A2

PACKING AUTOMOBILE EXHAUST SILENCERS

P1513

This invention relates to the packing of automobile exhaust silencers.

Such silencers contain packing in order to assist in silencing exhaust gases from the vehicle engine by virtue of conversion of kinetic energy of the exhaust gases into mechanical displacements of the packing and thus heating thereof.

One of the materials used to pack such silencers is glass fibre fluffed up into a wool-like consistency. This material can be produced by chopping continuous strands of glass fibre.

In the past such silencers have been packed with such material manually and, to assist in this process, it has been proposed to apply a vacuum to one end of the silencer casing.

In order to adapt the process for automatic operation, glass fibre material in wool-like form has been fed into a hopper, from which it passes along ducts before being metered into individual quantities, each

suitable for packing one silencer. However, the material has been prone to clog in the ducts and this has made the accurate ~~meeting~~ metering of the material difficult, if the expense of weigh pans is to be avoided.

The invention provides a method of packing a silencer casing which comprises establishing an air flow into and out of the silencer casing, chopping into discrete lengths a strand consisting of a plurality of continuous glass fibres, and allowing them to be carried into the silencer casing in the air flow.

It has been found that the individual fibres of each discrete length of strand can separate as they are being carried into the silencer in the air flow so that the packing fluffs up in the desired way in the silencer casing itself or as it is entering.

The strand, or roving, advantageously contains at least one hundred, preferably at least a thousand, individual continuous glass fibres whose diameter is advantageously less than 30 microns and preferably less than 15 microns. The fibres of the roving are preferably non-twisted.

Advantageously the roving is driven from two rollers in contact with each other; this makes it easy to meter accurate quantities of glass fibre into each silencer casing, since it is only necessary to leave the rollers running for a certain period of time in order to know exactly how much glass fibre has been fed into the silencer. A roller may also be provided for chopping the fibres, and they may be projected with the assistance of an air blast.

Advantageously, the air flow leaves the silencer via a perforated tube of the silencer. Preferably, the air flows through a restriction, the diameter of which is less than one inch, before it enters the casing: the fibre is fluffed up in the region of turbulence so created. The restriction may be connected to a tapering tubular member at its narrow end, the wide end of which draws the fibers in. The taper may be from 15° to 75° included angle.

The air flow may be produced by means of a vacuum applied to where the air flow leaves the casing. The vacuum applied to the silencer casing may be at least one inch of mercury, preferably at least five inches of mercury, and advantageously between seven and a half and twelve and a half inches of mercury.

The air flow may be established by means of a jet of compressed air which draws fibers into the air flow before it enters the casing. In the case of the restriction and tapering tubular member referred to, the jet preferably feeds into the restriction: it may be inclined at an angle $7\frac{1}{2}^{\circ}$ to $37\frac{1}{2}^{\circ}$ to the axis of the tubular member. The compressed air

pressure should be at least 70 pounds per square inch.

The invention also provides a silencer casing packed in accordance with any of the forms of the method of the invention.

Methods of, and apparatuses for, packing a silencer casing in accordance with the invention will now be described by way of example with reference to the accompanying drawings in which:

Figure 1 is partly sectional view of the first apparatus;

Figure 2 is a side view of a gun for feeding the roving into the silencer,

Figure 3 is a front view of the gun shown in Figure 2;

Figure 4 is a plan view of the gun shown in Figure 2; and

Figure 5 is a schematic view of the second apparatus.

Referring to Figure 1, the first apparatus for packing a silencer casing 1 comprises a vacuum producing apparatus 2, a sealing apparatus 3 and a gun 4.

The casing of the silencer is circular in section, and one end of it has been closed by an end piece 5, which supports a perforated tube 6 running along the length of the silencer casing. The end piece 5 supports a stub pipe 7 which connects to the rest of the exhaust assembly in use. A similar end piece bearing a stub pipe is welded to the other end of the

silencer when it has been packed.

The vacuum producing apparatus has a rubber sealing member 8 which fits tightly around the stub pipe 7. The vacuum is produced by means of a centrifugal compressor (not shown) driven by a forty horse power motor (not shown). This apparatus produces a vacuum of around ten inches of mercury.

The sealing apparatus 3 likewise includes a sealing member 9 which seals against the open end of the casing and also blocks off the open end of the perforated tube 6, since this must not be filled with any packing material. The sealing member has a circular aperture 10 whose diameter is $\frac{3}{4}$ inch.

Referring to Figure 2, the roving fed into the gun 4 consists of around two thousand mono-filamentary continuous glass fibres, whose diameters lie between about six and twelve microns. The fibres in the roving are parallel to each other, that is, the roving is not twisted. The roving is fed from a spool (not shown) containing a length of about a couple of hundred meters of the roving.

The gun has an air-powered motor, contained in housing 11, to which rubber roller 12 is coxially attached. The roving is driven by means of rubber roller 12 and steel roller 13 which is hard in contact with roller 12. The roving is cut into discrete lengths by means of a cutter

14 mounted diametrically through a further roller 15. Every half revolution of roller 15, the roving is severed at the point of contact with roller 12. The rollers are ocntained in a housing 16 having an inlet 17 and an outlet 18. The air exhaust from the air powered motor is fed into the housing 16 and, since the area of the outlet 18 is much greater than that of the inlet 17, the chopped lengths of roving are projected out of the gun with the aid of an air blast.

In operation of the method of the invention, a silencer casing 1 to be filled is fitted onto the vacuum producing apparatus 2 and a sealing apparatus is brought up to the open end of the silencer. The vacuum pump is started. The gun 4 is then run and left running for a pre-determined period of time. This pre-determined period corresponds to the desired weight of glass fibre it is desired to pack the particular silencer with, and this can be calculated simply from the weight per unit length of the roving and the velocity at which the roving is fed through the gun.

The chopped lengths of roving projected from the gun are all sucked through the aperture 10 in the sealing member 9 because the vacuum applied at the other end of the silencer casing, and the silencer is gradually filled with glass fibre. It has been found that the fibres of each chopped length of roving separate either before they enter the silencer casing or while they are in the silencer casing (probably the

separation mainly takes place within the silencer), and this results in the production of the desired wool-like form of the glass fibre in the silencer. The air flow within the silencer will of course be turbulent since it is being sucked through the perforated tube 6. The lengths of fibre do not pass into the tube 6 themselves.

Among the advantages of the invention are that it is possible to accurately meter the quantities of glass fibre with which each silencer is packed, and that the ducting required for handling the wool-like glass fibre is dispensed with.

The invention is of course applicable to any form of silencer, for example, such as the form where exhaust gases make multiple passes of the whole the part of the length of the silencer casing.

Various modifications are of course possible, for example, tests have also been carried out with an arcuate aperture 10 in the sealing member, the length of which is around four times its diameter. Although the roving "fluffed-up" in a satisfactory manner, it was nevertheless found that it "fluffed-up" better with the $\frac{3}{4}$ inch diameter aperture referred to earlier.

Referring to Figure 5, the second form of apparatus differs from the first in that there is no vacuum required to draw the roving pieces into the silencer, rather they are drawn in carried in an air flow.

A silencer 20 to be filled is closed at the lower end as seen in the drawing by a closing plate 21 which has an aperture through which a perforated tube 22 of the silencer extends. The silencer is mounted on a platform 23 through which air can pass. The upper end of the silencer as seen in the drawing is connected to the apparatus, in particular to a closing plate 24 which carries a plug 25 for closing the end of the perforated tube 22.

The chopped strands of roving are fed into the silencer casing via a tube 26 and conical member 27, the tube 26 being sealed in an aperture in the closing plate 24.

A gun 28 supplies roving to the wide end of the conical member: the gun 28 is identical to the gun 4 of the first apparatus except that air does not assist in projecting the cut strands of roving from the gun, the cut strands being projected solely be the rotation of the rollers. The roving used is the same as the first apparatus.

A narrow tube 29 opens into the tube 26, and compressed air is supplied to its other end.

It has been found that the compressed air fed along the tube 26 draws large quantites of air into the conical member 27, and through the tube 26 into the silencer casing. In the process, the cut strands of roving are carried in the air flow into the silencer casing. The air flow leaves the silencer casing via the perforated tube and its open end which passes through the closing plate 21. It has also been found that the cut strands are "fluffed-up" in the process, and that the casing is filled in a very satisfactory manner.

Examples of suitable dimensions and pressures are: tube 26, three inches long, one half inch diameter; conical member 27, semi-angle 30°, diameter at wide end, three inches; tube 29, angle to axis of conical member, 35°, air pressure 100 pounds per square inch.

It is believed that the narrow diameter of the tube 26 is important in "fluffing-up" the cut strands of roving, since only with a narrow diameter is sufficient turbulence created in the tube to achieve this. It is believed that the narrow opening 10 in the first apparatus is also responsible for creating the necessary turbulence. The narrower the diameter, the smaller the compressed air pressure or vacuum needed to fluff-up the fibre, but if the diameter is too small, the restriction is prone to clogging.

CLAIMS

1 A method of packing an automobile exhaust silencer casing, which comprises establishing an air flow into and out of the silencer casing, chopping into discrete lengths a strand consisting of a plurality of continuous glass fibres, and allowing them to be carried into the silencer casing in the air flow.

2 A method as claimed in claim 1, in which the strand consists of at least one hundred continuous glass fibres.

3 A method as claimed in claim 2, in which the strand consists of at least a thousand glass fibres.

4 A method as claimed in any one of claims 1 to 3, in which the diameters of the fibres of the strand are less than thirty microns.

5 A method as claimed in claim 4, in which the diameters of the continuous glass fibres of the strand are less than fifteen microns.

6 A method as claimed in any one of claims 1 to 5, in which the continuous glass fibres of the strand are not twisted.

7 A method as claimed in any one of claims 1 to 6, in which the strand is fed between two rollers engaging one another, one of which is driven.

8 A method as claimed in claim 7, in which the strand passes between a pair of rollers, one of which has a cutter running along a generator of the roller.

9 A method as claimed in claim 7 or claim 8, in which the discrete lengths are projected with the assistance of an air blast.

10 A method as claimed in any one of claims 1 to 9, in which the air flow leaves the silencer via a perforated tube of the silencer.

11 A method as claimed in any one of claims 1 to 10, in which the air flows through a restriction, the diameter of which is less than one inch, before it enters the silencer casing.

12 A method as claimed in claim 11, in which the restriction is connected to the narrow end of a tapering tube, the wide end of which draws in the chopped fibres.

13 A method as climed in any one of claims 1 to 12, in which the air flow is established by means of a vaccum applied where the air flow leaves the casing.

14 A method as claimed in any one of cliams 1 to 12, in which the air flow is established by means of a jet of compressed air which draws chopped fibres into the air flow before it enters the casing.

15 A method as claimed in claim 14, in which the jet feeds into a restriction which connects to the narrow end of a tapering tube, the wide end of which receives the chopped fibres.

16 A method as claimed in claim 15, in which the jet is inclined towards the region at which the air flow enters the silencer casing.

17 A method of packing an automobile silencer casing substantially as hereinbefore described with reference to the accompanying drawings.

18 A silencer casing packed according to the method of any one of claims 1 to 17.

19 An automobile exhaust system having a silencer as claimed in claim 18.

20 Apparatus for packing an automobile silencer casing, which comprises means for establishing an air flow into and out of the silencer casing, means for chopping into discrete lengths a strand consisting of a plurality of continuous glass fibres, the chopped fibres being allowed to be carried into the silencer casing in the air flow.

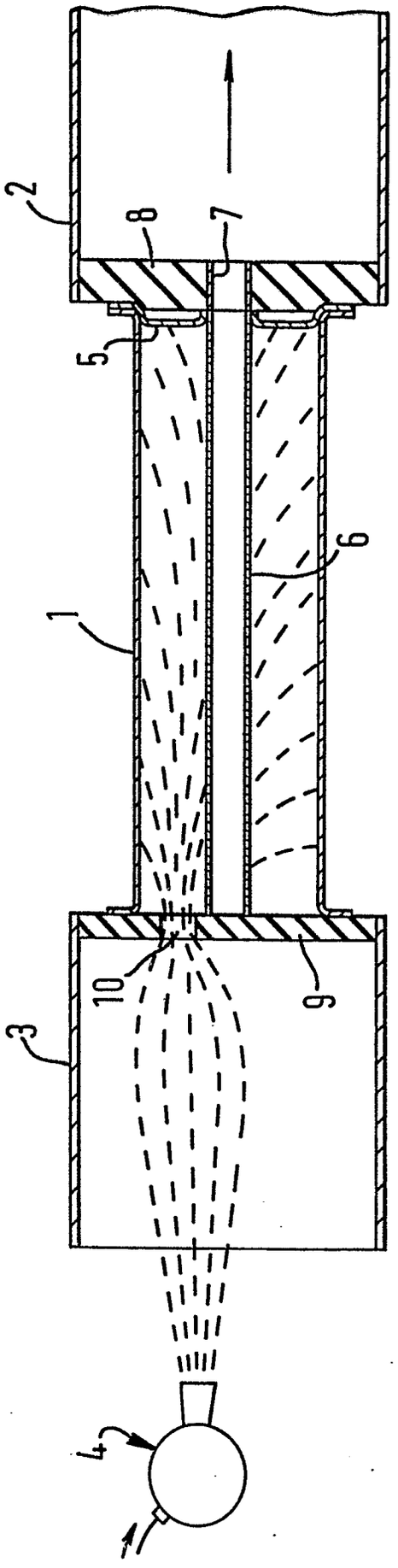

FIG.1

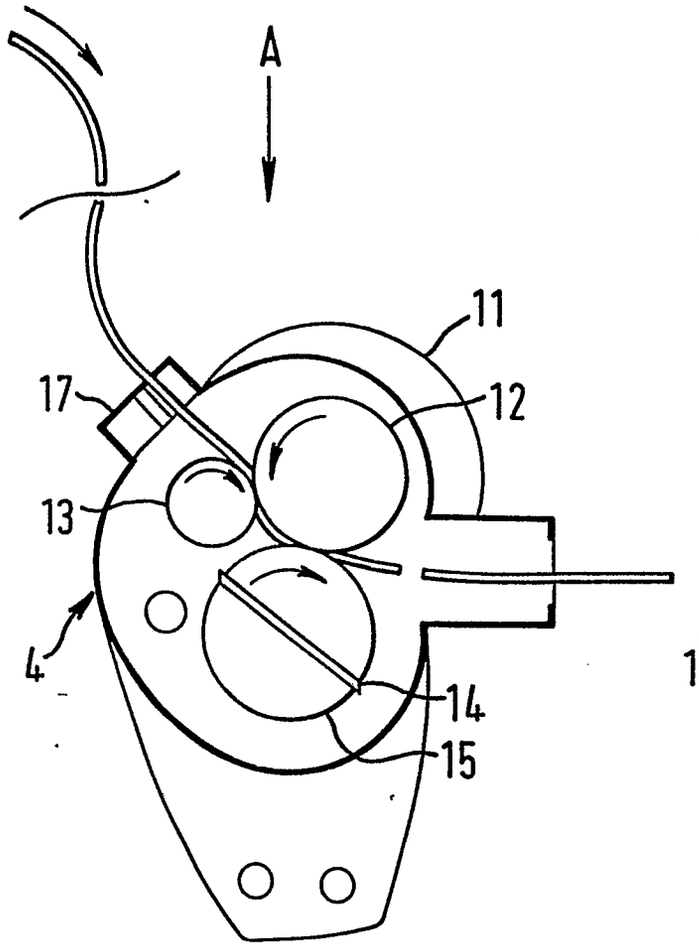

FIG. 2

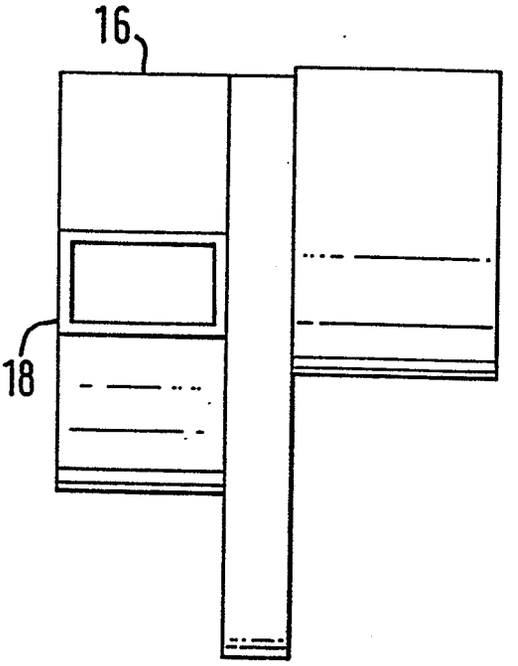

FIG. 3

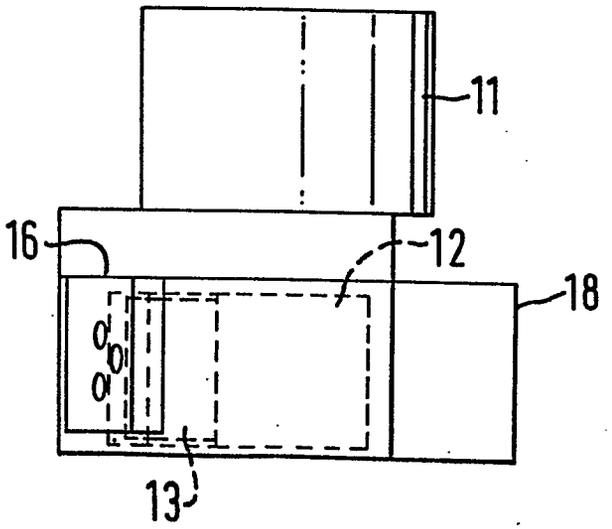

FIG. 4

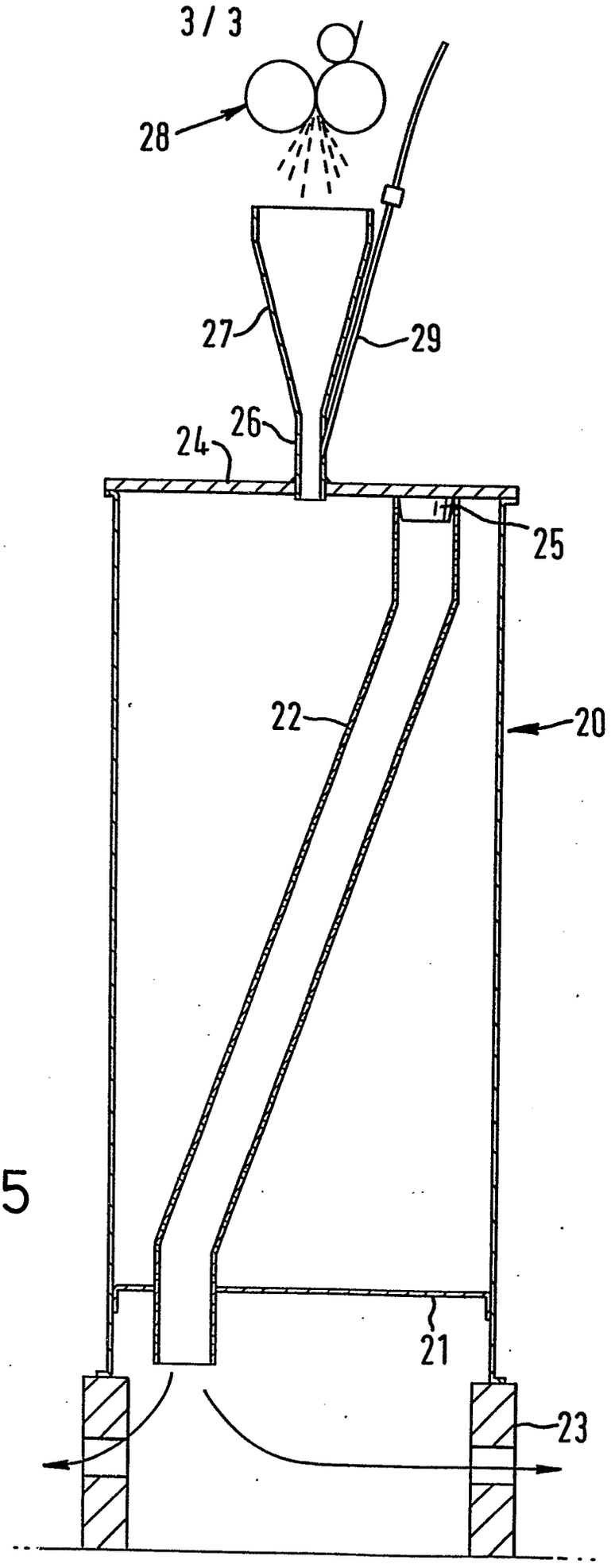

FIG.5