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(54) Modular spray system

(57) A spray nozzle system in the form of a modular nozzle assembly comprising a liquid inlet unit (110) having at least one tail pipe (118) for connection of a flexible hose and clamping means (116) enabling said unit to be clamped to a dry spray bar at a freely selected position therealong (Fig. 7), an alternative liquid inlet unit (18) having a liquid inlet pipe (24) and clamping means (20) enabling said unit to be clamped to a wet spray bar with said inlet pipe sealingly engaging an aperture in said bar (Fig. 1), a check valve unit (14 or 112) and a spray nozzle unit (10 or 114), either of said valve unit and said nozzle unit being connectible to either one of said two inlet units and said spray unit being connectible to said check valve unit.

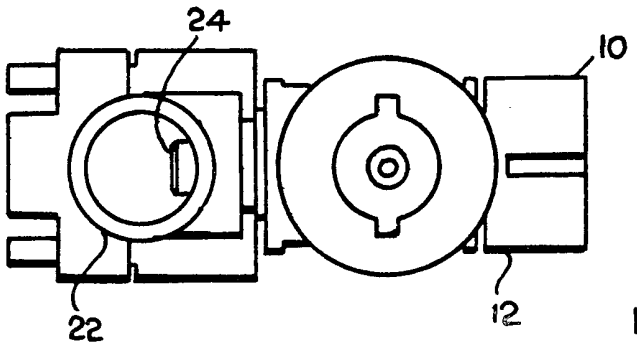

Fig. 1

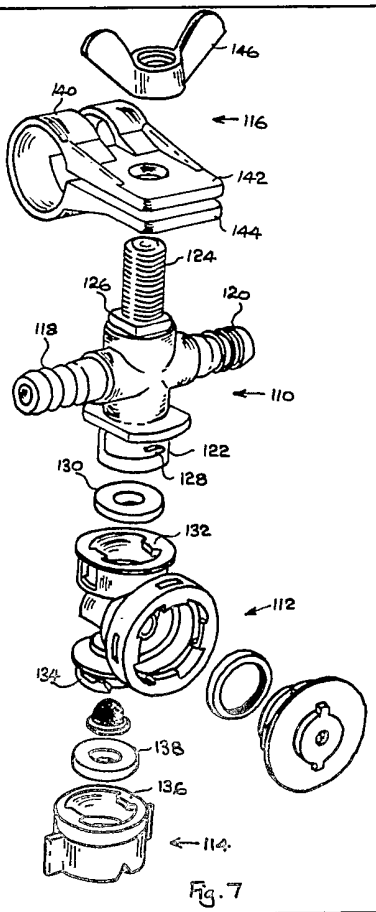

Fig. 7

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The drawings originally filed were informal and the print here reproduced is taken from a later filed formal copy.

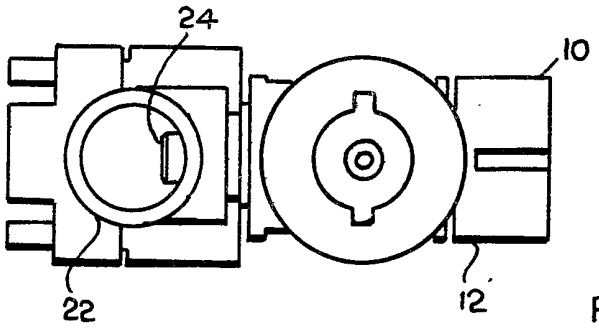


Fig. 1

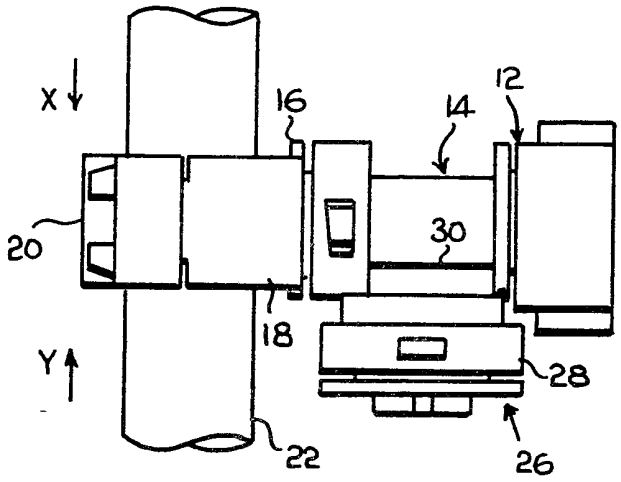


Fig. 2

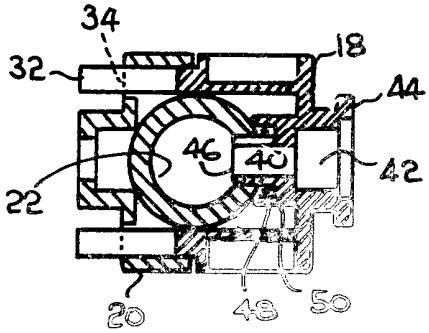


Fig. 3

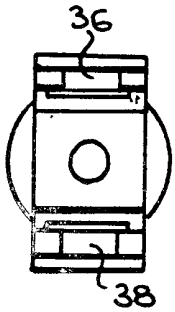


Fig. 3A

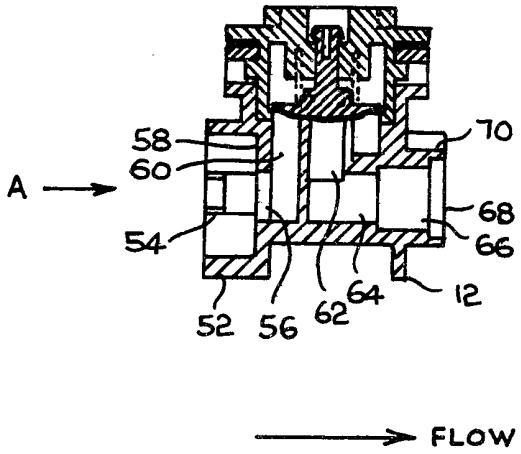


Fig. 4

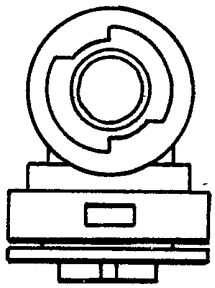


Fig. 5

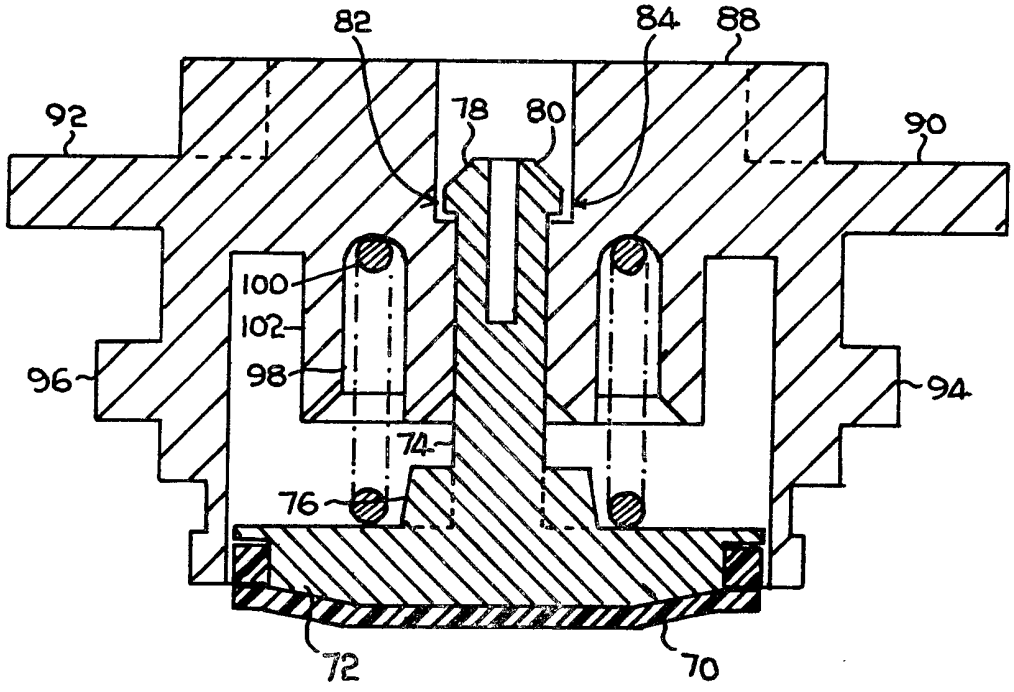
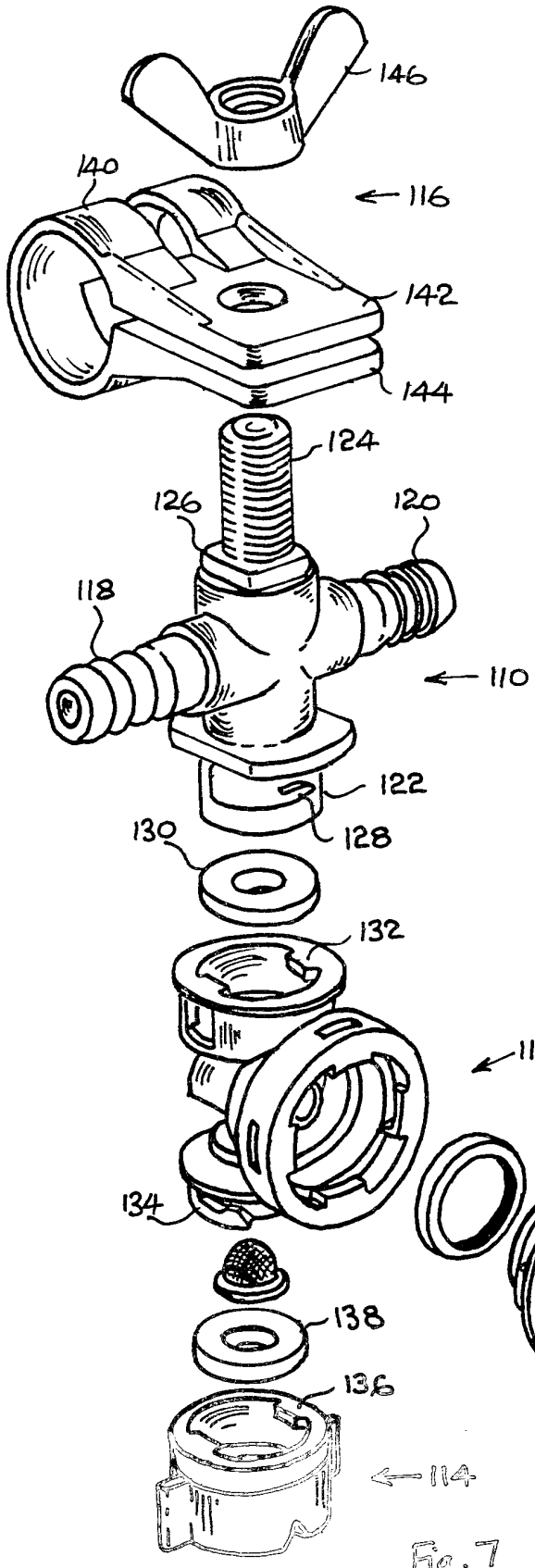


Fig. 6


146
140
116
142
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110
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112
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136
114

Fig. 7

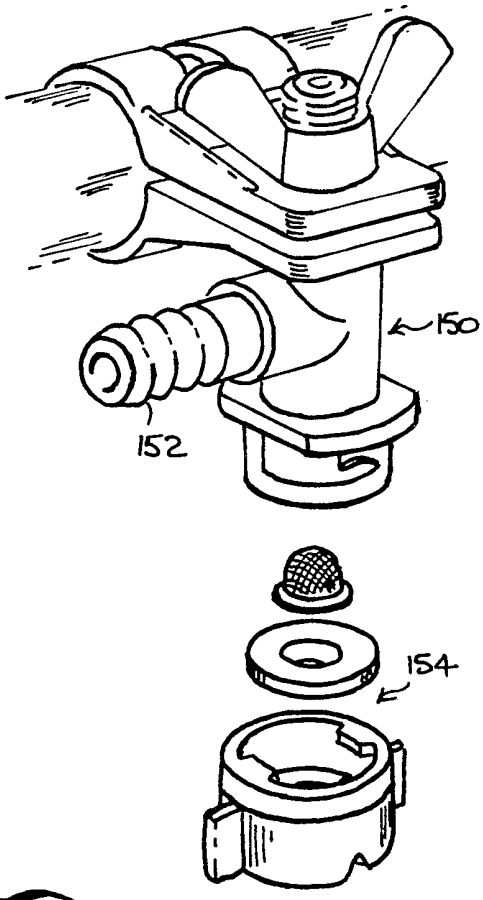
150
152
154

Fig. 8

SPECIFICATION

Improvements in spray nozzle systems

This invention relates to a spray nozzle system particularly for use in agriculture and horticulture.

Our Patent Application No. 8031387 concerns such a spray nozzle system, and more specifically relates to a check valve forming part of a spray nozzle. In the system described in said Application, a tubular spray bar or spray line conveys the liquid to be sprayed to the nozzles, which attach to the bar through clamps having probes which penetrate orifices in the wall of the spray bar. Clearly, the nozzles must be attached to the spray bar at the predetermined positions along the length thereof where said orifices are provided, usually distributed at a substantially uniform spacing along the entire length of the bar.

The check valve subject of the Application locates between the clamp and a nozzle and has for its purpose to ensure that the liquid pressure in the spray bar exceeds a given level before the check valve is opened to pass liquid to the nozzle.

In some instances, for example where agrochemicals are to be used in connection with vegetable crops, it is desired to spray either the crop and not the intervening land or vice versa. Cost saving alone may necessitate such selective spraying, although clearly other reasons can sometimes arise. In these instances, it can be disadvantageous that only a fixed span and fixed distribution of spray nozzles is available.

It is an object of this invention to provide a modular assembly of components for a spray nozzle system, including modules which may be employed without adaptation either in a spray system based on a wet spray bar wherein liquid under pressure is conveyed to the nozzles through the spray bar or in a spray system based on a dry spray bar or boom wherein the spray bar serves only for the purpose of mounting the nozzles and the liquid is conveyed to the nozzles separately from the spray bar. One such module is the check valve described and claimed in our Application No. 8031387 and the spray nozzle system described in said application constitutes an example of a modular assembly in accordance with the present invention.

According to one aspect of the present invention, there is provided a spray nozzle system comprising a liquid inlet unit which includes means enabling said unit to be clamped to a spray bar, a check valve unit and a nozzle unit, wherein said units are provided with matching, interengaging fittings enabling said nozzle unit to be connected to the inlet unit either directly or through the intermediary of said check valve unit.

According to another aspect of the present invention, there is provided a spray nozzle system in the form of a modular nozzle assembly comprising a liquid inlet unit having at least one tail pipe for connection of a flexible hose and clamping means enabling said unit to be clamped to a dry spray bar at a freely selected position therealong, an alternative liquid inlet unit having a liquid inlet pipe and clamping means enabling said unit to be clamped to a wet spray bar with said inlet pipe sealingly engaging an aperture in said bar, a check valve unit and a spray nozzle unit, either of said valve unit and said nozzle unit being connectible to either one of said two inlet units and said spray unit being connectible to said check valve unit.

Said matching, interengaging fittings are preferably bayonet-type fittings.

In a preferred system, the check valve unit and said nozzle unit are provided with respective pairs of diametrically opposed lugs adapted for gripping with the fingers to operate the bayonet type fittings by relative rotation of two units, while the inlet unit is preferably adapted for clamping to the spray bar in a predetermined orientation, and the respective bayonet type fittings are disposed on the respective units to predetermine the direction of a spray jet emergent from the nozzle unit relative to the orientation of the inlet unit.

Conveniently, the check valve unit may be colour coded according to the strength of the spring means therein, a plurality of said check valve units having differing colour codings being selectively fittable between the inlet unit and the nozzle unit by means of said matching, interengaging fittings, while the nozzle unit is preferably colour coded according to the nozzle spray characteristics, and a plurality of said nozzle units having differing colour codings are selectively fittable to the check valve unit by means of said matching, interengaging fittings.

In one modular system, corresponding to that described in our aforementioned copending Application, the liquid inlet unit is adapted to be clamped to a wet spray bar through which liquid under pressure is suppled to said inlet unit, the clamping means comprising a two part bracket the parts of which are securable together by a quick release means to clamp the inlet unit to said spray bar in a position in which a reduced diameter pipe carrying a resiliently deformable seal engages in an aperture in said spray bar.

In an alternative modular system, the liquid inlet unit has clamping means enabling its attachment at any point along the length of a dry spray bar, said inlet unit also having at least one tail pipe for connection of a flexible hose through which liquid under pressure is supplied to said inlet unit. In this case, the liquid inlet unit may comprise a body having an axial outlet provided with one of said

matching, interengaging fittings, at least one lateral inlet constituted by said at least one tail pipe and an axial threaded boss opposite the outlet, the unit also comprising a split ring clamp having an aperture freely receiving said threaded boss, whereby the screwing of a nut on to the boss both secures the said body to the clamp and the clamp to the spray bar. The said body preferably has a polygonal section at its base for engagement with an aperture of corresponding shape in the ring-type clamp.

Further features of the present invention will be apparent from the following description of two embodiments thereof, making reference to the accompanying drawings, in which:–

Figure 1 is a side elevation of a nozzle holder and check valve assembly mounted on a supply pipe (wet spray bar),

Figure 2 is a plan view of the assembly shown in Fig. 1,

Figure 3 is a cross-section view through the two part bracket which secures the check valve and nozzle assembly on to the supply pipe,

Figure 4 is a cross-section through the check valve assembly which is located intermediate the supply pipe and the nozzle,

Figure 5 is an end view in the direction of arrow 'A' in Fig. 4 and shows how the check valve assembly can be secured to one of the brackets,

Figure 6 is an enlarged scale cross-section through the check valve assembly shown in Fig. 4,

Figure 7 is an exploded view of a twin inlet, alternative spray nozzle assembly, and

Figure 8 shows a single inlet, alternative spray nozzle assembly attached to a dry spray bar, with a nozzle module in exploded view.

Figs. 1 and 2 show a complete nozzle and check valve assembly mounted on a supply pipe (wet spray bar).

The assembly comprises a nozzle spray unit in the form of a nozzle tip nut 10 containing an orifice (not shown) through which liquid is forced under pressure to form a fine spray. The nut 10 is formed with a bayonet connection (not shown but see Figs. 7 and 8) for fitting to a complementary bayonet connection formed in the end face 12 of a housing 14. The latter includes at the opposite end another flange 16 having another bayonet or similar connection by which it is secured to one half 18 of a two part bracket (nozzle inlet unit) the other part of which 20 is secured thereto in a manner to be hereinafter described.

The two part bracket surrounds a pipe 22 which contains a liquid under pressure such as a fertilizer or weed killer or the like. The transfer of the liquid in the pipe to the orifice (not shown) in the nozzle tip nut 10 is by means of tapering tubular probes one of which is shown at 24 protruding into the interior of the pipe 22 in Fig. 1.

Intermediate the nozzle tip nut 10 and the bracket member 18 is located a check valve assembly or check valve unit generally designated by reference numeral 26. The check valve assembly includes a removable cap 28 secured by a bayonet fitting (not shown but see Figs. 7 and 8) to a laterally extended housing 30 extending from the cylindrical housing 14. The check valve will be described in more detail with reference to the later Figures.

The purpose of the check valve is to inhibit the flow of liquid from the pipe 22 to the nozzle orifice except when the pressure in the pipe is greater than a given value.

The communication between the housing 14 and the inside of the pipe is best seen with reference to Fig. 3 which shows the two bracket halves in cross-section around the pipe 22. The bracket part 18 includes four upstanding arms one of which is designated by reference numeral 32 which is best shown in Fig. 2 including an enlarged head having a shoulder, the position of which is shown in dotted outline at 34 in Fig. 3. The bracket portion 20 is secured to the bracket portion 18 by pushing the arms 32 through slots formed on opposite sides of the member 20 until enlarged heads at the remote ends of the arms 32 overlie the edges of the slots so as to prevent the two parts from movig apart. It is a simple matter to squeeze the heads together in the direction of the two arrows 'X' and 'Y' in Fig. 2 so as to disengage the overhanging shoulders such as 34 and allow the part 20 to be slid along the arms away from the part 18 to split the joint.

Fig. 3a shows the heads of the arms in the two slots denoted by reference numerals 36 and 38.

Communication with the interior of the pipe 22 is achieved through the bore 40 and enlarged diameter bore 42. A bayonet flange 44 surrounds the opening to the bore 42. It is to this bayonet flange that the left-hand end of the housing 14 is attached.

The pipe 22 includes apertures along its length through the wall thereof through which the tubular probe 46 will fit and 'O' ring seals 48 which surround the probe 46 (24 in Fig. 1) serve to seal the latter to the pipe 22.

The resilience of the material forming the two halves of the bracket 18 and 20 is selected so as to be sufficient to grip the pipe firmly when the two bracket parts are firmly secured together and in turn the dimensions of the internal integral collar 50 containing the bore 40 are selected so that, when the bracket part 18 is firmly clamped to the bracket part 20, the seal 48 is compressed into sealing engagement with the wall of the pipe 22.

Fig. 4 is a cross-section viewed through the main body of the check valve and mounting

part for attaching to the bracket at the left-hand end and the nozzle tip at the right-hand end as shown in Fig. 1.

The left-hand end 52 is adapted to fit over and around the bayonet flange 44 (see Fig. 3) and a central cylindrical tubular connection 54 communicates with the bores 40 and 42 when the two parts are securely joined together.

An aperture 56 in an internal wall 58 communicates with an annular region 60 within the housing, the axis of which is perpendicular to the general axis of the bayonet fitting formed by the parts 44 and 52.

The upper part of the annular region 60 constitutes an inlet aperture for a check valve and a central concentric reduced diameter tube 62 constitutes the outlet aperture from the check valve and this communicates with a series of bores 64 and 66 which terminate in an aperture 68 which constitutes the male portion 70 of a bayonet fitting the female portion of which is contained on the nozzle tip nut 10 to allow the latter to be fitted thereto.

Details of the nozzle tip 10 are not given since it essentially comprises nothing more than a quick release collar containing a concentric central aperture through which liquid under pressure can flow to an outlet orifice in the end face of the collar.

Detail of the check valve assembly is obtained from the enlarged scale drawing of Fig. 6.

This latter illustrates a complete sub-assembly which can be fitted quickly at will to the intermediate housing section 14 in Fig. 2 and constitutes the closure member for the check valve assembly.

The main sealing member is a cap shaped diaphragm 70 which is stretched across and around the outer rim of a slightly convexed thrust plate 72 which on its rearward face contains a central spigot 74 surrounded at its lower end by an enlarged collar 76.

The upper end of a spigot is bifurcated and two barb like heads are formed at the upper end thereof, the two heads in cross-section being denoted by reference numerals 78 and 80. The heads overlie shoulders 82 and 84 formed in the upper end of the bore through which the spigot is pushed and prevent the spigot from being pulled rearwardly therethrough.

The bore containing the heads which itself is denoted by reference numeral 86 is contained centrally within a cylindrical housing 88 which latter includes radially oppositely directed lugs or ears 90 and 92 and also includes a bayonet flange 94 and 96 by which the sub-assembly can be quick release fitted to the right-hand end of the intermediate housing 14 of Figs. 1 and 2.

The thrust plate 72 is urged in a generally downward direction as shown in Fig. 6 under the action of a helical compression spring 98. This latter is located in an annular slot 100 formed in a central cylindrical region 102 within the overall member 88 and a degree of axial alignment is provided for by arranging that the internal diameter of the spring 78 is just fractionally greater than the external diameter of the collar 76.

The shape of the underside of the thrust pate 72 is chosen so that the central and slightly more protruding region pushes the diaphragm 70 into contact therewith so as to close off the central exit 62.

Movement of the thrust plate 72 in an upward direction as shown in Fig. 6, lifts the diaphragm 70 off the tubular member 62 and allows liquid to flow from the outer annular space 60 into the inner tubular member 62 and from thence to the outlet nozzle orifice.

Although one size of bracket 20 is shown in the drawings, two or more brackets may be provided and the curved recesses formed therein and in the cooperating end 18 to accommodate different diameter pipes such as 22.

The described modular design enables fitment of a standard liquid inlet nozzle holder, subsequent attachment of a diaphragm operated anti-drip device (D.V.C.) in the form of a second module by removing the existing spray nozzle, fitting the D.C.V. device in its place and replacing the spray nozzle on the appropriate end of the D.C.V. device.

The spray nozzle of Fig. 7 again essentially comprises a liquid inlet module 110, a check valve module 112 and a nozzle module 114.

The check valve module 112 and the nozzle module 114, the latter including a filter cup, are essentially as previously described with reference to Figs. 1 to 6. The modified system of Figs. 7 and 8 primarily concerns the liquid inlet module 110 and its clamping means, the latter generally designated 116.

The liquid inlet module comprises a connector having twin inlets in the form of oppositely directed tail pipes 118, 120 suited to connection of a flexible hose (not shown), and an outlet 122 coplanar with the inlets and perpendicular thereto. Opposite the outlet 122 is a threaded boss 124 having a squared-section 126 at its base.

It will be noted that the outlet 122 includes one part 128 of a bayonet type connection which enables the liquid inlet module 110 to be connected through a sealing washer 130 to a cooperating part 132 of the bayonet type connection provided on the check valve module 112. Likewise, parts 134, 136 of a second, similar, bayonet type connection, respectively provided on the check valve module 112 and the nozzle module 114, enable these two modules to be secured together through a sealing washer 138.

The clamping means 116 comprises a clamp of the split ring-type, having a ring 140 which can be squeezed to grip a dry spray bar

or boom and apertured wings 142, 144 which freely receive the threaded boss 124 on the liquid inlet module to enable a wing nut 146 to be screwed on to said boss and tightened to secure the liquid inlet module to the clamp and at the same time to squeeze the clamping ring tight on the spray bar.

The apertured wing 144 of the clamp has a squared recess (not shown) which receives the squared section 126 at the base of the boss 124 on the liquid inlet module, thereby to locate the liquid inlet module 110 in a chosen orientation relative to the length of the spray bar. Desirably, the tail pipes 118, 120 for connection of flexible hose will then be parallel to the length of the spray bar. Additionally, however, the bayonet type fittings will assume set positions, which is desirable for the reason previously explained.

Fig. 2 shows a modified spray nozzle having a liquid inlet module 150 with a single inlet 152, and a nozzle unit 154 for connecting directly to said liquid inlet unit, i.e. the check valve is omitted. This alternative arrangement is readily made possible by the modular assembly of the spray nozzle enabled by the uniform bayonet type fittings. The check valve may be omitted, for example, if an adequate liquid supply pressure is assuredly available even for the nozzles most remote from the supply.

It will readily be apparent that this aspect of the invention enables spray nozzles to be positioned in any desired distribution along a dry spray bar or boom, according to requirements. A regular distribution is available for overall, uniform, spraying; equally a non-uniform distribution is available for selective spraying. As the nozzles are supplied with liquid through flexible hose detachably connecting to the liquid inlet units, it is practicable to connect up only some of the nozzles if desired, without detaching the unused nozzles from the spray bar. This facility enables the possibility of denser or less dense spraying, and enables overspraying more readily to be avoided. Movement of the nozzles is readily enabled by the finger operable wing nuts, without requiring the operator to remove protective clothing. As far as the modular assembly of the nozzle is concerned, the same check valve modules and spray nozzle units are usable not only with the liquid inlet units of Figs. 7 and 8, but also with the liquid inlet nozzle holder described in connection with Figs. 1 to 6. Thus, the complete system provides common modular units (check valves and spray nozzles) for use both with inlets clamping to a wet spray bar and with inlets clamping to a dry spray bar.

CLAIMS

1. A spray nozzle system comprising a liquid inlet unit which includes means enabling said unit to be clamped to a spray bar, a check valve unit and a nozzle unit, wherein said units are provided with matching, interengaging fittings enabling said nozzle unit to be connected to the inlet unit either directly or through the intermediary of said check valve unit.

2. A spray nozzle system according to claim 1, wherein said matching, interengaging fittings are bayonet-type fittings.

3. A spray nozzle system according to claim 2, wherein both said check valve unit and said nozzle unit are provided with respective pairs of diametrically opposed lugs adapted for gripping with the fingers to operate the bayonet type fittings by relative rotation of two units.

4. A spray nozzle system according to claim 2 or claim 3, in which the inlet unit is adapted for clamping to the spray bar in a predetermined orientation, and the respective bayonet type fittings are disposed on the respective units to predetermine the direction of a spray jet emergent from the nozzle unit relative to the orientation of the inlet unit.

5. A spray nozzle system according to any of claims 1 to 4, wherein the check valve unit comprises a cylindrical seating member having inlet and outlet apertures, a diaphragm stretched across said apertures, spring means urging the diaphragm in a direction to close off the inlet aperture from the outlet aperture, said spring means being yieldable under a predetermined liquid inlet pressure, the diaphragm being in the form of a shallow dish having a circumferential annular wall, and a cylindrical housing accommodating said spring means, the peripheral portion of the diaphragm being trapped between said cylindrical seating member and an annular shoulder on said housing.

6. A spray nozzle system according to claim 5, wherein, in said check valve, the seating is generally circular and defines a cylindrical member which constitutes a fluid inlet, and the outlet constitutes a concentric cylindrical tube of reduced diameter, the end of the open end of the cylindrical tubular member being substantially coplanar with the open end of the cylindrical housing constituting the said inlet so that the diaphragm, when stretched thereacross, closes off the central outlet from the annular opening defining the said inlet aperture.

7. A spray nozzle system according to claim 6 wherein, in said check valve, the colour of at least a part of the cylindrical member contains a spring means or the cylindrical member into which it is fitted is coloured in a distinctive colour, the choice of which is determined by the strength of the spring located therein.

8. A spray nozzle system according to any of claims 5 to 7, wherein the check valve unit is colour coded according to the strength of the spring means therein, a plurality of said

check valve units having differing colour codings being selectively fittable between the inlet unit and the nozzle unit by means of said matching, interengaging fittings.

9. A spray nozzle system according to any of claims 1 to 8, wherein the nozzle unit is colour coded according to the nozzle spray characteristics, and a plurality of said nozzle units having differing colour codings are selectively fittable to the check valve unit by means of said matching, interengaging fittings.

10. A spray nozzle system according to any of claims 1 to 9, wherein the liquid inlet unit is adapted to be clamped to a wet spray bar through which liquid under pressure is supplied to said inlet unit, the clamping means comprising a two part bracket the parts of which are securable together by a quick release means to clamp the inlet unit to said spray bar in a position in which a reduced diameter inlet pipe carrying a resiliently deformable seal engages in an aperture in said spray bar.

11. A spray nozzle system according to any of claims 1 to 9, wherein the liquid inlet unit has clamping means enabling its attachment at any point along the length of a dry spray bar, said inlet unit also having at least one tail pipe for connection of a flexible hose through which liquid under pressure is supplied to said inlet unit.

12. A spray nozzle system according to claim 11, wherein the inlet unit comprises a body having an axial outlet provided with one of said matching, interengaging fittings, at least one laterial inlet constituted by said at least one tail pipe and an axial threaded boss opposite the outlet, the unit also comprising a split ring clamp having an aperture freely receiving said threaded boss, whereby the screwing of a nut on to the boss both secures the said body to the clamp and the clamp to the spray bar.

13. A spray nozzle system according to claim 12, wherein the said body has a polygonal section at its base for engagement with an aperture of corresponding shape in the ring-type clamp.

14. A spray nozzle system in the form of a modular nozzle assembly comprising a liquid inlet unit having at least one tail pipe for connection of a flexible hose and clamping means enabling said unit to be clamped to a dry spray bar at a freely selected position therealong, an alternative liquid inlet unit having a liquid inlet pipe and clamping means enabling said unit to be clamped to a wet spray bar with said inlet pipe sealingly engaging an aperture in said bar, a check valve unit and a spray nozzle unit, either of said valve unit and said nozzle unit being connectable to either one of said two inlet units and said spray unit being connectible to said check valve unit.

15. A spray nozzle system according to any of claims 1 to 14, when fitted to a wet or dry spray bar.

16. A spray nozzle assembly substantially as hereinbefore described with reference to Figs. 1 to 6 or to Figs. 7 and 8 of the accompanying drawings.

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