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(54) Material handling system

(57) Particulate material falls from a larger to a smaller orifice via a conduit designed to minimise the risk of clogging. An upper portion (22) is angled and tapers. It has a non-circular (suitably facetted) cross-section, to discourage helical flow. The lower, outlet portion (26) of the conduit is vertical. It tapers non-symmetrically, so that its outlet end (36) is offset relative to the inlet end (28. The lower portion (26) has one or more transition points (34, 44) at which the steepness of the internal wall increases.

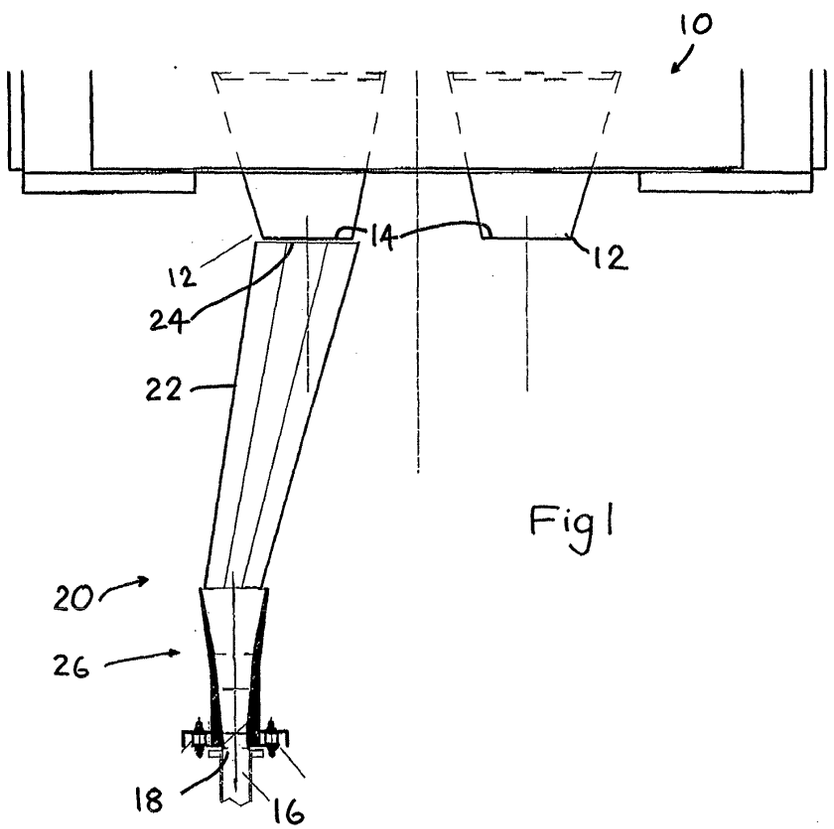

Fig 1

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Description

[0001] The present invention relates to systems for handling particulate materials, e.g. foodstuffs.

[0002] In one aspect the invention relates to a conduit having an inlet and an outlet, the outlet being of smaller cross-sectional area than the inlet. Generally the inlet is intended to be higher than the outlet, and the conduit is arranged so that particulate material can fall from the inlet to the outlet . The inlet may be intended to receive weighed batches or charges of particulate material from a weighing unit. The outlet may be intended to be coupled to a downstream processing station, having an inlet of similar dimensions to the conduit's outlet. The processing station may be a packaging station, e.g. comprising a bag making machine.

[0003] In another aspect the invention relates to a packaging assembly having a first station (e.g. a weighing station) for providing batches of particulate product and a second station for treating (e.g. packaging) batches. The second station has an inlet smaller than the outlet of the first station and they are coupled via a conduit which embodies the first aspect.

[0004] It is a known problem of existing systems in which particulate material has to be fed through a relatively narrow orifice that blockages occur.

[0005] It is a known problem of existing systems in which batches of particulate material are fed discretely along a conduit that the batches tend to spread out excessively and cease to be separate from adjacent batches.

[0006] Preferred embodiments of the invention may enable one to ameliorate or solve either or both of these problems.

[0007] According to the invention, a conduit has a tapering portion of noncircular internal cross-section for discouraging helical flow along it. It is preferably of facetted cross-section. The noncircular conduit portion is preferably offset, in that its outlet is at a lower level than its inlet, and laterally spaced from it. It may communicate with a second tapering portion. This may have internal walls that are generally steeper than those of the first tapering portion. It may have one or more transitions at which the wall steepness increases. Upper and lower portions of the second tapering portion may both extend substantially vertically, with one being laterally offset with respect to the other. The upper portion may have one or more internal fins extending downwardly to restrain swirling.

[0008] The conduit, or at least the second tapering portion, may be mounted so as to be vibratable and coupled to a vibratory device.

[0009] A preferred type of embodiment works on the principle of keeping the charge going, letting the speed build up as the charge drops through the system, but limiting the amount the charge spreads out (or disseminates). This means that the charge enters into the smallest diameter at a high speed and the particles making up the charge are spread out to an extent so that the density of the charge at this point is low. Therefore the chances of a jam are very low. This combined with the shape of the outlet chute and with the use of vibration lower the chance of jamming to nearly zero. Because the charge is travelling fast, even with the spread there will be a clear gap between the charges. This allows for the down line processing such as bag making or carton filling.

[0010] An embodiment of the invention will now be described by way of example with reference to the accompanying drawings in which:

Fig. 1 is a vertical section through an embodiment of the invention and;
Fig. 2 is an enlarged view of the outlet chute shown in Fig. 1.

[0011] Fig. 1 shows part of a weighing station 10, which may be generally conventional. It has one or more outlets 12, each having an outlet port 14 of relatively large cross-sectional area. Spaced below the weighing unit 10, there is a respective bag-making machine 16 associated with each outlet 12. In Fig. 1, only one is shown. It has an upper mouth 18 which is of much smaller cross-sectional area than the outlet port 14 of the weighing machine 10. The two are coupled together by means of a conduit assembly 20.

[0012] The conduit assembly 20 has an upper chute portion 22. This is an angled, tapering tube, of facetted cross-section. The illustrated example is octagonal in section. Its upper opening 24 is of very similar cross-sectional area to the outlet port 14 of the weighing machine. Being octagonal, it cannot match it exactly, so it is very slightly larger so that no particulate material emerging through the port 14 can fall outside the chute 22.

[0013] The chute extends steeply downwardly and slightly laterally to its outlet end where it is coupled to an outlet chute 26. This may be of generally circular cross-section and may extend substantially vertically. It is shown in more detail in Fig. 2.

[0014] Its upper mouth 28 is very slightly larger than the outlet aperture 30 of the upper chute 22. The upper section 32 of the outlet chute 26 tapers slightly, to an annular vertex region 34. Below this, in the outlet portion of the outlet chute, the internal wall is closer to the vertical. It is still tapered. The tapering has an asymmetry, such that the outlet 36 is slightly off-centred with respect to the upper inlet 28. Thus as shown in Fig. 2, at one side 38 the wall has a continuous taper whereas at the other side 40, the tapering ends at a vertex 44 and the final portion of the internal wall 46 extends vertically (that is, parallel to the axis), with the result that the centre line 48 of the exit aperture 36 is slightly off set from the centre line 50 of the inlet aperture 30. The lower portion of the outlet chute is smoothly shaped so that, circumferentially, there is a smooth transition from the ver-

tical portion 46 to the angle of taper at the diametrically opposite portion. The offsetting is achieved without any internal step that would interfere with particle flow.

[0015] In use, the weighing machine 10 accumulates successive batches or charges of particulate material, and releases them at intervals, into the top of the conduit 20. Each charge drops in through the mouth 24 without any retardation. The facetted chute is quite steep, despite the offsetting, so the material can pass through quickly. When particulate material falls through a simple tubular conduit, particles tend to diverge from a direct path, parallel to the axis. There is a tendency to adopt helical paths. Much kinetic energy tends to be lost when this occurs, resulting in some particles travelling through the conduit much slower than the rest. The batch or charge of material thus becomes spread out.

[0016] However, with the facetted chute, the particles are kept moving substantially in the intended, downstream direction. If they start to deviate and move across the chute, the facets interrupt this component of their motion.

[0017] The outlet chute 26 has very steep sides, to keep the particles moving smoothly, with minimum contact. The final portion is offset. This produces an angular transition, which eases the passage from the larger to the smaller diameter, corresponding to the inlet diameter of the packaging machine 16.

[0018] Because of the design of the conduit, the charge of material does not spread out substantially during transit and it passes through the exit orifice at high speed. The overall length of the conduit is such that there will have been some spreading out in the direction of travel. Some spreading is actually desirable, since it reduces the density of the material and thus reduces the chance of a jam. Because the charge is travelling fast, even with the spreading that does occur, there will be a clear gap between successive charges. This facilitates downstream processing such as bag-making or carton filling.

Claims

1. A conduit for conveying particulate material from an inlet to an outlet which is lower than the inlet and of smaller cross-sectional area, wherein said conduit has a tapering portion of noncircular internal cross-section for discouraging helical flow along it, said noncircular conduit portion having an offset, such that its outlet is at a lower level than its inlet, and laterally spaced from it.

2. A conduit according to claim 1 wherein said noncircular conduit portion is facetted.

3. A conduit according to claim 1 or claim 2 in which said noncircular conduit portion communicates with a second tapering portion which has internal walls that are generally steeper than those of the first tapering portion.

4. A conduit according to claim 3 wherein said second tapering portion has one or more transitions at which the wall steepness increases.

5. A conduit according to claim 4 wherein upper and lower portions of the second tapering portion both extend substantially vertically, with one being laterally offset with respect to the other.

6. A conduit according to claim 5 wherein said upper portion of the second tapering portion has one or more internal fins extending downwardly to restrain swirling.

7. A conduit assembly including a conduit according to any preceding claim wherein the conduit or, if present, at least the second tapering portion, is mounted so as to be vibratable and is coupled to a vibratory device.

8. A packaging assembly having a first station for providing batches of particulate product and a second station for treating batches, wherein the second station has an inlet smaller than the outlet of the first station and they are coupled via a conduit or conduit assembly according to any preceding claim.

9. A method of conveying a batch of particulate material from a first orifice to a second orifice of smaller cross-sectional area comprising coupling said orifices by means of a conduit according to any of claims 1-6 or an assembly according to claim 7 and discharging the batch through the first orifice into the conduit.

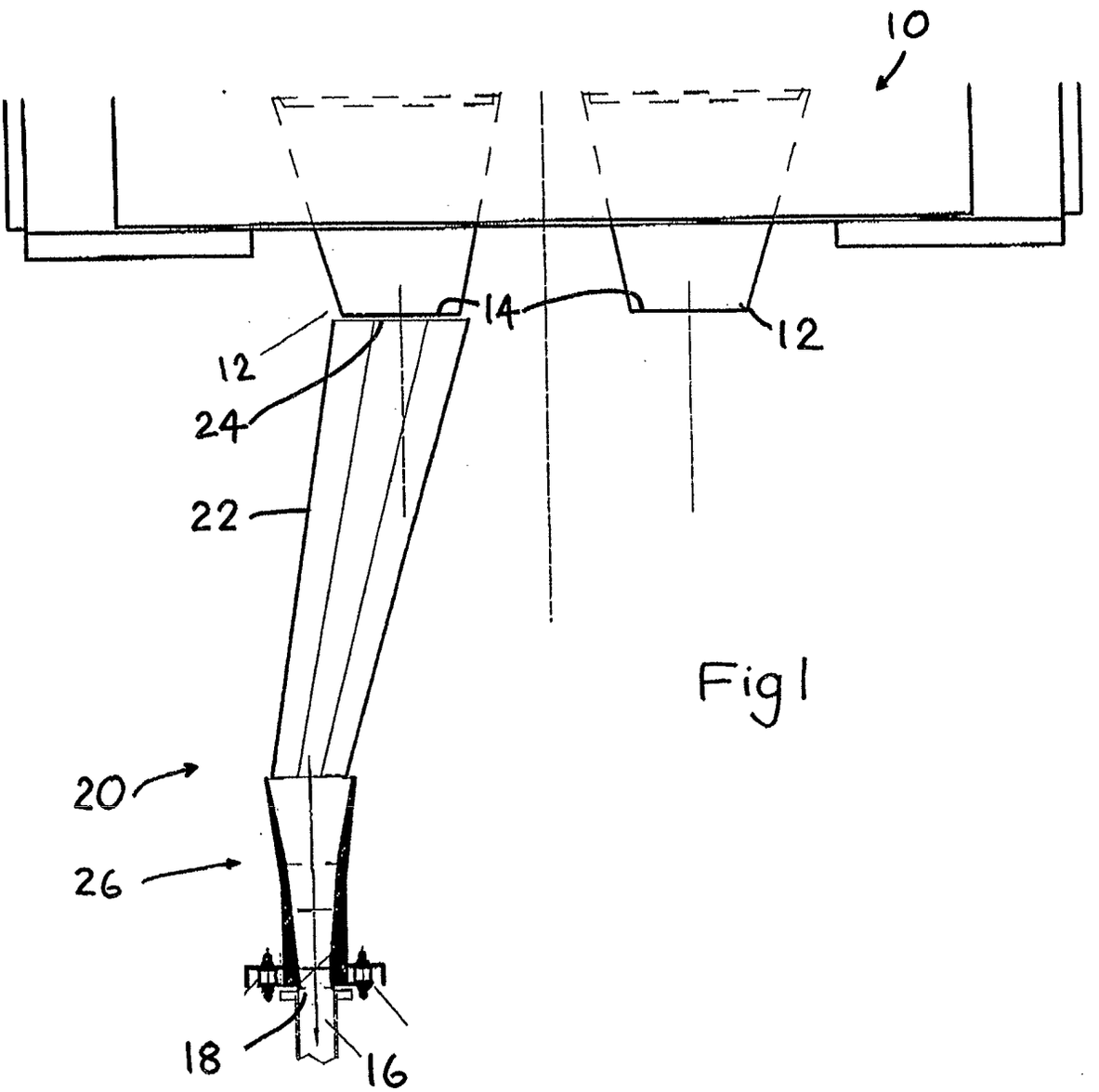

Fig 1

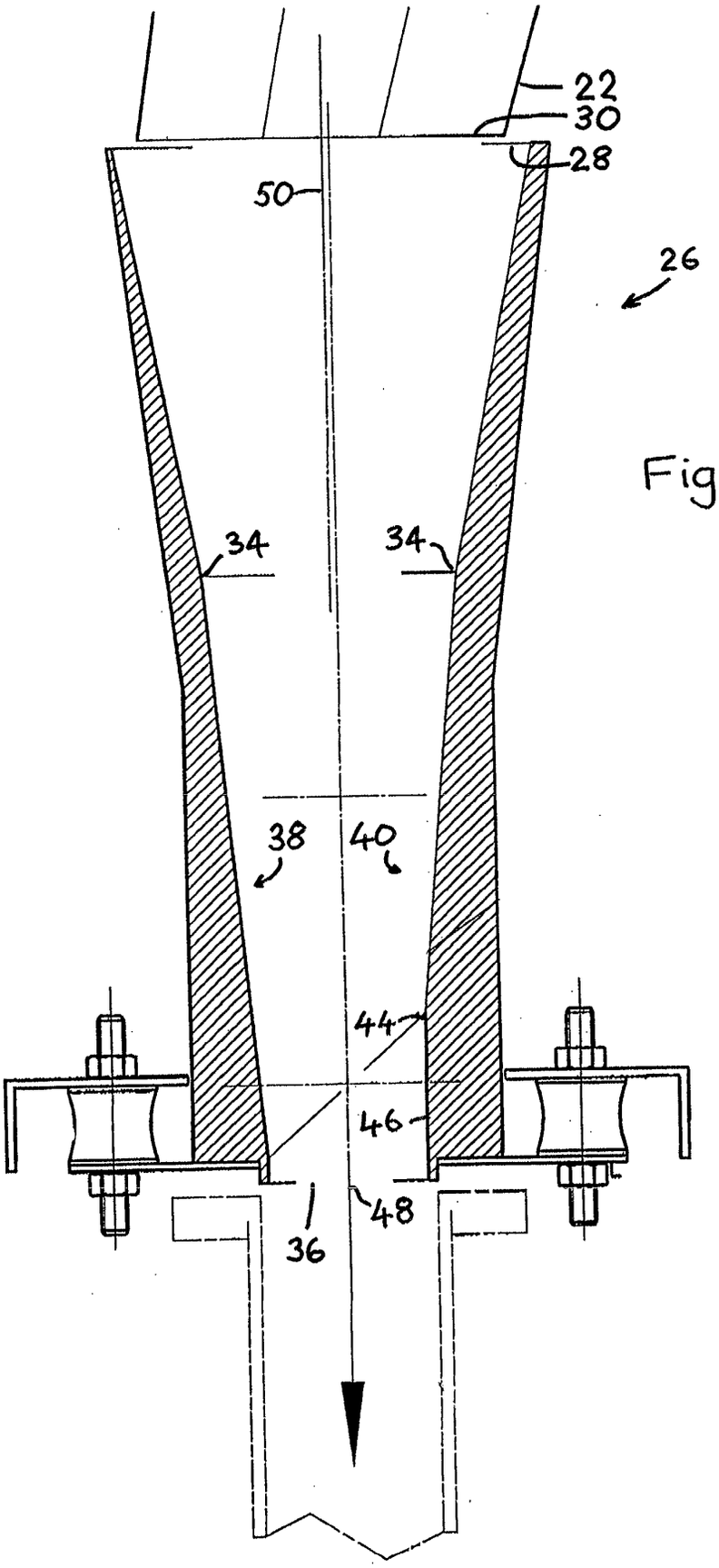

Fig 2

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EUROPEAN SEARCH REPORT

Application Number
EP 02 25 6168

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
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The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	16 December 2002	Grentzius, W

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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ANNEX TO THE EUROPEAN SEARCH REPORT ON EUROPEAN PATENT APPLICATION NO. EP 02 25 6168

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
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