Sept. 20, 1971 H. J. SEAMAN, JR 3,606,168

RECIRCULATING SPRAY NOZZLE

Filed Dec. 27, 1968

Fig. 1

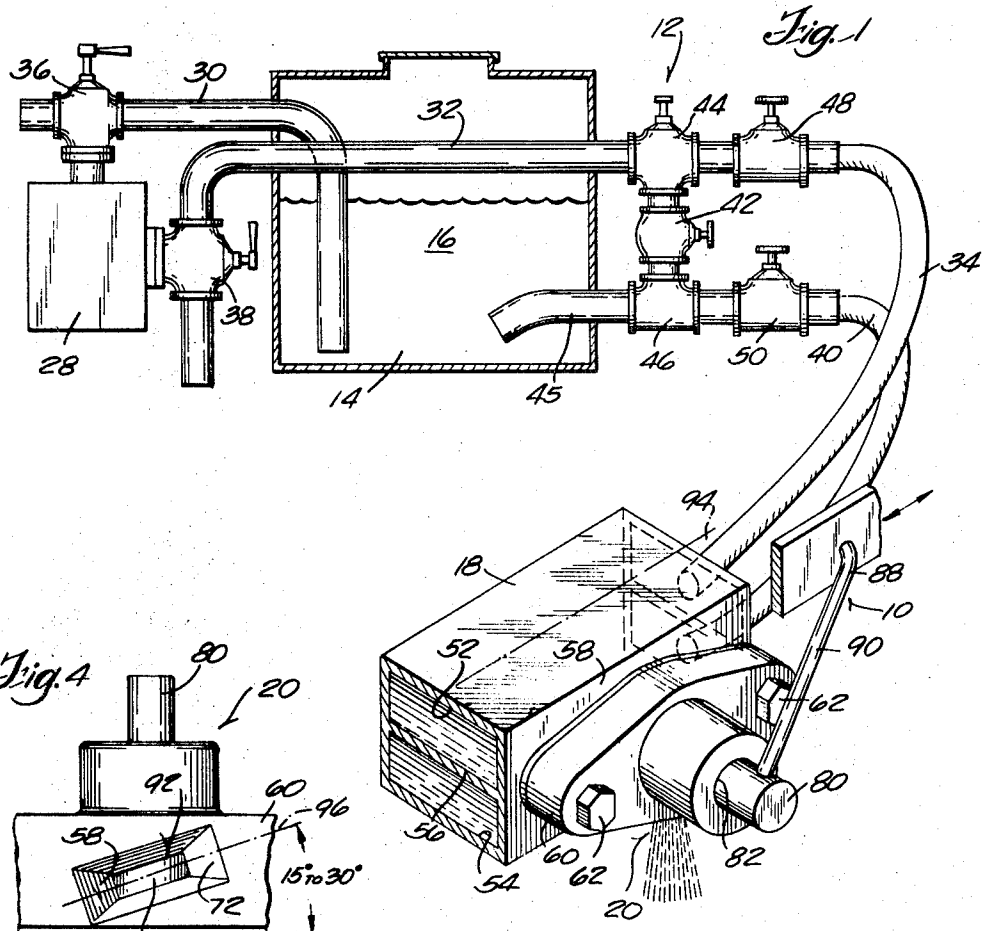


Fig. 4

Fig. 2

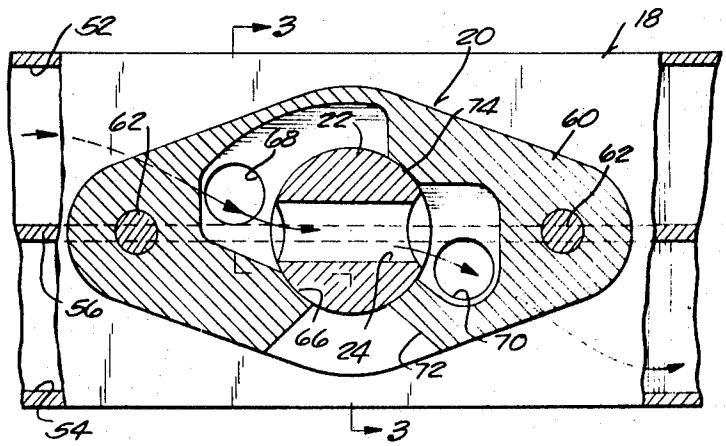
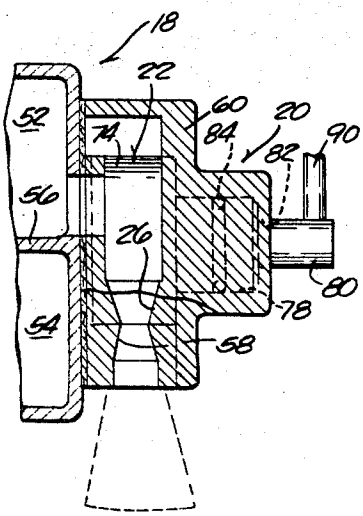


Fig. 3



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RECIRCULATING SPRAY NOZZLE

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ABSTRACT OF THE DISCLOSURE

A spraying apparatus for heated bituminous material including a spray bar divided by a horizontally disposed partition into inlet and outlet flow passages and a number of spray valves mounted on the spray bar, each spray valve having an inlet port connected to the inlet flow passage in the spray bar, an outlet port connected to the outlet flow passage in the spray bar and a spray port open to the atmosphere and a valve plug having a flow passage terminating in a spray nozzle port, the valve plug being mounted for rotary motion in said valve to selectively connect the flow passage to the inlet port and to either the outlet port or the spray port.

BACKGROUND OF THE INVENTION

Bituminous material used for road surfacing must be heated to reduce the viscosity of the material sufficiently to permit the material to be sprayed evenly through the spray nozzle ports in the spray valves. As long as the bituminous material remains heated, it will flow freely through the spray valves. However, when the spray valves are closed, the material in the valves begins to cool and solidify, partially blocking the passages in the spray valves causing bare spots and/or streaks the next time the spray valves are opened. A recent improvement is the recirculating type spray bar in which the material continues to circulate through the spray bar when the valves are closed. This helps to keep the spray bar warm, but the spray valves must depend on heat transfer from the spray bar to maintain spraying temperature. This function is impeded by the presence of a gasket between the spray valve and the spray bar which is normally used to prevent leakage. The gasket acts as an insulation reducing the amount of heat transferred to said spray valves.

The bituminous material must be sprayed onto the road surface at a constant rate generally measured in gallons per square yard of road surface. If the rate is too high, material is wasted and if too low, the road surface will fail. In a recirculating type spray bar, the spray valves are bypassed and the bituminous material is recirculated through the spray bar only. During the periods of recirculation, the pump engine speed control is adjusted to provide the required flow rate based on the load produced by the spray bar. When the spray valves are opened, a change in load occurs resulting in a change in flow rate and a discrepancy in the amount of material sprayed onto the road surface until the engine speed control adjusts to the new load condition. The spray fan from the spray nozzles must be set to provide sufficient overlap for proper coverage of the road surface. In spray valves having a separate nozzle screwed into the valve body, adjustment of the spray nozzle is often required due to vibration in order to maintain the proper relation of the spray fans. Too much overlap results in a waste of bituminous material while too little overlap will result in a poor road surface.

SUMMARY OF THE INVENTION

The spraying apparatus of this invention provides a continuous flow path for the bituminous material through the flow passages of the spray bar and the spray valve and nozzle assemblies during both spraying and recirculating of bituminous material through the spray bar. Each of the spray valve and nozzle assemblies is provided with inlet and outlet ports connected directly to the inlet and outlet flow passages in the spray bar and a spray port for spraying heated bituminous material onto the road surface. Flow of heated bituminous material through the spray valve and nozzle assemblies is controlled by valve plugs having flow passages terminating in spray nozzle ports, the valve plugs being selectively moveable to connect the inlet port to either the spray port or to the outlet port through the flow passages in the valve plug. By maintaining a continuous flow of heated bituminous material through the spray bar and spray valve and nozzle assemblies, the spraying apparatus including the spray valve and nozzle assemblies, the spraying apparatus including the spray valve and nozzle assembly will always be at a high enough temperature to heat the material passing through the assembly and will prevent the congealing of bituminous material in the spray valve passages.

This spraying apparatus also provides a constant flow of bituminous material when the valve plugs are moved from the recirculating to the spraying positions due to the continuous flow of bituminous material through the spray nozzle ports provided in the valve plugs. The load on the pump will be determined by the spray nozzle ports and will remain the same whether the bituminous material is recirculating through the spray bar or is being sprayed onto the road surface. The continuous flow of bituminous material through the flow passage in the valve plug prevents the bituminous material from congealing in the flow passages and thereby eliminates the possibility of streaking.

A further advantage of this spray valve nozzle assembly is that, due to the spray orifice being an integral part of the valve plug, the angle between the plane of the spray fan and the spray bar with respect to the vertical axis will always remain constant. This is quite important since too small an angle will cause interference of adjacent spray fans, and too great an angle will produce too narrow a coverage and insufficient overlap of spray fans.

Other objects and advantages of the present invention will become apparent when read in connection with the accompanying drawings, in which:

FIG. 1 is a schematic view of the circulating system for the heated bituminous material connected to the spraying apparatus.

FIG. 2 is a front view in section of one of the spray valves showing the flow path of the heated bituminous material through the spray valve.

FIG. 3 is a side view taken on line 3—3 of FIG. 2 showing the valve plug for the spray valve.

FIG. 4 is a bottom view of a portion of the spray bar showing the angular relation of the spray nozzle port to the spray bar.

DESCRIPTION OF THE INVENTION

Although the disclosure hereof is detailed and exact to enable those skilled in the art to practice the invention, the physical embodiments herein disclosed merely exemplify the invention which may be embodied in other specific structure. The scope of the invention is defined in the claims appended hereto.

Referring to the drawing, the spraying apparatus 10 of this invention is shown connected to a recirculating system 12 for a bituminous material 14 which has been heated by conventional means in a reservoir 16. The heated bituminous material 14 is pumped through the circulating system 12 to a spray bar 18 and recirculated

through the spray bar or sprayed onto a road surface by means of a number of spray valve and nozzle assemblies **20**. The flow of the bituminous material **14** through the spray assemblies **20** is controlled by means of valve plugs **22** each of which has a flow passage **24** terminating in a spray nozzle port or orifice **26**. The valve plugs **22** are selectively moveable to provide a spray path or a recirculating flow path through the spray assemblies **20**.

The heated bituminous material **14** in the reservoir **16** is continuously circulated through the spray bar **18** and back to the reservoir **16** by means of a pump **28** connected to a suction pipe **30** positioned in the reservoir **16** and to a pressure pipe **32** connected to the spray bar **18** by a hose **34**. Control valves **36** and **38** are provided in the suction pipe **30** and the pressure pipe **32**, respectively, to allow for filling or draining of bituminous material to the reservoir **16**. The heated bituminous material **14** is returned from the spray bar **18** to the reservoir **16** through a hose **40** connected to a pipe **45**. The bituminous material is circulated through the recirculating system **12** without passing through the spray bar **18** by means of a bypass valve **42** connected to a three way pipe fitting **44** in pressure pipe **32** and a three way pipe fitting **46** in return pipe **45**. The flow of bituminous material to the spray bar **18** is controlled by control valves **48** and **50** provided in pressure pipe **32** and return pipe **45**, respectively.

The spray bar **18** is divided into an inlet flow passage **52** and a return flow passage **54** by means of a horizontally disposed partition **56**. Circulation of bituminous material from the inlet flow path **52** to the outlet flow path **54** in the spray bar **18** is achieved by means of the spray valve and nozzle assemblies **20** mounted on the outside of wall **58** of the spray bar **14**. Each of the spray assemblies **20** includes a housing **60** secured to the outer wall **58** of the spray bar **18** by means of bolts **62**. Leakage of bituminous material between the housing **60** and wall **58** is prevented by means of a gasket **64** positioned between the housing **60** and the wall **58**. The housing **60** includes a central chamber **66** which is connected to the inlet passage **52** through a port **68** in wall **58** and to the return passage **54** through an outlet port **70** in wall **58**. A spray port **72** is provided in the lower part of the housing **60** to allow the bituminous material to be sprayed onto a road surface.

The flow of bituminous material **14** through the housing **60** is controlled by means of the valve plugs **22** which are mounted for rotary motion within the housing **60**. The valve plugs **22** include an annular body portion **74** positioned within chamber **66** and a hub **76** positioned in well **78** in the housing **60** with a valve stem **80** projecting outwardly through an aperture **82** in housing **60**. The valve plugs are sealed within the chamber **66** of the housing **60** by means of an O-ring **84** positioned in a groove **86** in the outer periphery of the hub **76**. The valve plugs **22** separate the inlet port **68** from the outlet port **70** and the spray port **72**. The inlet port **68** is selectively connected to the outlet port **70** or to the spray port **72** by rotating the valve plug **22** to align the passage **24** in the valve plug **22** with the inlet port **68** and either the outlet port **70** or the spray port **72**.

The valve plugs **22** can be rotated manually by means of a common actuating bar **88** connected to the valve stem **80** by a radially extending arm **90**. The actuating bar **88** is moved relative to the spray bar **18** to rotate the valve stems **80** to align the flow passage **24** in the annular body portion **74** with the ports in the housing **60**.

The bituminous material **14** is sprayed onto the road surface by means of the spray nozzle port or orifice **26** provided at the end of the passage **24**. The spray nozzle port **26** converges inwardly near the end of the flow passage **24** and then diverges outwardly to an elongated slot **92**. An even distribution of bituminous material is produced across the full width of the spray bar **18** by means of the angular relation of the slot **92** to the axis **94** of the spray bar **18**. The spray bar of the adjacent spray valve and nozzle assemblies **20** will overlap sufficiently to produce a continuous spray of bituminous material across the full width of the spray bar. This angular relationship can be seen in FIG. 4 where the longitudinal axis **96** is shown intersecting the axis **94** of the spray bar **18** at an angle of 15 to 30°. Since this relationship is fixed due to the location of the slot **92** in the valve plug, a continuous spray will be produced each time a spraying operation is started.

In operation, the bituminous material is heated in the reservoir **16** and pumped through the circulating system **12** when heated sufficiently to become flowable. Valves **48** and **50** are then opened and valve **42** closed to circulate the bituminous material through the spray bar **18** and spray valve and nozzle assemblies **20**. The actuating bar **88** is then moved to rotate the valve plugs **22** to align the passage **24** with the inlet port **68** and the spray port **72**. When the spraying operation is completed, the actuating bar **88** is moved to rotate the valve plug **22** and align the passage **24** with the inlet port **68** and outlet port **70**. A continuous flow of bituminous material **14** will then pass continuously through the spray valve and nozzle assemblies **20** whenever the spray apparatus is being used.

A continuous load is imposed on the pump **28** by locating the spray nozzle port **26** at the end of the flow passage **24** in the valve plug **22**. The bituminous material will flow through the nozzle **26** when the material is recirculating as well as when the material is being sprayed onto a road surface.

Although only a single spray bar **18** is shown in the drawing, it should be apparent that the spray bar is adaptable to a variety of different spraying structures where the material to be sprayed must be kept in constant motion.

What is claimed is:

1. A spraying apparatus comprising

a spray bar having an inlet flow passage and an outlet flow passage, and

a number of spray valves mounted on said bar, each of said valves including a valve plug for selectively connecting said inlet flow passage either to said outlet flow passage or to a spray port diverging outwardly from said valve plug.

2. An apparatus according to claim **1** wherein said valve plug includes a flow passage having a converging outlet.

3. An apparatus according to claim **1** wherein each of said spray ports are angularly offset from the longitudinal axis of said housing.

4. An apparatus according to claim **10** wherein said spray ports are angularly offset from the longitudinal axis of said housing to produce overlapping shaped sprays of bitumen.

5. An apparatus according to claim **1** including means for simultaneously moving said valve plugs in said spray valves.

6. An apparatus for spraying heated bituminous material comprising

a spray bar,

a partition dividing said spray bar into an inlet flow passage having a number of inlet ports and an outlet flow passage having a number of outlet ports,

a number of spray valves mounted on said spray bar,

each of said spray valves including a housing having a central chamber enclosing one of said inlet ports and one of said outlet ports and an elongate diverging spray port,

a valve plug mounted in said chamber in each of said housings to separate the inlet port from said outlet port and said spray port,

said valve plug including a flow passage having a converging outlet, and

means for moving said plug to connect said flow passage in said valve plug with said inlet port and either said outlet port or said spray port.

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