Jan. 1, 1952 R. A. NORBOM 2,580,823

NOZZLE CONSTRUCTION FOR USE IN THE PNEUMATIC HANDLING OF FLOUR AND THE LIKE

Filed Aug. 8, 1950 2 SHEETS—SHEET 1

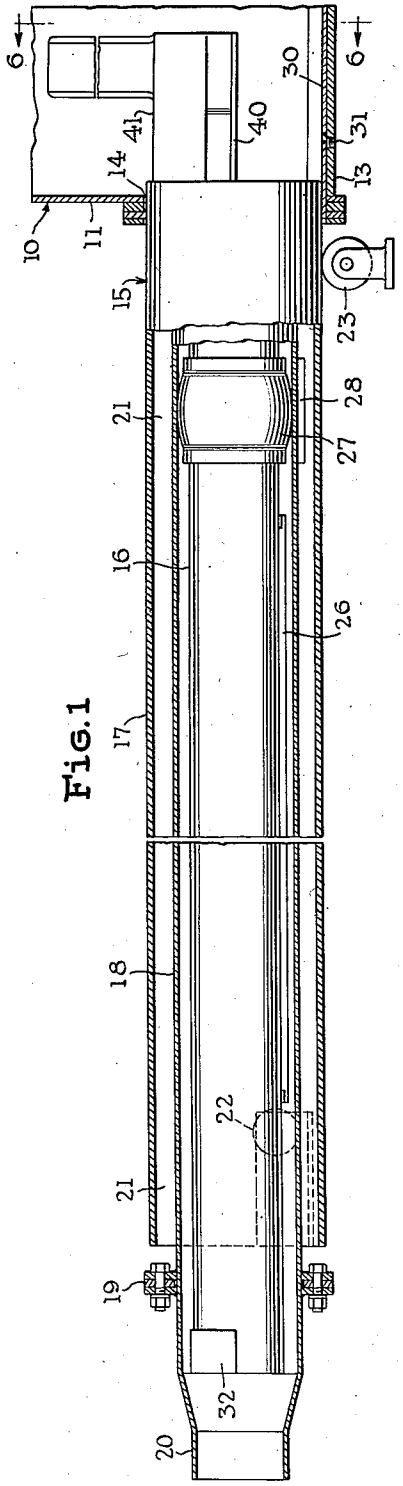


Fig. 1

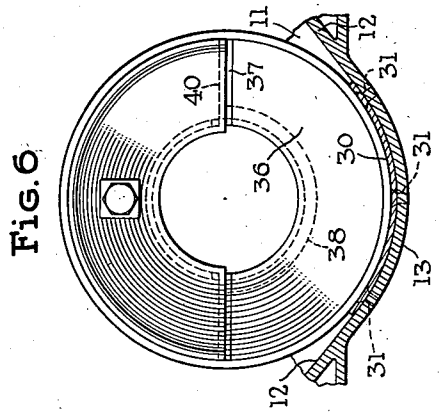


Fig. 6

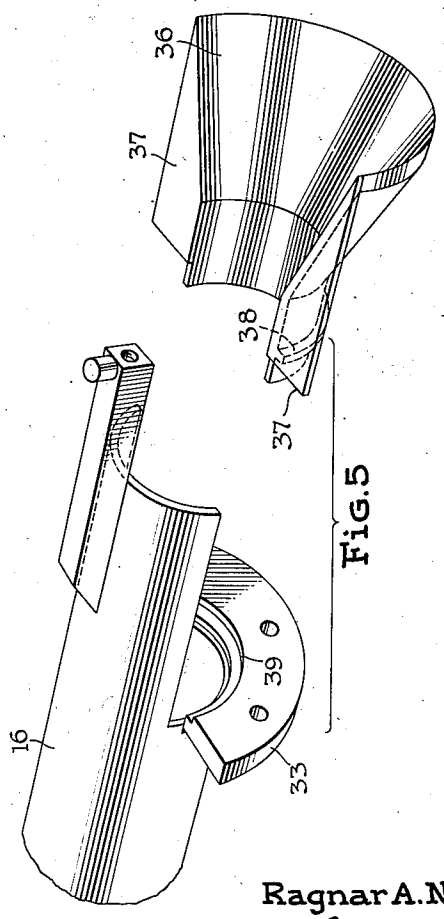


Fig. 5

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NOZZLE CONSTRUCTION FOR USE IN THE PNEUMATIC HANDLING OF FLOUR AND THE LIKE

Filed Aug. 8, 1950 2 SHEETS—SHEET 2

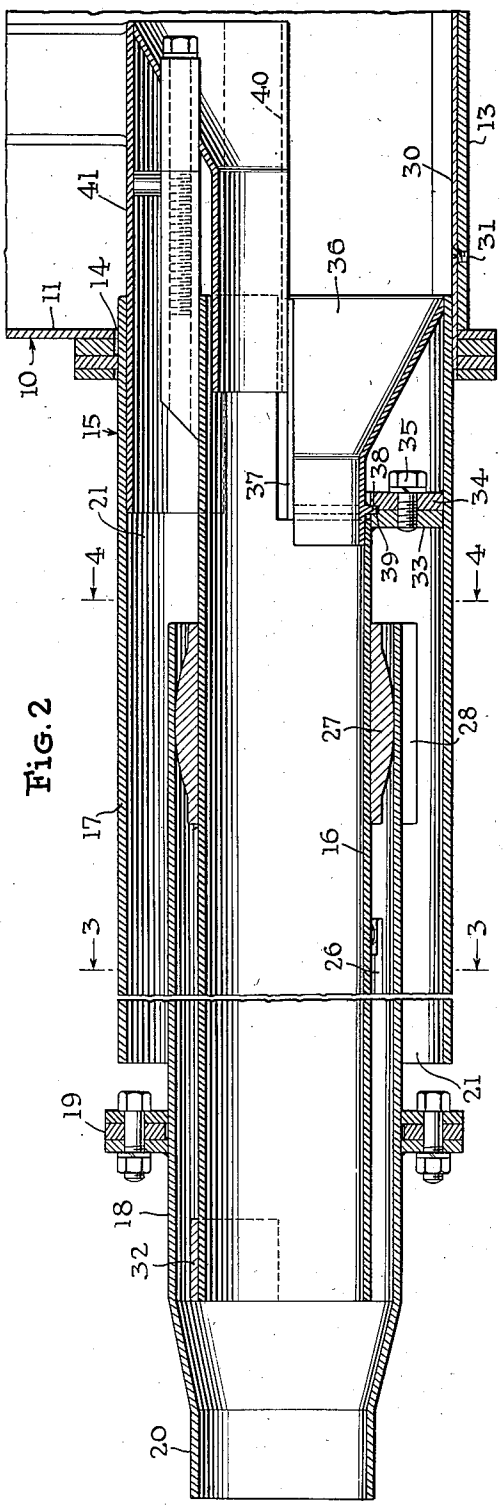


Fig. 2

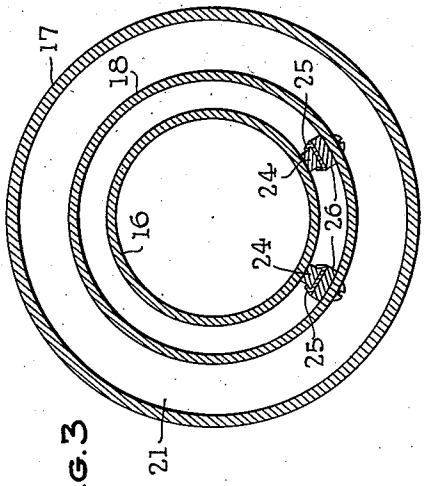


Fig. 3

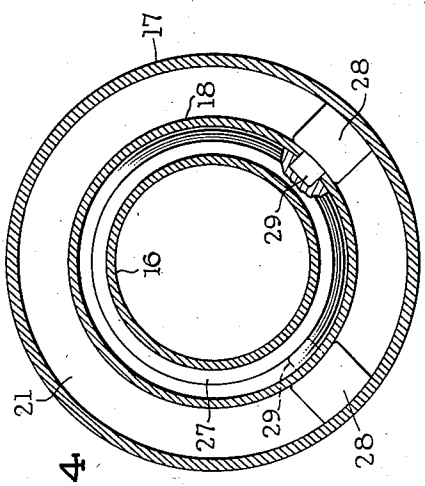


Fig. 4

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2,580,823

NOZZLE CONSTRUCTION FOR USE IN THE PNEUMATIC HANDLING OF FLOUR AND THE LIKE

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7 Claims. (Cl. 302—58)

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This invention relates to the handling of finely divided bulk material, and more particularly to improvements in a suction nozzle for the discharge of the contents of a container by a pneumatic conveyor system. A nozzle of the type with which this invention is concerned comprises an extensible metallic tube, mounted in a horizontal position exteriorly of a container, and adapted to be extended through an end wall of the latter and reciprocated along the bottom wall of the container, from end to end thereof. Nozzles of this type are shown and described in detail in U. S. Patents Nos. 2,440,379 and 2,502,740 and in my copending application, Serial No. 101,153, filed June 24, 1949, now U. S. Patent No. 2,523,229. Such nozzles are adapted to handle those pulverized, granular, or powdered materials that are susceptible of being conveyed in an air stream, but are particularly employed for discharging flour, and similar granular or finely divided comestibles, from cargo vehicles or storage bins.

Although the nozzle head disclosed in the aforementioned Patent No. 2,502,740 minimizes dusting of the material being handled and although the nozzle moves at a relatively slow rate (12 ft./min.), the pneumatic handling of certain types of powdered material, and flour in particular, is subject to an explosive hazard. Under some conditions the suspension of flour particles in air forms an explosive mixture which a chance spark or excessive frictional heat might ignite. When foodstuffs are handled, lubrication of the metal-to-metal sliding contacts to eliminate excessive frictional heat is impossible because of both the resulting contamination and the possibility of clogging the nozzle. Reduction of friction by combinations of various metal-to-metal bearing contacts or sliding surfaces imposes the difficult problem of avoiding metals which are toxic.

Still another problem has developed in the use of the nozzle head shown in the previously mentioned Patent No. 2,502,740. The extensible portion of nozzles of the type under consideration comprises two spaced concentric tubes. The inner tube forms the suction discharge conduit while the space between the inner and outer tubes forms a duct for conveying material-entraining outside air to the intake end of the nozzle. It is desirable that the inner tube be removable from the entire assembly for periodic inspection, cleaning, etc. In the construction shown in the aforementioned Patent No. 2,502,740, however, the inner and outer tubes are welded together at their forward ends, thus rendering removal of the inner tube impossible.

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Hence, it is an object of this invention to provide an extensible suction nozzle, of the type under consideration, with long-wearing, non-toxic, non-metallic bearings having low frictional resistance, and consequent low bearing temperature, at all points of sliding contact of the nozzle parts.

It is another object of this invention to provide a suction nozzle of the type under consideration with a readily dismantleable extensible portion.

Other objects and advantages of the invention will be evident from the following description and accompanying drawings in which:

Figure 1 is an elevational view, partly in section, of a suction nozzle embodying this invention. The nozzle is shown in operative relationship with a container, only a portion of which is illustrated;

Figure 2 is an enlarged sectional view corresponding to Figure 1;

Figure 3 is a sectional view taken on line 3—3 of Figure 2;

Figure 4 is a sectional view taken on line 4—4 of Figure 2;

Figure 5 is a fragmentary exploded perspective view illustrating portions of the forward end of the suction nozzle; and

Figure 6 is a fragmentary sectional view taken on line 6—6 of Figure 1.

Referring now to the drawings there is shown in Figures 1 and 2, a lower end portion of an elongated closed container or bin 10 having vertical end walls 11 and side wall slope sheets 12 (Figure 6), which converge downwardly to a generally rounded trough 13 disposed centrally along the bottom of the container. Projecting snugly through an opening 14 in the lower portion of one end wall 11, and resting in the trough 13, is the extensible portion 15 of an elongated tubular suction nozzle of steel, or other appropriate metallic material. Suitable mechanism (not shown), such as that described in the aforementioned Patent No. 2,440,379 and Patent No. 2,523,229, is connected to the extensible portion 15, exteriorly of the container, for effecting reciprocation thereof from one end of the trough 13 to the other, in order to withdraw the contents of the container by suction. The extensible portion of the nozzle comprises a pair of concentrically-arranged spaced tubular conduits 16 and 17, respectively, which are secured together at their forward ends, i. e. at the intake end of

the nozzle or nozzle head. The inner conduit 16 is the suction discharge conduit and has the rearward end thereof telescoped within the forward end of a fixed tube 18 mounted in a horizontal position, as by the support 19, exteriorly of the container 10 in alignment with the trough 13. The rearward end 20 of the tube 18 is adapted to have connected thereto the suction hose (not shown) of a pneumatic conveyor system.

The inner conduit 16 is of smaller diameter than the tube 18 and has sealing engagement therein, as later described. The outer conduit 17 is of somewhat greater diameter than the tube 18 so that the annular space between the outer conduit and the tube and between the outer conduit and the inner conduit 16 (when the nozzle is extended) forms a duct 21 having its rearward end in communication with the atmosphere, exteriorly of the container, in order to supply material-entraining air to the nozzle head.

The extensible portion 15 of the nozzle may be supported for reciprocating movement by means of rollers 22 (Figure 1), one mounted on each side of the outer conduit 17 adjacent the rearward end thereof and riding on longitudinal fixed guide rails (not shown). One or more fixed rollers 23 (Figure 1) also may be mounted beneath the outer conduit 17 exteriorly of the container 10 and adjacent its end wall 11 for supporting the extensible portion of the nozzle where it enters the container.

Mounted in the lower portion of the fixed tube 18 are two spaced longitudinally-extending rub strips or slide bearings 24 which bear against the underside of the inner conduit for supporting the same. These strips 24, which are shown best in Figure 3, preferably are of a synthetic linear polyamide, commonly known as nylon, which has the excellent bearing properties of high load-carrying capacity and reduced frictional resistance, with consequent little development of heat. Nylon also is non-toxic. The rub strips 24 are clamped in channels 25 that are welded or otherwise suitably secured to metallic plates 26. These latter are bolted at their ends, or otherwise suitably secured, to the fixed tube 18.

Mounted within the forward end of the fixed tube 18 is a generally-annular sleeve bearing 27, also of nylon. The inner surface of the sleeve bearing 27 is cylindrical and snugly embraces the outer surface of the inner conduit 16. The outer surface of the sleeve bearing 27 is convex in longitudinal or axial section, as shown in Figure 2, so the bearing makes substantially line contact with the inner surface of the fixed tube 18. This construction permits free and easy recirprocation of the inner conduit 16 within the tube 18 even though slight misalignments occur. Additionally, the sleeve bearing 27 forms a closure or seal for the annular space between the inner conduit 16 and the fixed tube 18 to prevent bypassing suction from the nozzle head. The forward end of the fixed tube 18 is supported on two spaced bearing blocks 28, (Figure 4) also of nylon, which rest on the inner surface of the outer conduit 17. The upper portions of the blocks 28 are provided with lugs 29 which extend rather loosely through apertures in the wall of the fixed tube 18 and project rather loosely into corresponding recesses in the sleeve bearing 27, to thus retain both the bearing 27 and the blocks 28 in operating position. Additionally, this construction of the bearing and the blocks renders them both self-adjusting to any surface irregularities or misalignments.

Preferably the bottom of the trough 13 is provided with a nylon strip 30 (see Figure 6) of corresponding transverse curvature and extending from end to end thereof for supporting the extensible portion 15 of the nozzle during its reciprocating movement within the container 10. This strip 30 preferably is secured within the trough by both nylon screws 31 and appropriate cement, although other suitable securing means may be employed. Similarly secured to the upper side of the rearward end of the inner conduit 16 is a nylon pad 32 (Figure 2) for engagement with the inner surface of the fixed tube 18 to prevent metal-to-metal contact, in the event such end of the inner conduit is upwardly displaced for any reason.

Because nylon is of that class of materials which under some circumstances develop static charges of electricity upon being rubbed, it is highly desirable that all metallic parts in rubbing contact with the various nylon bearings be grounded in some appropriate manner. Such grounding completely eliminates any possibility of a spark by static discharge.

The upper portion of the nozzle head is substantially the same as that shown in the aforementioned Patent No. 2,502,740. The lower portion, however, is of somewhat different construction. As shown best in Figures 2 and 5, the lower half of the forward end of the inner conduit 16 is terminated short of the forward end of the outer conduit 17 and is provided with an outer half-circle radial flange 33, welded or otherwise suitably secured thereto. Just forward of this flange 33 the outer conduit 17 is similarly provided with an inner half-circle radial flange 34. Bolts 35 connect the two flanges 33 and 34 to thereby secure the forward end of the inner conduit 16 within, and in concentric relation to, the outer conduit 17. It also will be seen that the flanges 33 and 34 form a closure for the lower half of the forward end of the duct 21. A member 36, shaped generally like half a funnel (Figure 5), and having longitudinal side flanges 37, forms an outwardly flaring extension of the lower half of the forward end of the inner conduit 16. The rearward end of the member 36 is provided with an outer arcuate rib 38 which fits in a corresponding arcuate groove 39 formed in the inner surfaces of the flanges 33 and 34. The rib 38 thus prevents longitudinal displacement of the member 36, while the side flanges 40 of the adjustable extension 41 of the upper half of the duct 21 bear upon the side flanges 37 of the member 36 to prevent upward displacement thereof. It will thus be seen that upon removal of the adjustable extension 41, the member 36 can be lifted up and away to expose the bolts 35 which can then be removed for detachment of the inner conduit 16 from the entire nozzle assembly.

From the foregoing it will be seen that the objects of the invention have been accomplished in a simple and inexpensive manner. It also is apparent that various structural changes in the specific embodiment of the invention shown and described will be evident to one skilled in the art. Therefore, the invention embraces all modifications that come within the spirit and scope of the following claims.

I claim:

1. A suction nozzle for use with a pneumatic conveyor system to effect the discharge of finely divided bulk material from a container having a horizontally disposed bottom wall, said nozzle comprising: a fixed tubular conduit adapted to

be mounted in a horizontal position exteriorly of the container; a concentrically-arranged, extensible, double-wall tubular conduit telescopingly associated with said fixed conduit for projection into the container and axial movement along the bottom wall thereof, the inner wall of said extensible conduit forming a suction discharge passageway and the space between the walls of said extensible conduit forming a duct for conveying material-entraining air from outside the container for discharge adjacent the intake end of said passageway, said fixed conduit being received between the two walls of said extensible conduit; a non-metallic sleeve bearing mounted within and engaging the inner surface of the forward end of said fixed conduit and embracing the outer surface of the inner wall of said extensible conduit; and non-metallic bearing blocks carried by a lower portion of said forward end of the fixed conduit and engaging the inner surface of the outer wall of said extensible conduit.

2. The structure defined in claim 1 in which the bearing blocks have projections thereon extending loosely through corresponding openings in the fixed conduit and into corresponding recesses in the sleeve bearing to retain said blocks and said bearing in place.

3. The structure defined in claim 1 in which both of the conduits are circular in transverse section and the outer surface of the sleeve bearing is shaped in axial section to make substantially line contact with the inner surface of the fixed conduit.

4. The structure defined in claim 1 in which the sleeve bearing and the bearing blocks are of synthetic linear polyamide.

5. The structure defined in claim 1 including non-metallic bearing strips secured longitudinally within the fixed conduit beneath the inner wall of the extensible conduit for supporting engagement with said inner wall.

6. A suction nozzle for use with a pneumatic conveyor system to effect the discharge of finely divided bulk material from a container having a horizontally disposed bottom wall, said nozzle being adapted to project through an upstanding wall of the container for axial movement in a horizontal position along the bottom wall thereof, said nozzle comprising: inner and outer spaced concentric tubular conduits, one end of said inner conduit being adapted to be connected to the suction intake of a pneumatic conveyor system, the other end thereof forming a material intake opening, and the space between said conduits forming a duct for conveying material-entraining air from outside the container for discharge adjacent said intake opening, the lower portion of the forward end of said inner conduit terminating short of the forward end of the outer conduit; flange means detachably connecting the lower portion of the forward end of said inner conduit to said outer conduit and closing the lower portion of the forward end of said duct; means detachably secured in place by said flange means and engaging the forward end of the lower portion of said outer duct to form a forwardly flaring extension of the lower portion of the forward end of said inner duct; and detachable means overhanging said intake opening and defining an extension of the upper portion of said duct, said extension being closed at the forward end thereof and having air discharge openings in the opposite lower sides thereof.

7. The nozzle structure defined in claim 1 in combination with a container having side walls which converge downwardly to form a trough-shaped horizontal bottom, and a bearing strip for said nozzle composed of synthetic linear polyamide secured to said bottom for substantially the full length thereof.

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