

[54] **SLUICE TYPE FEEDING DEVICE**

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- [22] Filed: **July 25, 1974**
- [21] Appl. No.: **491,687**

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[30] **Foreign Application Priority Data**

July 27, 1973 Switzerland..... 10966/73

- [52] U.S. Cl..... **302/36, 302/49, 302/62, 417/477**
- [51] Int. Cl..... **B65g 53/46**
- [58] Field of Search 302/36, 42, 49, 52, 62, 302/64; 417/477, 479

[56] **References Cited**

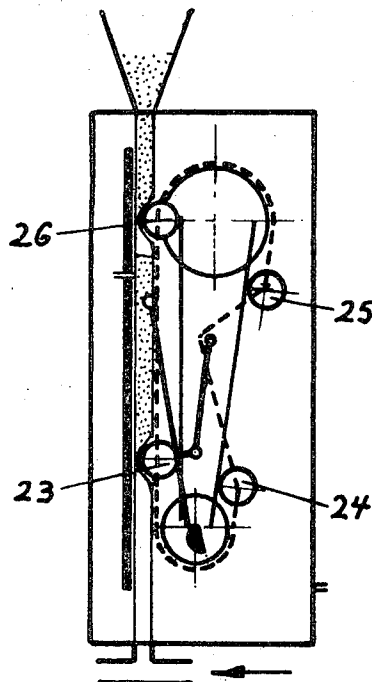
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[57] **ABSTRACT**

A gravity feed device for a pneumatic material distributing system. The material is sluiced through a rubber hose by pinch rollers which move successively downward along the hose. The volume of the hose section between successive upper and lower rollers is increased by delaying the downward travel of the upper roller relative to the downward travel of the lower roller. Such volume increase protects sluiced granular material against crushing and jamming.

8 Claims, 9 Drawing Figures



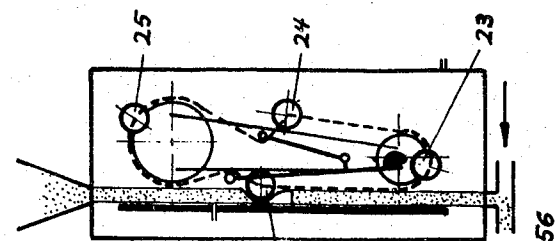


Fig. 5

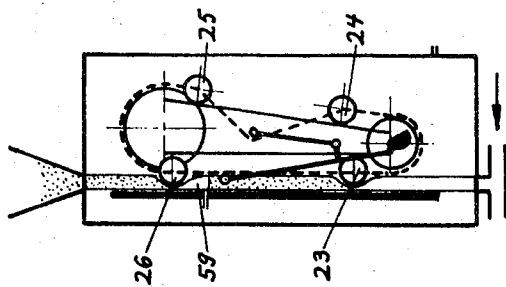


Fig. 4

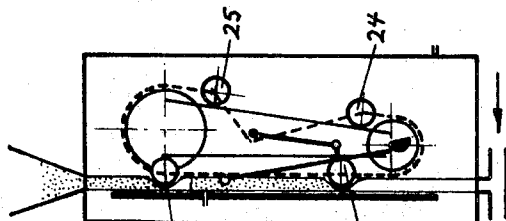


Fig. 3

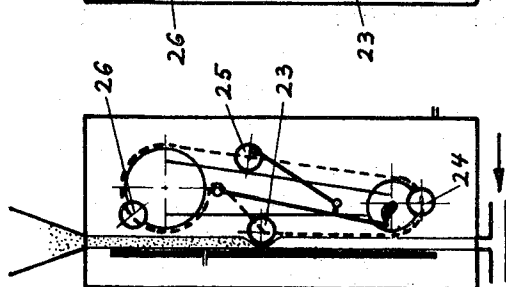


Fig. 2

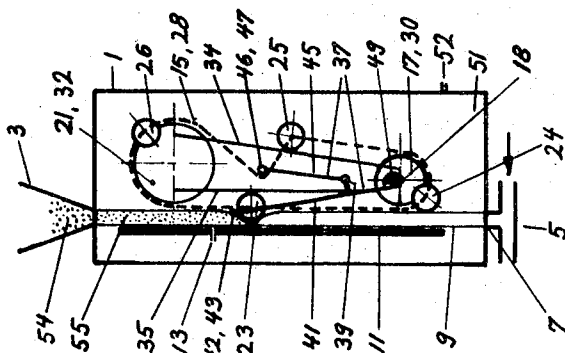


Fig. 1

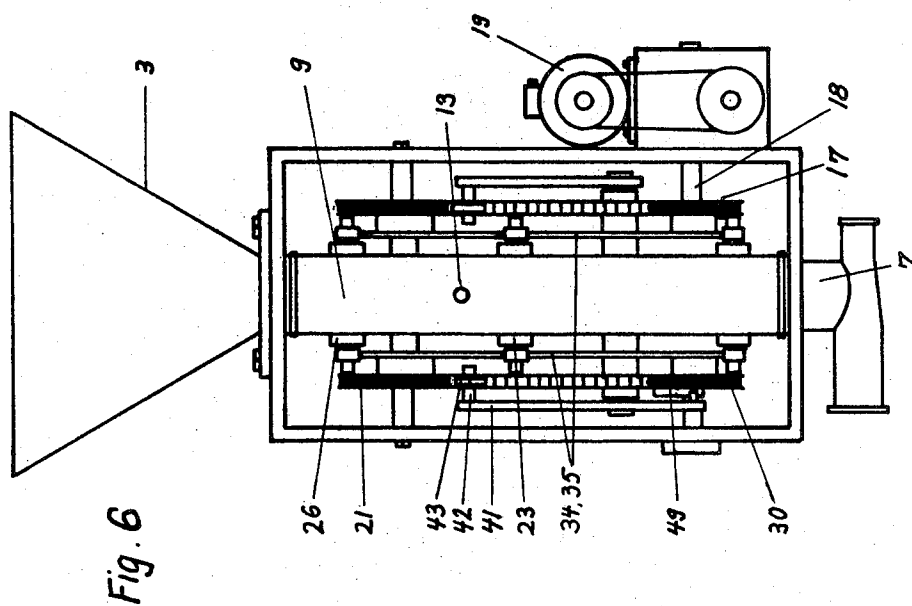
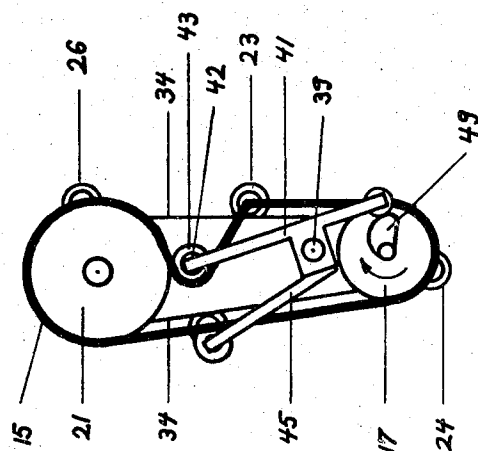


Fig. 7



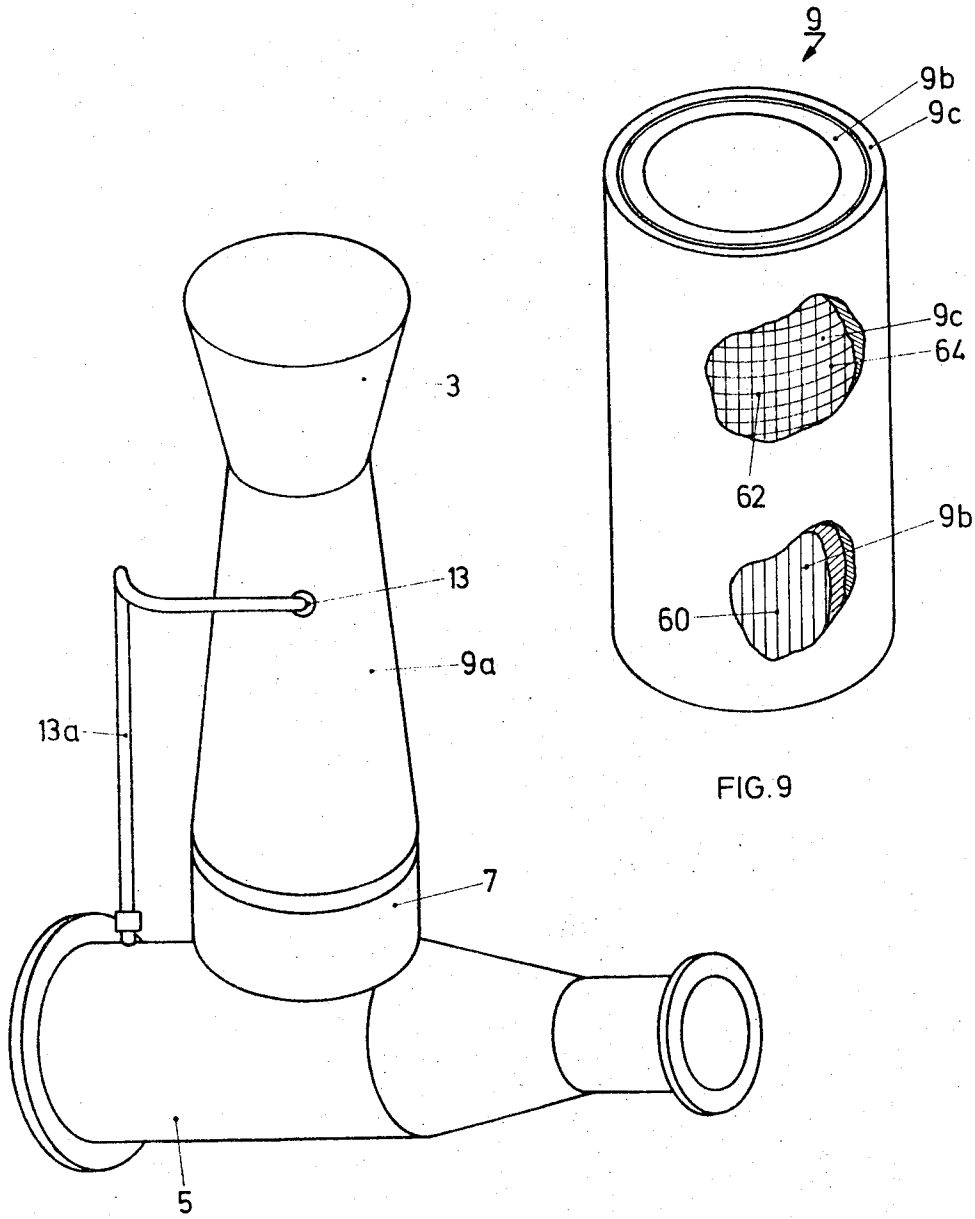


FIG. 8

FIG. 9

SLUICE TYPE FEEDING DEVICE

BACKGROUND OF THE INVENTION

The invention relates to a sluice type feeding device for material distributing systems and it is concerned more particularly with the provision of an improved device for sluicing material into distributing systems which are pressurized in order to advance the material received from the feeding device. To that end the invention contemplates the provision of an inclined rubber elastic hose or a plurality of such hoses arranged side by side, and the provision of a plurality of pinch elements which are circulated by an endless drive mechanism so as to provide travelling constrictions along the hose.

Pressure sluices have heretofore been known wherein flexible wall portions are provided by means of a flexible hose. Such flexible hose is compressed by rollers which are connected to a chain drive. The successive clamping rollers alternately form one or two travelling constrictions as they are guided along the hose.

In prior art pressure sluices of this type the hose volume between two constrictions remains constant and is completely filled by the material to be sluiced. That means that when the rollers bear upon the hose they compress and damage the material therein. On the other hand, the hose cannot be sealed tightly at the constrictions because of the intervening material, and the pressure sluice will be leaking.

The heretofore known devices of the mentioned type also have the disadvantage that they are either leaky, or become jammed in operation or can only be used for certain products.

SUMMARY OF THE INVENTION

Generally the invention provides an improved sluice-type feeding device which overcomes the hereinbefore mentioned disadvantages and shortcomings of the prior art.

More specifically, the improved feeding device incorporating the invention comprises two successive hose pinching elements which define a chamber in the associated hose or hoses and whereby the volume of said chamber is increased during the period between its formation and its discharge in order to insure tight sealing of the chamber by the second pinching element following the first.

DRAWINGS

The foregoing and other objects and advantages of the invention will become more fully apparent as this disclosure proceeds with reference to the accompanying drawings, wherein:

FIGS. 1-5 are side elevations of a device incorporating the invention and illustrating various phases of operation;

FIG. 6 is a rear view of the device from which the backing wall for the hose has been removed;

FIG. 7 is a partial view of the device according to FIG. 6 with the controlled chain tensioning bracket in the position according to FIG. 2;

FIG. 8 is an enlarged perspective view of a modified detail of construction; and

FIG. 9 is an enlarged perspective view of a portion of connecting hose of the device shown in FIGS. 1-6.

DETAILED DESCRIPTION

The sluice type feeding device is enclosed within a housing 1 which carries a material inlet funnel 3. Underneath is a pneumatic material distributing system 5 which has an attaching stud 7. A connecting hose 9 connects the outlet of the funnel 3 with the attaching stud 7 of the pneumatic distributing system 5. At the rear side of the distributing system the hose 9 is backed by an abutment wall 11. The hose 9 is provided with a pressure equalizing passage 13 whose function will be explained later. The moving part of the device includes a chain drive 15 with a driving sprocket 17 which is carried on a shaft 18 and driven by a power unit 19 (FIG. 6). The chain drive 15 further includes an upper chain sprocket 21. A duplicate chain drive 28 which is spaced laterally from and extends parallel to the chain drive 15 comprises a drive sprocket 30 and an upper chain sprocket 32. Arranged between the two chain drives 15 and 28 are four idlers 23, 24, 25 and 26. The rollers 23-26 are connected by associated drag lugs with the two chain drives 15 and 28. They are guided on roller guide tracks 34 and 35. As may be seen from FIG. 7, the rollers 23-26 may be guided on the tracks 34, 35 by ball bearings. A controlled chain tensioning bracket 37 is rockably supported on a stationary pin 39. The chain tensioning bracket comprises a first tensioning arm 41 having a stud 42 and a sprocket 43 thereon in cooperative engagement with the chain of the associated chain drive 15 or 28. A second chain tensioning arm 45 is rigidly connected with the first chain tensioning arm 41 and in turn has a stud 46 and sprocket 47 thereon which like sprocket 43 cooperates with the chain of the associated chain drive. The two tensioning arms 41 and 45 are interconnected in such a manner that upon rocking of the bracket 37 the two rearward chain stretches next to the hose 9 or, alternately, the forward two chain stretches are tensioned, and the remaining chain stretches are correspondingly relieved. Actuation of the chain tensioning bracket 37 is effected by a cam disc 49 on the shaft 18.

The housing 1 surrounds an interior space 51 which may be depressurized through an evacuating connection 52. When this is done the interior pressure within the hose 9 will become effective after each hose pinching travel of a roller to restore the hose to its rounded configuration and thereby insure filling of the latter with material from the funnel 3. In FIGS. 1-5 the funnel 3 holds supply material 54; the hose 9 as well as a chamber formed by one or two of the rollers 23-26 hold supply material 55, and the distributing system 5 contains supply material 56.

It is necessary to position the device in such a manner that the supply material falls under its own weight from the funnel 3 through the connecting hose 9, and the rollers 23-26 therefore actually serve as sluicing elements rather than as propelling elements as they function definitely in the case of hose pumps. In this manner it is possible to introduce any kind of material and particularly granular material into pneumatic distributing systems which are pressurized at the material inlet station and which therefore absolutely require a good, tight seal for the sluicing injection of the supply material.

The herein disclosed sluice type feeding device operates as follows:

In the first phase (FIG. 1) the supply material 54 falls freely from the funnel 3 into the connecting hose 9 to

the height of the roller 23. At the same time the downwardly moving pinch roller 23 produces a certain suction effect upon the material within the funnel 3.

In the second phase (FIG. 2) the free end of the controlled chain tensioning bracket 37 engages the hump of the cam disc 49 and rocks the bracket 37 clockwise on the stationary pin 39. As a result, the first tensioning arm with the sprocket 43 thereon draws the associated rearward chain stretch against the upper chain sprocket 21 as shown in FIG. 2 and as also illustrated by FIG. 7. Analogously the second chain stretch which is synchronized with the first chain stretch is drawn against the upper chain sprocket 32. Correspondingly, the second chain tensioning arms 45 with the sprockets 47 thereon relieve the two forward chain stretches whereby the first tensioning arms 41 are permitted to move. Due to this movement the spacing between the rollers 23 and 26 is decreased.

The third phase is illustrated by FIG. 3. The roller 26 moves into contact with the connecting hose 9 and compresses the latter. At the same time the free end of the first tensioning arm 41 slips from the hump of the cam disc 49 and a tensioning spring, not shown, restores the chain tensioning bracket 37 to its original FIG. 1 position. The spacing between the rollers 23 and 26 now increases and resumes its normal length. Within the chamber of the hose 9 which extends between the two rollers an air cushion 59 develops whereby the material within the hose 9 is protected against damage and congestion during the continued movement of the roller 26.

During the further travel of the rollers (Phase 4, FIG. 4) the air cushion 59 moves into communication with the pressure equalizing passage 13 which is connected by a suitable tube such as the tube 13a shown in FIG. 8 with the pneumatic distributing system 5. This provides for an equalization of the pressure at the material inlet of the pneumatic distributing system and the pressure within the hose chamber between the rollers 23 and 26.

In the next phase (FIG. 5) which corresponds to phase 1 (FIG. 1) the roller 23 opens the connecting hose 9 and the supply material falls under its own weight through the rest of the hose and through the attaching stud 7 into the piping of the pneumatic distributing system 5. At the moment when the hose is opened by the roller 23 the upper roller 26 must already have reclosed the hose to prevent the pressure within the pneumatic distributing system 5 from leaking upward through the hose 9 into the funnel 3. The material which has dropped into the distributing system 5 is conveyed pneumatically to its destination.

As has already been pointed out hereinbefore, the herein disclosed device is not a pumping device but rather a sluice type feeding device. Hose pumps are not suitable for the intended purpose except for handling media that lend themselves to pumping, that is, liquid or paste-like substances. Such pumps cannot be used for granular or solid materials. On the other hand, according to the invention, the material is fed into an inclined hose so that it is actually conveyed by its own weight. However, care must be taken to provide sufficient room within the hose for the incoming material so that it will not be jammed during the subsequent pinching of the hose. This is accomplished according to the invention by delaying the movement of the upper pinch roller with respect to the movement of the lower pinch

roller and thereby increasing the volume of the hose chamber between the successive pinch rollers and developing an air cushion in the upper part of said chamber.

In principle, it would also be possible to increase the volume of the hose section between successive pinch rollers by installing a downwardly flaring hose, as for instance a conical hose 9a (FIG. 8), between the funnel 3 and the attachment stud 7. In that case the velocity of the successive pinch rollers could be kept constant. In this manner it would be possible to develop the absolutely necessary air cushion, such as the air cushion 59 shown in FIG. 4.

Before the material passage from the connecting hose 9 to the pneumatic distributing system is established the pressure in the hose should be raised to a value which ideally should be equal to or even somewhat higher than the pressure in the distributing system 5. This is accomplished by the mentioned pressure equalization via the attachment stud 7. If this were not done the higher pressure in the distributing system 5 would cause the material in the hose 9 to be pushed back and under the upper pinch roller.

By reason of the mentioned evacuation of the space 51 which insures full expansion of the hose 9, the degree of filling the hose 9 can be optimized. The space 51 is preferably evacuated to a pressure of, for instance, 0.6 ata. This is absolutely necessary if for purpose of high output capacity high velocities of the devices and pinch rollers are incurred.

It is also possible to provide several funnels and several hoses side by side and to operate the hoses by the same but wider pinch rollers. Such an arrangement could be used, for instance, for the mixing of components.

The requirements for the connecting or sluicing hose 9 (FIGS. 1-6) and 9a (FIG. 8) are severe. The hose must be soft, flexible and wearproof and yet it must be able to withstand pressure and be stretchproof lengthwise. The core 9b (FIG. 9) consists of thick walled, wearproof and soft rubber and is fabric reinforced lengthwise. The lengthwise reinforcement 60 (FIG. 9) prevents downward displacement of the hose 9 or 9a while it is acted upon by the pinch rollers. Due to the absence of cross reinforcement the core remains readily pinchable. However, it is not pressure resistant. For that reason, a second, thin walled fabric hose 9c having crosswise and lengthwise reinforcements 62 and 64, respectively, is pulled over the thick walled flexible core 9b. The core has some clearance within the fabric hose 9c. As a result, no objectionably high tension stresses are developed in the fabric hose during the pinching, so that the life of the hose will be considerably prolonged.

As distinguished from cell wheel sluices and rotor systems the present invention provides a closed system. There are no rotary seals which come into contact with the supply material. Consequently, the power requirement will be low and wear can be reduced to a minimum. No dust is produced which is passed by leakage air upward into the funnel or outward through defective seals.

The device may be equipped with a funnel for operating it or it may be flanged directly to a silo. It is capable to sluice dry material of powderlike up to coarse grained consistency. In connection with bowl type mixing equipment moist to wet materials may be handled.

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Due to the volume controlled dosing of the material by the pinch rollers a continuous feed is obtainable which permits direct spraying of the emitted conveyed materials.

I claim:

1. A sluice type feeding device for pneumatic material distributing systems comprising at least one compressible conveying hose, a plurality of successive pinch elements cooperable with said hose to define a material confining chamber therein between an upper and lower of said pinch elements, and drive means for said pinch elements operable to increase the volume of said chamber as said pinch elements move along said hose.

2. A sluice type feeding device as set forth in claim 1 wherein said conveying hose has a downwardly flaring configuration.

3. A sluice type feeding device as set forth in claim 1 wherein a plurality of rollers forming said pinch elements are mounted on a pair of endless chain drives for movement along said conveying hose, and wherein tensioning means for said chain drives are operable to elongate one pair of chain stretches of said drives while simultaneously shortening the other pair of chain stretches of said drives.

4. A sluice type feeding device as set forth in claim 3 wherein said tensioning means for said chain drives

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comprise a double armed lever system which is rockable selectively in opposite directions about a fixed pivot element, rocking of said lever system in one direction being effective to elongate one pair of chain stretches of said drives while simultaneously shortening the other pair of chain stretches of said drives, and rocking of said lever system in the other direction being effective to shorten said one pair of chain stretches of said drives while simultaneously elongating said other pair of chain stretches of said drives.

5. A sluice type feeding device as set forth in claim 4 and further comprising cam means operable by said chain drives to rock said double armed lever system.

6. A sluice type feeding device as set forth in claim 3 and further comprising guide tracks for said pinch rollers.

7. A sluice type feeding device as set forth in claim 1 and further comprising pressure equalizing means operatively interposed between said material confining chamber of said conveying hose and an associated pneumatic material distributing system.

8. A sluice type feeding device as set forth in claim 1, wherein said conveying hose comprises a tubular, elastic core and a lengthwise fabric reinforcement thereof, and an outer crosswise and lengthwise reinforced fabric hose surrounding said core.

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