United States Patent

Cozzarin et al.

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[54] **AERATED POWDER PUMP**

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[52] **U.S. Cl.** **222/195**, 222/226, 302/50, 415/72, 415/197, 417/900

[51] **Int. Cl.** **B65g 3/12**

[58] **Field of Search** 415/72–75; 259/147, 151; 302/49, 50; 417/900; 222/195

[56] **References Cited**

UNITED STATES PATENTS

1,953,091	4/1934	Westberg et al.	302/49
2,355,774	8/1944	Baker	302/50
2,966,860	1/1931	Maynard	417/900
1,185,118	5/1916	MacMichael	259/147
1,506,089	8/1924	Schuster	259/147
1,731,953	10/1929	Thomson	259/147
1,765,544	6/1930	Schuster	259/148
3,073,250	1/1963	Musser	418/48
3,499,389	3/1970	Seeberger et al.	418/48
3,572,646	3/1971	Kocher	415/72
2,897,596	8/1959	Maurer	417/900

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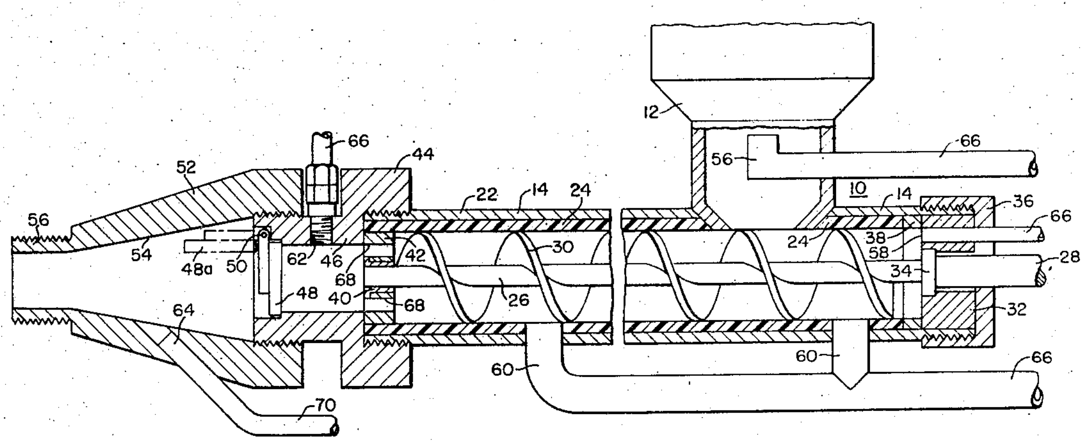
[57] **ABSTRACT**

A pump for handling dry powdered material and including a stator forming a pump chamber, a rotor within the chamber and having an external helical fin thereon, the chamber having a material inlet and an outlet and gas inlet means at spaced intervals along the stator for injecting pressurized gas into the chamber, whereby the powdered material is aerated as the material moves through the chamber from the inlet to the outlet. The internal wall of the stator is preferably provided with a coating of polytetrafluoroetylene to minimize adhesion of the material to the stator wall.

5 Claims, 2 Drawing Figures



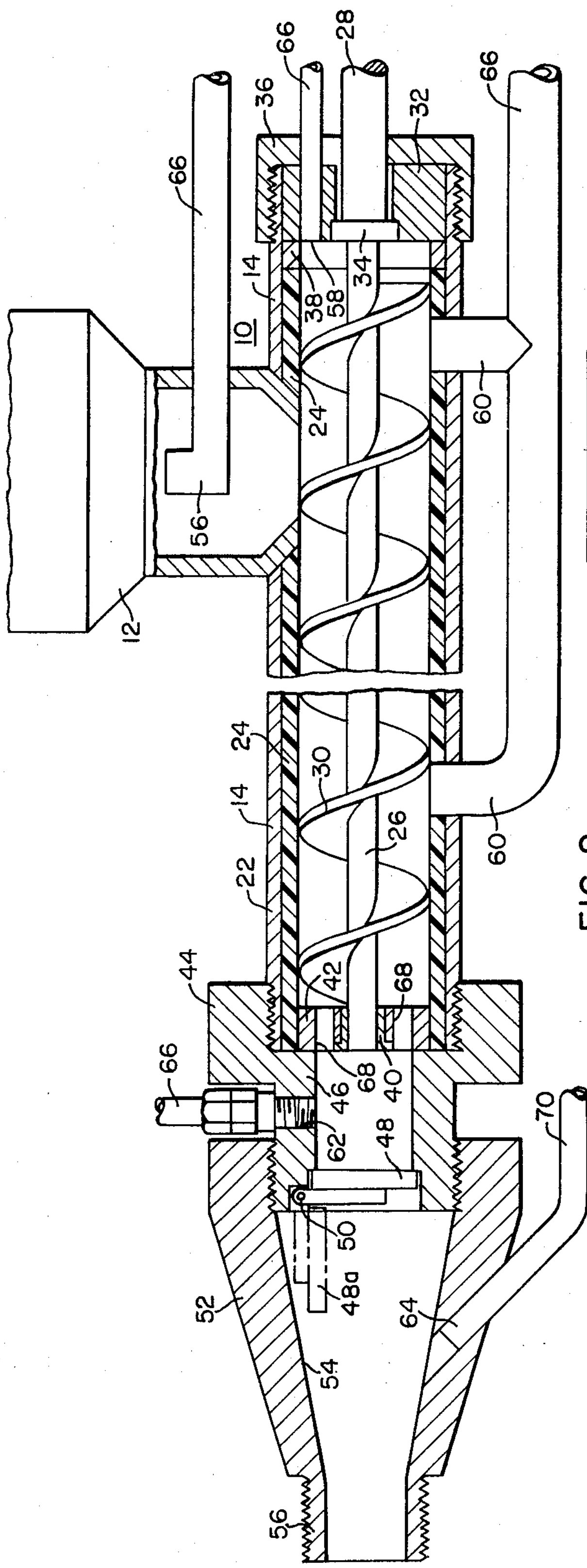


FIG. 2

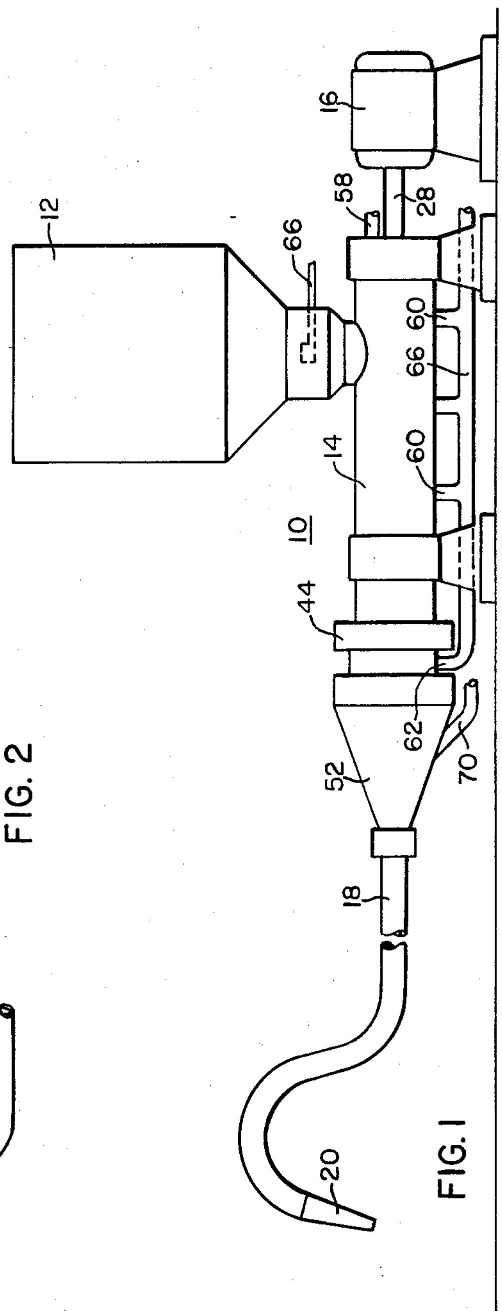


FIG. 1

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AERATED POWDER PUMP

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates to an aerated pump and more particularly, it pertains to a system for pumping and spraying powdered resin.

2. Description of the Prior Art

Handling certain powdered materials such as flour, powdered metals, clay, and certain resins has been satisfactory where the material is pumped through a totally enclosed system of pipes. Such materials may be pumped in a so-called "progressive cavity" pump similar to that disclosed in U.S. Pat. No. 3,280,753, in which a metal rotor is in engagement with a stator composed of flexible resilient material such as rubber.

Where the powdered material being pumped is composed of a blend of certain resins and of a catalyst or curing agent, a problem arises. It has been found that with such a blend of powdered materials, the progressive cavity pump is practically useless, (particularly at higher speeds), because the metal rotor creates friction with a rubber stator and the heat created by the friction causes the catalyst or curing agent to set up and harden the powdered resin in the blend, thereby causing the pump to become inoperative.

SUMMARY OF THE INVENTION

In accordance with this invention it has been found that the foregoing problem may be overcome by providing the pump stator having an elongated cylindrical chamber and having a powder inlet and a powder outlet, the inner walls of the chamber being composed of a minimal friction material, a rotor within the pump chamber having a helical fin extending to the inner surface of the stator, gas injection means at spaced intervals along the length of the stator for injecting powder-fluidizing gas into the chamber, and additional air injection means on the side of the powder outlet remote from the chamber for moving the powder through the pump.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an elevational view showing the pump; and

FIG. 2 is an enlarged sectional view showing the pump stator, rotor, and powder outlet end of the stator.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The apparatus of the present invention is a pump assembly generally indicated at **10** in FIG. **1**. It includes a hopper **12**, a pump **14**, and a variable speed motor **16**. The exit end of the pump is preferably provided with a hose **18**, the outer end of which is provided with a spray nozzle **20**.

As shown more particularly in FIG. **2**, the pump **14** is an elongated cylindrical member having an outer casing **22** which together with an inner lining **24** forms a stator for a pump rotor **26**. The rotor, which is propelled by the motor **16** through a shaft **28**, is provided with a helical fin **30** so that the rotor **26** functions in a manner similar to an auger. The outer peripheral portion of the fin **30** extends to and contacts the inner surface of the lining **24**. The rotor and fin may be composed of any rigid material. Such material may include a metal and is preferably composed of steel.

The right end portion of the rotor **26** is journaled in a brass collar **32** and includes a flange **34** to prevent longitudinal thrust of the rotor **26**. The brass collar **32** is seated within the open end portion of the casing **22** where it is retained by a closure **36**. A sealing collar **38** is disposed between the collar **32** and the inner liner **24**.

The opposite end of the rotor **26** is journaled in a collar **40** which is preferably composed of a low adhesion material such as polytetrafluoroethylene. The collar **40** is disposed in a mounting member or spider **42**, which is located within the outlet end of the pump **10** where it is retained in place by an adapter **44**. A central bore **46** of the adaptor **44** communicates with the chamber of the pump **14**. The end of the bore **46**, remote from the spider **42**, is provided with a check valve **48** which is pivotally mounted at **50** to permit the flow of powdered material to the left (as viewed in FIG. **2**) and to prevent the reverse flow of the material into the pump stator. For that purpose the valve **48** swings clockwise to an open (broken line) position **48***a* when sufficient pressure within the pump chamber is maintained. However, when pressure in the pump chamber drops below the pressure on the left side of the valve, the valve **48** moves counterclockwise to the closed (solid line) position.

The adaptor **44** is composed of a material having a low coefficient of adhesion such as polytetrafluoroethylene. The exit end of the adaptor **44** is connected to a member **52** having a funnel-like inner surface **54** and having a threaded end portion **56** to which the hose **18** is connected. The member **52** may be composed of metal or of a material having a low coefficient of low adhesion such as polytetrafluoroethylene.

The pump assembly **10** including the hopper **12**, the pump **14**, the hose **18**, and the spray nozzle **20** also includes means for aerating with air or other gas to circulate through the several parts for the purpose of "-fluffing" or fluidizing the blended resinous material as it passes through the pump assembly. The aerating means includes a source of pressurized air (not shown) or other gas (such as nitrogen) which is innocuous to the materials comprising the resinous powder. The pressure is maintained at about 4 pounds per square inch and the gas is applied at strategic areas throughout the pump assembly **10** through several spaced nozzles. The nozzles include a nozzle **56** near the lower end of the fluidizing hopper **12**, a nozzle **58** at the right end of the pump **14**, and a plurality (for example) three nozzles **60** (FIG. **1**) at spaced intervals along the pump **14**. Another nozzle **62** is provided in the adaptor **44** and communicates with the central bore **46**. Still another nozzle **64** is provided in the member **52** where it communicates with the chamber formed by the surface **54**. All of the nozzles **56** to **62** are connected by similar gas conduits **66** to the common source of gas pressure. Accordingly, a gas is applied throughout the assembly so as to provide a continuous aerating condition to the powdered resinous material as it passes through the pump, and thereby prevent the powdered material from depositing and accumulating within the pump.

As the resinous material passes from the hopper into the rotor chamber of the pump **14** and then through the spider **42** having openings **68** into the bore **46**, and thence through the member **52** into the hose, the gas entering the assembly maintains the resinous material in a substantially fluidized state.

A typical example of the resinous powder may include a blend of two solid epoxy resins, a yellow pigment, an amine curing agent or catalyst, and a silica filler.

The several parts including the inner pump lining **24**, the collar **40**, the adaptor **44**, and the check valve **48**, being composed of a material having a low adhesion coefficient such as polytetrafluoroethylene, contribute to the overall effect of preventing adherence of the resinous material to the surfaces of the pump. More particularly, the lining **24** provides a minimum of frictional resistance to the resinous powder as it is propelled through the pump chamber. The lining **24** prevents the creation of any hot spots between the helical fin **30** and the stator which would otherwise cause the curing agent or catalyst, constituting part of the resinous powder, from setting up and hardening, causing ultimate pump failure.

The nozzle **64** normally functions with the other nozzles **56** to **62** to fluidize the resinous powder as it passes through the member **52**. The nozzle **64** however is connected to a conduit **70** which is maintained in operation for some time, such as upwards for one minute, after shutdown of the rest of the pump **10** in order to blow all of the resinous powder out of the member **52**, the hose **18**, and the nozzle **20**. During the blowing out period after the pump is shut down, the check valve **48** returns to the closed (solid line) position, whereby air entering the member **52** via the nozzle **64** is prevented from blowing resinous material back into the bore **46** and the pump chamber.

Accordingly, the several air injection nozzles **56–64** cooperate with the rotor **26** and the several parts including the lining **24** to prevent the resinous powder from depositing and packing anywhere in the pump and particularly at the outlet end thereof as the powder is directed into the hose and out of the manually operated nozzle **20**. The pump is adapted to move about 1 pound of resinous powder in 1 minute, and has an average output of about 6 pounds in 10 minutes.

It is understood that the above specification and drawings are merely exemplary and not in limitation of the invention.

What is claimed is:

1. An apparatus for propelling a dry powdered resinous material comprising

1. an elongated cylindrical stator chamber having internal walls and a powdered material inlet and outlet;
2. rotor means of uniform diameter within said chamber for propelling said material from said inlet to said outlet;
3. a liner lining the walls of said chamber, said liner being of a material having a low coefficient of friction, and said liner being interposed between said rotor means and said chamber walls so as to prevent all contact between said rotor means and said chamber walls;
4. gas injection means along the walls of said chamber for introducing gas into said chamber for maintaining said material in a fluidized state;
5. a check valve at the outlet end of said chamber for preventing the reverse flow of said material;
6. a fitting attached to said chamber over said outlet; and
7. gas injection means for introducing gas into said fitting.

2. The apparatus of claim **1** wherein a bearing of a material having a low coefficient of friction supports said rotor means at said outlet.

3. The apparatus of claim **2** wherein said bearing material is polytetrafluoroethylene.

4. The apparatus of claim **1** wherein the lining is composed of polytetrafluoroethylene.

5. The apparatus of claim **1** wherein the rotor means is a rotatable shaft having a helical fin extending to the lining of the chamber walls.

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