Aug. 14, 1962 F. E. COFFMAN 3,049,439

INTERNAL MIX CATALYST TYPE SPRAY GUN AND PROCESS EMPLOYING SAME

Filed April 11, 1960 2 Sheets-Sheet 1

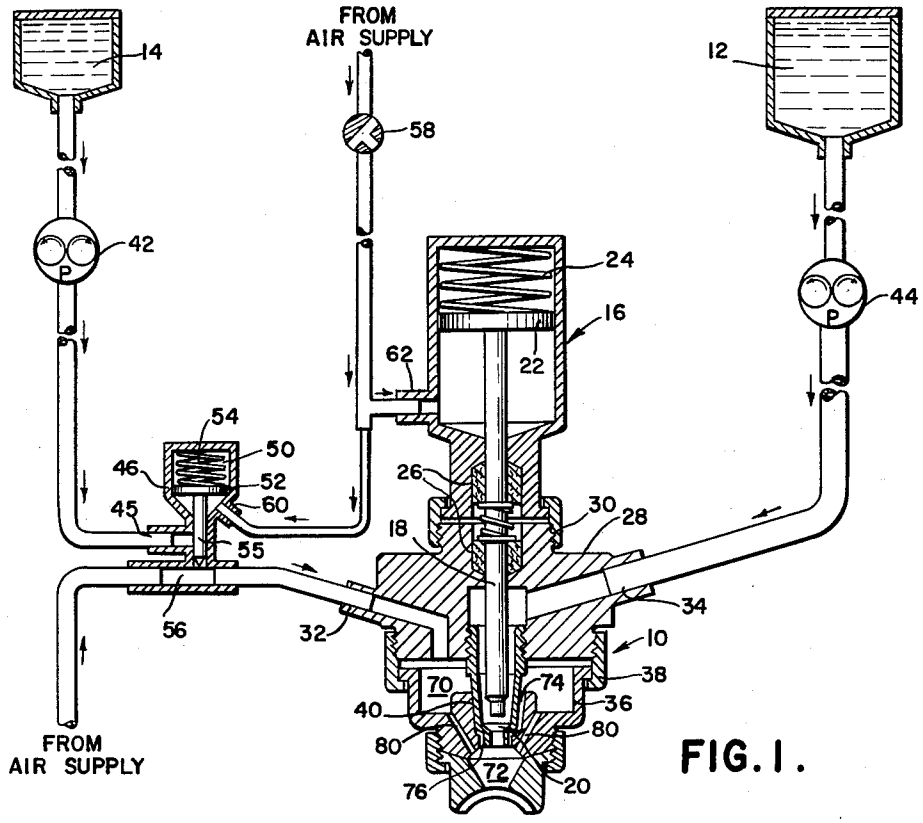


FIG. 1.

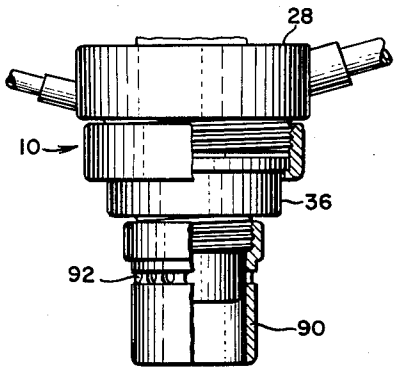


FIG. 3.

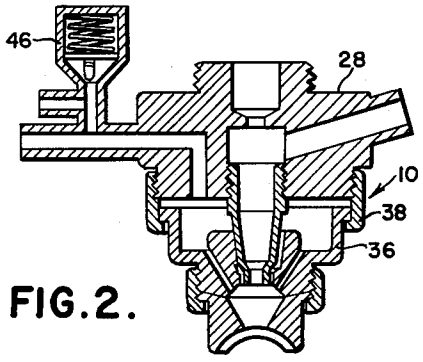


FIG. 2.

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INTERNAL MIX CATALYST TYPE SPRAY GUN AND PROCESS EMPLOYING SAME

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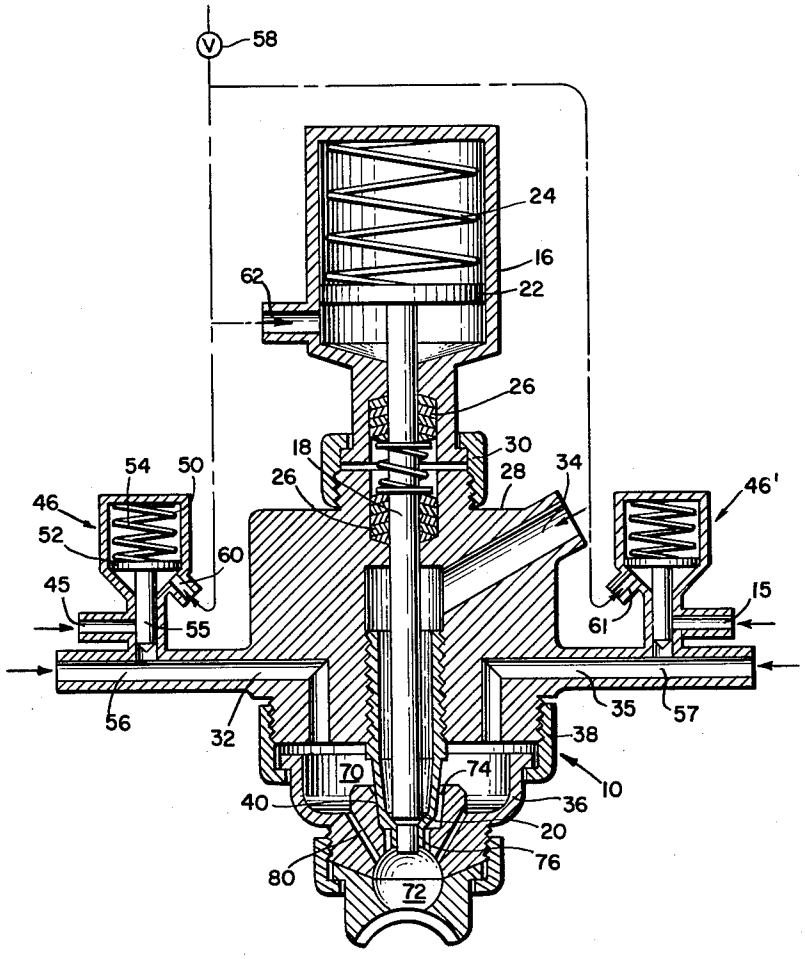


FIG. 4.

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INTERNAL MIX CATALYST TYPE SPRAY GUN AND PROCESS EMPLOYING SAME

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The present invention relates to surface coating apparatus and more particularly to apparatus for applying a coating material to surfaces and the like wherein a plurality of materials must be intimately mixed during the spraying operation.

A particular use of the present invention is in the application of markers to roads and highways. Recently, coating compositions have been developed for this use which require the addition of an accelerator to a resin composition during the spraying operation to hasten the polymerization and setting of the resin composition on the base surface. In some cases, more than one additive is required such as dryers, hardeners, catalysts, or fillers.

It has heretofore been proposed to utilize two or more spray guns which spray together the materials to be mixed. It has also been suggested that the materials be mixed together in a tank immediately before spraying and then spraying the pre-mixed material simultaneously. These methods and apparatus have certain drawbacks.

It is therefore an object of the present invention to provide means for spraying a coating material and an additive thereto by pre-mixing the coating material and the additive within the spray gun immediately prior to spraying the mixture therefrom.

Still another object of the present invention is to provide a spraying apparatus for internally mixing within the spray gun a plurality of materials admitted thereto from separate sources of supply.

Still another object of the present invention is to provide spraying apparatus which includes a spray gun for receiving from independent sources a resin paint binder and an accelerator or catalyst, the spray gun ejecting the paint binder and accelerator in a premixed atomized spray onto a base surface.

Still another object of the present invention is to provide spraying apparatus for road marking which includes a spray gun for receiving from independent sources a resin paint binder, an accelerator or catalyst and small glass spheres, the spray gun ejecting the three materials in an atomized spray to effect a premixed reflective coating on the surface being marked which sets almost instantaneously.

Other objects and the nature and advantages of the instant invention will be apparent from the following description taken in conjunction with the accompanying drawings, wherein:

FIG. 1 is a diagrammatic illustration of the apparatus embodied in the present invention;

FIG. 2 shows a modified form of the spray gun,

FIG. 3 shows the application of a gun shroud onto the spray gun, and

FIG. 4 is a diagrammatic illustration of a modified form of the apparatus.

Referring to the drawings, the application embodied herein is diagrammatically illustrated in FIG. 1 and includes a spray gun indicated generally as **10**. The spray gun **10** is particularly suited for traffic lane marking and is associated with the conventional equipment required such as a compressor and prime mover, which are adapted to be mounted on a vehicle preferably of the self-propelled type. The vehicle also carries the

source of supply **12** of a resin paint binder and a separate source of supply **14** of an accelerator. Additional sources of supply may be included for additional ingredients, such as the small glass beads, etc. as indicated at **15** in FIG. 4.

The apparatus also includes a source of compressed air which serves a two-fold purpose. The compressed air is utilized for atomizing the material, and is also utilized for controlling the supply of the ingredients to the gun by controlling the opening and closing of the supply valves.

The spray gun **10** includes an operating cylinder **16** that controls the flow of the paint binder by raising and lowering a needle valve **18** which seats on a valve seat **20**. A piston **22** is connected to the upper end of the needle **18**, the piston operating within the cylinder **16** against a spring **24**. A packing seal **26** is located around the needle **18** between the operating cylinder **16** and the main gun body **28**. A threaded ring **30** acts to hold the parts of the spray gun together. The main body of the gun **28** as shown in FIG. 1 has two ports **32**, **34**. Port **32** admits the accelerator mixed with the atomizing air. Port **34** admits the resin binder material. As shown in FIG. 4 the main body **28** has three ports **32**, **34** and **35**. The port **35** admits glass beads mixed with atomizing air. The air cap **36** is held onto the main gun body **28** by a threaded ring **38**. The valve seat **20** is threadedly engaged with the main gun body and is tapered on its outer surface to position the tapered portion **40** of the air cap **36**.

The pumps **42** and **44** are shown of the positive displacement type driven by an outside source of rotary or reciprocatory motive power. The pump **42** conveys the accelerator from its source **14** to the port **45** of feed valve **46**. The pump **44** conveys the resin binder material from its source **12** to port **34** to supply the resin material directly to the spray gun. The two sources of supply **12** and **14** may be pressurized by the compressed air or may use a gravity flow supply.

The feed valve **46** has an air operated cylinder **50** with a piston **52** operating therein against a spring **54** and is connected at its lower end to a needle **55**. The valve body has a through port **56** for the flow of the atomizing air to the spray gun. The port **45** of the valve body permits the entrance of the accelerator to the valve, and when actuated, the valve permits the flow of accelerator into the port **56** and the stream of atomizing air. The feed valve **46** is actuated by control air which passes through a valve **58** passing into cylinder port **60** below the piston **52**. The control air passing through valve **58** also enters the cylinder **16** through port **62** to operate the piston **22**.

As shown in FIG. 4, a feed valve **46'**, similar to the feed valve **46** is included for permitting the entrance of glass spheres into the port **57** and the stream of atomizing air flowing into the port **57**. The feed valve **46'** is likewise actuated by control air from the valve **58** passing into cylinder port **61**.

Actuation of the control valve **58**, thus may be seen to actuate both the feed valve **46** for the accelerator and the feed valve **18** for the resin material in the form of the invention shown in FIG. 1 and also for actuating the feed valve **46'** in the form of the invention shown in FIG. 4.

The heart of this invention lies in the construction of the air cap **36** of the spray gun **10**. When the air cap **36** is mounted on the valve seat **20**, a chamber **70** is formed surrounding the valve seat **20** and connected to the port **32** in FIG. 1, and the ports **32** and **35** in FIG. 4. An atomizing chamber **72** is located below the chamber **70** and is in direct connection with the valve seat **20**, and also with the chamber **70**. Chamber **70** is connected

to atomizing chamber **72** by a plurality of holes **74** spaced evenly around the tapered portion of the air cap **36** adjacent to the valve seat **20**, and a controlled size ring shaped orifice **76** between the lower end of the outside of the valve seat **20** and the air cap **36**. The mixture of atomizing air and accelerator flowing into port **32** passes into chamber **70** and thence through holes **74** and orifice **76** surrounding the valve seat **20**. The resin binder which flows into port **34** and thence around needle **18** and between needle **18** and valve seat **20** passes into chamber **72** and is immediately surrounded and sprayed out of the gun by the atomizing air. To improve the mixing of the accelerator and the resin binder in the chamber **72** and to insure uniformity, additional holes **80** are provided between chamber **70** and atomizing chamber **72** which are slanted so that the atomizing air and accelerator passing through the holes **80** are diretced to the center of chamber **72**. The atomizing chamber **72** is shown to be diamond-shaped in FIG. 1; however, it also could be spherical as in FIG. 4, or of another suitable shape so that there are no dead spots where the material might accumulate and solidify.

As shown in FIG. 4, the mixture of glass beads and atomizing air flowing into port **35** in FIG. 4 also passes into chamber **70** where it mixes with the accelerator entering through port **32** and the mixture of accelerator, glass beads and atomizing air passes into chamber **70**.

In operation, when the valve **58** is actuated, operating air opens the valve **18** and the valve **46** to admit the resin binder through port **34**, around needle valve **18** and into chamber **72**, and to admit the atomizing air and accelerator through port **32**, chamber **70** and holes **74** and **80** into chamber **72**. In chamber **72** the atomizing air-accelerator mixture entering through holes **74** around the valve seat **20** picks up the resin binder and conveys it downwardly. The atomizing air-accelerator mixture entering through holes **80** contacts the stream of resin-air-accelerator centrally of the atomizing chamber **72** causing a complete pre-mixing before the mixture is sprayed out of the nozzle onto the base surface to be coated.

When it is desired to pre-mix another material, such as glass beads, along with the accelerator, the apparatus shown in FIG. 4 is utilized and the operation is readily apparent.

An example of the use of a spray gun in accordance with the present invention is in the spraying of a non-slip floor paint where it may be desirable to introduce pumice or other grit into the atomized stream.

As shown in FIGS. 2 and 4 the valve means **46** and **46'** may be embodied as an integral portion of the spray gun body.

A gun shroud **90** is shown in FIG. 3 threadedly engaged to the spray gun surrounding the nozzle. To prevent the catalyzed material mist from solidifying in the top or dome of the shroud **90**, a plurality of holes **92** are provided drilled through the outside periphery at the top of the shroud, thereby permitting air to be drawn in the shroud and prevent the build-up of solidified material.

The width of the marker sprayed onto a highway surface is determined by the height of the spray gun from the surface as well as the shape of the nozzle.

When immediate reflectivity of the road marker is desired, a second spray gun, not shown, is carried by the vehicle, positioned to the rear of spray gun **10**. Dry glass spheres are ejected in a fan-like pattern onto the surface of the freshly sprayed road marker and become partially embedded therein before the composition completely cures.

It will be obvious to those skilled in the art that various changes may be made without departing from the spirit of the invention and therefore the invention is not limited to what is shown in the drawings and described in the specification but only as indicated in the appended claims.

What is claimed is:

1. In apparatus for applying a coating to a surface by means of an atomizing fluid, a spray gun having a first inlet port, a second inlet port, a first chamber, a mixing chamber, a nozzle at the exit of said mixing chamber, a first source of supply for a material to be sprayed in communication with said first inlet port, a second source of supply including the atomizing fluid and an additive for the material to be sprayed in communication with said second inlet port, a first conduit connecting said first inlet port and said mixing chamber, a second conduit connecting said second inlet port and said first chamber, a first plurality of openings connecting said first chamber and said mixing chamber, said openings being directed towards the central portion of said mixing chamber, and a second plurality of openings immediately surrounding the point of entry of said first conduit into said mixing chamber, said openings connecting said first chamber and said mixing chamber whereby the material being sprayed is intimately mixed with said additive and said atomizing fluid in said mixing chamber prior to being sprayed through said nozzle.

2. Apparatus in accordance with claim 1, including a third inlet port connecting with said first chamber, a third source of supply for a second additive, and a conduit for conducting a portion of said atomizing fluid into communication with said third inlet port, whereby said additives are mixed in said first chamber and are injected into the material to be sprayed in said mixing chamber prior to being sprayed through said nozzle.

3. In apparatus in accordance with claim 1 wherein said mixing chamber is hollow and frustro-diamond-shaped having upper and lower frustro-conical portions meeting at an expanded central point with the material to be sprayed entering at the top thereof, the nozzle being located at the bottom thereof, and the additive-atomizing air openings directed towards the central portion of said mixing chamber entering at points slightly above the widest portion of said mixing chamber.

4. In apparatus in accordance with claim 1 wherein said mixing chamber is frustro-spherical shaped with the material to be sprayed entering at the top thereof, the nozzle being located at the bottom thereof, and the additive atomizing air openings directed towards the central portion of said mixing chamber entering at points slightly above the widest portion of said mixing chamber.

5. Apparatus for applying a coating to a surface comprising a spray gun, said spray gun including a first inlet port, a second inlet port, a first chamber, a mixing chamber, a nozzle at the exit of said mixing chamber, a first source of supply for a material to be sprayed in communication with said first inlet port, a first conduit connecting said first inlet port and said mixing chamber, a second source of supply for an additive for the material to be sprayed in communication with said second inlet port, a valve means located between said second source of supply and said second inlet port, said valve means controlling the flow of said additive, a source of atomizing fluid in communication with the exit from said valve means to form a mixture of additive and atomizing fluid entering said second inlet port, a second conduit connecting said second inlet port and said first chamber, a plurality of openings connecting said first chamber and said mixing chamber, said openings being directed towards the central portion of said mixing chamber, and a second plurality of openings immediately surrounding the point of entry of said first conduit into said mixing chamber, said openings connecting said first chamber and said mixing chamber whereby the material being sprayed is intimately mixed with said additive and said atomizing fluid in said mixing chamber prior to being sprayed through said nozzle.

6. Apparatus in accordance with claim 5, including a third inlet port connecting with said first chamber, a

third source of supply for a second additive, and a conduit for conducting a portion of said atomizing fluid into communication with said third inlet port, whereby said additives are mixed in said first chamber and are injected into the material to be sprayed in said mixing chamber prior to being sprayed through said nozzle.

7. In apparatus in accordance with claim 5 wherein a second valve means is located in said first conduit immediately before its entry into said mixing chamber for controlling the flow of material to be sprayed.

8. In apparatus in accordance with claim 5 wherein said mixing chamber is hollow and frustro-diamond-shaped having upper and lower frustro-conical portions meeting at an expanded central point with the material to be sprayed entering at the top thereof, the nozzle being located at the bottom thereof, and the addititive-atomizing air openings directed towards the central portion of said mixing chamber entering at points slightly above the widest portion of said mixing chamber.

9. In apparatus in accordance with claim 5 wherein said mixing chamber is frustro-spherical shaped with the material to be sprayed entering at the top thereof, the nozzle being located at the bottom thereof, and the additive-atomizing air openings directed towards the central portion of said mixing chamber entering at points slightly above the widest portion of said mixing chamber.

10. In a method of applying a marker to a surface, comprising the steps of supplying a first stream of resin paint binder to a spray gun mixing chamber at the top thereof, supplying a second stream of atomizing fluid carrying an accelerator for rapidly curing said resin paint binder to said spray gun, admitting a portion of said second stream to the mixing chamber at the top thereof surrounding said first stream, admitting the balance of said sceond stream to said mixing chamber at a plurality of points spaced about its upper portion each being directed toward the center of said mixing chamber whereby said first stream and said second stream are uniformly premixed, and spraying said pre-mixed streams out of the bottom portion of said mixing chamber, said binder curing on said surface into a solid.

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