Sept. 3, 1935. H. STEINHART ET AL. 2,013,640

METHOD FOR APPLYING COATING LIQUIDS SUCH AS PAINTS, VARNISHES OR THE LIKE

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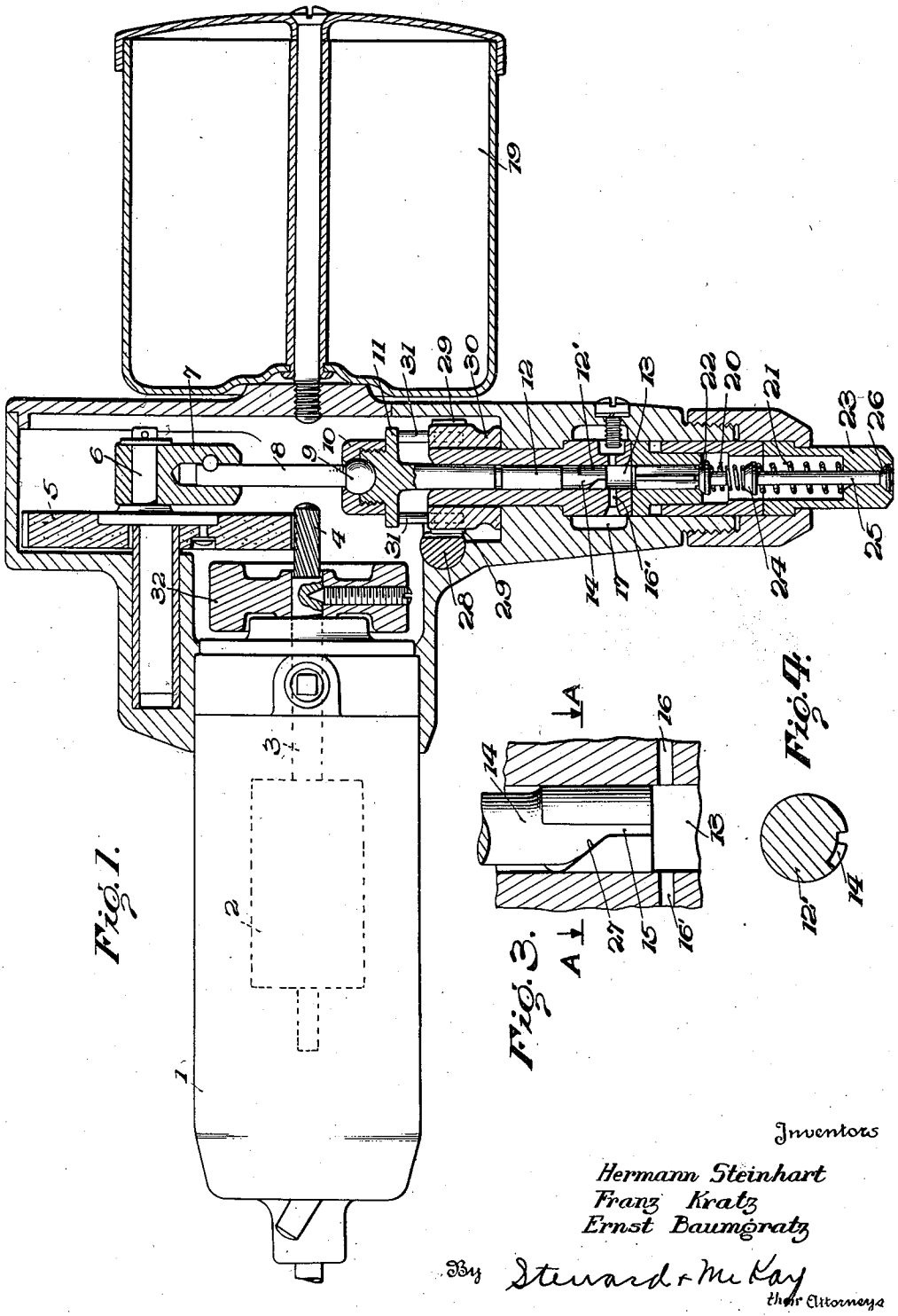

Fig. 1.

Fig. 3.

Fig. 4.

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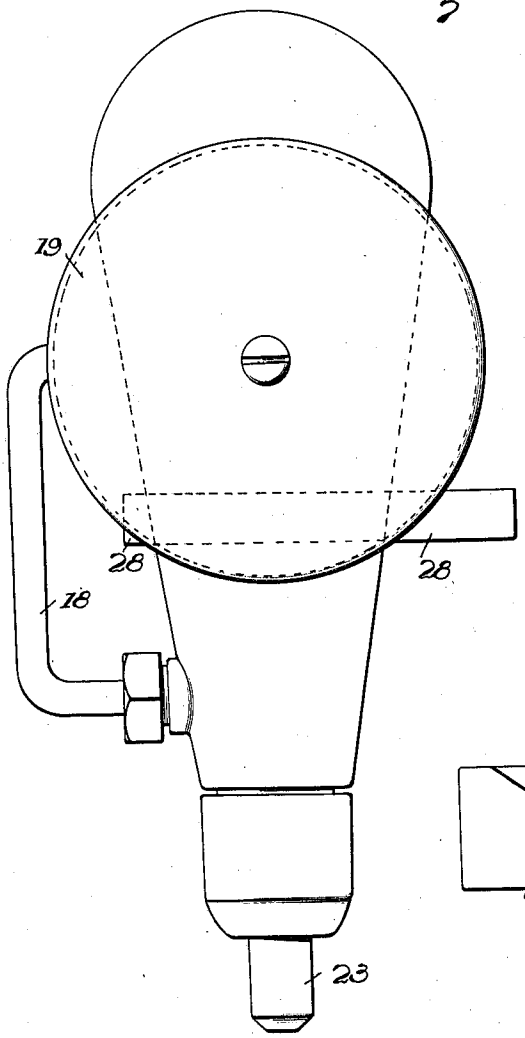
Fig. 2.



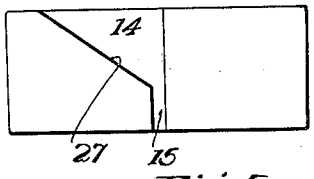


Fig. 5.

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METHOD FOR APPLYING COATING LIQUIDS SUCH AS PAINTS, VARNISHES, OR THE LIKE

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Original application August 2, 1934, Serial No. 738,142. Divided and this application January 17, 1935, Serial No. 2,294. In Germany April 7, 1932, and Great Britain April 7, 1933

1 Claim. (Cl. 91—68)

The present invention relates to applying coating liquids such as paints, varnishes or the like.

Apparatus in which compressed air is employed for spraying 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 objects 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 outlet 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 recognition of the fact that it is necessary to employ very high pressures e. g. of more than 100 atmospheres and to create such pressures by applying to the coating liquid a series of intermittent pressure impulses in rapid succession.

The invention has as starting point the deliberation that the want of success of spraying paints under pressure owes to the lack of a sufficient pressure and ejecting rate respectively to the paint. All attempts to improve the atomizing by a new nozzle construction had to fail on account of the lack of sufficient pressure which was lmited by the practicability of the container walls and conducting tubes. All known constructions of these parts will not allow such a modification, as to resist to such high pressures as were found to be indispensably necessary. An entirely new way was to be gone.

The newness of the method set forth by the invention resides in the extremely high pressures which are used and mastered in a way which is characterized by two factors.

First.—There is always a very little fraction of the spraying liquid put under pressure. This small quantity can much more easily be brought to the high pressure. The thickness of the walls of the small compressing chambers lies within limits which are practicable even in a hand operated pistol.

Second.—Each of the said small fractions of the liquid supply is pressed by intermittent strokes, each stroke bringing one of these small quantities from the atmosphere's pressure up to the high spraying pressure. Therefore the velocity of such a stroke must be very great. The impacts to the small liquid portions are comparable to hammer blows in the same sense as the constant pressure on the liquid is comparable to an imposing weight.

The combination.—Small portions to be pressed, impactlike compressing and ejecting of such a portion by one stroke only is a very simple manner of getting high pressure and therewith the high ejecting rate on our surface-treating liquid.

The new method of spraying paints may be performed in the most efficient way by piston pumps of that sort which is known for fuel injection.

Our invention therefore relates to a new coating method rather than a method of spraying liquids in general.

An example of a pistol by which the method according to the invention can be performed is shown in the accompanying drawings.

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 electric 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 eccentrically fastened a pin 6 on which the head 7 of a connecting rod 8 is revolubly 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 very little 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 working 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 periphery. 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 chamber 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 movement 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 spraying 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 counterforce of the spring, for instance, 100–200 atmospheres, 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 opens into the atmosphere and at the same time is 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 to 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 strokes follow each other in rapid succession.

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 or adjustment of the bar 28, it may be connected to a trigger lever. 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.

The apparatus disclosed herein is disclosed and claimed in our copending application Serial No. 738,142, filed August 2, 1934, of which this application is a division.

We declare that what we claim is:

In the art of coating, spraying a coating liquid at high pressures above 100 atmospheres produced by applying to only a relatively small quantity of said liquid a series of impulses in rapid succession whereby the coating is uniformly applied and use of compressed air is obviated.

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