Jan. 22, 1957 J. D. LEAR 2,778,679

AEROSOL GENERATOR

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Fig. 1.

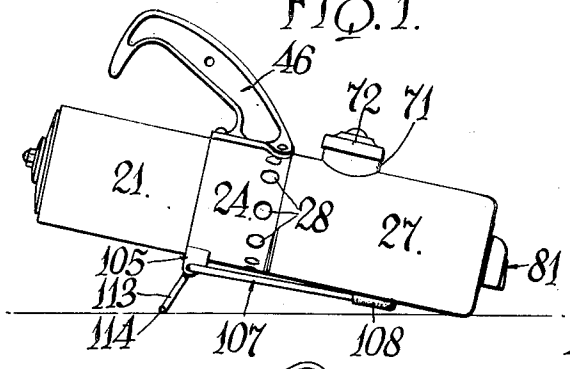
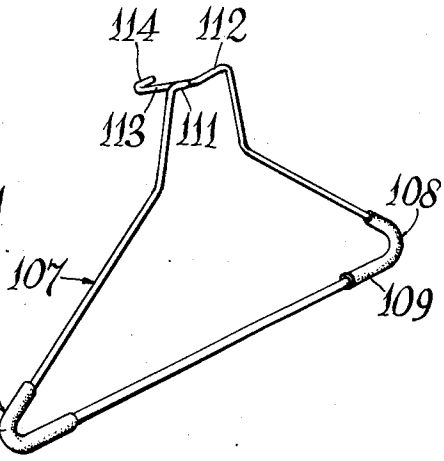


Fig. 4.



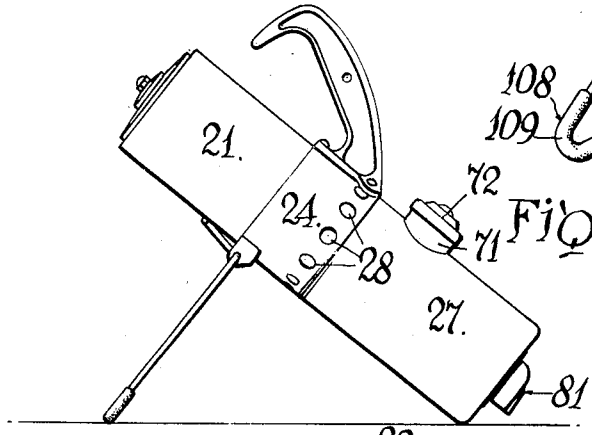


Fig. 2.

Fig. 3.

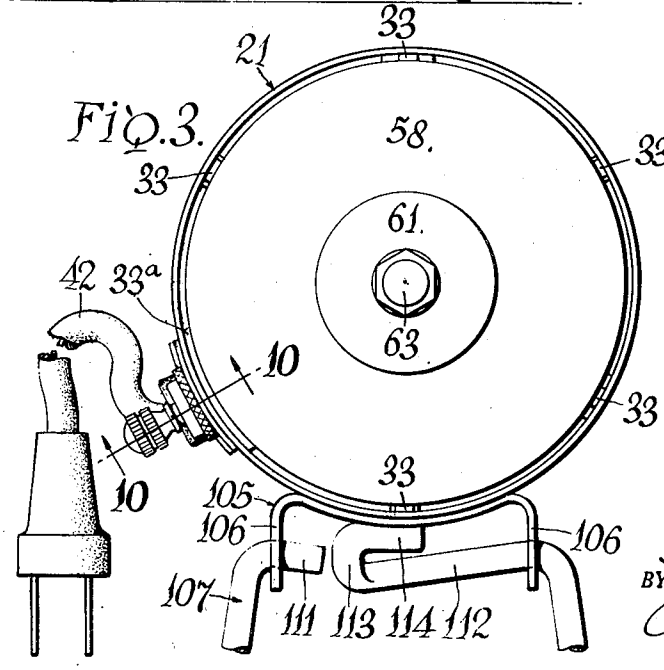
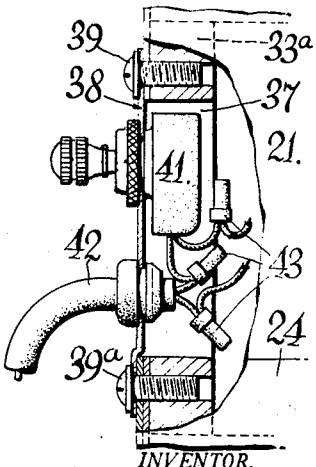


Fig. 10.



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Fig. 5.

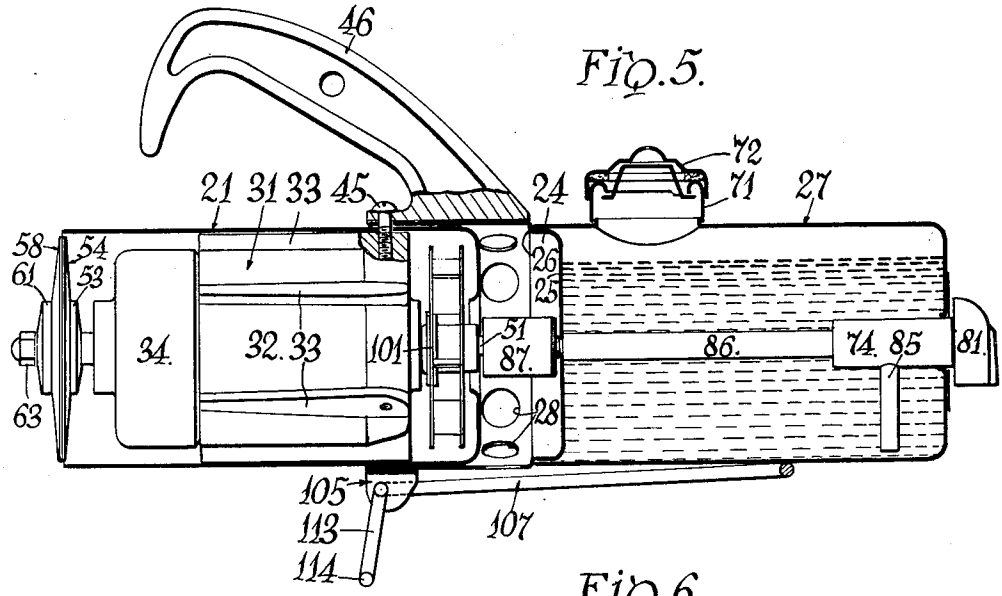
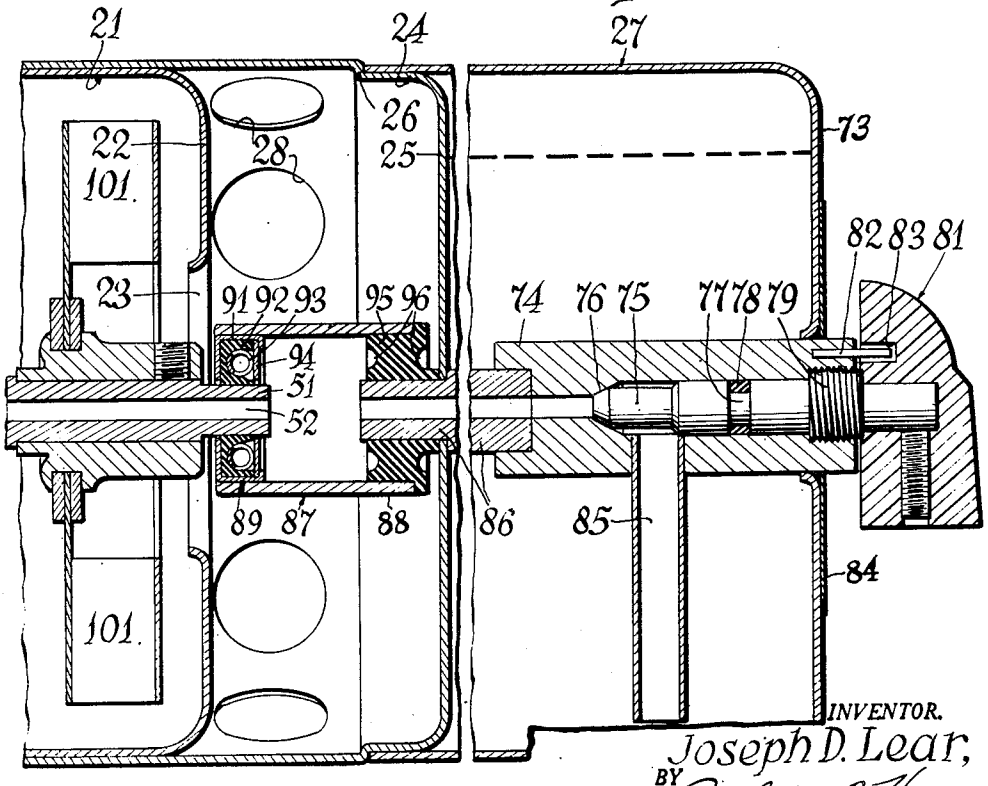


Fig. 6.



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Fig. 7.

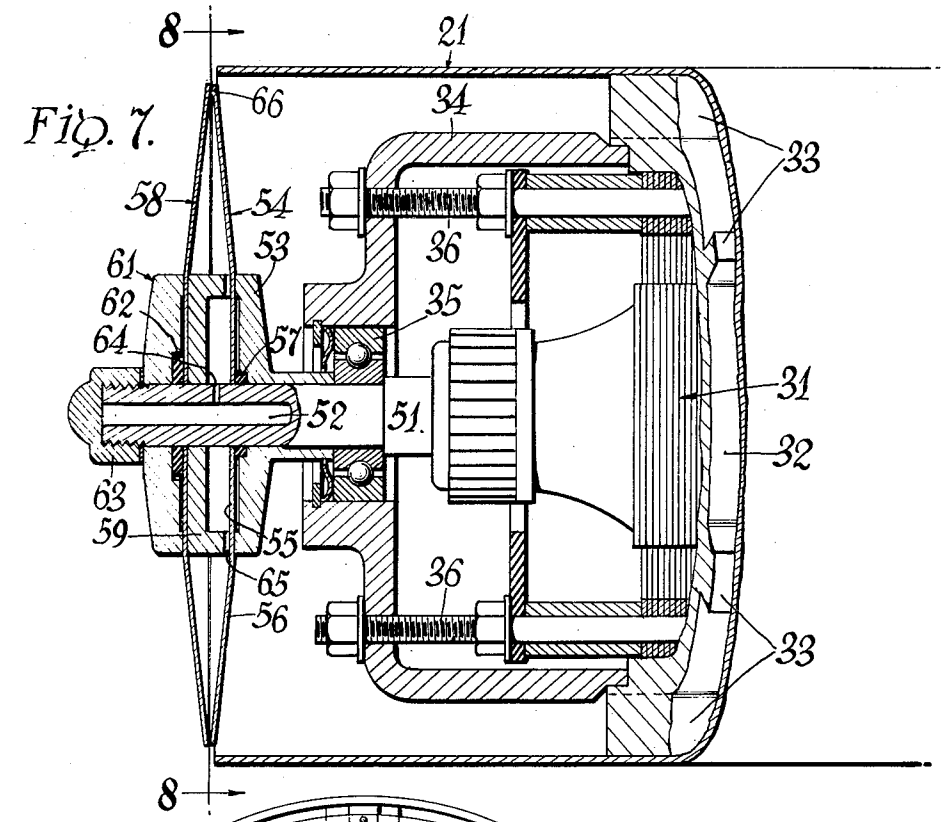


Fig. 8.

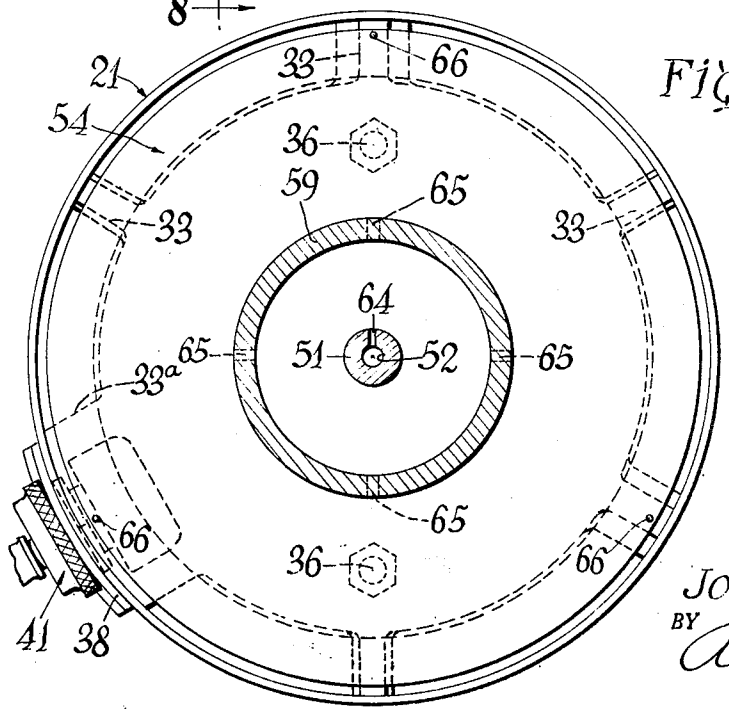
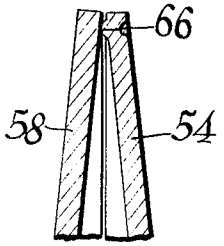


Fig. 9.



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United States Patent Office

2,778,679

Patented Jan. 22, 1957

2,778,679

AEROSOL GENERATOR

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Application August 24, 1953, Serial No. 375,964

2 Claims. (Cl. 299—63)

This invention relates to aerosol generators, and it has particular reference to a generator which is light in weight, durable, easy to assemble, and capable of developing extremely fine mists or droplets of liquid particles which may be air borne for considerable distances.

It has heretofore been proposed to disperse insecticides, fungicides, disinfectants, and the like, by centrifugally discharging solutions thereof from revolving discs into the path of an air stream, thereby atomizing the liquid into a fine spray wherein the particles are of the order of fifty microns or less in diameter, and hence are sufficiently small and light to be carried by the air into contact with remotely located crops, vegetation, or other surfaces for which a specific treatment is indicated. Fine particle size is desirable, not only to project the aerosol some distance from the generator, but also to apply the particles in a uniform thin film without overdosage. Apparatus intended for such purposes has taken the form of a motor driven centrifugal pump supplied from a liquid reservoir, wherein the pump rotor is formed of discs having an extremely thin peripheral discharge opening, in conjunction with an air fan, also driven by the motor, for blowing air through a shroud or casing around the periphery of the pump.

The present invention relates to an improved generator of the type just described, the novel and advantageous features of which will be set forth in the following description, reference being made to the accompanying drawings, wherein:

Fig. 1 is a side elevation of the generator, when positioned to discharge the aerosol with a relatively flat trajectory;

Fig. 2 is also a side elevation, with the generator set to discharge at a high angle trajectory;

Fig. 3 is a front elevation on an enlarged scale;

Fig. 4 is a perspective of the adjustable supporting standard;

Fig. 5 is an axial section through the generator casing, with internal parts shown in elevation;

Fig. 6 is an additionally enlarged fragmentary section through the reservoir and fan end of the generator, showing also an improved shaft coupling and liquid seal;

Fig. 7 is an enlarged fragmentary section through the pump end of the casing;

Fig. 8 is a section on the line 8—8 of Fig. 7;

Fig. 9 is a fragmentary section through the periphery of the pump, showing means to render the pump self priming; and

Fig. 10 is a fragmentary section on the line 10—10 of Fig. 3, showing a built-in switch and connection box.

The generator of the present invention comprises three shell or casing sections, which are interfitted to provide a generally cylindrical elongated body. These include a motor and fan casing 21 having an end wall 22 formed with a concentric opening 23 (see Fig. 6) which fits lightly into a central adapter section 24 having an apertured end wall 25. The section 24 is formed with a

shoulder 26 adjacent the end wall 25, and the reduced portion of the section 24 fits snugly into the third or reservoir casing section 27, and it is secured therein by soldering or welding the joint to render the same leakproof. The section 24 is formed with an annular series of apertures 28, to admit air through the aperture 23 to the suction side of the motor casing section 21, as will more fully appear hereinafter. It will be seen that these three sections, which are advantageously fabricated of sheet metal, may be readily assembled to contain all of the elements required for the complete machine.

Referring also to Figs. 5, 7, and 8, the motor casing section 21 has mounted therein an electric motor 31, which includes a main cylindrical frame 32 formed with spaced radial ribs 33 having bearing engagement with the internal wall of the casing 21, thereby supporting the motor concentrically with the casing. The motor 31 is also provided with a front end bell 34 containing a shaft bearing 35, and the bell is secured to the main frame 32 by bolts 36. One of the ribs 33*a*, here shown as the rib at the 300° or "eight o'clock" position in Fig. 8, is somewhat wider than the other ribs, and it is cut away or cored between its ends, as shown in Fig. 10, to provide an elongated pocket or switch box 37, communicating with the interior of the frame 32. The casing section 21 is also cut away at the area overlying the box 37, and the opening is covered by a cap plate 38, detachably secured by screws 39, 39*a*. The plate 38 provides a support for a control switch 41 and the end of a current supply cable 42, and there is adequate space in the box 37 for wire junctions 43, by means of which electricity is supplied to the motor 31.

The provision of this switch box simplifies the assembly of the motor in its frame, and facilitates making the necessary connections without having excessive lengths of wire which are frequently a nuisance to stow away, and which often are broken due to interference with other parts. It may be noted in passing that the motor herein contemplated is a high speed (16,000 R. P. M.) universal D. C.-A. C. type, and hence no further description of the motor details or circuitry is required here, as they are well understood by those versed in the electrical arts. The built-in switch box also places the control switch at a point where it is always accessible to the user of the machine.

It will be further noted from Fig. 10 that the screw 39*a* passes through not only the casing section 21, but also through the section 24, as one end of the cap 38 overlaps the telescoped portions of the shells 21 and 24. Other screws, such as that designated by the reference numeral 45 in Fig. 5, which are in circumferential alignment with the screw 39*a*, also pass through both casing sections to enter tapped holes in alternate ribs 33. By removing these screws, the section 21 and its contents may be withdrawn from the assembly without disturbing the wiring in the box 37. The screw 45 shown in Fig. 5 also serves to retain a carrying handle 46 of any appropriate shape.

The shaft 51 of the motor 31 is formed with an axial bore 52 throughout its length. The outer or left hand end of the shaft is provided with an annular collar 53, which constitutes a backing for a centrifugal pump impeller disc 54. As shown, the disc 54 is substantially saucer shape, having a flat or normal portion 55 which abuts the collar 53, and a tapering or conical portion 56 extending therefrom to its periphery. The disc 54 is, of course, concentrically pierced to fit over the shaft 51, and leakage at this joint is prevented by an O-ring seal 57. A complementary impeller disc 58, having the same shape and size as the disc 54, is also mounted on the shaft 51, the concave sides of the discs facing toward each other. The discs are spaced internally by a cup shaped collar 59, and they are retained in position by a

washer 61 containing a sealing ring 62, and a nut 63 threaded onto the end of the shaft 51.

The shaft 51 is formed with a radial duct 64 in the space between the discs 54 and 58, to discharge liquid into the cavity of the collar 59. The collar, in turn, is formed with a series of circumferentially aligned ducts 65 around its rim, so that liquid flowing through the bore 52 may find its way out between the discs 54 and 58, and thence to the periphery of the pump. The ducts 64 and 65 are of relatively small diameter, and of the order of a few hundredths or tenths of an inch, in order to assist in breaking up the emergent liquid into a fine spray.

Referring particularly to Figs. 8 and 9, it will be noted that the periphery of one of the discs 54 or 58 (here the disc 54 but not necessarily so) has been punched at three equally spaced arcs to form small dimples 66, which serve to space the discs slightly at their perimeters. This is contrary to the teachings of the prior art, which proposed that discs of this character should close against each other resiliently when the pump was not in motion, and open slightly under centrifugal force when revolving. It had been thought that by so providing a minute self-closing discharge gap, finer particle size would be obtained, and it is true that such prior machines were, and are, capable of generating aerosols of very fine particle size.

However, there would frequently be occurrences when, upon bringing the pump up to its intended high speed, no aerosol would be formed, the liquid being unable to escape between the discs. It has now been discovered that this undesired result did not, as was naturally suspected, follow from a misfitting of the discs, or squeezing them too tightly together. It now appears, on the best evidence available, that air entrapped in the liquid, or between the discs, formed a barrier layer at the periphery of the impeller, which, despite some compressive force upon it, precluded the flow of liquid. The dimples 66, which have an elevation of only a few thousandths of an inch, permit this air to escape readily, thus permitting free liquid flow, and rendering the pump "self-priming" under all conditions of operation. Equally fine and uniform particle size is also attained.

Attention is now invited to Figs. 5 and 6, for a discussion of the adapter and reservoir sections 24 and 27. The section 27 is formed with a filling opening 71, normally closed by a conventional bayonet joint cap 72. The end wall 73 is centrally pierced to receive a valve body 74, which is soldered or welded to retain it in place and provide a liquid tight joint. The body 74 is axially bored and counterbored to receive a valve stem 75 adapted to abut a valve seat 76 in the body 74. The stem 75 is formed with a reduced portion 77 adapted to receive a sealing ring 78, and with a threaded portion 79 engageable in a companion thread in the valve body. An operating knob 81 is secured to the outer end of the stem 75, and its rotation is limited by a stop pin 82 riding in a slot 83 in the knob 81. It will be obvious that the valve may be moved from fully closed to maximum open working positions by rotating the knob 81, and the degree of opening may be indicated by suitable marks on an index plate 84 secured on the wall 73.

A tube 85, secured in a radial hole in the valve body 74 on the inlet side of the seat 76, extends downwardly into the casing 27, to provide means to supply liquid to the valve and pump. A suction tube 86, sealed in the hole in the wall 25 of the adapter section 24, seats in the end of the valve body 74, and it communicates with the adjacent end of the shaft bore 52 through a sealing coupling 87, located in the adapter section 24.

Heretofore, great difficulty has been experienced in providing a reliable connection between the fixed outlet from the reservoir, and the inlet end of the hollow shaft leading to the impeller. Expensive constructions of seals were adopted in order to prevent leakage, and even this expedient was inadequate in service to eliminate many premature failures. The coupling 87, which is comparatively inexpensive, has been found to provide an excellent leak proof connection between the fixed and rotary members, and to have a long service life.

The coupling 87 comprises a cylindrical sleeve 88, having a sealing element 89 tightly fitted in one end. The element 89 comprises a metallic cup 91 having a disc 92 of resilient material, such as a Buna type synthetic rubber, pressed therein, and the rubber is distended by means of a coil spring 93 embedded therein. A closure plate 94 retains the rubber from axial movement, and the rim of the cup 91 is spun over the plate 94 to retain it in place. The cup, rubber, and plate are, of course, centrally apertured, so that the element 89 may be pressed over the end of the shaft 51, to provide a leakproof joint. A lubricant, such as molybdenum disulphide, may be worked into the joint between the shaft and the rubber.

The opposite end of the cylinder 88 receives a cylindrical gasket 95, also of oil resistant material, formed with annular grooves 96 on the ends, and with a central aperture which may be hand pressed over the end of the suction tube 86. In operation, the motor shaft rotates in the element 89, and the sleeve 88 and gasket 95 are relatively stationary. The utility of the coupling 87 resides in the circumstance that it is practically impossible, particularly in mass production manufacture, and where sheet metal parts are involved, to bring the shaft 51 into exact alignment with the end of the tube 86. A radial displacement in excess of one thousandth of an inch is sufficient to destroy other types of seals between rotating and fixed members. With the present seal, any unavoidable small radial or angular misalignment is compensated by a slight adjustment which is absorbed in the gasket 95, and the joint is thereby maintained liquidtight.

The shaft 51, adjacent the coupling 87, has mounted thereon a fan 101, to induce a flow of air through the openings 28 and the aperture 23, and propel the air between the ribs 33 of the motor frame 32, and thence through the narrow annular orifice between the end of the casing 21 and the peripheries of the impeller discs 54 and 58. In operation, the pump acts as a centrifugal pump, drawing liquid from the reservoir casing 27, through the hollow shaft 51, and expelling it through the small gap between the impeller discs in very fine droplets. These are further broken up by the air blast as they emerge from the impeller, to provide an aerosol spray or fog, which is directed toward the material undergoing treatment.

It is frequently desirable to place the generator on the ground or other support, and direct it toward the target for operation over a considerable period of time. For this purpose, a hinge pin plate 105, having depending lugs 106, is secured to the bottom of the casing section 24, and the lugs are pierced to receive the ends of a supporting standard or bail 107. This standard is of generally triangular shape, as shown in Fig. 4, and may be formed readily by bending a length of rod. The lower apices 108 may be covered with pieces of synthetic rubber tubing 109, to prevent marring a surface such as a table or counter top. One end 111 of the bail is of the ordinary short bent shape, while the other end has a somewhat longer inwardly bent portion 112, which in turn is bent at right angles to provide a leg 113, and the end of the leg is again bent at right angles, and parallel to the portion 112, to form a foot 114. By inspection of Figs. 1 and 2, it will be seen that the base of the standard may be placed on the supporting surface, with the foot 114 abutting the casing section 21, or the bail may be folded back against the casing section 27, in which case the leg 113 and foot 114 provide a low angle inclination.

It will accordingly be understood that the present invention provides an improved aerosol generator, wherein the liquid and motor casings may be readily fabricated from sheet metal and interconnected through an equally easily fabricated adapter section. The motor casing 21 may be readily detached from the adapter casing 24, in which

event the shaft 51 either pulls out from the coupling 87, or pulls the coupling with it, depending upon the frictional grip between the joints. The motor 31 may also be withdrawn readily from the casing 21, and the impeller may likewise be removed without disturbing the motor. Improvements have also been made in the location of the motor control switch, the impeller, the coupling, and the supporting standard, the latter accommodating itself to deliver the aerosol at either low or high trajectories, and being self-locking in either position.

While the invention has been described with respect to a single embodiment, it is intended, of course, that there shall be encompassed within its scope all those variations and modifications which are covered by the following claims.

I claim:

1. An aerosol generator comprising a cylindrical motor casing having an open end and a closed end formed with an axial aperture, an adapter casing having an open end telescopingly engaging the closed end portion of the motor casing, said adapter casing having a wall at its opposite end, and a reservoir casing telescopingly engaging the adapter casing at said opposite end, a motor mounted in the motor casing in spaced relation to the wall thereof, said motor having a shaft formed with an axial duct therein, an impeller mounted on one end of the motor shaft and having a periphery closely spaced with respect to the open end of the motor casing, a fan mounted on the motor shaft adjacent the closed end thereof, said adapter casing being formed with a plurality of circumferential apertures between the closed end of the motor casing and said wall of said adapter casing, whereby air may be admitted through the adapter casing apertures and the axial aperture of said motor casing for propulsion by said fan toward said impeller, a suction tube extending through the wall of the adapter casing into the reservoir casing, said suction tube being substantially in axial alignment with the motor shaft, a conduit and valve in the reservoir casing for supplying to said suction tube liquid adapted to be contained in the reservoir casing, and a shaft seal having an end positioned over the fan end of the motor shaft and another end over the adapter end of the suction tube, said seal having an internal hollow portion in fluid communication with the suction tube and duct of the motor shaft, whereby liquid adapted to be contained in the reservoir casing may flow to said impeller.

2. An aerosol generator comprising a casing having a motor driven impeller and a fan mounted therein, together with a reservoir for liquid adapted to be supplied to said impeller, and a standard connected to said casing for supporting said casing upon a surface at different angles, said casing having a hinge plate secured to the circumference thereof, said plate having depending lugs formed with apertures, a rod bent into a generally triangular formation having free ends pivotally mounted in said apertures, one of said ends being bent outwardly from the sides and base of said formation to provide a leg, said leg being bent substantially parallel to said formation to form a foot, said leg being of less length than the height of said formation, whereby said standard may be swung to support said casing either on the base of said formation or said foot.

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