April 3, 1962 H. A. BALL 3,027,869

SPRAY APPARATUS FOR APPLYING COATINGS

Filed Jan. 11, 1957 4 Sheets-Sheet 1

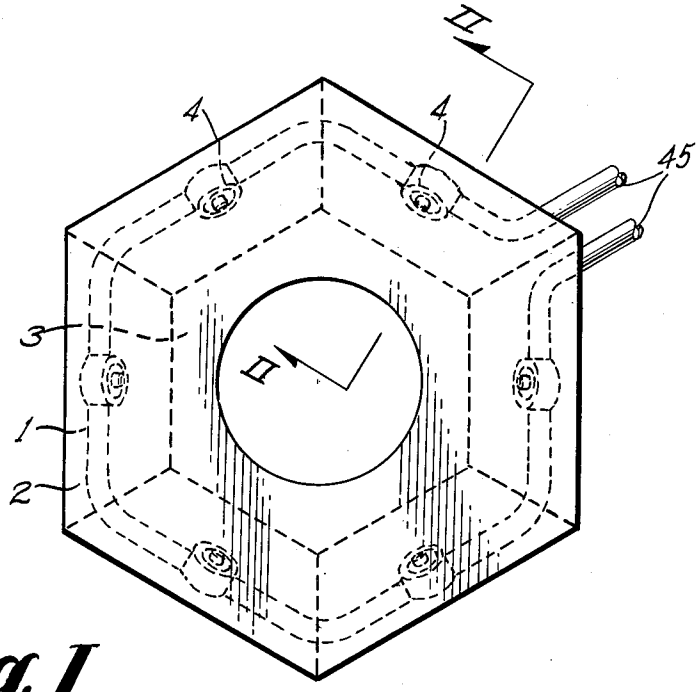

Fig. I

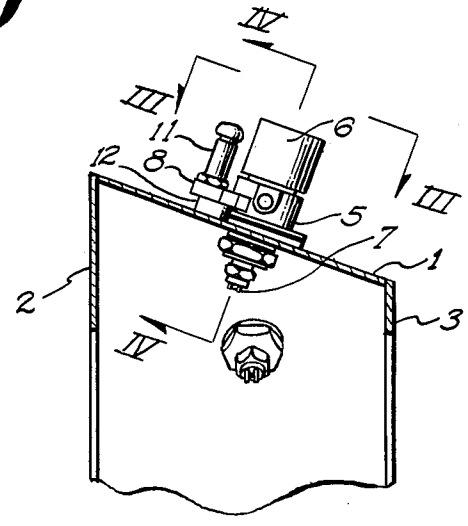

Fig. II

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SPRAY APPARATUS FOR APPLYING COATINGS

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Fig. III

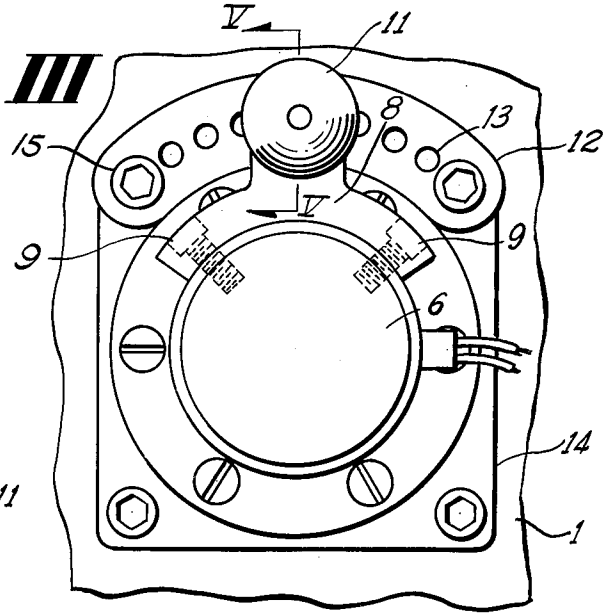
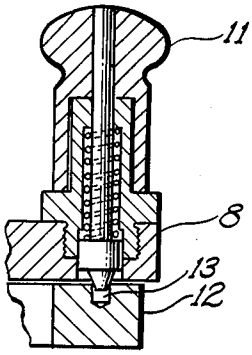


Fig. V



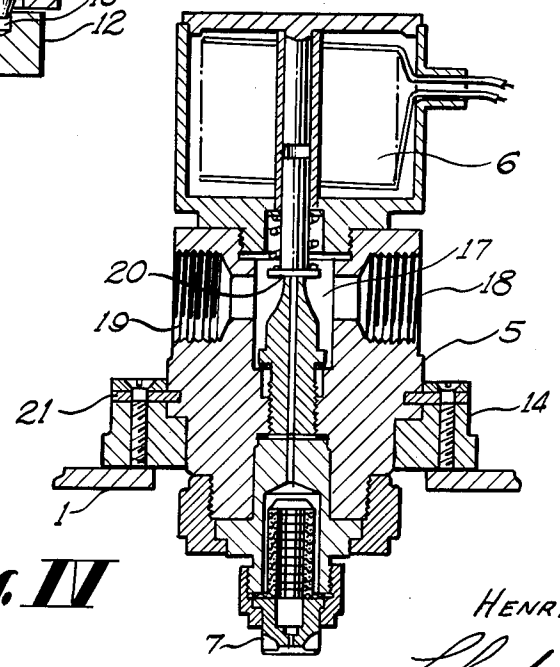


Fig. IV

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April 3, 1962 H. A. BALL 3,027,869

SPRAY APPARATUS FOR APPLYING COATINGS

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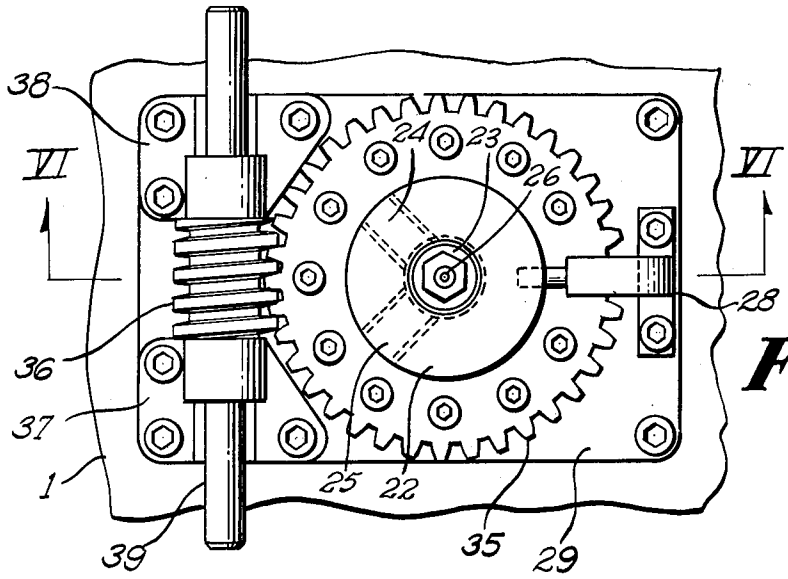

Fig. VII

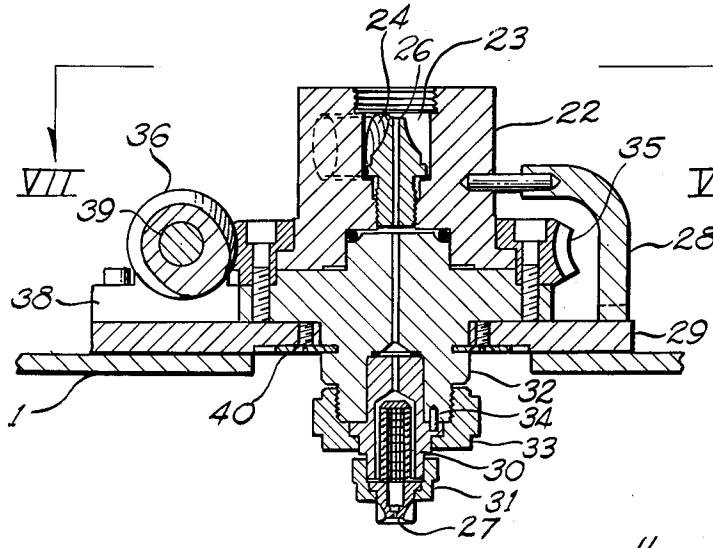

Fig. VI

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April 3, 1962 H. A. BALL 3,027,869

SPRAY APPARATUS FOR APPLYING COATINGS

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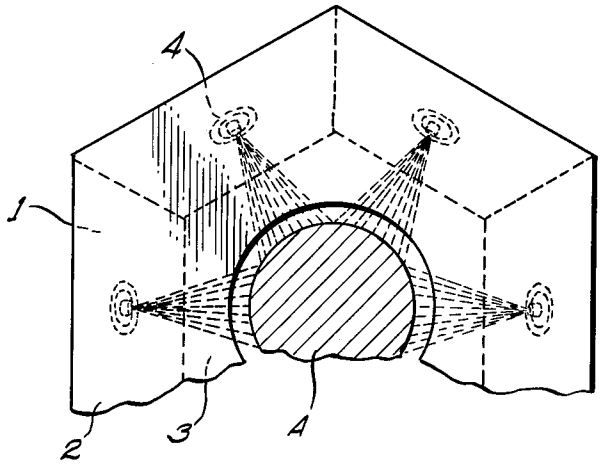

Fig. VIII

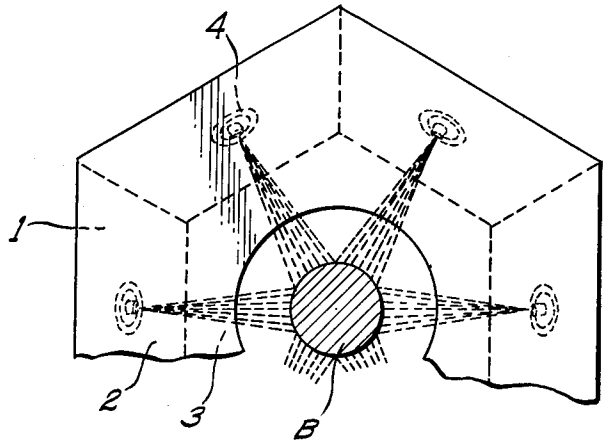

Fig. IX

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United States Patent Office 3,027,869 Patented Apr. 3, 1962

3,027,869

SPRAY APPARATUS FOR APPLYING COATINGS

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Filed Jan. 11, 1957, Ser. No. 633,602
12 Claims. (Cl. 118—316)

This invention pertains to apparatus for applying coatings to objects. More particularly, this invention relates to mechanically controlled apparatus for radially applying thin film-forming compositions, attenuated by a volatile carrying liquid, to objects without the use of air.

Certain of the apparatus and methods in prior use for radially applying coating compositions to objects have comprised flooding the coating composition on the object by direct mechanical, or electrostatic methods, and mechanically wiping or air wiping the object to spread the coating composition and remove the excess. This practice resulted in non-uniform applications and waste of the coating composition. In certain of the apparatus and methods in prior use it has been the practice to collect and reuse the excess coating composition. The contamination of the coating composition resulting therefrom caused variations in the quality of the coating and ultimately rendered the coating composition unusable. In many instances, it was previously necessary to enclose the spraying apparatus with a tank or shield to prevent the dissemination of over-spray and to collect the excess coating material, thereby rendering the apparatus unwieldy and adjustment difficult.

Certain other apparatus and methods in prior use for applying coating compositions to objects have comprised the use of air to accomplish the atomization of the coating composition. This practice has resulted in an uncontrollable and wasteful over-spray and a premature oxidation of the coating composition caused by the excess air.

Therefore, one object of this invention, which constitutes an improvement over my inventions disclosed in my copending applications, Serial Nos. 514,255 and 514,271, now abandoned, is to provide an economical means of radially applying a thin, uniform coating to objects with the speed required in production line methods. A further object of this invention is to reduce waste or loss of the coating composition to a minimal amount. A further object of this invention is to eliminate the necessity for wiping the object after the application of the coating. A still further object of this invention is to eliminate the excess air from the coating composition and to reduce premature oxidation thereby. Further and additional objects will appear from the following description and the appended claims.

Briefly to describe the primary features of a coating apparatus embodying my invention, I provide a housing which is basically in the shape of a hollow multi-lateral truncated pyramid, having a base and top plate, in each of which there is a circular opening centered on the longitudinal axis of the said housing. A rotatable, mechanically controlled nozzle assembly is mounted on each of the sides of the said housing so that the longitudinal axis of each nozzle assembly is perpendicular to the plane of the side upon which it is mounted. Each of the said rotatable nozzles is identical and capable of projecting a flat pattern spray of the type well known in the airless spray painting art. The individual nozzle assemblies comprise a casing having inlets and outlets therein for the coating composition, so that the coating composition may be conducted through the supply system to each nozzle assembly in series. In one form of apparatus embodying my invention, the separate nozzle assemblies are connected through flexible conduits for conducting the

said coating composition, thereby permitting the nozzle assemblies to be rotated without restriction. In this form of apparatus, the rotation of the nozzle assemblies is accomplished manually and each assembly is locked in a position such that each flat spray, so twisted, will efficiently coat its assigned area of the object to be coated. The said manual rotation of the individual nozzle assemblies is quickly and easily accomplished by means of a lift-pin locking type handle which seats in pre-positioned receptacles in a fixed base. This innovation of rotatable nozzles adds versatility to the apparatus embodying my invention, in that it makes possible the efficient, economical coating of objects through a widely variable size range without the necessity for changing the size of the spray housing apparatus.

Referring now to the drawings,

FIG. I is an elevational view of one form of my coating apparatus.

FIG. II is a partial cross-sectional view through the coating apparatus shown in FIG. I and taken in the plane of section line II—II of FIG. I.

FIG. III is a fragmentary elevational view of one of the rotatable nozzle assemblies of my coating apparatus and taken in the plane of section line III—III of FIG. II.

FIG. IV is a cross-sectional view through one type of the rotatable assemblies used in my coating apparatus and taken in the plane of section line IV—IV of FIG. II.

FIG. V is a partial cross-sectional view through the rotating and locking pin assembly on one type of the rotable nozzle assemblies used in my coating apparatus and taken in the plane of section line V—V of FIG. III.

FIG. VI is a cross-sectional view through still another form of rotatable nozzle assembly used in my coating apparatus shown without the mechanical operative means in position, and taken in the plane of section line VI—VI of FIG. VII.

FIG. VII is an elevational view of the form of rotatable nozzle assembly shown in FIG. VI and is taken in the plane of section line VII—VII of FIG. VI without the mechanical operative means in position.

FIG. VIII is an elevational view of my coating apparatus in operation with the nozzle assemblies rotated to a position to present a broad spray cloud for coating a relatively large object, A, shown in position for coating.

FIG. IX is an elevational view of my coating apparatus in operation with the nozzle assemblies rotated to a position to present a narrow spray cloud for coating a relatively small object, B, shown in position for coating.

The numeral 1 indicates a housing which is shown as a hollow six-sided truncated pyramid in this embodiment of my coating apparatus. The plate 2 partially encloses one end of the housing 1 while plate 3 partially encloses the other end. A plurality of nozzle assemblies 4, comprising basically a casing 5, mechanical operative means 6, nozzle 7 of the flat spray type, and rotating and locking means, are mounted on the sides of the housing 1. The rotating and locking means employed in this embodiment of my invention consists in a yoke 8 rigidly engaged to the casing 5 by means of screws 9, a spring activated pall or handle 11 threaded into a receptacle in the yoke 8, and a locking plate 12 in the form of a circular arc and having disposed therein a plurality of holes 13 for engaging the pall 11 in pre-determined positions, thereby regulating the rotation of the several nozzle assemblies. The locking plate 12 is rigidly engaged to the base plate 14 by screws 15, and the said base plate 14 is rigidly engaged to the housing 1, thereby disposing the nozzle 7 inwardly into the housing 1 through holes in the sides thereof. The internal structure of the nozzle assemblies consists in a chamber 17 in casing 5 having an inlet 18 and an outlet 19 therein for coating

material and a valve seat 20 which cooperates with the mechanical operative means 6 to interrupt the flow of the coating material to the nozzle 7 which communicates with the said valve seat 20. The entire nozzle assembly is rotatably held in place by a lock ring 21 cooperating with the base plate 14.

In FIGURES VI and VII, a different form of nozzle assembly which I have used in my coating apparatus is shown. In this nozzle assembly the casing 22 is much the same in structure as casing 5, that is, comprising an internal chamber 23 having an inlet 24 and outlet 25 for coating material and a valve seat 26 which cooperates with mechanical operative means (not shown on the drawings but similar to operative means 6) to interrupt the flow of coating material to the nozzle 27. However, in this form of nozzle assembly, the casing 22 is non-rotatably held by the bracket 28 which is rigidly engaged to the base plate 29. The nozzle 27 is non-rotatably engaged to the nozzle base 30 by means of a special cap nut 31, and this sub-assembly is non-rotatably engaged to the nozzle mounting 32 by means of a cap nut 33 and a locking pin 34. A circular gear 35 is non-rotatably engaged to the nozzle mounting 32 and cooperates with worm gear 36 which is rotatably mounted on the base plate 29 by brackets 37 and 38. The worm gear 36 is rigidly attached to drive shaft 39 which may be connected by universal joints (not shown) or flexible shafts (not shown) to each next adjacent nozzle assembly drive shaft. The entire nozzle assembly is engaged to the base plate 29 by means of bracket 28 and lock ring 40, and the base plate 29 is rigidly mounted on the housing 1 in the same manner as heretofore described with regard to the other form of nozzle assembly, the nozzle 27 thereby being disposed inwardly into the housing 1. It is obvious that a rotation of drive shaft 39 and worm gear 36 will cause rotation of the nozzle sub-assembly basically comprising nozzle 27, nozzle base 30, nozzle mounting 32, and circular gear 35; whereas the casing 22 is not rotated thereby. This arrangement facilitates the connection of conductive means for coating material to the inlet 24 and outlet 25, in that, rigid conduit may be used for the said conductive means, whereas in the type disclosed previously, flexible conduit must be used so as to permit rotation of the entire assembly. Whichever conduit is employed in the particular embodiment of my invention, the general arrangement thereof is depicted in FIG. 1 and is designated with the numeral 45.

The coating composition contemplated for the proper functioning of my coating apparatus comprises a film-forming material attenuated by a volatile carrying liquid which is introduced from the supply system into the several nozzle assemblies at a temperature of from 100° to 200° F. and under mechanical pressure of from 300 to 500 pounds per square inch. The nozzle orifice is restricted in size so that in an order of heat-reduced viscosity and abrupt release of the mechanical pressure at the inward terminus of the said nozzle orifice the coating composition is resolved into the condition of a propelled free cloud thereby liberating a proportion of the volatile liquid comprised in the said coating composition while adhering to the said object the film-forming material which hardens and becomes heat stable upon application.

The said rotatable nozzle assemblies are so arranged that when my coating apparatus is being used to coat an object of the largest size which it is capable of coating, the said nozzle assemblies are rotated to a position wherein the extremities of the flat pattern clouds of coating composition intersect each of those next adjacent approximately at the outermost boundary of the work being coated. On the other hand, when my coating apparatus is being used to coat an object of the smallest size which it is capable of coating, the said nozzle assemblies are rotated to a position wherein the flat pattern clouds of coating composition are turned to resemble the blades

of an air screw with their divergent terminals inwardly disposed at approximately the outermost boundary of the work being coated and their convergent terminals outwardly disposed at the nozzle orifices. When my coating apparatus is being used to coat objects of sizes intermediate to the two aforementioned extremes, the said nozzle assemblies are rotated to pre-determined positions so as to provide a given slant or twist to the flat pattern clouds of coating composition, much in the same manner as the pitch is changed on a variable pitch air screw, thereby to provide the maximally efficient pattern of the clouds of coating composition for coating an object of given size.

It will immediately be seen that the rotated patterns for coating relatively small objects would tend to deposit more coating composition on the object than the rotated patterns for coating relatively large objects because the object, moving axially relatively to my coating apparatus, in the former circumstance would pass through a more extended distance of the cloud. However, this condition is controllable, and by regulating the speed of travel of the object being coated, or the mechanical pressure applied to the coating composition, or both, the amount of coating composition deposited on the object is regulated quite simply to prevent too much or too little of the coating composition being deposited on the object.

The rotation of the said rotatable nozzle assemblies may be synchronized as in the form of my apparatus shown in FIG. VI and FIG. VII and explained relative thereto, or the nozzle assemblies may be individually controlled as in the form of my apparatus shown in FIG. II, FIG. III, and FIG. IV and explained relative thereto. Obviously, the form of my apparatus which utilizes the synchronized rotatable nozzle assemblies is best adapted to the coating of objects possessing a circular cross-section. On the other hand, the form of my apparatus which utilizes the individually controlled nozzle assemblies can coat objects of circular cross-section equally well but is also adaptable for coating objects possessing an irregular cross-section by merely regulating the rotation of the separate nozzle assemblies to different appropriate positions.

Even further versatility may be achieved with my invention by changing the number of nozzles which are operative at a particular time. It is to be noted that each of the rotatable nozzle assemblies possesses its own mechanical operative means for interrupting the flow of coating composition to the nozzle orifice. These mechanical operative means may be of the solenoid, pneumatic, or hydraulic types, but I have found the solenoid type to be preferable from the standpoint of speed and facility of operation.

Therefore, if my invention were constructed in a form comprising say twelve separate nozzle assemblies, it will readily be seen that, because of the individual mechanical operative means which can be controlled from the remote position, it can be used with say six, eight, ten, or twelve nozzles propelling clouds of coating composition, thereby utilizing the capabilities of my apparatus efficiently through a widely variant range in the size of the objects being coated.

In the form of my apparatus which I have shown in the accompanying drawings, the housing has six sides. However, this is not to be construed as a limitation, for the housing may have more or less sides, or even be basically round in cross-section.

An important feature of the novelty of my invention is found in the arrangement of the structure comprising shut-off valves in close proximity to the nozzles, thereby permitting the interruption of the coating operation at the completion of any stage in a production line without allowing the run out of any liquid coating composition contained in the nozzle assemblies, at the same time permitting the continued circulation of the coating composition through the supply system for the immediate resump-

tion of operation. This arrangement of the shut-off mechanisms proximate to the nozzles, provides sensitive, immediately effective means of controlling the operation of the coating apparatus, and affords a continuously present supply of the heated coating composition under the influence of mechanical pressure for instant response to intermittent operation of the coating apparatus without the loss of coating composition.

I have operated the apparatus embodying my invention successfully by applying a mechanical pressure of 400 pounds per square inch to the attenuated coating composition which was heated to 180° F. Under these conditions the coating composition was resolved into a finely dispersed free cloud upon issuance from the nozzles having orifice .011 inch in diameter, and no condensation of the coating composition into liquid droplets during passage from the nozzles to the work was observable. When elongated objects of circular cross-section were passed through my coating apparatus and intersected the propelled free clouds of coating composition under these conditions at a speed of 300 feet per minute, the resultant coating on the objects was thin and uniform and the flow thereof was negligible.

To determine the quantitative disposition of the coating composition accomplished by the apparatus embodying my invention operations were conducted using a coating composition comprising 50 percent of film-forming solid material and 50 percent of volatile carrying liquid by weight, the film-forming solid material comprising drying oils, dryer catalysts, and resins, and the volatile carrying liquid comprising naphtha. This constituency resulted in a coating composition comprising 43 percent of film-forming solid material and 57 percent of volatile carrying liquid by volume. The quantity of coating composition so constituted which was used would have produced a wet coating on the object 2.32 mils thick if the entire amount projected had reached the object, however, actual measurement showed that the wet coating was only 1.70 mils thick, from which it is concluded that a very substantial proportion of the volatile carrying liquid comprised in the coating composition was liberated during passage from the nozzles to the object. The remainder of the volatile carrying liquid was liberated after adherence to the object, resulting in a dry coating 1.00 mil thick.

Variations of the pressure, temperature, number of operating nozzles, rotation of nozzle assemblies, speed of relative movement, and constituency of the coating composition may be made to effect a wide range of desired coating results.

Certain changes may be made in the arrangement set forth in the specification and shown in the drawings, it being understood that modifications in the precise embodiment of the invention may be made within the scope of the following claims without departing from the spirit of the invention.

I claim as my invention:

1. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings being rotatable about their longitudinal axes disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, and mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles.

2. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, and rotating means for turning the said nozzles and valve casings about their longitudinal axes.

3. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, rotating means for turning the said nozzles and valve casings about their longitudinal axes, and locking means for securing the said nozzles and valve casings in rotated positions.

4. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings being rotatable about their longitudinal axes disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of the said valve casings having an inlet and outlet for coating material and a valve seat therein, flexible conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting as between one certain pair of adjacent valve casings where the said flexible conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, and mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles.

5. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings being rotatable about their longitudinal axes disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of the said valve casings having an inlet and outlet for coating material and a valve seat therein, flexible conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting

as between one certain pair of adjacent valve casings where the said flexible conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, and rotating means for turning the said nozzles and valve casings about their longitudinal axes.

6. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings being rotatable about their longitudinal axes disposed inwardly through and rotatably mounted on the sides of the said housing in uniform radial spaced relation, each of the said valve casings having an inlet and outlet for coating material and a valve seat therein, flexible conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting as between one certain pair of adjacent valve casings where the said flexible conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle non-rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, rotating means for turning the said nozzles and valve casings about their longitudinal axes, and locking means for securing the said nozzles and valve casings in rotated positions.

7. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of the said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle being rotatable about its longitudinal axis inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, and mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles.

8. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of the said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having a orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, and rotating means for turning the said nozzles about their longitudinal axes.

9. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of said valve casings having an inlet for receiving coating material from a supply system and a valve seat therein, a nozzle inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles about their longitudinal axes, rotating means for turning the said nozzles, and locking means for securing the said nozzles in rotated positions.

10. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of said valve casings having an inlet and outlet for coating material and a valve seat therein, rigid conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting as between one certain pair of adjacent valve casings where the said rigid conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle being rotatable about its longitudinal axes inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inwardly extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, and mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles.

11. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of said valve casings having an inlet and outlet for coating material and a valve seat therein, rigid conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting as between one certain pair of adjacent valve casings where the said rigid conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle being rotatable about its longitudinal axes inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating material to the said nozzles, and rotating means for turning the said nozzles about their longitudinal axes.

12. A device for applying a thin film of coating material to an object, comprising a housing for encircling an object in non-engaging relation thereto, a plurality of valve casings non-rotatably mounted on the outside of the said housing in uniform radial spaced relation, each of said valve casings having an inlet and outlet for coating material and a valve seat therein, rigid conduits connecting the outlet in each valve casing to the inlet of the next adjacent valve casing excepting as between one certain pair of adjacent valve casings where the said rigid conduits are comprised in the supply lead and return communicating with a supply system for coating material, a nozzle being rotatable about its longitudinal axes inwardly disposed through the side of the said housing rotatably mounted on each of the said valve casings at its inward extremity and communicating with the said valve seat, each of said nozzles having an orifice capable of projecting a flat spray and being so restricted that under pressure delivery of the said coating material therefrom issuance tends to resolve the said coating material into the condition of a propelled free cloud, mechanical operative means cooperating with each of the said valve casings and valve seats to interrupt the flow of coating

material to the said nozzles about their longitudinal axes, rotating means for turning the said nozzles, and locking means for securing the said nozzles in rotated positions.

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