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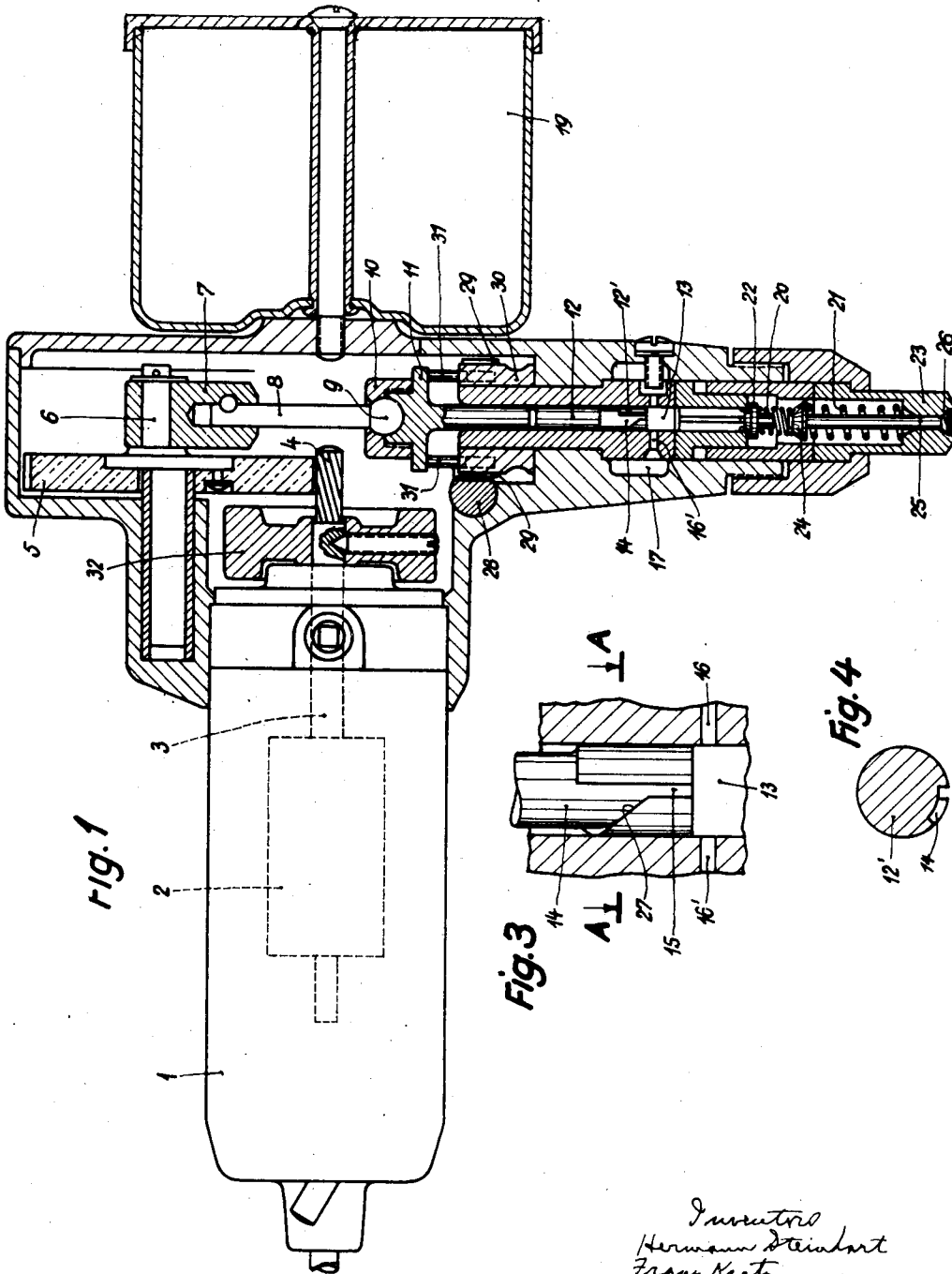
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2,013,639

APPARATUS FOR SPRAYING LIQUIDS SUCH AS PAINTS, VARNISHES OR THE LIKE

Filed Aug. 2, 1934

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

Fig. 2

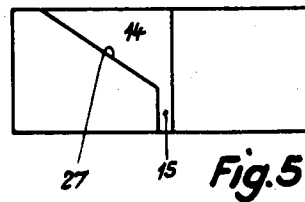
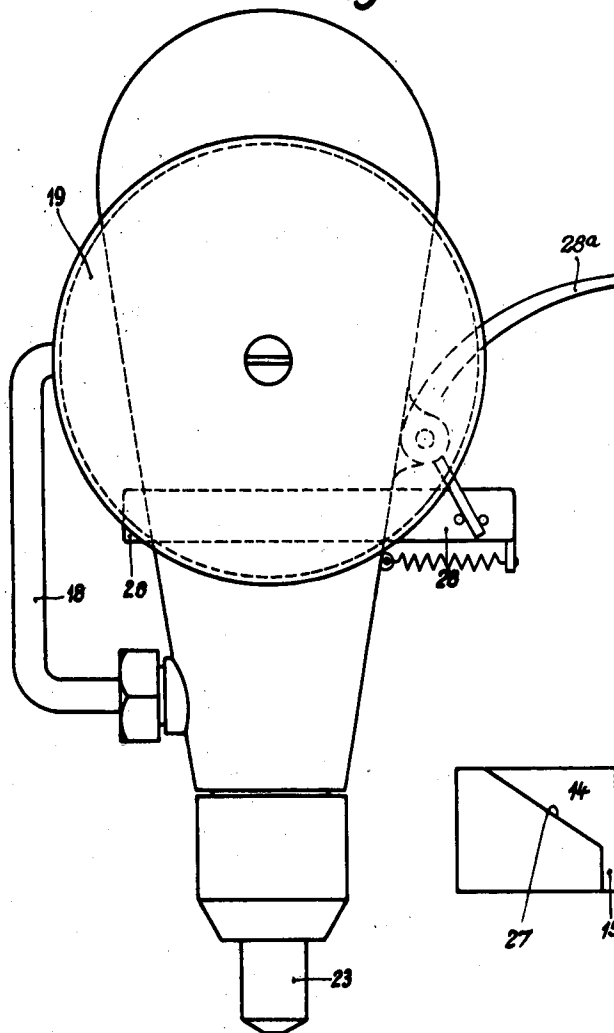


Fig. 5

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UNITED STATES PATENT OFFICE

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APPARATUS FOR SPRAYING LIQUIDS SUCH
AS PAINTS, VARNISHES, OR THE LIKE

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In Germany April 7, 1932

7 Claims. (Cl. 299—97)

The present invention relates to the spraying
of liquids such as paints, varnishes or the like.

Apparatus in which compressed air is em-
ployed for spraying liquids, more especially
paints, on to objects of all kinds are already
known. In this method the particles of paint
are carried by a current of compressed air and
precipitated in the form of a spray on the ob-
jects in question. This compressed air method
however, has the drawback that a cloud of paint
is formed which spreads out on all sides, and
not only soils the surroundings of the working
place, but also deleteriously affects the health of
the worker operating the spraying apparatus.

The further known method of placing the
paint itself under pressure and blowing it out by
air without mingling with the air has hitherto
not been successful, because the pressures used
did not produce such an atomization at the out-
let of the nozzle which fulfilled all requirements
in regard to a uniform application of the paint.
That is a mere trickling.

The present invention is based on the recogni-
tion of the fact that the employment of pressures
of at least 100 atmospheres, that is, an increase
by many times of the usual pressures, is necessary
for attaining this object. For this purpose,
means are provided according to the invention
for bringing the liquid to such a high pressure,
for example, to several hundred atmospheres,
that it is at once atomized into the finest parti-
cles on emerging from a narrow nozzle, owing to
the sudden relaxation of pressure and yet con-
tinues only in a single definite direction.

Two examples of construction of the invention
are shown in the accompanying drawings which
show hand appliances constructed in accordance
with the invention.

Figure 1 is an elevation of an appliance using
a piston pump, partly in section, and

Figure 2 is a plan view thereof.

Figures 3-5 show details of the pump piston.
In the handle 1 of the appliance a small elec-
tric motor 2 is contained, the shaft 3 of which
terminates in a pinion 4, which gears with a
toothed wheel 5. To the toothed wheel 5 is eccen-
trically fastened a pin 6 on which the head 7 of a
connecting rod 8 is revolvably mounted. The
connecting rod 8 at its other end has a ball-joint
9. The ball head of this joint is connected by a
nut 10 with the rear end 11 of a piston rod 12.
At the front end of the piston-rod 12 is a piston
12' which, driven by the connecting rod, performs
a reciprocating movement. 13 is a compression
chamber situated in front of the piston.

14 is a chamber recessed out on the periphery
of the piston 12'. To explain the mode of work-
ing of this chamber, the piston is shown on an
enlarged scale in Fig. 3. Fig. 4 shows a section
through the piston on the line A-A of Fig. 3, and
Fig. 5 is a development of the piston periph-
ery. As will be seen from Figs. 3-5, the recessed
part 14 communicates with the compression
chamber 13 through a slot 15. 16 and 16' are
two openings in the wall of the cylinder, which
are in communication with the paint supply
chamber 17. The chamber 17 is connected by
the pipe 18 (Fig. 2) with the paint container 19.

On the upward stroke of the piston, the cham-
ber 13 is filled through the openings 16, 16' with
the paint to be sprayed. When the piston again
moves forward it closes the openings 16 and 16'.
As soon as these openings are closed the pressure
on the liquid begins. The spring 20 opposes the
pressure on the valve 22 seated in the bottom of
the cylinder. The spring 20 is relatively weak.
It has no importance for the spraying operation;
it acts only as a pressure spring for the non-
return valve 22 which is adapted to prevent the
paint being again sucked back from the ante-
chamber of the nozzle on the backward move-
ment of the piston. The substantial force which
opposes the pressure of the paint is the force of
the spring 21. This spring is extremely strong.
It bears at one side against the wall 23 of a spray-
ing nozzle situated below the cylinder, and on
the other side against a stop 24, which is secured
at the upper end of the nozzle needle 25. As soon
as the pressure of the paint overcomes the coun-
terforce of the spring, for instance, 100-200 at-
mospheres, the valve head 26 of the nozzle needle
is raised from its seat, and the paint standing
under the extremely high pressure is discharged
through the small opening which results into the
atmosphere and at the same time atomized into
the finest particles.

The spraying out of the paint during each
stroke lasts until in the downward movement of
the piston the edge 27 at the forward end of the
recess 14 in the piston reaches the opening 16'
in the cylinder wall. The pressure of the paint
immediately drops, since the pressure becomes
equalized from the compression chamber 13
through the slot 15, the chamber 14, the paint
supply chamber 17 and the connecting pipe 18 to
the paint container 19.

The quantity of paint to be sprayed by the
hand appliance per stroke of the piston or per
unit of time for a given piston speed may be
easily adjusted by turning the piston rod 12 about

its axis. For this purpose, a toothed rack-bar 28 is employed, which engages in the toothed ring 29 of a sleeve 30 surrounding the upper end of the cylinder. In the sleeve 30 two pins 31 are axially displaceable, and are connected with the upper end 11 of the piston rod 12. If the toothed rack-bar 28 which projects out from the pump casing (see Fig. 2) is displaced, the toothed ring 29, and thus also the pump piston 12, is turned about its axis. For an easy displacement of the bar 28, it may be connected to a trigger lever 28^a. By this means the position of the edge 27 is varied in relation to the opening 16'. According as the piston is rotated in one direction or the other, a longer or a shorter time is necessary, on the downward movement of the piston, until the inclined edge 27 and thus the recessed chamber 14 reaches the opening 16'. The equalization of pressure, and thus the end of the spraying at each stroke consequently takes place later or earlier according to the arbitrary adjustment of the toothed rack-bar, so that the quantity of paint sprayed can be conveniently controlled in this way.

On the shaft 3 of the motor 2 is also mounted a flywheel 32 which tends to relieve the motor from the extreme variations in load as the piston 12' reciprocates in opposite directions and to ensure smooth running thereof.

In the arrangement described a relatively small motor is employed, for by the adjustment of the toothed rack-bar 28 the motor can be allowed to run idly until it has had sufficient time to accelerate all the masses.

If very large quantities of paint are to be sprayed with the apparatus described, the paint container 19 is not built on the hand appliance, but arranged at another suitable place and connected by a flexible pipe with the paint supply chamber 17.

The appliance described is made in the form of a pistol, the motor being arranged in the handle and the pump in the barrel of the pistol. Other constructions could however also be employed.

The object of our invention may be also used for spraying other liquids than paint in finest particles on to objects of all kinds. The process disclosed herein is disclosed and claimed in our divisional application Serial No. 2294, filed January 17, 1935.

We declare that what we claim is:

1. An apparatus for spraying liquids such as paint, varnish or the like comprising a piston pump for compressing liquid to high pressure in which pump the piston has a recessed chamber on its periphery by which the pressure in the compression chamber and in the supply pipe is equalized and thus the effective stroke of the piston terminated when the edge of the forward end of the recessed chamber reaches the supply opening in the cylinder wall on the forward stroke of the piston, said forward edge of the recessed chamber being inclined whilst the piston is adapted for angular displacement about its own axis in order to vary the effective stroke of the piston and thus to vary the quantity of liquid delivered per stroke, a nozzle and nozzle needle tending to prevent passage of liquid through the nozzle and standing under a spring pressure and releasing only at a pressure of at least 100 atmospheres, said pumping and spraying device being arranged within the barrel of a pistol-shaped hand-appliance whilst an electric motor driving the pump is arranged within the handle of the pistol.

2. An apparatus for spraying liquids such as

paint, varnish or the like comprising a piston pump for compressing liquid to high pressure in which pump the piston has a recessed chamber on its periphery and communicating with the piston head by which the pressure in the compression chamber and in the supply pipe is equalized and thus the effective stroke of the piston terminated when the edge of the forward end of the recessed chamber reaches the supply opening in the cylinder wall on the forward stroke of the piston, said forward edge of the recessed chamber being inclined and said piston being adapted for angular displacement about its own axis in order to vary the effective stroke of the piston and thus to vary the quantity of liquid delivered per stroke, a nozzle and nozzle needle tending to prevent passage of liquid through the nozzle and standing under a spring pressure and releasing only at a pressure of at least 100 atmospheres, said pumping and spraying device being arranged within the barrel of a pistol-shaped hand-appliance, an electric motor for driving the pump being arranged within the handle of said appliance, a paint container arranged on said hand-appliance, and means including a trigger for effecting angular displacement of the piston.

3. A unit spray device of the character described for applying coating liquids such as paints, varnishes or the like in a spray of finely divided form comprising a nozzle, and a pump including a piston for compressing liquid to high pressure and forcing it through said nozzle, said pump piston having a recessed peripheral chamber communicating with the piston head by which the pressure in the compression chamber and supply pipe of said pump is equalized and thus the effective stroke of the piston terminated when the edge of the forward end of the recessed chamber reaches the supply opening in the pump cylinder wall on the forward stroke of said piston, said forward edge of the recessed chamber being inclined and said piston being adapted for angular displacement about its axis in order to vary the effective stroke of the piston and thus to vary the quantity of liquid delivered per stroke, and means including a trigger for effecting angular displacement of said piston.

4. A unit spray device of the character described for applying liquids such as paints, varnishes or the like in a spray of finely divided form comprising a liquid supply, a nozzle, valve means tending to prevent passage of liquid through said nozzle and loaded to release only at a pressure of at least 100 atmospheres, a pump provided with a reciprocable piston and having its discharge outlet adjacent said nozzle, and an electric motor for rapidly reciprocating said piston to intermittently apply pressure impulses in rapid succession and at high velocity directly to relatively small quantities of said liquid to force it at high velocity and pressure and without admixture of air through said nozzle, said pump piston having a recessed peripheral chamber communicating with the piston head by which the pressure in the compression chamber and supply pipe of said pump is equalized and thus the effective stroke of the piston terminated when the edge of the forward end of the recessed chamber reaches the supply opening in the pump cylinder wall on the forward stroke of said piston, said forward edge of the recessed chamber being inclined and said piston being adapted for angular displacement about its axis in order to vary the effective stroke of the piston and thus to vary the quantity of liquid delivered per stroke, and means

including a trigger for effecting angular displacement of said piston.

5. A unit spray device of the character described for applying coating liquids such as paints, varnishes or the like in a spray of finely divided form comprising a nozzle, a pump provided with a reciprocable piston and having its discharge outlet adjacent said nozzle, and a motor for rapidly reciprocating said piston to intermittently apply pressure impulses in rapid succession and at high velocity directly to relatively small quantities of said liquid to force it at high velocity and pressure and without admixture of air through said nozzle, said piston having a recessed peripheral chamber communicating with the piston head by which the pressure in the compression chamber and supply pipe of said pump is equalized and thus the effective stroke of the piston terminated when the edge of the forward end of the recessed chamber reaches the supply opening in the pump cylinder wall on the forward stroke of said piston, said forward edge of the recessed chamber being inclined and said piston being adapted for angular displacement about its axis in order to vary the effective stroke of the piston and thus to vary the quantity of liquid delivered per stroke, and means for effecting angular displacement of said piston.

6. A portable self-contained hand spray device for applying coating liquids such as paints, varnishes or the like in a spray of finely divided

form comprising a liquid supply, a nozzle, provided with means for applying high resistance to the passage of liquid therethrough, a pump provided with a reciprocable piston and having its discharge outlet adjacent said nozzle, and a motor for rapidly reciprocating said piston to intermittently apply pressure impulses in rapid succession and at high velocity directly to relatively small quantities of said liquid to force it at high velocity and pressure and without admixture of air through said nozzle as a substantially continuous spray.

7. A portable self-contained hand spray device for applying liquids such as paints, varnishes or the like in a spray of finely divided form comprising a liquid supply, a nozzle, valve means tending to prevent passage of liquid through said nozzle and loaded to release only at a pressure of at least 100 atmospheres, a pump provided with a reciprocable piston and having its discharge outlet adjacent said nozzle, and a motor for rapidly reciprocating said piston to intermittently apply pressure impulses in rapid succession and at high velocity directly to relatively small quantities of said liquid to force it at high velocity and pressure and without admixture of air through said nozzle as a substantially continuous spray.

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