July 18, 1950 G. A. FISHER 2,515,865

ROAD MARKING APPARATUS

Filed May 24, 1946 2 Sheets-Sheet 1

Fig. 1.

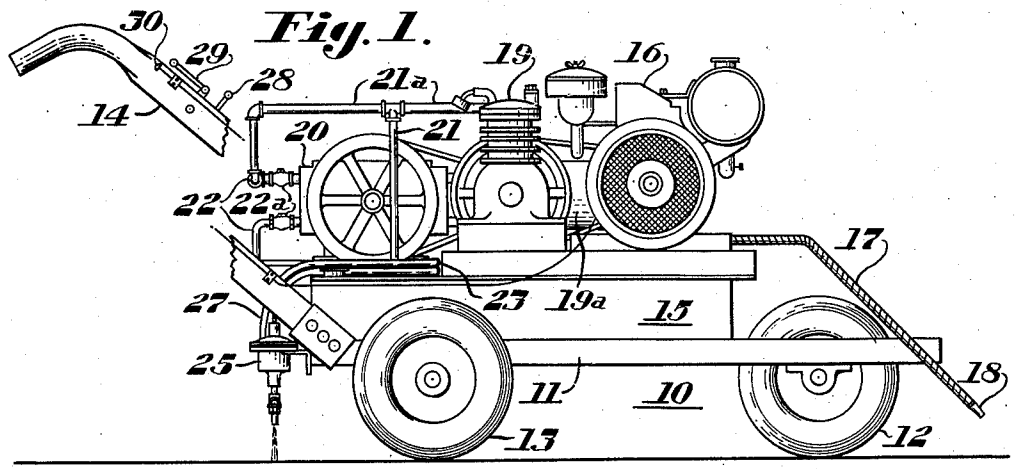


Fig. 5.

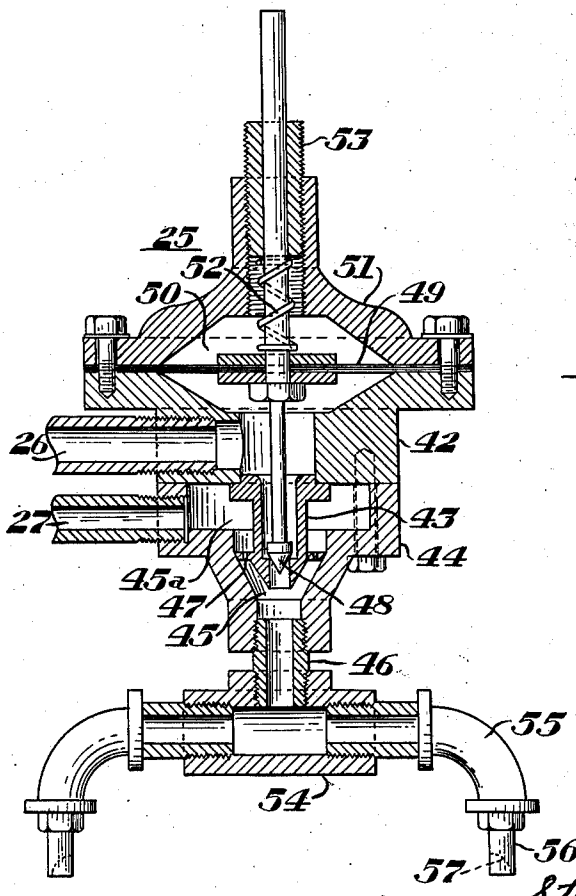


Fig. 2.

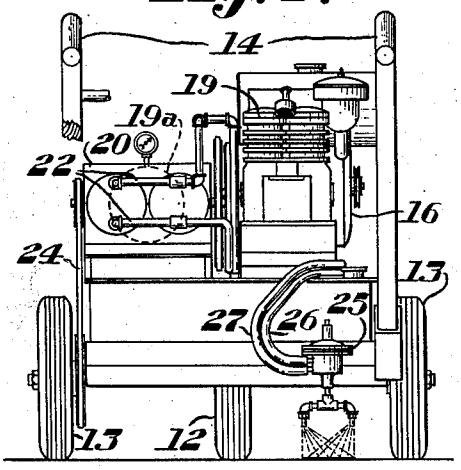
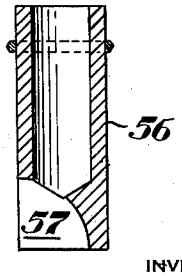


Fig. 6.



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Fig. 3.

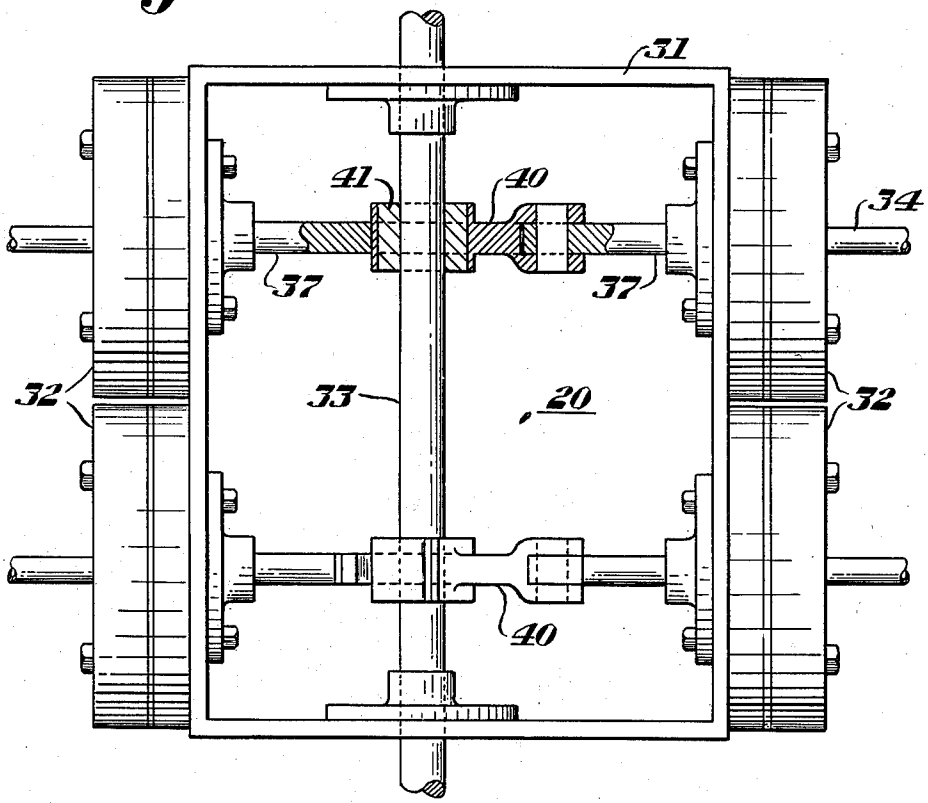
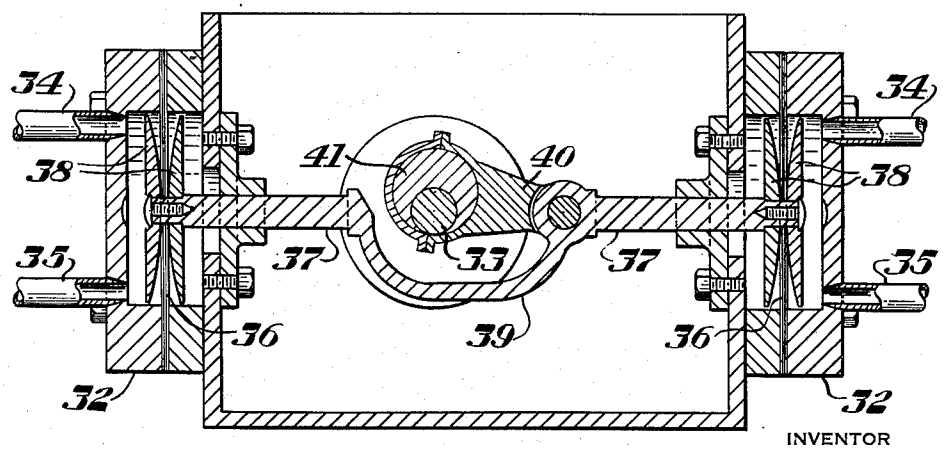


Fig. 4.



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ROAD MARKING APPARATUS

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10 Claims. (Cl. 91—12)

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This invention relates broadly to a spray-painting device and, in particular, to an automotive vehicle for painting zone stripes on roadways, parking areas, airports and the like while traveling thereover.

Various forms of road-marking devices have been proposed heretofore but, so far as I am aware, none of them has proved the ultimate solution for the problem of accurately laying a stripe of uniform thickness with sharply defined edges. A recent development in highway marking stripes, furthermore, has made the requirement for exactitude in the thickness of the layer of paint considerably more stringent. This is the luminous marking stripe which is made by depositing glass beads or other reflecting particles on a paint stripe while the paint is still wet. For satisfactory reflection, the thickness of the paint layer must be one half the diameter of the beads within very close tolerances. If the paint layer is too thin, the beads do not become bedded therein with sufficient depth to be firmly adherent. If the paint layer is too thick, the beads are immersed and covered over by the paint. The beads may be as small as .030'' or as large as .120''.

I have invented a novel apparatus for applying marking stripes to roadways and the like which is capable of laying a stripe of the exact thickness required for satisfactory deposition of reflecting particles. In a preferred embodiment, I provide an automotive vehicle including a paint tank having an air compressor and a pump mounted thereon as well as an engine for driving it. The vehicle is driven at a speed proportional to that at which the pump operates so that the amount of paint dispensed is accurately controlled in accordance with the length of the stripe applied. The invention also contemplates an improved form of positive-displacement pump for delivering paint in a substantially constant stream, as well as a novel form of gun or spray head capable of laying a stripe with sharply defined edges, without the use of "blinds" or side guards.

For a complete understanding of the invention, reference is made to the accompanying drawings illustrating a present preferred embodiment. In the drawings,

Figure 1 is a side elevation of the machine;

Figure 2 is an end elevation, such as would be seen by looking from the left of Figure 1;

Figure 3 is a plan view of the pump;

Figure 4 is a longitudinal section therethrough taken along the plane of line IV—IV of Figure 3;

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Figure 5 is a transverse section through the gun or spray head; and

Figure 6 is a longitudinal section through one of the nozzles of the paint gun.

Referring in detail to the drawings, my road-marking vehicle indicated generally at 10 comprises a frame or chassis 11 having a front wheel 12 and rear wheels 13 mounted thereon and steering handles 14 extending rearwardly therefrom. The wheels are fitted with pneumatic tires. A paint tank 15 of suitable capacity is mounted on the frame 11. The tank is preferably fabricated from plate so as to provide a support for the remaining apparatus.

An internal combustion engine 16 is mounted on the tank 15 toward the front end thereof. The exhaust pipe from the engine, indicated at 17, is a flexible tube and extends forwardly and downwardly in front of the vehicle terminating in a nozzle 18 adapted to blow dust and dirt off of a strip of the roadway along which the vehicle travels. A compressor 19 mounted adjacent the engine 16 is driven thereby through a belt drive. The compressor serves to accumulate a supply of air in a tank 19a under suitable pressure for atomizing paint supplied to a paint gun in a manner which will be explained later.

A pump 20 is mounted on the tank 15 next to the compressor 19 and is belt-driven by a pulley on the compressor. The pump is a multiple-cylinder diaphragm pump adapted to deliver a substantially constant supply of paint and the detailed construction thereof will be described hereinafter. For the present, it will suffice to state that the pump draws paint from the tank 15 through a connection 21 and branches 21a and delivers it through connections 22 to a terminal fitting 23. These branches and connections are provided with suitable check valves 22a. The tank 19a is also connected to this fitting.

A traction drive 24 is provided for one of the wheels 13 as shown in Figure 2 and comprises a belt trained around a pulley on the shaft of the pump 20 and a pulley secured to the wheel. The operation of the pump and travel of the vehicle are thus coordinated or correlated so that a predetermined amount of paint is delivered by the pump for a given travel of the vehicle.

A paint gun 25 is mounted on the frame 11. Flexible pipe lines 26 and 27 supply paint and air, respectively, to the gun. The supply of paint to the gun is controlled by a valve 28 on the handles 14. This valve is connected by suitable piping (not shown) to the fitting 23 and serves in one position to deliver the output of the pump

to the gun. In the other position, the valve diverts the pump output to a return connection to the tank 15, cutting off the supply of paint from the gun.

The engine 16 drives the compressor 19 to the pump 20 continuously. The drive for the traction wheel, however, is rendered effective only when desired by means of a belt tightener (not shown) controlled by a lever 29 mounted on the handles 14. This serves in the manner of a clutch to cause the engine to drive the traction wheel when it is desired to cause the vehicle to move. A hand throttle 30 for controlling the fuel supply of the engine 16 is also mounted on the handles 14.

The pump 20 comprises a box-like frame 31 having a plurality of diaphragm chambers 32 arranged in spaced opposed pairs. A drive shaft 33 journaled in the two opposite sides of the frame extends between the chambers of each pair. Each chamber has an inlet 34 and an outlet 35 and is provided with a flexible diaphragm 36. A reciprocating plunger extends into each diaphragm chamber and is provided with spaced discs 38 having convex surfaces adjacent the diaphragm for deforming it in opposite directions. The plunger of one diaphragm chamber of each pair has an extension 39 pivoted to the plunger of the opposed chamber and to a connecting rod 40. The connecting rods are actuated by eccentrics 41 on the shaft 33. The plungers 37 with their discs 38 constitute actuators for the diaphragms. The eccentrics 41 are so spaced angularly on the shaft that one of the diaphragms makes a compression movement on each quarter turn of the shaft. That is to say, the operation of the diaphragm is so timed that a substantially continuous delivery of paint is maintained. It will be understood that, as the diaphragms are deformed on the suction stroke, paint is drawn from the tank 15 through the connection 21, one of the branches 21*a* and an inlet check valve 22*a* adjacent the inlet 34. On the compression stroke, the paint is forced through the outlet 35 and the outlet check valve 22*a* into one of the connections 22 leading to the terminal fitting 23.

The spray gun 25, as indicated in Figure 5, comprises a body 42 to which one of the paint lines 26 is connected. A paint nozzle 43 held against the body 42 by a cap 44 secured thereto is adapted to discharge paint into a mixing chamber 45 formed in the cover. The cover also provides an air chamber 45*a* surrounding the nozzle 43 to which the air line 27 is connected. Air ports 47 in the wall of the nozzle 43 between the chambers 45*a* and 46 admit atomizing air from the latter to the former.

The flow of paint through the nozzle 43 is controlled by a needle valve 48. This valve is operated by a diaphragm 49 extending across a chamber 50 formed partly in the body 42 and partly in a cover 51 secured thereon. The lower face of the diaphragm 50 is subject to the back pressure of the paint in the line 26. This pressure is opposed by a spring 52 on the stem of the valve 48 which extends through the diaphragm and outwardly of the cover 51 through an adjusting sleeve 53 threaded therein. The pressure exerted by the spring may be varied by turning this sleeve. It will be apparent that when the back pressure of the paint in the line 26 is sufficient to overcome the force of the spring on the diaphragm, the valve 48 will be opened to admit paint into the mixing chamber 45. In this way, it is possible to control the discharge of paint from the gun by the valve 28 which causes the output of the pump to be delivered to gun 25 or returned to the tank 15.

A T 54 is connected to the outlet of the mixing chamber 45 by a nipple 46. Elbows 55 connected to the T are provided with nozzles 56. As shown in Figure 6, each nozzle comprises a tube closed at one end having an arcuate radial slot 57 milled in the closed end and intersecting the bore. This causes the nozzle to discharge a flat brushlike spray having a sharply defined edge on one side. As shown in Figure 2, the sprays from the two nozzles intersect or overlap, both sprays being directed downwardly and angularly toward each other. By this arrangement, it is possible to apply a stripe of the desired width having sharply defined edges, without using side guards or blinds as has been necessary heretofore.

It will be apparent from the foregoing description that the invention provides a simple and efficient road-marking apparatus capable of rapidly applying a stripe of precisely the desired thickness to suit it for the application of reflecting particles. The thickness of the stripe applied, of course, is determined by the volume of paint delivered by the pump for a given distance traveled by the vehicle. This may be controlled by properly dimensioning the pulleys traversed by the traction drive belt 24. The pump 20, being of the diaphragm type, is a positive displacement pump but does not have any close fitting moving parts which would be subject to rapid wear under the abrasive action of most paint compositions. The paint gun delivers a finely atomized spray assuring uniform coverage and the nozzles are such as to keep the edges of the stripe straight and true. The discharge of paint from the gun is readily controlled by a simple transfer valve mounted on the steering handles for the convenience of the operator. The engine exhaust is utilized to blow dust and dirt off the roadway ahead of the gun, thus assuring a clean surface for the application of paint.

Although I have illustrated and described but a preferred embodiment of the invention, it will be recognized that changes in the details disclosed may be made without departing from the spirit of the invention or the scope of the appended claims.

I claim:

1. Apparatus for marking roads with a uniform thickness of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle, and a driving connection between the motor and the pump whereby the vehicle and pump are driven at speeds varying in constant proportion as the speed of the motor varies and the gun thereby receives paint in quantities varying with the speed of the vehicle, said gun comprising means to release said varying quantities of paint at a substantially constant pressure into a stream of compressed air from the compressor, thus forming a mixture in which the paint content varies in proportion to the speed of the vehicle.

2. Apparatus for marking roads with a uniform thickness of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a positive feed pump to force paint in an even flow from the reservoir into the gun, a motor, a driving connection

between the motor and a wheel of the vehicle, and a driving connection beween the motor and the pump whereby the vehicle and pump are driven at speeds varying in constant proportion as the speed of the motor varies and the gun thereby receives paint in quantities varying with the speed of the vehicle, said gun comprising biased valve means to release said varying quantities of paint at a substantially constant pressure into a stream of compressed air from the compressor, thus forming a mixture in which the paint content varies in proportion to the speed of the vehicle.

3. Apparatus for marking roads with a uniformly thick coating of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle and a driving connection between the motor and the pump whereby the vehicle and pump are driven by the motor at speeds varying in constant proportion as the speed of the motor varies, said gun comprising a passage therethrough connected to the compressor to receive a stream of compressed air, a chamber in the gun connected to the pump to receive paint from the pump, an outlet from the chamber into the said passage, and a valve in the outlet biased to release the paint from the chamber at a substantially constant predetermined pressure, whereby a mixture of paint and air is formed in the gun having a paint content which varies in direct proportion to the speed of the vehicle.

4. Apparatus for marking roads with a uniformly thick coating of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a positive feed pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle and a driving connection between the motor and the pump whereby the vehicle and pump are driven by the motor at speeds varying in constant proportion as the speed of the motor varies, said gun comprising a chamber in the gun connected to the pump to receive paint from the pump, an outlet from the chamber passage, a valve in the outlet, a diaphragm forming one wall of the chamber and attached to the valve to move the valve from the outlet as the pressure of paint in the chamber deflects the diaphragm, biasing means opposing movement of the diaphragm and valve in response to pressure of paint in the chamber whereby paint pumped into the chamber at varying rates is released from the chamber at a substantially constant predetermined pressure, and a passage through the gun into which the chamber outlet opens and which is connected to the compressor to receive a stream of compressed air, whereby a mixture of paint and air is formed in the gun having a paint content which varies in direct proportion to the speed of the vehicle.

5. Apparatus for marking roads with a uniformly thick coating of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a positive feed pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle and a driving connection between the motor and the pump whereby the vehicle and pump are driven by the motor at speeds varying in constant proportion as the speed of the motor varies, said gun comprising a chamber in the gun connected to the pump to receive paint from the pump, an outlet from the chamber passage, a valve in the outlet, a diaphragm forming one wall of the chamber and attached to the valve to move the valve from the outlet as the pressure of paint in the chamber deflects the diaphragm, a spring engaging the valve to oppose movement of the diaphragm and valve in response to pressure of paint in the chamber so that paint pumped into the chamber at varying rates is released from the chamber at a substantially constant predetermined pressure, a member adjustably mounted in the gun and engaging the spring in order to adjust said predetermined pressure, and a passage through the gun into which the chamber outlet opens and which is connected to the compressor to receive a stream of compressed air, whereby a mixture of paint and air is formed in the gun having a paint content which varies in direct proportion to the speed of the vehicle.

6. Apparatus for marking roads with a uniformly thick coating of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle and a driving connection between the motor and the pump, whereby the vehicle and pump are driven by the motor at speeds varying in constant proportion as the speed of the motor varies, said pump being a multi-chambered diaphragm pump, whereby the paint is positively fed to the gun in a smooth flow and at a rate directly proportional to the speed of the pump and of the vehicle, said gun comprising means to receive paint in varying quantities from the pump and to release it at a substantially constant pressure into a stream of compressed air from the compressor, thus forming a mixture in which the paint content varies in proportion to the speed of the vehicle.

7. Apparatus for marking roads with a uniformly thick coating of paint comprising a wheeled vehicle having mounted thereon a paint reservoir, a paint gun to mark the road, an air compressor to supply compressed air to the gun, a pump to force paint from the reservoir into the gun, a motor, a driving connection between the motor and a wheel of the vehicle and a driving connection between the motor and the pump, whereby the vehicle and pump are driven by the motor at speeds varying in constant proportion as the speed of the motor varies, said pump comprising a plurality of diaphragm chambers arranged in opposite pairs, a diaphragm and an actuator therefor in each chamber, and an eccentric shaft extending between the opposed chambers for driving said actuators, whereby the paint is positively fed to the gun in a smooth flow and at a rate directly proportional to the speed of the pump and of the vehicle, said gun comprising means to receive paint in varying quantities from the pump and to feed it at a substantially constant pressure into a stream of compressed air from the compressor, thus forming a mixture in which the paint content varies in proportion to the speed of the vehicle.

8. A paint gun adapted to receive varying quantities of paint and to mix the paint at a

constant pressure with a stream of compressed air, comprising a chamber to receive a forced flow of paint, an outlet from the chamber and a valve controlling said outlet, said valve being biased to release the paint forced into the chamber at a substantially constant predetermined pressure, a passage through the gun to receive a stream of compressed air, said chamber outlet opening into said passage to release paint into the passage, whereby varying quantities of paint may be pumped into the gun and fed at a substantially constant pressure into a stream of compressed air to form a spray.

9. A paint gun adapted to receive varying quantities of paint and to mix the paint at a constant pressure with a stream of compressed air, comprising a chamber to receive a forced flow of paint, an outlet from the chamber, a valve in the outlet, a diaphragm forming one wall of the chamber and attached to the valve to move the valve from the outlet as the pressure of paint in the chamber deflects the diaphragm, biasing means opposing movement of the diaphragm in response to pressure of the paint in the chamber, whereby paint is released from the outlet at a substantially constant predetermined pressure, a passage through the gun to receive a stream of compressed air, said chamber outlet opening into said passage to release paint into the passage, whereby varying quantities of paint may be pumped into the gun and fed at a substantially constant pressure into a stream of compressed air to form a spray.

10. A spray gun adapted to receive varying quantities of paint and to mix the paint at a constant pressure with a stream of compressed air, comprising a chamber for paint received from the pump, an outlet from the chamber, a valve adapted to close the outlet, a diaphragm forming a wall of the chamber and attached to the valve to move the valve from the outlet as the pressure of paint in the chamber deflects the diaphragm, biasing means opposing movement of the diaphragm in response to pressure of paint in the chamber, whereby paint may be pumped through the chamber at varying rates but is released from the chamber at a substantially constant predetermined pressure, means to adjust the biasing means to vary the predetermined pressure, a passage through the gun to receive a stream of compressed air, said chamber outlet opening into said passage to release paint into the passage, whereby varying quantities of paint may be pumped into the gun and fed at a substantially constant pressure into a stream of compressed air to form a spray.

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Certificate of Correction

Patent No. 2,515,865 July 18, 1950

GEORGE A. FISHER

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows:

Column 3, line 55, for "45*a* and 46" read *45 and 45a*; column 7, line 34, for the word "spray" read *paint*;

and that the said Letters Patent should be read as corrected above, so that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 17th day of October, A. D. 1950.

[SEAL]

THOMAS F. MURPHY,
Assistant Commissioner of Patents.