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COMPLETE SPECIFICATION

An Improved Electric Spraying Pistol

I, THEODOR KREBS, of Oberbuchsiten, Switzerland, of Swiss Nationality, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to an electric spraying pistol in which a pressure pump supplies the pressure necessary for the atomisation of the spraying material and the piston thereof is oscillated by an electromagnetically operated armature. In the atomisation of liquids of different viscosity, it is frequently necessary to use nozzles with circular holes disposed between the nozzles with straight orifices, but when a limited number of nozzles are used it is not always possible to obtain the best atomisation. Moreover, in order to obtain a favourable atomisation for the comparatively small storage space of pressure fluid, it is necessary to use a special spraying nozzle. It is especially important for the good operation of the spraying pistol to ensure that the working of the movable parts shall be frictionless as possible. Finally, should it be necessary to disassemble and re-assemble the pump cylinder, the positioning of the suction pipe between the pump piston and the pressure valve of the pump must be absolutely accurate.

The invention is characterised by this that the oscillating armature is provided with a bearing at its end removed from the pressure bolt of the pump piston, which bearing is non-displaceable in a plane parallel to the surface of the electromagnet, which contacts the surface of the oscillating armature, that said surface of the electromagnet is inclined to the axis of the pump, which inclination is determined by the end position of the oscillating armature when it abuts the electromagnet, that an abutment limits the displacement of the pump cylinder in the bore of the casing of the spraying pistol into

the position in which the central line of a recess provided for holding the pump cylinder at its outer periphery coincides with the central line of the outer end of the suction pipe which is screwed in to the casing of the spraying pistol, and that the pump piston delivers the pressure liquid into a whirling space, from which the pressure liquid flows into the spraying nozzle orifice.

The accompanying drawings illustrate, by way of example, various constructions according to the invention.

Fig. 1 is part longitudinal section of one example of construction;

Fig. 2 is a longitudinal section of the examples shown in Fig. 1, on an enlarged scale;

Fig. 3 is a longitudinal section of a second example of construction;

Fig. 4 is a longitudinal section of a third example of construction;

Fig. 5 is a longitudinal section of a fourth example of construction;

Fig. 6 is a longitudinal section of a fifth form of construction;

Fig. 7 is a longitudinal section of a sixth form of construction;

Fig. 8 is a front view, partly in section, of the oscillating armature, taken along the line A—B of Fig. 7;

Fig. 9 is a longitudinal section of the spraying nozzle on an enlarged scale;

Fig. 10 is a longitudinal section of a second form of construction of the spraying nozzles;

Fig. 11 is a longitudinal section of a third form of construction of the spraying nozzle; and

Fig. 12 is a side elevation of the spraying pistol with the screwed on spraying nozzle, according to Fig. 11, shown partly in section.

In the various figures, 1 is the casing of the spraying pistol, 10 is the pump piston, 11 is the return spring, 12 is the pump cylinder and 8 is the pressure bolt of the pump piston.

Referring to the construction shown in 90

Figs. 1 and 2 a longitudinal groove 12a is provided on the outer periphery of the pump cylinder at its inner end; a pin 1c is secured to the casing 1 of the spraying pistol, which pin projects into the groove 12a; this pin may consist for instance, of the inner end of a screw 1a screwed into the casing 1. The groove 12a has such a length that the pin 1c abuts against the inner end 12b of the groove 12a when the central line of the recess 12c of the pump cylinder 12 coincides with the central line of the outer end 18a of the suction pipe which is incorporated in the casing of the spraying piston.

The incorporation and the attachment of the pump cylinder is effected by the pump cylinder being pushed from the front end into the bore provided for the pump cylinder until the inner end 12d of the pump cylinder abuts against the cylindrical part 1c of the screw 1a. By turning the pump cylinder, the opening of the groove 12a reaches the cylindrical part 1c of the screw 1a and the pump cylinder can now be further pushed into the casing 1 until the cylindrical part 1c of the screw 1a lies against the inner end 12b of the groove 12a. In this position, the central line of the recess 12c provided on the periphery of the pump cylinder coincides with the central line of the screw-thread provided in the casing 1 for the outer end of the suction pipe 18. Now, the suction pipe is screwed into the casing 1, whereby the outer spherical or conical end 18a of the suction pipe comes to lie in the spherical or conical recess 12c of the pump cylinder, so that the pump cylinder is secured against axial displacement.

In the example of construction shown in Fig. 3, a longitudinal groove 1a is provided in the bore of the casing 1 of the pump cylinder, which longitudinal groove extends up to the outer end of the casing 1. A pin 1c secured to the pump cylinder 12 projects into the groove 1a; this pin may for instance consist of the outer end of a screw 12a which is screwed into the pump cylinder. The groove 1a has such a length that the pin 1c abuts against the end 1b of the groove 1a when the central line of the recess 12c in the pump cylinder 12 coincides with the central line of the outer end 18a of the suction pipe 18, which is screwed into the casing of the spraying pistol.

Since the groove 1a extends up to the outer end of the pump cylinder, the pin 1c can be introduced into the groove 1a without any difficulty when the pump cylinder is pushed into the bore provided in the casing 1 for the pump cylinder, and no subsequent rotation of the pump cylinder is necessary in order to introduce the pin into the groove, as may be the case with the example of construction shown in Figs. 1 and 2.

Fig. 4 shows a modification of the con-

struction shown in Fig. 3 in which a vertical slot 1a is provided in the casing 1 of the spraying pistol, through which slot the pin 1c is introduced and is detachably connected with the pump cylinder. As soon as the pump cylinder has reached its right position with respect to the casing, the pin 1c has also reached the inner end 1b of the slot 1a in the casing of the spraying pistol.

In the example of construction shown in Fig. 5, the pump cylinder 12 is provided with a flange 12e which abuts against the stop 1b of the casing 1 acting as an abutment when the pump cylinder is pushed into the bore provided for the pump cylinder in the casing of the spraying pistol. Also in this case the central line of the recess 12c of the pump cylinder 12 coincides with the central line of the screw-thread provided in the casing for the suction pipe 18.

In the example of construction shown in Figs. 6, 7 and 8, the angle α which the surface 4a of the electromagnet encloses with the axis of the pump piston is greater than 90° . In the construction shown in Fig. 6, one side of the lower end of the oscillating armature 5 abuts against the lower front side of the packet of stampings 4 of the electromagnet 23, whilst a spherical recess 5d is provided on the opposite side into which comes to lie the spherical end of a pin 5a, which is guided in the bore 5e of a bolt 5f screwed into the casing and, by means of a spring 56 provided in this bore, presses the lower end of the oscillating armature 5 against the lower end of the packet of stampings of the electromagnet 23.

The upper end of the oscillating armature 5 is reduced up to its middle 5g on the side facing the pressure bolt 8, and is provided on this surface with a longitudinal slot 5c in which engages the pressure bolt 8. Against the flat side 5h of the oscillating armature 5 opposite to that of the longitudinal slot, lies the spherical end of the adjusting bolt 24, which is reduced to accommodate the regulating spring 7, and is guided at its inner and outer ends in the regulating screw 6 which can be adjusted in the casing by a screw-thread connection.

In the modified constructions shown in Figs. 7 and 8, the lower extended end of the lower oscillating armature 5 is pivoted to a pin 5a by means of a spindle 5k, which pin is guided in the bore 5e of a bolt 5f screwed into the casing. By means of a spring 5b, provided in this bore, the lower end of the oscillating armature 5 is pressed against the lower end of the packet of stampings 4 of the electromagnet by the pin 5a.

In this form of construction, the upper end of the oscillating armature 5 is provided on the side facing the pressure bolt 8 with a longitudinal slot 5c in which engages the pressure bolt 8, and is reduced up to its

middle 5h on the side opposite this slot. Against this reduced flat side 5h of the oscillating armature 5 lies the spherical end of the adjusting bolt 24 which is reduced to accommodate the adjusting spring 7, and is guided at its inner and outer end in the adjusting screw 6, which can be displaced in the casing by a screw-thread connection.

In the form of construction shown in Fig. 9, the outer end of the pressure pump cylinder 12 is closed by a screw cap in which the cylindrical spraying nozzle 3a is incorporated, which nozzle closes the whirling space 3f by its end facing the nozzle orifice 3e, and is provided on a circumferential edge 3c contacting the inner surface of that space with a great number of indentations which are at a distance from the axis of the nozzle. In this form of construction, the said edge of the cylindrical spraying nozzle 3a touching the conical inner surface of the whirling space 3f along a circumferential line 3c is provided with at least six notches, which open into the space 3f at a definite angle with respect to the radius passing through the outer inlet points of the notches.

Fig. 10 is a modification of the construction shown in Fig. 9, in which the outer end of the pressure pump cylinder is also provided with a screw cap 3, in which lies the cylindrical spraying nozzle 3a, which is however, provided at its outer end with a removable cap 3d in which lies a portion of the space 3f and the nozzle orifice 3e. In this construction the cap 3d is screwed on to the screw cap.

Figs. 11 and 12 show a construction in which a rotary movement is imparted to the spraying material by means of helical grooves f provided on the needle side of the nozzle piston b. This rotary movement is imparted to the spraying material around the nozzle needle d of the nozzle piston b, which nozzle needle projects into the whirling space c of the screw cap i, this space being closed by the end of the nozzle piston b facing the nozzle orifice e. The annular outlet formed by the orifice e of the screw cap i and the nozzle needle projecting therein can be varied continuously by the relative displacement of the screw cap of the nozzle orifice with respect to the nozzle needle. The whirling space of the screw cap i of the nozzle orifice passes from a cylindrical part c into a conical part c' which lies on the side of the nozzle orifice e.

On the opposite side of the said whirling space with respect to the nozzle orifice, there is provided a hollow space c'', which is open to the outside. On the peripheral surface of the nozzle piston b four helical grooves f are provided, of which two next to one another are at right angles to each other and all of them connect the whirling space c of the screw cap i with the annular space e' pro-

vided on the peripheral surface of the piston b, which space leads through a bore f' that is at right angles to the longitudinal axis of the piston of the nozzle needle to the pressure space g for the spraying material. The space c in the screw cap i of the nozzle orifice is made tight to the outside by a packing ring h provided on the peripheral surface of the nozzle needle piston b and the screw cap i of the nozzle orifice is held in its position opposite the piston b of the nozzle needle by a screw-thread connection. The end of the nozzle needle piston b facing the spraying pistol is firmly connected with the outer end of the pressure pump cylinder 12.

In my Specification No. 732,606 I claim a spray-gun in which the spraying is effected without the use of compressed air by a piston pump actuated by the oscillating armature of an electromagnet, and for purposes of regulating the piston stroke a regulating screw acts on the pump piston through an interposed spring member, characterised by the feature that one side of the bottom end of a bar-like oscillating armature bears against the lower front end of the bundle of laminations of an electromagnet secured in the rear part of the spray-gun, whilst the opposite side of the bottom end of the oscillating armature is secured against displacement in its longitudinal and transverse directions by a spring-mounted pin.

What I claim is:—

1. Electric spraying pistol in which a pressure pump supplies the pressure necessary for the atomisation of the spraying material and the piston of this pressure pump is caused to oscillate by an electromagnetically operated armature, characterised by that the oscillating armature is provided with a bearing at its end removed from the pressure bolt of the pump piston, which bearing is non-displaceable in a plane parallel to the surface of the electromagnet, which contacts the surface of the oscillating armature, that said surface of the electromagnet is inclined to the axis of the pump which inclination is determined by the end position of the oscillating armature when it abuts the electromagnet, that an abutment limits the displacement of the pump cylinder in the bore of the casing of the spraying pistol into the position in which the central line of a recess provided for holding the pump cylinder at its outer periphery coincides with the central line of the outer end of the suction pipe which is screwed in to the casing of the spraying pistol, and that the pump piston delivers the pressure liquid into a whirling space, from which the pressure liquid flows into the spraying nozzle orifice.

2. A spraying pistol as claimed in Claim 1, characterised by that a longitudinal groove is provided on the outer periphery of the inner end of the pump cylinder and a pin



middle 5h on the side opposite this slot. Against this reduced flat side 5h of the oscillating armature 5 lies the spherical end of the adjusting bolt 24 which is reduced to accommodate the adjusting spring 7, and is guided at its inner and outer end in the adjusting screw 6, which can be displaced in the casing by a screw-thread connection.

In the form of construction shown in Fig. 9, the outer end of the pressure pump cylinder 12 is closed by a screw cap in which the cylindrical spraying nozzle 3a is incorporated, which nozzle closes the whirling space 3f by its end facing the nozzle orifice 3e, and is provided on a circumferential edge 3c contacting the inner surface of that space with a great number of indentations which are at a distance from the axis of the nozzle. In this form of construction, the said edge of the cylindrical spraying nozzle 3a touching the conical inner surface of the whirling space 3f along a circumferential line 3c is provided with at least six notches, which open into the space 3f at a definite angle with respect to the radius passing through the outer inlet points of the notches.

Fig. 10 is a modification of the construction shown in Fig. 9, in which the outer end of the pressure pump cylinder is also provided with a screw cap 3, in which lies the cylindrical spraying nozzle 3a, which is however, provided at its outer end with a removable cap 3d in which lies a portion of the space 3f and the nozzle orifice 3e. In this construction the cap 3d is screwed on to the screw cap.

Figs. 11 and 12 show a construction in which a rotary movement is imparted to the spraying material by means of helical grooves f provided on the needle side of the nozzle piston b. This rotary movement is imparted to the spraying material around the nozzle needle d of the nozzle piston b, which nozzle needle projects into the whirling space c of the screw cap i, this space being closed by the end of the nozzle piston b facing the nozzle orifice e. The annular outlet formed by the orifice e of the screw cap i and the nozzle needle projecting therein can be varied continuously by the relative displacement of the screw cap of the nozzle orifice with respect to the nozzle needle. The whirling space of the screw cap i of the nozzle orifice passes from a cylindrical part c into a conical part c' which lies on the side of the nozzle orifice e.

On the opposite side of the said whirling space with respect to the nozzle orifice, there is provided a hollow space c'', which is open to the outside. On the peripheral surface of the nozzle piston b four helical grooves f are provided, of which two next to one another are at right angles to each other and all of them connect the whirling space c of the screw cap i with the annular space c'' pro-

vided on the peripheral surface of the piston b, which space leads through a bore f' that is at right angles to the longitudinal axis of the piston of the nozzle needle to the pressure space g for the spraying material. The space c in the screw cap i of the nozzle orifice is made tight to the outside by a packing ring h provided on the peripheral surface of the nozzle needle piston b and the screw cap i of the nozzle orifice is held in its position opposite the piston b of the nozzle needle by a screw-thread connection, the end of the nozzle needle piston b facing the spraying pistol is firmly connected with the outer end of the pressure pump cylinder 12.

In my Specification No. 732,606 I claim a spray-gun in which the spraying is effected without the use of compressed air by a piston pump actuated by the oscillating armature of an electromagnet, and for purposes of regulating the piston stroke a regulating screw acts on the pump piston through an interposed spring member, characterised by the feature that one side of the bottom end of a bar-like oscillating armature bears against the lower front end of the bundle of laminations of an electromagnet secured in the rear part of the spray-gun, whilst the opposite side of the bottom end of the oscillating armature is secured against displacement in its longitudinal and transverse directions by a spring-mounted pin.

What I claim is:—

1. Electric spraying pistol in which a pressure pump supplies the pressure necessary for the atomisation of the spraying material and the piston of this pressure pump is caused to oscillate by an electromagnetically operated armature, characterised by that the oscillating armature is provided with a bearing at its end removed from the pressure bolt of the pump piston, which bearing is non-displaceable in a plane parallel to the surface of the electromagnet, which contacts the surface of the oscillating armature, that said surface of the electromagnet is inclined to the axis of the pump which inclination is determined by the end position of the oscillating armature when it abuts the electromagnet, that an abutment limits the displacement of the pump cylinder in the bore of the casing of the spraying pistol into the position in which the central line of a recess provided for holding the pump cylinder at its outer periphery coincides with the central line of the outer end of the suction pipe which is screwed in to the casing of the spraying pistol, and that the pump piston delivers the pressure liquid into a whirling space, from which the pressure liquid flows into the spraying nozzle orifice.

2. A spraying pistol as claimed in Claim 1, characterised by that a longitudinal groove is provided on the outer periphery of the inner end of the pump cylinder and a pin



projecting into the said groove is firmly connected to the casing of the spraying pistol, that the said groove is of such length that the pin abuts against the inner end of the 5 groove when the central line of the recess provided on the outer periphery of the pump cylinder coincides with the central line of the outer end of the suction pipe incorporated in the casing of the spraying pistol.

10 3. A spraying pistol as claimed in Claims 1 and 2, characterised by this that the pin that is guided in the groove of the pump cylinder consists of the inner end of a screw which is screwed into the casing of the spray- 15 ing pistol.

4. A spraying pistol as claimed in Claim 1, characterised by that a longitudinal groove is provided in the bore of the casing of the spraying pistol intended for the pump 20 cylinder, which longitudinal groove extends up to the outer end of the casing, that a pin which is firmly connected to the pump cylinder projects into the said groove, and that the groove has such a length that the 25 pin abuts against its inner end when the centre line of the recess provided on the outer periphery of the pump cylinder coincides with the centre line of the outer end of the suction pipe which is screwed into the 30 casing of the spraying pistol.

5. A spraying pistol as claimed in Claims 1 and 4, characterised by that the pin guided in the groove of the casing of the spraying pistol consists of the outer end of a screw 35 which is screwed into the pump cylinder.

6. A spraying pistol as claimed in Claim 1, characterised by that a vertical slot is provided in the casing of the spraying pistol in which the pin which is to be fixed in the 40 pump cylinder is guided, and that as soon as the pump cylinder comes to lie in its right position with respect to the casing of the spraying pistol, the pin abuts against the inner end of the slot in the casing of the 45 spraying pistol.

7. A spraying pistol as claimed in Claim 1, characterised by that the pump cylinder is provided with a flange which comes to lie against reduced part in the casing of the 50 spraying pistol and serves as an abutment when the pump cylinder is pushed into the bore provided in the casing for the pump cylinder, and that in this position of the pump cylinder the centre line of the recess 55 provided on the outer periphery of the pump cylinder coincides with the centre line of the screw-thread provided in the casing of the spraying pistol for the suction pipe.

8. A spraying pistol as claimed in Claim 60 1, characterised by that the angle which the surface of the electromagnet contacting the oscillating armature encloses with the axis of the pump piston is greater than 90° .

9. A spraying pistol as claimed in Claim 1, 65 characterised by that the one side of the

lower end of the oscillating armature abuts against the lower front side of the packet of stampings of the electromagnet and a spherical recess is provided on the opposite side into which comes to lie the spherical 70 end of a pin which is guided in the bore of a bolt screwed into the casing, and presses by means of a spring, provided in this bore, the lower end of the oscillating armature against the lower end of the packet of stampings of 75 the electromagnet.

10. A spraying pistol as claimed in Claim 1, characterised by that the upper end of the oscillating armature is reduced up to its centre on the side facing the pressure bolt 80 and longitudinal slot is provided in this surface in which engages the pressure bolt of the pump piston, and that the spherical end of the adjusting bolt abuts against the flat side of the oscillating armature lying opposite 85 the said longitudinal slot, which adjusting bolt is reduced in order to receive the regulating spring and is guided at its inner and outer ends in a regulating screw, which can be displaced in the casing by a screw-thread 90 connection.

11. A spraying pistol as claimed in Claim 1, characterised by that the lower extended end of the oscillating armature is articulated to a pin by means of a shaft which pin is 95 guided in the bore of a bolt screwed into the casing and that, under the action of a spring provided in the said bore, the lower end of the oscillating armature is pressed by means of the pin against the lower end of the 100 packet of stampings of the electromagnet.

12. A spraying pistol as claimed in Claim 1, characterised by that the upper end of the oscillating armature is provided on the side facing the pressure bolt with a longitudinal 105 slot in which engages the pressure bolt, that the said upper end is reduced on the side lying opposite the slot up to its middle, and that the spherical end of a regulating bolt abuts against the reduced flat side of the 110 oscillating armature which regulating bolt is reduced and is guided at its inner and its outer end in a regulating screw which is adapted to be displaced by screw-threading in the casing. 115

13. A spraying pistol as claimed in Claim 1, characterised by that a screw-cap is provided at the outer end of the pump cylinder, into which the cylindrical spraying nozzle is built, the latter closing a whirling space with 120 the front end facing the nozzle orifice and being provided with a large number of notches, which are at a distance from the axis of the nozzle, along an edge contacting the inner surface of the said space along a 125 circular line.

14. A spraying pistol as claimed in Claims 1 and 13, characterised by that the conical inner surface of the whirling space is provided with at least six notches on an edge 130



of the cylindrical spraying nozzle making contact along the circular line, which notches open into the interior of the said space, at a definite angle with respect to the radius 5 which passes through the outer inlet point of the notches.

15. A spraying pistol as claimed in Claim 1, characterised by that a screw-cap is provided at the outer end of the pressure pump 10 cylinder, in which the cylindrical spraying nozzle is mounted, and that the said screw-cap is provided at its outer end with a removable cap, in which there is provided part of the whirling space and the nozzle orifice.

16. A spraying pistol as claimed in Claims 1 and 15, characterised by that the removable cap is screwed onto the screw-cap.

17. A spraying pistol as claimed in Claim 1, characterised by that a rotary movement is 20 imparted to the spraying material around a nozzle needle by means of helical grooves which are provided on the needle side of a nozzle piston, in the space of the screw cap closed by the nozzle needle piston into which 25 the nozzle needle projects, and that an annular outlet surface which is formed by the hole of the nozzle screw-cap and the nozzle needle projecting into the said hole is continuously varied by the relative dis- 30 placement of the screw-cap with respect to the nozzle needle.

18. A spraying pistol as claimed in Claims 1 and 17, characterised by that the whirling space of the screw-cap of the nozzle orifice 35 passes from a cylindrical part towards the hole of the said screw-cap into a conical part,

and that a cylindrical hollow space which is open towards the outside is provided on the side lying opposite the whirling space with respect to the nozzle orifice.

19. A spraying pistol as claimed in Claims 1 and 18, characterised by that on the peripheral surface of the nozzle needle piston four helical grooves are provided, of which the two next to one another are at right 45 angles to each other, and all of them connect the whirling space of the screw-cap of the nozzle with an annular space provided on the peripheral surface of the piston of the nozzle needle, which annular space leads through 50 a bore which is at right angles to the longitudinal axis of the piston of the nozzle needle into the pressure space for the spraying material.

20. A spraying pistol as claimed in Claims 1 and 19, characterised by that the whirling space of the screw-cap of the nozzle is made tight towards the outside by means of a packing ring provided in the peripheral surface of the piston of the nozzle needle, that the 60 screw-cap of the nozzle is held in its position with respect to the piston of the nozzle needle by means of a screw connection, and that the end of the nozzle needle piston facing the spraying pistol is firmly connected to 65 the outer end of the pressure pump cylinder of the spraying pistol.

21. An improved electrical spraying pistol, substantially as described with reference to the accompanying drawings.

MARKS & CLERK.

