Nov. 6, 1945. J. W. R. STEWART 2,388,445

SPRAYING PROPORTIONER

Filed Sept. 3, 1942

Fig. 1.

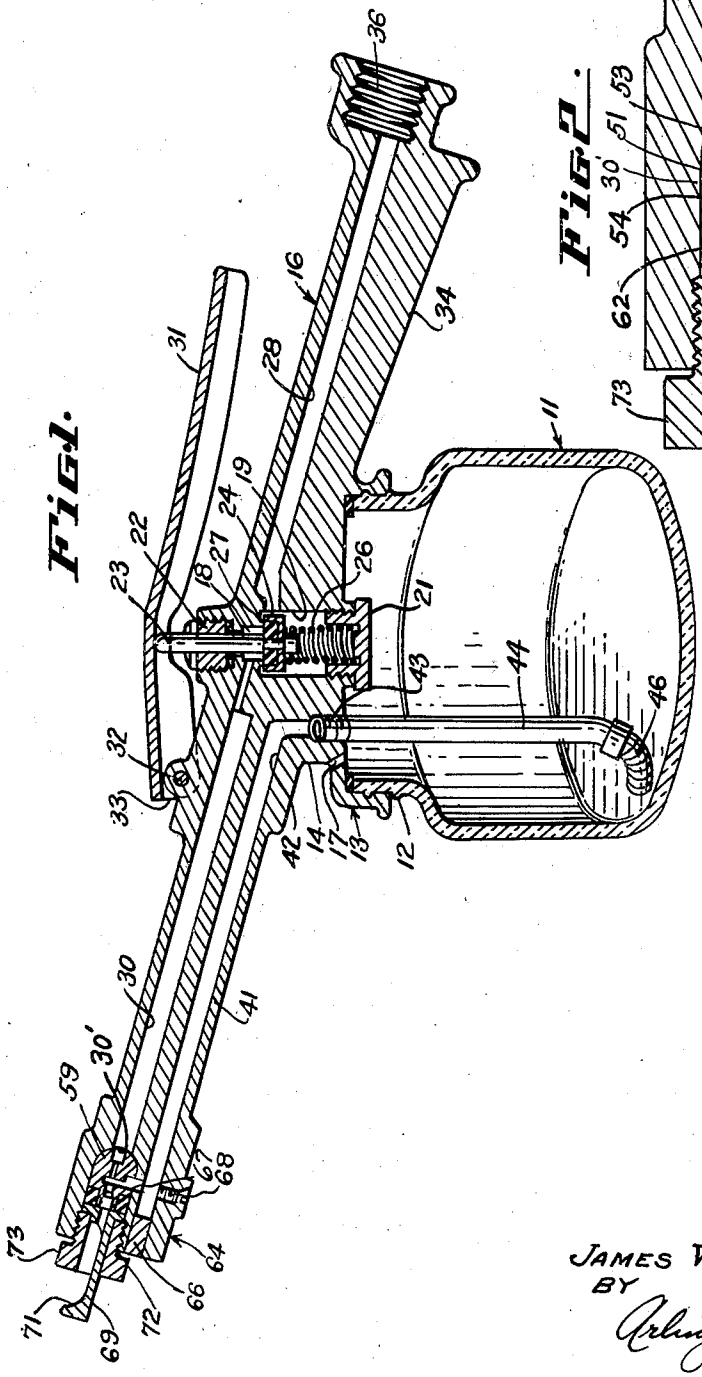
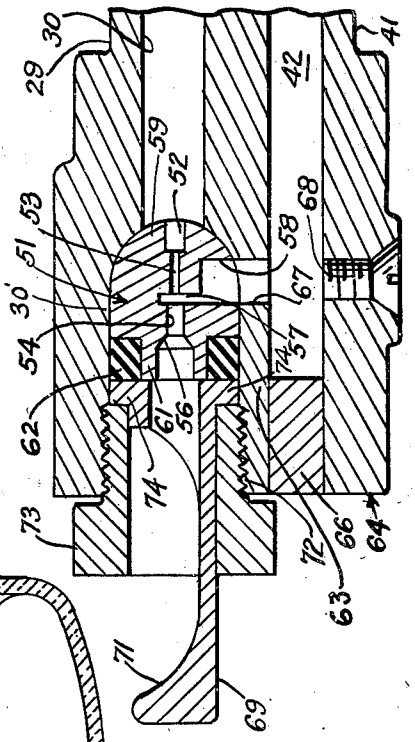


Fig. 2.



INVENTOR
JAMES W.R. STEWART
BY
Arlington & White
ATTORNEY.

Patented Nov. 6, 1945

2,388,445

UNITED STATES PATENT OFFICE

2,388,445

SPRAYING PROPORTIONER

James W. R. Stewart, Berkeley, Calif., assignor to Stanley A. Hayes, Berkeley, Calif.

Application September 3, 1942, Serial No. 457,117

1 Claim. (Cl. 299—84)

The invention, in general, relates to measuring devices for delivering uniform, predetermined mixtures of liquid materials under all variations of pressure under which the devices normally would be operated. More particularly, the invention relates to equipment for spraying effective amounts of liquid insecticides, fungicides, germicides and the like.

As is probably well known, the average user of spray devices for controlling plant pests is unskilled. The difficulties encountered by users of such devices are not so much in the selection of proper materials but, rather, in being able to effect therewith the dissemination of a constant, efficaceous amount of the materials without destroying plant life and yet obtaining the extermination of the pests. In many of the spraying devices heretofore marketed an inherent disadvantage thereof resides in the incapability of such devices, generally, to function automatically under variable pressures of a motivating and carrier fluid or liquid. In other words, once a proportionate, effective mixture of materials has been selected for projection from these prior devices, and the control valve of the device set for delivering such proportionate mixture, a user of the device is helpless to change the proportions under a lowering or raising of the pressure of the motivating liquid except and unless the user remains constantly alert to such pressure variations and manually re-sets the control valve re-currently in response to such pressure variations. Frequently, considerable damage to plant life has resulted because of the inattentiveness of users of these devices to pressure variations and a failure to re-set the control valve thereof to meet the lower or higher pressure value as the case may be. Other spray guns or devices currently marketed not only have the disadvantage just mentioned but are ineffective for proper pest control because they are dependent to a large extent upon air pressure in addition to the pressure of a motivating liquid to effect the projection of the spray from the gun.

A primary object of the present improvement is to provide a device for spraying insecticides, germicides, fungicides and the like in a liquid carrier which affords automatic dissemination of predetermined, constant proportionate mixtures of spray material and carrier liquid under all normal pressure variations of the carrier liquid.

Another object of the invention is to provide a device of the aforementioned character which is of such simple construction and mode of operation that it is capable of ready use safely by the skilled and the unskilled alike.

A still further object of my present invention is to provide an improved spraying proportioner of the indicated nature which is further characterized by its capability of functioning automatically to compensate for pressure variations of the motivating liquid so as to maintain the projection of a uniform and constant proportionate mixture at all times.

Another object of the present improvement is to provide a device of the indicated nature which is further characterized by the embodiment therein of a unique, air-sealed jet affording substantially steady and unobstructed flow of the carrier fluid at all pressures thereof without likelihood of formation of eddy currents or other disturbance to effect the projection of a constant proportionate spray mixture under all normal conditions of use.

The foregoing and other objects are attained in a preferred embodiment of my spraying proportioner which is illustrated in the accompanying drawing. It is to be understood that while I have shown a preferred embodiment of the invention in the drawing, I am not to be limited to the precise embodiment shown, nor to the precise assembly depicted, as my invention, as defined in the appended claims, can be embodied in a plurality and variety of forms.

Referring to the drawing:

Figure 1 is a sectional view of a preferred embodiment of my invention.

Figure 2 is an enlarged cross-sectional detail of the metering jet of the preferred embodiment of the invention.

In its preferred form, the spraying proportioner of my invention preferably comprises, in combination with a container for holding a liquid pest control material, such as an insecticide, a fungicide or a germicide, a spray forming and dispensing apparatus comprising means for conducting a stream of a carrier liquid having a variable pressure head, means communicating with the interior of said container and with said stream of carrier liquid for effecting the entrainment of the liquid material of said container into said stream of carrier liquid, together with a metering jet in the path of and communicating with said stream of carrier liquid for automatically regulating the amount of pest control material entrained therein from said container regardless of the pressure head of said carrier liquid whereby a constant, predetermined pro-

portionate spray mixture of carrier liquid and pest control material is projected under all pressure heads of said carrier liquid.

While there are numerous manually settable and controlled spray guns available on the market which operate to entrain pest control material from a container thereof into a carrier liquid, many of such devices embodying Venturi jets for ejecting the material from the container, it is to be especially observed from the following description and annexed drawing that the preferred embodiment of my present invention embraces a dual purpose Venturi jet in that, in addition to its ejector action, it automatically meters the amount of pest control material to the amount of carrier liquid for effecting the projection of constant proportionate mixtures of these materials under all pressure variations of the carrier liquid. The metering nozzle of my invention will conveniently hereinafter be referred to as the metering jet of the device. It also is to be especially observed that the metering jet, per se, of the combination is a fixed element with respect to the remaining parts and that such metering jet alone governs the proportionate mixtures projected, rather than utilizing or depending upon air nozzles requiring manual setting and adjustment. Further, that the preferred embodiment of my invention is not dependent upon the manual setting of valves or other control means but operates automatically and in response to variations of the pressure of the carrier liquid alone so that at all times of use of the device there is projected an effective, constant proportionate mixture of pest control material and carrier liquid.

Inasmuch as the improved spraying proportioner of my invention has been found to be especially useful as applied to devices employed for controlling plant pests, whereby suitable insecticides, germicides or fungicides are applied to the plant in the form of a spray, I have depicted my present improvement in the annexed drawing in combination with a device of such character. In general, these pest control material disseminating devices include, as shown, a suitable container for holding a desired amount of the material to be sprayed, a gun mounted upon the container for conducting and projecting a carrier liquid for the material, and a nozzle for breaking up the mixture of material and carrier liquid into a finely divided spray. While any suitable receptacle may be employed for holding the pest control material, I preferably use a glass jar 11 having a threaded neck 12 for removably receiving a screw cap 13 which, in the preferred embodiment of the invention, is conveniently formed integral with an enlarged portion 14 of an elongated gun barrel 16. This gun barrel has two bores, one for the carrier liquid and the other for the pest control material. The cap or closure 13 of the jar is, of course, provided with the usual port 17, or atmospheric vent, for supplying the requisite pressure head above the material in the jar for the ejecting action when the carrier liquid, such as water under pressure, is conducted through and projected from the gun barrel 16.

As illustrated particularly in Figure 1 of the drawing, the enlarged portion 14 of the gun is so formed as to provide a valve casing 18 defining a substantially vertical, generally cylindrical valve chamber 19 which is sealed at the bottom by means of a suitable screw plug 21 and at the top preferably by means of a threaded closure sleeve 22 which includes a central bore for slidably passing a pin 23 which constitutes the stem of a valve 24 for controlling water flow through the gun. A suitable compression spring 26 is disposed in valve chamber 19 between the bottom plug 21 and the valve 24, the spring normally holding the valve closed and seated against an interior, annular shoulder 27 of the valve casing 18. Valve 24, when closed, prevents flow of water from the bore 28 of the gun barrel through chamber 19 into the bore 30 which is substantially a continuation of the bore 28, and which extends from the valve chamber 19 to the discharge end 64 of the gun barrel. The means which are preferably employed for opening valve 24 at will and to the extent desired consists of a hand lever 31 which conveniently is fulcrumed on the gun barrel by means of a pin 32 which pierces the barrel as well as a pair of spaced ears 33 formed on the lower side of the lever 31. The lever 31 rests upon the projecting upper end of the valve stem 23, and the spring 26 is of sufficient strength to maintain the pin or valve stem in its highest position sustaining the weight of lever 31 and maintaining the valve 24 closed.

To open the valve, it is only necessary to depress hand lever 31 which in turn depresses the pin or valve stem 23 against the action of the spring 26. It will be observed that the gun barrel 16 is so formed as to provide a hand grip portion 34 on one end thereof to facilitate the handling of the gun in use, and that the gun is readily gripped and manipulated with the palm and thumb of the hand engaging the lever 31 and the fingers partially surrounding the handle 34. Adjacent to the handle of the gun, there is provided an integral coupling 36 suitably threaded for detachably fastening the gun to a standard faucet or garden hose, not shown, and to place the gun barrel bore 28 in communication with a source of water under pressure, also not shown.

A bore 42 substantially parallel to the bore 30, extends through the gun barrel from its discharge end 64 into the enlarged portion 14 of the gun, the said enlarged portion forming a cap 13 for the container 11. The bore 42 turns down through the cap 13 and forms an internally threaded outlet 43 for the container 11. A threaded tube 44 is removably screwed into the outlet 43 and projects into the container 11 substantially to the bottom thereof. A suitable strainer 46 is secured to the lower end of the tube 44 to prevent undissolved particles of pest control material from entering and clogging the bore 42 of the gun.

In accordance with my present invention, my improved spraying proportioner embodies a specially constructed metering jet, which is designated generally by the reference numeral 51 in the annexed drawing and which is fixedly located within an enlarged portion 39' of the bore 30 at its discharge end as shown. The specially constructed metering jet insures the projection automatically of a constant, effective proportionate mixture of pest control material and carrier liquid under whatever pressure of the carrier liquid obtains within the normal range thereof between 20 pounds per square inch to 175 pounds per square inch. As particularly illustrated in Figure 2 of the drawing, the jet 51 is formed with a series of axially aligned passages of circular cross-section which vary in diameter from the inlet to the outlet of the jet. This series of varying diameter passages include a relatively short inlet passage 52 which merges with a relatively long central passage 53 of smaller diameter than

the diameter of passage 52. The central passage 53, in turn, merges with a relatively short passage 54 which is of slightly larger diameter than passage 53 and the short passage 54 merges into a passage 56 of much larger diameter but having a flaring inlet, as shown. See, in this connection, Figure 2 of the drawing. In addition to the series of axially aligned passages 52 to 56 inclusive between the inlet and the outlet of the jet 51, there is also formed therein a transversely arranged slit 57 which extends across the passages 53 and 54 between the outlet of passage 53 and the inlet of passage 54. The slit 57 communicates with an enlarged side inlet 58 formed in the jet which serves as a means of passing the pest control material from the bore 42 into the jet through transverse slit 57.

The ratios between the diameters and the lengths of the passages 53 and 54 of the metering jet 51 are critical, and the point at which the transverse slit 57 bisects these two passages also is critical. To illustrate, as to the ratio between the diameters of the two passages 53 and 54, let it be assumed that the axially formed passage 53 is made to a diameter of .0410 of an inch while passage 54 is made to a diameter of .0437 of an inch, and that with a jet of such construction a spraying proportioner of my present improvement will effect the projection of a constant proportionate mixture, under all pressures of the carrier liquid within the normal range of pressures thereof, of one part by volume of pest control material to 24 parts by volume of carrier liquid. If the passage 54 is made .0001 of an inch larger while the passage 53 is maintained at the same diameter as before, i. e., 0.0410 of an inch, the proportionate mixture projected will change so that the spraying proportioner will project one part by volume of pest control material to 20 parts by volume of carrier liquid. On the other hand, if the passage 54 is made .0001 of an inch smaller while the passage 53 is maintained the same diameter as before, or .0410 of an inch, the projected mixture will be one part by volume of pest control material to 28 parts by volume of carrier liquid or water. It must be understood, with respect to the foregoing examples, that the position of the transverse slit 57 as well as its width, remains unchanged with respect to the passages 53 and 54 of the jet. To illustrate the effect of altering the lengths of the passages 53 and 54 as regards one another, let it be assumed that the passage 53 is made shorter than the passage 54. In this case, there would not be an accurate measuring of the carrier liquid for the passage 53 would not become filled completely under all varying pressures thereof, and since the ratios between pest control material and carrier liquid are governed by the complete solid stream filling of passage 53 under all pressures of the carrier liquid, the resultant projected mixtures would be continually getting out of balance. Also, in this same connection, with the passage 54 longer than the passage 53, there is provided too much surface for coating with pest control material and a consequent plugging of such passage. Naturally, as the coating of the walls of passage 54 increases, the proportions of the projected mixture changes, and the system is out of balance. Hence, passage 54 must be shorter than passage 53 to insure a balanced jet. However, passage 54 cannot be made too short otherwise no vacuum is effected and no material would be entrained with the carrier liquid.

As stated above, the location of the transverse slit 57 with relation to the passages 53 and 54 also is critical, for if the position of the slit be changed the jet is thrown out of balance, in the sense that the projected proportionate mixture would vary with the varying pressures of the carrier liquid. If the slit, for example, were to be formed in the jet 51 so as to bisect the passage 53, rather than be located at the juncture of the passages 53 and 54, then passage 53 is reduced in length and will not be filled completely with the carrier liquid as above explained. As a result, the carrier liquid can not effectively entrain the proper amount of material from the jar 11. In such position of the slit 57, the proportionate mixture projected by the spraying proportioner at, say 80 pounds per square inch pressure of carrier liquid, might be approximately one part by volume of pest control material to approximately 24 parts by volume of water while at, say 30 pounds per square inch water pressure, the mixture may be approximately one part by volume of pest control material to approximately 16 parts by volume of the water. Since the carrier liquid pressure might vary appreciably while the proportioner is being used, such variations in the projected mixtures might be quite harmful on plant life as well as be ineffective in the control of a given pest. On the other hand, if the transverse slit 57 were changed as to position so that it bisected the passage 54, rather than be located at the juncture between passage 53 and 54, the jet 51 would not be sealed in the sense of creating the proper suction, and the amount of entrained pest control material would be materially reduced. If the transverse slit 57 is located too far toward the outlet end of the jet, no suction at all would be created and no pest control material would be entrained in the carrier liquid. Moreover, if the slit 57 were to be made too wide, there would be no vacuum and no pest control material likewise would be entrained. Preferably, the slit 57 is cut to approximately .0400 of an inch.

Another critical feature of the construction of the metering jet 51 resides in the chamfering of the mouth of the inlet passage 52. I have found that at high water pressures a relatively high turbulence is created around the mouth of the inlet orifice if the mouth is not chamfered, such turbulence materially affecting the flow of water into and through the jet and clearly throwing the proportions of carrier liquid and pest control material out of balance. Chamfering of the mouth of the inlet orifice to passage 52 also affords the flow of a smooth, straight solid stream of water from the discharge tube 29 into the jet, which smooth solid stream is maintained through the central passage 53 to completely fill the same and thereby insure constant proportions between the carrier liquid and the pest control material under all pressures of the carrier liquid.

As particularly illustrated in Figure 2 of the drawing, the metering jet 51 is fixedly located within a greatly enlarged portion 30' of the bore 30 of the gun barrel at its outlet end. Preferably, the inlet end of the metering jet 51 is rounded to provide, in effect, a ball seat 59 for the jet within the bore thus preventing air or water leakage past the jet at the point between the jet and the inner wall of the bore. The outlet end of the metering jet preferably is formed with an extending reduced portion or boss 61 thereon affording a seat for a mass 62 of malleable material, such

as soft lead, which is disposed and tamped into position around the boss, after pressing the metering jet into position within the enlarged bore 30'. As shown, the mass 62 of malleable material fills the space between the metering jet 51 and the interior wall of the enlarged bore 30' and thus the jet 51 is sealed into position so that water can not pass around the same. The gun barrel is cast with an enlarged discharge end to accommodate the enlarged bore 30'. In forming the bore 42, the end of the gun barrel necessarily must be pierced but it is conveniently closed with a sealing plug 66, as shown.

To the end that uniform, unobstructed flow of pest control material be established between the jar 11 and the metering jet 51, the outlet end of material discharging bore 42 is provided with a relatively wide side outlet 67 which registers with the enlarged side inlet 58 of the metering jet which, in turn, merges with the transverse slit 57 of the jet. Since the water discharging bore 30 and the material discharging bore 42 are both formed in a single gun barrel casting, in forming the wide side outlet 67 for the material discharging bore 42 it is found expedient to pierce the opposite side of the gun barrel thus forming a hole which conveniently is closed with a sealing screw-plug 68, as shown.

In accordance with my invention, an adjustable spray or nozzle deflector 69 is provided in the outlet of the gun and is so formed as to break up the projected mixture into a finely divided spray. To this end, the outer extremity of the deflector 69 is turned to a smooth curved surface 71 of short radius, as shown, so that a finely divided spray is formed when the mixture leaving the jet 51 impinges on the curved surface 71 of the deflector. In conjunction with the deflector 69, I conveniently provide a lock-nut 72 which, as shown, is detachably mounted in the enlarged bore 30' by threaded engagement therewith. The lock-nut 72 is preferably provided with a knurled head 73 to facilitate turning thereof by the fingers. The inner end of the lock-nut 72, when the nut is tightened to its fullest extent, bears upon an out-turned flange 14, conveniently formed on the inner end of the deflector 69. It is clear that the deflector can be adjusted to any desired position for the spraying of plants or foliage and the adjustment of the same is a relatively simple matter. For example, it is only necessary first to loosen the lock-nut 72 by grasping the knurled head thereof and turning, then twisting or turning the deflector 69 so that its curved surface is directed as desired, and then the lock-nut tightened again so that its inner end bears against the flange 74 of the deflector. With the surface 74 of the deflector disposed in the position indicated in Figure 1 of the drawing, the under side of plant leaves and foliage may be effectively sprayed. If the surface 71 is turned through 180° and locked in that position, the spraying proportioner may be employed to spray downwardly upon foliage. If a straight, solid stream is desired to be projected the deflector 69 as well as the lock-nut 72 can be removed from the device. With these parts removed, a straight, solid full stream of a predetermined, constant proportionate mixture of a carrier liquid and a pest control material may be turned upwardly to reach appreciable heights for the treatment of trees and high foliage.

It is to be understood that the appended claims are to be accorded a range of equivalents commensurate in scope with the advance made over the prior art.

I claim:

A spraying proportioner comprising, in combination with a container adapted to hold a quantity of liquid pest control material, a container head removably mounted on said container and consisting of a cap having a vent therein, a gun barrel integral with said cap; said barrel having a bore therein for the passage of a carrier liquid and terminating in an enlarged bore portion adjacent its discharge end, a valve controlling flow of carrier liquid through said bore, a metering jet disposed in said enlarged bore portion of said gun barrel; said metering jet consisting of a unitary structure having a series of aligned communicating passages of circular cross-section extending therethrough as well as a side inlet, said passages including in series a relatively short inlet passage, a relatively long central passage of smaller diameter than said inlet passage, a short passage of greater diameter than said central passage, and an outlet passage of greater diameter than that last mentioned short passage, means establishing communication between the interior of said container and the side inlet of said metering jet; said means including a slit in said jet extending transversely thereof between said central and sealing passages.

JAMES W. R. STEWART.