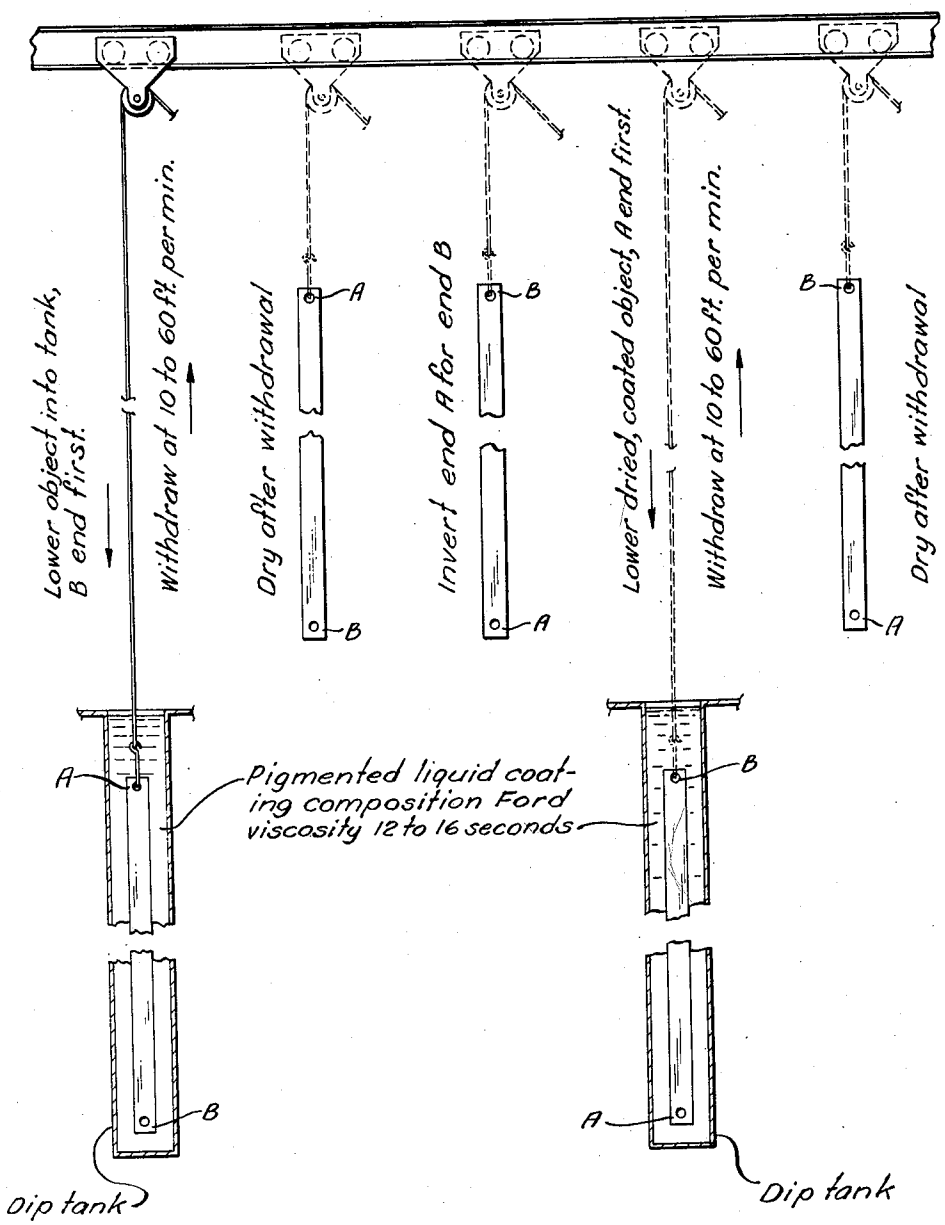
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COATING METAL ARTICLES

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COATING METAL ARTICLES

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The invention relates to methods of providing a pigmented coating, such as a paint coating, on metal objects which are relatively long compared to their width and thickness and have a uniform cross section from end to end, e.g. extrudes.

In the metal industries, the problem frequently arises of providing a uniform coating of paint or the like on long articles especially those produced by the extrusion method. As is well known, the extrusion process permits making metal objects of almost any length in a wide variety of cross-sectional shapes which are uniform from end to end. Oftentimes the shape of the cross section of an extrude involves great complexity of form making it difficult, if not impossible, to coat uniformly with paint, or paint-like materials such as an enamel, by any conventionally available method including dipping.

While dipping is the preferred conventionally available method of applying a paint coating to long objects as extrudes, it is not effective to produce a coating of uniform thickness economically and quickly. Accordingly, it is the principal object of the invention to provide an improved method of applying a paint or like pigmented coating material to metal objects having a length which is relatively great compared to their girth. A particular object is to provide an improved method of the character indicated which can be executed rapidly, produces a coating of uniform thickness, and is economical of coating material. Other objects and advantages will appear as the description of the invention proceeds, reference being had to the accompanying drawing which illustrates schematically the sequence of steps of the method.

The invention is predicated upon the discovery that by adjusting the viscosity of the liquid pigmented coating material within certain critical limits, hereinafter set forth, long objects of uniform cross section can be coated very rapidly and uniformly by an endwise dip in one direction in the coating material followed by a rapid withdrawal of the vertically disposed object, at least partial drying, and then another endwise dip in the opposite direction followed by a rapid withdrawal of the vertically disposed object from the coating material, the rate of withdrawal in each direction being critical and related to the viscosity of the coating material as hereinafter disclosed. Thus by a proper control of the viscosity of the pigmented coating material, and by a rapid rate of endwise withdrawal of the object (that is withdrawal with the longitudinal axis of the object vertical) from the coating material, the object becomes coated with a relatively thin film of the coating material, the thickness of the coating tapering slightly from the lower end of the object where the film is the thickest to the upper end where the film is the thinnest. After allowing a sufficient time for the film produced by the first endwise dip to set, the so-coated object is turned end for end and given a second dip in the coating material and again similarly withdrawn rapidly in the vertical position. The second endwise dip puts another film, somewhat thicker than the first, of the coating material on the object, the film

as before tapering in thickness from the end last leaving the coating material (bottom end in second withdrawal), where the second film is the thickest, to the opposite end where the second film is the thinnest. Since the two films have substantially the same taper but in opposite directions, the resulting double film makes a single coating of uniform thickness from one end of the object to the other. Since the rate at which the coating material can be applied is limited only by the rate at which the article can be introduced endwise into a bath of the coating material, the rate of withdrawal, and the setting time of the coating material between dips, uniform coatings can be produced with extreme rapidity.

In applying the method, various coating materials may be used which are recognized in the trade as paints, enamels, primers, and the like, comprising a drying liquid vehicle and a pigment in suspension in the vehicle. The term pigmented liquid coating material is used herein and in the appended claims to mean any coating material of the foregoing character. In practicing the invention, conventional liquid pigmented coating materials may be used but require appropriate thinning so that a particular viscosity is achieved within the operating temperature of the method which is between about 55° and 110° F.

In defining the viscosity which the liquid pigmented coating material should have, for use in accordance with the invention, reference is had to the "Standard Method of Test for Viscosity of Paints, Varnishes, and Lacquers by Ford Viscosity Cup" as set forth under ASTM designation: D1200–54 adopted, 1954, using a No. 4 Ford cup at 80° F. In accordance with the foregoing test, the preferred viscosity of the coating material is about 14 seconds. However, good results may be had with viscosities as high as 16 and as low as 12 seconds.

The bath of coating material may be adjusted as to viscosity usually by the addition of a suitable thinner when the conventional pigmented coating materials are too viscous for use in the invention or by bodying with a suitable bodying agent if the coating material is too thin. Suitable thinners are organic liquids which are of low viscosity and compatible with the coating material. Examples of thinners are toluene, methyl isobutyl ketone, methanol, ethanol, acetone.

As aforesaid, the rate of vertical endwise withdrawal of the object from the pigmented coating material is critical and may range from a minimum of 10 feet per minute to as much as 60 feet per minute with temperatures of 55° to 110° F. A preferred operating temperature for the coating material is 70° to 80° F. using a withdrawal rate of 30 to 40 feet per minute and a viscosity of No. 4 Ford viscosity cup of 14 seconds.

The following example is illustrative of the practice of the invention as applied to coating metal extrudes with a primer.

Example

A commercial primer, comprising 35 percent solids, a vinyl butyral resin, and zinc chromate pigment, was diluted with from about 175 parts of thinner per 100 parts by volume of primer. The thinner comprised toluene, methyl isobutyl ketone, methanol, and acetone and reduced the viscosity, as measured by a No. 4 Ford cup, in accordance with the aforementioned viscosity test, to about 14 seconds at 80° F. The so-thinned primer was then ready for use. An extrude about 9 feet long and having a uniform cross section of complex profile from end to end was hung from one end with gripping jaws attached to a cable of a hoist. The extrude was lowered vertically by the hoist into a vertically disposed cylindrical tank, containing the aforesaid diluted primer at 75° F., to a depth sufficient to completely immerse the extrude in the primer except for a small portion of the

extreme upper end where the gripping jaws were secured to the extrude. The rate of immersion (not critical) of the extrude in the primer was about 50 feet per minute. The immersed extrude was then withdrawn at the rate of 33 feet per minute (in the critical range). The so-withdrawn extrude thereby had acquired a thin coating of the primer. The so-coated extrude was set aside in air for 40 minutes to dry. The so-treated extrude was then turned end for end and the gripping jaws were removed and attached to the opposite end. The extrude was then again lowered vertically into the primer as before but in the opposite direction at the rate of about 50 feet per minute (not critical) and then immediately withdrawn from the primer at the rate of 33 feet per minute (in the critical range). The resulting coated extrude was then set aside in air for 20 minutes to dry after which it was oven baked at 275° to 300° F. for 20 minutes. After baking the coated extrude was found to have a primer coating of substantially uniform thickness of 0.5 mil from end to end along the portion between the extreme ends where the gripping jaws were secured.

The foregoing example is illustrative of the uniformity and speed of the coating method in spite of the double dip or immersion procedure. Speed is attained because the rate of immersion is not critical although fast, being limited only by one's ability to get the work into the coating bath and obtain contact between the work and the coating material and by the time required for withdrawal which, in accordance with the invention, is rapid being critically correlated with the viscosity of the coating bath, and by the time required between the first withdrawal and second immersion to set the first coat sufficiently to prevent it from being disturbed during the second immersion.

The actual over-all time of coating an article, in accordance with the invention, except for the time allowed for drying which, of course, varies with the nature of the pigmented coating material used, is exceedingly short as already indicated mainly because the withdrawal rate is from 10 to 60 times faster than the rate of withdrawal in conventional dip coating operations in which the withdrawal rate is less than 1 foot per minute. The method, because of its speed, has the further advantage of requiring fewer tanks or vessels for holding the coating material, and the required floor space for the operation is greatly decreased for the same output of coated articles.

Although the invention has been described more particularly in connection with providing a uniform pigmented coating on metal extrudes, it is to be understood that the method is not limited to coating extrudes. It is manifest that any other metal articles which are straight, relatively long, and of uniform cross section, such as tubes, rods, bars, strips, bands, structural shapes, including angles, T sections, H sections, Z sections, moldings, and the like, may be coated by the method.

I claim:

1. The method of coating a straight metal object having a greater length than girth and of uniform cross section from end to end with a pigmented liquid coating material which comprises lowering the vertically disposed object endwise into a bath of pigmented liquid coating material so as to totally immerse the same while in the vertically disposed position, withdrawing the so vertically disposed object endwise from the coating material at a rate between 10 and 60 feet per minute, drying the coated object while so vertically disposed so as to set thereon the film of coating material, inverting the so filmed object end for end lowering the vertically disposed so inverted object endwise into the coating material so as to again totally immerse the same while in the vertically disposed position, again withdrawing the so vertically disposed object endwise from the coating material at a rate between 10 and 60 feet per minute, and then drying the resulting coated object while held vertically disposed, the pigmented liquid coating composition having a viscosity at 80° F. of from 12 to 16 seconds as measured by the Ford viscosity cup No. 4, and a temperature of 55° to 110° F.

2. The method according to claim 1 in which the pigmented liquid coating material is a paint.

3. The method according to claim 1 in which the pigmented liquid coating material contains zinc chromate pigment.

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