ELECTROSTATIC SPRAY GUN

1. The present invention refers to a spray gun which enables the simultaneous atomisation of several different fluid materials having separate channels and passages carrying said fluid and concentrically arranged bells surrounded by a spray head. In the channels described and electrically connected to a high-voltage power source to decelerate the flow of the fluid and to produce turbulence in it. In the spray gun there is provided an air space between the internal surface of the spray head and the blades fitted over the outer surface of the outer bell, said air space being connected with an air cushion opening into the inner bell; furthermore, having bores connected to a compressed air duct, in the mantle of said outer bell air passage openings are located.

The usual guns have internal passages in the known apparatus for introducing the paint to the spray bell is no advantage. On the contrary, it is disadvantageous, since it decreases the weight and the safety requirements, besides their layout, too, is complicated.

The spray gun developed for the purpose and which is the subject of present invention has separate channels carrying different fluid materials opening into concentrically arranged bells surrounded by a spray head, each bell having an inner space to store said fluid, a film-producing surface on its inner surface and an atomising edge for the atomisation of said fluid, said atomising edge being suitable for a relative axial and angular displacement, and having in the channels grids electrically connected to a pole of the high voltage power source for decelerating the flow of fluid and for producing turbulence in it, furthermore, having an air space between the internal surface of the spray head and the blades fitted over the outer surface of the outer bell, said air space being connected with an air cushion between the glass sleeve of the outer bell and the outer surface of the outer passage, and said air cushion opening into the inner bell; furthermore having bores in said spray head connected to a compressed air duct, furthermore having air passage openings in the mantle of said outer bell.

The principal advantage offered by the spray gun according to the invention lies in the arrangement of the grids within the body of the spray gun, separated from one another. This enables the charging-up of the paints with high-voltage current, at a certain distance from the point of atomisation. This solution absolutely precludes the hazard of electric shock on touching any part of the gun, and spark formation. The hidden arrangement of the grids allows the use of higher voltages in charging up the materials to be sprayed, whereby a wide variety of materials becomes suitable for electrostatic spraying. The application of higher voltage, on the other hand, enhances ionisation of the material to be sprayed.

A further advantage offered by the spray gun according to the invention is that, except the grids and the metal inserts, all of its parts are made of insulating materials which not only meet safety criteria to the full, but enable the reduction of the weight and dimensions of the gun to half of the weight and dimensions of its known counterparts.

The air cushion between the inner surface of the sleeve of the outer bell and the outer surface of the outer passage leads one of the paints, has a twofold role. It renders lubrication between the two surfaces unnecessary and minimises friction enabling higher revolution speed of the bells without increasing power consumption on the one hand, and prevents paint from getting between the two surfaces, dispensing with packing problems, on the other.

By the application of the air cushion and a sliding bearing in the second bell, the revolution speed of the bells can be increased from 5000 to 8000 r.p.m. with a simultaneous reduction of power consumption of the drive by 40 percent, as compared to the known counterparts and atomising the same quantity of material, i.e., that of paint. By higher revolution speed, the amount of paint sprayed per unit of time can be increased, the efficiency of coating enhanced, and its quality improved.

The invention will be further described, by way of example with reference to the accompanying drawings, in which—

FIG. 1 is the horizontal cross sectional view of the spray gun according to the invention.

FIG. 2 is a section on line 2—2 of FIGURE 1.
the hand portion through which the fluid material enters the gun. To this passage are connected the channels 1 and 2 represented in Fig. 1.

One of the paints used for spraying enters through channel 1, and the other paint used for spraying enters through channel 2. To channel 1 insert 1 is connected in which grid 35 is removably located. To channel 2 insert 3 is connected in which grid 36 is removably located. Grids 35 and 36 are located in inserts 3 and 4, perpendicularly to the axis of the flow of the fluid. Insert 3 is concentrically arranged in insert 4. Inserts 3 and 4 as well as grids 35 and 36 are made of any suitable conductive metal.

The mesh size and the dimensions of the grids are dependent on the viscosity and density of the fluid material flowing through them. Both mesh size and dimensions are adjustable. Inserts 3 and 4 are electrically connected with grids 35 and 36 and coupled to the negative pole of a high-voltage power source 5, by means of a cable 6. The positive pole of the high-voltage power source 5 is grounded.

One end of a passage 7 is connected to insert 4. To the other end of the said passage 7 the end of smaller cross-section of a connecting outer bell 11 is connected. One end of the passage 8 is connected to insert 3. At the other end of said passage 8 holes 21 are arranged. Passage 8 is concentrically located in passage 7 and supports at its end perforated with said holes 21 the end of smaller cross-section of a tapering inner bell 17. In the disc-shaped part 28 of said inner bell 17 which connects said latter with the inner bell 11 openings 23 are arranged. Bell 17 with-in bell 11 is either rigidly fixed, for instance by welding or by friction, in such a way that the two tapering surfaces rub over each other. The hub of bell 11 is fitted with a sliding bearing 10 made of glass, the hub of bell 17 is fitted with a sliding bearing 22.

Both bells 11 and 17, are surrounded by a spray head 9 in which bores 13 are arranged. To bores 13 a compressed-air duct 26 fitted with a control valve 25 is connected, through which duct compressed air 27 is delivered in known manner from a container (not shown in the figure) to the spray gun.

The outer bell 11 has a film-producing surface 24 on its inner surface and an atomising edge 15; also the inner bell 17 has a film-producing surface 19 on its inner surface and an atomising edge 18. In addition, over the mantle of the outer bell 11, bladed 12 are fitted. In the mantle of bell 11 openings 16 are arranged, close to edge 15. Bells 11 and 17 are fixed to the end of channel 8 by means of a threaded ring 20. Bell 11 revolves at the end of channel 7 which latter, at the same time, forms the shaft of bell 11.

Part of the compressed air 27 entering through bores 13 in the spray head 9 and reaching the clearance between the external surface of shaft 7 and the internal surface of the sliding bearing 10, forms an air cushion 14 between said two surfaces. In such manner, the bell 11 revolves free from friction.

With the exception of inserts 3 and 4 and the grids 35 and 36, all components of the spray gun are made of an insulating material.

The spray gun according to the invention function as follows:

The first fluid, i.e., paint entering channel 1, passes through insert 4 and the grid 35. The other fluid, i.e., paint entering channel 2 passes through insert 3 and the grid 36. The fluids flowing through inserts 3 and 4 and grids 35 and 36, are charged up to high voltage from the high voltage power source 5 through the cable 6 whilst the metal grids 35 and 36 decelerate the flow of the fluid and disturb the cross section of the fluid column. This turbulence enhances the charge-up of the fluid particles with negative ions. Subsequently, one of the charged-up fluids passes to the internal space of bell 11 through passage 7 and thence, through opening 23 to the film-producing surface 24 of bell 11, and finally, to the atomising edge 15, there to be atomised. The other fluid passes to the internal space of bell 17 through passage 8 and holes 21 and is atomised on the edge 18 while travelling over the film producing surface 19.

Compressed air entering the spray head 9 through bores 13 and passing through opening 16 of the bell 11 reach the air space situated between bells 11 and 17. Compressed spray exerted for part of the air cavates together the fluid particles atomised at the atomising edge 18 of bell 17 diverging in direction 29, and partly pushes the fluid 30 atomised at the atomising edge 15 of the bell 11 towards the subject to be coated. This operation brings about a spray pattern uniformly distributed over the surface of the subject to be coated, without sprayless area in its centre.

The bores 13 in the spray head 9 are developed in such a way that they should open in the space between the blades 12 near to the end of small cross section of bell 11.

Passing simultaneously a black fluid through channel 1 and passage 7 into bell 11 to its atomising edge 15 and a white fluid through channel 2 and passage 8 into bell 17 to its atomising edge 18 and atomising both fluids on said edges 15 and 18 due to compressed air 27 arriving from duct 26, such a spray pattern can be achieved in which the free area within the black band is filled out with the white paint, provided that the atomising edge 18 extends further than the atomising edge 15. In such manner, a third colour can be produced from the two colours, the shade of which depends on the ratio of the two starting colours fed into the gun. The shade, viz., the superposition of the two colours can be adjusted partly by relatively displacing the bells 11 and 17 in axial direction and partly by rotating the bells 11 and 17 relatively to each other.

In the spray gun according to the invention, the ratio and conditions of the flow of the fluids in the passages can be regulated in several ways. For instance, by varying the pressure in the passages, or by varying the passage cross sections. In the spray gun according to the invention more than two channels and passages can be located, consequently it can be provided with more than two inserts, grids, bells respectively, for atomising simultaneously more than two sorts of materials.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that changes and modifications may be made in the invention.

What I claim is:

1. Spray gun for the simultaneous electrostatic atomisation of several different fluid materials, in which are separate channels carrying said fluids and opening into concentrically arranged bells, the outermost bell having bladed fitted into outer surface thereon, surrounded by a spray head, each bell having an inner space to store said fluid, a film-producing surface on its inner surface and an atomising edge for the atomisation of said fluid, said atomising edge being suitable for a relative axial and angular displacement, and having in the channels grids electrically connected to a pole of the high-voltage power source, for decelerating the flow of the fluid and for producing turbulence in it, furthermore having an air space between the internal surface of the spray head and the bladed fitted over the outer surface of the outer bell, said air space being connected with an air cushion between a glass sleeve carried by the outer bell and the outer surface of the outer passage, and said air cushion opening into the outer bell; furthermore having said said bell and connected to a compressed air duct, furthermore having air passage openings in the mantle of said outer bell.

2. Spray gun according to claim 1 wherein the dimensions and the mesh size of the grids are variable depending on the viscosity and density of said fluid material flowing through them.

3. Spray gun according to claim 1 wherein said grids and said inserts are made of metal and all the other parts of the spray gun are made of insulating material.

(References on following page)
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<th>FOREIGN PATENTS</th>
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<tbody>
<tr>
<td><strong>UNITED STATES PATENTS</strong></td>
<td><strong>FOREIGN PATENTS</strong></td>
</tr>
<tr>
<td>3,144,209 8/1964 Griffiths 239-15</td>
<td>EVERETT W. KIRBY, Primary Examiner</td>
</tr>
<tr>
<td>3,178,114 4/1965 Point 239-15</td>
<td>U.S. Cl. X.R.</td>
</tr>
<tr>
<td>3,275,239 9/1966 Oesterle 239-3</td>
<td>239-224</td>
</tr>
<tr>
<td>3,358,931 12/1967 Wirth 239-15</td>
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