

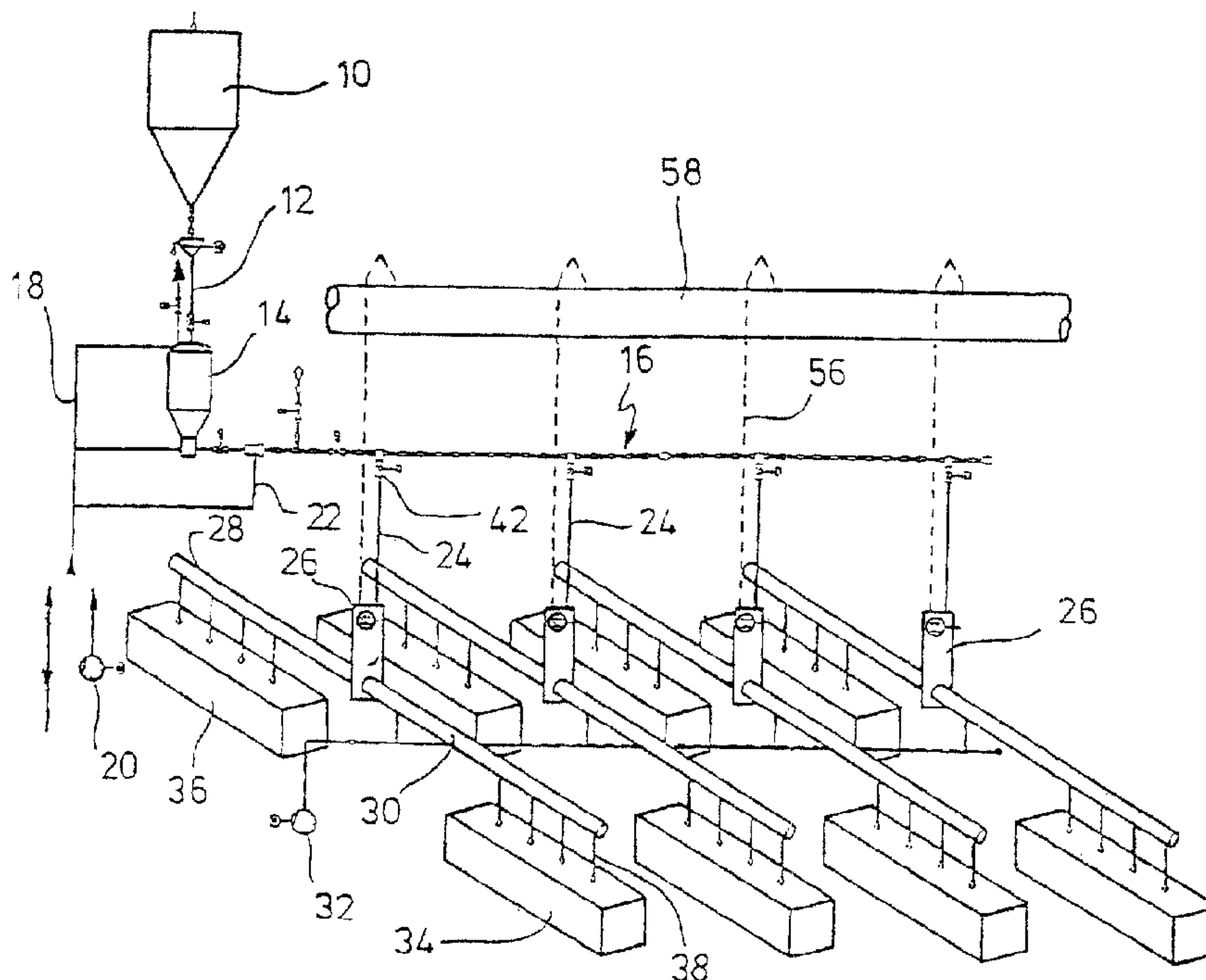


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 (72) Inventeurs/Inventors:
VON GELDERN, KLAUS, DE;
IRMSCHER, VOLKMAR, DE;
SORGER, HEINO, DE
 (73) Propriétaire/Owner:
MOLLER MATERIALS HANDLING GMBH, DE
 (74) Agent: RIDOUT & MAYBEE LLP

(54) Titre : INSTALLATION D'ALIMENTATION POUR DIVERS DISPOSITIFS DE CHARGEMENT, PAR EXEMPLE CELUI DES CUVES DE FOURS DE FUSION DE L'ALUMINIUM, A L'AIDE DE MATIERES EN VRAC, PAR EXEMPLE DE L'OXYDE D'ALUMINIUM PULVERISE

(54) Title: INSTALLATION FOR FEEDING A PLURALITY OF LOADS, E.G. CELLS OF ALUMINIUM MELTING FURNACES, WITH BULK MATERIALS, E.G. PULVERISED ALUMINIUM OXIDE



(57) Abrégé/Abstract:

Installation for feeding a plurality of loads, e.g. cells of aluminium melting furnaces, with bulk material, e.g. pulverised aluminium oxide, said installation comprising a silo for the bulk material of a pressure vessel or pump delivering machinery which is connected with a conveying line, a plurality of receiving vessels in the vicinity of the loads, said receiving vessels being connected with the conveying line via valves, and with at least one pneumatic conveying chute or pneumatic pipe channel, connecting a receiving vessel with a plurality of loads of the furnaces, said conveying chute or pipe channel comprising at least one discharge per load.

Abstract

Installation for feeding a plurality of loads, e.g. cells of aluminium melting furnaces, with bulk material, e.g. pulverised aluminium oxide, said installation comprising a silo for the bulk material of a pressure vessel or pump delivering machinery which is connected with a conveying line, a plurality of receiving vessels in the vicinity of the loads, said receiving vessels being connected with the conveying line via valves, and with at least one pneumatic conveying chute or pneumatic pipe channel, connecting a receiving vessel with a plurality of loads of the furnaces, said conveying chute or pipe channel comprising at least one discharge per load.

Installation for feeding a plurality of loads, e. g. cells of aluminium melting furnaces, with bulk material, e. g. pulverised aluminium oxide

The invention is concerned with an installation for feeding a plurality of loads, e. g. cells of aluminium melting furnaces, with bulk material, e. g. pulverised aluminium oxides.

In EP 0 122 925 an installation has been disclosed, wherein a storage bunker, e.g. for aluminium oxide, is connected with a pneumatic (air fluidising) conveying chute. The conveying chute comprises a multiplicity of lateral discharges, each one connected with a pneumatic conveying chute, said chute comprising on its part discharges for individual cells of an aluminium melt furnace.

EP 0 224 436 discloses an installation for feeding bulk material containers, wherein a pneumatic conveying line is connected in distances with the containers via a valve arrangement. The valve arrangement is such that the valve closes automatically when the fill level in the container reaches a predetermined value.

It is an objective of the present invention to provide an installation for feeding a plurality of loads, e.g. cells of aluminium melt furnaces, with pulverised aluminium oxide, said installation enabling the supply of a big number of cells with relatively low energy consumption.

The invention provides according to an aspect, for an installation for feeding cells of a furnace with bulk material. The installation comprises: a silo containing the bulk material; a pressure vessel connected with the silo; a conveying line connected with the pressure vessel; a plurality of receiving vessels in the vicinity of the cells, each of the receiving vessels being connected with the conveying line via a valve; and at least one pneumatic conveying chute connecting each of the receiving vessels with the cells, the at least one conveying chute comprising at least one discharge per load.

In the installation according to the invention, the silo, e.g. for aluminium oxide, is connected with a pressure vessel or pump delivering machinery, which on its part feeds a pneumatic

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conveying line (or air conveyer). Pressure vessel or pump delivering machineries, respectively, for bulk material conveying are generally known. Using these systems a long distance may be by-passed with relatively low energy consumption. It is therefore possible to provide a plurality of acceptance sites, even disposed at a distance, with the material to be

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delivered, e.g. aluminium oxide. According to the invention, in the vicinity of the sites to be provided, e.g. of the aluminium melt furnaces, so-called receiving or intermediate vessels are arranged with the conveying lines, which are connected with the conveying line via valves. The receiving vessel itself is connected with a plurality of loads, e.g. cells of the aluminium melt furnace, via at least one pneumatic conveying chute, the pneumatic conveying chute having discharges for each cell of the furnace.

A pneumatic conveying chute for conveying bulk material is also known. For the immediate feeding of e.g. aluminium furnaces, it has the considerable advantage that a pressure-tight sealing of the furnace cells is not required. Upon using a pneumatic conveying line at this point, a pressure-tight sealing is indispensable, because otherwise considerable amounts of dust would leak out of the furnace cells and would contaminate the surrounding of the furnace.

It is understood, that above and below with conveying chute also a tube may be denoted which comprises a separate channel in its downward region that can be flushed with air, the limitation in upward direction thereof being permeable, so that in this manner the desired fluidisation of the bulk material to be conveyed is achieved.

When rigidly connecting the conveying chute with the receiving vessel and the corresponding entry to the loads, e.g. the cells of the aluminium melt furnace, the risk exists that an adjustment of the conveying chutes in longitudinal direction is required because of the structural arrangements. Therefore an embodiment of the invention provides that the conveying chutes have a first chute segment connected with the receiver vessel, and a second segment which is connected with the lateral discharge and which co-operates with the first chute segment in a telescopic manner. Thus a spatial adaptation of the conveying chutes can be realised. Furthermore it is possible to change the position of the receiving vessel without having to change the junctions on the aluminium melt furnace and the conveying chutes, respectively.

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The second segment co-operating in a telescopic manner with the first chute segment can also be constructed as a pneumatic conveying line by providing it with a sieve-shaped aerating plate and connecting it to compressed air. Thus it is guaranteed that a problem-free conveying of the bulk material up to the discharge, e.g. to the aluminium melt furnace, is secured.

The fill-up valve between the pneumatic conveying line and the receiving vessel is controllable. It must naturally be prevented that the receiving vessel is congested and causes a jam in the conveying line under certain circumstances. According to the invention, a controlling means for actuating the valve is therefore provided, and the controlling means responds to a fill level indicator device which detects when the level in the receiving vessel reaches a predetermined upper value.

It is conceivable to provide for a second fill level indicator in the receiving vessel, which responds when the receiver is approaching the state of emptiness. In this case, the valve is then opened again. During the operation of the aluminium melt furnaces, e.g. aluminium oxide is discontinuously conveyed through the pneumatic conveying line. As the consumption per time unit is known, the delivery per time unit can be accommodated to this consumption. This also holds for the receiver vessel, so that a fill level measurement for the downward level may also be omitted. If appropriate, the valve can be controlled in a time-dependent manner, namely, it can be opened after a certain time after closing, this time corresponding to that one which is required for each cell of the furnace to be continuously fed from the receiving vessel.

According to a further embodiment of the invention two or more pneumatic conveying chutes per receiving vessel are provided, preferentially on opposing sides, each leading to a load arrangement, e.g. an aluminium melt furnace with a plurality of electrolytic cells.

According to another embodiment of the invention a monitoring and indicating device is provided for the valves. It determines whether the valve is actually closed, after a

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corresponding actuation signal for adjustment into the closing position has been transmitted to the valve from the fill level indicator and the controlling means, respectively. It has also to be determined whether the valve has been adjusted into the opening position after a fresh refilling of the receiving vessel has become necessary.

A conventional feed valve for such pneumatic conveying systems may be employed as the valve. According to one embodiment of the invention the valve is provided to be a valve ball with an axial passage as the valve member, mounted rotationally in a valve body. An elastic sealing ring is disposed on the side of the valve ball facing the conveying line and cooperates with the valve ball. On the opposite side of the valve ball, sufficient distance to the valve body is provided. To actuate the valve ball, e.g. a pneumatic actuation unit is used with which the valve ball is deviated to an angle of 90° from the opening position into the closing position and vice versa. The internal pressure in the receiving vessel is lower than in the pneumatic conveying line operating at overpressure. In the closed position of the valve a pressure difference at the sealing ring is consequently generated, so that the latter is inevitably pressed against the ball surface. The sealing action increases with increasing pressure difference.

The valve ball is sealed only unilaterally, on the side of the higher pressure. On the side of lower pressure no sealing exists, the body featuring a large spacing towards the ball instead. In this way the forces required to open and close the valve are reduced to a minimum. Furthermore, no deposition of bulk material can occur upon perpendicular incorporation of the feed valve, especially in the opened position. This increases the operational safety of the valve, because the forces required to actuate the valve remain calculable.

According to a further embodiment of the invention the conveying line is provided to be connected at opposing sides of a cylindrical body open-ended in the downward direction, and the valve body is provided to be disposed at the bottom end of the cylindrical body in a sealed manner.

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A configuration example of the invention is subsequently explained in more detail by means of drawings.

Fig. 1 shows an installation according to the invention in a schematic manner.

Fig. 2 shows a detail of the installation according to the invention.

Fig. 3 perspectively shows a feed valve for the installation according to Fig. 1

Fig. 4 shows a section through the feed valve according to Fig. 3

Fig. 5 shows as a section a conveying chute for the installation according to Fig. 1

In Fig. 1 a receiving vessel 10 may be conceived, containing e.g. aluminium oxide powder. It is conveyed via a line 12, which contains a sieve and at least one shut-off device which are not dwelled on further here, to a pressure vessel 14. The pressure vessel is connected to a pneumatic conveying line 16. The pressure vessel is in connection with a compressed-air pipe 18, which is joint to a compressor 20 or to a compressed-air network. The compressed-air pipe 18 is conducted to the upper end of the pressure vessel 14 at the one hand, and to the bottom end on the other hand, as apparent from Fig. 1. Furthermore, a branching 22 immediately leads into the conveying line 16. By means of the demonstrated system bulk material, here aluminium oxide powder, may be conveyed through the conveying line 16, and if necessary over a relatively large distance without causing too high pressure losses and pressure drops.

In distances branch lines 24 are attached to the pneumatic conveying line 16, each leading to a receiving vessel 26. Pneumatic conveying chutes 28, 30 are attached on opposing sides at the bottom end to the receiving vessels 26. The pneumatic conveying chutes 28, 30, which are fed with compressed-air by a compressor 32, are conducted to separate aluminium

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melting furnaces 34, 36, per cell of the furnaces 34 being provided one or several discharges for the conveying line 30, as illustrated e.g. with 38.

In Fig. 2, two receiving vessels 26 are depicted in an enlarged view. One recognises that at each case a valve 40 is disposed in the branch line 24, which is actuated by a pneumatic actuation device 42.

In the receiving vessel 26, having e.g. a volume specific for the installation of 0,5 m³, a fill level indicator 42 is provided which determines when the level in vessel 26 reaches a maximum value. In this case the valve 40 is then closed. It is reopened when either a predetermined time has passed, or when a minimum level is determined in the receiver 26 by a subsequent fill level measurement.

A monitoring device is also attached to the valves, formed e.g. by limit switches, as indicated by the chain dotted circle 46. This device determines whether the valve 40 has been adjusted to the intended position or not after issuing an actuation command to it, which may be determined e.g. with the aid of the limit switch. This may be indicated e.g. by a monitor 48.

It is further to be seen from Fig.2 in which manner a conveying chute 28 is connected with two cells 50, 52 of a furnace 36 or 34.

The receiving vessels 26 are connected with an exhaust gas channel 58 via lines 56. The air outbreathed from the receiving vessels enters into these lines when they are filled via the pneumatic conveying line 16.

During operation aluminium oxide powder is conveyed in the conveying line 16 and brought into a receiving vessel when valve 42 is opened. As the consumption of the aluminium melt furnaces 34, 36 is known, no special control or adjustment of the deliveries per time unit to be adjusted is required. Admittedly, it is also possible to provide a

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corresponding control or a stop of the conveying, respectively, when corresponding circumstances are given.

In Figs. 3 and 4 a valve 40 is illustrated in more detail. One recognises from Fig. 3 that the valve is arranged at the bottom end of a cylindrical vessel 60, to which are connected on opposing sides pipe segments 62, 64. e.g. by welding. On the ends of the pipe segments 62, 64 flanges 66, 68 are disposed for junction with the corresponding end of the conveying line 16 (not shown). A flange 70 is weld to the bottom end of the cylindrical vessel 60 for connection with the upper flange 72 of the body 74 of the valve 40.

The cylindrical valve body 74 mounts a valve ball 76 around a horizontal axis. The actuation of the valve ball 76 for deviation at an angle of $\pm 90^\circ$ is performed by the pneumatic actuation device 42, which is not to be dwelled on in detail, because such devices are known in the prior art.

As is recognisable from the two different positions in Fig. 4, with the aid of valve ball 76 the passage in downward direction from the cylindrical vessel 60 can be locked or unblocked. For this purpose an elastic ring sealing 78 is clamped between a shoulder of the body 74 and a locking 80, which is arched under tension towards the upward direction and is brought into close attachment with the outer side of the valve ball 40. In the locking position of the valve ball 76 a passage in downward direction is blocked with the aid of sealing 78. Because in the receiving vessel 26 a much lower pressure exists than in the conveying line 16, the pressure difference at the sealing ring 78 causes it to be pressed with a relatively high force against the outer side of the valve ball 76. For the rest, relatively much unoccupied space exists between the ball 78 and the body 74, so that material can not be deposited to adversely affect the movement rate of the valve ball 76.

It still remains to be mentioned that e.g. a compressed-air pipe 82 with a smaller diameter is disposed in the conveying line 16 and therefore also in the pipe segments 62, 64, which

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comprises cut orifices directed downwards 84, a screen 86 being disposed in their region. Such design of a pneumatic conveying line is actually known, however.

In Fig. 5 at 90 an example for a conveying chute is shown, which is composed of a first pipe-like chute segment 92 and a second pipe-like segment 94, the latter co-operating in a telescopic manner with the former. The chute segment 92 is connected via the lateral connecting piece 96 with the receiving vessel (not shown), e.g. the receiving vessel 26 according to Figs 1 and 2. It has an air-permeable chute knitting 98 in its bottom region, which is connected to compressed-air at 100 and 102, respectively, in order to disintegrate the material which enters the chute 90 via the connecting piece 96. The second segment 94 has a discharge piece 106, which is rigidly connected with a cell of an aluminium melting furnace or even with a further conveying chute. Thus, the conveying chute can be adjusted in longitudinal direction according to the spatial conditions.

The pipe-like segment 94 is provided at one end with a flange 108, which is connected with a ring 110 via screws 112 for clamping a sealing package 114, which at 116 on the pipe side is brought into close attachment with a ring which is welded to the segment 94. An additional ring 118 within the segment 94 serves for guidance between the segments 92,94.

In the second segment 94 a perforated plate 120 is shown at 120, whereby a downward chute segment 122 is formed which is provided with a compressed-air connection 124 for disintegrating the material which arrives from the first section 92 into the second section 94, before it drops into the connecting piece 106. The end of the second segment 94 is closed with a blind flange 126.

It is also imaginable to provide with the second segment several connecting pieces in distances, each one connected with one electrolytic cell of an aluminium melt furnace. In this case, a disintegration device can also be provided between the connecting pieces or discharges, as shown at 120.

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The first chute segment 92 is also sealingly closed with a blind flange at the right end 128.

The installation shown in the Figs. 1 to 5 and described above can be used for other loads of bulk material where the loads are arranged in groups, as well as upon spatial separation of the individual groups.

Claims

1. Installation for feeding cells of a furnace with bulk material, said installation comprising:

a silo containing the bulk material;

a pressure vessel connected with the silo;

a conveying line connected with the pressure vessel;

a plurality of receiving vessels in the vicinity of the cells, each said receiving vessels being connected with the conveying line via a valve; and

at least one pneumatic conveying chute connecting each said receiving vessels with the cells, said at least one conveying chute comprising at least one discharge per load.

2. The installation as claimed in claim 1, characterised in that each said receiving vessels comprises a fill level indicator, said fill level indicator being connected with a controlling means and the valve, the controlling means closing the valve, when the fill level has reached a predetermined height.

3. The installation as claimed in claim 1, characterised in that at least two pneumatic conveyer chutes are connected with each said receiver vessels.

4. The installation as claimed in any one of claims 1 to 3, characterised in that the valve further comprises a monitoring and indicating device, said device determining and/or indicating when the valve does not have the preset switching condition.

5. The installation as claimed in any one of claims 1 to 4, characterised in that the valve is arranged at the bottom end of a cylindrical vessel and the valve has a cylindrical valve body which comprises a valve ball around a horizontal axis, whereby an axial passage downward the cylindrical body can be blocked or unblocked, an elastic sealing ring being disposed on a side of the valve ball facing the conveying line and being in sealing

co-operation with said valve ball, and the opposing side of the valve ball featuring a spacing to the wall of the valve body.

6. The installation as claimed in claim 5, characterised in that the conveying line is connected at opposing sides to the cylindrical vessel which is open-ended in the downward direction, and the valve body is disposed at the bottom end of said cylindrical vessel.

7. The installation as claimed in any one of claims 1 to 6, characterised in that said at least one conveying chute comprises first and second segments, the first segment being rigidly connectable with each said receiving vessels, and the second segment having laterally said at least one discharge, and co-operating in a telescopic manner with the first segment or a further chute segment.

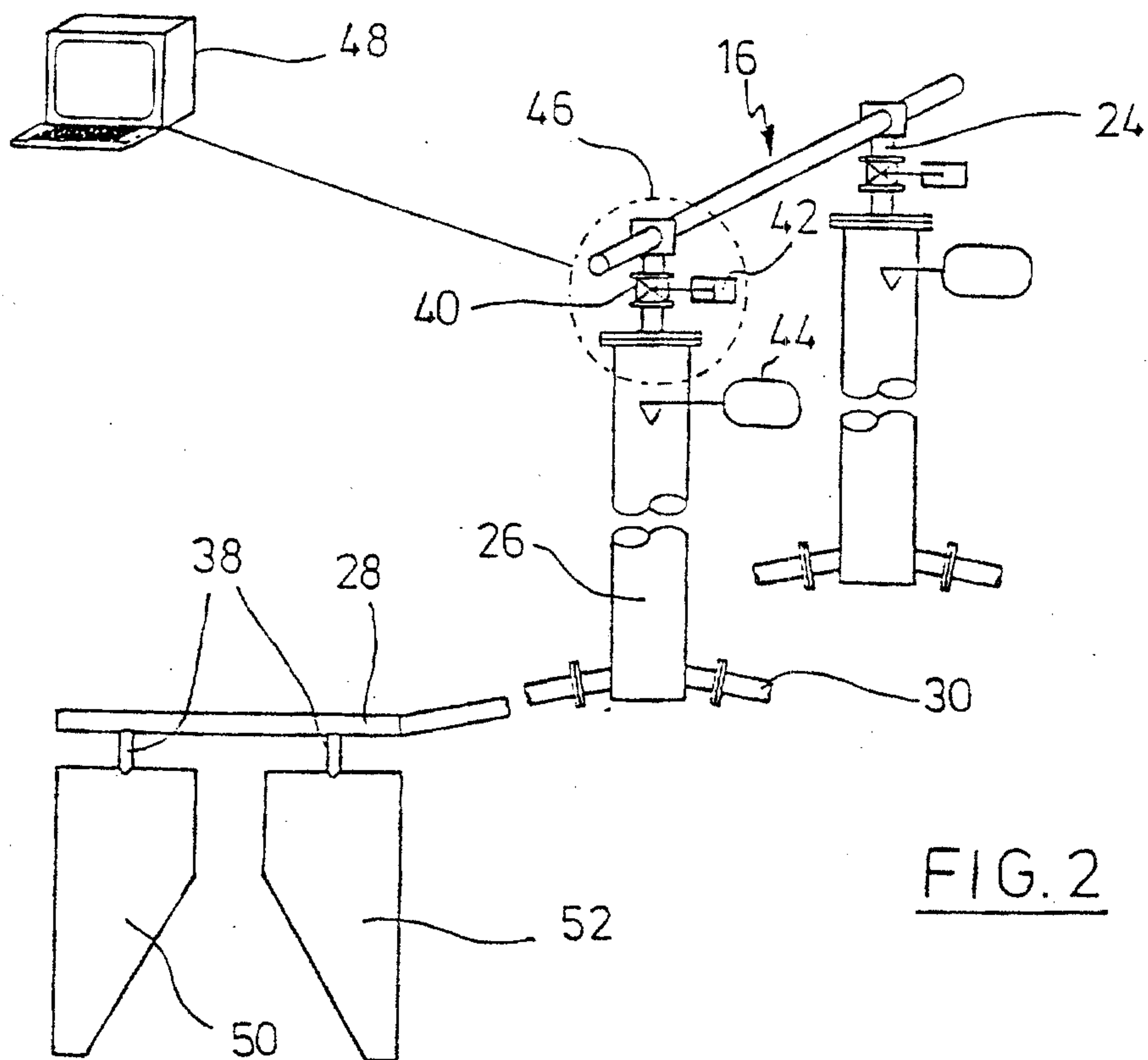
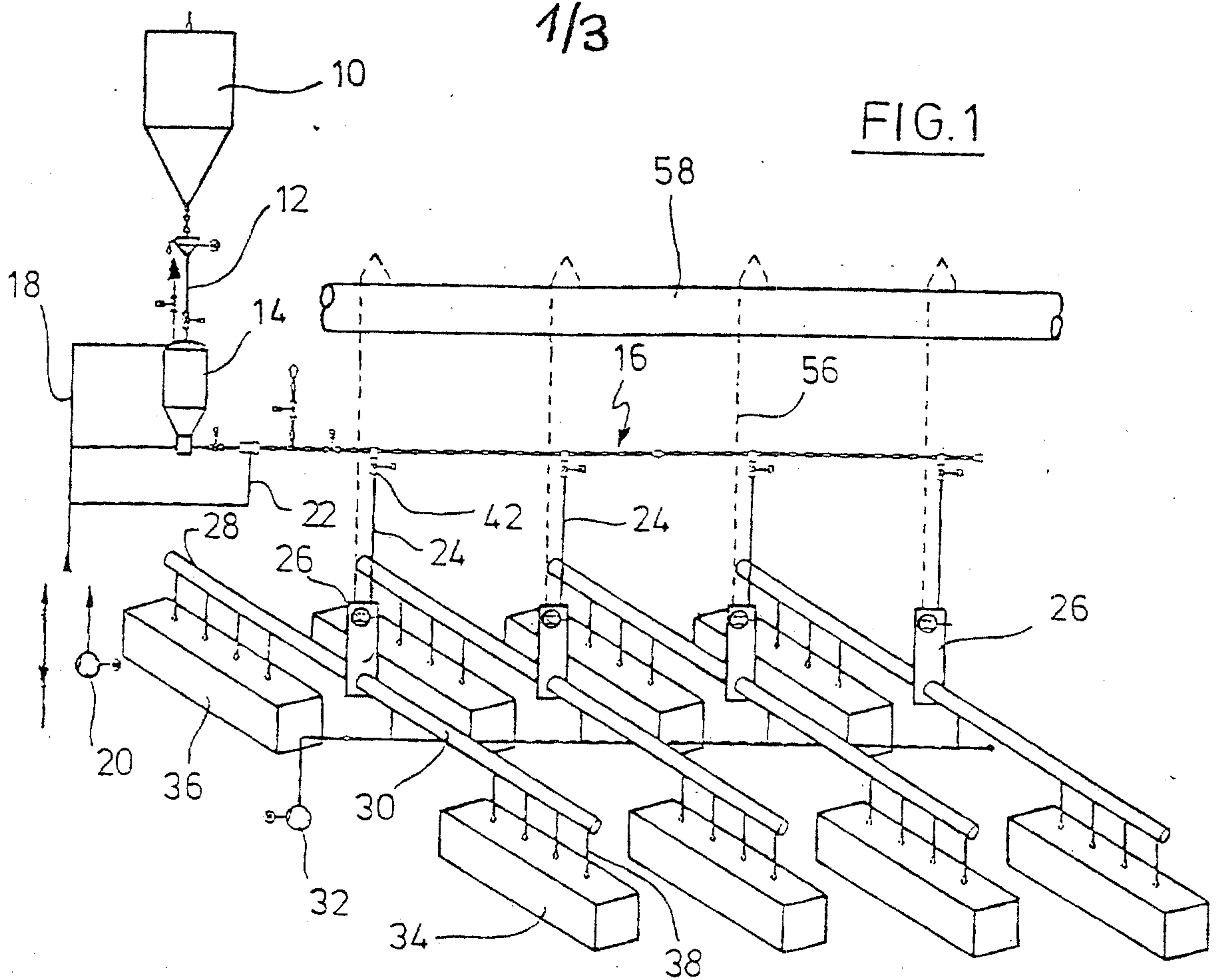
8. The installation as claimed in claim 7, characterised in that the second segment between the at least one discharge and the first segment is constructed as a pneumatic conveying chute.

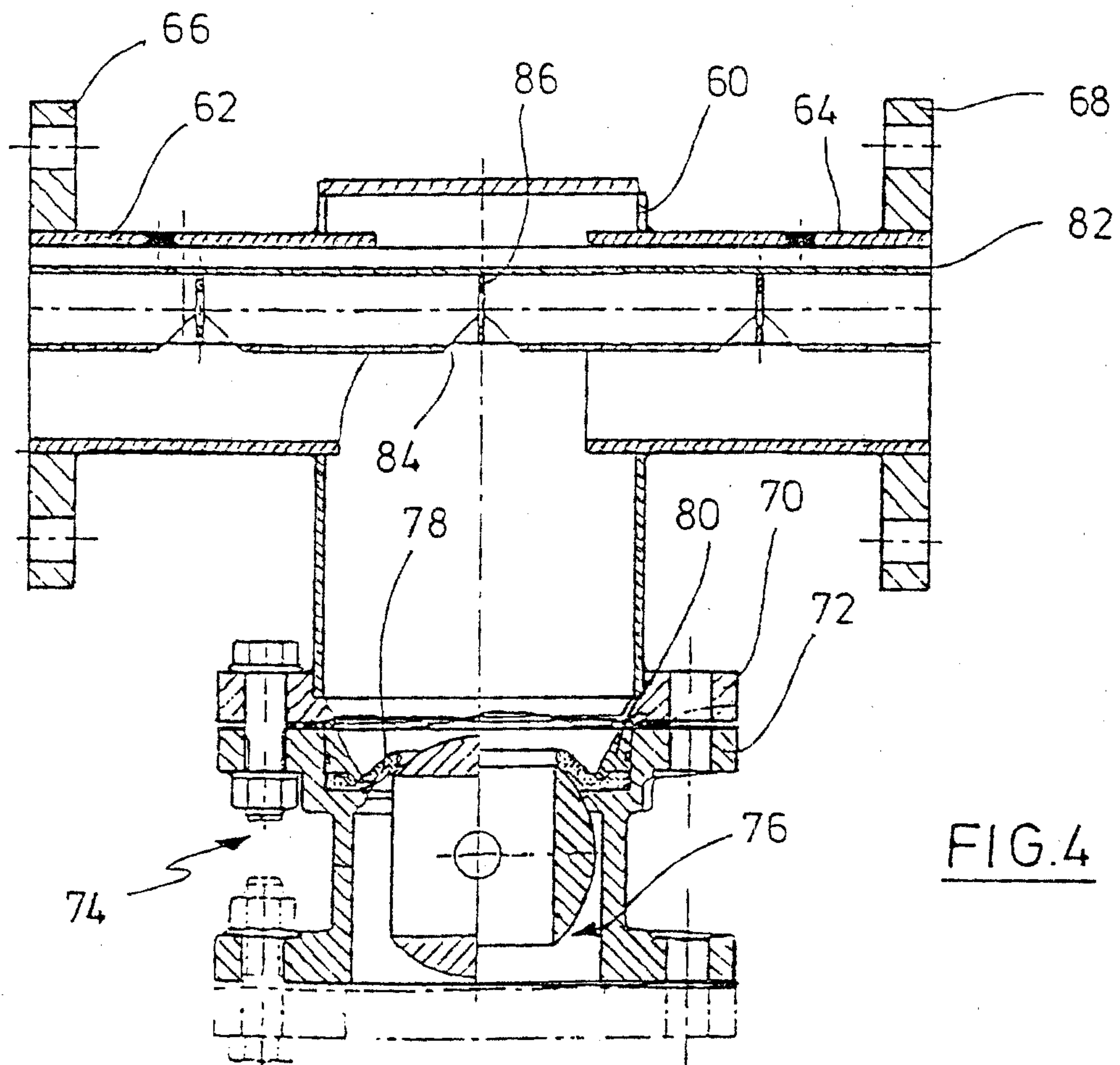
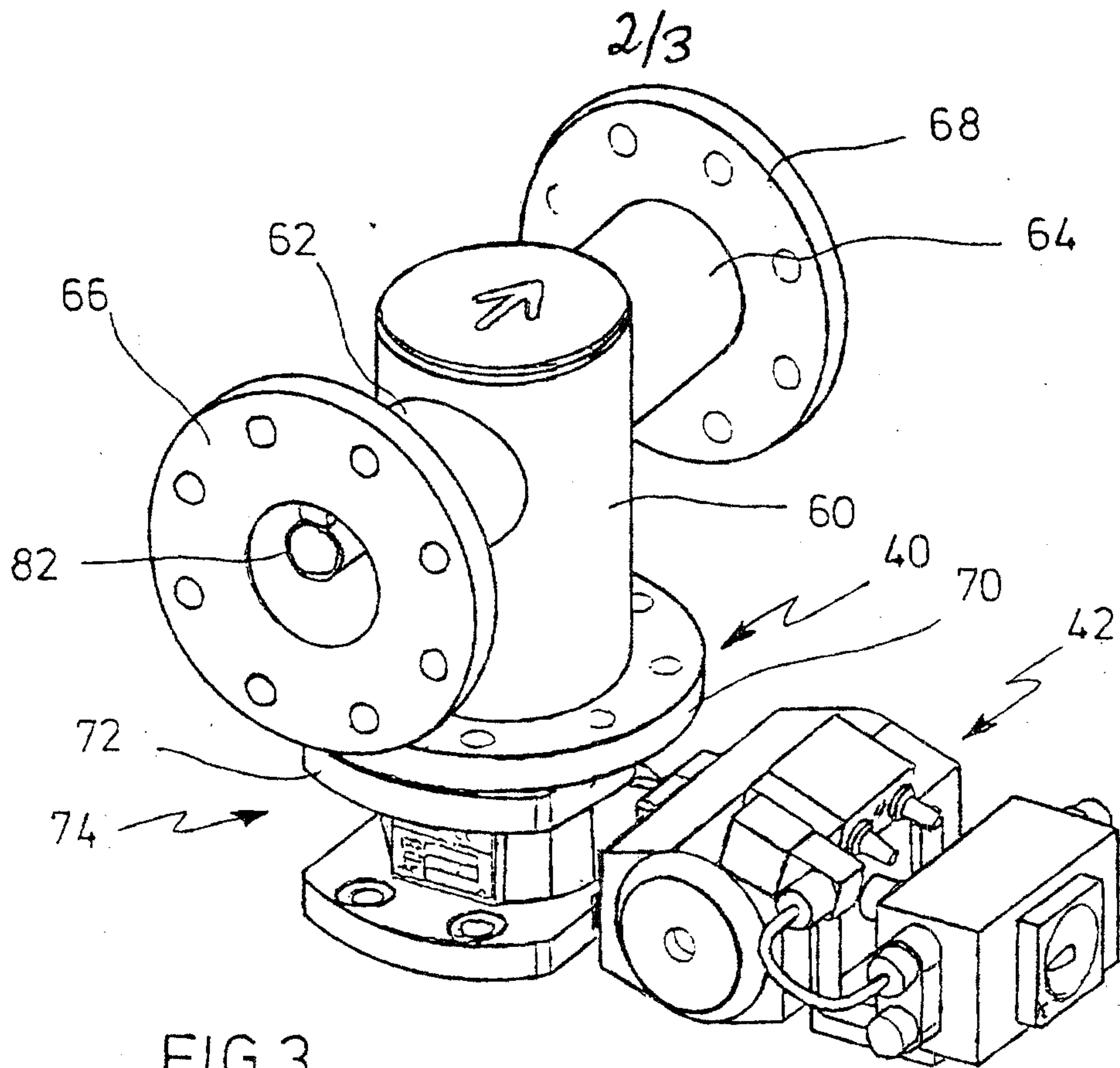
9. The installation as claimed in claim 7 or 8, characterised in that said first and second segments are constructed as pipes.

10. The installation as claimed in any one of claims 1 to 9, characterized in that the furnace is an aluminium melting furnace.

11. The installation as claimed in any one of claims 1 to 10, characterised in that the bulk material is pulverised aluminium oxide.

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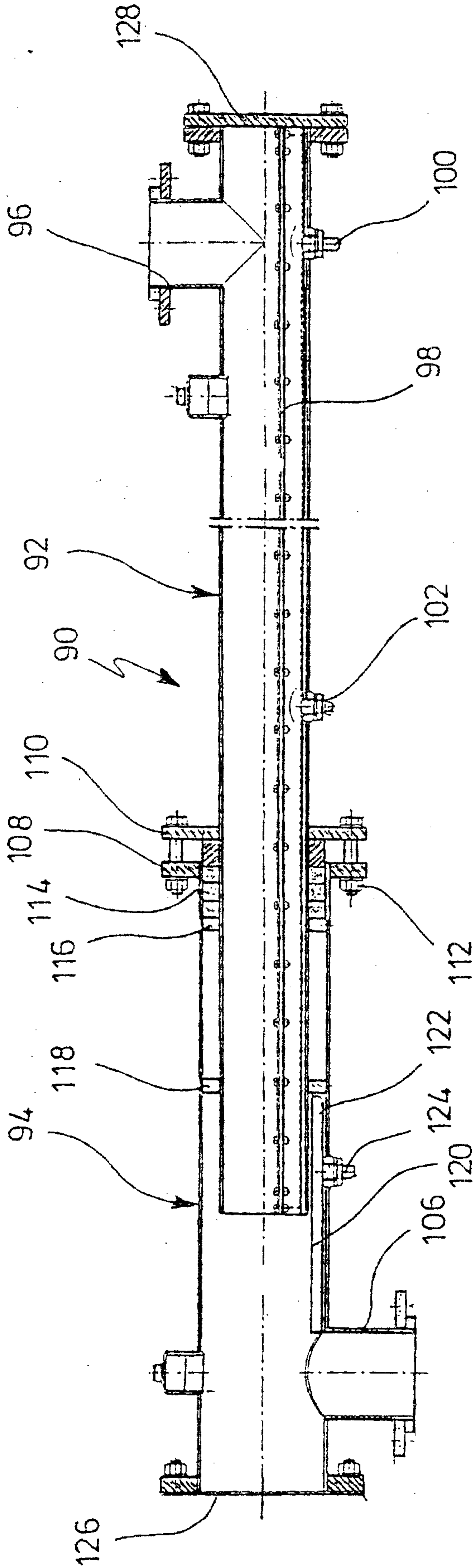


FIG. 5

