United States Patent [19]

Schlottmann et al.

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[54] **APPARATUS FOR DRY PACKING OF SURFACES**

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[21] Appl. No.: **377,371**

Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 26,992, April 9, 1970, abandoned, and a continuation of Ser. No. 194,254, Nov. 1, 1971, abandoned.

[52] **U.S. Cl.** **239/345;** 239/379; 239/434

[51] **Int. Cl.** **B05b 7/30**

[58] **Field of Search** 239/336, 434, 325, 379, 239/345

[56] **References Cited**

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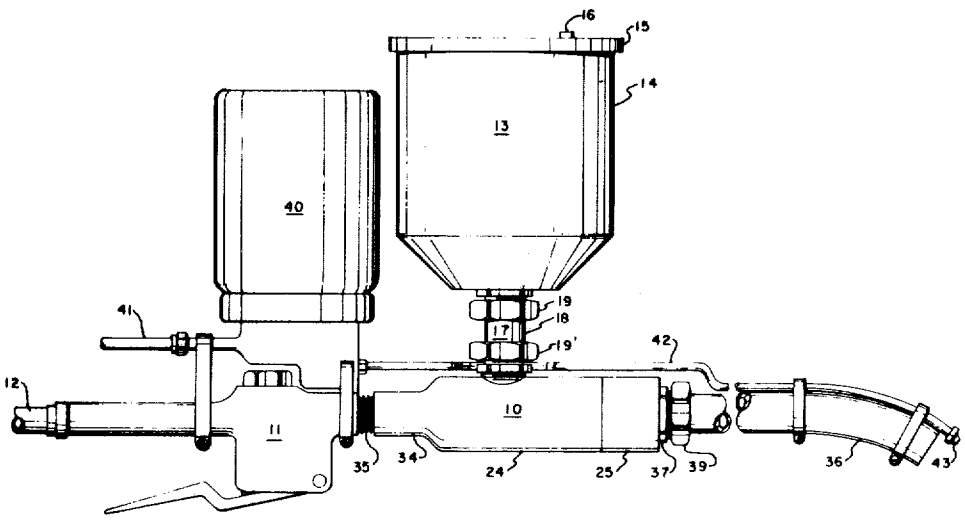
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[57] **ABSTRACT**

The apparatus for dry packing comprises a cylindrical tube including a chamber-like portion, an air entrance-way jet-like orifice portion distally disposed in the chamber-like portion at one of the terminal ends thereof, and a venturi-like portion at the opposite terminal end of the chamber-like portion issuing into a distributing orifice-like tube exitway; a material reservoir having an exitway, the terminal end of which is suitably fastened in the chamber-like portion of the cylindrical tube between the jet-like orifice portion and the venturi-like portion.

4 Claims, 6 Drawing Figures



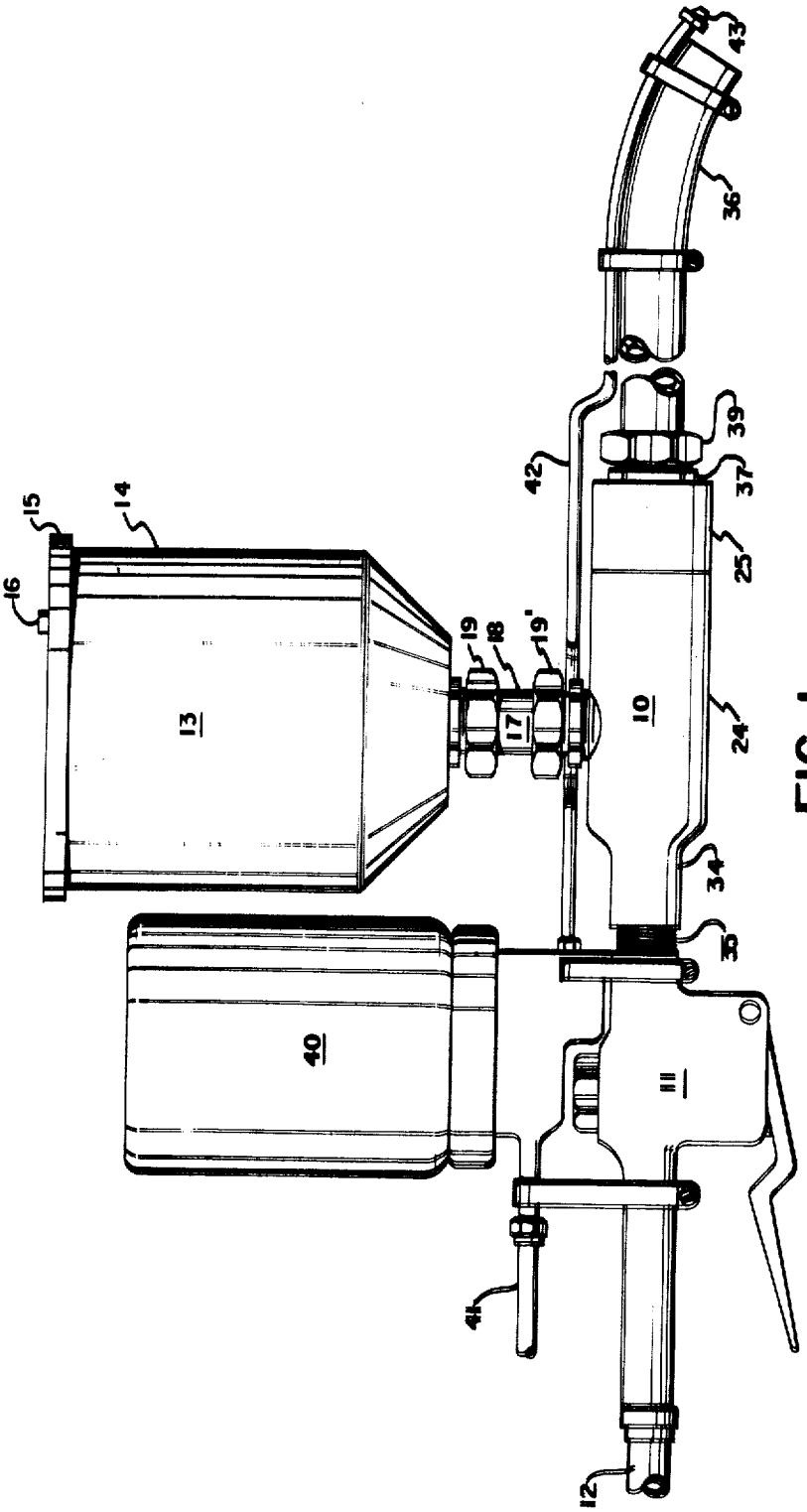


FIG. 1

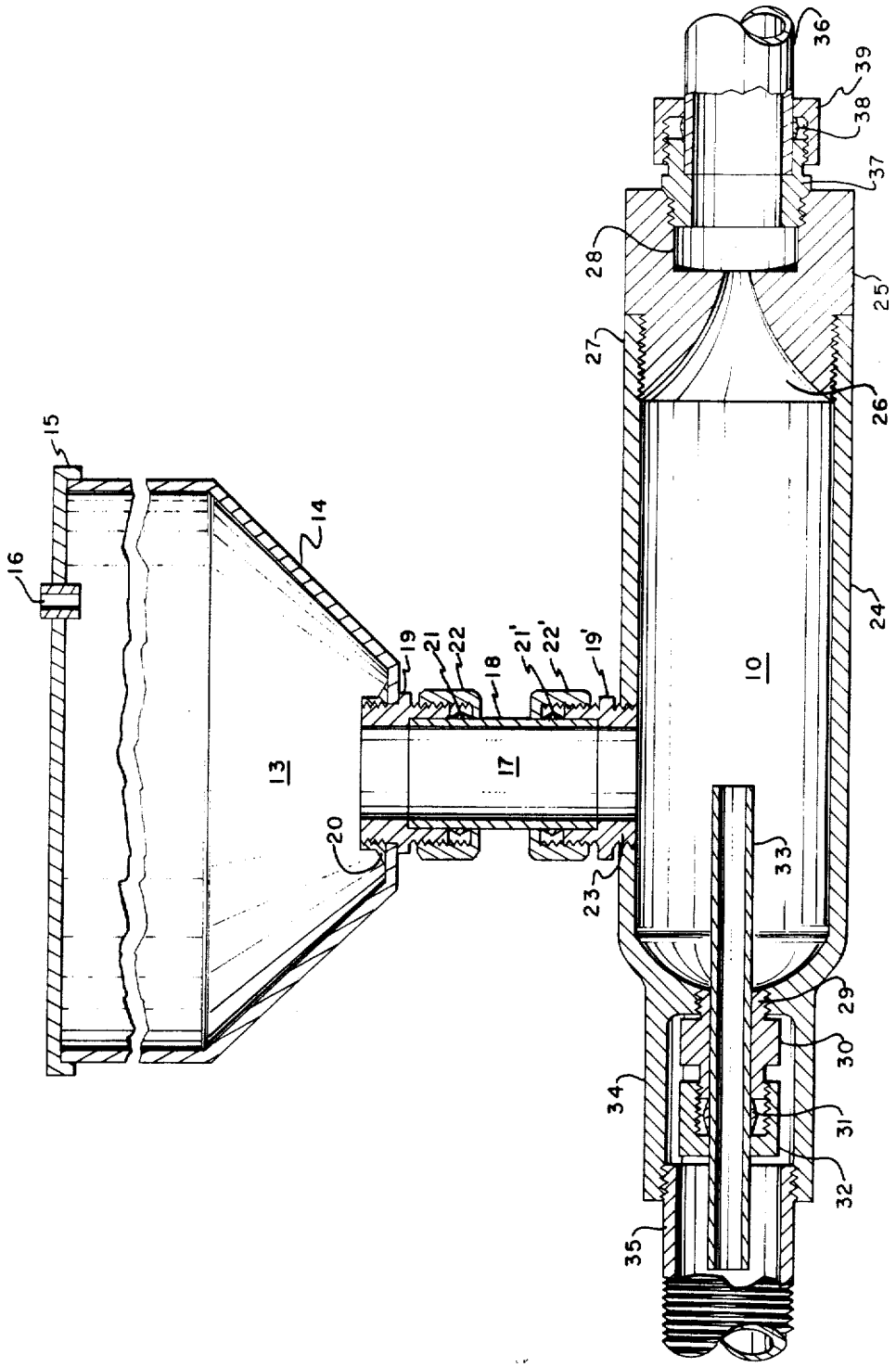

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FIG. 2

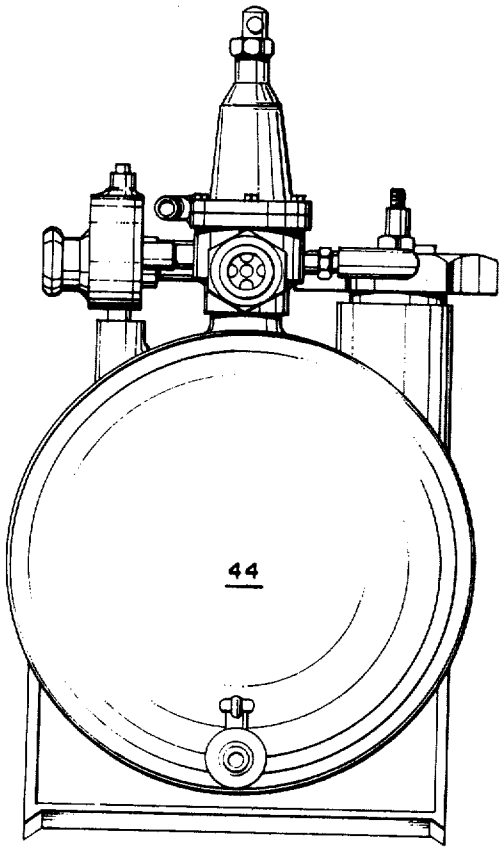


FIG. 4

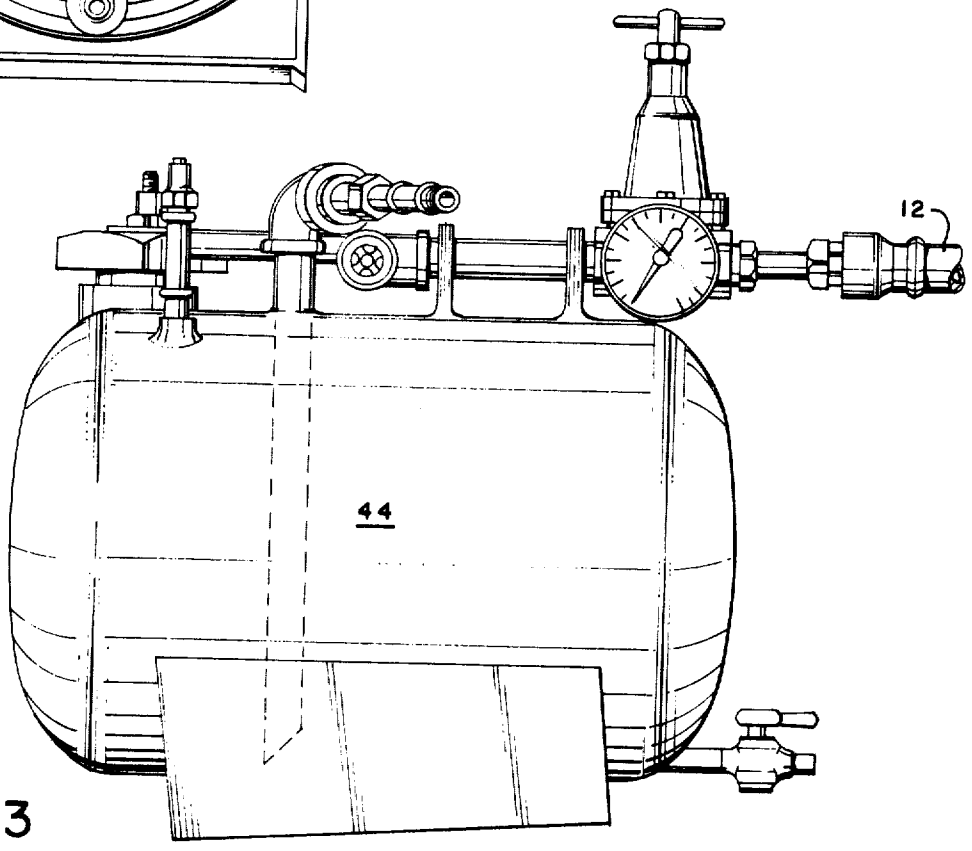


FIG. 3

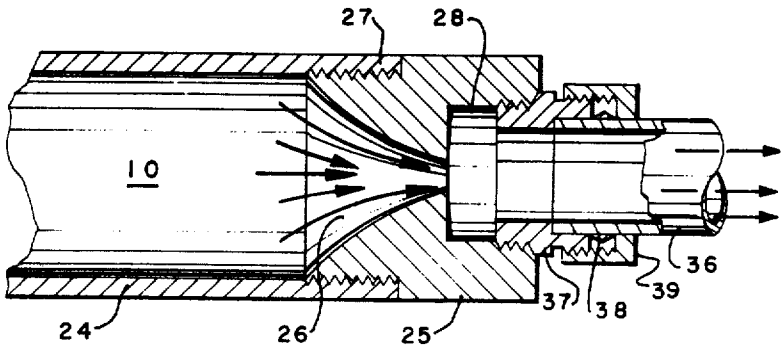


FIG. 5

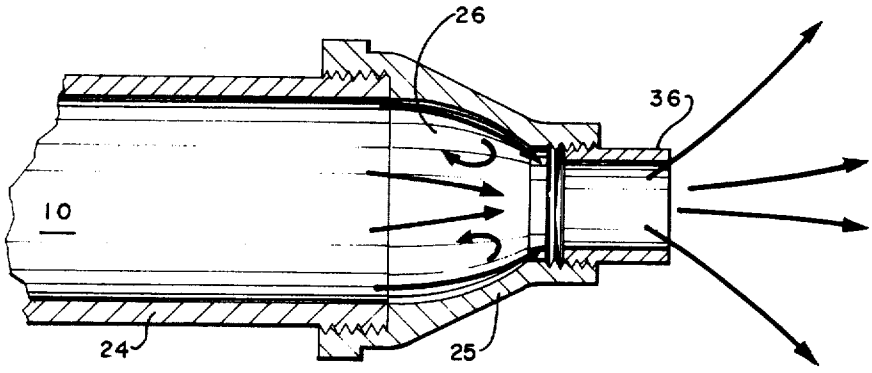


FIG. 6

APPARATUS FOR DRY PACKING OF SURFACES

REFERENCE TO OTHER APPLICATIONS

This is a continuation-part of application, Ser. No. 26,992, filed Apr. 9, 1970 and a continuation of Ser. No. 194,254, filed Nov. 1, 1971 both of which are now abandoned.

FIELD OF INVENTION

The present invention relates to the pparatus for dry packing surfaces of buildings and structures, and more particularly, to an apparatus for finishing such surfaces with substantially dry materials.

BRIEF DESCRIPTION OF THE PRIOR ART

The exposed surfaces of concrete buildings and convrete structures, such as tunnels, bridges, and the like, are commonly finished by wetting the cured surface, packing calcined limestone material, such as Portland cement, which has been mixed with wetted sand with a hand trowel onto the wetted surface, and then dragging burlap material across the surface. This method of finishing is commonly called "dry pack and sack finishing." In order to assure bonding of the mixed material to the surface, the surface is usually sprayed with water or water mixed with a commonly known adhesive solution until moisture sufficiently penetrates and is absorbed in the surface to draw the comentatious material into the surface as the moisture is evaporated. It is essential to the process that dry materials impinge the surface with sufficient force to be packed in order to eliminate shrinkage and so that the materials become monolithically and structurally integrated with the structure. The above described method of finishing surfaces is time consuming and expensive, requiring skilled persons to make proper application. Gunniting, a commonly known method of applying motar and plaster in a semiplastic, wet state and blowing it onto surfaces, has also been used to provide finishes to such surfaces, but can not provide a mono-lithically, structurally integrated element in a surface. Further, bonding has generally not been successful between a finished or cured surface and the surface material applied and hence, the gunniting process is more frequently used to build up a total surface, rather than the mere surface finishing or structurally integrating of material into a surface.

The mixed material tends to segregate when it is trowelled, worked, or handled. When the mixed material becomes saturated with moisture it tends to run. Hence, when working the mixed material, such as by "puddling" the mixed material to smooth the finish, the material is caused to segregate since the lighter calcined material is carried by the moisture to the exposed surface. This also reduces the bond because it is the calcined portion of the mixed material that is required to be drawn into the porous surface during evaporation to cause the mixed material to adhere to the surface.

Pneumatic applicators of calcined materials have been long known in the art. Such applicators have been employed with mixtures in suspensions (see McCormack, No. 1,755,329), or with light powder. Applicators carrying suspensions have been operable because the suspension liquid has been an effective lubricant which reduces the requirement for driven force. Powders, including gypsum and asbestus, having low specific gravity may be applied because of the low density

of the body of material. In either case, the apparatus per se has usually included an injector tube which discharges high pressure stream of air distally ahead of and the nozzle from the intersection of the mortar supply receptacle and the venturi-like chamber. This arrangement causes a low pressure region behind the discharge of the injector, to suck material from the receptacle. Modifications to pneumatic applicator have centered on increasing the flow, on the ability of the apparatus to carry materials of higher specific gravity or density by increasing the pressure of the injector tube, or by increasing the by-pass of the duct between the injector and the chamber. As shall become apparent it would appear that a substantial advantage in actual net force may be had by development of the location of the discharge with respect the structure of the chamber, to both draw material as set out above, and to drive material to an earlier point in the chamber by oncoming air.

Accordingly, it is an object of the present invention to provide a method for dry packing exposed surfaces, such as holes, cavities, cracks, planar surfaces, and the like, of buildings and structures, including the steps of mixing calcined limestone or calcined gypsum material with wetted sand, wetting the surface to be finished with a commonly known admixture of water or adhesive solution, uniformly suspending the calcined material and sand mixture in a chamber, and blowing the mixture into the wetted surface with sufficient force to cause the mixed material to monolithically pack in the surface for structurally integrating the material into surfaces of buildings and structures, said steps requiring nominal skill; and to provide in a method of dry packing surfaces of buildings and structures a method of applying wetting materials to finishing materials previously applied so that the thickness of the surface dry packed material may be varied.

Another object of the present invention is to provide a means operable to turbulate and suspend a substantially dry calcined material and sand mixture in a chamber and to blow the mixture into a wetted surface with sufficient force to cause the mixed material to be structurally integrated with the surface.

While emphasis is placed herein on the use of the apparatus and method of this invention to apply materials to surfaces of concrete buildings and concrete structures, the method and apparatus here disclosed has a number of features particularly desirable for such as finishing plaster surfaces and stucco surfaces. Accordingly, it is a further object of the invention to provide an improved method and apparatus for applying substantially dry stucco and plaster to surfaces.

SUMMARY OF THE INVENTION

The apparatus for dry packing comprises a cylindrical tube including a chamber-like portion, an air entrance-way Jet-like orifice portion distally disposed in the chamber-like portion at one of the terminal ends thereof, and a venturi-like portion at the opposite terminal end of the chamber-like portion issuing into a distributing orifice-like tube exitway; a material reservoir having an exitway, the terminal end of which is suitably fastened in the chamber-like portion of the cylindrical tube between the jet-like orifice portion and the venturi-like portion.

The apparatus of the present invention includes a chamber in which the mixed material is drawn from a reservoir by turbulance created in the chamber as air

from a suitable source is blown in and through the chamber. The chamber includes a venturi-like portion at its discharge end which causes an air pressure zone in the chamber sufficient to suspend the particles of the mixed materials to be suspended in the chamber and as it is blown through the orifice of the venturi-like portion. The venturi-like portion issues into a distributing tube exitway portion of a diameter greater than the orifice of the venturi-like portion, thereby providing a zone of pressure in the tube different from that in the chamber.

At the end of the chamber opposite the venturi-like portion, an orifice tube is provided. By positioning the orifice tube in the chamber relative to the mixed materials discharge portion of the material reservoir which is suitably connected to the chamber, the quantity of mixed materials drawn from the reservoir may be varied. A suitable mixed material reservoir which may be used with the apparatus of this invention comprises a hopper portion which may include a cover having a vent therein, and an exitway suitably connected in the chamber.

Air under pressure from any suitable source may be connected to the chamber to effect operation of the apparatus, and a commonly known air valve may be disposed between the air source and the apparatus to control the operation.

A centrifugal wheel might be substituted to throw the mixed material into the path of an air stream to be suspended therein while the material is being carried by the air stream to the surface. However, control of such means is difficult.

It shall be emphasized that the various features of both the method and apparatus of this invention are of utility apart from each other. Nevertheless, they are particularly useful in combination and will now be more fully described in conjunction with drawings showing an entire apparatus embodying all such features.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a side elevational view of the apparatus in accordance with the present invention, illustrating its normal position for use.

FIG. 2 is a cross-sectional view drawn to a larger scale showing the apparatus of the invention in detail.

FIG. 3 is a side elevational view of an air supply tank of this invention.

FIG. 4 is a front elevational view of the supply tank.

FIG. 5 is a fragmentary cross-sectional view of the chamber 24 and orifice-like tube portion and distributing means of this invention, and shown with vector lines of the flow of dry packing material.

FIG. 6 is a fragmentary cross-sectional view of the orifice-like tube portion of an applicator gun of the prior art shown with vector lines of dry packing material.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to the drawings and more particularly to FIG. 1, a cylindrical tube 10 is shown connected to a commonly known, hand operated air valve 11. Air under pressure from any suitable source is supplied through a hose 12 and through the valve 11 to effect operation in the tube 10. A mixed materials reservoir 13 comprises a hopper portion 14, a cover 15 including a vent 16, and a discharge portion 17. Although discharge portion 17 may be welded at one of its terminal end and be connected to the cylinder tube 10, the discharge portion 17 shown to advantage in FIG. 2 comprises a tube 18 suitably fastened to hopper portion 14 by a commonly known conduit press type fitting 19 which includes a locking nut 20, a binding ring 21, and a binding nut 22. A similar conduit press type fitting 19', including binding ring 21' and binding nut 22', provides means by which reservoir 13 may be suitably fastened into a threaded material entranceway 23 disposed in the cylinder tube 10.

The cylinder portion 10 is provided with a chamber 24 and an orifice-like tube portion 25. The orifice-like tube portion 25 is provided at one of its terminal ends with threads 27 so that it may removably fasten in the chamber 24. The orifice-like portion 25 includes a venturi-like portion 26 which issues into an orifice 28 at the end opposite threads 27. The venturi-like portion 26 has a convexly curved cone-shaped configuration in cross-section. This configuration of the venturi-like portion 26 to focus the flow of material and to minimize turbulation in material in the throat region of the portion 26.

The chamber 24 is provided with a threaded inlet portion 29 in the wall of chamber 24 opposite the orifice-like tube portion 25. A commonly known press type fitting 30 including a binding portion 29 of chamber 24. A jet-like orifice tube 33 is held by fitting 30 and extends into the chamber 24.

A sleeve portion 34 extends rearwardly from the chamber 24 and is threaded to receive a nipple 35. The hand operated air valve 11 may be connected to the nipple 35 to suitably fasten the valve 11 to the cylinder tube 10.

A mixed material distributing means 36 is provided at orifice-like portion 25 and may be suitably connected to portion 25 by a press type fitting 37 which includes a binding ring 38 and a binding nut 39.

In operation air under pressure is caused to be blown at substantially high velocity through jet-like orifice tube 33 into the chamber 24. As the air tries to escape through the material discharge portion 17 of reservoir 13, it tends to be circulated in the chamber 24 and in the hopper 14, since only a portion of the air may escape through vent 16, and thereby tends to be caused to be returned along a path of least resistance toward the chamber. Hence, the air carries with it the mixed materials from the reservoir 13, turbulating the materials as the air is circulated; and, by the weight of the materials, the materials fall uniformly into the chamber 24. The venturi-like portion 26 tends to cause an area of low pressure in the chamber 24 and to cause the mixed materials to be suspended uniformly without the air mass. It has been found in practice that the volume of mixed materials carried from the reservoir 13 by the air, as well as the uniform turbulating of the materials, may be controlled by moving the terminal end of jet-like orifice 33 forwardly and rearwardly in the chamber 24. That is to say segregation of mixed materials may be controlled in this manner, as well as the quantity of material to be suspended in a given volume of the air mass.

It must be appreciated that the convex concave curvature in rectilinear cross-section of venturi-like portion 26 focusses the non-coherring dry-pack material into a substantially descrete stream. As shown in FIG.

5 by the vector lines, material driven by the tube 33 goes through extensive turbulence within the chamber 24, then is swept over the convexity of the portion into a substancially rationalized stream of particle which exists as a narrow, discharge jet. This may be contrasted with pneumatic applications of the prior art, shown in FIG. 6, which employ a bell-shaped orifice portions 26 (here appearing as concave curved configuration). In the prior art, material channeled into the tapering walls of the portion 26 is turbulated in the pockets formed by the bell shape of the portion 26, and exits the portion 26 in an incoherent mesh of particle paths which fan and the discharge 36. Clearly, pockets formed in the portion 26 must be scoured by oncoming material. Further, the prior art depends upon the cylindrically configured discharge 36 to channel oncoming material which include a majority of incoherent particle sector paths. These characteristics of the prior art may be contrasted with the present apparatus wherein an ideal material focusing pattern is achieved by the filled-space configuration of the portion 26. The discharge 36, thus, is not a true channeling means because material is already conducted in a discrete jet.

"Dry pack" material for monolithically integrating the materials with surfaces generally comprises a uniform mixture of calcined limestone material, such as Portland cement, or calcined gypsum, such as plaster of Paris, and water-saturated fine sand. It has been found to advantage to add any of a variety of commonly known adhesive solutions to the water before saturating the sand. However, it is to be understood that the mixtures of calcined materials and sand are substantially dry, the sand carrying moisture in the interstitial pores thereof only. Before applying "dry pack" mixed materials to a surface, it is common practice to wet the surfaces with water or a solution of water and known adhesive solutions until the water or solution sufficiently penetrates the surface to tend to cause the calcined material to be drawn into it as the moisture retained in the surface is evaporated. Novelty taught by the method of the present invention resides in the steps of uniformly turbulating and suspending the mixed materials in an air mass and in causing that mass to be blown against the surface with sufficient force to cause the materials to be packed together, so that the materials become monolithically and structurally integrated with the surface. Hence, shrinkage of the materials, when cured, is nominal, because of the excess material mass forced into the surface, over that which may be applied by other means. It should also be pointed out that material so packed tends to be expanded by the addition of moisture. In practice it has been found necessary to create a zone of turbulance in the mixed material before suspending the material in the air mass because a smooth air stream tends to pick up only the very fine calcined portion of the mixed material and to cause segregation thereof. It has also been found that the thickness of the material which may be packed is limited by the amount or quantity of moisture available. By wetting, additional moisture to material, additional quantities of dry material may be packed into the surface to vary the thickness thereof. The material has been found to become homogeneous when the moisture is evaporated. However, the moisture by expanding the substantially dry material tends to cause the material to be packed with greater force into the surface and to become more readily integrated structurally therewith. It has also been found that the amount of moisture which may be applied to the material is limited, since too great a quantity will cause the material to run and carry away the calcined material portion of the mixed material. A finely atomized mist has been found to be more easily controlled. Although moisture may be added concurrently with the material application, control balance between the moisture and the material is much more difficult. Therefore, it is preferable to add the moisture between successive applications of material, and, thereby, "build-up" the finish.

Accordingly, a commonly known canister type, atomizing spray gun 40 supplied with air under pressure from a suitable source through a hose 41 is provided and mounted on the hand operated air valve 11. A tube 42 is disposed between the spray gun 40 and an atomizing nozzle 43 at its opposite terminal end. A suitable control valve, commonly known, may be disposed between the air source and the spray gun 40 to effect operation as desired. Although preferred combinations and subcombinations of the present apparatus and method are herein shown and described, it is, of course, to be understood that various changes may be made herein. More particularly, as indicated earlier in this specification, the entire apparatus and method described hereinabove is of great utility in applying stucco and plaster to exterior and interior surfaces of buildings. In addition, the invention is of great utility in filling-in or caulking around such building elements as doors, windows, and the like. Moreover, the more advantageous features of the invention, forming subassemblies of the complete apparatus and steps in the method, are usable apart from each other. Accordingly, this invention is not to be considered limited to the structure and uses particularly described herein, but rather by the scope of the appended claims.

We claim:

1. An apparatus for dry packing surfaces, comprising a cylindrical tube having a chamber-like portion formed by a venturi-like portion in one of its terminal ends and by a wall portion at the terminal end opposite said venturi-like portion, said venturi-like portion issuing into an orifice-like distributing portion said wall portion including an inlet disposed therein, a jet-like orifice tube selectively distally disposed in said inlet causing air under pressure from a suitable source to be blown at high velocity into said chamber portion of said cylindrical tube, a material discharge portion disposed in said cylindrical tube between said venturi-like portion and said wall portion discharging material into said cylinder portion, said chamber portion both suspending material particles therein and blowing said material particles through said venturi-like portion and said orifice-like distributing portion.

2. The apparatus of claim 1 including a reservoir disposed on said material discharge portion and having a cover, a vent portion in said cover, said reservoir having means for turbulating material therein when air from said chamber portion escapes into said material discharge portion and said reservoir through said vent portion.

3. The apparatus of claim 2 including an air operated atomizing spray gun carried by said cylindrical tube, said spray gun being supplied with water under pressure from a suitable source and having an atomizing nozzle disposed at the terminal end of said orifice-like distributing portion opposite said venturi-like portion, said spray gun discharing atomized liquid particles into the path of said suspended dry material particles blown from said orifice-like distributing portion.

4. The apparatus of claim 1 wherein said venturi-like portion includes convexly curved cone-shaped walls in rectilinear cross-section.

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