

July 10, 1962

H. A. CARTWRIGHT
HOT SPRAY BARS

3,043,518

Filed July 2, 1959

3 Sheets-Sheet 1

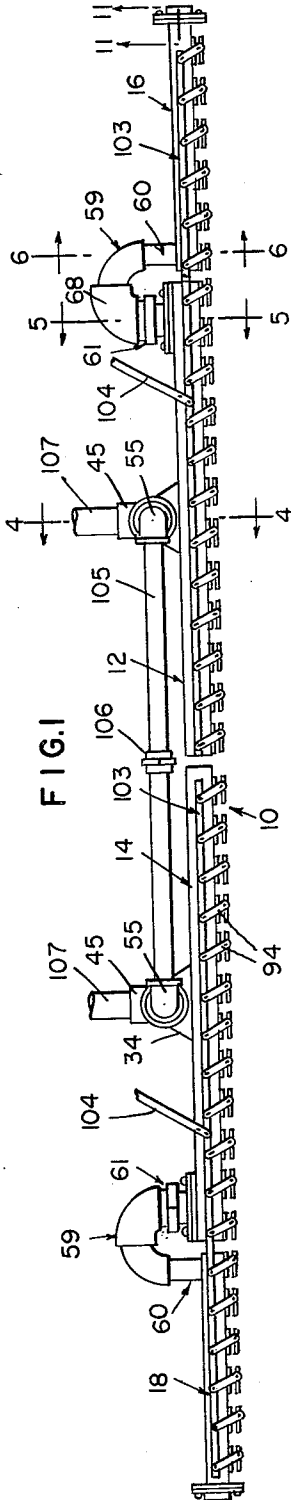
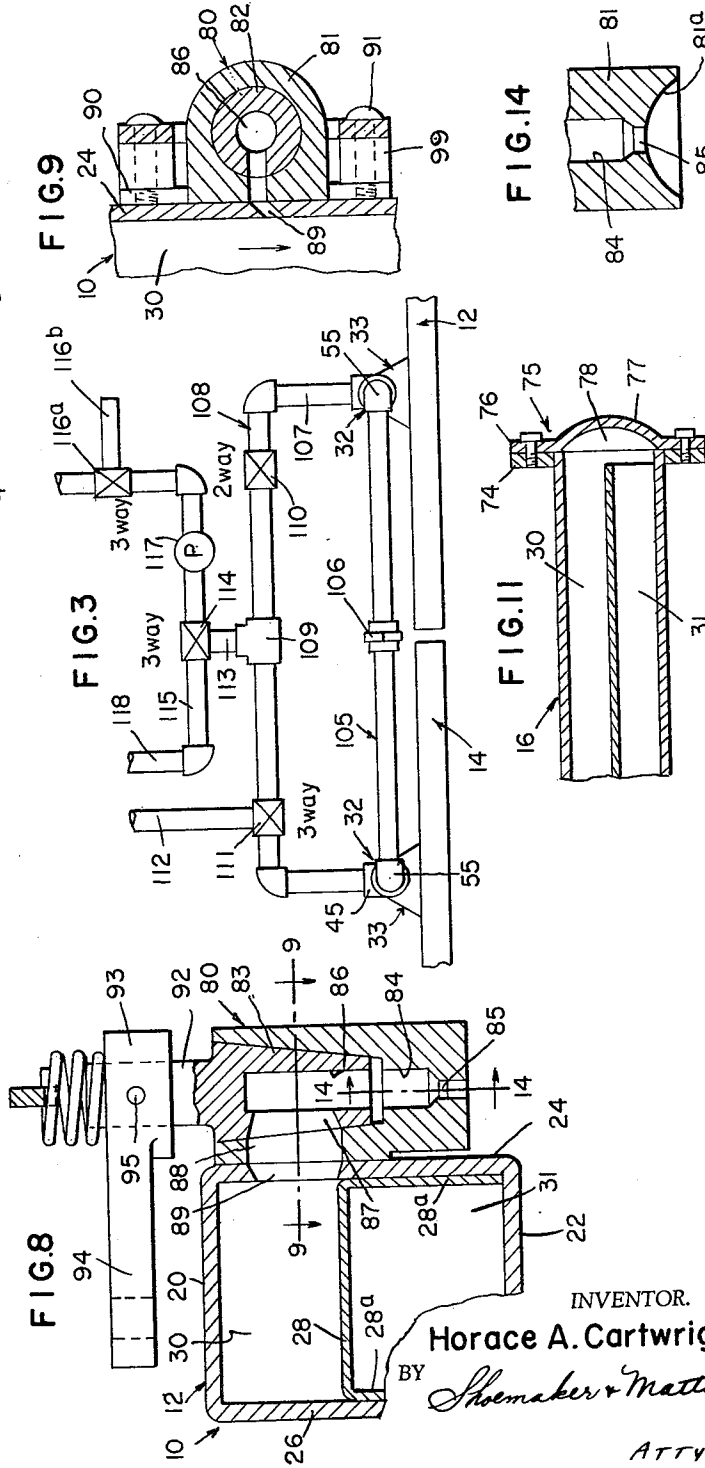
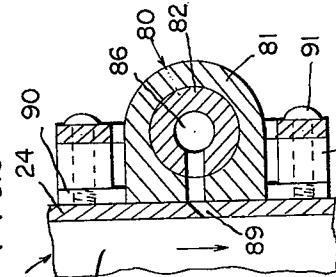


FIG. 9



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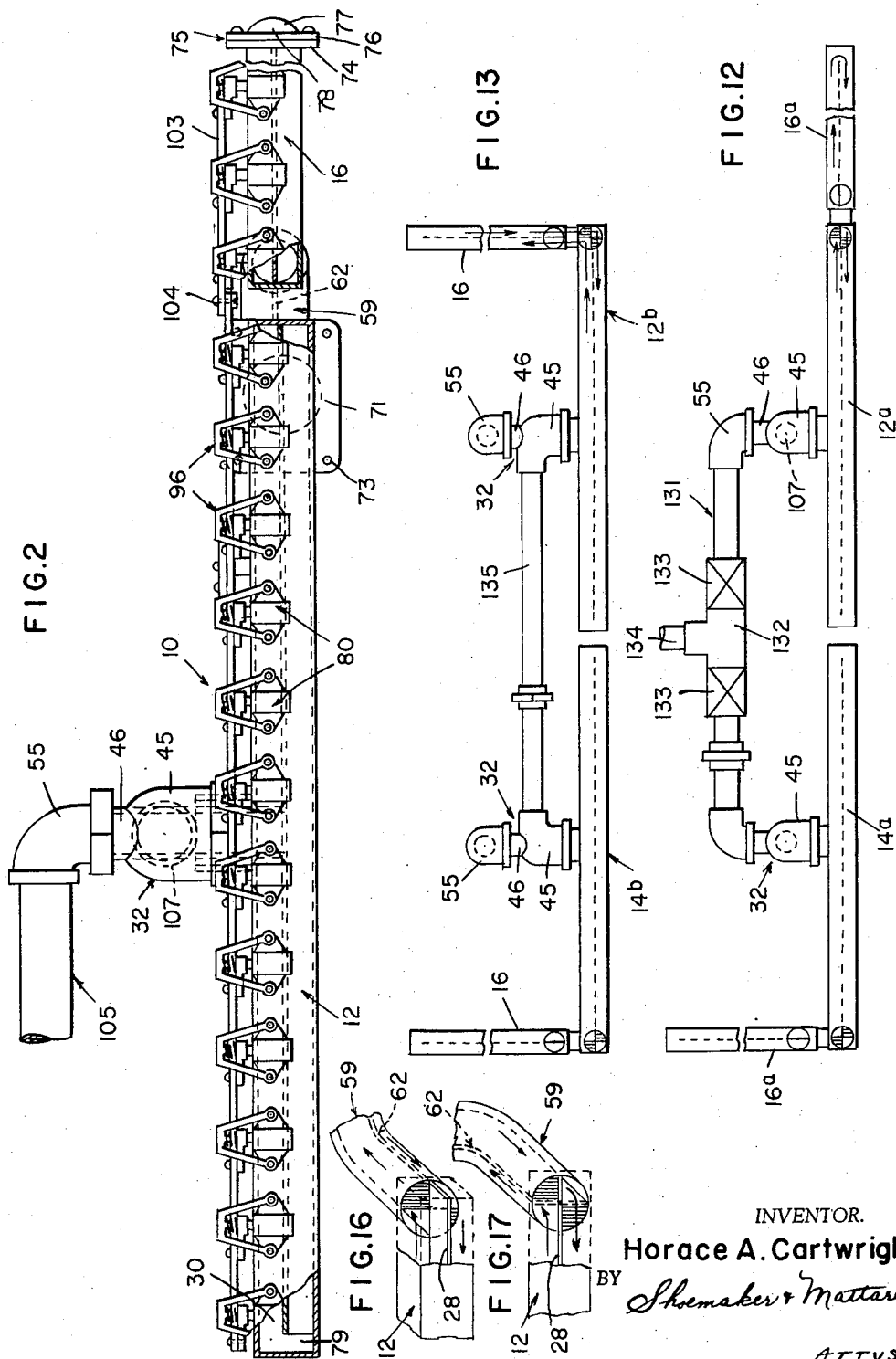
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3 Sheets-Sheet 2



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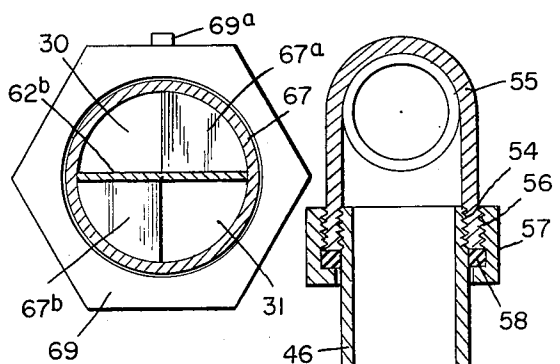


FIG. 15

FIG. 4

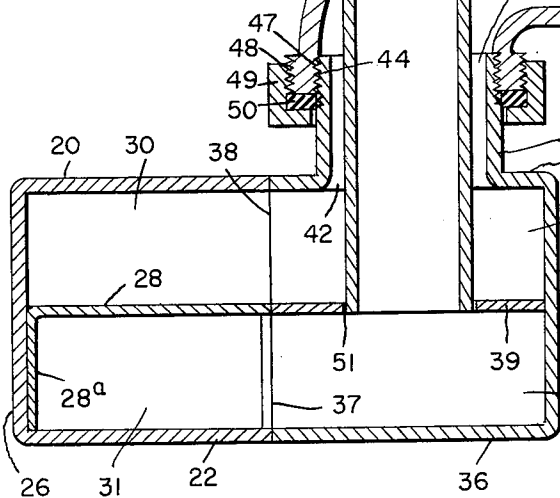


FIG. 5

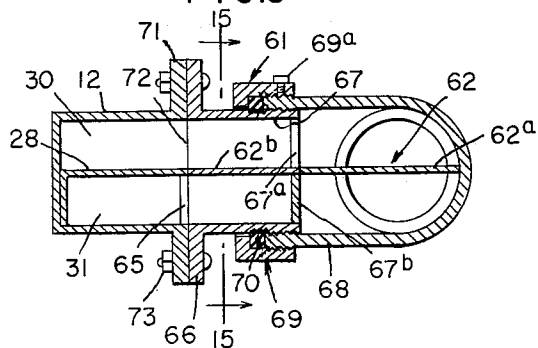
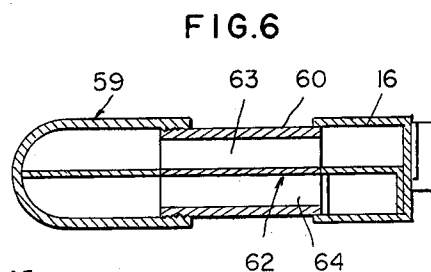


FIG. 6

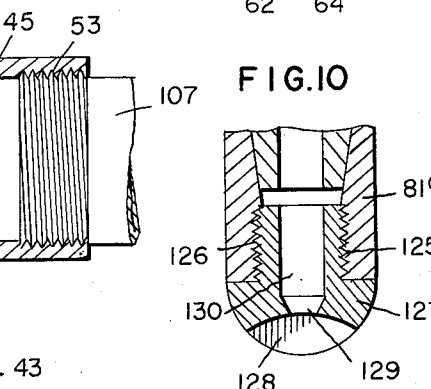


FIG. 10

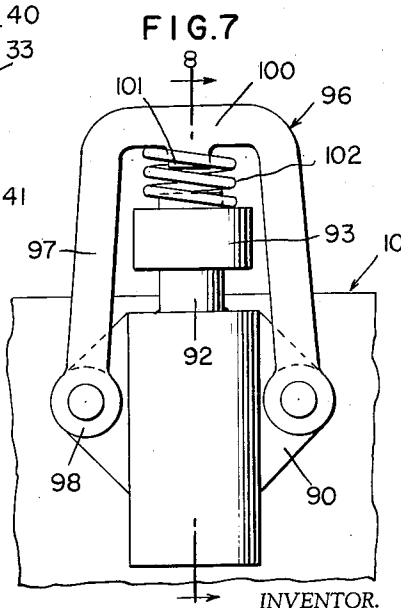


FIG. 7

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3,043,518

HOT SPRAY BARS

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10 Claims. (Cl. 239-124)

This invention relates generally to the class of road building or road surfacing machinery and is directed particularly to improvements in machines or structures forming a part of road working machines adapted to the spraying or distributing of heated bituminous material onto a road surface.

In connection with the operation of machines for spraying bituminous material in connection with the building of roadways, one of the problems involved has to do with the opening of the spray nozzles or the unclogging of such nozzles if the machine has been shut down and the bituminous material has cooled. As is, of course, well known to those familiar with the art, such bituminous material is heated so as to soften it or fluidize it so that it can be readily sprayed in an even coating over a road surface. Some material after cooling remains in the spray nozzles and in the pipes and therefore when the spraying machine is again put into service it is important, in order that it may function with maximum efficiency, that the congealed bituminous material be thoroughly softened in all of the pipelines leading to the nozzles as well as in the nozzles themselves.

It is a particular object in view of the foregoing to provide an improved hot spray bar structure which is designed so that the bituminous spray material, after being heated up in the carrying receptacle, can be circulated to the outer end of the bar or to the outer ends of coupled-together sections of the bar and returned to the tank or receptacle, prior to the opening of the spray nozzles, so that the bar and the nozzles can be heated and any congealed material therein can be softened or melted to the proper fluid condition so that upon the opening of the nozzles, the spray material can then be discharged in the proper manner.

It is another object of the present invention to provide a new and novel form of hot spray bar and nozzles mounted thereon wherein the nozzles are attached to the spray bar in such manner that after hot material is circulated therethrough preliminarily to the operation of the machine, the heat from the material will be transferred to the nozzles and thus heat up the same to fluidize any congealed material therein.

In known types of spraying apparatus used for distributing heated bituminous material over a road surface, use is commonly made of screens or strainers located in various positions, either in the spray bar or in the nozzle structures themselves, which are designed to prevent the clogging of the nozzles by the passage therein of hard particles of the bituminous material or small stones or other debris which may get into the material. Such screens or strainers are also frequently used to strain the material going into the tank from which the material is conveyed to the spray bars or nozzles. The use of such screens or strainers causes a slowing down of the time consumed in loading the spray machine. Also it is more difficult to pump cold material when it is in a viscous state through a screen and the screens are often removed to facilitate these operations. Additionally, the use of screens may result in the breaking of the emulsion of the liquid bituminous material.

In addition to the fact that screens used for straining the material going into the tank have the objection of slowing down the loading time, the use of such screens in the spray bars or the nozzles also interferes with the free flowing of the material to the nozzles.

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It is accordingly another object of the present invention, in the light of the foregoing to provide a new and novel means for straining out hard particles or any small objects which may be entrained in the stream of material, before they reach the nozzles and where such hard particles or other pieces of material are of a size to prevent them from going through the nozzle orifice and additionally to provide such a straining means which can be readily cleared of particles in the ports or apertures leading to the nozzles, by the movement of the fluidized spray material through the spray bars during the operation of heating up the bars and the nozzles.

More particularly, the invention has for an object to provide a spray bar structure having spray nozzles attached or secured thereto with narrow straining slots in the spray bar leading through corresponding slots into the spray nozzles and wherein such slots have a width materially less than the diameter of the spray nozzle orifice so that any foreign material caught in the slots leading to the spray nozzles may be removed or washed away by the flow of the circulating material, this being accomplished by forming the slots so that they will be directed obliquely through the wall of the spray bar to which the nozzles are attached in the direction in which the fluid material flows through the spray bar.

A further object of the invention is to provide a new hot spray bar and valve controlled pipe system connected therewith, by means of which through the proper manipulation of control valves, the bituminous spray material can be heated and circulated outwardly and back through the spray bar or spray bar sections to effect the desired heating of the bars and of the nozzles mounted thereon and the consequent softening and eventual melting of congealed portions or slugs of the bituminous material in the pipes, spray bars, and nozzles.

The invention will be best understood from a consideration of the following detail description taken in connection with the accompanying drawings forming part of the specification, with the understanding, however, that the invention is not confined to a strict conformity with the showing of the drawings but may be changed or modified so long as such changes or modifications mark no material departure from the salient features of the invention as expressed in the appended claims.

In the drawings:

FIG. 1 is a view in top plan of a multisection hot spray bar structure constructed in accordance with the present invention and showing a multiplicity of spray nozzles mounted thereon and also showing in part pipelines connected with the bar for conducting bituminous material from a receptacle or tank to the bar and back to the tank;

FIG. 2 is a view looking at the rear side of two connected sections of the spray bar and showing the valves and other parts in elevation, the view being on an enlarged scale;

FIG. 3 is a diagrammatic illustration of one arrangement of pipelines associated with the center sections or main sections of the spray bar structure, by means of which the control of the circulation of the fluid to and from the spray bars is effected;

FIG. 4 is a sectional view on an enlarged scale taken substantially on the line 4-4 of FIG. 1 illustrating in detail one of the unitary fittings for supplying bituminous material to a spray bar section and for returning such material from the section to the supply tank;

FIG. 5 is a sectional view on an enlarged scale taken substantially on the line 5-5 of FIG. 1;

FIG. 6 is a sectional view on an enlarged scale taken substantially on the line 6-6 of FIG. 1;

FIG. 7 is a view in elevation and on an enlarged scale of one of the spray nozzles together with a portion of the spray bar to which it is attached;

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FIG. 8 is a sectional view taken substantially on the line 8—8 of FIG. 7;

FIG. 9 is a horizontal section taken substantially on the line 9—9 of FIG. 8;

FIG. 10 is a sectional detail of a modified construction of the orifice end of a spray nozzle;

FIG. 11 is a sectional view on an enlarged scale taken substantially on the line 11—11 of FIG. 1;

FIG. 12 is a diagrammatic illustration of another pipe and valve arrangement for conducting the material to the spray bars and returning it therefrom; and

FIG. 13 is a further diagrammatic illustration of still another pipe system connected with the center sections of the spray bar;

FIG. 14 is a sectional view taken substantially on the line 14—14 of FIG. 8.

FIG. 15 is a sectional view taken substantially on the line 15—15 of FIG. 5.

FIG. 16 is a diagrammatic view illustrating the manner in which flow of liquid is controlled in passing from the outflow channel of a middle bar or pipe section to and through a U-coupling fitting and back into the return flow channel of the middle section when the outlying section is extended horizontally and in which case the division wall in the coupling is horizontal.

FIG. 17 is a diagrammatic view corresponding to FIG. 16 and showing the manner in which the quarter blocking sections function to insure continuous flow of the liquid through the outlying section when the latter is turned to vertical inoperative position and in which case the division wall in the coupling is disposed in a vertical plane.

Referring now more particularly to the drawings, it is pointed out that since the present invention is directed to the spray bar construction, the piping system connected therewith and the spray valves, no illustration is given of the manner in which the spray bar is mounted upon a vehicle body or connected with a supply tank or receptacle since it will be readily apparent that any suitable means may be employed for mounting the hot spray bar and the pipes directly connected therewith upon a suitable structure for conducting it over a road surface.

In FIG. 1 there is illustrated a four-section spray bar structure which is generally designated 10 and which embodies the right and left middle bar or pipe sections 12 and 14 respectively and the corresponding right and left extension sections 16 and 18 which are swivelly coupled in the manner hereinafter described with the center sections, to be swung upwardly to out-of-service positions.

The spray bar in each of its sections preferably is of polygonal cross sectional form as illustrated in FIG. 8 and comprises, when in rectangular form as shown, the top and bottom horizontal walls 20 and 22 and the front and back walls 24 and 26 respectively.

While the spray bar sections are preferably of rectangular cross section, they may, of course, be made circular if desired, but in that case suitable provision would be made for mounting the hereinafter described spray nozzles against a flat surface of the spray bar whereby efficient heating of the nozzles by hot material flowing through the spray bars could be effected.

Each of the spray bar sections has extending longitudinally therethrough a dividing wall or septum 28 which divides the bar into an upper channel 30 and a lower channel 31.

The upper channel 30 may be defined as the outflow channel while the lower channel 31 may be defined as the return flow channel. The dividing member here shown, by which the wall or septum 28 is provided, is in the form of a relatively thin wall body of U-shaped cross section, the side portions 28a of which lie against the inner sides of the front and back walls 24 and 26, as shown.

Each of the two middle or main sections 12 and 14 of the spray bar structure is connected with a combined, one wall, two-way fitting which is generally designated 32 and is shown in enlarged section in FIG. 4. This fitting is coupled with the back wall 26 of the spray bar

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section 12 or 14 through the medium of a box 33 which has convergent rearwardly projecting side walls 34 and the top and bottom walls 35 and 36, the box thus assuming an approximately triangular form or configuration as seen in top plan with an open side 37 between the divergent end edges of the walls 34, which fits over an opening of corresponding size formed in the back wall 26 as indicated at 38 and the box 33 is divided by the plate or septum 39 forming the upper and lower chambers 40 and 41 respectively which communicate with the upper and lower channels 30 and 31 of the spray bar.

The top wall 35 of the box 33 has an opening 42 which is defined by upstanding neck 43 externally screw threaded adjacent to its upper end as indicated at 44.

The fitting 32 embodies an elbow section 45 and a straight tubular section 46 which are rigidly joined together. The elbow section has one end both internally and externally screw threaded as indicated at 47 and 48 respectively and is adapted to have the threaded end of the neck 43 engaged therein with the threads 47 while the threads 48 on the outer side of this end of the coupling are engaged by a gland nut 49 which encircles the neck 43 and maintains a packing 50 against the end of the coupling and around the neck, as illustrated.

The tubular portion 46 of the fitting 32 extends through the outer or convex wall of the right angular coupling 45 and extends a substantial distance beyond the end of the coupling which is attached to the neck 43 into the box 33 where it is rotatably fitted in the opening 51 formed in the division wall or septum 39 so that it communicates only with the chamber 41.

As shown, the tubular portion 46 of the fitting is of an overall diameter materially less than the inside diameter of the neck 43 so that there is thus provided the material entrance passageway 52.

The opposite end of the elbow coupling 45 is, as shown in FIG. 4, directed at right angles to the tubular portion 46 and is internally screw threaded as at 53 for connection with feed or return pipelines as hereinafter described.

The top or outer end of the tubular portion 46 is also externally threaded as indicated at 54 for connection with an end of an elbow coupling 55 and the elbow coupling is externally threaded at the end which is joined to the portion 46, as indicated at 56, for threaded connection with a packing gland nut 57 which compresses a packing 58 against the adjacent end of the elbow coupling 55 to provide a fluid-tight, but swivel, joint. The gland nut 49 hereinbefore referred to also provides a swivel coupling between the fitting 32 and the adjacent spray bar section whereby such section may be rotated on a vertical axis when desired.

The middle sections 12 and 14 of the spray bar are normally set in end aligned relation as shown in FIG. 1 and the outlying sections 16 and 18, when used, are coupled with the remote ends of the middle sections 12 and 14 by tubular U-coupling fittings 59 which function to convey the bituminous material from the outflow channels 30 of the middle sections to corresponding channels of the outlying sections and also to carry the return flow of the material across between the adjacent ends of the spray bar sections. These U-couplings comprise the legs 60 and 61.

Each tubular U-coupling fitting is divided centrally throughout its length or from one end thereof to the other by a wall or septum which is generally designated 62 and which wall or septum is illustrated in FIGS. 5 and 6. As will be seen upon reference to these figures, this division wall 62 forms channels 63 and 64 through the tubular coupling which respectively constitute outflow and return channels and may be also defined as upper and lower channels since they assume this relationship when the outlying portions of the spray bar are in working or horizontal position. Thus it will be apparent that the upper or outflow channel 63 communicates with the upper or outflow channel 30 of the adjacent spray bar

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portion 12 or 16 while the return flow or lower channel 64 communicates through the opening 65 in a side portion 28a of the channel member which provides the septum 28, with the return flow or lower channels 31 of the central and outlying spray bar sections 12—16 or 14—18.

The leg 60 of the coupling 59 is fixed as by welding or in any suitable manner in an aperture in the back wall 26 of the spray bar section 16 but the other leg 61 is swivelly joined to the back wall 26 of the portion 12 so that the outlying portion 16 can be swung upwardly on an axis line passing transversely and horizontally through the spray bar portion 12. As best shown in FIG. 5, this swivel coupling includes a mounting plate 66 having a short neck 67 joined thereto and opening therethrough and which neck 67 forms an element of the leg 61. This neck section 67 is externally screw threaded as illustrated and has threaded thereon one end of the L member 68 which forms a part of the leg. This threaded end of the L member 68 is also externally screw threaded as shown in FIG. 5 and has threaded thereon the gland collar or nut 69 which is held against turning movement on the threads of the member 68 by a set screw 69a or in any other suitable manner. The gland nut maintains in place around the neck portion 67 the packing ring 70 against which the end of the portion 68 presses. When the outlying section 16 or 18 is swung from operative position as it is illustrated in FIG. 1 to inoperative position as illustrated in diagrammatic FIG. 13, for example, or at the left hand side of FIG. 12, this gland nut or collar 69 will rotate with the U-coupling. In this rotation of the coupling it will, of course, be apparent that the part 68, which makes a $\frac{1}{4}$ turn, will move slightly axially on and with respect to the leg portion 67 by reason of the threaded connection between these parts 67 and 68, slightly moving or further compressing the packing.

The division wall in each of the U-couplings and which is generally designated 62 is formed in two parts which are designated 62a and 62b. The part 62a extends from the end of the leg 60 which is attached to the outlying section of the spray bar into the L portion 68 and terminates, as shown in FIG. 5, substantially in the plane of the outer end of the neck 67. The second part 62b of the division wall 62 lies in and is of the same length as the neck 67 joining at its inner end with the adjacent edge of the septum 28. Thus the part 62b divides the neck 67 in the upper and lower halves and at the outer end of the neck there are fitted the upper and lower quarter circular blocking plates 67a and 67b respectively. The blocking plate 67a occupies one-half of the semi-circular upper channel area in the neck 67 while the blocking plate 67b occupies one-half of the lower semi-circular channel area in the neck. These quarter circular blocking plates are diametrically separated from one another and on opposite sides of the wall or septum portion 62b as shown in FIG. 15.

When the outlying sections 16 and 18 of the spray bar structure are to be taken out of service and are turned to an upright position as shown in FIG. 13, for example, it will be apparent that the part 62a of the dividing septum 62 in the U-couplings will be turned to a right angular or perpendicular relation with the part 62b. It is, of course, desirable that even with the outlying sections raised and out of service, the hot spray liquid continues to circulate through these sections in order to prevent the material congealing in the nozzles. It will thus be seen that without the provision of the quarter circular blocking plates 67a and 67b, when the outlying sections are vertically disposed, the outflowing fluid in the channels 30 of the middle sections 12 and 14 would enter both channels of the U-couplings and flow into both channels in the outlying sections and thus there would be no circulation in the outlying sections, whereas by the provision of the quarter circular blocking plates located as illustrated and described and if reference now be had to FIGS. 16 and 17, it will be seen that when the

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U-coupling is turned from its horizontal position, as diagrammatically illustrated in FIG. 16 to the vertical position as diagrammatically illustrated in FIG. 17, thus turning the septum part 62a also to a vertical position, the portion of the return flow channel which would thus be brought into communication with the outflow channel 30 and the portion of the outflow channel of the U-coupling which would be brought into communication with the return flow channel 31 of the central portion, will be shut off. Consequently the outflowing liquid in the channel 30 of the central section will pass into the proper outflow channel of the U-coupling and the outer bar section and will be properly circulated therethrough and returned to the return flow channel 31 of the adjacent middle section of the spray bar structure.

The attachment of the plate 66 with the back wall 26 of the spray bar section 12 is preferably by means of a mounting plate 71 which has a central opening 72 aligning with a similar opening in the wall 26 and the plates 66 and 71 are detachably coupled together by bolts 73 whereby the swivel coupling 59 can be detached for the removal of the outer spray bar 16 if and when desired. In such case, after detaching the outer spray bar section, the opening 72 can be closed by a suitable imperforate plate secured thereto in place of the mounting plate 66 which forms a part of the coupling.

The outer end of each of the outlying sections 16 and 18 carries an encircling flange 74 and is closed by a flanged cap 75. This flanged cap embodies the plate or flange portion 76 and a domed or outwardly curving portion 77 which, when the cap is secured in place against the flange 74, provides a return bend passage 78. By this means the material flowing outwardly through the upper channel 30 can reverse its flow to return through the lower channel 31, as will be obvious.

Also in order to provide for return flow of the material from the passage or channel 30 at the innermost end of each of the middle or central sections 14, the dividing wall or septum 28 terminates short of the inner end wall of the respective section providing the return flow passageway 79 shown in FIG. 2.

The closure cap 75, being readily removable from the outer end of each of the outlying sections, provides a means whereby an additional section may be attached so that the overall length of the spray bar can be extended as will be readily obvious.

Extending throughout the length of the spray bar structure and carried by each of the sections are spray valves which are relatively closely spaced and are mounted upon the vertical wall 24 and each of these valves is generally designated 80. As hereinbefore stated, by forming the spray bar sections of tubular material of rectangular cross section, there is provided a flat, vertical wall against which the valves can be firmly secured but, of course, it will be obvious that if it is desired to use tubing or piping of circular form, suitable flat bosses may be provided thereon against which the valves 80 can be secured. The primary purpose of providing a wide, flat surface against which to mount the valves is so that the maximum of heat transference from the wall of the spray bar to the body of the valve will be obtained when the hot bituminous material is circulated through the spray bar, to thereby soften or melt any congealed slugs of the material which may reside in the passages leading to the valves and in the body of the valve itself, especially in the orifice thereof.

Referring especially to FIGS. 8, 9 and 14, it will be seen that the spray valve 80, here illustrated and which is of course in multiple throughout the length of the spray bar sections, comprises the elongate body portion 81. This body of the valve is preferably of cast brass, but may be made of any other suitable material and has a tapered seat 82 in the upper portion thereof and extending lengthwise thereof to receive the tapered rotary plug 83. The tapered seat or socket 82 which receives the

plug 83 opens through the top of the body 81 and at its lower end it communicates with a bore 84 which leads to the spray orifice 85.

In the embodiment of the valve structures shown in FIGS. 8, 9 and 14, the bottom end of the body 81 is milled out to form the shallow, narrow arcuate slot 81a. From the bottom of this slot, the spray orifice 85 is drilled on the axial center of the plug as illustrated and is suitably broached to desired size to form an accurate circular opening through which the spray material is ejected into the arcuate slot or recess 81a and this recess by its formation causes a fanning out of the sprayed material.

The tapered rotary plug 83 has the longitudinal bore 86 therein which communicates with the bore 84 and the side of the plug 83 and also the upper portion of the body 81 has the slots 87 and 88 respectively milled therein. These slots are in the upper part of the valve body and the plug and when the valve is mounted on the wall 24 of the spray pipe, the slot 88 communicates with a slot 89 which is milled in the wall 24 above the dividing wall or diaphragm 28 so as to communicate only with the upper channel 30 of the pipe.

The feed slots 89 which lead from the supply channel 30 are, as shown in FIG. 9, directed obliquely through the wall 24 to face at their inner ends in a direction opposite to the direction in which the material flows through the channel during the spraying operation so that as the material flows across the slot during the operation of heating up the bars and nozzles as hereinbefore set forth, it will sweep the inlet edge free or clean of any particles of material which may have become lodged therein during the time that the spray bar is spraying and the bituminous material is passing through the slot 89 to and through the valves. The direction of flow of material is indicated by the arrow in FIG. 9 to illustrate the manner in which the material sweeps across the inlet end of the slot for the purpose described.

The slots 89 leading to the valves, as well as the slots 87 and 88, are elongated vertically but are of a width materially less than the diameter of the discharge orifice 85. Thus any particles of material which are small enough to pass through the slots leading into the valve will be freely discharged from the orifice 85 and thus the clogging of the valve will be avoided.

As shown in FIG. 9, the body of the valve 80 is formed with laterally projecting mounting ears 90 through which extend suitable mounting bolts or screws 91 which are threaded into the wall 24 of the spray pipe.

The valve plug 83 carries the upstanding stem 92 which is encircled by the collar 93 of an actuating arm or lever 94, the collar 93 being pinned as at 95 or otherwise suitably secured to the valve stem and the stem extends slightly above the collar as illustrated.

For effectively maintaining the valve plug firmly seated, there is provided a yoke 96 which, as shown in FIG. 7, is substantially U-form and is arranged in inverted position over the valve stem with the leg portions 97 thereof lying on opposite sides of the valve body and terminating in the eyes 98 through each of which extends a mounting bolt 91. Suitable spaces 99 may be provided for positioning the yoke outwardly from the mounting ears 90 to a position where the horizontal portion 100 which connects the legs 97 will lie directly over the center of the valve stem 92. This portion 100 of the yoke carries, on the inner side thereof, the short lug 101 which lies between the legs 97 and directly above the end of the valve stem and interposed between the collar 93 and the part 100 of the yoke is a coil spring 102 the lower end of which receives the top end of the valve stem while the upper end of the spring has the lug 101 extended thereinto.

For the simultaneous actuation of the valves of the spray bar, the crank arms or levers 94 are coupled together by the actuating bars 103. It will, of course, be apparent

from FIG. 1 that there is one of these connecting or actuating bars 103 associated with each of the sections of the spray bar structure and at the outer ends of the central portions 12 and 14 of the spray bar structure the adjacent ends of the actuating bars 103 may be suitably pivotally coupled by a bolt, cotter key or the like 104 whereby the connections may be broken if and when desired for the purpose of swinging the outlying sections 16 and 18 upwardly into inoperative position. Also, as will be readily apparent, in such case the valves on the outlying sections will be closed so that if the middle sections are in operation, the fluent material cannot escape from the inoperative sections.

In FIG. 1, there are shown a pair of operating arms or levers 104 each of which is connected with a valve operating bar 103. These levers may be suitably connected in any well-known manner with mechanism on the tank carrier whereby the operator of the spraying machine can open or close the valves at will. Since such spraying mechanism forms no part of the present invention and such mechanisms are of varied construction and well known, it is not considered necessary to illustrate the same.

FIG. 3 illustrates one plan for a pipe coupling between the central sections 12 and 14 of the four-part spray bar structure shown in FIG. 1. As previously described and as is illustrated, each of the central sections 12 and 14 has associated therewith a two-way fitting 32. Connecting the upper ends of the tubes 46 of the fittings is a cross-over pipe which is generally designated 105 which is in two parts and which parts are coupled by the coupling 106.

Each of the elbow or right angle couplings has connected therewith a pipe section 107 which are preferably in parallel relation as shown and the opposite ends of these pipe sections 107 are connected by a pipe line which is generally designated 108 and which includes midway of its ends the T-coupling 109 and a two-way valve 110 on one side of the T-coupling and a three-way valve 111 on the other side of the T-coupling. The three-way valve 111 has a pipe line 112 connected therewith which functions in the operation of the system to return the bituminous material to the tank or receptacle in which it is heated for use.

Connected with the lateral leg of the T-coupling 109, by means of a nipple 113, is a three-way control valve 114 which is interposed in a pipe line 115, which pipe line on one side of the valve 114 is supplied from the tank or receptacle with the bituminous material by way of the supply pipe 116 and a pump 117. The pipe line 115 on the opposite side of the valve 114 from the pump is connected with a return pipe 118 which leads to the supply tank.

In the operation of the apparatus as thus far described, if the apparatus has stood for a sufficient length of time for the bituminous material in the pipes to become stiff or congealed, the operator may first turn the control valve 114 to a position where the fluid can be drawn by the pump through pipe line 116 from the tank and passed back to the tank and circulated in this manner while it is being heated. After the material has become sufficiently hot, the control valve 114 may be turned so as to deflect the flow through the nipple 113 and the valve 111 is turned to a position where it will direct fluid flow from the left side of the system to the return pipe 112 but block the flow of fluid from the T-coupling 109. This will cause the fluid to flow to the right through the valve 110, which, of course, is open and the fluid will then pass into the angle coupling 45 of the fitting 32 which is connected to the central part 12 of the spray pipe structure and from this coupling it will enter the chamber 40 of the box 33 and flow into the upper or outflow channel 30. The fluid will then divide and flow to the right and to the left in the channel 30 passing outwardly to and through the coupling 59 the channel 30 of the outlying section 16 and

returning from the outer end of this latter section by way of the lower channel 31, around through the coupling 59 to the lower channel of the middle section 12, to the lower chamber 41 of the box 33 from which it will flow upwardly into the pipe or tube 46. At the same time, the fluid which has moved to the left in the section 12 will flow around the inner end thereof by way of the return passage 79 and come back to join the fluid in the box chamber 41 to flow through the pipe 46. Passing from the pipe 46 of the right hand fixture 32, the fluid will then enter the cross-over pipe 105 which is connected with the upper end of the tube 46 of the left hand fixture 32 and from here it will enter the chamber 41 of the left hand box 43 and flow outwardly through the lower channel 31 of the middle section 14 and outlying section 18, returning by way of the channel 30 to the chamber 40 of the left hand fixture 32. From this chamber it will be readily apparent upon reference to FIG. 4, that the fluid will then rise through the passage 32 and flow outwardly through the coupling 45 to the return pipe 112.

During the preceding operation, it will be understood that all of the valves 80 will be kept in closed position, the purpose being to heat the valves by the hot fluid passing through the channels and, as hereinbefore described, thus effecting the melting or fluidizing of any congealed material in the valves or valve passages.

After the valves have been heated and the passages have been opened, the spraying operation is begun by opening all of the valves through the medium of the bars 103 and the valves 110 and 111 may then be set so that the fluid from the pump 117 will divide and travel in both directions from the T-coupling 109. With this setting, the fluid flowing to the center and outlying sections 12 and 16 respectively will enter the chamber 40 of each of the boxes 33 by way of the coupling 45 and the passage 52 and pass into the outflowing channels 30. The fluid passing across the return passages at the ends of the middle and outlying sections will fill the sections and come back through the pipes 46 and fill the cross-over pipe and there remain static as there is no return passage open for it to pass back to the tank. Thus the fluid will be supplied equally to all of the nozzles.

In the spray nozzle structure illustrated in detail in FIGS. 8 and 9, the body 81 is shown as having the drilled and broached spray opening 85 formed directly therein. In FIG. 10 a slightly modified construction of the spray valve and nozzle is as shown. In this modification, the body 81a has a tapped and threaded bore 125 in the lower end and axially thereof and into this tapped, threaded bore there is fitted the stem portion 126 of a nozzle tip or head 127. This head 127 is substantially semi-spherical and it has formed therein by suitable milling operation the arcuate slot 128 and the central part of the head is drilled to form the constricting opening 129 which leads into the passage 130 which corresponds to the passage or bore 84 in the body 81.

FIGS. 12 and 13 illustrate two alternative arrangements for the valved piping system which may be employed in substitution for the arrangement shown in FIG. 3.

FIG. 12 is a diagrammatic view looking in a horizontal plane toward the back of the spray bar structure or at the faces of the spray bar sections to which the spray nozzles and valves, not shown, are secured. The unitary fittings 32 are accordingly illustrated as having the tubes 46 disposed vertically as they are in the arrangement shown in FIGS. 1, 2 and 3 and the tubes 46 are connected together at their upper ends by a valved transverse pipeline 131 through the medium of the L couplings 55. This pipe line or conduit has included therein the T-coupling 132 and the two-way control valves 133 located on opposite sides of the T-coupling, by means of which valves passage of fluid from one fitting 32 or the other may be shut off while fluid from the other fitting

may flow back to the return pipeline 134 which is connected with the T-coupling 132 as shown.

The L couplings 45 in this pipe arrangement of FIG. 12 are to be connected with a supply header, not shown, connected with the tank containing the bituminous material. Thus it will be seen that with this pipe arrangement, the material may be supplied by the header from the supply source to both L couplings 45 to circulate through either one or both of the adjacent central sections 12a and 14a of the spray bar and then returned by way of the tubes 46 and either or both valves 133, into the conduit or pipe line 131 and through the coupling 132 to the supply source.

Where it may be desired to use only one of the spray bar sections, then the valve 133 adjacent to the spray bar section which is to be cut out of use is closed and it will be readily apparent from a consideration of the construction of the fitting 32 how the fluid from the supply source will circulate through one spray bar section and be returned through the adjacent open valve 133 to the supply.

In the diagrammatic showing in FIG. 12 as well as in the showing forming FIG. 13, the outlying spray bar sections are shown in outline and designated 16a and 18a and, of course, it will be understood that these sections would be connected with the adjacent middle sections by a coupling such as that shown in FIG. 1 and generally designated 59.

In the diagrammatically illustrated pipe system forming FIG. 13, the view of the spray bars and the attached units 32 is horizontal as in FIG. 12. However, in this arrangement, the L couplings 45 are located to have the horizontal ends thereof directed toward one another and these horizontally directed ends of the couplings are joined together by the pipe 135.

The L couplings 55 connected with the upper ends of the tubes 46 are to be connected with a suitable header by means of which the bituminous material may be supplied to the spray bar sections.

In FIG. 3, the pipe section 116 which is connected with the tank may have inserted therein a three-way valve 116a which is connected with a nipple 116b adapted to have a supply pipe threadably, or otherwise, coupled to its outer end. By this means a supply pipe or hose can be run from a storage tank to supply the bituminous liquid to the tank of the machine carrying the hot spray bar structure. Thus by the provision of the three-way valve 116a a direct line may be opened between the nipple 116b and that portion of the pipe 116 leading to the operating machine tank and cutting out that portion of the line 116 which is nearest to the pump 117 and after the material has been run into the machine tank, then the valve 116a may be turned to the proper position to close the nipple 116b and re-establish direct communication through the pipeline 116 between the machine tank and the pump 117. Also it will be seen that by means of this coupling the bituminous material in heated condition may be caused to pass through the pipe system and through the channels of the spray bar sections to clear the same of any material remaining therein.

I claim:

1. In a liquid spraying apparatus, the new combination of a tubular spray bar having a longitudinal dividing septum therein providing parallel channels communicating with one another at one end of the bar, a combined feed and discharge unit operatively connected to the spray bar, said unit comprising two tubular parts having outer end portions each adapted for connection with a liquid conduit and having coaxial swivelly joined inner end portions one of which has an end communicating with one channel and having an inner end opening into the other channel, spray valves carried by the spray bar and having communication with one only of said channels and a valve controlled conduit system adapted for connection with a source of liquid and operatively coupled with the said outer ends of said tubular parts

whereby said parts may function selectively as inlets and outlets.

2. In a liquid spraying apparatus, a spray bar structure comprising two end aligned tubular bar sections, a septum in and extending longitudinally of each bar section to form two longitudinal channels, said channels in each bar section communicating, a one structure feed and discharge unit carried on each bar midway of the ends thereof, each unit comprising a first tubular section and a second tubular section, the first tubular section having an inner end portion communicating with one channel of the adjacent bar section, the second tubular section having an inner end portion communicating with the other channel of the adjacent bar section, a crossover pipe coupling two corresponding tubular sections of the two units, conduit means connected with each of the other tubular sections of the units for selectively conducting liquid away from and back to a supply source, spray valves carried by each bar section adapted when open to receive liquid from one channel only, and at least one control valve in the conduit means having a first operating position in which liquid is caused to circulate through the channels of the bar sections and return to the supply source and a second position blocking said return for the discharge of the liquid through the open spray valves, the tubular sections of each unit being in part fixedly joined together and in part coaxially arranged and swivel-coupled with the inner end portions of one tubular section within and radially spaced from the coaxial other section.

3. In apparatus for spraying bituminous liquid, a spray bar structure embodying two independent sections, valved spray nozzles carried by each section, and a conduit system including supply and return piping for connecting the said two sections of the spray bar structure together and with a source of supply of the bituminous material and means for forming out-flow and return-flow channels in each of the sections of the spray bar structure whereby heated bituminous liquid may first be caused to circulate through the channels to fluidize viscous and congealed bituminous liquid therein and in the closed spray nozzle valves and then caused to flow through the out-flow channel only to the opened spray nozzle valves the connection between the supply and return piping and each of the sections of the spray bar structure including, in a single fitting, an L section having an elongate tube section extending through the convex side of the wall thereof, the inner end portions of the tube section extending coaxially through and being in radially spaced relation with one end of the L section and said inner end portion of the tube section being in communication with one of said channels and said one end of the L section being in communication with the other one of said channels.

4. The invention according to claim 3, wherein each said connection includes a swivel coupling between the said one end of the L section and the spray bar whereby the spray bar is rotatable about a vertical axis on the fitting.

5. In a spraying apparatus, a tubular spray bar, a septum longitudinally dividing the same into two channels communicating at one end with one another, valved spray nozzles secured to and along a side of the bar and having communication with one channel, a box secured to the side of the bar opposite from the nozzles and having a horizontal division wall providing an upper chamber opening into one channel and a lower chamber opening into the other channel, the box having an upstanding neck opening into said upper chamber, and a feed and discharge fitting embodying an L portion coupled at one end to the top of said neck and an elongate tubular portion extending through the top convex side of the L and projecting at one end through the said one end of the L into the box and through an opening in said horizontal division wall and opening in said lower chamber and the

tubular portion being in radially spaced relation with the interior of said one end of the L.

6. In a spraying apparatus, a first elongate tubular main spray bar having an inner end and an outer end and having a front and a back side, a dividing septum in and extending lengthwise of said bar and forming in the bar a liquid outflow channel and a liquid return flow channel, the channels being in communication at the inner end of the bar, a combined liquid feed and discharge unit attached to the bar and including means for directing fluid flow from a supply source into said outflow channel and means for receiving fluid from the return flow channel and directing it back to said source, a second elongate tubular spray bar having an inner end and an outer end and having a front and a back side, a dividing septum in and extending lengthwise of said second bar and forming therein a liquid outflow channel and a liquid return flow channel, said channels of the second bar being in communication at the outer end of the second bar, a tubular U-coupling having two legs, one leg being secured to the outer end of and opening into the second bar through said back side thereof, said one leg being in two swivelly coupled parts whereby the second bar may be swung from a horizontal operating position to an upright non-operating position, a division wall extending through the tubular U-coupling and dividing the latter into liquid outflow and return flow passages which align respectively with the liquid outflow and return flow channels when the inner and outer bars are in horizontal operating position, said division wall being divided in two parts at the swivel coupling between said two leg parts whereby one part of the division wall turns to a position in which it presents an edge substantially perpendicular to an adjacent edge of the other part when said second bar is turned to upright non-operating position, means semi-partitioning said outflow and return flow passages at the said adjacent edges of the two wall parts for insuring passage of liquid from the outflow channel of the first bar only to the outflow channel of the second bar and from the return flow channel of the second bar only to the return channel of the first bar when the second bar is in said non-operating position, and valved spray nozzles carried by both bars and adapted to have operative communication with one channel only with their respective bars.

7. In a spraying apparatus, a first elongate tubular main spray bar having an inner end and an outer end, a dividing septum in and extending lengthwise of said bar and forming in the bar a liquid outflow channel and a liquid return flow channel, the channels being in communication at the inner end of the bar, a combined liquid feed and discharge unit attached to the bar and including means for directing fluid flow from a supply source into said outflow channel and means for receiving fluid from the return flow channel and directing it back to said source, a second elongate tubular spray bar having an inner end and an outer end, a dividing septum in and extending lengthwise of said second bar and forming therein a liquid outflow channel and a liquid return flow channel, said channels of the second bar being in communication at the outer end of the second bar, a tubular U-coupling having two legs, one leg being secured to the outer end of and opening into the second bar, said one leg being in two swivelly coupled parts so that the second bar may be swung from a horizontal operating position to an upright non-operating position, a division wall extending through the tubular U-coupling and dividing the latter into liquid outflow and return flow passages which align respectively with the liquid outflow and return flow channels when the inner and outer bars are in horizontal operating position, said division wall being divided in two parts at the swivel coupling between said two leg parts whereby one part of the division wall turns to a position substantially perpendicular to the other part when said second bar is in upright non-operating posi-

tion, means for insuring passage of liquid from the outflow channel of the first bar only to the outflow channel of the second bar and from the return flow channel of the second bar only to the return channel of the first bar when the second bar is in said non-operating position, comprising two quarter-circular locking bodies, one quarter-circular body being secured to the said other part of said division wall in a position to block movement of fluid from the outflow channel of said one bar into the return flow passage of the U-coupling when the second part is in non-operating position and the other quarter-circular body being secured to the said other part of said division wall in a position to block movement of fluid from the return flow passage of the U-coupling into the outflow channel of said one bar when the second bar is in the said non-operating position, and valved spray nozzles carried by both bars and adapted to have operative communication with one channel only with their respective bars.

8. In a spraying apparatus, a tubular spray bar, a septum longitudinally dividing the tubular spray bar into upper and lower channels communicating with one another at one end of the bar, valved spray nozzles secured to and along a side of the bar and having communication with one channel, a box secured to the side of the bar opposite from the nozzles and having a horizontal division wall providing an upper chamber opening into the upper one of said channels and a lower chamber opening into the lower one of said channels, the box having an upstanding neck opening into said upper chamber, a feed and discharge fitting embodying an L portion coupled at one end to the top end of said neck and an elongate tubular portion extending through the top convex side of the L and projecting at one end through the said one end of the L and through said neck and into the box, the said tubular portion further extending through an opening in said horizontal division wall and opening into said lower chamber, the tubular portion being in radially spaced relation with the interior of the said one end of the L and of said neck, and the coupling of said one end of the L portion with said neck being a packed rotatable coupling and the said one end of said tubular portion being freely rotatable in the said opening in the horizontal division wall.

9. In a liquid spraying apparatus, a spray bar structure comprising two end aligned tubular bar sections, a septum in and extending longitudinally of each bar section to form two longitudinal channels, said channels in each bar section communicating, a one structure feed and discharge unit carried on each bar section midway of the ends thereof, each unit comprising a first tubular section and a second tubular section, the first tubular section having an inner end portion communicating with

one channel of the adjacent bar section, a crossover pipe coupling two corresponding tubular sections of the two units, conduit means connected with each of the other tubular sections of the units for selectively conducting liquid away from and back to a supply source, spray valves carried by each bar section adapted when open to receive liquid from one channel only, and at least one control valve in the conduit means having a first operating position in which liquid is caused to circulate through the channels of the bar sections and return to the supply source and a second position blocking said return for the discharge of the liquid through the open spray valves, the inner end portion of one tubular section of each unit extending through the wall of the other tubular section and being fixed thereto and extending through and being coaxial with and radially spaced from the inner end portion of the other tubular section and there being a swivel connection between the said inner end portion of the other tubular section of each unit and the bar section by which it is carried.

10. In a spraying apparatus, a tubular spray bar, a septum longitudinally dividing the same into two channels communicating with one another at one end, a plurality of valved spray nozzles secured to a flat surface of the wall of the bar, each spray nozzle comprising a body having a rotary valve plug chamber and a channeled rotary plug seating in and upon the wall of the chamber and a discharge orifice leading from the channeled plug, and said chambered valve body and said wall of the bar having registering slots therein leading from one of said channels into the channeled plug of each valve and said slots each having a width materially less than the diameter of the discharge orifice for the straining out from liquid passing therethrough of particles too large to pass through the orifice, the said slot in the wall of the spray bar extending through the said wall of the spray bar oblique to the path of fluid flow through the channel, the disposition of the slot being such that the entrance end thereof is directed oppositely to the direction of fluid flow during a spraying operation whereby upon the reversal of the direction of fluid flow the fluid will sweep across said entrance to effect withdrawal of obstructing material therefrom.

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