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[56] **References Cited**

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[54] **REDUCING THE ATMOSPHERIC OXYGEN**  
**CONTENT OF BULK MATERIALS WHICH CAN**  
**FLOW OR BE TRICKLED**  
**6 Claims, 2 Drawing Figs.**

**ABSTRACT:** For reducing the atmospheric oxygen content of bulk material, an apparatus is provided in which the material is poured or trickled through a confining passageway through which a protective or scavenging gas passes in counterflow. The material is thus prepared for packaging, and the apparatus may be directly combined with a packaging machine.

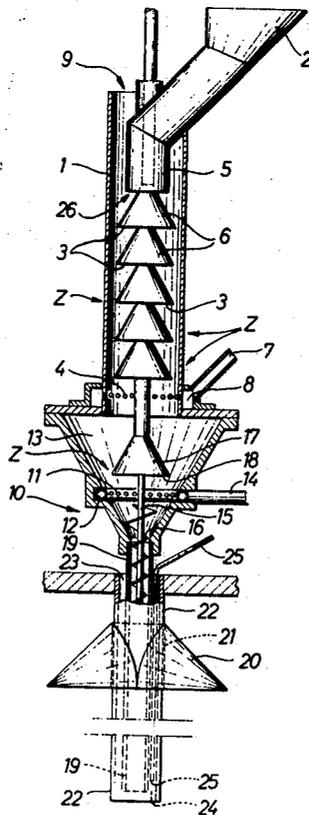
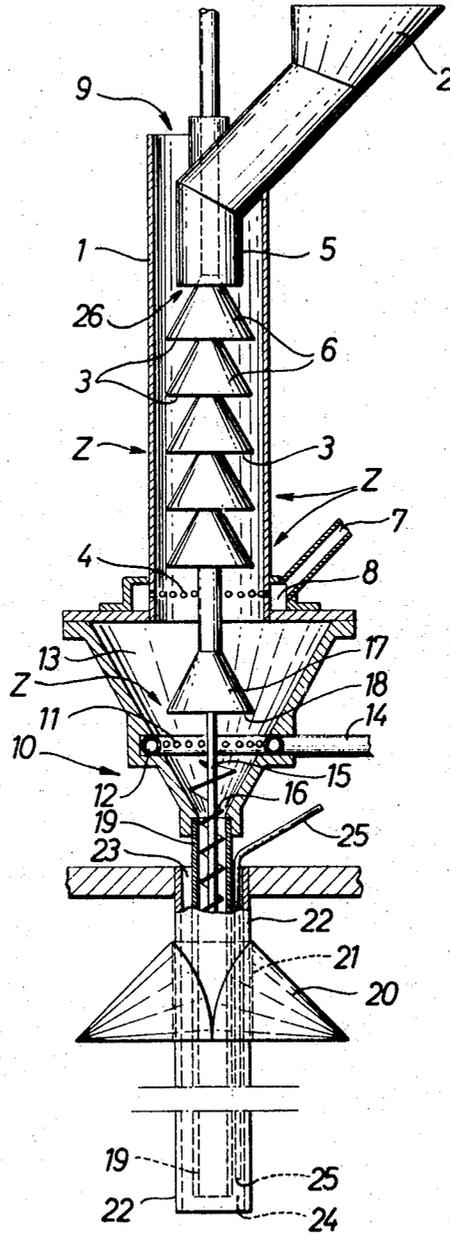


FIG. 1





## REDUCING THE ATMOSPHERIC OXYGEN CONTENT OF BULK MATERIALS WHICH CAN FLOW OR BE TRICKLED

This invention relates to an apparatus for reducing the atmospheric oxygen content of fluent or pourable bulk materials by gas exchange, and is particularly useful in connection with such materials.

It is known to retard the deterioration of materials which are susceptible to atmospheric oxygen by maintaining them under vacuum or in a protective gas atmosphere, and to provide suitable packaging for this purpose. The packages containing the material in these cases are evacuated, sometimes filled with a protective gas, and then closed in gastight fashion. Another known method consists in placing the bulk material in large quantities in a vessel or silo under vacuum and then filling the vessel with a protective gas whereby, in effect, a gas exchange takes place. The filling of packaging containers with material treated in this way then takes place with air excluded.

These methods, however, call for a comparatively large technical expenditure, particularly where high rates of output are required.

It is an object of the invention, therefore, to devise an apparatus for reducing the atmospheric air content of fluent or pourable bulk materials in which these drawbacks are avoided.

To achieve this object, the invention provides an apparatus which has means for feeding solid material for treatment in loose condition through a confining conduit, and means for propelling gas through said conduit in countercurrent to the material for treatment. A particularly advantageous form of this apparatus has a vertical conducting shaft which is open at its upper end and supplied with the pourable material, a device in said shaft for fining out the material in at least one zone of the shaft, and means for supplying protecting or scavenging gas through nozzle openings into said shaft to flow through said zone in countercurrent to the pourable material.

This washing by gas passing in countercurrent to the pourable material has the surprising effect of reducing the atmospheric oxygen content of the material treated to a very low level, with comparatively small quantities of scavenging gas, thus enabling the treated material to be packaged immediately following the gas washing.

Two embodiments of the invention are illustrated by way of example in the accompanying drawings, in which:

FIG. 1 is an elevational view, partly in cross section, of an apparatus in accordance with an embodiment of the invention, to be used in conjunction with a tubular bag machine, and

FIG. 2 is a similar view of the lower part of a modified form of the apparatus illustrated in FIG. 1.

The apparatus illustrated in FIG. 1, intended for the reduction of the atmospheric oxygen content of pourable materials for packaging, primarily comprises a confined conduit in the form of a tubular shaft 1, a supply hopper 2 for introducing the material to be treated into shaft 1, at least one circular edge 3 over which the pourable material can be trickled, and a plurality of nozzles 4 for the admission of scavenging gas.

The pourable material is loaded into the supply hopper 2 and thence passes through a pipe connection 5 into the tubular shaft 1 where it encounters a plurality of spaced conducting cones 6 each arranged apex uppermost. These cones 6 are bounded at their lower ends by the annular edges 3.

The scavenging gas is blown through the nozzles 4, which are located below the edge 3 of the lowermost conducting cone 6, in countercurrent to the pourable material trickling over the edges 3. The nozzles 4 are arranged for this purpose in an annular channel 8 to which the gas is supplied through a tubular conduit 7. Since the tubular shaft 1 is not sealed around the pipe section 5 adjoining the hopper 2 but has a vent opening 9 at this part, and since, at its lower end, it is closed from the exterior by a worm dispensing device 10, the scavenging gas blown in through nozzles 4 flows opposite to the direction of descent and showering of the pourable materi-

al and expresses the air from the material, particularly at zones Z. As a result of the repeated trickling over the edges 3 all parts of the poured material are brought into intensive contact with the scavenging gas.

In the embodiment illustrated in FIG. 1, the scavenging gas can alternatively be introduced at a lower level than the nozzles 4, for example through nozzle orifices 11 in an annular conduit 12 which is mounted in a hopper 13 of the worm-dispensing device 10 arranged below the shaft 1. In this event, scavenging gas is introduced through a tubular conduit 14 connected to the annular conduit 12. A conducting cone 17 with a circular edge 18, over which the pourable material may be trickled as described above, is arranged above the nozzle orifices 11 on the driving spindle 15 of the dispensing worm 16 of the dispensing device 10, so that cone 17 may turn with the dispensing worm 16 during a dispensing operation. This worm is of known type and the spindle 15 passes vertically through the hopper 13. The dispensing worm 16 conveys the filling material through a tube 19 into a tube of packaging material (not shown) which is transversely sealed, withdrawn and divided into individual bags continuously, in known fashion.

The forming of the tube of packaging material from an endless foil strip is likewise carried out in known manner, in that the strip is conducted over a forming shoulder 20 and then into a slit 21 between this shoulder and a hollow forming mandrel 22. The tube 19 around the dispensing worm 16 is arranged inside the forming mandrel 22 so as to leave an annular gap 23 which is in communication at the lower part 24 thereof, with a pipe 25 through which a protective gas is blown. This serves to hinder the ingress of external air into the bulk material, which has been extensively freed of atmospheric oxygen, during the formation of the tube of packaging material or the eventual bags.

It will be appreciated that other means for loosening or finely dividing the filling material may be used in place of the conducting cones 6, 17 and their edges 3, 18, over which the pourable material trickles under gravity, or the gap 26 defined between the cone 6 and the delivery pipe section 5, for example agitating tools or the like. Again, however, provision will be made for introduction of the scavenging gas so that it passes in counterflow through the poured material over a distance which is made as long as is convenient, and is utilized to the best advantage.

A modified form of apparatus is illustrated in FIG. 2. This shows the lower part of a gas-treating apparatus of which the upper part (not shown) may be identical with that illustrated in FIG. 1. It will be noted, however, that the cone 17 of the FIG. 1 arrangement is not used in the hopper 13 in FIG. 2.

Furthermore, the gas-admission openings are, in this instance, disposed at the narrowest part of the material conduit to the dispensing tube 19. Thus the gas admission means 11, 12 and 14 are omitted in FIG. 2 and are replaced by nozzles 30 in an annular channel 32 supplied with gas from a connection pipe 33.

It will also be noted that, instead of using the conducting cone 17 of FIG. 1 in hopper 13, a rotary agitating blade 34 is employed. The upper part (not shown) of the apparatus of FIG. 2 can be of identical form to the corresponding part in FIG. 1 or may simply be constituted by a smooth tube without any conducting cones 6.

The modification illustrated in FIG. 2 is of particular advantage if only small quantities of material have to be delivered at a time as a result of which smaller quantities of scavenging gas are required. In instances of this character, the apparatus illustrated in FIG. 1 may be subject to the disadvantage that because of the relatively large number of orifices 4, the pressure, and hence the speed, of gas emerging therefrom will necessarily be low. There is consequently the danger that some of these orifices may be stopped up by material lodging therein, and this would interfere with the uniformity of gas flow through the descending material.

In the arrangement illustrated in FIG. 2 the gas admission openings are concentrated in a small area and the pressure can

thus be higher and the danger of stoppage avoided. Moreover the consumption of gas should, in many cases, be smaller with the FIG. 2 arrangement.

As stated, the present invention is not limited to the example given, that is to say for packaging purposes, because a more universal application is feasible where gas exchange with solid, flowable bulk materials is required.

We claim:

1. In an apparatus for reducing the atmospheric oxygen content of fluent solid materials by gas exchange, an improvement which comprises means for feeding solid material for treatment in loose condition through a confining conduit, means for propelling scavenging or protecting gas through said conduit in countercurrent with the material for removing the air from said material, said means for feeding solid material comprising a vertical conducting shaft supplied with the pourable material and having an open upper end, and a device in said shaft for fining out the material in at least one zone of the shaft, said means for propelling gas comprising means for supplying said gas through nozzle openings into said shaft to flow through said zone in countercurrent with the pourable material, said device for fining out the material comprising a plurality of upwardly tapering cones arranged in superimposed fashion in said tubular shaft with the lower circular bounding edge of each cone spaced from said shaft to define an annular gap therewith, said nozzles for admission of the protecting or scavenging gas being arranged in circular array beneath the bounding edge of the lowermost of said cones.

2. In an apparatus for reducing the atmospheric oxygen content of fluent solid materials by gas exchange, an improvement which comprises means for feeding solid material for treatment in loose condition through a confining conduit, means for propelling scavenging or protecting gas through said conduit in countercurrent with the material for removing the air from said material, said conduit having an outlet at the lower

end thereof for material from which air has been removed, a dispensing device coupled to said conduit at the outlet thereof, said dispensing device including a feed hopper, a conducting cone mounted apex-up in said feed hopper with the lower annular edge of said cone spaced from said hopper, and an annular conduit with a plurality of nozzles opening into the feed hopper beneath the lower annular edge of said cone.

3. Apparatus according to claim 2 wherein said means for feeding solid material comprises a tubular conducting shaft with an open upper end, and a plurality of superimposed conducting cones in said shaft, the lower end of said shaft being mounted on said feed hopper.

4. Apparatus according to claim 1 wherein said nozzles are arranged in an annular channel disposed around the conducting shaft.

5. Apparatus according to claim 1, comprising a dispensing device including a feed hopper coupled to said shaft for receiving treated material therefrom.

6. In an apparatus for reducing the atmospheric oxygen content of fluent solid materials by gas exchange, an improvement which comprises means for feeding solid material for treatment in loose condition through a confining conduit, means for propelling scavenging or protecting gas through said conduit in countercurrent with the material for removing the air from said material, a dispensing device with a feed hopper joined to said confining conduit, a dispensing tube connected to said feed hopper, and a tubular bagmaking machine having a hollow mandrel for forming tubular bag material, said hollow mandrel surrounding said dispensing tube with an annular clearance therebetween, and further means for supplying a protective or scavenging gas through said clearance in counterflow with pourable material passing through said dispensing tube.

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