

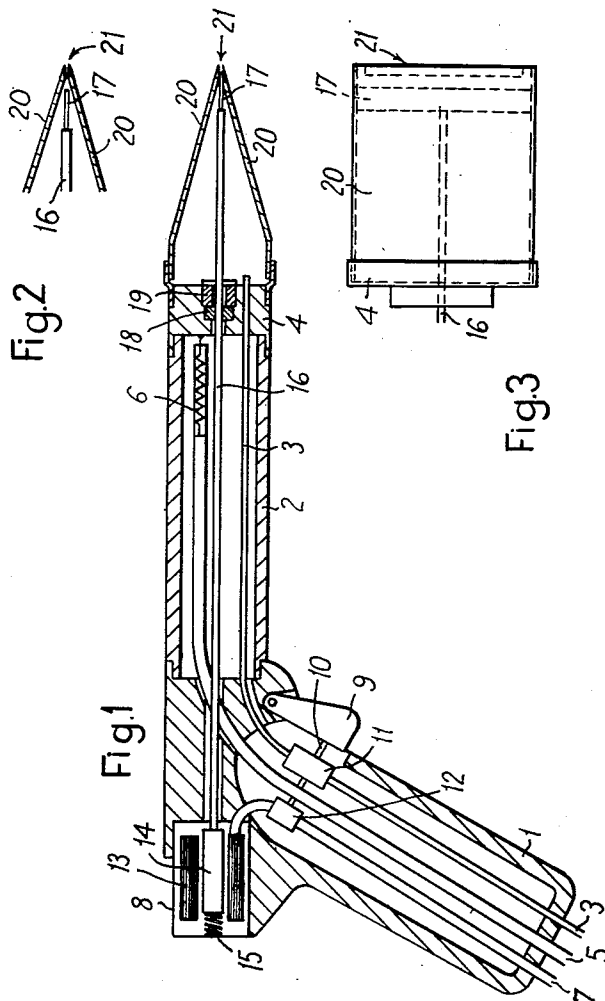
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M. A. R. POINT ET AL
GUNS FOR ATOMIZATION AND ELECTROSTATIC
PROJECTION OF PARTICLES

3,039,696

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2 Sheets-Sheet 1



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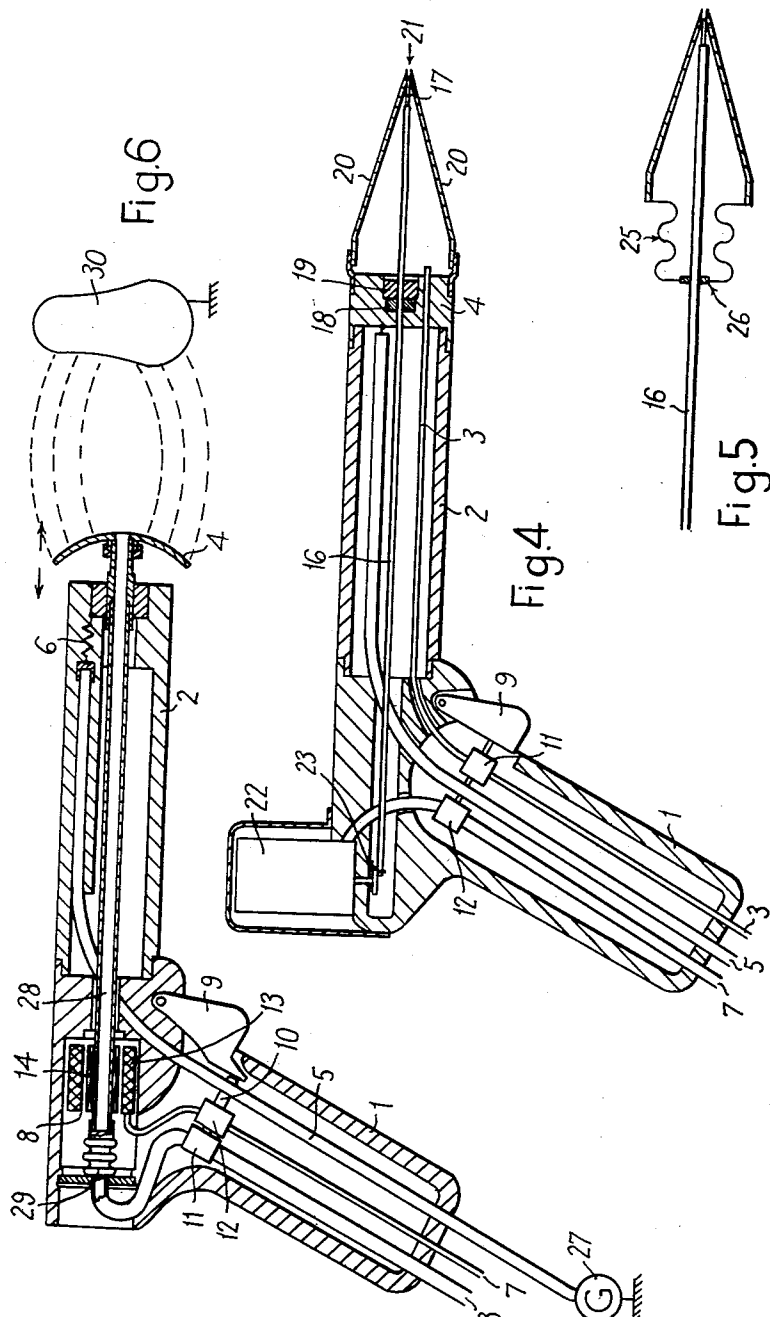
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GUNS FOR ATOMIZATION AND ELECTROSTATIC PROJECTION OF PARTICLES

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The present invention relates to guns, particularly for hand use, for the atomization and electrostatic projection of liquids for the purpose of covering objects, for example with paint.

Apparatus of this kind is known comprising a rotating electrostatic head, made of conducting, semi-conducting or insulating material, in various shapes, in which centrifugal force combines with the electrostatic forces arising between the head and the object to be covered in order to atomize the paint and to project the resulting fine particles on to the object.

According to the present invention, the necessity of rotating the electrostatic head is avoided, the latter being subjected to longitudinal mechanical vibrations in a manner to combine the mechanical action of these longitudinal vibrations with the electrostatic forces existing between the head and the object.

In order more clearly to explain the technical characteristics and the advantages of the invention, several embodiments of guns for electrostatic painting will now be described, by way of example, with reference to the accompanying drawings, in which:

FIGURE 1 is a longitudinal axial section of a gun according to the invention, the outlet orifice of the electrostatic head being closed.

FIGURE 2 is a section of the extremity of the head showing the outlet orifice open.

FIGURE 3 is a plan view of the electrostatic head of FIGURE 1.

FIGURE 4 is a section, similar to that of FIGURE 1, of a modification.

FIGURE 5 shows a modification of the liquid-tight joint between the electrostatic head and the control rod of insulating material.

FIGURE 6 is a longitudinal axial section of another embodiment of gun according to the invention.

Referring to FIGURE 1, it will be seen that the gun comprises a metallic handle 1 to which is fixed, in any appropriate manner, an elongated insulating body 2. Into the handle extend

(a) A pipe 3 of insulating material for the supply of paint under pressure; it opens into the interior of the hollow part of the electrostatic head 4, fixed to the end of the insulating body 2,

(b) A high tension cable 5 which is connected to the head 4 by means of a protective electric resistance 6 of which the value can be several tens of megohms, for example about 50 megohms, and

(c) A low tension cable 7 which is connected to a vibrator 8 which will be described below.

The handle 1 also comprises a trigger 9, operable by the user and associated with a rod 10 by means of which can be controlled a valve 11, which can be progressively opened, inserted in the paint supply pipe 3, and an electric switch 12 connected in the cable 7 supplying current to the vibrator 8. This vibrator, disposed in the rear part of the handle 1, comprises a coil 13 fed with alternating current, for example mains current, by the cable 7, a plunger core 14, preferably of mutually insulated magnetic sheets or of an agglomerated magnetic material such as ferrite, and a restoring spring 15 fixed at one of its ends

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to the end of the vibrator housing and at its other end to the plunger core 14. The latter is extended by a control rod 16 of insulating material having at its end a thin metallic blade 17. The rod 16 passes into the head 4 through an opening in the base of the head 4 provided with a gland 18 which is adjusted by a screw 19 to be liquid-tight while permitting longitudinal displacements of the rod 16.

The electrostatic head 4, of metal or of slightly conducting material, is formed by two flat walls or lips 20 forming therebetween at their free bevelled ends a straight passage 21 into which the blade 17 can be inserted in order to close it. To this end the thickness of the blade 17 is slightly greater than the distance which separates, in the absence of constraints, the two slightly flexible lips 20.

The arrangement of these parts is such that, in the position of rest, the passage 21 is closed.

The operation of the device is as follows:

The high tension being applied to the cable 5, the operator presses on the trigger 9 in order to allow the material to be atomized to be supplied to the head 4 through the pipe 3, and in order to close the circuit of the vibrator 8.

The core 14 of this latter produces a reciprocating longitudinal movement of the rod 16 and the blade 17 in such a manner that this latter closes the passage 21 (FIGURE 1) and opens it (FIGURE 2) successively at the frequency at which the vibrator 8 oscillates. There is thus produced the desired discontinuous and periodic supply of atomized particles towards the object (not shown) to be covered.

In the modification of FIGURE 4, similar parts to those in FIGURE 1 bear the same reference numerals. This modification concerns the means for driving the rod 16. In place of the vibrator 8 a small electric motor 22 is used which actuates the rod 16 through the medium of an appropriate eccentric 23. The motor is fed through the low tension cable 7. The operation of the device is the same as described with reference to the previous embodiment.

In the two embodiments which have been described, it will be seen that the control rod 16 penetrates into the head 4 through a gland 18. It is quite evident that this gland can be replaced by any other equivalent device. For example, as shown in FIGURE 5, a bellows device 25 can be used fixed at one end to the rear of the head 4 and at its other end to a collar 26 fixed to the control rod 16 and forming a tight joint with it. The bellows 25 can itself be replaced by any equivalent flexible device; for example a flexible diaphragm of metal or other elastic material.

Referring to FIGURE 6, which shows another embodiment of a gun according to the invention, it will be seen that the gun comprises a handle 1 to which is fixed in any appropriate manner an elongated body 2 of insulating material. Into this handle extend:

(a) A high tension cable 5 supplied from a high tension generator 27 and connected to the electrostatic head 4, possibly with the insertion of a protective electrical resistance 6. The head 4 may be made of conducting, semi-conducting or insulating material,

(b) A slow tension cable 7 for the supply of current to a vibrator 8, and

(c) A pipe 3 for the supply of paint under pressure.

The handle 1 comprises a trigger 9 which, by means of a rod 10 actuated thereby, controls the actuation of an electric switch 12 connected in the circuit to the vibrator 8 and also a valve 11 for regulating the supply of paint through the pipe 3.

The vibrator 8, for example of the electromagnetic type, comprises a coil 13 supplied with alternating cur-

rent by the cable 7 which is connected, for example, to the mains supply operating at an industrial frequency of 50-60 cycles per second.

The core 14 of the vibrator is fixed to a tube 28 of insulating material which serves a dual purposes. Firstly it is fixed at its outer end to the head 4 after having passed through the end wall of the body 2 which is provided with an appropriate metal bearing. At its other end the tube 28 is attached in a liquid-tight manner to a bellows 29 disposed at the rear of the handle 1 and itself connected to the paint supply pipe 3. The tube 28 can thus conduct the paint to the centre of the head 4. Secondly, since the tube 28 is fixed to the core 14 of the vibrator, it transmits the longitudinal vibrations thereof to the head 4, the bellows 29 permitting these vibrations without the supply of paint through the tube 28 being interrupted.

The operation of the device is as follows:

The high tension being connected to the head 4, the operator actuates the trigger 9 which closes the switch 12 whereby current is fed to the vibrator 8 via the cable 7; moreover the valve 11 opens and starts the supply of paint. The paint is supplied through the tube 28 to the centre of the head 4 which is submitted to the longitudinal vibrations of the core 14 of the vibrator. The mechanical action of these vibrations produces the formation of a film of paint on the surface of the head and cooperates with the electrostatic forces of the field created between the head and the object to be covered (which is preferably connected to earth), in order to draw off this film from the head, to atomize it, and to project the resulting particles on to the object 30.

In the drawing the head is represented as a portion of a sphere but it is to be understood that it can have other shapes.

In the embodiments described, the electrostatic head has been vibrated at a relatively low frequency, namely that of the electric mains supply network. For some applications, or in order to atomize some products, it may be advantageous to use higher frequencies, for example those in the audible frequency spectrum or even ultrasonic frequencies. The member which vibrates the head must, obviously, be adapted to the frequency being used. Thus for example, in the field of ultrasonics, where the invention has interesting applications, the vibrator could be a piezo-electric or magnetostrictive device of an appropriate type.

In the embodiment of FIGURE 6 it has been indicated that the paint arrives through the hollow tube 28 which produces a vibratory movement of the electrostatic head. According to a modification and without departing from the scope of the invention, the paint supply pipe 3, after leaving the valve 11, could be extended to the interior of the hollow insulating body 2, traverse its end and finally terminate at the electrostatic head 4. The tube 28 could then be replaced by a simple rod, similar to the rod 16 of FIGURE 1.

We claim:

1. A gun for the electrostatic atomization and projection of fine particles of a coating material onto an object to be covered, said gun having a fixed head, means for applying mechanical vibrations to a member of the head of said gun, means for applying an electrostatic potential to the head of said gun, wherein the head comprises two fixed flat plates which progressively converge

towards one another and form between their outer ends a narrow opening with flexible edges, means for feeding coating material between said plates towards said opening, and a thin longitudinally vibratable blade, for feeding said opening with coating material in a discontinuous and periodic manner.

2. Gun according to claim 1, wherein an insulating control rod is fixed to the movable core of an electromagnetic vibrator and carries, at its other extremity said thin blade of a thickness at least equal to that of the said opening, said blade alternately opening and closing said opening under the action of the said generator.

3. Gun according to claim 2, wherein a restoring spring is located between the core of the electromagnetic vibrator and its casing such that, when the coil of the vibrator is not energised, the thin blade is moved by the spring into the said opening in order to close it.

4. Gun according to claim 1, wherein an insulating control rod is connected at one of its ends to an eccentric device rotated by an electric motor supported by the handle of the gun, said rod carrying at its other end said thin blade of a thickness at least equal to that of the said opening, said blade alternately closing and opening said opening under the action of the eccentric device.

5. Gun according to claim 2, wherein the rod passes into the head through a fluid-tight gland.

6. Gun according to claim 2 wherein a flexible device, for example a bellows, which is fixed in a liquid-tight manner at one part to the head and by another part to the control rod.

7. A gun for the electrostatic atomization and projection of fine particles of a coating material onto an object to be covered, said gun having a body and a head, said head comprising two fixed flat plates which progressively converge towards one another and form between their outer ends a narrow opening with flexible edges, means for feeding coating material between said plates toward said opening, a thin longitudinally vibratable blade for feeding said opening with coating material in a discontinuous and periodic manner, a rod extending through the body and attached to the blade, means for reciprocating said rod to apply longitudinal vibrations to said blade and means for applying an electrostatic potential to said head.

8. A gun for the electrostatic atomization and projection of fine particles of a coating material onto an object to be covered, said gun having a body and a head, said head comprising two fixed flat plates which progressively converge towards one another and form between their outer ends a narrow opening with flexible edges, means for feeding coating material between said plates towards said opening, a thin longitudinally vibratable blade for feeding said opening with coating material in a discontinuous and periodic manner, an insulating rod extending through the body and attached to the blade, a fluid-tight seal around said rod, means for reciprocating said rod to apply longitudinal vibrations to said blade and means for applying an electrostatic potential to said head.

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