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MATERIAL HANDLING APPARATUS

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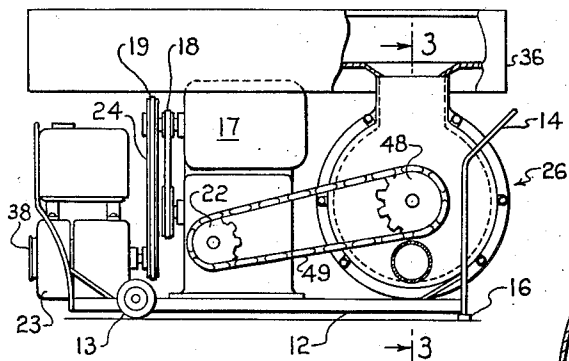


Fig. 1.

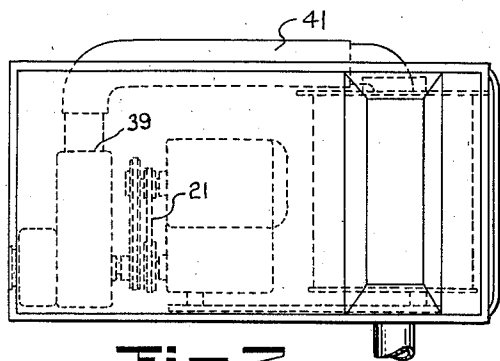


Fig. 2.

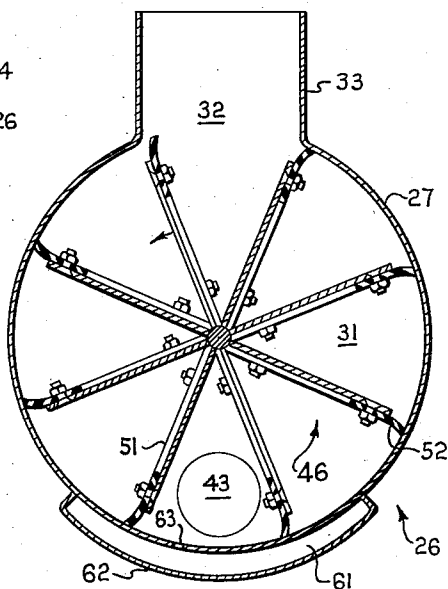


Fig. 4.

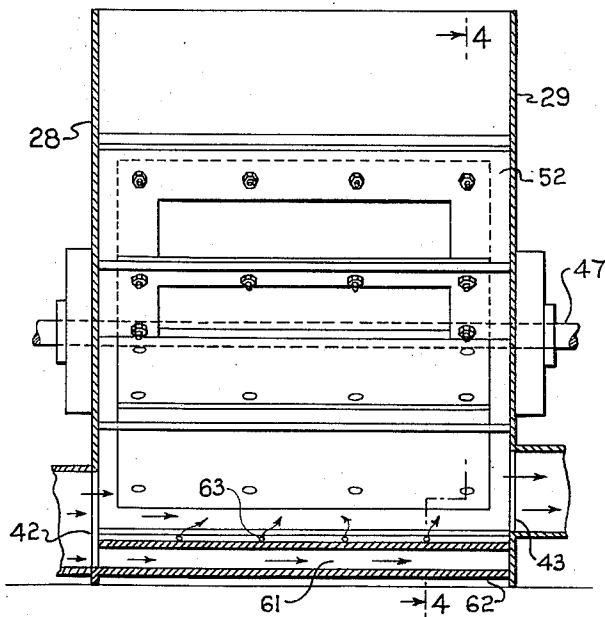


Fig. 3.

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MATERIAL HANDLING APPARATUS

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4 Claims. (Cl. 302—49)

This invention generally relates to the art of handling and conveying materials, and is more particularly directed towards an apparatus in which air is utilized as the carrier for the material.

In many instances, air blowers or similar equipment are used to provide a stream of air for the purpose of moving solid particles of material between spaced positions. Usually such air stream is confined within a conduit into which the material is operatively deposited. By way of example only, in the placing of rock wool or similar insulating material in a building, it is conventional practice to utilize such an arrangement whereby the blower and material may be placed exteriorly of the structure to be insulated, and the material thus carried through a flexible conduit by an air stream for deposit in the desired locations. This type of system has in general been widely accepted, but is subject to certain shortcomings and features of disadvantages. For example, in the case of such materials as rock wool, glass wool and the like, the insulating value is determined largely by the number of small air pockets curtailed therein. Since the material is usually brought to the site in sacks, it has been found that unless the material is fluffed or separated to a considerable extent prior to application, it will have little insulating value. In view of this, most insulating contractors use excessively long and wide conduits and a high capacity blower, so that the material in passing therealong will be expanded, creating the necessary air pockets. This, of course, entails the use of expensive and bulky equipment.

While the foregoing discussion has been pointed at the conveying of insulating materials, numerous other substances are benefited in some manner if a fluffing action takes place. For example, in the conveying of various seed crops, such action will tend to assist in the final separation of the grain from the chaff, straw, etc. Consequently, the present invention is not intended to be limited to operations on any specific material, but rather to an apparatus capable of moving and fluffing materials having a wide range of physical properties.

It is accordingly an object of the present invention to provide apparatus adapted to move material by an air carrier stream, on which the blower and other parts of the structure may be economically produced on a small physical scale, yet which is capable of handling large product flow.

Another object of this invention is to provide apparatus of the character described in which a maximum fluffing of the product is effected directly within the apparatus whereby the product may be discharged in a desirable condition substantially immediately adjacent the outlet of the apparatus.

A further object of the invention is to provide apparatus of the type referred to in which the product is acted upon by a source of air to produce a fluffing of the material and the transportation thereof to a discharge outlet.

The invention possesses other objects and features of

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advantage, some of which, with the foregoing, will be set forth in the following description of the preferred form of the invention which is illustrated in the drawing accompanying and forming part of the specification.

It is to be understood, however, that variations in the showing made by the said drawing and description may be adopted within the scope of the invention, as set forth in the claims.

Referring to said drawing:

Figure 1 is a side elevational view of the apparatus of the present invention.

Figure 2 is a top plan view thereof, with portions of the material hopper removed.

Figure 3 is a vertical cross-sectional view taken substantially in the plane indicated by line 3—3 of Figure 1.

Figure 4 is a cross-sectional view taken substantially in the plane indicated by line 4—4 of Figure 3.

The exemplary apparatus disclosed in the drawing is particularly designed for use in installing insulating material, but as was previously mentioned, and as will hereinafter be made clear, the teachings of the present invention are not to be construed as limited thereto, since the method of agitating or fluffing the material being conveyed is applicable to numerous other environments.

With reference to the drawing, the disclosed apparatus will be seen to include a horizontally disposed frame 12 upon which the various units are mounted, and in order to permit ready movement of the entire machine, a pair of wheels 13 are provided adjacent one end of the frame and a handle 14 adjacent the other end thereof, the handle terminating in short legs 16 which, together with the wheels 13, engage the ground or other supporting surface.

A motor 17 is disposed medially of the frame ends and the drive shaft thereof as provided with a pair of sprockets 18 and 19, the former being operatively connected with a chain or belt 21 for driving a gear reduction unit 22, and the latter driving an air blower 23 through a chain or belt 24.

Positioned adjacent one end of the frame 12 is the material receiving and agitating unit of the present invention, and generally indicated by the numeral 26. This unit, as best seen in Figures 3 and 4 of the drawing is provided with a generally cylindrical housing wall 27 which extends transversely of the frame and whose ends are substantially closed by end walls 28 and 29 so as to define a chamber 31 therebetween. The upper end of the housing wall 27 is open to define a material inlet 32 to the chamber, such opening extending for approximately forty degrees in width for the entire length of the housing. Preferably, the portions of the wall 27 are deformed upwardly to define a vertical throat 33 through which the material passes in entering the chamber 31.

Material to be agitated, fluffed and conveyed may be initially deposited in a hopper 36 overlying the throat 33 and preferably extending for the length of the apparatus. The portion of the hopper immediately overlying the throat 33 may be flared towards such throat to assist the material in passing from the hopper to the throat and thence into the chamber 31.

Air is caused to be passed axially through the chamber 31, whereby material deposited therein will be carried by the air stream to any desired remote position. In this connection, it will be noted that the blower 23 is provided with an air inlet 38 and an air outlet 39, the latter being operatively connected to the chamber 31 by a conduit 41. More particularly, it will be seen that end wall 28, adjacent the bottom of a vertical diameter thereof, is provided with an air inlet opening 42, while the other end wall 29 of the housing is provided with an air and material discharge opening 43 in general axial alignment with the inlet opening 42. Thus, when material is deposited

into the chamber, it will be picked up by the air stream between the openings 42 and 43 and discharged through the latter through a flexible conduit or the like to any desired remote location.

In order to properly feed material to the air stream, and in order to prevent the high velocity air stream from passing upwardly or otherwise deflecting from its generally axial path through the housing, there is provided within the chamber 31 an impeller 46. The impeller includes a shaft 47 extending axially and centrally of the cylindrical chamber 31 and suitably journaled in the end walls 28 and 29 thereof. One end of the shaft is provided with a sprocket 48 which is driven by the speed reducing unit 22 by a chain or belt 49, whereby the shaft is driven at a much slower speed than the blower 23. Secured to the shaft 47 are a plurality of radial vanes 51, and bolted or otherwise releasably attached to each vane is a rubber, neoprene or other flexible blade 52 which engages and slides along the walls 27, 28 and 29 during shaft rotation so as to provide a substantial air seal.

It is important to note that the spacing between adjacent vanes or blades is such that when adjacent blades are equidistant from the axes of the openings 42 and 43, the blades will be slightly spaced therefrom. By way of example, assuming a housing with approximately a 10½ inch diameter, the openings 42 and 43 would have a 2 inch diameter, and as seen in Figure 4, the blade spacing would result in a space of about ½ inch on each side of the openings 42 and 43 to the respective blades. If the spacing was substantially increased, all of the material between adjacent vanes would not be carried off by the air stream resulting in an undesirable recirculation of material. Decreasing the spacing would likewise deleteriously affect optimum operation.

From the foregoing description, it will be understood that material will gradually fall from the hopper 36 through the throat 33 and into chamber 31, whereat the vanes will bring continuous successive charges under the influence of the air stream for discharge through the opening 43. This, however, would not serve to provide the desirable fluffing action previously discussed.

In accordance with the teachings of the present invention, means are provided for agitating or fluffing the material directly within the chamber 31 so that when a material such as rock wool is being used, it will be expanded volumewise to create the desirable air cells throughout the mass of material prior to its exit through the discharge opening 43. In this manner, irrespective of the shortness of length of the conduit attached to the discharge opening, the material will arrive at its destination in proper condition.

As here illustrated, such means includes the use of a plurality of air jets adapted to enter the chamber 31 substantially normal to the axial air flow therealong thereby creating a high degree of product agitation. Such jets are provided by means of an auxiliary air chamber 61 defined by a wall 62, positioned in parallel spaced subjacent relation to the housing wall 27. This wall extends for the length of the housing and in a transverse direction for approximately 90 degrees of width, i.e., about 45 degrees on each side of the axes of the openings 42 and 43. End walls 28 and 29 extend downwardly to cover the ends of the chamber 61, and at the transverse edges the wall 62 is flanged into contact with the housing wall. A series of small jet apertures 63 on housing wall 27 operatively connect the chambers 61 and 31, and with particular reference to Figure 3 of the drawing, it will be seen that the inlet opening 42 in end wall 28 likewise opens into one end of the chamber 61. It will be noted that the height of chamber 61 is approximately one-fifth the diameter of inlet opening 42. Thus, assuming the overall diameter of opening 42 to be 2½ inches, the upper two inches will be directed into chamber 31, closely corresponding to the 2-inch outlet diameter. Preferably the apertures 63 are

positioned axially of the housing wall 27 and slightly in advance of the axes of the end wall openings.

The foregoing construction will result in high velocity air jets striking the material and air stream substantially normal to its longitudinal movement through the housing, creating turbulence, agitation, and a fluffing or separating action on the material.

What is claimed is:

1. Apparatus of the character described, comprising a housing, means at the upper end of said housing adapted to receive material, a plurality of vanes mounted for rotation about a longitudinal horizontal axis and in engagement with said housing, said housing having an air inlet opening at one end of said housing and a substantially aligned communicating air and material discharge opening at the other end thereof, and means directing a portion of air entering said housing through said inlet opening substantially normal to the flow of air between said inlet and outlet openings and in communication with said flow of air.

2. Apparatus of the character described including a housing having a generally cylindrical side wall and opposed vertically disposed end walls, means defining a material inlet opening adjacent an upper end portion of said side wall, each of said end walls having an opening therein in general axial alignment, a horizontal shaft journaled for rotation in said end walls and carrying a plurality of radial vanes thereon, means defining a relatively narrow air chamber adjacent the lower end portion of said side wall extending between said end walls and in alignment and in communication with a portion of one of said end wall openings, and means establishing flow communication between said air chamber and the interior of said housing.

3. Apparatus of the character described including a housing having a generally cylindrical side wall and opposed vertically disposed end walls, means defining a material inlet opening extending across substantially the entire upper end portion of said side wall, each of said end walls having an opening therein adjacent the lower end portion thereof and in general axial alignment, a horizontal shaft journaled for rotation in said end walls and carrying a plurality of radial vanes thereon, means defining a relatively narrow air chamber adjacent the lower end portion of said side wall in communication with a portion of one of said end wall openings, and extending for substantially the entire length of said side wall, and said last named means including a plurality of upwardly directed air apertures for directing a portion of air flow from said one of said end wall openings into said housing substantially normal to and intersecting the air flow between said end wall openings.

4. Apparatus of the character described comprising a housing having a substantially semi-cylindrical bottom portion and an open top portion defining a chamber, end walls enclosing the ends of said housing, a shaft journaled for rotation on said end walls, a plurality of radial blades on said shaft in engagement with said bottom portion upon shaft rotation, an arcuate wall disposed in spaced subjacent relation to said bottom portion, each of said end walls having a substantially aligned opening communicating with said chamber, and one of said wall openings further communicating with the space between said arcuate wall and said bottom portion, and said latter portion having a plurality of jet apertures therethrough.

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