United States Patent

[11] 3,578,215

[72] Inventor **Roger B. Bushnell**
Ashford, Middlesex, England

[21] Appl. No. **839,502**
[22] Filed **July 7, 1969**
[45] Patented **May 11, 1971**

[73] Assignee **Controsion Electrostatic Limited**
London, England

[32] Priority **July 15, 1968**
[33] **Great Britain**
[31] **33637/68**

[54] **POWDER DELIVERY ARRANGEMENTS**
5 Claims, 1 Drawing Fig.

[52] **U.S. Cl.** **222/193,** 302/50
[51] **Int. Cl.** **B67d 5/54**
[50] **Field of Search** 222/193; 302/37, 50; 239/654, 655

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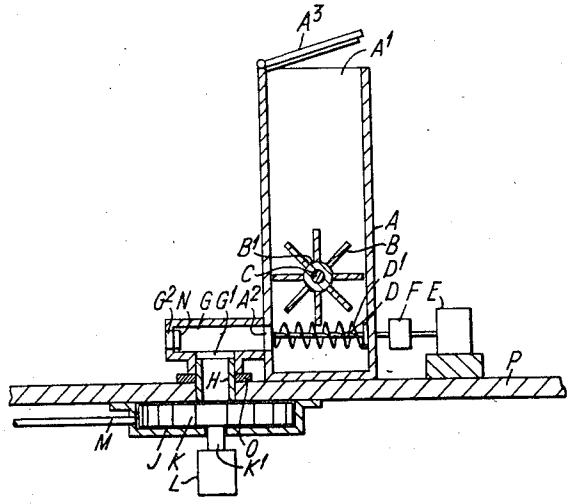
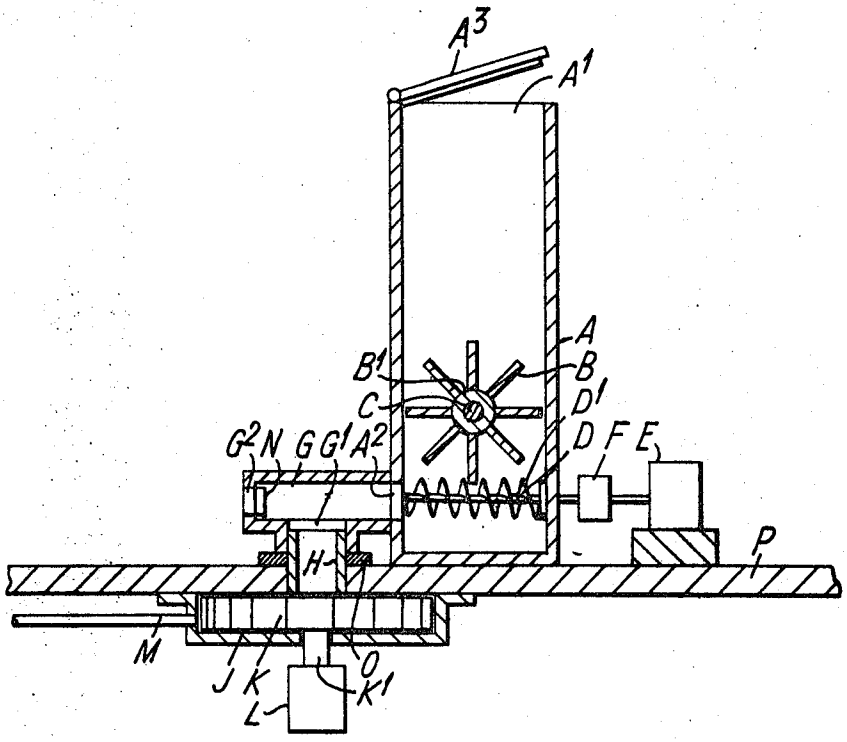
Primary Examiner—Stanley H. Tollberg
Assistant Examiner—H. S. Lane
Attorney—Holcombe, Wetherill & Brisebois

ABSTRACT: This invention relates to a powder delivery arrangement, for example for the delivery of powdered paint to a spray gun for the spray coating of surfaces, and comprises a hopper into which the powder is introduced, a stirring device in the hopper for preventing clogging of the powder, a worm shaft in the hopper for driving the powder received from the stirring device out from the hopper into a chamber containing a centrifugal fan which sucks the powder received from the hopper and drives it through a delivery pipe. The powder expelled from the hopper may conveniently be delivered into an intermediate compartment having an air inlet preferably provided with a filter device, the centrifugal fan acting to suck a mixture of powder and air from such compartment The hopper together with the stirring device and worm shaft within it is preferably removably mounted for interchange with alternative hoppers. The stirring device and the worm shaft are preferably driven by a variably speed motor.

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POWDER DELIVERY ARRANGEMENTS

This invention relates to a powder delivery arrangement, more especially but not exclusively intended for the delivery of powdered paint or the like to a spray gun for the electrostatic spray coating of surfaces.

In known powder delivery arrangements for this purpose, it has been the common practice to use a compressor for delivering the powder, but in practice this arrangement has usually resulted in the contamination of the delivered powder by impurities such as oil and moisture emanating from the compressor. Such impurities tend to clog the delivery pipes and also have a harmful effect on the resultant sprayed coating. The known arrangements are also unable to deal satisfactorily with powders of small particle size, since the compressor tends to compact the particles and to form lumps.

The present invention has for its object to provide an improved delivery arrangement which does not employ a compressor and thus avoids the difficulties associated with the use of a compressor.

The powder delivery arrangement according to this invention comprises a hopper into which the powder is introduced, a stirring device in the hopper for preventing clogging of the powder, a shaft in the lower part of the hopper carrying a worm for driving the powder received from the stirring device out from the hopper into a chamber containing a centrifugal fan or impeller which sucks the powder received from the hopper and drives it through a delivery pipe.

The arrangement preferably includes an intermediate compartment provided with an air inlet, the powder expelled from the hopper by the worm being delivered into such compartment, the centrifugal fan or impeller acting to such a mixture of powder and air from the compartment. The intermediate compartment may also be provided with a filter device for filtering the air entering the compartment through the air inlet.

The hopper together with the stirring device and worm shaft within it is preferably mounted so as to be readily removable from the other parts of the arrangement for interchange with alternative hoppers.

The stirring device and the worm shaft are preferably driven by a variable speed motor to enable their speed to be suited to the particular powder concerned. Such variable speed motor is preferably mounted outside the hopper and is connected to the stirring device and the worm shaft in the hopper through a coupling device which is disengageable to permit removal of the hopper.

The invention may be carried into practice in various ways, but a preferred practical powder delivery arrangement according thereto is illustrated somewhat diagrammatically by way of example in sectioned view in the accompanying drawing.

This arrangement is especially suitable for the delivery of paint powder to a spraying device for the spray coating of surfaces, and will for convenience be described with reference to such use.

In this arrangement, the powder to be delivered is initially fed through an inlet opening A^1 to a hopper A, conveniently of rectangular cross section. Within this hopper, a stirring device B, consisting of a set of angularly spaced vanes radiating from a sleeve B^1, is freely rotatable on a horizontal shaft C secured to the hopper walls, the vanes of the stirring device extending nearly to the sidewalls of the hopper. Beneath this stirring device B, a shaft D carrying a worm D^1 is rotatably mounted in the hopper close to the bottom thereof, this shaft conveniently extending in a direction at right angles to that of the fixed shaft C. The worm shaft D and the stirring device B are both driven by a variable speed electric motor E mounted outside the hopper A, the drive from the motor being transmitted through a disengageable coupling F directly to the worm shaft D, whilst the stirring device is driven by the engagement of the tips of its vanes with the worm D^1.

The stirring device B, which rotates at a relatively slow speed, acts to prevent any clogging of the powder in the hopper and feeds the powder down to the worm D^1, which acts to expel the powder horizontally from the hopper through an outlet A^2 lying generally in line with the worm shaft axis. The speeds of rotation of the worm D^1 and of the stirring device B are in practice adjusted to suit the nature of the powder in the hopper and the size of the particles thereof by adjustment of the speed of drive of the motor E.

The powder expelled from the hopper through the outlet A^2 enters a small compartment G, which is carried by the hopper and has an outlet G^1 in its bottom wall surrounding a short inlet tube H leading into a cylindrical fan chamber J. A centrifugal fan or impeller K is mounted on a vertical shaft K^1 within the fan chamber J, such shaft being driven at relatively high speed by an electric motor L mounted beneath the fan chamber. The vanes of the fan or impeller K extend close to the top and bottom walls and also to the cylindrical wall of the fan chamber, the shaft K^1 lying in alignment with the inlet tube J^1. This fan or impeller K acts to suck the powder from the small compartment G and to deliver it through a delivery pipe M extending laterally from the fan compartment. Such pipe M may for example deliver the powder direct to a spraying device (not shown).

It will usually be desirable, for the satisfactory operation of the spraying device, to deliver a mixture of air and powder thereto, and in such case the small compartment G may be provided with an air inlet G^2 of suitable size, so that the fan or impeller K will suck the desired mixture of air and powder from the compartment G. Such air inlet may be adjustable in size to enable the quantity of air in the mixture to be adjusted to suit requirements. The air inlet may also be provided, if desired, with a filter device N to remove any impurities sucked in with the air. A similar filter device may be provided on a removable cover indicated at A^3 for the inlet opening to the hopper, to prevent impurities being sucked in through such opening during powder delivery.

The hopper A, together with the stirring device B and the worm D within it, and the intermediate compartment G carried by it, can be detached as a unit from the remainder of the apparatus, by disengagement of the coupling F, thus permitting interchange with other similar units. This makes it possible rapidly to change from one powder to another, for example of a different color without the delay involved in the thorough cleaning of the hopper, which would otherwise be necessary for a change of powder. A soft pad O may be provided if desired, around the small pipe H, against which the intermediate chamber outlet G^1 is tightly pressed, to minimize risk of escape of powder between the engaging walls of the outlet G^1 and the small pipe H.

The delivery device will usually be mounted on a supporting framework (for example a wheeled framework) part of which is indicated at P in the drawing.

It will be clear that the above-described arrangement, not only minimizes risk of contamination of the powder by impurities, but also enables delivery of powder of extremely fine particle size without risk of clogging, owing to the action of the stirring device, the centrifugal fan being effective in breaking up any lumps, which may have passed the stirring device.

It will be appreciated that the arrangement may be modified in various ways, within the scope of the invention, to suit requirements.

I claim:

1. A powder delivery arrangement, comprising a hopper into which the powder to be delivered is introduced, a stirring device in the hopper for preventing clogging of the powder therein, a shaft mounted in the lower part of the hopper beneath the stirring device and carrying a worm, means for driving the stirring device and the shaft whereby the worm expels the powder received from the stirring device out from the hopper through an outlet opening in an approximately horizontal direction, an intermediate chamber at the side of the hopper which receives the powder expelled approximately horizontally from the hopper and is provided with an air inlet opening through which air from the atmosphere can enter the intermediate chamber in a direction different from that in which the powder enters such chamber, the chamber also hav-

ing an outlet opening through which powder and air can escape from the chamber in a direction different from that in which the air enters the chamber, whereby the air and powder will be intimately mixed together in the intermediate chamber owing to the turbulence set up therein, a fan chamber disposed at least in part beneath the intermediate chamber and having an inlet opening directly communicating with the outlet opening from the intermediate chamber, a centrifugal fan in such fan chamber, a powder delivery pipe extending from the fan chamber, and means for driving the centrifugal fan whereby the fan sucks down into the fan chamber from the intermediate chamber an intermediate mixture of air and powder and drives such mixture out from the fan chamber through the powder delivery pipe.

2. A powder delivery arrangement as claimed in claim **1**, including a filter device in the intermediate compartment for filtering the air entering such compartment through the air inlet.

3. A powder delivery arrangement as claimed in claim **1**, including detachable mounting means for the hopper whereby the hopper together with the stirring device and the worm shaft within it can be removed from the other parts of the powder delivery arrangement for interchange with alternative hoppers.

4. A powder delivery arrangement as claimed in claim **3**, including a variable speed motor mounted outside the hopper and constituting the driving means for the stirring device and the worm shaft therein, and a disengageable coupling device interposed in the drive from the motor to the stirring device and the worm shaft for facilitating removal of the hopper.

5. A powder delivery arrangement as claimed in claim **1**, in which the means for driving the stirring device and the worm shaft comprises a variable speed motor.