Aug. 11, 1936. C. S. EVANS ET AL 2,050,522

SPRAY APPARATUS

Filed Nov. 28, 1933 2 Sheets-Sheet 1

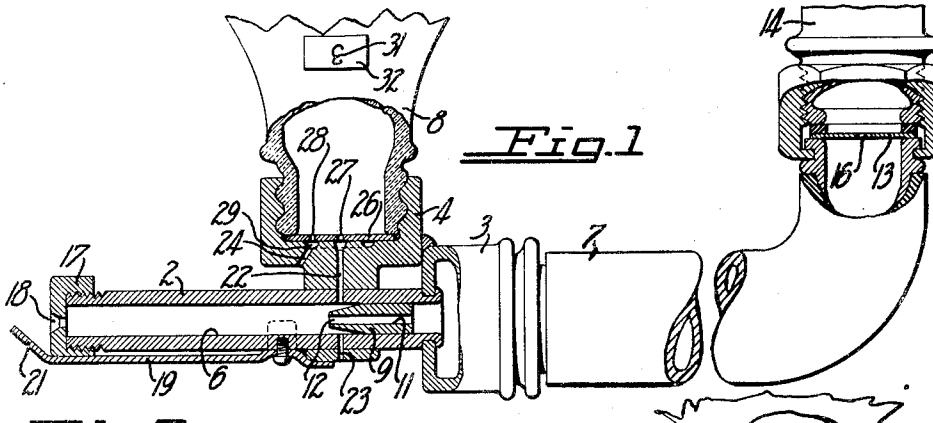

Fig. 1

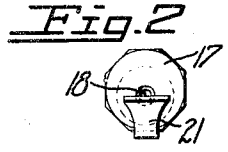

Fig. 2

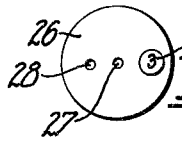

Fig. 3

Fig. 6

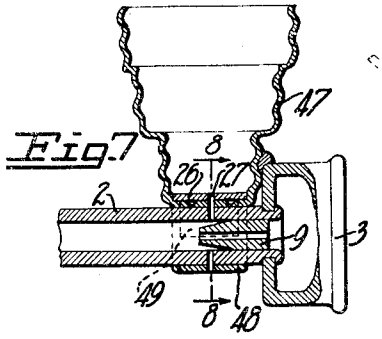

Fig. 7

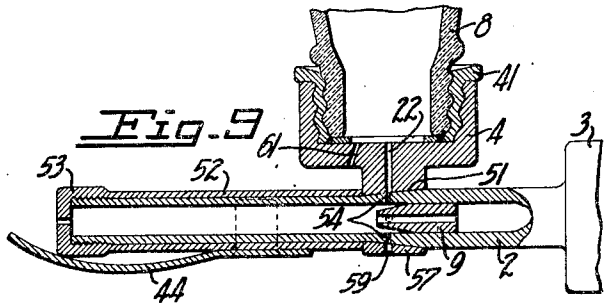

Fig. 9

Fig. 8

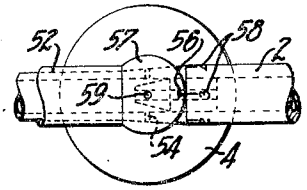

Fig. 10

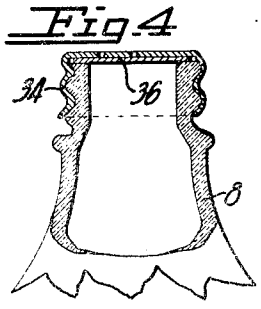

Fig. 4

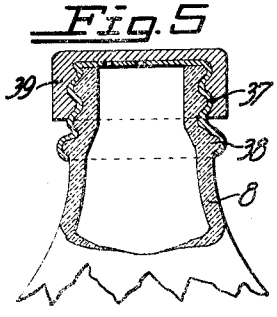

Fig. 5

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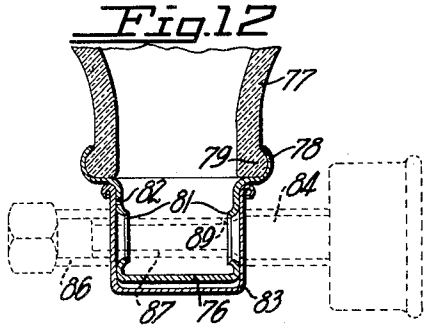
SPRAY APPARATUS

Filed Nov. 28, 1933 2 Sheets-Sheet 2

Fig. 12



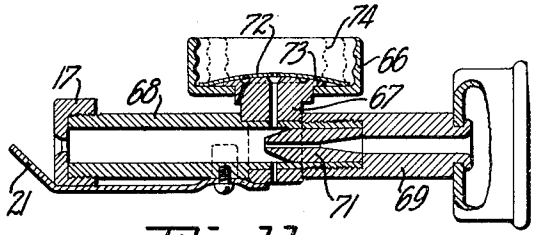


Fig. 11

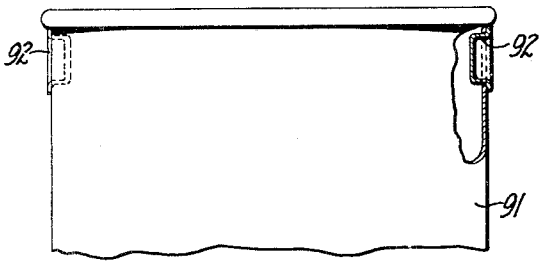


Fig. 13

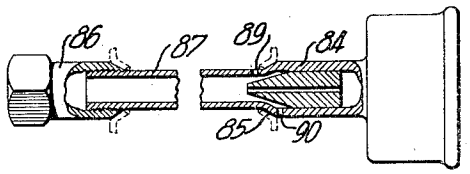


Fig. 14

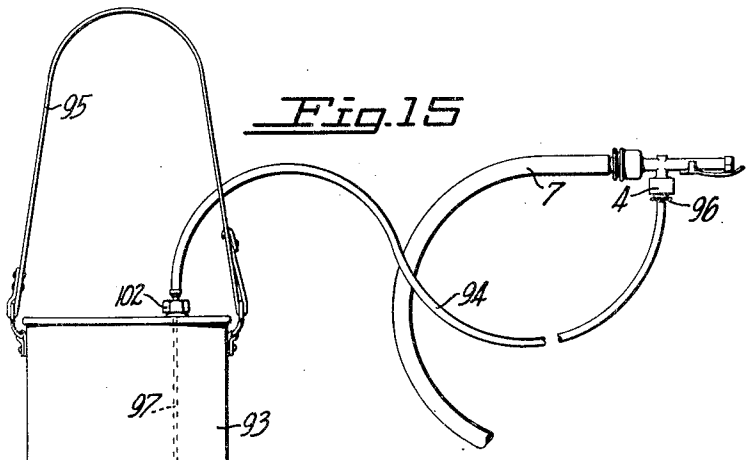


Fig. 15

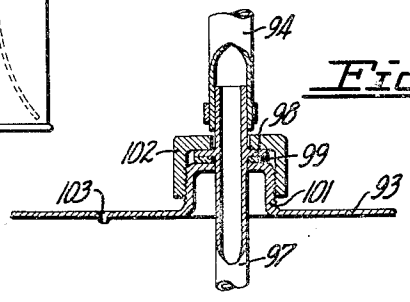


Fig. 16

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UNITED STATES PATENT OFFICE

2,050,522

SPRAY APPARATUS

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Application November 28, 1933, Serial No. 700,090

9 Claims. (Cl. 299—84)

Our invention relates to spray apparatus, and more particularly to a spray head in which a concentrated spray fluid is entrained by a diluting fluid.

It is among the objects of our invention to provide improved means for effecting a proper and uniform mixture of the concentrated and diluting fluids.

Another object of our invention is to provide apparatus in which the original packing container for the spray fluid may be incorporated as part of the spray head assembly.

Another object of our invention is to provide gauge means in conjunction with the spray fluid container for controlling the amount of fluid fed from the container into the spray head to produce a final spray composition of predetermined strength.

Another object of our invention is to provide gauge means of the character described which is incorporated as part of the closure which seals the container.

A still further object of our invention is to provide means for relieving the pressure in the hose supplying the diluting fluid when the spray head is in operation.

The invention possesses other objects and features of advantage, some of which, with the foregoing, will be set forth in the following description of our invention. It is to be understood that we do not limit ourselves to this disclosure of species of our invention, as we may adopt variant embodiments thereof within the scope of the claims.

Referring to the drawings:

Figure 1 is a side view, partly in section and partly in elevation, showing the spray apparatus embodying our invention; portions of the spray fluid bottle and the hose being omitted to shorten the view.

Figure 2 is a front elevational view of the spray nozzle.

Figure 3 is a detail view showing the gauge disk.

Figures 4 and 5 are detail views, largely in vertical section, illustrating alternate closures for the spray fluid bottle.

Figure 6 is a side view, partly in section and partly in elevation, showing a further modification of our spray head construction.

Figure 7 is a side view, partly in section and partly in elevation, showing a modified form of spray head construction; and

Figure 8 is a transverse vertical sectional view of the same taken in the direction indicated by the line 8—8 of Figure 7.

Figure 9 is a similar view showing other variations in construction; and

Figure 10 shows a detail of the adjustment provided in the same.

Figure 11 is a side view, partly in section and partly in elevation, showing still another form of our spray head construction.

Figure 12 is a vertical section view showing still further variations in the container and its mounting construction; the body portion of the spray head being outlined in dotted lines to illustrate the final assembly.

Figure 13 is a side elevational view showing a spray fluid container in the nature of a can and adapted for use in conjunction with a spray head similar to that outlined in Figure 12, portions of the can being broken away to illustrate the construction more clearly.

Figure 14 is a side view, partly in section and partly in elevation, showing the type of head employed with the containers illustrated in Figures 12 and 13.

Figure 15 is a side elevational view showing the adaptation of our spray head to a separate spray fluid holding tank; and

Figure 16 is a detailed view, largely in vertical section, showing the tank hose connection.

In terms of broad inclusion, the spray apparatus embodying our invention comprises a spray head having a mixing chamber. Means are provided for introducing a predetermined quantity of a diluting fluid into the chamber, and means are provided for admitting a concentrated spray fluid into the chamber in predetermined proportion to the amount of diluting fluid introduced. The diluting fluid is preferably injected into the chamber under pressure, and the concentrated fluid is preferably admitted adjacent the point of injection of the pressure fluid.

Means are preferably provided for regulating the quantity of spray fluid admitted to the chamber, and preferably means are also provided for introducing air into the chamber adjacent the point of injection of the diluting fluid. The concentrated spray fluid is preferably held in a container or bottle detachably mounted on the spray head and the means for controlling the flow of concentrated fluid into the head is preferably in the nature of a gauge disk removably interposed between the container and head. The container holding the spray fluid which comprises part of the spray head assembly may conveniently be the same one in which the fluid is originally packed, and related indicia are preferably pro-

vided on both the gauge disk and container for indentifying one with the other.

A closure for sealing the container is also provided, in which the gauge disk is preferably incorporated. The spray head is preferably designed for use with an ordinary garden hose, and in which water at ordinary pressures serves as the diluting fluid. In order to prevent undue pressure from building up in the hose, an apertured disk is preferably interposed between the hose and bib; the aperture in the disk being of substantially the same size as the orifice of the injector in the spray head.

In greater detail, and referring particularly to Figure 1, the apparatus embodying our invention comprises a spray head having a tubular barrel portion 2, upon which a pair of couplings 3 and 4 are mounted. These elements of the spray head may be separately formed and assembled as shown in Figure 1, or they may be formed as an integral casting as illustrated in Figure 6. The coupling 3 communictes directly with the rear end of the bore 6 in the barrel 2 and provides a connection for a hose 7, while the side coupling 4 provides a socket in which a container 8 may be threaded. The container is shown as a glass bottle, but it is understood that any suitable receptacle may be employed.

The hose 7 communicates with a suitable source of diluting fluid under pressure, preferably water, and may conveniently be an ordinary garden hose. Means are provided for injecting the water into the bore or chamber 6 of the spray head. This is accomplished by an injector 9 pressed into the rear end of the barrel 2 and having a longitudinal bore 11 providing a restricted orifice 12. By this arrangement a predetermined quantity of water, determined by the size of the orifice 12, is introduced into the chamber 6.

In order to relieve the pressure in the hose caused by the restriction in the flow of the water at the spray head, a disk 13 is preferably interposed between the entrance end of the hose and the bib 14. This disk is provided with an aperture 16 substantially equal in size to the orifice 12 of the injector, so that water is admitted into the hose at approximately the same rate as it is passing out through the spray head. This arrangement prevents the pressure from building up in the hose when the spray head is in operation.

The forward end of the barrel 2 forms the nozzle of the spray head. This end is preferably threaded to receive an eccentrically mounted nozzle cap 17 having an opening or orifice 18 disposed centrally of the bore in the barrel 2. The nozzle opening is preferably of substantially the same or larger size than the orifice 12 of the injector 9 to prevent back pressures from building up in the chamber 6. A resilient strip 19 is mounted to extend along the barrel 2 and is provided with an inturned tip 21 to form an inclined deflector plate projecting into the path of the fluid issuing from the nozzle opening 18. This deflector plate governs the shape of the final spray and is adjustable relative to the axis of the streaming fluid by the action of the eccentrically mounted nozzle cap 17, as will be readily understood.

The container or bottle 8 comprising part of the spray head assembly holds a supply of a concentrated spray fluid, such as an insecticide, fungicide or soluble fertilizer, and may conveniently be the same container in which the fluid was originally packed and sold. We preferably supply a plurality of these bottles, containing fluids of different composition and strength, each being adaptable for incorporation in the spray head assembly.

The convenience of this combination will become immediately apparent. A gardener for example has with one of our spray heads a complete spray equipment at his command; the particular job to be done determining the type of spray fluid bottle which is screwed into the head.

The introduction of the concentrated fluid into the mixing chamber 6 of the spray head is effected through a passage 22 disposed centrally of the bottle coupling 4 and opening out in the chamber 6 at a point adjacent the injection of the pressure fluid. As clearly shown in Figure 1, the forward end of the injector 9 is bevelled and the fluid passage 22 is ported into the mixing chamber behind the orifice 12, so that the concentrated fluid is introduced into the recess provided between the sloping forward end of the injector and the walls of the chamber.

The injector action creates a partial vacuum in the regions surrounding the orifice 12 which aids in drawing the concentrated spray fluid down through the passage 22. As the spray fluid enters the mixing chamber it is entrained by the fast moving water stream, at which time the turbulence of the flow thoroughly mixes the fluids. The final spray composition leaving the nozzle of the spray head is therefore a mixture of concentrated and diluting fluids; the percentage of active spray fluid in the diluting fluid or water of course depending upon the quantities of the respective fluids fed into the mixing chamber.

To provide air for the injector a passage 23 is provided in the spray head, communicating with the atmosphere and opening into the mixing chamber adjacent the point of injection of the pressure fluid. Another air duct 24 is also provided in the spray head, communicating with the atmosphere and opening out in the base of the coupling 4 adjacent the passage 22. The latter duct provides air for the container to displace the fluid as the latter is withdrawn through the passage 22.

In order to control the amount of concentrated spray or active fluid admitted to the mixing chamber suitable gauge means, such as the gauge disk 26, is interposed between the spray head and the neck of the supply bottle 8. In the assembled apparatus the gauge disk lies in the bottom of the bottle coupling 4, as shown in Figure 1. A central aperture 27 is provided in the disk to register with the flared upper end of the fluid passage 22, and a second aperture 28 is also provided to register with the air duct 24. To facilitate the registration of the latter an annular groove 29 is preferably provided in the bottom of the coupling, with which the air passage 24 connects. By this arrangement communication is effected between the aperture 28 and the duct 24 regardless of the position of the gauge disk.

The size of the aperture 27 in the gauge disk 26 determines the rate at which the spray fluid may be drawn into the mixing chamber 6 and entrained by the water stream. Since a city water pressure is maintained at a substantially constant pressure, the volume of water passing through the spray head is determined by the size of the nozzle orifice 12. Actually city water pressures vary, but the pressure may usually be assumed to

be constant within the practical limits of operation of our device.

The only variable factor therefore is the strength of the spray fluid in the bottle 8. The strength of the particular spray fluid being supplied therefore determines the size of opening 27 in the gauge disk 26. A gauge disk is supplied with each bottle, which is apertured in accordance with the strength of solution in the bottle.

When excessively high or low water pressures are encountered so as to materially increase or decrease the volume of water passing through the head, correction is made by using a gauge disk having a different aperture. An excessively high water pressure may be reduced by decreasing the size of the port 16 in the bib disk 13, but we prefer to make the correction in the gauge disk.

A distinguishing mark or indicia 31 relating to the strength of the contents of the bottle is preferably provided on the label 32 of the container; and corresponding indicia 33 is preferably provided on the gauge disk for permanently identifying the disk with its container. At times it may be desired to vary the strength of the final spray composition issuing from the spray head, without using a different fluid in the bottle 8. In this case several of the disks 26 may be provided with each bottle, each disk having a different aperture designed to deliver into the mixing chamber a quantity of spray fluid having a calculated ratio to the diluting fluid.

It is understood that the passage 22 without the use of the gauge disk may serve to proportion the spray fluid. The gauge disk is preferably employed however since it provides means for varying the proportions. When the disk is employed the passage 22 is always of the same or larger size than the disk aperture 27.

The gauge disk or disks 26 may be packaged with the bottle 8 in different ways. For example, the disk may be packed separately in the carton with the bottle, or it may be attached to the neck of the bottle by means of a wire or cord. We prefer however to incorporate the disk as a part of the bottle closure. A simple way of doing this is to slip the disk or disks inside the bottle cap before the latter is applied to seal the bottle. When ready to use, a purchaser unscrews the cap and then removes the disk for incorporation with the bottle in the spray head assembly.

Another method of incorporating the gauge disk in the bottle closure is illustrated in Figure 4. In this case the top of the cap 34 is apertured to provide the disk; the liner 36 of the cap serving to close the apertures when the bottle is sealed. When this type of construction is used the purchaser unscrews the cap, removes the liner 36 and then screws the cap back on the bottle. The bottle with its cap in place is then threaded into the spray head coupling; the latter of course being of sufficient size to receive both bottle and cap.

Another type of closure is shown in Figure 5. In this case an inner cap 37 having an apertured top to provide the gauge disk is threaded on a bottle 8 having a rib 38 about which the lower end of the cap may be crimped. This inner cap therefore is permanently mounted on the bottle. An outer cap 39 is threaded over the inner cap to seal the bottle. When this construction is employed the purchaser merely removes the outer cap 39 and then screws both bottle and inner cap into the spray head.

Figure 6 illustrates a type of spray head construction which is adaptable for receiving different sized bottles, or bottles which may or may not have included the cap type of gauge disk. The adaption of the mounting construction to receive different sized bottle necks is effected by a removable liner or bushing 41 threaded in the coupling 4 and having inner threads for receiving the bottle. The spray head of Figure 6 also illustrates a variant form of deflector plate construction. In this case an ordinary nozzle cap 42 is provided, and the adjustment of the deflector plate is effected by sliding the holder 43 along the barrel 2 of the spray head. A curved resilient arm 44 working against the nozzle cap 42 causes the deflector plate portion 46 to be adjusted relative to the axis of the fluid stream, as will be readily understood.

Another type of coupling construction for receiving different sized bottles is shown in Figure 7. In this embodiment of our invention the bottle coupling 47 may be stamped from sheet metal, and comprises a series of threaded sections; the diameter of the sections decreasing toward the bottom, as clearly shown in the figure referred to. The yoke portion 48 of the coupling 47 is preferably rectangularly shaped, as best shown in Figure 8, and a saddle block 49 is provided as a filler over the top of the spray head barrel 2. The gauge disk in this construction is seated with a press fit in the bottom of the lower section.

Still another form of spray head embodying the improvements of our invention is shown in Figures 9 and 10, in which the gauge means comprises an integral part of the spray head construction. In this case the bottle coupling 4 is rotatably mounted on a conical surface 51 provided on the barrel 2. The coupling is held in a selected position by the clamping action of a sleeve extension 52 of the nozzle cap 53. The purpose of this adjustable mounting is to provide means for selectively registering the spray fluid duct 22 with one of a plurality of different sized ports 54 disposed about the barrel 2. The ports 54 are oppositely disposed; four of these ports being shown for purposes of illustration.

A pointer 56 is preferably provided on the bottom of the yoke portion 57 of the bottle coupling 4, and suitable indicia 58 are inscribed on the barrel 2 for cooperating with the pointer to indicate which of the ports 54 is in registration with the fluid passage 22. This arrangement is best shown in Figure 10. From Figure 9 it will be seen that when one of the ports is in register with the fluid passage 22 an opposite port is in register with an aperture 59 provided in the yoke 57.

A passage is thus completed to the atmosphere for supplying air to the injector. As in the previous cases, an air duct 61 is provided in the coupling 4 to admit air into the bottle 8. In this construction the proportioning between the spray fluid and water is controlled by registering the fluid passage 22 with a selected one of the different sized ports 54. The indicia 58 on the barrel 2 preferably corresponds with similar indicia marked on the bottle 8 so that the proper dilution of a spray fluid of particular strength may be had.

Still another embodiment of our invention is shown in Figure 11, in which the bottle coupling 66 is removably mounted on its holding yoke 67. The barrel of the spray head is also formed in two parts, the forward section 68 being threaded into the rear section 69 with the yoke 67 locked therebetween. In this case the injector 71 is pressed into the rear end of the forward

barrel section 88, with the rear end of the injector flush with the rear end of the forward section.

The top of the holding yoke 67 is provided with a curved or crowned surface over which a complementary curved gauge disk 72 may seat. When a bottle is threaded into the coupling 66 the assembly is securely locked together with the bottom flange of the coupling caught under the lip 73 of the holding yoke. An advantage of the present construction is that the coupling 66 is removable and may be provided in a number of different sizes, indicated by the dotted lines 74, into which different sized bottles may be screwed.

Another variant form of construction embodying the improvements of our invention is illustrated in Figure 12. In this case an extension neck 76, preferably of metal, is permanently mounted on the top of a bottle 77 by having a flange 78 crimped about a bead 79 around the bottle neck. The extension neck 76 is provided with a pair of oppositely disposed and inwardly flared openings 81, and is also provided with an air duct 82. These openings are closed by a cap 83 to seal the bottle.

The remaining portions of the spray head in this assembly are indicated by dotted lines, but shown separately in Figure 14. It comprises a two-section barrel having a hose coupling and barrel portion 84, provided with a conical face 85 for seating in one of the flared openings 81, and having an enlarged forward barrel portion 86 threaded on a reduced extension 87 of the rear section and also having a conical face adapted to seat in the other flared opening. In this arrangement the spray fluid is drawn from the bottle into the mixing chamber of the spray head through a port 89 formed in the reduced portion 87; and air is drawn in through the port 90, which lies just outside the cap.

A variation of the apparatus shown in Figure 12 is illustrated in Figure 13. This shows the adaptation of our spray head to a can 91. A pair of oppositely disposed openings normally plugged by a pair of caps 92 are provided at one end of the can. When this type of spray fluid container is to be used the pressed fitted caps 92 are removed, and a spray head similar to that shown in Figure 14 is inserted through the can openings, and locked into operative position. When the conical faces of the barrel sections are forced together they form their own seats by forcing in the edges of the can openings, as will be readily understood. A suitable nail hole punched in the can will provide an opening for admitting air.

In each of the foregoing spray head constructions, in which the concentrated spray fluid container comprises part of the spray head assembly, the operator controls the introduction of the spray fluid by the position of the fluid bottle. With the bottle inverted, as shown in Figure 1, the spray fluid will be drawn into the mixing chamber, while with the bottle in an upright position under the spray head the spray fluid cannot be drawn into the head. The apparatus in the latter condition operates as an ordinary water sprinkler, which may be turned into spray apparatus at a moments notice.

A still further embodiment of our invention particularly suitable for orchard spraying, is shown in Figures 15 and 16. In this case a separate spray fluid container 93 which may be a gallon can is provided; and a second hose 94 is included in the assembly for conducting the fluid from the can 93 to the spray head. The can is provided with suitable ears to which a shoulder strap 95 is connected to facilitate the transport of the can by the user. Any one of our spray heads may be employed; a suitable nipple 96 being provided on one end of the hose 94 to thread into the coupling 4 of the spray head.

The other end of the hose 94 is connected to the upper end of a tube 97 which projects downwardly into the can 93. The tube 97 preferably comprises part of the permanent assembly, and is provided with a flange 98 which rests on the gasket 99, and is locked between a neck 101 formed on the can and an apertured cap 102 carried by the tube above the flange, and adapted to be threaded on the neck.

When the product is to be used a purchaser unscrews the cap which seals the can, inserts the tube 97 and screws down the cap 102. A suitable nail hole 103 punched in the top of the can conveniently provides a port for admitting air. This rig is intended for use in cases where a relatively heavy stream of toxic spray must be thrown a considerable distance such for example as in an orchard of full grown trees; or in cases where a liquid fertilizer is to be spread. In both these cases the amounts of spray liquid passing in unit time through the spray head is large, and therefore a larger supply must be provided to avoid frequent interruption.

We claim:

1. In combination, a bottle for holding a fluid, a socketed element engaging the neck of the bottle, and a gauge disk interposed between said element and bottle and having an aperture providing a discharge port for controlling the flow of the fluid from the bottle and also having a second aperture providing an inlet port for admitting air into the bottle.

2. In combination, a fluid holding bottle, and a gauge disk removably seated over the neck of the bottle and having a plurality of apertures, one of said apertures providing an orifice for controlling the amount of fluid being discharged from the bottle and another of said apertures providing a port for admitting air to the bottle.

3. In combination, a spray head, a fluid holding bottle removably mounted on the head for introducing fluid into said head, and a gauge disk having a plurality of apertures seated over the neck of the bottle and removably interposed between the spray head and bottle, one of said apertures providing an orifice for controlling the amount of fluid discharged into the head and another of said apertures providing a port for admitting air to the bottle, said head having passages therein for conducting the fluid from the control aperture into the head and for conveying air from the atmosphere to the air admitting aperture.

4. In combination, a spray head having a threaded socket, a plurality of passages in the head ported into the bottom of the socket, a gauge disk lying against the bottom of the socket and having a plurality of apertures registering with said passages, and a fluid holding bottle having a threaded neck screwed into said socket and bearing against the gauge disk and sealing the latter against the bottom of the socket.

5. In combination, a spray head having a socket with an annular groove in the bottom thereof, a passage in the head communicating

with said socket groove, a fluid holding bottle engaging the socket, and a guage disk interposed between the bottle and socket and having an aperture registering with said groove.

6. In combination, a spray head having a socket with an annular groove in the bottom thereof, a passage in the head communicating with said socket groove, a second passage in the head opening into the central portions of the socket, a fluid holding bottle engaging the socket, and a gauge disk interposed between said bottle and socket and having one aperture registering with the central passage and another aperture registering with said groove.

7. In combination, a spray head having a mixing chamber, a nozzle in the head and having a discharge orifice for directing a stream of diluting fluid into the mixing chamber, a bottle on the head for holding a concentrated fluid, a passage in the head communicating with the bottle and ported into the chamber adjacently behind the nozzle orifice, a second passage in the head opening to the atmosphere and also ported into the chamber adjacently behind said injector orifice, a third passage in the head communicating between the bottle and atmosphere, and a gauge disk interposed between the bottle and head and having apertures registering with said bottle communicating passages.

8. In combination, a spray head having a tubular body providing a mixing chamber, a hose coupling on the rear end of the body for admitting water into the mixing chamber, a nozzle fitting closely within the tubular body and having a bore for introducing a predetermined flow of water into the chamber, a threaded bottle coupling having a bottom therein and mounted on the side of the spray head body adjacent said nozzle, a passage in the head leading from the bottom of the bottle coupling and ported into the mixing chamber, a second passage in the head leading from the bottom of the bottle coupling and opening to the atmosphere, a gauge disk lying against the bottom of the bottle coupling socket and having apertures registering with said passages, and a bottle for holding a concentrated fluid and having a threaded neck screwed into the bottle socket and bearing against the gauge disk and sealing the latter against the bottom of the socket, the gauge disk aperture registering with the chamber communicating aperture providing a flow control orifice for proportioning the concentrated fluid relative to the water.

9. In a spray head, a bottle socket having fluid discharge and air inlet passages opening in the bottom thereof, a gauge disk lying in surface-to-surface contact with the bottom of the socket and having apertures registering with said passages, the aperture registering with the fluid discharge passage having a cross sectional area smaller than said passage for controlling the fluid flow, and a fluid holding bottle having a neck engaged in said socket and bearing against the gauge disk for sealing the latter against the bottom of the socket.

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