July 15, 1969 J. P. RYDER ET AL 3,455,507

SPRAY DISPENSER

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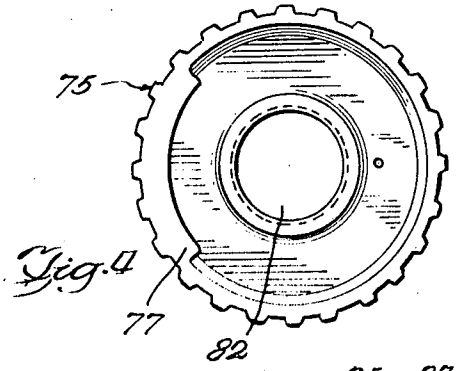


Fig. 4

Fig. 1

INVENTORS
James P. Ryder
Frans Brouwer
BY
Dressler, Goldsmith, Clement & Gordon
ATTORNEYS

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Fig. 2

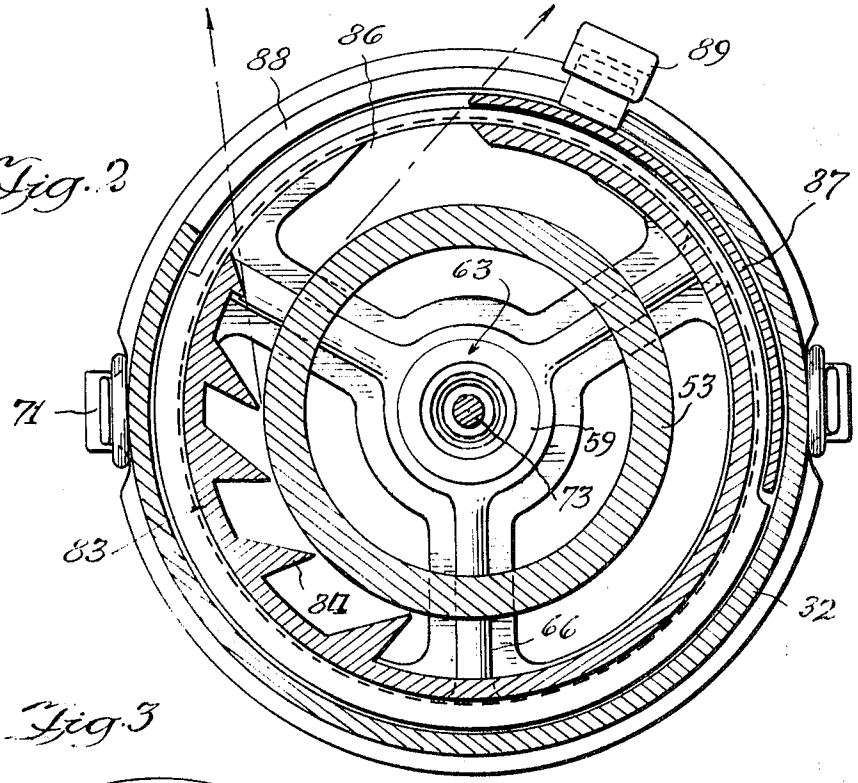


Fig. 3

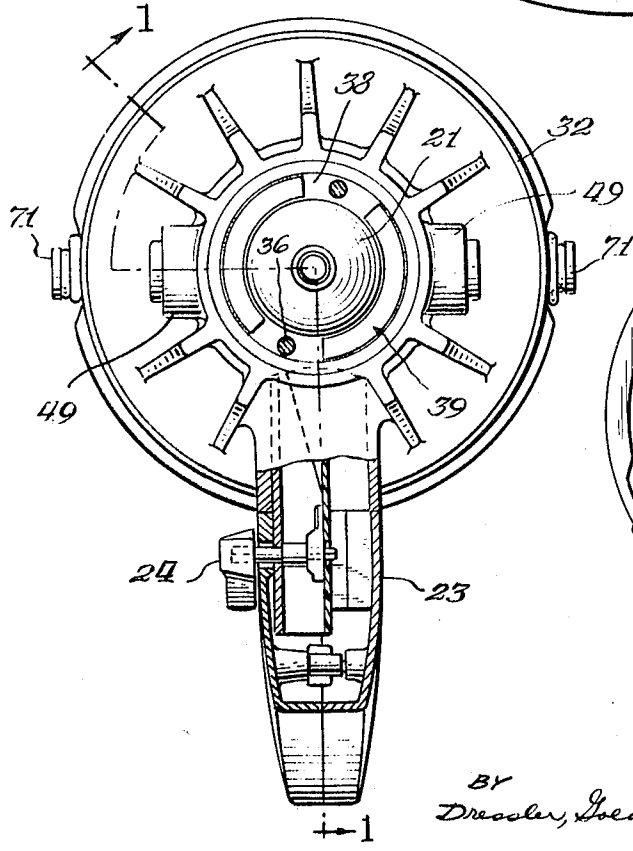
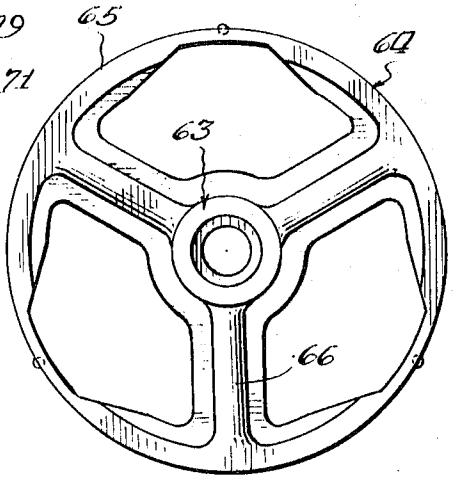


Fig. 5



INVENTORS
James P. Ryder
Ivars Brouwers
BY
Dressler, Goldsmith, Clement & Gordon
ATTORNEYS

July 15, 1969 J. P. RYDER ET AL 3,455,507

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Fig. 11

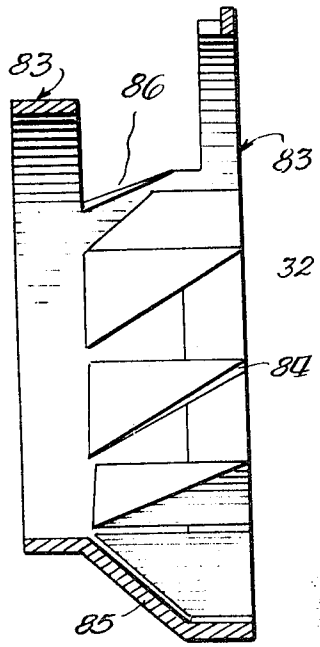


Fig. 10

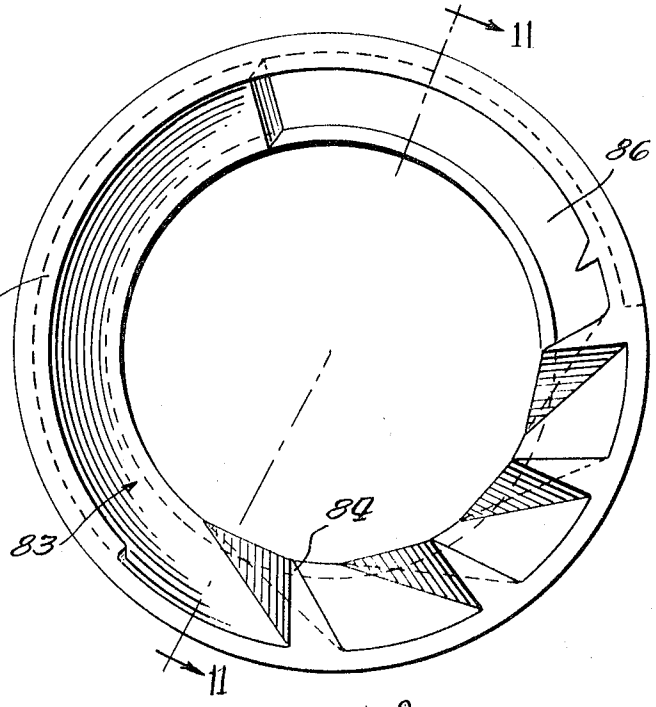


Fig. 9

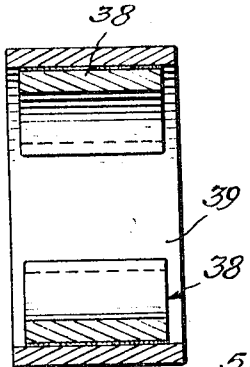


Fig. 8

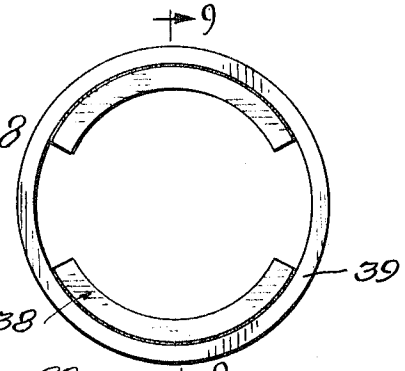


Fig. 6

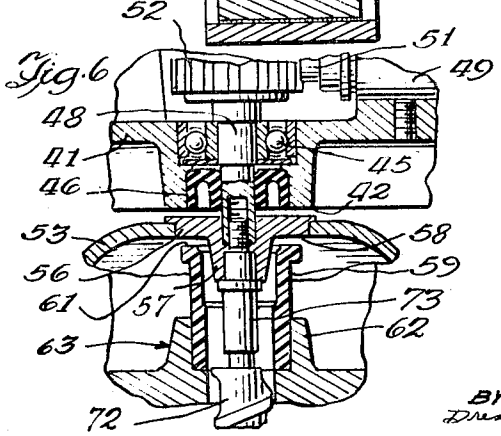
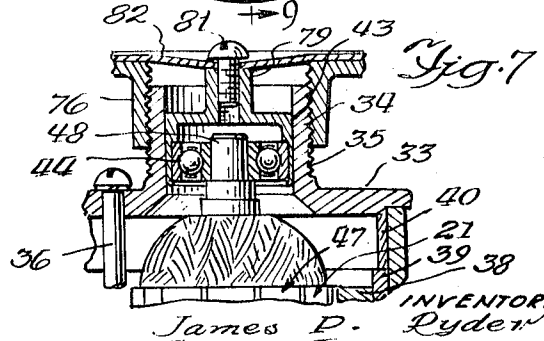


Fig. 7



INVENTORS
James P. Ryder
Ivans Brouwer
BY
Dressler, Goetzmill, Clement & Borden ATTORNEYS

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SPRAY DISPENSER

James P. Ryder, Arlington Heights, and Frans Brouwer, Glencoe, Ill., assignors to Whitney Forbes, Inc., a corporation of Illinois

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U.S. Cl. 239—215 13 Claims

ABSTRACT OF THE DISCLOSURE

A spray dispenser having a rotatable spraying disk and a screw conveyor for feeding liquid to the underside of the spraying disk. The spraying disk is attached to the shaft of a motor which is movable axially to vary the dimension of an opening for metering the amount of liquid fed to the disk.

This invention relates to a spray dispenser, and more particularly, to a motor driven spray gun for dispensing a liquid such as paint. Although paint is described herein as a specific example of a type of liquid which can be dispensed by the apparatus of the present invention, it is to be understood that other liquids may also be dispensed and that no limitation with respect to paint is intended.

In prior art dispensing apparatus, attempts to regulate the volume of liquid moved toward the discharge outlet of a motor driven spray apparatus have often depended upon means for partially blocking the open end of a feed tube. A portion of the mechanism for partially blocking the open end of the feed tube is generally immersed in the paint and cannot always be moved freely.

In the spray dispenser of the present invention, the paint is sprayed outwardly by a spraying disk fixed to the shaft of a motor for driving the disk. The underside of the disk is spaced above the upper edge of a bushing with which it cooperates to define a metering opening through which the paint is forced by a screw conveyor. The dimension of the metering opening is regulated by moving the spraying disk axially. The parts of the mechanism that must be moved to move the disk axially are free of the paint and may be moved easily at any time.

Suitable structure by means of which the above mentioned and other advantages of the invention are attained is fully described in the following specification, taken in conjunction with the accompanying drawings showing an illustrative embodiment of the invention, in which:

FIG. 1 is a cross sectional view of a spray gun embodying the invention and taken generally along the line 1—1 of FIG. 3;

FIG. 2 is a cross sectional view taken along the line 2—2 of FIG.1;

FIG. 3 is a cross sectional view taken generally along the line 3—3 of FIG. 1;

FIG. 4 is a bottom elevational view of a control cap for moving the motor, shaft, and spraying disk axially;

FIG. 5 is a top plane view of the plate for supporting the screw conveyor;

FIG. 6 is a fragmentary cross sectional view taken along the line 6—6 of FIG. 1;

FIG. 7 is a fragmentary cross sectional view taken along the line 7—7 of FIG. 1;

FIG. 8 is a top plan view of the armature and the ring in which it is mounted;

FIG. 9 is a cross sectional view taken along the line 9—9 of FIG. 8;

FIG. 10 is a cross sectional view taken generally along the line 10—10 of FIG. 1; and

FIG. 11 is a cross sectional view taken along the line 11—11 of FIG. 10.

Referring to the drawings, the spray dispenser includes a housing 22 having a handle 23 extending therefrom. A liquid receptacle 69 is detachably connected to the housing 22. The housing encloses an electrical motor 21 which drives a spraying disk 53 and the screw 72 of a screw conveyor. The feed tube 68 of the screw conveyor is immovably connected to a bushing 59, the top rim 61 of which is positioned adjacent the inner surface of the disk 53.

A motor speed control circuit 25 is mounted in the handle 23 and is connected in series with lines 26 which are used for connecting the motor 21 to a current source.

An off-on switch 28, which is actuated by a trigger 29 extending through an opening in the handle, is used to provide rapid starting and stopping of the motor 21. When the trigger 29 is pulled, the motor speed control circuit 25 is completed, and the speed of the motor 21 can be varied by turning a knob (not shown) which is keyed to the shaft 24 of a speed control potentiometer. The potentiometer is connected to vary the firing of a silicon controlled rectifier of a conventional SCR motor speed control circuit. When the trigger 29 is released, it is urged to its off position by spring 31, This causes a load resistor to be connected across the motor armature terminals, thereby creating an effective brake. Pulling on the trigger 29 (to start the motor) disconnects the load resistor from the circuit.

The housing 22 includes an open ended cylindrical wall 32 having its upper end partially closed by a top plate 33 having a centrally disposed upstanding tubular collar 34 provided with an exterior thread 35. The plate 33 is held against the upper edge of the wall 32 by screws 36 threaded into lugs 37 extending inwardly from the wall. The permanent magnets 38 of the motor field structure are secured within a soft steel ring 39 by an adhesive, such as an epoxy resin. The ring 39, with the magnets 38 secured thereto, is mounted in the housing 32. A partition 41 extending across the housing has a tubular collar 42 depending therefrom in axial alignment with the collar.

A bearing slide assembly 43, mounted in the collar 34, has a ball bearing 44 mounted therein. A second ball bearing 45 is mounted in the collar 42. A shaft seal 46 is mounted in the collar 42 below the bearing 45. A rotor 47 located centrally of the field 38 and 39 has a shaft 48 projecting from its opposite ends. The shaft has its ends journaled in the bearings 44 and 45. Diametrically opposed brush housings 49 extending through the wall 32 each support a brush 51 in contact with a commutator 52 secured to the shaft 48.

The inverted cup-shaped spraying disk 53 is secured to the lower end of the shaft 48 within the cylindrical wall 32 below the partition 41. The lower edge of the disk is inclined upwardly from the inner surface of the disk, as indicated at 54, and terminates in a sharp peripheral edge 55. The motor 21 rotates the disk at high speed, and the paint, which is fed to the inner concave surface of the disk, is forced outwardly by centrifugal force. The paint moves up the inclined surface 54, and when it reaches the sharp peripheral edge 55 it is thrown outwardly therefrom in the form of substantially a "sheet" of spray.

The disk 53 has a central section 56 of stainless steel, with which it engages the shaft 48. Section 56 has a flat surface 58 on its underside, extending outwardly from a boss 57. The surface 58 is located above bushing 59 having a flat annular rim 61 located directly below the surface 58 of section 56. The bushing is preferably polytetrafluoroethylene, but may be made of any suitable material. The flat surfaces 58 and 61 define a circular metering opening therebetween. The lower end of the bushing 59 is seated in an upstanding cup 62 forming part of the hub 63 of a support plate 64 secured to the lower edge

of the cylindrical wall **32**. The support plate **64** comprises a circumferential rim **65** and a plurality of radial spokes **66** supporting the hub **63**.

The hub **63** has an inverted cup **67** depending from its lower side in axial alignment with the cup **62**. Feed tube **68** has its upper end secured within the cup **67**. The lower end of the feed tube is located near the bottom of a receptacle **69** having an open top and detachably secured to the lower edge of the cylindrical wall **32** by latches **71**. Conveyor screw **72** housed in the feed tube has its upper end secured to an adapter **73** that extends through a vertical bore in the boss **57** and is secured to the lower end of the shaft **48**. Thus, it also affixes the boss **57** of the spraying disk **53** to the shaft **48**. The ridges **74** of the conveyor screw are close to the inner surface of the feed tube, but have enough clearance to permit rotation of the screw. The helix of the screw is so directed that rotation of the screw causes the paint in the receptacle **69** to move upwardly and be forced outwardly through the metering opening between the rim **61** and the flat surface **58**.

The amount of paint that flows through the metering opening is regulated by moving the spraying disk **53** axially relative to the bushing **69** which is stationary. The spraying disk is rigidly secured to shaft **48**, and the rotor **47** and shaft **48** are moved axially to move the disk **53**. The axial movement of the disk **53** is regulated by a control cap **75** having an inner annular wall **76** in threaded engagement with the collar **34**. The inner surface of the cap **75** has a recess **77**, the ends of which engage a clip **78** to limit the rotational movement of the cap.

Referring to FIGURE 7, the bearing slide assembly **43** has an upstanding collar **79** that extends above the upper edge of the collar **34** and is interiorly threaded to receive a screw **81**. A spring disk **82** is secured to the top of the cap **75** and covers the opening defined by the annular wall **76**. The screw **81** extends through an aperture in the spring disk **82** and holds it against the top of the collar **79**. Rotation of the cap **75** in either direction causes the spring disk to move the bearing slide assembly in an axial direction. The shaft **48** is fixed in the bearing **44** so as to move axially in each direction with the bearing slide asembly. When the cap **75** is rotated in a clockwise direction, the bearing slide assembly, the shaft, the rotor and the spraying disk move downwardly to reduce the dimension of the metering opening. Rotation of the cap in the counterclockwise direction increases the dimension of the opening. The inner annular wall **76** contains **32** threads per inch so that one turn of the control cap **75** will move the spraying disk **53** an axial distance of $\frac{1}{32}$ inch.

Referring to FIGS. 1, 2, 10 and 11, an inner shield **83** mounted between the partition **41** and the support plate **64** and within the space defined by the cylindrical wall **32** intercepts most of the paint thrown outwardly by the disk **53** and directs it back into the receptacle **69**. A plurality of fins **84** project inwardly from the side wall **85** of the shield over a portion of its surface to intercept excess paint. A discharge opening **86** in a portion of the side wall **85** provides a passageway for some of the paint thrown outwardly by the disk **53**.

An arc-shaped plate **87** is mounted for sliding movement adjacent the side wall **85** to cover or uncover a portion of the discharge opening **86**, thereby increasing or reducing the area through which the paint thrown outwardly by the disk **53** may be dispensed. The tubular wall **32** has an opening **88** in register with the opening **86** so that substantially all of the paint passing through the opening **86** will aso pass through the opening **88** to be deposited on the surface to be painted. A handle **89** passes through the opening **88** and is rigidly secured to the plate **87** to facilitate sliding movement of the plate to reduce or increase the length of the opening **86**.

In order to increase the vertical height of the spray pattern and to facilitate using the spray dispenser, a degree of wobble is introduced into the spraying disk **53**. To this end, the disk **53** is mounted to the central section **55** in a manner whereby the axis of the disk is at a slight angle with respect to the axis of shaft **48**. Hence the disk will wobble in a direction parallel to the rotational axis.

Although we have described an embodiment of our invention in considerable detail, it will be understood that the description thereof is intended to be illustrative, rather than restrictive, as many details of construction may be modified or changed without departing from the spirit or scope of the invention. Accordingly, we do not desire to be restricted to the exact details of construction described.

We claim:

1. A spray dispenser comprising a housing, a receptacle secured to said housing for holding a liquid to be dispensed in spray form, a rotatable disk mounted in said housing for spraying said liquid, means for rotating said disk, means for feeding said liquid from said receptacle to the side of said spraying disk which faces the bottom of said receptacle, a metering opening defined by said feeding means and the adjacent side of said spraying disk, and means for varying the size of said metering opening to regulate the volume of liquid fed to said spraying disk.

2. A spray dispenser as recited in claim **1**, in which said varying means includes means for moving said disk axially.

3. A spray dispenser as recited in claim **1**, wherein the disk rotating means is an electric motor.

4. A spray dispenser as recited in claim **3**, wherein the electric motor is a permanent magnet field motor including armature terminals.

5. A spray dispenser as recited in claim **4**, including means for introducing a load resistance across said armature terminals to brake the motor operation.

6. A spray dispenser as recited in claim **1**, wherein said feeding means includes a screw conveyor connected to said rotating means.

7. A spray dispenser comprising a housing and a receptacle secured thereto, said receptacle being adapted to hold liquid to be dispensed in spray form, a motor comprising a field structure and a rotor mounted in said housing, said rotor being movable axially relative to said housing, a shaft projecting axially from said rotor, a spraying disk fixed to said shaft, a fixed member having its upper surface spaced below the underside of said disk and cooperating therewith to define a metering opening therebetween, and means for moving said rotor, shaft and disk axially to vary the size of said metering opening.

8. A spray dispenser as recited in claim **7**, in which a top plate is secured to the upper end of said housing and a tubular collar extends upwardly from said top plate; a bearing slide assembly mounted in said collar in engagement with said shaft; said moving means comprising a cap; and means securing said cap to said bearing slide assembly.

9. A spray dispenser as recited in claim **7**, including means for varying the speed of said motor.

10. A spray dispenser as recited in claim **7**, including a screw conveyor which comprises a feed tube connected to said fixed member and a screw connected to said shaft.

11. A spray dispenser comprising a housing, a receptical secured to said housing for holding a liquid to be dispensed in spray form, a rotatable spraying disk mounted in said housing for spraying said liquid, means for rotating said disk, means for feeding said liquid from said receptacle to one side of said spraying disk, said liquid feeding means and said disk being spaced from each other to define a metering opening therebetween, and means for moving said disk axially to vary the size of said metering opening.

12. A spray dispenser comprising a housing, a receptacle secured to said housing for holding a liquid to be dispensed in spray form, a rotatable disk mounted in said housing for spraying said liquid, said housing comprising a wall encircling said disk, an inner shield mounted between said wall and said disk to intercept liquid thrown outwardly from said disk by centrifugal force, said shield having an opening in register with an opening defined by said wall to form an outlet for liquid thrown outwardly from said disk, a plate mounted for sliding movement between said wall opening and said shield opening, a handle secured to said plate to enable movement of said plate to vary the outlet opening, means for rotating said disk, means for feeding said liquid from said receptacle to said spraying disk, a metering opening defined by said feeding means and the adjacent side of said spraying disk, and means for varying the size of said metering opening to regulate the volume of liquid fed to said spraying disk.

13. A spray dispenser comprising a housing, a receptacle secured to said housing for holding a liquid to be dispensed in spray form, a rotatable disk mounted in said housing for spraying said liquid, means for rotating said disk about an axis which is at an angle with respect to the axis of said disk, whereby wobble is provided to increase the vertical height of the spray pattern, means for feeding said liquid from said receptacle to said spraying disk, a metering opening defined by said feeding means and the adjacent side of said spraying disk, and means for varying the size of said metering opening to regulate the volume of liquid fed to said spraying disk.

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EVERETT W. KIRBY, Primary Examiner

U.S. Cl. X.R.

239—218.5, 222, 224, 332, 375; 261—91