Jan. 13, 1959 G. M. BOYD 2,868,163

APPARATUS FOR COATING CAVITIES

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Fig. 1.

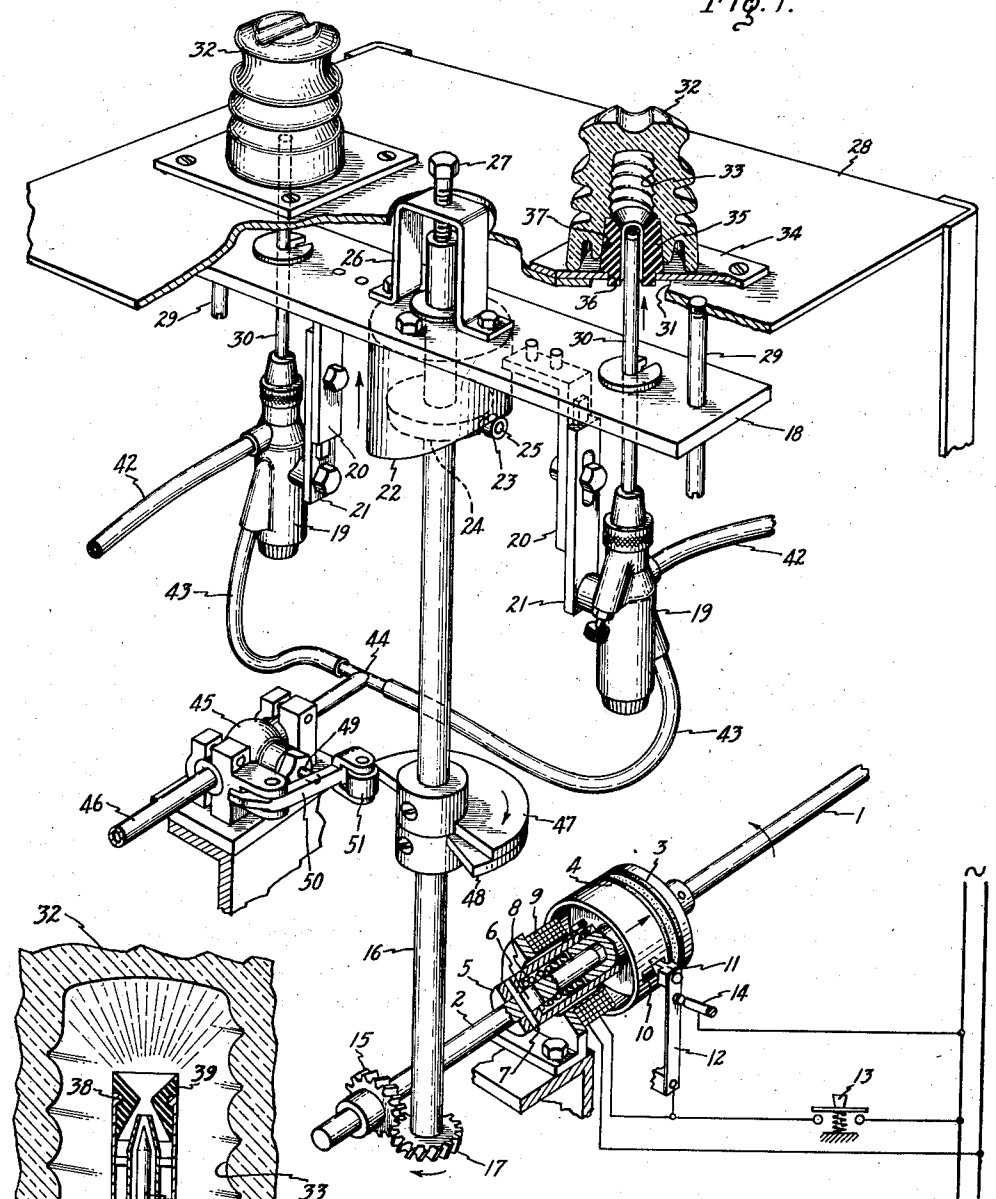

Fig. 2.

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APPARATUS FOR COATING CAVITIES

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This invention relates to an apparatus for coating cavities, and more particularly, to a machine or apparatus for applying a uniform coating to blind cavities or the like.

In the porcelain or ceramic electrical insulator art prior to firing of the molded insulators, a liquid glaze is applied to predetermined portions of the insulators in order to get a finished product having the desired electrical and mechanical properties. Some porcelain or ceramic electrical insulators have blind cavities or pinholes and difficutly has been encountered in applying a uniform coating to said blind cavities or pinholes. Some of the past methods of applying glaze coatings to said blind cavities or pinholes have been brushing, flushing, or flooding. Said past methods when practiced manually result in high costs, are time consuming, and are subject to the disadvantage that the uniformity and accuracy of the glaze application is subject to the operator's skill. Also, said past methods invariably result in crawling or puddling of the glaze due to heavy droplets, and an improper fit of the pin in the pinhole or blind cavities.

It is an object of this invention to overcome the above-mentioned defects and disadvantages by providing an apparatus or machine whereby a blind cavity can be repetitively coated in a uniform manner subject to little chance of operator judgment or error.

My invention comprises an apparatus for repetitively applying a uniform coating to blind cavities, said apparatus comprising an axially fixed rotary shaft, means for rotating said shaft, at least one spray gun movable in opposite directions parallel to the axis of said shaft, means for imparting reciprocating movement to said spray gun during rotation of said shaft, valve means controlling spraying by said spray gun, and means rotatable with said shaft and cooperative with said valve means for causing spraying by said spray gun during a predetermined portion of each reciprocating cycle of said spray gun.

My invention further comprises a spraying machine having an axially fixed rotary shaft, means for rotating said shaft a single revolution, at least one spray gun movable for one reciprocating cycle parallel to the axis of said shaft during said single revolution of said shaft, cam means for causing said reciprocating spray gun movement comprising a cam follower rotatable with said shaft and a truncated cylindrical cam movable simultaneuosly with said spray gun, said truncated cylindrical cam concentrically disposed about said shaft and in contact with said shaft rotatable cam follower, valve means controlling spraying by said spray gun, and adjustable cam means rotatable with said shaft and cooperative with said valve means to cause spraying by said spray gun during a predetermined portion of said one reciprocating cycle.

The features of my invention which I believe to be novel are set forth with particularity in the appended claims. My invention itself, however, both as to its organization and method of operation, together with further objects and advantages thereof, may best be

understood by reference to the following description taken in connection with the accompanying drawing.

In the drawing, Fig. 1 is a partly broken away perspective view of one form of my invention. Fig. 2 is an enlarged detailed view of the right-hand spray gun tip of Fig. 1 during spraying. Like reference numerals will be used in Figs. 1 and 2 to indicate similar parts.

Referring now to the drawing, and more particuiarly to Fig. 1, shown therein is a shaft 1 rotatable counterclockwise by a not shown motor or the like, and another shaft 2. Rotary motion is transmitted from shaft 1 to shaft 2 by a single revolution clutch. One clutch disc 3 of said single revolution clutch is attached to the shaft 1. Another clutch disc 4 is slidably connected at its hub portion to the shaft 2 so that the disc 4 can be moved for engagement and disengagement with the disc 3. A sleeve-like armature member 5 is connected at its right-hand end to the hub portion of disc 4 and is concentrically disposed about the shaft 2 and spaced therefrom. A lost motion connection is provided between sleeve 5 and shaft 2 by virtue of a slot 6 in shaft 2 and a pin 7 passing through the left-hand end of sleeve 5 and slot 6. Disposed within sleeve 5 is a spring 8. Spring 8 at its left-hand end bears against the left-hand end of sleeve 5 and at its right-hand end against a stop collar fixed to shaft 2 by a pin or the like. Accordingly, spring 8 always biases disc 4 away from disc 3.

The means for controlling engagement and disengagement of discs 3 and 4 comprises a solenoid coil 9, a notch 10 formed in the rim portion of disc 4, and a sear or wedge-shaped catch tooth 11 cooperative with notch 10 and carried by a spring contact finger 12. Depression of the push button 13 will result in energization of the solenoid coil 9. When the solenoid coil 9 is energized, the sleeve-like aramture member 5 is caused to move in a right-hand direction whereby the clutch disc 4 will become engaged with the clutch disc 3. The moment disc 4 makes contact with the disc 3 rotary movement in a counterclockwise direction is imparted to the disc 4 and the shaft 2. Rotation of the disc 4 causes the wedge-shape catch tooth 11 to move out of the notch 10 whereby the spring contact finger 12 is placed in electrical contact with a contact 14. Therefore, energization of the solenoid coil 9 continues even though the push button 13 is released whereby the disc 4 remains in contact with the disc 3. After the disc 4 has made one complete revolution, the notch 10 will again be disposed opposite to the sear 11. Accordingly, the spring contact finger 12 will bias the sear 11 into the notch 10. When the sear 11 moves into the notch 10 electrical contact between the spring contact finger 12 and contact 14 is broken whereby the solenoid coil 9 is de-energized. Therefore, the spring 8 is now free to move the sleeve-like aramture member 5 in a left-hand direction whereby the disc 4 is disengaged from the disc 3. Thus, it will be seen that with each depression of the push button 13, the shaft 2 will make one complete revolution and then stop, until a subsequent depression of push button 13, even though the shaft 1 is continuously rotating.

Connected to the left-hand end of shaft 2 is a gear 15. An upright shaft 16 disposed generally perpendicular to shaft 2 carries a gear 17 at its lower end engageable with the gear 15. Gears 15 and 17 have a one to one ratio whereby each time shaft 2 makes one complete revolution counterclockwise shaft 16 will make one complete revolution in a clockwise direction.

Carried by a movable flat carriage member 18 are a plurality of spray guns 19. Spray guns 19 constitute no part of this invention and are well known devices which can be purchased on the market. Carriage 18 is disposed generally perpendicular to upright shaft 16 and is journalled on the upper end of shaft 16 for reciprocat-

ing movement along said upper end of shaft 16. Guns 19 reciprocate simultaneously with carriage 18 in opposite directions generally parallel to the axis of shaft 16. Each of the guns 19 are connected to carriage 18 by an inverted L-shaped bracket 20 and a plate 21 having cooperating tongue and groove means therebetween. Accordingly, the initial starting position of the guns 19 during their reciprocating movement can be adjustably altered by raising or lowering the plates 21 with respect to the brackets 20.

The means for imparting vertical reciprocating movement to carriage 18 and the spray guns 19 carried thereby comprises a cam 22 connected to carriage 18 and a cam follower 23 connected to shaft 16. The cam 22 is a frustum-like or truncated cylindrical member connected at its upper end to the underside of carriage 18 and concentrically disposed about shaft 16. The lower end edge of cam 22 is inclined or lies in a plane disposed nonperpendicularly with respect to the axis of shaft 16. Connected to shaft 16 adjacent the lower end of cam 22 and rotatable therewith is a circular disc 24. Cam follower 23 is adapted for rotary movement about a pin 25 extending radially from disc 24 and is continuously in engagement with the lower end edge of cam 22. Accordingly, when the shaft 16 rotates once, the carriage 18 and guns 19 will be moved through one reciprocating cycle.

Positioned upon the upper surface of carriage 18 and connected thereto is an inverted U-shaped member 26. The base portion or leg connecting portion of inverted U-shaped member 26 is superposed with respect to the upper end of shaft 16 and spaced therefrom. Threaded through said base or leg connecting portion of inverted U-shaped member 26 is an adjusting screw or adjustable stop member 27 which can be turned down for contact with the upper end of shaft 16. The cam 22 with its predetermined lower end edge slope will give a predetermined stroke to the carriage 18 and guns 19 when the shaft 16 makes one revolution. However, this predetermined stroke can be shortened by turning down adjusting screw 27 until it abuts the upper end of shaft 16 and raises the cam 22 with respect to the cam follower 23. Thereafter, when the shaft 16 makes one complete revolution during initial clockwise travel of cam follower 23, the cam follower 23 will be out of engagement with the lower end edge of cam 22 after which the cam follower 23 will become engaged with cam 22 to first raise and then lower the carriage 18 and guns 19 at a shortened stroke. During the remaining portion of said clockwise travel of cam follower 23, the cam follower 23 will be out of engagement with the lower end edge of cam 22.

Superposed with respect to the movable flat carriage member 18 and vertically spaced therefrom is a flat stationary table 28 parallel with respect to that flat carriage 18. Guide rods 29 parallel with respect to the barrels 30 of spray guns 19 and shaft 16 are connected to the stationary table 28 and extend downwardly therefrom through the carriage 18 and serve to steady the carriage 18 and the guns 19 during their reciprocating motion.

Formed in the stationary table 28 are openings 31 concentrically disposed with respect to the line of travel of the spray gun barrels 30. Ceramic or porcelain insulators 32 having blind cavities or pinholes 33 therein are supported on the stationary table 28 and axially aligned with respect to the line of travel of the spray gun barrels 30 by plates 34 and spraying masks or shields 35. It will be obvious that my invention can be used for the spraying of electrical insulators configured differently than those shown in Fig. 1. Accordingly, the plates 34 and masks or shields 35 are removably connected to table 28 for replacement by other types of plates and masks or shields to support and align differently configured electrical insulators. Formed in plates 34 are openings 36 axially aligned with respect to the spray gun barrels 30. The lower ends of the masks or shields 35 are differentially diametered and the neck portions thereof fit snugly into openings 36 and the shoulder portions thereof rest upon the upper surfaces of the plates 34. The masks or shields 35 have a generally frustum or truncated cone-like hollow configuration. The tapered exterior side walls of the masks or shields 35 fit snugly into the tapered openings or flange portions 37 of the electrical insulators 32 to align the axes of the pinholes 33 with respect to the axes of the spray gun barrels 30. The upper ends of the masks or shields 35 are seated in the shoulder portions of the electrical insulators 32 formed between the differentially diametered pinholes 33 and openings 37. By having the upper ends of the masks or shields 35 seated in said insulator shoulder portions provision is also made for preventing the application of glaze beyond a predetermined plane of termination, namely, below the blind cavities or pinholes 33.

Spray guns 19 are of the internal mix type, readily available on the commercial market, which will cause a full-cone shaped spray to coat the entire surfaces of the blind cavities 33, even on reverse slopes, as shown in Fig. 2. The air cap on internal mix type guns heretofore was made of hardened steel and is not satisfactory for the spraying of abrasive glazes at high velocity inasmuch as the abrasiveness and high velocity of the glaze slurry quickly wears out the air cap. In my invention I provide an air cap constructed out of a resilient or elastic material, as rubber having a durometer stiffness of about 30 to 75 units. The life span of such a rubber cap is about 30 times that of a hardened steel air cap.

In Fig. 2 is illustrated my internal mix spray gun tip after it has entered the blind cavity of pinhole 33 during spraying. The internal mix spray gun tip comprises the spray gun barrel or tubular member 30. The upper end of barrel or tubular member 30 is open and formed on said upper end is an internal bead 38. The internal bead 38 cooperates with an external centrally disposed circumferentially extending groove formed in a resilient or elastic material air cap 39 to hold cap 39 securely on the upper end of the barrel or tubular member 30. The air cap 39 is annular or cylindrical and has diverging openings at opposite ends thereof connected by a restricted passage. Positioned internally of the barrel 30 and concentrically disposed therewith and spaced therefrom is a tubular member 40. The upper end of tubular member 40 has a converging opening therein directed towards said restricted passage. Disposed interiorally of the tubular member 40 and spaced therefrom is a needle valve member 41, the upper tip of which cooperates with said converging opening of tubular member 40. As will be obvious to those skilled in the art, the tubular member 40 is a passage for the material or glaze slurry to be sprayed, and the annular space defined by the spaced tubular members 30 and 40 is a passage for a gas. When the spray guns 19 are actuated, the tip of the needle valve member 41 is retracted from the converging opening of the tubular member 40 to release a spraying material or glaze slurry under a pressure of about 5 to 40 p. s. i. Concomitantly air or gas under a pressure of about 20 to 80 p. s. i. is injected into the annular cylindrical air passage defined by spaced tubular members 30 and 40. Said spraying material and air under pressure will intermix in said air cap and thence gush out of the air cap in a full-shaped cone spray as illustrated in Fig. 2.

The means for controlling the duration and period of spraying by the spray guns 19 during their reciprocating cycle comprises a valve and an adjustable cam means carried by shaft 16. Referring again to Fig. 1, connected to each of the spray guns 19 is a hose 42 connected at its opposite end to a liquid glaze pressure tank, not shown, said liquid glaze having a controlled percent solids and viscosity. Also, connected to each of the spray guns 19 is a hose 43, the hoses 43 being connected by a T-shaped conduit 44 to the outlet side of an air valve 45. The inlet side of the air valve 45 is connected by a hose 46 to an air pressure tank, not shown.

Connected to the shaft 16 at their hub portions are a pair of generally semi-circular cams 47 and 48. The cams 47 and 48 overlay each other and are adjustably attached to the shaft 16 whereby their degree of overlap relative to each other may be readily altered. The valve member 45 has a button 49, depression of which will permit the passage of air through valve 45 and release of which will close the valve 45. Said button 49 is adapted to be depressed and released by a lever arm 50 pivoted adjacent its left-hand end. The right-hand end of lever 50 has a U-shaped portion thereon carrying a roller 51. The roller 51 lies in the path of clockwise rotation of the cams 47 and 48. Accordingly, when the shaft 16 is rotated clockwise one revolution, the cams 47 and 48 will strike the roller 51 and pivot the lever arm 50 to depress the button 49 and open the air valve 45. In Fig. 1 the cams 47 and 48 are shown in their initial starting position. During the approximately first half of rotation of cams 47 and 48 clockwise, the valve 45 will be closed. However, during the approximately second half of rotation of the cams 47 and 48, said cams will be deflecting the roller 51 leftwardly to retain air valve 45 open to cause spraying by the spray guns. If it is desired to accelerate the instant at which spraying commences, the cam 48 can be adjustably rotated clockwise with respect to the cam 47. Such adjustment will also increase the duration of the spraying period. If the spraying period is desired to be decreased to less than about 180° revolution of the shaft 16, the cams 47 and 48 can be replaced by sector-like cams of less than 180°. Thus, through a proper selection of the configuration and disposition of the cams 47 and 48, as well as a proper correlation of said configuration and disposition with each stroke of the range of strokes obtainable by adjustment of the screw 27, a very fine degree of control is obtainable to repetitively give a uniform glaze coating to blind cavities substantially free of operator judgment and error.

In the operation of my invention, it is proposed that first an operator place two electrical insulators 32 in position for spraying. Thereafter depression of the button 13 by the operator will impart one complete revolution to the shaft 16. As the shaft 16 rotates clockwise, the cams 47 and 48 and the cam follower 23 will be rotated clockwise simultaneously with the shaft 16. During approximately the first 180° of revolution of the cam follower 23, the cam 22, carriage 18, and spray gun barrels 30 will be moved upwardly. At the end of said first 180° revolution of the cam follower 23, the spray gun barrels 30 will be disposed within the blind cavities 33 adjacent the upper end thereof. However, during said first 180° revolution of the cam follower 23, the cams 47 and 48 will not as yet have struck the roller 51 to open the valve 45. During the approximately second 180° revolution of the cam follower 23, the cam 22 and table 18 will be lowered whereby the spray gun barrels 30 will also move downwardly out of the blind cavities 33. Also, during said second 180° revolution of the cam follower 23, the semi-circular cams 47 and 48 will continuously abut the roller 51 to retain the valve 45 open whereby the spray guns 19 are spraying glaze material on the interior walls of the blind cavities 33 during the retracting stroke of the spray gun barrels 30. After the shaft 16 has made one complete revolution, the spray gun barrels 30 will have been returned to their initial position shown in Fig. 1 and the cams 47 and 48 will have passed the roller 51 whereby the air valve 45 is now closed and spraying of glaze by the spray guns 19 has ceased. The sprayed insulators 32 can now be removed, and after the apparatus is reloaded with two other insulators, an identical spraying cycle can be repeated to give an identical coating to said two other insulators.

While there has been shown and described a particular embodiment of the invention, it will be obvious to those skilled in the art that changes and modifications may be made without departing from the invention, and that it is intended by the appended claims to cover all such changes and modifications as fall within the true spirit and scope of the invention.

What I claim as new and desire to secure by Letters Patent of the United States is:

1. A spraying apparatus comprising a shaft, a carriage, means mounting said carriage on said shaft for sliding movement therealong, a plurality of spray guns, means mounting said guns on said carriage for movement therewith, drive means connected to said shaft for rotating the same, and means for reciprocating said carriage along said shaft, said carriage reciprocating means comprising a first cam, means connecting said first cam to said carriage for movement therewith, a cam follower which engages said first cam, and means connecting said follower to said shaft for rotation therewith; and means for controlling spraying by said guns comprising a valve, means connecting said valve to said guns, a second cam which engages said valve, and means connecting said second cam to said shaft for rotation therewith.

2. A spraying apparatus comprising an upright shaft, a carriage, means mounting said carriage on said shaft for sliding movement therealong, a plurality of spray guns, means mounting said guns on said carriage for movement therewith, drive means connected to said shaft for rotating the same, and means for reciprocating said carriage along said shaft once during each turn of said shaft, said carriage reciprocating means comprising a cylindrical shaped cam which is concentrically disposed with respect to said shaft, means connecting said cam to said carriage for movement therewith, said cam having an end edge which is inclined with respect to said shaft, a cam follower which engages said end edge, and means connecting said follower to said shaft for rotation therewith; and adjustable means for controlling spraying by said guns comprising a valve, means connecting said valve to said guns, a pair of overlapping cams which engage said valve, means connecting said pair of cams to said shaft for rotation therewith, and said last mentioned means being adjustable for adjusting the overlap between said pair of cams.

3. A spraying apparatus comprising an upright shaft, a carriage, means mounting said carriage on said shaft for sliding movement therealong, a plurality of elongated upright spray guns, means mounting said guns on said carriage for movement therewith, drive means connected to said shaft for rotating the same, and means for reciprocating said carriage along said shaft, said carriage reciprocating means comprising a first cam, means connecting said first cam to said carriage for movement therewith, a cam follower which engages said first cam, and means connecting said follower to said shaft for rotation therewith; and means for controlling spraying by said guns comprising a valve, means connecting said valve to said guns, a second cam which engages said valve, and means connecting said second cam to said shaft for rotation therewith; and a work supporting table above said carriage, said table having apertures formed therein which are aligned with said guns.

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