Oct. 16, 1962 E. N. PATON 3,058,443

MACHINE FOR THE ELECTROSTATIC DEPOSITION OF POWDERS ON HEATED SURFACES

Filed May 27, 1959 2 Sheets-Sheet 1

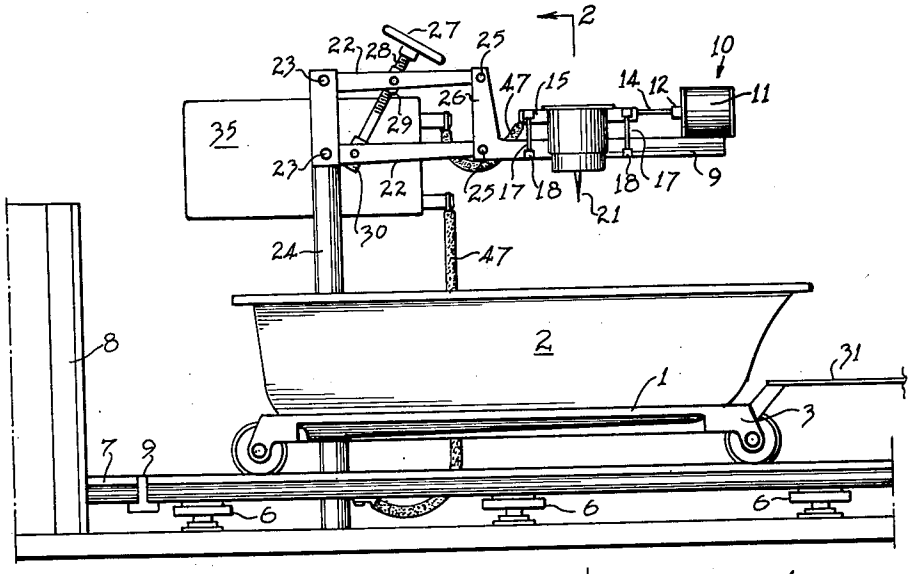


FIG. 1

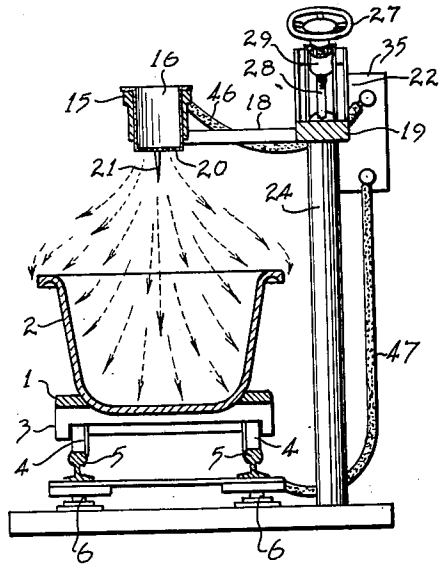


FIG. 2

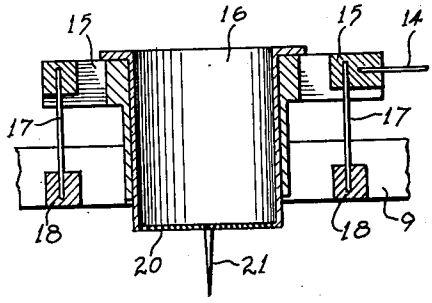
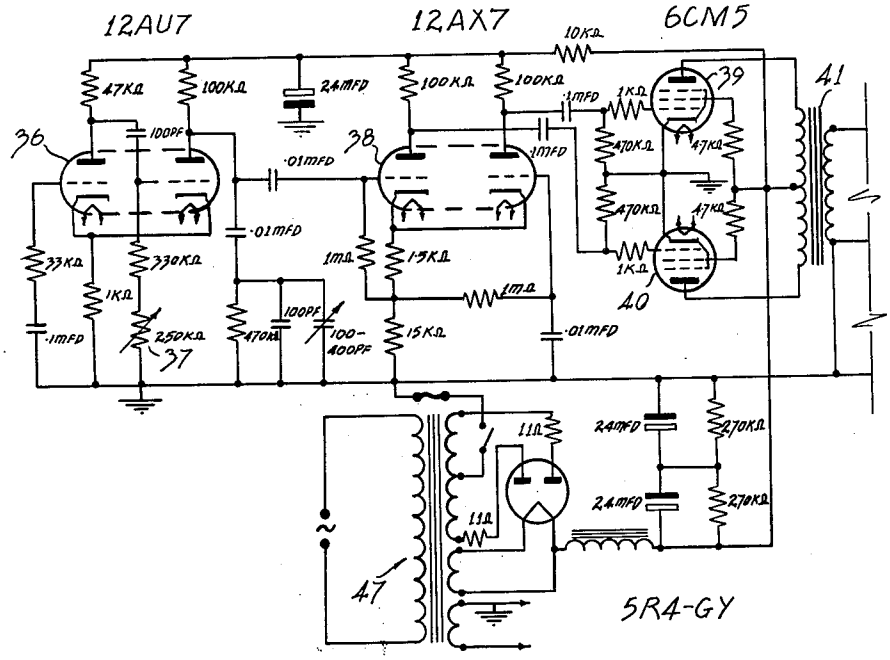


FIG. 3

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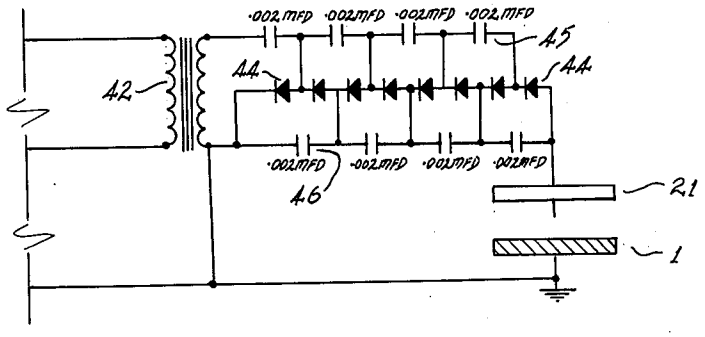


FIG 4

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MACHINE FOR THE ELECTROSTATIC DEPOSITION OF POWDERS ON HEATED SURFACES

Erskine Norman Paton, 1 Dashwood Road, Beaumont, South Australia, Australia

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1 Claim. (Cl. 118—622)

This invention relates to a method of electrostatically depositing powders on heated surfaces, and as an example it relates to the depositing of enamels or the like on bath tubs or other surfaces where deposition must take place under relatively high temperatures.

At the present time when enamelling cast iron bathtubs it is customary to apply the enamelling powders mechanically, and great difficulty exists in handling the powders and having them correctly dispersed on a surface which is at relatively high temperature.

It was realised that considerable problems exist in effecting electrostatic deposition because deposition will not be effectively carried out under conditions where ionisation of particles can take place, and of course when using the temperatures involved in the enamelling process, ionisation would most likely be present to a substantial degree.

Also there is the problem of being able to get the powder to disperse correctly within a bathtub or similar recessed article, the shape of the article controlling the field and therefore tending to deposit to the surfaces nearest to the powder container or electrode, such as on the upper edges of the bathtub, the problem existing in being able to get the correct deposition right down into the bathtub as well as down the steep sides.

It has now been found that using this invention it is possible to apply enamels to bathtubs or the like by electrostatic means provided certain conditions are observed, namely that the deposition will be effected partly under control of the electrostatic force and partly under control of gravity, the apparatus therefore envisaging a support onto which the bathtubs or the like can be placed, and above the support at the required height, a container in which the enamelling powder is held and from which it can be discharged at the required rate by vibration or under other control, and electrostatic field being induced between the container and the bathtub so that the powder, as it is discharged from the container, will fall downwardly under gravity into the bathtub, but at the same time some of the powder will be deflected towards the bathtub by the electrostatic field, the arrangement being such that the required coating over the whole of the internal surfaces of the bathtub can be achieved.

It will be realized of course that the coating powder will be an agglomeration of particles of different size, and therefore of different weight, and some of the particles, namely, the heavier particles, will tend to move straight down without any appreciable deflection by the electrostatic field, but the lighter particles will tend to move under the electrostatic field to follow the lines of the field.

By a correct selection of the powder and the distance of the electrodes and the strength of the field it is thus possible to coat the entire surfaces of a bathtub without any problem, ionisation of the air in the vicinity of the bathtub, if it does take place, not destroying the correct distribution of the particles under such conditions.

To enable the invention to be fully understood an embodiment thereof will now be described with reference to the accompanying drawings in which:

FIG. 1 is a side elevation of apparatus whereby the invention can be carried out,

FIG. 2 is a section on line 2—2 of FIG. 1,

FIG. 3 is an enlarged transverse section of the powder discharge mechanism, and

FIG. 4 is a schematic view of an electrical circuit diagram suitable for producing the necessary electrostatic field.

A platform 1 is adapted to support a bathtub 2 or similar object which is to be coated with enamel, the platform 1 forming part of a trolley 3 provided with wheels 4 engaging tracks 5 supported on insulators 6 so that the bathtub can have a potential applied thereto.

This trolley 3 can be moved to bring a bathtub 2 or the like from an oven 8 to the treating locality, the tracks 7 extending into the oven 8 but being insulated by a member 9 to avoid loss of potential from the rails 5.

Disposed above the treating locality is a frame 9 on which is supported a vibrator unit 10 having within it an electrical coil 11 and an armature 12, vibration of the armature being effected by applying alternating current to the coil 11.

The armature 12 is coupled by means of a rod 14 to a frame 15 which is adapted to support the powder container 16, the frame 15 being carried on flexible insulating blades 17 secured at their upper ends to the frame 15 and at their lower ends to blocks 18 projecting from the base 9 so that the vibration of the armature 12 can be applied to the frame 15 and thus to the powder container 16.

The powder container 16 is provided with a perforated bottom 20 through which the powder can flow when the container 16 is vibrated, and at the centre of this perforated bottom 20 is an electrode 21 which points downwardly towards the treating locality for the bathtub.

The base 9 is adjustable in height to allow an exact selection of the distance between the electrode 21 and the bathtub 2, adjustment being achieved by means of a pair of parallel motion arms 22 connected by pivots 23 to a support 24 at their one end, and at their other end by pivots 25 to a bracket 26 attached to the base 9.

A hand wheel 27 fitted to a threaded shaft 28 engaging a threaded aperture in a block 29 on the one arm 22, and having a reaction point in a block 30 on the other arm but at a different distance from the pivots 23, allows rise and fall of the system so that a very accurate height regulation of the electrode 21 can be effected.

The carriage 3 with the bathtub on it can be moved forward and backward on the tracks 5 by means of an insulated rod 31 so that the bathtub 2 traverses beneath the electrode 21 during powder deposition, this allowing compensation for the length of the bathtub and ensuring uniform deposition over the entire length.

The power supply unit 35 can conveniently comprise a saw tooth generator valve 36 which is provided with a frequency varying variable resistor 37, this valve 36 driving a phase splitter valve 38 which in turn drives a pair of power output valves 39 and 40 to provide an alternating current output to the output transformer 41 which in turn feeds an induction coil 42 to step up the voltage to the required value.

As it is necessary to have direct current on the electrode 21, a rectifying type of voltage multiplier is coupled to the induction coil 42 comprising a series of rectifiers 44 in series with each other and bridged by means of condensers 45, the output from this voltage multiplier being fed to the electrode 21 through the lead 46, the return being taken through the lead 47 to the rails 5 and thus to the carriage 3 and bathtub 2.

In the circuit diagram actual values of components have been shown so that the voltage producing means can be readily understood, but it is obvious that other forms of voltage production can be used, the one shown being however ideally suited to the present problem in that voltage regulation can be readily effected by simply changing the frequency of oscillation of the generator valve.

As an example of the type of powder which can be dispersed by this apparatus, an enamel powder having the following characteristics may be used.

Frit size larger than 60 mesh 0.15%=240 microns
Frit size larger than 100 mesh 4.2%=147 microns
Frit size larger than 150 mesh 9.51%=104 microns
Frit size larger than 200 mesh 10.3%=74 microns
Frit size larger than 325 mesh 15.44%=54 microns
Frit size smaller than 325 mesh 60.4%=46 microns

With regard to the power supply, for a normal size bathtub the spacing of the electrode above the floor of the bathtub could be 36 inches using a voltage differential between the electrode **18** and the bathtub **2** of 90,000 volts.

I claim:

A machine for electrostatically depositing powder on the internal heated surface of a bathtub during enamelling comprising a base to receive and support the bathtub on to which the powder is to be deposited, a carriage on rails to allow the base to move longitudinally, a container disposed directly above the path of movement of the said base to hold the said powder, said container being provided with apertures in the bottom thereof and of a size to allow particles of the said powder to pass therethrough, an electrode depending from the centre of the

said apertured bottom of the container, means connected between the said electrode and the said base to apply an electrostatic field between the said electrode and the said base moving the said powder at least in part downwardly, a vibrator coupled to the said container to cause powder to feed from the said container through the apertures into the said electrostatic field whereby deposition takes place both by gravity effects and by electrically induced motion so that the lighter particles are deposited in a first zone on said surface and the heavier particles are deposited on a second zone remote from the first said zone.

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