

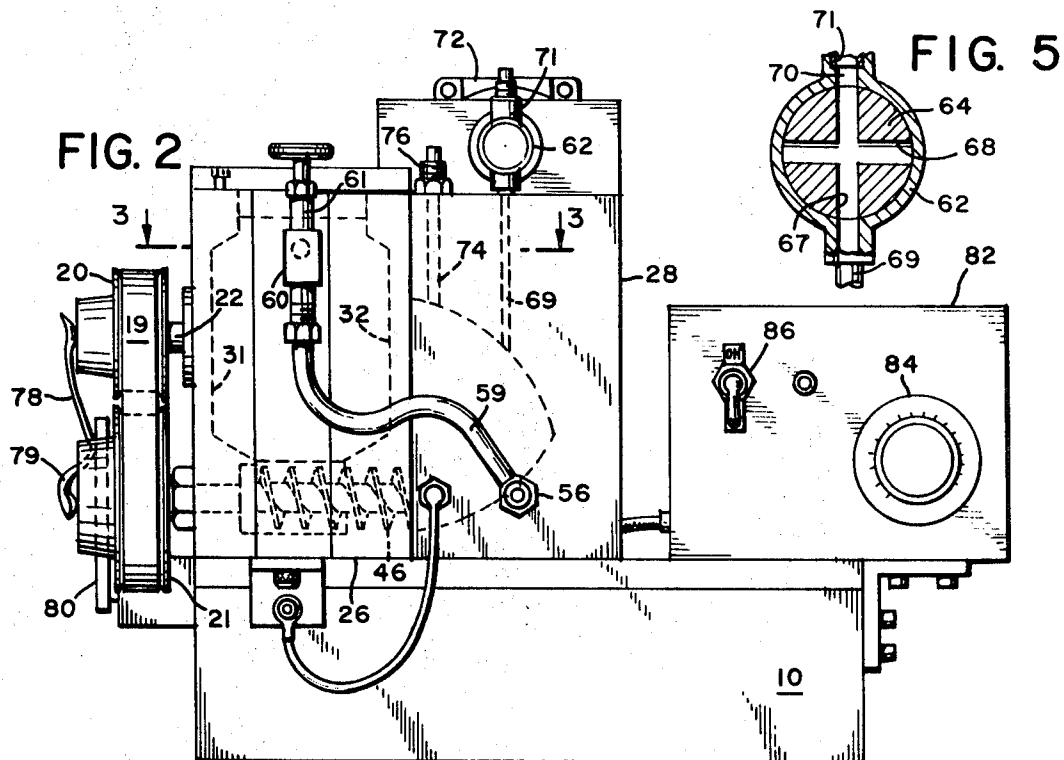
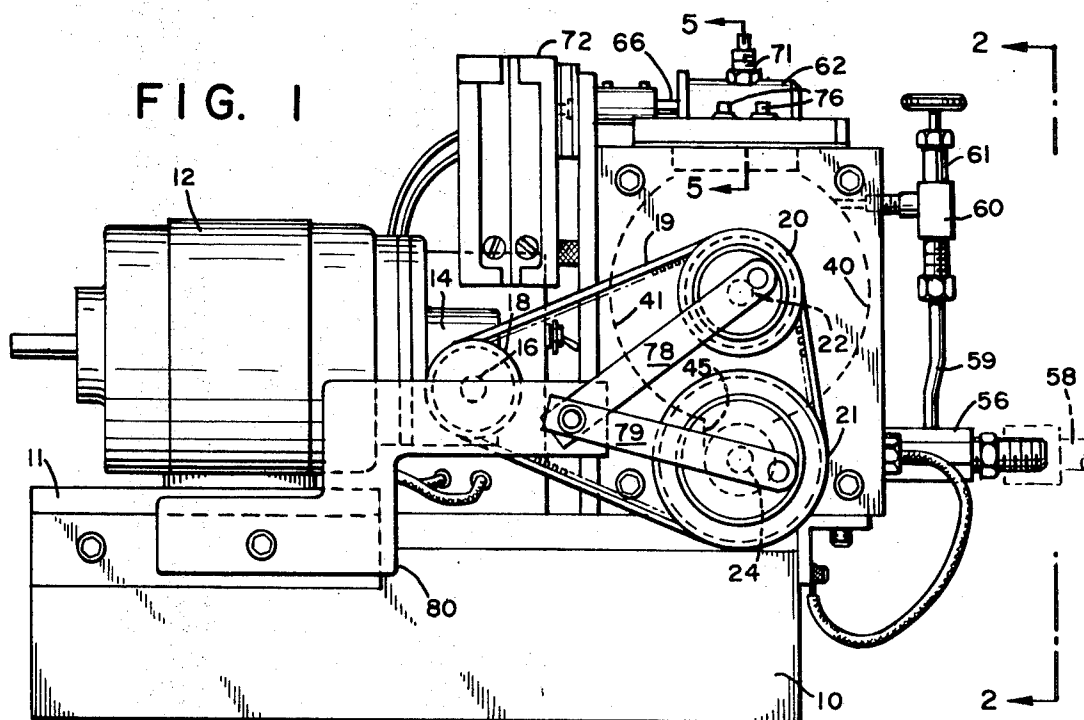
Sept. 20, 1971

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POWDER FEEDING ASSEMBLY

3,606,481

Filed Oct. 22, 1969

2 Sheets-Sheet 1



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3,606,481

POWDER FEEDING ASSEMBLY

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Filed Oct. 22, 1969, Ser. No. 868,487

Int. Cl. B65g 53/40

U.S. Cl. 302—50

3 Claims

ABSTRACT OF THE DISCLOSURE

A powder feed assembly having a housing provided with a powder reservoir and a powder fluidizing chamber. The reservoir has a sump at its lower end and a conveyor in the sump to deliver powder to the fluidizing chamber. A conduit delivers a carrier gas under pressure to the chamber. Another conduit connects the chamber with the reservoir to equalize the pressure therein and valve means can vary the pressure. There is also a valve for rapidly venting pressure in the chamber intermittently and a delivery conduit from its chamber for the fluidized powder.

This invention relates to a feeder for delivering metal or other powders in a fluidized state to a powder spray device, such as a plasma gun, a flame spray gun, or any other apparatus. Powdered materials, such as plastics, ceramics, metals, or mixtures thereof, may be sprayed directly onto substrates to form a continuous coating and the rate of feed varies with the nature of the powder or powders being sprayed and the material forming the substrate and its surface characteristics.

The powder from a reservoir is entrained into the carrier gas and the combined gas and powder are conducted through a conduit to a hot zone, such as a plasma or flame jet where the particles soften and melt. They continue their movement and impinge on a substrate to form a coating.

The principal object of the invention is to provide an apparatus which feeds the powder at a uniform, predetermined rate which can be varied.

Another object of the invention is to provide an apparatus through which the powder freely flows in a fluidized state with a substantially constant concentration of the powder in the carrier gas so that its eventual application in a softened state as a coating to a substrate can be of uniform thickness.

Methods of aerating granular particles in order to improve their flow properties are known in the art. A carrier gas at a controlled velocity and pressure is introduced into the powder reservoir at a gradually increasing rate. The bed expands until the particles begin to move and these particles are supported on the gas stream. The top of the dense-phase bed has a well-defined level resembling a boiling liquid. As the gas velocity is increased, entrainment of the particles in the carrier gas increases to a point where the bed level disappears and a single dilute-phase suspension is present through the entire vessel.

Yet another object of the invention is to provide an improved powder feed apparatus wherein the rate of feed of the powder can be varied by changing the speed of a feed screw which delivers powder from a reservoir to a fluidizing chamber, by varying the speed of the motor which pumps the gas and by varying the pressure of the gas feed into the chamber.

In the drawings:

FIG. 1 is a front elevation of an apparatus of the present invention;

FIG. 2 is a side elevation thereof, this view being taken on line 2—2 of FIG. 1;

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FIG. 3 is a section taken on line 3—3 of FIG. 2; FIG. 4 is a vertical section taken through the housing sections;

FIG. 5 is a section taken on line 5—5 of FIG. 1.

The powder feed assembly of the present invention is mounted on a chassis 10 which supports a motor 12 with a speed reducer 14 to furnish a speed of about 48 r.p.m. in the motor output shaft 16. A pulley 18 is fast on this shaft and a belt 19 thereon drives two additional pulleys 20 and 21 fast on shafts 22 and 24.

A housing is formed in two parts 26 and 28 in juxtaposition along a line 29. A powder reservoir 30 is machined out of or otherwise formed in the first section and is defined by spaced walls 31 and 32 having aligned holes 34 serving as bearings for shaft 22 which has a single radial spoke 36 carried by a hub 38 fast thereon and which supports an arm 37 which agitates the powder on the bottom wall 39 of the powder reservoir.

The powder reservoir is further defined by two additional opposed walls 40 and 41 and a feed opening 42 in the top wall is closed by a closure cap 44. An opening 45 in the lower wall permits the powder to descend onto a screw conveyor 46 in a sump 48, the conveyor being fast on shaft 24. The forward end of the conveyor is positioned in a round opening 49 only slightly larger than the diameter of the conveyor, and the powder, already in a somewhat fluidized state, is fed into a powder fluidizing chamber 50 which is formed in the second housing section 28. This chamber is generally hemispherical in shape and is closed by wall 32 of first housing section 26.

The carrier gas, such as air, acetylene, nitrogen, helium, or mixtures thereof, under a pressure of about 60 lbs. p.s.i. is fed to a tube 51 positioned in a machined-out section 52 in the concavely curved wall of chamber 50. This tube has a number of discharge openings 54 and it is connected outside the chamber within fitting 56 connected with a conduit 58 leading to a source of the carrier gas in which the powder is to be entrained. Another conduit 59 leads to a fitting 60 in wall 40 of the powder reservoir. In this fashion, the pressures in chamber 50 and reservoir 30 are equalized and thus permit free movement of the powder to the fluidizing chamber. A needle valve 61 associated with fitting 60 permits the pressures in both chambers to be varied for various types of powders.

One significant improvement in the assembly of the present invention resides in a pulsating pressure relief device wherein the pressures in the powder feed chambers are vented about 100 times per minute. As a result of this action, the pressure in this fluidizing chamber is reduced, thereby preventing excess build-up of pressure in that chamber facilitating the flow of powder through the discharge orifice.

A valve housing 62 supports a cylindrical valve member 64 driven by a shaft 66, for rotation. The valve member has two intersecting radial holes 67 and 68 and when each one of the holes become aligned with a conduit 69 leading to the powder chamber and with a discharge orifice 70 in a fitting 71 on the valve housing, the pressure in the chamber drops for a fraction of a second to atmospheric pressure. The shaft is rotated by a separate motor 72. This rapid oscillation of pressures impart a high measure of fluidity to the powder.

The powder in its highly fluidized state is discharged through conduits 74 leading to fittings 76 and since there are generally two lines leading to the plasma torch, there are two of such conduits.

In a device of this character, it is necessary to ground all internal metallic parts to discharge static electricity and this avoids bridging of the powder. The shafts 22 and 24 are grounded by spring urged grounding plates

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78 and 79 which engage the ends of the shafts. The spring plates are mounted on an angular plate 80 secured to the chassis. A control box 82 has a knob 84 for controlling motor speed and an off-on switch 86.

It will be understood that motor 12 can be used for driving shaft 66 associated with valve 64 although the separate motor gives good results since the occasional need to vary the speed of this shaft may not be present with respect to motor shaft 16. In the event that too much or too little powder is being fed by the screw conveyor, this can be varied by substituting a different screw.

Also, any valve for controlling pressure may be used in place of the needle valve 61.

So far as the rate of feed of the powder is concerned, it will be appreciated that the faster the screw conveyor is turned the greater the quantity of powder that will be fed and to get the best results with different kinds of powders, conveyors with different flight formations may be used. In other words, different powders will agglomerate or bridge in different ways regardless of the particle size of the powder.

What we claim:

1. A powder feed assembly including a housing formed with a powder reservoir and a powder fluidizing chamber, the reservoir being formed with a sump at its lower end

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and a screw type conveyor in the sump to deliver powder to the fluidizing chamber, a first conduit for delivering a carrier gas under pressure to particles in the chamber for aerating the powder, a second conduit means connecting the chamber with the reservoir to equalize the pressures therein, a third conduit connected to the top of the chamber for delivering the fluidized powder, and a rotatable valve connected to a power shaft for intermittently venting the pressure in the chamber to aid in the fluidizing process.

2. The assembly of claim 1, wherein a motor is provided for rotating the conveyor and for turning the power shaft which operates the rotatable valve.

3. The assembly of claim 1, wherein said first conduit is provided with a plurality of holes for delivering the compressed gas to a number of points in the chamber.

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