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Hanson, Jr.

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[54] **LIQUID SPRAY HEAD FOR PRODUCING RECTANGULAR SPRAY PATTERNS**

[75] Inventor: **Harold W. Hanson, Jr.**, Newport Beach, Calif.

[73] Assignee: **Par-Way Mfg. Co.**, Los Angeles, Calif.

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[52] U.S. Cl. **239/520**, 239/524, 239/601, 239/DIG. 1

[51] **Int. Cl.** **B05b 1/02**, B05b 15/04

[58] **Field of Search** 239/DIG. 1, 518, 520, 524, 239/601, 548, 498, 499, 552

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Primary Examiner—Robert S. Ward, Jr.
Attorney, Agent, or Firm—Forrest J. Lilly

[57] **ABSTRACT**

A nozzle for spraying liquids is provided. In a useful example, cooking oil is sprayed into baking pans using a conduit which discharges the oil at a center point between two concentric closely-spaced circular discs, in parallel horizontal planes, the lower disc being smaller than the upper disc, there being a large number of small air passages in a circular pattern extending downwardly through the upper disc, all around the border of the lower disc. The oil flows radially out from between the discs, and is impinged upon by air under pressure issuing downwardly from the air passages. Thereby the oil film is largely atomized and sprayed downwardly. Oil from between the discs not so atomized reaches the internal surface of a conical skirt, and is guided thereby down the skirt and off the lower edge thereof in an atomized condition. A solid cone of atomized oil particles is thereby delivered downwardly in a burst of only a few hundredths of a second. A specially contrived skirt produces a square or rectangular pattern of the sprayed liquid.

9 Claims, 6 Drawing Figures

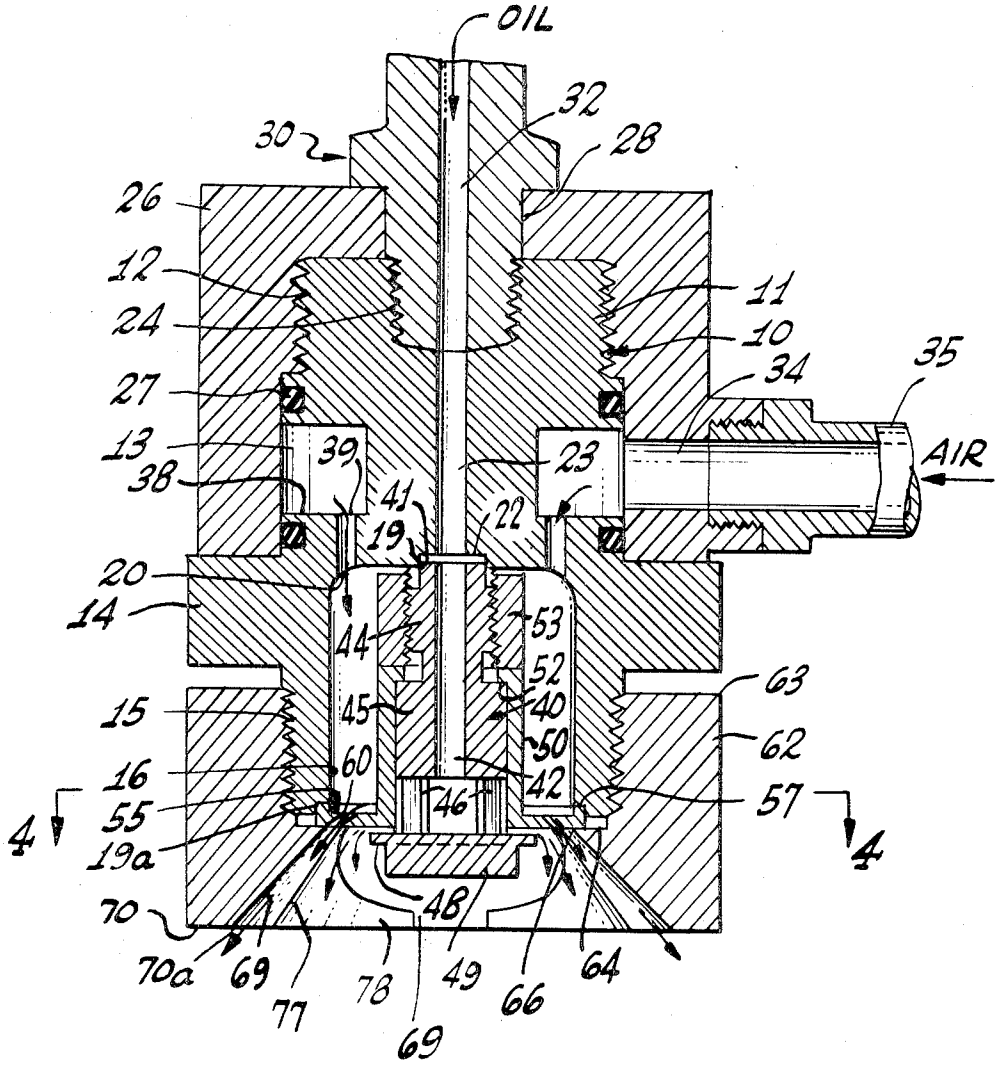


Fig. 1

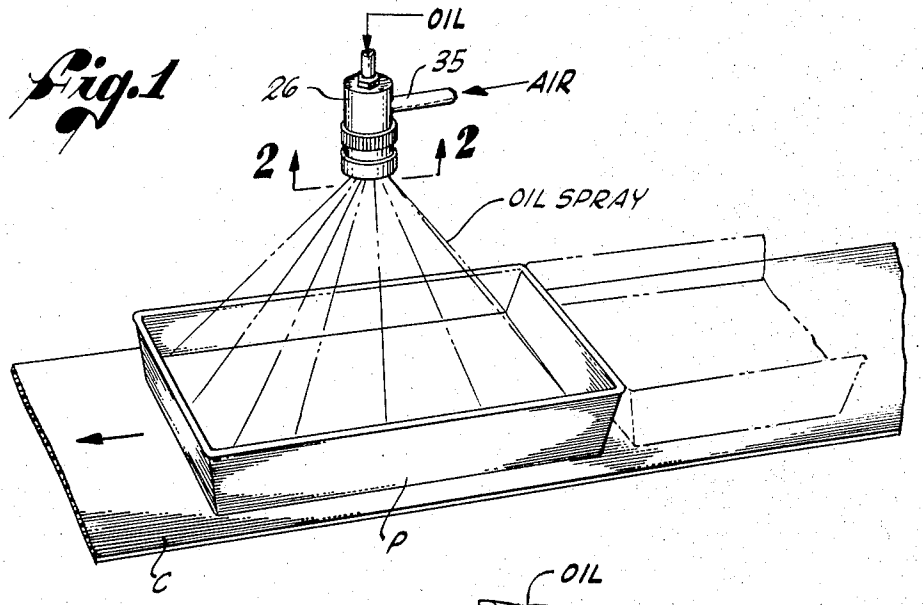


Fig. 2

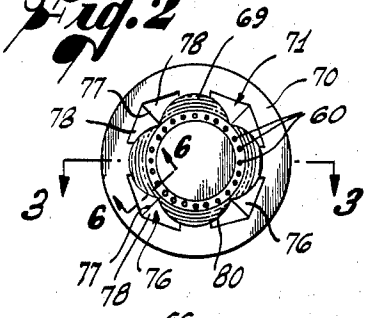


Fig. 6

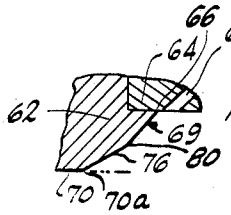


Fig. 3

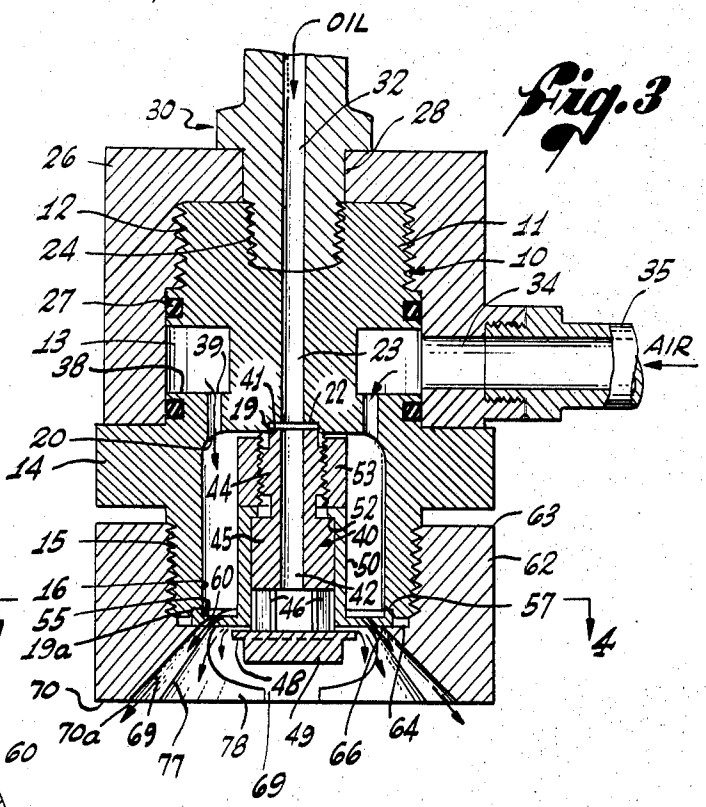


Fig. 4

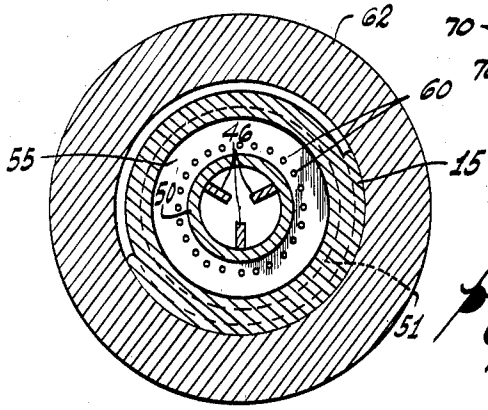
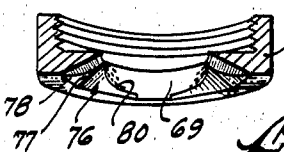


Fig. 5



LIQUID SPRAY HEAD FOR PRODUCING RECTANGULAR SPRAY PATTERNS

RELATED APPLICATION

This application is filed coincidently with an application filed by Beauford C. Doering, Ser. No. 344,075, filed Mar. 23, 1973, and covers and claims subject matter other than that claimed in Ser. No. 344,075.

BACKGROUND OF THE INVENTION

Confining attention, for illustrative purposes, largely to the baking oil or grease application, it is common practice in bakeries to spray baking pans with a cooking oil or grease to prevent sticking. Generally, the baking pan, often on a traveling conveyor, is stopped, the spray then turned on for a short time, and the conveyor then moved on. The primary purpose of this invention is to provide a spray head which can deliver a solid cone of substantially uniformly distributed spray particles, which is modified in cross-sectional outline by a specially contrived spray control skirt, so that the initial cone merges into a pyramid, yielding a square or rectangular outline.

BRIEF DESCRIPTION OF THE INVENTION

In accordance with the invention, broadly described, a spray head is provided to which air is delivered under considerable pressure, as 30 to 80 psi, and is valved on just before the burst of spray is required. A measured charge of oil, or other liquid, is then forced through the spray head, and formed into peripherally expanding layer of radially outward flow. The air under pressure impinges on this layer of liquid and breaks it up into finely divided downwardly directed particles. The liquid which is not thus broken up continues radially outward until it is deflected downward into a spray cone by encountering the inside surfaces of a spray control skirt whose angles and contour define the central angle, or angles, of the spray "cone," and also the exterior contour or perimeter thereof. This contour is a polygon, and can be rectangular, as square, or may have other forms.

DESCRIPTION OF THE DRAWINGS

FIG. 1 is a perspective view of a spray head in accordance with the invention, spraying atomized cooking oil into a rectangular pan on a conveyor;

FIG. 2 is a section taken in accordance with the line 2—2 of FIG. 1;

FIG. 3 is a transverse section, to an enlarged scale, taken on line 3—3 of FIG. 2;

FIG. 4 is a transverse section taken on line 4—4 of FIG. 3;

FIG. 5 is a perspective view of the spray control ring; and

FIG. 6 is a detail section taken in accordance with the line 6—6 of FIG. 2.

DESCRIPTION OF AN ILLUSTRATIVE EMBODIMENT

The drawings show, to approximately 1-to-1 scale in FIG. 2 of the original bristol board, an illustrative spray device to which the present invention may be added. By this improvement, the spray can, for example, be five inches square in outline at the plane where it strikes a 5-inch square baking pan. For larger sized pans, the spray head can be enlarged accordingly; and for rectangular pans, modifications are available.

The spray device, other than for the device for controlling the outline of the spray pattern, is disclosed and claimed in the aforementioned application, filed coincidently herewith, and assigned to a common assignee, Par-Way Mfg. Co.

The spray device illustrated has a main body **10** comprising a generally cylindrical upper part **11**, screw-threaded at the top, as at **12**, and formed therebelow with an annular peripheral air port **13**, below that with a peripherally milled external annular flange **14**, and it terminates at the bottom in a tubular, externally-threaded end **15**. The parts **11**, **13**, **14** and **15** are all coaxial. The tubular formation results from a bore **16** extending coaxially up into the end part **15**; and the end part **15** is formed with a shallow counterbore **19**.

Bore **16** is formed with a fillet **20** at the bottom, and meets a shallow coaxial reduced bore **22**. An oil, grease, or other liquid passage **23** extends through the body **10** from the bottom of bore **22** to the bottom of a tapped counterbore **24** in said upper body part **11**.

A connector fitting **26** in the nature of a cap screws onto the upper part **11** of the body and extends down past annular port **13** into engagement with body flange **14**. Packing rings **27** seal the air port **13**. The fitting **26** has a bore **28** receiving a threaded pipe fitting **30** adapted to be screwed into bore **24**, and provided with an oil, grease, or liquid passage **32** meeting the aforementioned passage **23**. The fitting **30** is somewhat diagrammatically illustrated, but will be understood to comprise in practice any hydraulic fitting adapted to couple an oil supply pipe or hose to the oil passage **23** in the body **10**. The fitting **26** can be a cap on the end of a support arm, not shown; and also, the upper part of the cap, above the lower end of threads **12** omitted. A large nut, not shown, screwed onto part **11** and down against the remaining ring-shaped part of the originally assumed cap then holds the parts in assembly with the support arm (not shown) jointed with said ring part.

Fitting **26** also has an air passage **34** communicating with annular port **13** and with conduit **35** which supplies air under pressure, which may be in the range of 35–80 psi, depending upon the scale of the head, or the degree of atomization required. The air port **13** is in the form of an annular groove encircling the body port **11**. A circular series of vertical air holes **39** are drilled between the inner end of bore **16** and the annular groove **13**. These holes may be, for example, **12** in number and of adequate bore to assure unrestricted flow. They supply a uniform flow of air down the bore **16**, in the cross-sectional form of an annulus.

A plug **40** mounted coaxially in body **11** has a coaxial duct or passage **42** for oil, grease, or liquids which is aligned with and communicates with the duct or passage **23** and **32**. The pin-like upper end extremity **41** of the plug is closely received in and aligned by the counterbore **22**. Just below the pin **41** the plug has an enlarged threaded section **44**, and below that a further enlarged cylindrical body **45**.

Three very thin, flat, radially-disposed struts **46** at 120° spacing extend vertically downward from the lower end of body **45**, outside the projected area of the duct **42**, and carry at their lower ends a flat imperforate oil deflection plate **48**, preferably an annular disc, whose center is aligned with the duct **42**. The lower side of this disc may have a cross bar **49** by which the

plug may be conveniently grasped during assembly or disassembly.

The plug body **45** fits slideably into a sleeve **50**, and engages at its upper end an internal shoulder **52** at the upper end of the sleeve. A milled nut **53** screws onto the upper end part **44** of the plug, and seats downwardly against the upper end of the sleeve **50**. The lower end of sleeve **50** carries a head plate **55** in the form of a flat annular flange, and the periphery of this member **55** has an upwardly-turned cylindric flange **57** which is very closely, but slideably, received inside the counterbore **19**. The bottom of this counterbore may serve as a positioning stop. The flange **55** is positioned a short distance, in this instance about 0.010 to 0.030 inch, above the disc **48**, to allow oil to flow radially at all points as it emerges from under the flange **55** and above the disc **48**, over the disc edge **49**. The flange **55** is provided, just outside the circle of the disc **48**, with an annular pattern of very small, closely-spaced, outwardly angled, air discharge ports **60**. Typically, these ports may be about **48** in number, have a diameter of 0.017 inch, and be at an angle of typically 45° to the longitudinal axis of the body **10**. Angles within a range of 30°–60° have been used successfully, however.

An annular spray head or nozzle **62** is screwed onto the threaded tubular member **15** at the lower end of body **10**, and holds sleeve **50** and plug **40** in place. This head **62** thus has a threaded bore **63** to receive member **15**, and has an annular ledge **64** at the bottom thereof which is abutted by a narrow outer edge portion of the underside of flange **55**. The ledge **64** has a sharp circular edge **66**, below which is a downwardly divergent or flared flow control skirt or surface **69** that leads from the edge **66** to a terminal bounding edge **70***a* at the intersection of surface **69** with the horizontal bottom **70**. The flared surface **69** may be substantially conical, but with local modifications, as at **71** in FIG. **2**, to achieve the modified spray patterns of the present invention.

The operation of the spray head will be described first with the assumption of a substantially conical skirt or control surface **69**, at 45° to the longitudinal axis of the spray head, and without modification as at **71**, so that a 90° atomized spray cone will result. This angle may range between about 60° and 110°, or thereabouts. After that will be described the improvements of the present invention, which will produce a spray cone with, say, a basic 90° central angle, but with modifications which square the corner portions of the 90° cone.

In the basic operation of the spray device, then, air under pressure is turned on an instant before the start of the pumping of a predetermined charge of liquid, cooking oil or grease, into the duct of the spray head. The total charge of this liquid goes through the spray head in one almost instantaneous burst, consuming perhaps a few hundredths of a second of time; and the liquid charge being emitted, the pressurized air is then cut off. Proper valving and timing to accomplish this sequence cycle is within the skill of the art and need not be disclosed herein for an understanding of the present invention.

It will thus be seen that charges are discharged in short intermittent bursts. The pan P may be stationary, or moving on a conveyor C, at the time it is coated with the oil, because of the very short duration of the burst of spray.

Considering the operation in more particular, as the oil, other liquid, or grease, exits from the lower end of the duct **42**, it strikes the face of the deflecting plate or disc **48** and is turned radially outward in all directions through the annular port between disc **48** and flange **55**, flowing off and past the edge of disc **48**, and in contact with the flange **55**. The radially outwardly flowing "disc" of liquid will be seen to decrease in velocity proportionally with the increase in radius, because of increasing cross-sectional area. The air ports **60** discharge fine streams of air at high pressure and velocity against and through this thin disc or layer of liquid. A large proportion of this liquid oil, thus impinged upon by the fine, high velocity air streams resulting from the high pressure of the air fed to the device, is broken up, atomized into fine spray particles, and thus blown downwardly in an expanding pattern. Some liquid particles are emitted in generally downward direction off the edge of the disc **48** as the radially flowing liquid passes thereover. Finally, and most importantly, another part of the expanding liquid layer, clinging to the underside of the flange even after passage over the air ports **60**, impinges upon the conical control surface **69**, and thence changes direction to run down this surface, and go off the lower bounding edge **71***a* of this surface at its intersection with the horizontal face **70**.

The liquid thus flowing down the substantially conical face **69** would go off the lower edge **71***a* thereof in a finely atomized spray with a relatively well-defined conical outline. The spray thus provided would thus be in the form of an expanding cone, filled with particles of atomized liquid which are directed down the cone to fill the pan with adequate uniformity. The particles run together on the surface of the pan, affording an oil or other coating of the requisite uniformity and thickness.

It will be seen that the invention supplies the atomized particles which make up the total spray cone from several sources within the spray head. This results in pressure gradients across the spray cone, but these gradients reduce in successive sections across the cone, with the result that towards the large end of the cone, the liquid particles have a uniformity of distribution that results in a deposit of liquid particles on the pan with the right density to assure the desired coating.

To achieve a substantially square spray outline, in accordance with the present invention, the conical flow surface **69** is modified at four locations, 90° apart, by forming the conical surface with obtuse dihedral angled indentations **76**. Thus at each of such four 90°-spaced locations, a radial cut is made along a straight bottom line **77** which is at substantially 60° to the longitudinal axis of the device and which intersects, or nearly or substantially intersects, the upper circular edge **66** at the top of the conical flow surface **69**. This bottom line **77** intersects the horizontal bottom surface **70**, and the indentations **76** thus have flat plane faces **78** which intersect one another, as dihedral angle planes, at the bottom edge line **77**. In the present embodiment, which has given the desired result, this dihedral angle is substantially 130°. Thus, I have a substantially conical, or frusto-conical, flow surface **69**, at a preferred angle of 45°, interrupted at 90° intervals by an indentation or valley defined at the bottom by a straight edge line **77** at an angle of substantially 60° in a radial plane, and provided with plane faces **78** meeting at the edge line **77** and thus forming an obtuse dihedral angle, which in

the illustrative embodiment is substantially 130°. The conical surface **69** and the plane faces **78** intersect one another along curved boundary lines **80.** It will be noted that in a radial plane, the conical surface **69** makes an angle of substantially 45° with the longitudinal axis, and that in any radial plane intersecting a plane face **76,** the angle with the axis is substantially 60°, a difference of 15°. In regions in which a radial plane intersects both a conical surface area **69** (at 45°) and then a plane face area **78** at 60° (FIG. 7), the radial liquid flow along the flow surface continues to remain attached to the flow surface over and beyond the 15° deflection angle at the curved boundary lines **78.** Thus, in these regions, the spray is emitted at progressively increasing angles in directions toward the valley lines **77,** so as to "square" out the conical spray at four points spaced 90° apart. Thus, with the shapes and angles described and illustrated, the emitted spray cone is modified to substantially the shape of a four-sided pyramid, such as conforms relatively closely to the outline of a square pan. Substantially rectangular spray patterns are accomplished by spacing the indentations as though they were at the four corners of a rectangle which is similar to the rectangular pan to be used.

I claim:

1. A spray head for spraying atomized particles of oil, grease or the like in a solid spray pattern, characterized by a rectangular outline, comprising:

a nozzle member having a divergent, frusto-conical spray discharge surface adapted to define and emit an expanding spray of the atomized particles in a rectangular pattern,

four circumferentially spaced indentations in said frusto-conical surface, each defined by two flat faces making an obtuse dihedral angle with a substantially straight bottom edge line, a prolongation of whose edge substantially intersects the longitudinal axis of symmetry of said frusto-conical surface and makes a greater angle with said axis than does a line substantially intersecting said axis and lying substantially across and contained in said frusto-conical surface, said indentations being so circumferentially spaced that the edges of said dihedral angles terminate at their radially outward ends in points which define a rectangle.

2. The spray head according to claim **1,** wherein said rectangle is a square.

3. The spray head according to claim **1,** wherein said obtuse dihedral angles are of the approximate order of 130°.

4. The spray head according to claim **1,** wherein said frusto-conical surface is at an angle of the order of 45° to said longitudinal axis, and the angle between said axis and said edges of said dihedral angles is of the order of 15° greater.

5. The spray head of claim **4,** wherein said dihedral angles are of the approximate order of 130°.

6. The spray head of claim **1,** wherein the angle between said longitudinal axis and said frusto-conical surface is of the order of 45°, and with said edges of said dihedral angles is of the order of 60°, and wherein said dihedral angle is of the order of 130°.

7. The spray head according to claim **1,** including also:

means located inside the smaller end of said divergent frusto-conical surface for projecting radially outward through a 360° angle a layer of oil, grease or the like, and

high pressure air jet means directed angularly outwardly and downwardly at and through the peripheral region of said layer just inside said smaller end of said divergent frusto-conical surface.

8. In a spray head for spraying atomized particles of oil, grease, or the like in a solid spray pattern having a rectangular outline, and having a nozzle containing a frusto-conical spray discharge surface therein adapted to define and emit an expanding spray of the atomized particles in a rectangular pattern, and having also means located inside the smaller end of said frusto-conical surface for projecting radially outward through a 360° angle a layer of oil, grease or the like, and high pressure air jet means directed angularly outwardly and downwardly at and through the peripheral region of said layer just inside said smaller end of said divergent frusto-conical surface, the improvement comprising:

four circumferentially spaced indentations in said frusto-conical surface, each defined by two flat faces making an obtuse dihedral angle with a substantially straight bottom edge line, a prolongation of whose edge substantially intersects the longitudinal axis of symmetry of said frusto-conical surface and makes a greater angle with said axis than does a line substantially intersecting said axis and lying substantially across and contained in said frusto-conical surface, said indentations being so circumferentially spaced that the edges of said dihedral angles terminate at their radially outward ends in points which define a rectangle.

9. A spray head for spraying atomized particles of oil, grease or the like in a solid spray pattern, characterized by a rectangular outline, comprising:

a nozzle member having a divergent, frusto-conical spray discharge surface adapted to define and emit an expanding spray of the atomized particles in a rectangular pattern,

not more than four circumferentially spaced indentations in said frusto-conical surface, each defined by two flat faces making an obtuse dihedral angle with a substantially straight bottom edge line, a prolongation of whose edge substantially intersects the longitudinal axis of symmetry of said frusto-conical surface and makes a greater angle with said axis than does a line substantially intersecting said axis and lying substantially across and contained in said frusto-conical surface, said indentations being so circumferentially spaced that the edges of said dihedral angles terminate at their radially outward ends in points which define a rectangle.

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