

Jan. 24, 1967

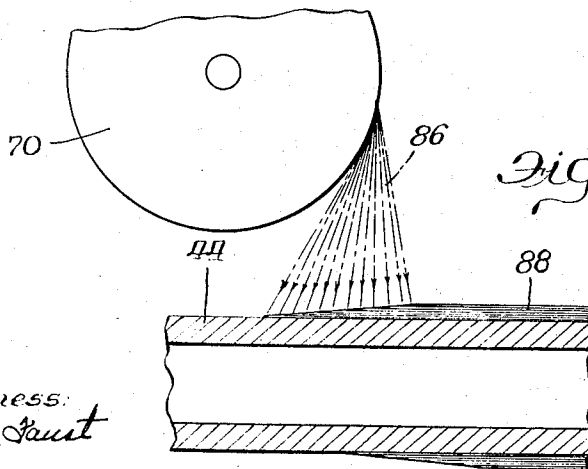
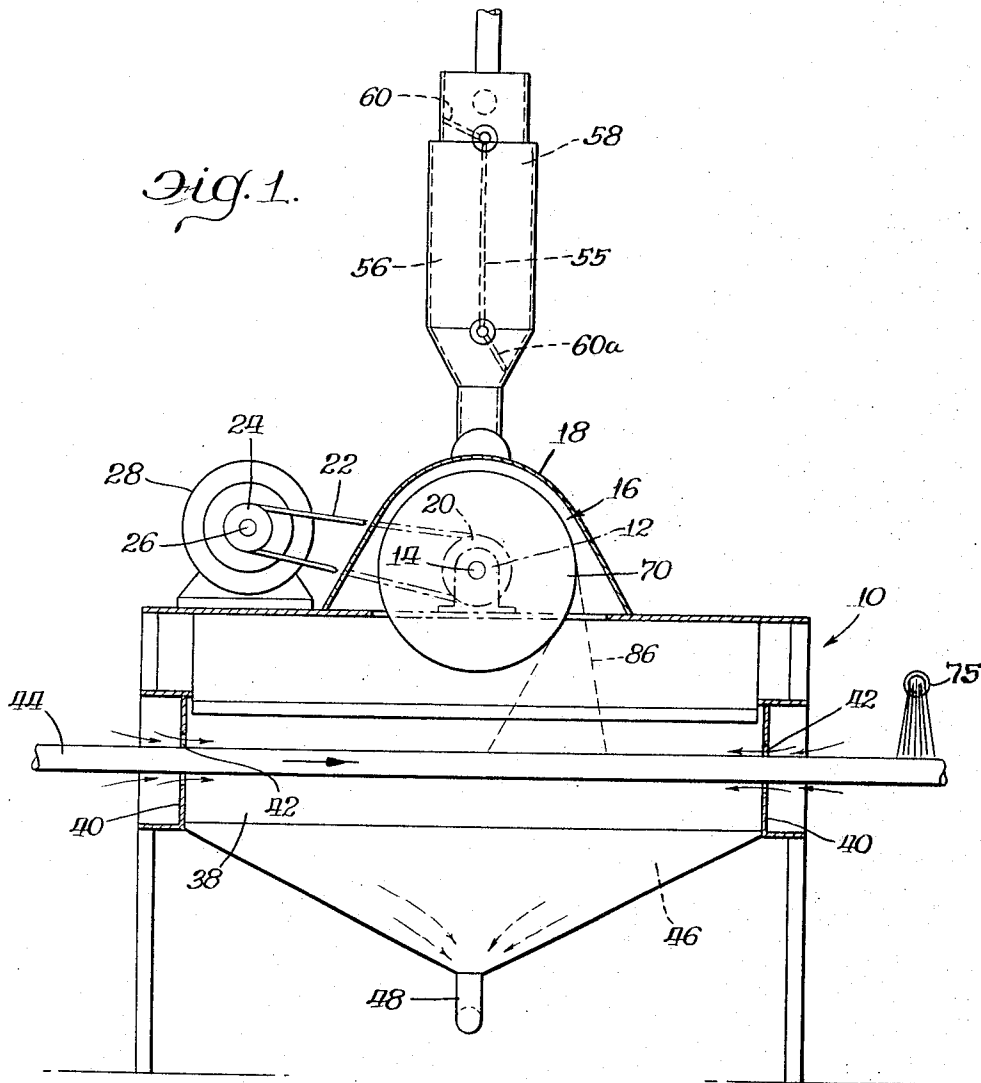
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APPARATUS FOR COATING ELONGATED OBJECTS

Filed Jan. 16, 1964

2 Sheets-Sheet 1



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2 Sheets-Sheet 2

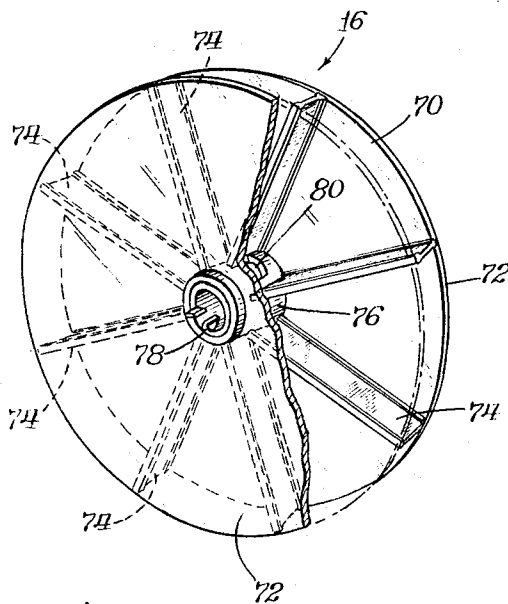


Fig. 3.

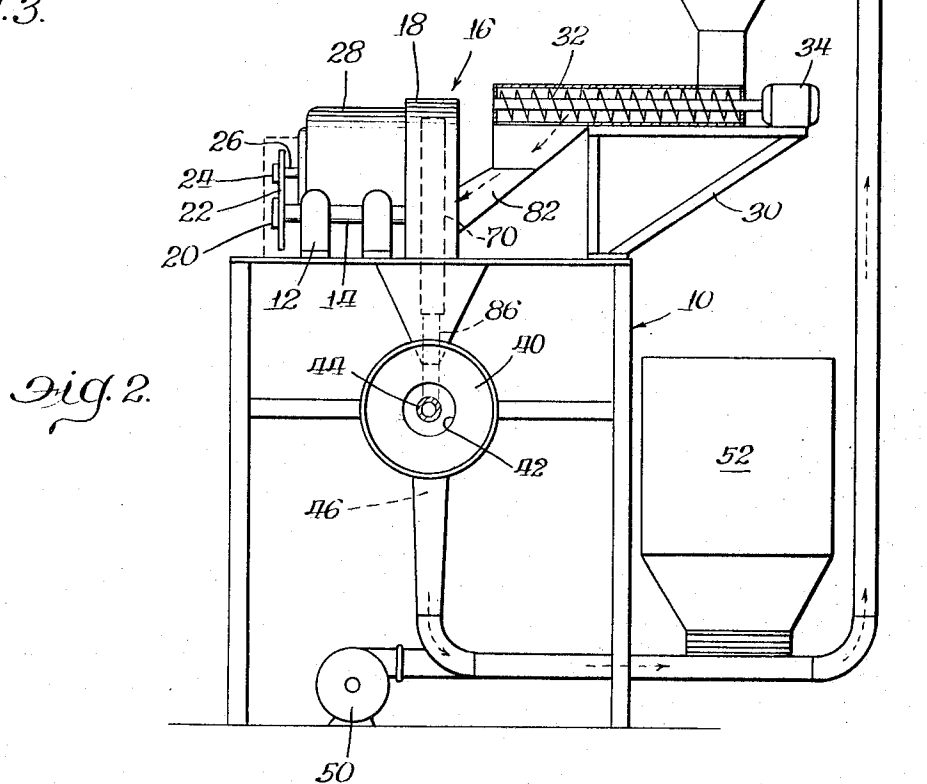


Fig. 2.

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APPARATUS FOR COATING ELONGATED OBJECTS

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This invention relates to the coating of elongated articles and particularly to an apparatus for applying powdered plastic coating material to the exterior surface of pipe or rods.

Resin type plastic coatings have been applied to pipe by various methods, including dipping, spraying, extruding, and by the fluid bed process. Applying a coating by the dipping method is not only time consuming and therefore expensive but also generally results in uneven, poorly bonded coatings. Spray coating of a resin dissolved in a suitable solvent is subject to the same disadvantages and has the additional disadvantage of excessive waste of material. The extrusion process generally results in a satisfactory coating but is limited to comparatively thick coatings of a limited number of materials, such as polyethylene and polyvinyl chloride, which lend themselves to this process. Furthermore, the equipment for extrusion is far more costly and complicated and less flexible than the equipment necessary for the practice of the present invention. The fluid bed process, wherein the coating material in powder form is suspended in a bed of moving air contained in a chamber and wherein the article to be coated is passed through the bed of air, does not lend itself to adequate quality control nor does it permit accuracy in maintaining the desired coating thickness.

The present invention has for its principal object the application of a thin, uniform, dense plastic coating to a pipe or other elongated object. The invention contemplates the application of such a coating by impelling the coating in powder form in progressively increasing thickness onto the outer surface of the object to be coated. The coating material may be either a thermo-setting type resin which is applied to a heated object so that the heat from the object effects the setting of the coating, or may be a thermo-plastic type resin wherein the heat from the object liquefies the powdered material so that a uniform coating results.

Other objects and advantages of the coating apparatus will be apparent from the following description and accompanying drawings wherein:

FIGURE 1 is a front elevational view, partially in section, of the preferred embodiment of the invention;

FIGURE 2 is a side elevational view, partially in section, of the device of FIGURE 1;

FIGURE 3 is a perspective view, with portions broken away for clarity, of a typical applying wheel which may be utilized to apply the powdered coating material; and

FIGURE 4 is a schematic view showing the flow pattern of the powdered material as it is thrown from the applying wheel onto the outer surface of a pipe.

Referring now to the drawings and particularly to FIGURES 1 and 2, it is seen that the apparatus comprises a frame 10 on top of which are mounted a pair of spaced pillow block bearings 12 through which is rotatably received a drive shaft 14.

Secured to one end of the drive shaft for rotation therewith is a powder applying means indicated generally at 16 which will be described in greater detail hereinafter. The applying means may be covered with a suitable guard 18 which is fastened to the top portion of the frame 10. Fastened to the other end of the drive shaft 14 is a

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pulley 20 interconnected by a belt 22 to a pulley 24 secured to the shaft 26 of a variable speed drive motor 28 which is secured by conventional means to the top of the frame 10.

Also secured to the top of frame 10 is a mounting bracket 30 which is arranged to carry a conventional screw or other type feeding device 32 which is driven by a low speed drive motor 34. The feeding device 32 is supplied with powdered material by a feed hopper indicated generally at 36 which will be explained in greater detail hereinafter.

The lower portion of the frame 10 is substantially enclosed to form a low pressure coating applying chamber 38. This low pressure coating chamber is best seen in FIGURE 1 and is provided at opposite ends with baffles 40 having openings 52 just large enough to receive an article 44 so that such article may be passed through the coating chamber in order to be coated. The article 44 may be advanced and rotated through the coating chamber by conventional means, various types of which are well known in the art.

Below the low pressure coating chamber is an excess material return chamber 46 which tapers downwardly into a return conduit 48 which interconnects the chamber 46 and the feed hopper 36. An impeller type blower 50 is arranged to force air into the return conduit 48 whereby the return conduit acts as a pneumatic conveyor to carry the excess material back into the feed hopper. A hopper 52 in which new unused powdered material is stored may be positioned over a portion of conduit 48 and arranged to feed powdered material in a conventional manner, such as for example by means of a star wheel, into the conduit.

The feed hopper 36 is divided by a baffle 55 into two separate chambers 56 and 58. A flapper valve 60 is arranged to be moved by means of a handle 61 selectively to close off one of the chambers 56 or 58 from the pneumatic conveyor 48, while leaving the other chamber open to receive material from the pneumatic conveyor. A second flapper valve 60a is disposed toward the lower end of the hopper and is arranged to be moved by a handle 61a to prevent flow of material from one of the chambers into the screw feed device 32 while leaving the other chamber open to accommodate flow of material therefrom into the feed device 32. Thus, while the coating arrangement is in operation, the flapper valves may be positioned, for example, as shown in FIGURE 1 so that material is free to flow from chamber 56 into the feed device 32 while flapper valve 60 closes off the upper portion of chamber 56 and prevents communication between this chamber and the pneumatic conveyor 48. Meanwhile, the mixture of new material and excess coating material which is being returned to the feed hopper 36 is fed into chamber 58 which is thus being filled while the adjacent chamber 56 is being emptied. When the chamber 56 has been emptied of its material, the positions of the flapper valves 60 and 60a are reversed whereupon the powdered material contained in chamber 58 will be free to flow into the feed device 32 while the chamber 56 is, in turn, being refilled with material from the pneumatic conveyor 48. The reason for this dual chamber and flapper valve arrangement in the feed hopper is that, without such an arrangement, the flow of air from the pneumatic conveyor tends to disrupt uniform flow from the feed hopper. However, utilization of the flapper valve enables the chamber from which material is being fed to be shut off from the disturbing influence of the incoming air. The air vent 62 is provided to permit the air coming into the feed hopper to escape into the atmosphere, and the filter is utilized to contain the powdered material in the hopper. It should be noted that the flapper valves could easily be operated automatically by conventional means if so desired.

The applying wheel 16, as best seen in FIGURE 3, in its preferred form comprises a rotating wheel 70 formed of plates 72 which extend downwardly through the top of frame 10 so as to communicate with the coating chamber 38. The plates are held in spaced relationship with each other and support between them a plurality of radially extending blades 74. The inner edges of the blades 74 wipe over the outer periphery of a stationary hub 76 internally of which is an impeller 78 which rotates with the wheel 70. The impeller 78 is hollow and communicates, by means of a chute 82, with the feed device 32. The stationary hub 76 is provided with an opening 80 affording communication between the impeller 78 and the spaces formed by the plates and adjacent blades. As the wheel is rotated and material is fed into the impeller 78, such material is thrown through the opening 80, is picked up at this point by the inner ends of successive blades, and is gradually accelerated as it moves to the periphery of the wheel. This action results in a fan-shaped material pattern having considerable extent in a direction axially of the object being coated, substantially as shown at 86 in FIGURE 4, whereby a coating 88 is progressively built up on the outer surface of, for example, a pipe 44. Preferably the wheel is rotated at a speed of at least approximately 1000 r.p.m. whereby the powdered material is impelled at high velocity onto the pipe which is being rotated and advanced through the applying chamber. Though the above described wheel provides the greatest amount of control, other types of centrifugal applying wheels may be utilized, provided that they produce a flow pattern having considerable extent in a direction axially of the object being coated.

Immediately on contacting the pipe which has been heated, as mentioned heretofore, the powdered material, if of the thermosetting type, begins to set and the setting action continues as the layer of coating is progressively built up. Therefore, by the time the pipe emerges from the coating chamber, it may be handled without damaging the coating. However, in order to operate the device at the highest possible speed, and to ensure complete hardening of the material prior to handling, a cold water quench is preferably provided at the discharge end of the coating chamber. The quench is shown schematically at 75 in FIG. 1. The preferred temperature of the pipe at the time the coating is applied is in the range of approximately 300° to 375° F. The preferred thickness of the coating which is applied to the pipe is in the approximate range of from 5 to 30 mils. If an attempt is made to apply a coating of a thickness substantially greater than 30 mils., complete curing and setting of the coating may not result unless the pipe has previously been heated to a temperature in excess of 375° F. Such heating is undesirable because the increased temperature approaches the tempering range of the metal of which the pipe is composed and this may result in poor physical properties in the metal.

In the event a thermo-plastic resin is utilized, the heat from the pipe, which once again is preferably heated to a temperature in the range of approximately 300° to 375° F., plasticizes the powdered resin to provide a uniform coating. The resin is hardened by the quench 75 as the pipe emerges from the coating chamber.

The coating material may be any thermo-setting or thermo-plastic resin which can be provided in powder form having an approximate fineness of 300 mesh Tyler and which, if thermosetting, will thermally set at a temperature not in excess of approximately 375° F., or which, if thermo-plastic, will plasticize at a temperature not in excess of approximately 375° F. Plastics meeting these requirements may be selected from the vinyls, polymers, or epoxys.

An example of a thermo-plastic resin which has been successfully utilized by the disclosed apparatus and method is polypropylene. A specific example of a thermo-setting resin which has been successfully utilized is epoxy resin.

The above described arrangement provides a hard, dense, uniform coating on elongated metal articles, the consistency and quality of which is difficult to equal by other applying methods.

It is believed that the superior quality of the coating results from the multi-layer build-up pattern whereby the curing and setting of the resin coating is begun before the final thickness is reached and also from the high velocity impingement of the powder against the heated pipe. Furthermore, the equipment of the disclosed invention is far simpler and much less costly to fabricate and maintain than other plastic coating arrangements wherein the quality and thickness of the coating can be successfully controlled.

I claim:

1. An arrangement for applying a powdered resin coating material to a simultaneously rotating and advancing heated elongated object, comprising a coating chamber, an applying wheel communicating with said chamber, said wheel having a plurality of radially extending blades; means for rotating said wheel; means for feeding said powdered material to the radially inner portion of successive blades whereby said material is projected against said object and reacted upon the heat of said object to form a uniform plastic coating thereon and wherein said powdered material feeding means includes a hopper divided into two compartments, means for conveying excess material into said two compartments from said chamber, a first valve means in said feed hopper for accommodating flow of powdered material to one of said compartments while shutting off flow of material to the other compartment; and a second valve means in said hopper for preventing said one compartment from discharging its powdered material contents to said applying wheel while said feeding means is filling said one compartment.

2. An arrangement for applying a powdered resin coating material to a rotary advancing elongated object, comprising: a substantially enclosed coating chamber; a material applying wheel communicating with said chamber; said wheel having a plurality of radially extending blades, means for rotating said wheel; a feed hopper divided into two compartments; conveyor means for receiving powdered coating material from one of said compartments and delivering said material to the radially inner portion of successive blades as they pass a predetermined point whereby said material is projected in a fan-shaped pattern onto the surface of said object; a pneumatic conveyor interconnecting said coating chamber and said hopper for conveying excess coating material from said chamber to said hopper; a first valve means in said feed hopper for accommodating flow of powdered material to one of said compartments while shutting off flow of material to the other compartment; and a second valve means in said hopper for preventing said one compartment from discharging its powdered material contents to said applying wheel while said feeding means is filling said one compartment; and means for introducing new coating material into the stream of excess coating material in said pneumatic conveyor.

3. An arrangement for applying a powdered resin coating material to a rotating advancing elongated object, comprising: a substantially enclosed coating chamber; a material applying wheel communicating with said chamber, means for rotating said wheel; a feed hopper divided into two compartments; conveyor means for receiving powdered coating material from one of said compartments and delivering said material in controllable amounts to said applying wheel whereby said material is projected onto the surface of said object; a pneumatic conveyor interconnecting said coating chamber and said hopper for conveying excess coating material from said chamber to said hopper; a first valve means in said feed hopper for accommodating flow of powdered material to one of said compartments while shutting off flow of material to the other compartments; and a second valve

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means in said hopper for preventing said one compartment from discharging its powdered material contents to said applying wheel while said feeding means is filling said one compartment; and means for introducing new coating material into the stream of excess coating material in said pneumatic conveyor.

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References Cited by the Examiner

UNITED STATES PATENTS

45,974	1/1865	Chambers	118—308 X	10
1,419,169	6/1922	Overbury	118—311	
2,102,738	12/1937	Perkins	239—223 X	

6

2,626,221	1/1953	Elliott	117—21	
2,688,563	9/1954	Kieffer	117—21	
2,710,588	6/1955	Parry et al.	118—308 X	
2,770,212	11/1956	Marantz	118—312 X	
2,943,599	7/1960	Heck	118—308	
3,085,548	4/1963	Sheehan	118—308	
3,208,868	9/1965	Strobel et al.	118—312 X	

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