Jan. 17, 1961 D. D. HOLCOMB 2,968,441

SPRAY NOZZLE ASSEMBLY FOR USE WITH AEROSOL CAN

Filed Aug. 15, 1958

2 Sheets-Sheet 1

FIG. 1

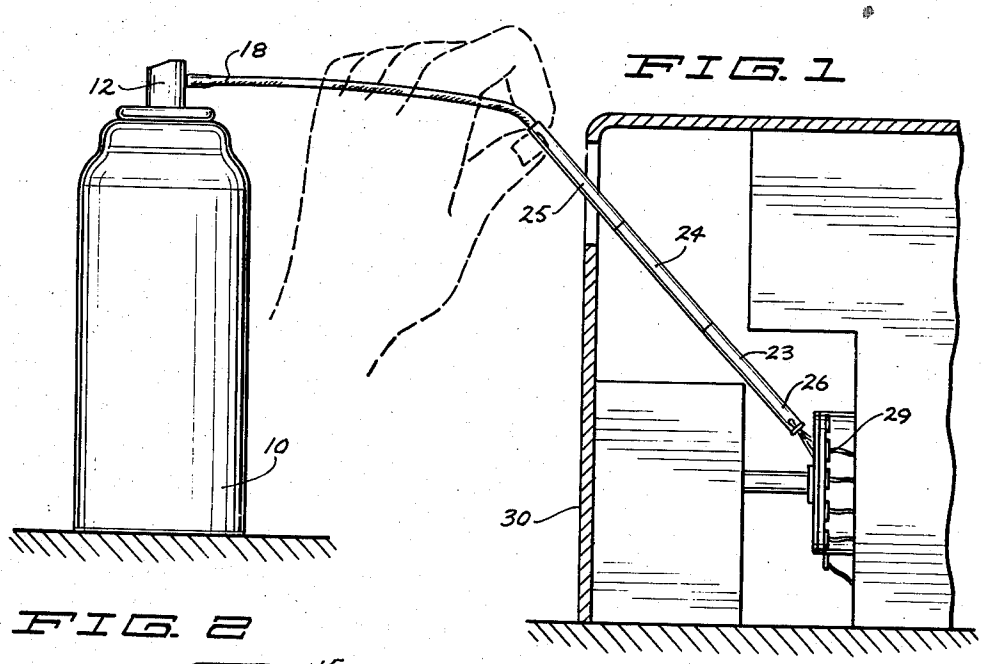

FIG. 2

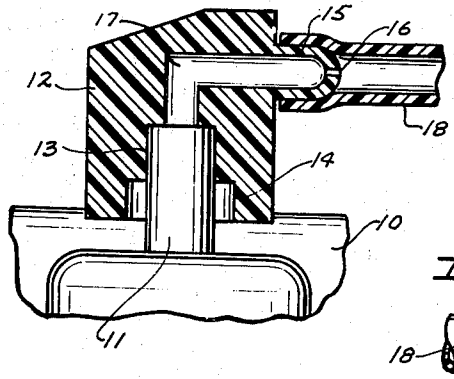

FIG. 3

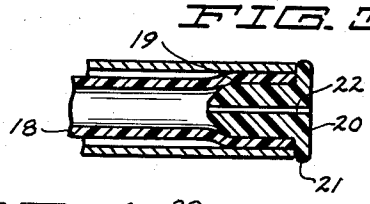

FIG. 4

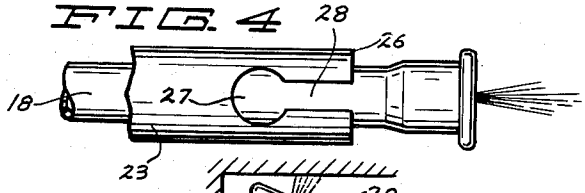

FIG. 5

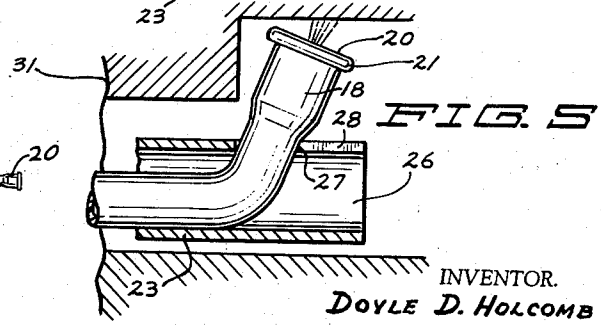

FIG. 6

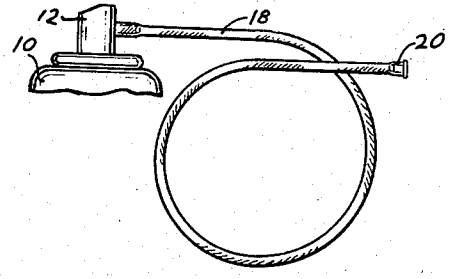

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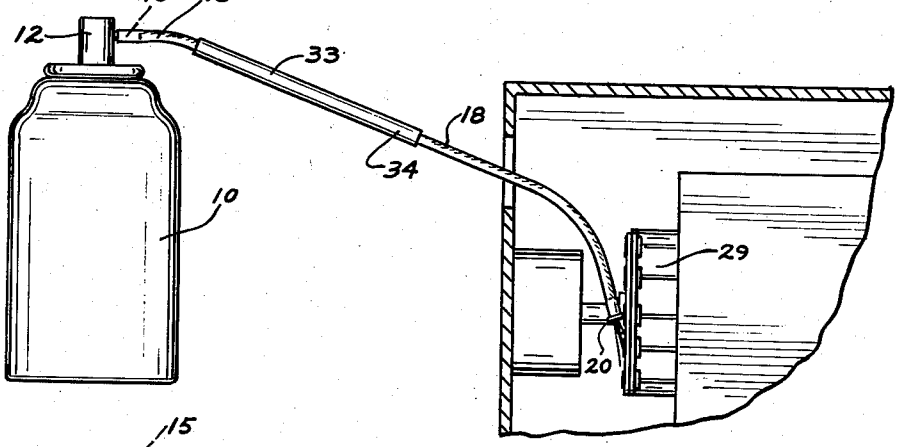
FIG. 7



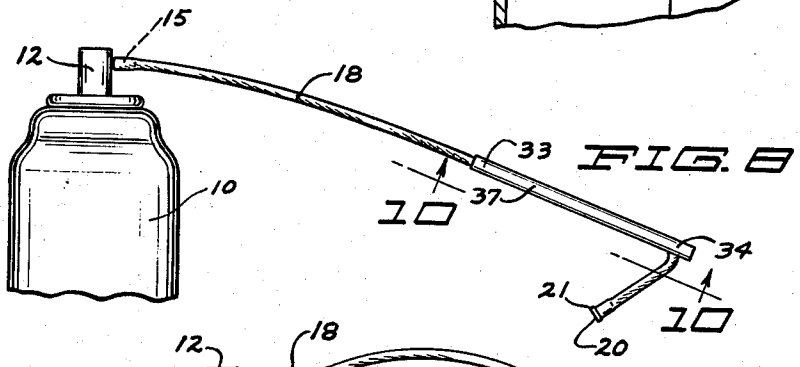


FIG. 8

10

10

FIG. 9

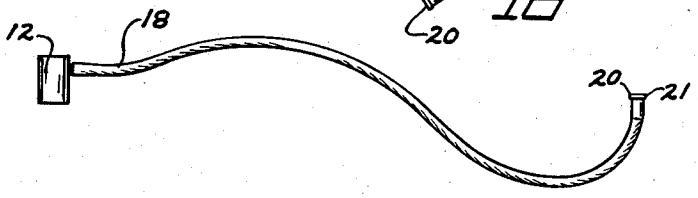


FIG. 11

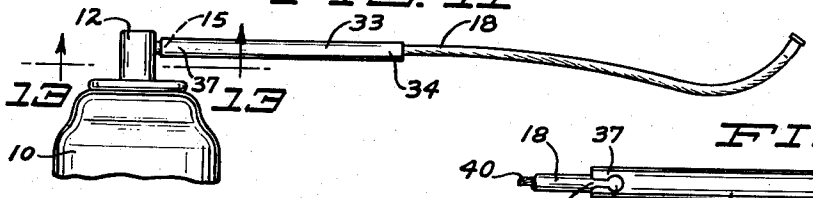


FIG. 10

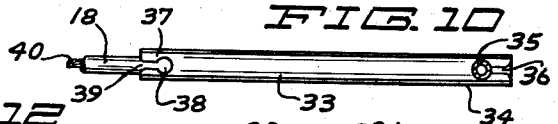
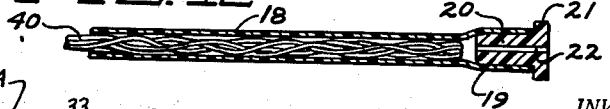


FIG. 12



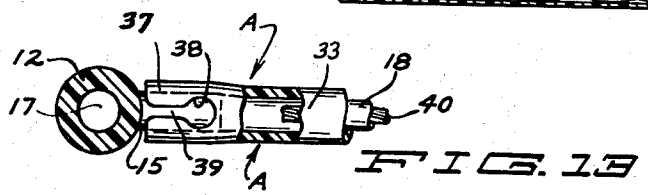


FIG. 13

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SPRAY NOZZLE ASSEMBLY FOR USE WITH AEROSOL CAN

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Filed Aug. 15, 1958, Ser. No. 756,269

6 Claims. (Cl. 239—337)

This is a continuation-in-part of my patent application for Spray Nozzle Assembly for Use With Aerosol Can, Serial No. 684,805, now abandoned filed September 18, 1957.

This invention has relation to a spray nozzle assembly for use on aerosol cans in order that the product sprayed from the can may be directed accurately on the location for its use even when this location is unavoidably separated from the can by various objects and structure. While the assembly of the present invention will find use in numerous situations, it is particularly useful in directing spray type electrical contact cleaning fluid onto the contact points of electrical equipment such as television channel tuning units when said equipment is located far in the interior of a television set.

An assembly made according to one form of the invention includes a valve actuating spray nozzle designed to replace the original spray nozzle, a length of flexible tubing having one end detachably connected over the spray orifice of the valve operating spray nozzle, and a remote spray nozzle removably connected to an opposite end of the flexible tubing. A plurality of stiff-walled pipes are slidably situated over the tubing between the two nozzles. When one or more of these pipes are hand held to be in bearing relation to the remote nozzle and to each other, the flexible tubing is held in a stiff condition so that the remote nozzle may be properly positioned with respect to the work area. Where it is necessary that the remote nozzle pass through a tortuous path in arriving in alinement with the work area, these stiff-walled pipes will be slid to position adjacent the valve actuating nozzle so that the remote nozzle and flexible tubing can be threaded into the desired position.

A circular opening and a slot between the circular opening and the outer end of the outermost section of the stiff-walled pipe are for holding the flexible tubing at an angle to the longitudinal axis of said pipe to cause the remote nozzle to be supported to discharge in direction out of axial alinement with said axis of said pipe.

A spray nozzle assembly made according to another form of the invention can include also a valve actuating spray nozzle designed to replace the original spray nozzle, a length of flexible tubing having one end detachably connected to the orifice of the valve operating spray nozzle, and a remote spray nozzle removably connected to an opposite end of the flexible tubing. A stiff-walled pipe is slidably situated over the flexible tubing between the two nozzles. The outer end portion of this stiff-walled pipe is also provided with a circular opening and a slot between said circular opening and the outer end of the pipe for supporting the flexible tubing in the circular opening to cause a bend to be set in said tubing.

In this form of the invention a length of deformable, non-resilient, woven wire is situated inside of the flexible tubing between the two nozzles. This wire is characterized by its ability to maintain the position into which it is deformed, and may be of a somewhat smaller diameter than the internal diameter of the flexible tubing. When

it is desired to cause the contents of the aerosol can to be sprayed along a tortuous path to reach the work area, the flexible tubing need only be deformed to conform to the configuration of this tortuous path, and the woven wire, having been deformed with the deformation of the flexible tubing, will hold the tubing in the desired position.

In this form of the invention, the innermost end of the stiff-walled pipe may also be slotted to allow the pipe to be pushed over that portion of the flexible tube which is mounted on the beak or projecting orifice portion of the valve actuating spray nozzle to the end that the flexible tubing will be held substantially straight out from the valve actuating spray nozzle. When the parts are so positioned, the aerosol can and spray nozzle assembly can be operated with a single hand.

In most instances, in order that the maximum pressure inside of the can can build up immediately adjacent the remote nozzle, the opening through the valve actuating spray nozzle will be somewhat greater in diameter than the opening through the remote nozzle.

Also, in the first form of the invention, and in the second form of the invention, where the flexible woven wire does not occupy the entire length of the flexible tubing, this flexible tubing can be manually pinched closed to prevent the escape of the contents of the aerosol can when the valve actuating spray nozzle of the assembly is being forced over the upright valve conduit member of the aerosol can.

In the drawings,

Fig. 1 is an elevational view of an aerosol can having the spray assembly of a first form of the present invention installed thereon and extending into position in alignment with electrical contacts to be cleaned past necessarily unmoveable objects and structure;

Fig. 2 is an enlarged, fragmentary vertical sectional view of the valve actuating spray nozzle and flexible tubing of the first form of the invention when associated with the outlet and valve mechanism of an aerosol can;

Fig. 3 is a fragmentary vertical sectional view of the flexible tubing, remote nozzle and stiff-walled pipe of the first form of the invention;

Fig. 4 is a fragmentary plan view of the structure of Fig. 3 with the stiff-walled pipe spaced in clearing relationship to the remote nozzle;

Fig. 5 is a fragmentary view of the flexible tubing, remote nozzle and stiff-walled pipe with parts in section and parts broken away showing the relationship of the tubing and nozzle to the pipe when it is desired to spray at an angle to the axis of the pipe;

Fig. 6 is a fragmentary elevational view of a modified form of the invention.

Fig. 7 is an elevational view of an aerosol can having the spray nozzle of a second form of the present invention installed and extending into position in alinement with electrical contacts to be cleaned past necessarily unmoveable objects and structure;

Fig. 8 is an elevational view of the can and assembly of Fig. 7 but with the flexible tube and wire supported in angular relation to the stiff-walled tube;

Fig. 9 is an elevational view of the device of Fig. 8 but with the stiff-walled tube removed therefrom;

Fig. 10 is an enlarged sectional view taken on line 10—10 in Fig. 8;

Fig. 11 is an elevational view of the assembly of the second form of the invention but with the stiff-walled tube supported over the flexible tube on the valve actuating spray nozzle;

Fig. 12 is an enlarged longitudinal sectional view of the flexible tube woven wire and remote discharge nozzle of the second form of the invention; and

Fig. 13 is an enlarged sectional view taken on the line 13—13 in Fig. 11.

An aerosol can 10 conventionally includes an upright valve conduit member 11 which, when depressed or tilted operates the aerosol valve to cause the liquid within the can to be discharged upwardly through the conduit member. See patent to Green, Patent No. 2,731,298, granted January 17, 1956. Such cans have a spray nozzle friction pressed over the upper end of the conduit member 11. These spray nozzles can be removed by pulling upwardly thereon while holding the aerosol can stationary. A valve actuating spray nozzle 12 of the invention can be forced over the conduit member 11 to position as seen in Fig. 2 of the drawings when an upper cavity 13 of the spray nozzle is the same diameter as the outer diameter of the conduit 11. Since valve conduit members such as 11 are generally made at present to have either one of two standard outside diameters, a lower cavity 14 is provided in the spray nozzle 12 to accommodate upright conduit members such as 11 which have the larger external diameter. A beak 15 is in integral part and extends forwardly from the remainder of the spray nozzle 12. It has a spray or jet opening or orifice 16 extending therethrough. The spray opening 16 is open to the interior of upright valve conduit member 11 through a passageway 17 in the nozzle 12. In order to have the proper spray effect, the size of the spray or jet opening must be relatively small. A diameter of 0.060 inch has been found suitable for this purpose.

A flexible, tubing 18 is removably mounted in frictional relationship to the outside of the beak 15. Transparent deformable, slightly resilient vinyl tubing has been found to be quite suitable for this purpose.

An opposite end of the length of flexible tubing 18 is removably and frictionally positioned over a substantially cylindrical body portion 19 of a remote spray nozzle 20. The tubing 18 may be in contact with an integral outwardly extending flange 21 of the spray nozzle 20. A spray or jet opening 22 extends through the remote spray nozzle 20 and is of a diameter no larger than that of the jet or spray opening 16 in the valve operating spray nozzle. A diameter of 0.040 inch has been found to be most satisfactory for this opening.

In a first form of the invention, as disclosed in Figs. 1 through 6, a plurality of stiff-walled pipes indicated 23, 24 and 25 herein are loosely fitted over the flexible tubing 18 between the two spray nozzles. The diameter of an outer end portion 26 of the outermost stiff-walled pipe 23 is such that it will fit snugly but freely over the outer diameter of the flexible tubing 18 and the cylindrical body portion 19 of the remote spray nozzle 20. The outer diameter of the outwardly extending flange 21 of the spray nozzle 20 is substantially the same as that of the outer end portion 26 of the stiff-walled pipe 23.

Each of the pipes 23, 24 and 25 are of uniform diameter and cross section so that when the inner-most pipe 25 is forced in direction toward the spray nozzle 20, it will butt up against the pipe 24 which will butt up against the pipe 23 to cause them to assume a straight line relationship with respect to each other as best seen in Fig. 1.

The outer end portion 26 of the pipe 23 has a circular opening 27 provided therein at location slightly spaced from the end of said pipe, and has a narrow slot 28 extending between the end of said pipe and said opening.

Operation of first form of the invention

It is often necessary to discharge the contents of an aerosol can into some location such as the electrical contacts points 29 illustrated in Fig. 1 as being in an otherwise unaccessible portion of a piece of electrical equipment symbolically illustrated at 30. To bring the remote spray nozzle 20 into position to have the spray or jet opening 22 thereof in alinement with the work to be sprayed, an operator will force a stiff-walled pipe 25 in direction toward the remote spray nozzle 20 to stiffen the outer length of flexible tubing 18. This stiffened tubing can then be positioned as seen in Fig. 1 and the operator can depress the valve actuating spray nozzle 12 to cause liquid to be discharged first through the spray opening 16, and then through the flexible tubing 18 and the spray opening 22. As soon as sufficient liquid has been discharged to accomplish the desired purpose, the valve operating spray nozzle 12 can be released and the pressure inside of the aerosol can will cause the conduit member 11 to move in upward direction to close the aerosol valve. The liquid will continue to spray from the remote nozzle 20 only until the pressure inside of the flexible tubing 18 and the atmospheric pressure have equalized. A certain amount of liquid will then remain in the tube 18, but the diameter of the orifice or spray opening 22 is sufficiently small so that the surface tension of the liquid will prevent leakage from the spray assembly.

There are numerous situations where the straight forward spraying of the contents of the aerosol can in alinement with the axis of the stiff-walled pipe 23 will not cause the material to be deposited on the electrical contacts which it is desired to treat. The situation is illustrated in Fig. 5, where an obstruction 31 is so constituted that a straight discharge from the tube and pipe will not be effective. In this situation the pipe 23 will be moved back along the flexible tubing 18 to the approximate position illustrated in Fig. 4. The flexible tubing is deformed or flattened to allow it to pass through the slot 28 and into the circular opening 27 in the outer end portion 26 of the pipe 23. The flexible tubing 18 will then be pulled through the opening 27 until the parts are positioned approximately as seen in Fig. 5. If a sharper bend is needed to direct the spray on the proper location, the remote spray nozzle 20 and the flexible tubing can be forced even further into the opening 27 to cause an alinement of the spray opening or orifice 22 to approach right angular relationship with respect to the axis of the pipe 23.

It is often possible to get the hand of the operator immediately adjacent the remote spray nozzle 20 when this nozzle is in position to deliver the spray to the desired location. In this situation, the stiff-walled pipes of the main form of the invention can be slid to position adjacent the valve actuating spray nozzle 12 if maximum flexibility of the outer end of the tubing 18 is needed. Or they can merely be allowed to slide loosely on the flexible tubing if only limited flexibility is necessary.

Where the electrical contacts to be treated are often located at positions in which the flexible tubing 18 must be threaded in a tortuous path, it may be desirable to omit the stiff-walled pipes from the assembly entirely. This is clearly illustrated in Fig. 6.

Inasmuch as the opening or orifices 16 and 22 are quite small, it is conceivable that they may become plugged with some foreign matter present in the aerosol can itself. For this reason, it is highly advantageous that the flexible tubing be transparent. Presence of foreign matter in the tubing can then be readily visually detected. Inasmuch as the tubing is replaceably frictionally held on the beak 15 of the valve actuating nozzle 12 and on the cylindrical portion 19 of the remote nozzle 20, and inasmuch as the valve actuating nozzle 12 can also be removed from the aerosol can, obstructions can quickly be cleared. This feature of the removability and replaceability of all of the parts with respect to each other is often important in replacing worn elements of the assembly and in moving the assembly from association with a spent aerosol can to association with a new fully loaded can. Should the stiff-walled pipe or one or more sections of it be needed for a certain period of use and be undesirable for other use, the flexible tubing 18 can be removed from either of the spray nozzles to add or remove pipe as is necessary.

In a second form of the invention as disclosed in Figs. 7 through 13, all parts identical with the parts shown in Figs. 1 through 6 bear identical numbers.

A single stiff-walled pipe 33 is situated around the flexible tubing 18 to be in sliding relationship therewith. An outer end portion 34 of said pipe 33 has a circular opening 35 provided therein at location slightly spaced from the end of said pipe, and has a narrow slot 36 extending between said pipe and said opening 35.

An inner end portion 37 of said stiff-walled pipe 33 has a circular opening 38 provided at location slightly spaced from the inner end of said pipe, and has a narrow slot 39 extending between the end of said pipe and said circular opening 38.

A length of flexible, non-resilient woven wire 40 is positioned inside of the flexible tubing 18 between the valve actuating spray nozzle and the remote spray nozzle 20.

Operation of second form of the invention

A spray nozzle assembly and aerosol can of the second form of the invention will operate the same as that of the first form of the invention with the exception that the presence of the flexible wire 40 inside of the vinyl tubing 18 will give certain distinctive advantages.

A wire 40 will be used which has the ability to retain the position into which it is bent so that when the flexible tube 18 is bent as shown in Fig. 9, for example, it will be held in that position by the wire 40 inside of it. The presence of this wire, and the presence of the circular opening 38 and slot 39 in the inner end portion of the stiff-walled pipe 33 make possible the operation of the aerosol can and spray assembly with one hand. In order to do this, the stiff-walled pipe 33 is pushed over that portion of the flexible tubing 18 which is positioned over the beak 15. In order to accomplish this, the inner end portion 37 of the pipe 33 will have to expand, and this expansion is possible because of the slot 39 and opening 38. With the parts so positioned as seen in Fig. 11, it will not be necessary to support the tubing 18 with one hand, and a single hand can grasp the can 10 while the index finger thereof depresses the valve actuating spray nozzle 12 to cause discharge of the contents of the can through the tube 18 and along the woven wire 40.

Another advantage of having the flexible woven wire 40 inside of the tubing 18 apparently stems from the fact that a substantial portion of the cross-sectional diameter of the passageway through the tubing is occupied by the strands of the wire. The remaining free area for the passage of the contents of the can is, of course, substantially greater than the diameter of the jet opening, so the discharge from the outer jet opening is not affected by the presence of the wire. The volume of liquid needed to completely fill the remaining space inside of the tube is, however, substantially less than when no woven wire is present. This results in a more nearly instantaneous discharge from the outer nozzle 20 when the valve 12 is depressed; and, probably more importantly, results in an almost immediate cessation of flow from said nozzle when the valve actuating spray nozzle 12 is released.

As in the case of the first form of the invention, the parts in the second form of the invention are all removable and replaceable. If the woven wire 40 is of length to terminate about as shown in Fig. 13, the flexible tubing 18 may be depressed between the fingers at the points indicated A—A at the time the valve actuating spray nozzle 12 is initially being forced down on the upright valve conduit member 11 of the aerosol can. When this is done, discharge from the can will be eliminated even though valve conduit member 11 is momentarily depressed during the operation.

As previously stated, the size of the outer orifice 22 will be small enough so that no liquid will drip from this orifice after the spray nozzle 12 has been released and the pressure inside and outside the tube has become equalized. This feature has the very obvious advantage that the liquid remaining in the tube after use will not run all over any electric serviceman's repair kit. It has also been found that the entrapment of a flexible tube full of

liquid by use of such a structure results in an initial immediate discharge of this liquid from the remote spray nozzle in a solid or dropful form rather than in atomized form which would result if the flexible tubing initially had air in it. This initial charge of unatomized fluid material gives a very beneficial effect in as much as this liquid is projected much straighter and more forcefully than is the bulk of the latter discharged atomized material. This allows several drops of the liquid to be directed into the interior of some electrical equipment and deposited directly thereon in some quantity. This effect takes place as the pressure inside the flexible tubing and behind the remote nozzle builds up from zero to delivery pressure of the aerosol can. As soon as the full pressure or almost a full pressure is obtained, this material becomes atomized as it leaves the nozzle. In many instances, this unatomized material will have accomplished substantially all of the results wanted, and it will be unnecessary to cause much of the atomized material to be discharged.

What is claimed is:

1. The combination with an aerosol can containing fluid under pressure and a discharge valve actuating liquid discharge conduit, of: a spray nozzle assembly including a valve actuating spray nozzle positioned on said discharge conduit and having an opening therethrough in communication with an open outer end of the conduit, a flexible, hollow tubing having a first end thereof in surrounding sealing relationship to said nozzle opening, a remote spray nozzle positioned in a second end of said tubing and having a spray orifice therethrough in communication with the interior of said tubing, a stiff-walled pipe in surrounding relationship to said flexible tubing, said remote nozzle including an outwardly extending flange of dimension to prevent passage of said pipe over said remote spray nozzle, an end portion of said pipe adjacent said remote spray nozzle being provided with a circular opening of diameter approximating the outer diameter of said flexible tubing at a position spaced from the end of said pipe and being provided with a slot between said circular opening and the end of said pipe, the width of said slot being less than the diameter of said circular opening.

2. The combination with an aerosol can containing fluid under pressure and a discharge valve actuating liquid discharge conduit, of: a spray nozzle assembly including a valve actuating spray nozzle positioned on said conduit and having a first spray orifice therein in communication with an open outer end of said discharge conduit, a flexible hollow tubing having a first end thereof in surrounding sealing relationship to said first orifice, a remote spray nozzle positioned in a second end of said tubing and having a second spray orifice therethrough in communication with the interior of said tubing, wherein the cross sectional area of the second spray orifice is smaller than the cross sectional area of the first spray orifice, a plurality of stiff-walled pipes of uniform cross sectional dimension each situated in surrounding relation to said flexible tubing, said remote spray nozzle including an outwardly extending flange of dimension to prevent the passage of said pipes over said remote nozzle; said second spray orifice being of cross sectional area sufficiently small to prevent leakage of liquid in said flexible tubing from said orifice when the pressure inside of the tubing is equal to the pressure outside thereof, said flexible tubing being removably and replaceably connected to each of said spray nozzles, said valve actuating spray nozzle being removably and replaceably positioned onto said aerosol can discharge conduit, and an outermost portion of the outermost pipe being provided with a circular opening adjacent and spaced from the outermost end of said pipe and being provided with a slot extending between said circular opening and said end of said pipe, the diameter of said circular opening approximating the diameter of said flexible tubing, and the width of said slot being less than the diameter of said circular opening.

3. The combination with a can containing fluid under pressure and a liquid discharge conduit, of: a spray nozzle assembly including a flexible, hollow tubing having a first end thereof in sealing relationship to said discharge conduit, a spray nozzle positioned in a second end of said tubing and having a spray orifice therethrough in communication with the interior of said tubing, a stiff-walled pipe in surrounding relationship to said flexible tubing, an end portion of said pipe adjacent said remote spray nozzle being provided with a circular opening of diameter approximating the outer diameter of said flexible tubing at a position spaced from the end of said pipe and being provided with a slot between said circular opening and the end of said pipe, the width of said slot being less than the diameter of said circular opening.

4. The combination with a can containing fluid under pressure and a discharge conduit, of: a spray nozzle assembly including a flexible, hollow tubing having a first end thereof in sealing relationship to said discharge conduit, a spray nozzle positioned in a second end of said tubing and having a spray orifice therethrough in communication with the interior of said tubing and otherwise unconnected to the remainder of the spray nozzle assembly, a stiff-walled pipe in surrounding relationship to said flexible tubing wherein said remote nozzle includes an outwardly extending flange of dimension to prevent passage of said pipe over said remote spray nozzle, wherein an end portion of said pipe adjacent said remote spray nozzle is provided with a circular opening of diameter approximating the outer diameter of said flexible tubing at a position spaced from the end of said pipe and is provided with a slot between said circular opening and the end of said pipe, the width of said slot being less than the diameter of said circular opening.

5. The combination with an aerosol can containing fluid under pressure and a discharge valve actuating liquid discharge conduit, of: a spray nozzle assembly including a valve actuating nozzle positioned on said discharge conduit and having an opening therethrough in communication with an outer open end of said conduit, a flexible, hollow tubing having a first end thereof in surrounding sealing relationship to said nozzle opening, a remote nozzle positioned in a second end of said tubing and having a spray orifice therethrough in communication with the interior of said tubing, a stiff-walled pipe in surrounding relationship to said flexible tubing and each otherwise unconnected to the remainder of the spray nozzle assembly, a length of relatively stiff, tractable, non-resilient, stranded, woven wire inside of said tubing, the cross sectional area of said wire being only slightly less than the corresponding cross sectional area of said tubing, said remote nozzle including an outwardly extending flange of dimension to prevent passage of said pipe over said remote nozzle, an end portion of said pipe adjacent said remote nozzle being provided with a circular opening of diameter approximating the outer diameter of said flexible tubing at a position spaced from the end said pipe and being provided with a slot between said circular opening and the end of said pipe, the width of said slot being less than the diameter of said circular opening.

6. The combination as specified in claim 5 wherein an inner end portion of said pipe is provided with a slot open to the inner end of said pipe.

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