Jan. 13, 1959 W. M. KNAIN 2,868,162

ENDLESS BELT PAINT APPLICATOR

Filed May 1, 1957 3 Sheets-Sheet 1

Fig. 1.

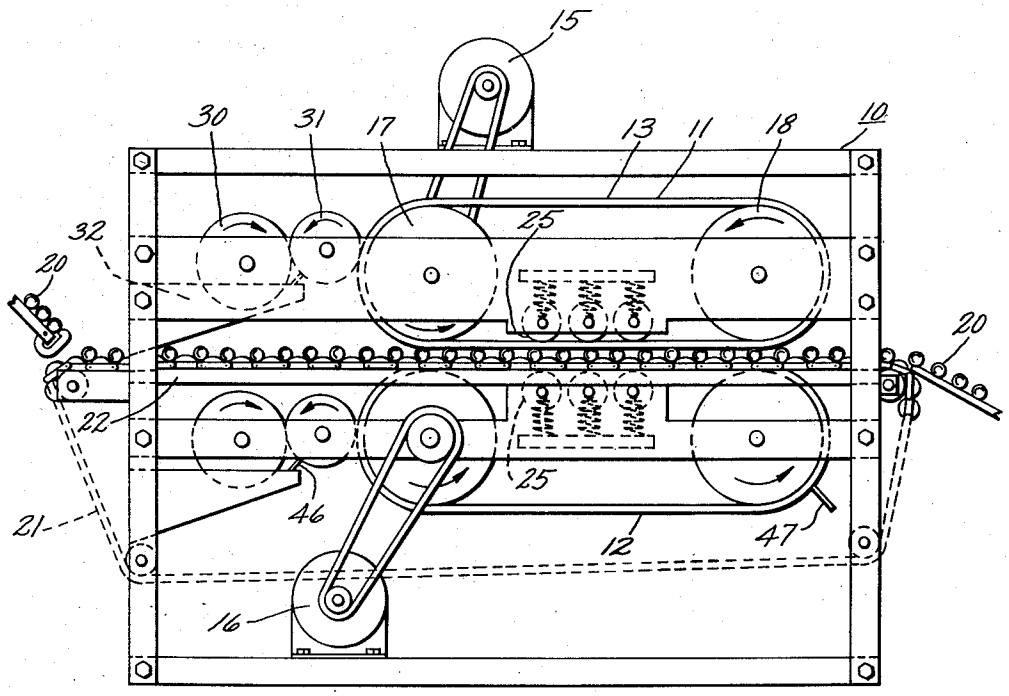
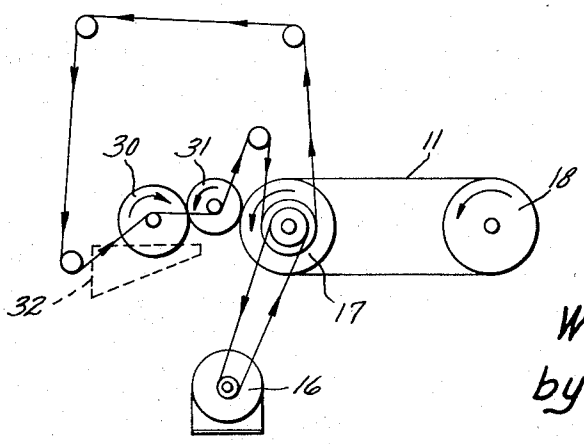


Fig. 2.



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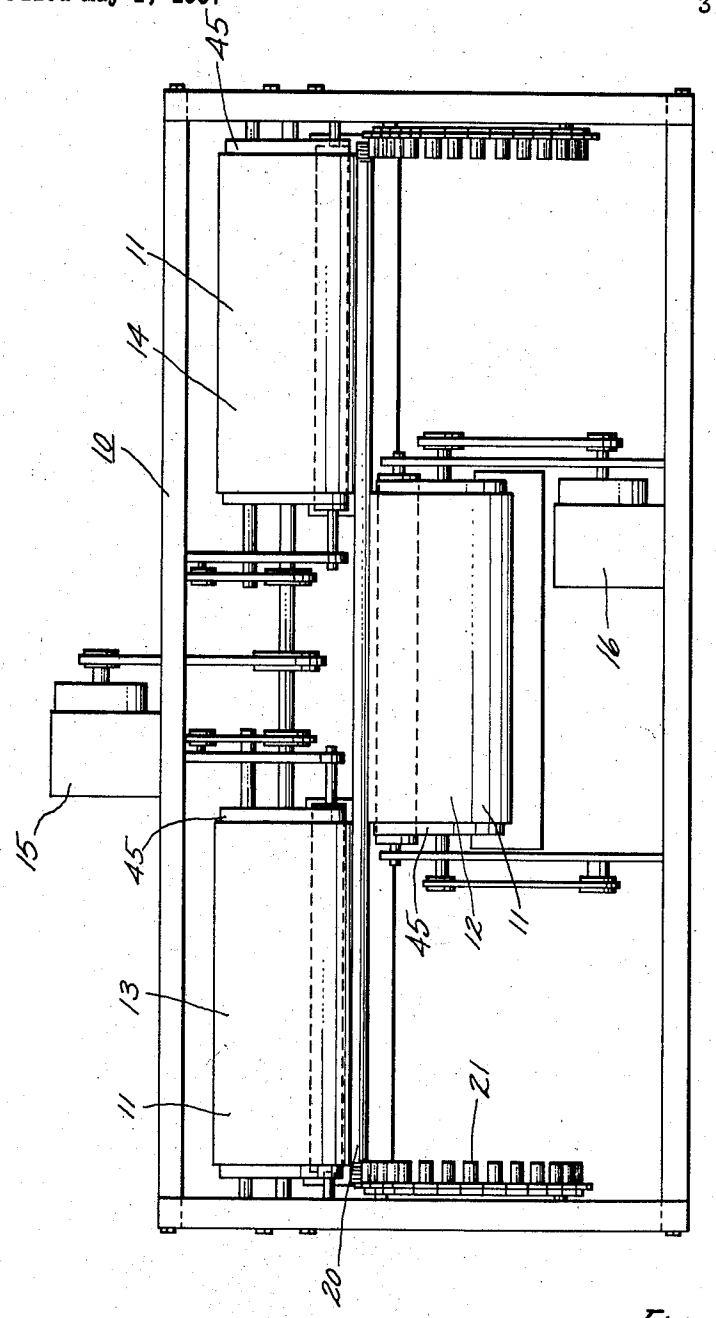


Fig. 3.

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FIG. 4.

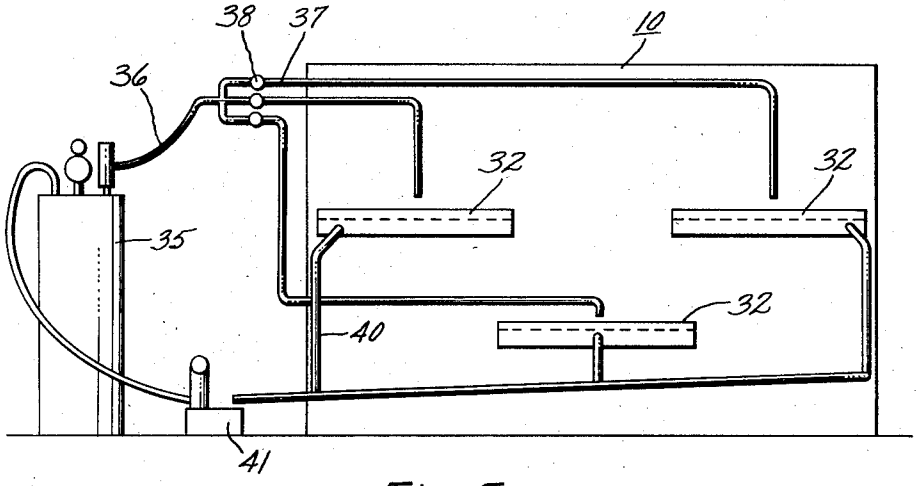


FIG. 5.

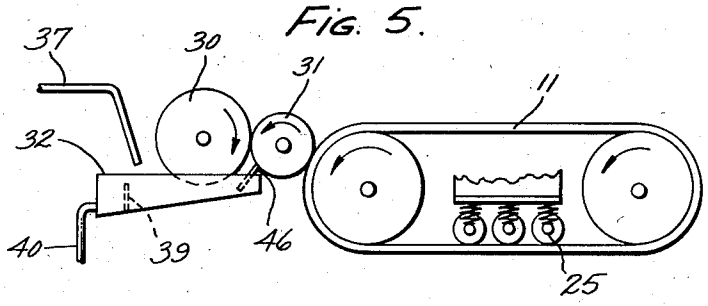
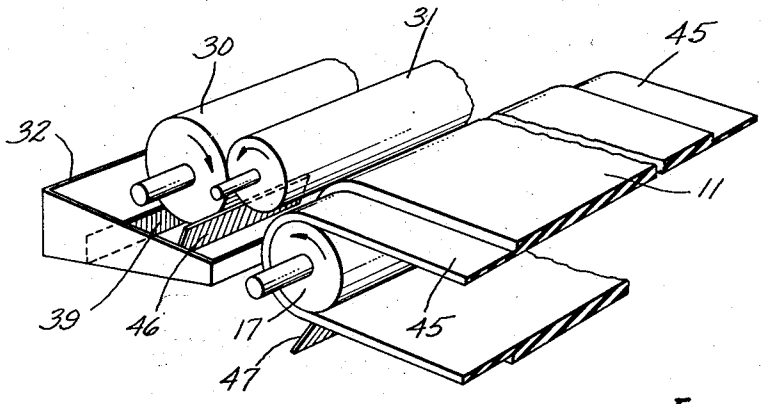


FIG. 6.



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United States Patent Office 2,868,162 Patented Jan. 13, 1959

2,868,162

ENDLESS BELT PAINT APPLICATOR

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Application May 1, 1957, Serial No. 656,399

6 Claims. (Cl. 118—219)

The present invention relates to a machine having endless resilient belts for applying a painted coating to long, cylindrical work such as electrical conduit or pipe.

There are two common methods of coating the outside surface of electrical conduit with a paint of lacquer, namely, by a dipping method or by spraying. Dipping the conduit into the paint is the most unsatisfactory because the conduit must be raised to a vertical position with an end coupling attached in order to provide a gripping point. It is undesirable to hoist the conduit to a vertical position since all of the other processing of the conduit is accomplished in a horizontal position, which results in a smooth flow of material through the factory with the least amount of handling. A second important disadvantage is that the paint also coats the inside of the conduit which is both unnecessary and undesirable. Electrical conduit must have a hard, rust inhibiting, and low friction inner coating in order to facilitate the pulling of the wires through the conduit. The type of paint commonly used on the outside of the conduit is unsatisfactory for use on the inner surface.

The second method, which was formerly used to a great extent, is the electrostatic spraying method where the conduit was sprayed in the horizontal position as the conduit rolled transversely in close side-by-side relation through the machine. Problems met with this spraying method are enumerated below:

(1) Overspray of paint to the conveyor mechanism resulted in the excessive loss of the paint. Also, it necessitated the thorough cleaning of the components which was difficult and time consuming. Failure to clean the machine periodically resulted in poor operating efficiency.

(2) The existence of a fire hazard due to the high voltage—80,000 to 90,000 volts—for successful electrostatic performance. Also, it is extremely difficult to observe the process due to the high voltage. Hence, it has been necessary to shut the machine down in order to examine its components carefully.

(3) Difficulty in securing uniform coverage from end to end; i. e., relatively damp and wet areas existed in different places along the conduit. Several lengths of conduit before and after any gaps in the flow of the conduit through the spray area received an excess of paint and had to be rejected. The inability to start and stop the flow of paint gradually was a problem that contributed to the excessive loss of the paint and the wet areas along the conduit.

The principal object of this invention is to utilize an endless belt type of paint applicator for coating long, cylindrical work such as electrical conduit.

A further object of this invention is to provide an endless belt paint coating machine with at least three belt units, there being one at the center and the others at the ends to provide a uniform coating of paint on the conduit.

A further object of this invention is to provide an endless belt paint coating machine with proper control measures to eliminate the accumulation of the paint at the edges of the belt.

A still further object of this invention is to provide a mechanism for controlling the thickness of the paint being applied to the belts of an endless belt paint coating machine.

The present invention relates to a machine for coating the outside of long, cylindrical work such as electrical conduit with a suitable painted surface. The machine in the preferred embodiment comprises three endless belt units, one being located at the center of the work while the other two are at each end of the work. The conduit is fed into the machine in a horizontal plane with the conduit moving transversely in close side-by-side relation. The center belt is below the work while the two end belts are above the work with the conduit moving therebetween. The belts all turn in the same direction but the center belt travels at a speed that is different from the other belts to give the conduit a rolling action with relation to the belts.

There are two rolls provided with each belt unit to apply the paint to the belt during the operation of the machine. The first roll is a paint pickup roll that is partly immersed in a tray or pan that contains a supply of paint. This roll accumulates paint on its outer surface and transfers it to the second roll which is a film thickness roll. This second roll is in rolling engagement with the first roll as well as with the belt. This second roll travels in the same direction as the belt and in the opposite direction from the first paint pickup roll. The paint that is applied to the belt but is not deposited on the conduit is first wiped off the belt by the film thickness roll just before a fresh coat is applied to the belt.

My invention will be better understood from the following description taken in connection with the accompanying drawings and its scope will be pointed out in the appended claims.

Figure 1 is a front elevational view of an endless belt paint coating machine embodying my invention.

Figure 2 is a schematic drawing showing the chain drive mechanism for controlling the direction and speed of movement of one of the belts and its paint applying rolls.

Figure 3 is a left side elevational view of the machine of Figure 1.

Figure 4 is a flow diagram of the paint supply system that feeds the three endless belt units.

Figure 5 is a diagrammatic showing of the method of transferring the paint from the paint pan to the endless belt.

Figure 6 is an isometric view of most of the elements of Figure 5 showing the particular character of the undercut edges of the belt.

Referring in detail to the drawing and in particular to Figure 1, 10 represents the structural framework of the machine. This machine is rather massive in appearance and utilizes heavy I beams and thick metal plates which are joined together to support the endless belt units 11. Looking at the right side view of Figure 3, it will be clear that there are three belt units 11. The central unit 12 is arranged below the work while the two remaining units 13 and 14 are disposed at each end and above the work. The two upper units 13 and 14 are driven by a single variable speed hydraulic drive 15, while the lower unit 12 has a separate variable speed hydraulic drive 16. The entire upper and lower belt units are independently mounted so that they may be raised and lowered to handle work of different diameters. This is necessary since the guide means that supports the work through the machine is fixed relative to the framework of the machine.

Going back to Figure 1, the two belt units which are shown in this view are the lower belt unit 12 and the upper belt unit 14. Each belt is made of soft rubber material combined with a reinforcing fabric, and is

assembled by stretching it between two rollers 17 and 18. The rollers 17 are the driven rollers while rollers 18 are merely idlers.

The front view of the machine of Figure 1 shows a long series of closely spaced units of electrical conduit 20, in end view, as they move through the machine from left to right. Previously, the conduit has been threaded at each end, pickled, the outer surface has been shot-blasted, a zinc coating has been applied to the outer surface, and the inner surface has been covered with a paint. The conduit is in this condition as it approaches the paint applying machine of this invention. The purpose of this machine is to roll a continuous outer coating of paint onto the conduit, but to leave the threaded ends of the conduit free of paint. Then the conduit is passed through an oven where the inner and outer coats of paint are baked to permanently set the paint. After a cooling operation, the conduit is ready for bundling and shipment to the customer.

Turning back to a consideration of the machine of Figure 1, an endless conveyor chain 21 is arranged in a vertical plane at the front and one at the back of the machine for supporting each threaded end of the conduit between adjacent links of the chain. A suitable indexing means (not shown) feeds the conduit from the left onto the parallel chains 21. The upper run of each chain 21 includes a rigid supporting guide way 22 which prevents the chains from sagging as they convey the conduit through the machine. One particular setup for our one inch conduit is given by way of example to show the relationship of the speed of the belts and of the conduit as it moves through the machine. The conveyor chain travels in a clockwise direction from left to right at a speed of approximately 3.3 feet per minute. All of the belts travel in a counterclockwise direction, but the speed of the upper belts is approximately 32 feet per minute while the speed of the lower belt is approximately 26 feet per minute. As the diameter of the work changes from one inch to four inches, these relative speeds would also change so that the same surface area of the conduits would be coated during the pass between the belts. On the larger sizes the speed of the conveyor would have to be reduced so the conduit would make the necessary revolutions during its run through the machine. The differential in speeds of the upper and lower belts may be easily adjusted to vary the speed of rotation of the conduit.

Conduit is not always shipped from the steel mills in a perfectly straight condition; however, this machine is designed to handle such bent conduit. This is true because the belts are alternately spaced and they provide a friction drive which is exerted from both the bottom and top of the work. The application of the forces to both the bottom and top of the work tends to increase the torque on the conduit so that it rolls between the belts and accumulates a uniform coating of paint. A grouping of spring loaded pressure rollers 25 are combined with each belt unit 11 to hold the conduit engaging surfaces of the belts against the conduit to afford substantially uniform rotation of the conduit as it passes through the machine.

Now that I have discussed the manner in which the paint is applied to the conduit by means of the three belt units, consideration will be given to the problem of supplying the paint to the belts. Each belt unit 11 is acted upon by two rolls 30 and 31. Since these rolls are identical for each belt unit, only one set of them will be discussed. Roll 30 is a paint pickup roll with its lower end immersed in a paint pan or trough 32. As the roll 30 turns clockwise, its outer surface is dripping wet with paint as it rises out of the pan 32. The second roll, roll 31, is a film thickness roll that is driven in the counterclockwise direction and bears against the roll 30. This film thickness roll also bears against the belt as it travels over the driven roller 17. The pivotal axis of the roll 31 is slightly above the plane that contains the pivotal axes of the driven roller 17 and the paint pickup roll 30.

Attention is now directed to Figures 4–6 for a more detailed discussion of the paint supply system for this machine. The framework 10 of the machine is shown as a blank rectangle, while the three paint pans 32 are shown in their proper relative positions for each of the three belt units 11. This Figure 4 is taken as a left side view of the machine shown in Figure 1. A tank of paint is shown at 35. This tank includes an agitator (not shown) for continuously stirring the paint to prevent the settlement of the pigment. The paint is pumped through a line 36 to three secondary lines 37, which are controlled by the hand throttle valves 38. Now looking at Figure 5, the paint pan 32 is shown divided into two sections by a partition or weir 39. This weir controls the depth of the paint contacting the pickup roll 30. If the paint rises above a predetermined amount, it will flow over the weir 39 and into the return line 40 which discharges into a sump 41 that returns the paint to the first tank 35. Hence, it will be understood that the paint is constantly circulating from the tank 35 to all three paint pans 32 and then back to the sump 41 to be returned to the tank 35. It may also be desirable to have the secondary paint lines 37 deposit the paint directly into the trough or valley formed between the rolls 30 and 31, eliminating thereby the need for weir 39 and requiring closer control of the throttle valves 38. Also sump 41 may be eliminated by changing the elevation of paint tank 35 so that the return lines 40 discharge directly into the tank 35.

One difficulty experienced in testing this machine is that excess paint tends to flow towards the sides of the belts and accumulate there, as well as to run over the edges and contaminate the back side of the belt. This presents two difficulties, namely, the application of an excess of paint on the conduit where the edges of the belts engage the conduit and, secondly, the degradation of the belt material due to the presence of paint on the back side of the belt. This results in the loss of the basic flat belt form at the edges which is detrimental to belt life. This problem has been solved by undercutting the edges of the belts as at 45 and being careful not to apply any paint to these undercut portions. Scraper bars 46 are mounted in the paint pans 32 to bear against the side edges of the film thickness roll 31 to insure that no paint is transferred from this roll to the undercut portions 45 of the belt or onto the working surface of the belt to within a distance of approximately 3/8" of the undercut portions. The scraper bars 46 are adjustable so that this 3/8" dimension may be varied to secure optimum control of the build-up of excess paint at the edge of the working surface of the belt. The paint on the belt naturally tends to move toward the side edges but additional scraper bars 47 are used to remove any paint that might have been deposited in the undercut portions 45 of the belts. In other words, the side edges of the belts are given undercut extensions which are used to carry off the excess paint that might build up on the edges. Hence, the working surface of the belt is that part of the belt between the undercut portions 45.

Having described above my invention of a novel machine and method of utilizing endless belts for applying paint to long, cylindrical work such as electrical conduit, it will be readily understood by those skilled in this art that I have produced a simple and inexpensive method of applying paint so as to avoid dipping or spraying the work. Suitable cleaning facilities have been included in the basic machine so that it may run for long periods before it need be shut down and thoroughly cleaned in order to obtain its highest efficiency. There is very little loss of paint compared with the two alternate methods of applying the paint to this type of work.

Modifications of my invention will occur to those skilled in this art, and it is to be understood, therefore, that this invention is not limited to the particular em-

bodiments disclosed, but that it is intended to cover all modifications which are within the true spirit and scope of this invention.

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

1. An endless belt paint coating machine for long, cylindrical work pieces which are transversely fed into the machine in close side-by-side relation, the opposite ends of the work pieces being supported on a pair of endless conveyors, a rigid supporting guide way backing up a segment of each conveyor so the weight of the work pieces moving through the machine will be carried by the guide ways, the machine comprising three endless coating belts, each belt being stretched on a pair of rollers, one of said belts being arranged at the center of the machine for engaging the work pieces while the other two of said belts are disposed on the opposite side of the work pieces with one belt at each end, the two end belts slightly overlapping the edges of the center belt to obtain complete paint coverage of the unsupported length of the work pieces, all of the belts being driven in the same direction with the center belt moving at a different speed from the two side belts, the belts bearing against the work pieces and causing them to revolve whereby paint applied to the outer surface of the belts will adhere to the revolving work pieces to form a continuous coating.

2. An endless belt paint coating machine for long, cylindrical work pieces which are transversely fed into the machine in close side-by-side relation, the opposite ends of the work pieces being supported on a parallel pair of endless conveyors that are each disposed in a vertical plane and have a horizontal segment for carrying the work pieces through the machine, a rigid guide way underlying the horizontal segment of each conveyor so the weight of the work pieces moving through the machine will be carried by the guide ways, the machine comprising at least three endless coating belts to engage the work pieces simultaneously, each belt being stretched on a pair of rollers, the belts being disposed above and below the work pieces with the work moving in a horizontal plane between the belts, one belt engaging the central portion of the work pieces while the other two belts are on the opposite side of the work pieces with one belt at each end thereof, the two end belts slightly overlapping the side edges of the center belt to obtain complete paint coverage of the unsupported length of the work pieces all of the belts being driven to turn in the same direction with the center belt moving at a different speed from the two end belts so that the cylindrical work pieces will revolve at a speed that corresponds to the speed of delivery of the work to the machine, and means for applying paint to the belts, said paint being transferred to the work pieces.

3. A paint coating machine as recited in claim 2 wherein the outer surface of each belt is undercut at the edges thereof, and paint applied to each belt by means of a pair of rolls, the first roll being a paint pickup roll which dips into a supply of paint and carries some of it on its outer surface, the second roll being a film thickness roll and in rolling engagement with the pickup roll and the belt, the first roll turning in the opposite direction from the belt while the second roll travels in the same direction, said paint being applied only to the surface of the belts between the undercut edges so that the paint will not accumulate at the edges.

4. A paint coating machine for long, cylindrical work pieces which are fed transversely into the machine in close side-by-side relation comprising at least three endless coating belts, there being one of said belts on one side of the work and the other two of said belts on the opposite side, the said one belt being at the center while the other two said belts are at each end of the work, each belt being of resilient material and stretched over a pair of rollers, the portion of the belt between the two rollers and in engagement with the work being acted upon by a series of spring biased roller members for exerting pressure on the work, and means for rolling paint onto the outer surface of the belts so that said paint will be transferred to the work as the belts turn in the same direction to rotate the work pieces as they move through the machine.

5. A paint coating machine for long, cylindrical work pieces comprising at least three endless belts of resilient material, each belt being stretched between a pair of rollers, one of which is driven, there being one belt operating beneath the work pieces while the two remaining belts are above the work pieces and at each end thereof, the work pieces moving transversely through the machine in close side-by-side relation, the ends of the work pieces being supported by a pair of endless chains which carry the work pieces into the machine and support the said work pieces as the belts are caused to roll across the said work pieces and rotate them, means for introducing paint to the outer surface of said belts, the said paint being applied to each belt by a first and second pair of rolls, the first roll being a paint pickup roll that is caused to revolve in a container of paint so that the paint will be deposited on its outer surface, the second roll being a film thickness roll in engagement with the first roll but turning in the opposite direction, the said second roll collecting only a small proportion of the paint of the first roll thereby causing an accumulation of paint in the valley formed by the two rolls, the second roll bearing against the outer surface of an adjacent belt and turning in the same direction so that the film thickness roll will first scrape the belt before it applies a predetermined thickness of paint to the belt.

6. A paint coating machine as recited in claim 5 wherein the two paint applying rolls are disposed adjacent the driven roller of the belt and the two rolls are adjustable with relation to each other and with relation to the belt to provide a controlled thickness of the paint on the belt.

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