

March 3, 1970

S. T. ADAMS

3,498,540

NOZZLE FOR POWDER SPRAYING

Filed July 5, 1967

FIG. 1

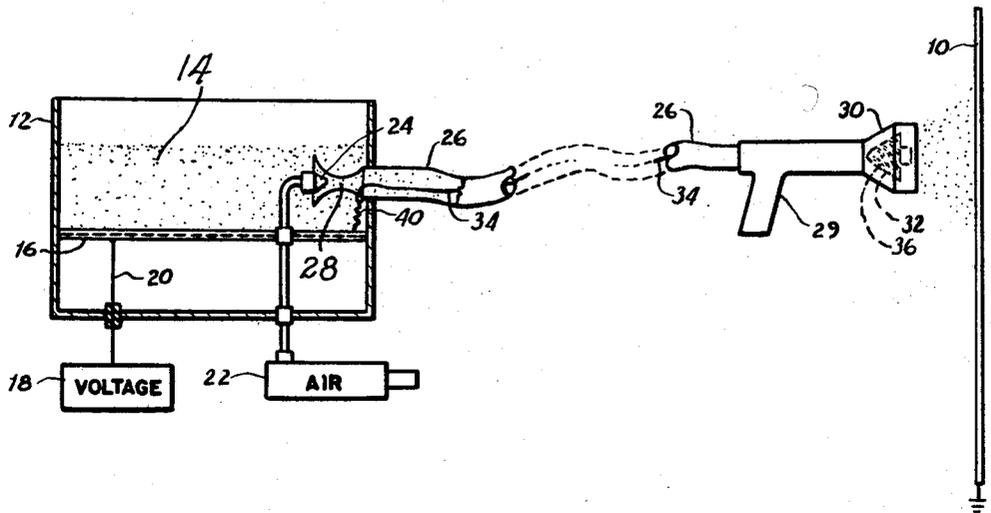


FIG. 3

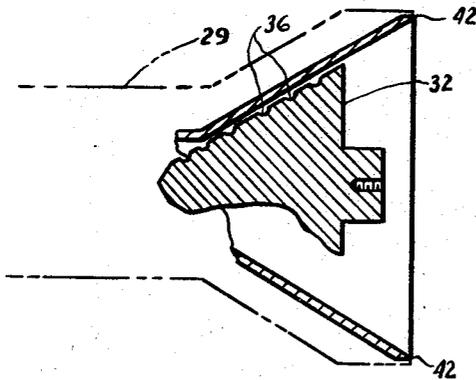


FIG. 2

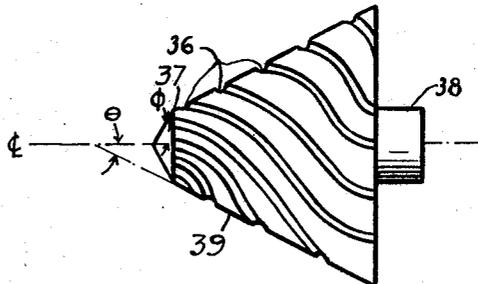
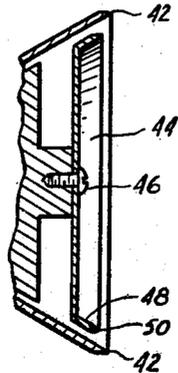


FIG. 4



INVENTOR.
STEVEN T. ADAMS

BY *Scudder Hunt Schuttler & Wilkerson*

ATTORNEYS

1

2

3,498,540

NOZZLE FOR POWDER SPRAYING

Steven T. Adams, Stamford, Conn., assignor to Electrostatic Equipment Corporation, South Norwalk, Conn.

Filed July 3, 1967, Ser. No. 650,670

Int. Cl. B05b 5/02

U.S. Cl. 239—15

5 Claims

ABSTRACT OF THE DISCLOSURE

A gun for spraying charged powder consists of a hose into which air and powder is introduced and a nozzle assembly at the other end of the hose. The nozzle assembly consists of a funnel diverging outwardly from the hose and engaged by the hose and a conical plug inserted into the funnel and engaging the walls thereof. The cone is provided with a plurality of spiral slots in the wall thereof so that the powder traverses the nozzle assembly through the spiral slots wiping the charged wall of the funnel and being charged thereby.

This invention relates to spraying of electrostatically charged powder and, more particularly, relates to an improved nozzle construction for charging and spraying of powder.

Coating of objects with electrostatically charged powder with subsequent fusion of the powder into a protective coating has many applications. Small objects are usually introduced into a fluid bed of charged powder particles. However, large objects cannot be handled in similar manner and it is desirable to provide means for bringing the powder to such large objects.

Although it is relatively easy to blow uncharged powder on an object, it has been found quite difficult to provide suitable equipment for directing particles towards an object and simultaneously charging the particles for electrostatic coating of the article. Apparatus for this function are known as powder guns or powder nozzle assemblies and both terms will be used interchangeably in the specification.

In one nozzle assembly known to the art, a rotating disc is provided in the terminal end of a nozzle through which a powder suspension in an air blast is forced. The rotating disc is charged and by its rotation, whirls the powder and charges the powder. However, this requires a driving motor at the end of the nozzle which is both expensive and makes the nozzle difficult to handle.

Another nozzle known to the art injects an air blast at right angles to the powder stream to cause rotation of the powder stream. This rotation brings the powder against a charged surface for charging of the same. However, in this nozzle, the complexity of additional air blasts unduly complicates the nozzle assembly and it has been found that the nozzle is more prone to clogging.

It is, therefore, an object of the present invention to provide an improved spray gun for the spraying of electrostatically charged powder particles.

In accordance with this object, there is provided, in a preferred embodiment of this invention, a gun for spraying electrostatically charged powder which comprises a source of air to inject air into a hose. A venturi is provided at the entrance of the hose to pick up powder particles which may be charged or uncharged at the entrance of the hose. At the exit end of the hose, a nozzle assembly is provided which comprises a charging funnel which is charged with high voltage. A plug is inserted within the charging funnel. The plug is provided with a plurality of spiral slots. The powder carried by the moving air stream travels through the spiral slots and is charged during such travel by wiping contact with the charged funnel. The

powder is then ejected in a powder spray of charged particles which may be directed towards the large object to be coated. An additional charging effect is provided by forming the funnel with a sharp edge at the exit end and additionally by providing a conductive dish having a sharp edge positioned adjacent to the exit end of the funnel to provide a gap therebetween.

Having briefly described this invention, it will be described in greater detail in the following portions of the specification, which may best be understood by reference to the accompanying drawings, of which:

FIG. 1 is a partially sectioned view of a powder spraying apparatus in accordance with the present invention;

FIG. 2 is an elevation view of a portion of the apparatus shown in FIG. 1;

FIG. 3 is a partially sectioned view of another embodiment of a portion of the apparatus shown in FIG. 1; and

FIG. 4 is a partially sectioned view of still another embodiment of the apparatus shown in FIG. 3.

In FIG. 1, there is shown an apparatus for spraying electrostatically charged powder on a large object 10. The apparatus consists of a fluid bed apparatus 12 which provides an air suspension of powder 14 which may be charged particles when charged from an electrode 16, the potential of which is applied by high voltage DC generator 18 via lead 20. A source of air under pressure 22 is coupled to a nozzle 24 which blows the air into a hose 26. A venturi 28 is provided to pick up powder particles from the suspension 14. The powder particles are blown through the hose. At the exit end of the hose, a nozzle assembly is provided which consists of a funnel 30 within which is mounted a cone 32. The funnel is charged to a high voltage DC for charging of the powder particles by coupling the funnel to the high voltage electrode 16 by lead 34. As is shown in FIG. 1 and more clearly in FIG. 2, the cone is provided with a plurality of spiral slots 32. The powder carried by the air blown through the hose traverses the nozzle through the spiral slots. As the powder travels through the slots, the powder particles wipe the walls of the charged cone 30. It has been found that in this manner, very effective charging of the powder particles is obtained and the powder spray can be directionally controlled by movement of the funnel 30.

Specifically, in one embodiment, the cone 32 was fabricated from brass stock with a base diameter of 2 inches and a height to the truncated apex of 1½ inches. The angle ϕ was 66° and the angle θ was 26½°. Ten spiral slots were provided, 36° apart. Each slot made a complete revolution in its path from top to bottom in the cone. The width of each slot was 3/32 of an inch. A knurled knob 38 is provided purely for handling purposes. In most cases, the cone is merely inserted in the funnel and is held thereby by the frictional engagement with the walls of the funnel. Additional securement may be obtained by spot soldering, dowel pins and like conventional fastening means. With this specific design of the nozzle, the air introduced was ranged from 5 to 35 p.s.i. at the powder pickup and the gun was capable of dispensing approximately 100 lbs. of powder per hour.

Since the funnel is charged, the outer surface may be left uninsulated only for permanent installation or mechanical control. If it is to be hand directed, the outer surface must be insulated. It is usually preferable to insert a protective resistor 40 to limit current should the operator accidentally come in contact with any of the charged surface.

The gun has been described in connection with a fluid bed arrangement primarily because it is usually employed with electrostatic fluid bed apparatus. However, the gun assembly can be used with initially uncharged powder from a conventional fluid bed since the precharging of the powder has relatively little effect upon the gun's

operation. It has been found that the charge has no particular value in its travel through the hose. Similarly, the hose may be utilized with other types of powder supplies such as mechanical metering of powder into the air stream. The charging is primarily and most effectively done at the funnel 30.

In some applications, it has been found that improved charging may be obtained by using a funnel as shown in FIG. 3 which is provided with a sharp exit edge 42. The sharp edge augments powder charging as the powder exits from the slot and passes the sharp edge of the funnel. Additional augmentation of charging may be obtained by using the embodiment shown in FIG. 4 in which the exit end of the funnel is provided with a sharp edge 42 and which includes a conductive cover plate 44 secured by fastening device 46 to the cone. The cover plate 44 is conductive and is provided with an upturned rim 48 having a sharp edge 50 thereon. As the powder passes between the sharp edges 50 of the plate and 42 of the funnel, increased effectiveness of powder charging is noted. The embodiment shown in FIG. 4 is not normally needed but is oftentimes advantageous when charging extremely small particle sizes and powders which are difficult to charge.

This invention may be variously modified and embodied within the scope of the subjoined claims.

What is claimed is:

1. An electrostatic gun comprising a hose, means for introducing air and powder particles into the entrance end of said hose, a nozzle assembly at the exit end of said hose, said nozzle assembly comprising a funnel coupled to said hose and diverging outwardly therefrom, a cone fixedly supported within said funnel and in contact with the walls thereof, said cone being provided with a plurality of spiral slots in the wall thereof

so that said powder is directed through said spiral slots and wipe the walls of said funnel, and means for charging said funnel.

2. An electrostatic gun in accordance with claim 1 in which said means for introducing air in powder comprises a fluid bed apparatus, a nozzle for injecting air into the entrance end of said hose, and a venturi section to pull said powder from said fluid bed into said hose.

3. An electrostatic gun in accordance with claim 1 in which said slots in said cone each describe a complete revolution from the apex to the base of said cone.

4. An electrostatic gun in accordance with claim 1 in which the exit end of said funnel is provided with a sharpened edge.

5. An electrostatic gun in accordance with claim 1 which includes a plate affixed to the exit end of said funnel, said plate having a diameter smaller than the exit end of the funnel to define a gap between the funnel edge and the edge of said plate, the edge of said plate being sharpened.

References Cited

UNITED STATES PATENTS

555,062	2/1896	Murphy	239—488
1,155,735	10/1915	Josse et al.	239—488
1,832,096	11/1931	Chaffee et al.	239—15
2,893,893	7/1959	Crouse	239—15
3,263,127	7/1966	Point et al.	239—15
3,327,948	6/1967	Gignoux	239—15

EVERETT W. KIRBY, Primary Examiner

U. S. Cl. X.R.

239—15, 488

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,498,540

Dated March 3, 1970

Inventor(s) Steven T. Adams

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

In the specification, Column 2, Line 47 should read -- The angle ϕ , which exists between the axis of the cone 32 and the surface of the small cone-shaped portion 37 thereof, was 66° and the angle θ , which exists between the same axis and the surface 39 of the larger frustoconical portion, was $26-1/2^\circ$. Ten--; Cancel Claims 1 - 5, and substitute therefor the following claims:

1. An electrostatic gun comprising a hose, means for introducing air and powder particles into the entrance of said hose, a nozzle assembly at the end of said hose, said nozzle assembly comprising a funnel coupled to said hose and diverging outwardly therefrom, a cone fixedly supported within said funnel and in contact with the walls thereof, said cone being provided with a plurality of spiral slots each describing a complete revolution from the apex to the base of said cone in the wall thereof so that the powder particles introduced by said hose are diverted through said spiral slots and wipe the walls of said funnel, and means for charging said funnel.

2. An electrostatic gun comprising a hose; means for introducing air and powder particles into the entrance end of said hose; a nozzle assembly at the exit end of said hose, said nozzle assembly comprising a funnel coupled to said hose and diverging outwardly therefrom and a cone fixedly supported within said funnel and in contact with the walls thereof, said cone being provided with a plurality of spiral slots in the wall thereof so that the powder particles introduced by said hose are diverted through said spiral slots and wipe the walls of said funnel; means for charging said funnel; and a plate affixed to the exit end of said funnel having a sharpened edge and a diameter smaller than the exit end of said funnel to define a gap between the funnel edge and said plate edge.

In the heading to the printed specification, line 7, "5 Claims" should read -- 2 Claims --.

SIGNED AND
SEALED

FEB 9 1971

(SEAL)

Attest:

Edward M. Fletcher, Jr.

Attesting Officer

WILLIAM E. SCHEUYLER, JR.
Commissioner of Patents