Jan. 27, 1953 O. C. STAHL 2,626,426

COATING METHOD AND APPARATUS FOR PLASTIC TUBING AND THE LIKE

Filed April 29, 1950 3 Sheets-Sheet 1

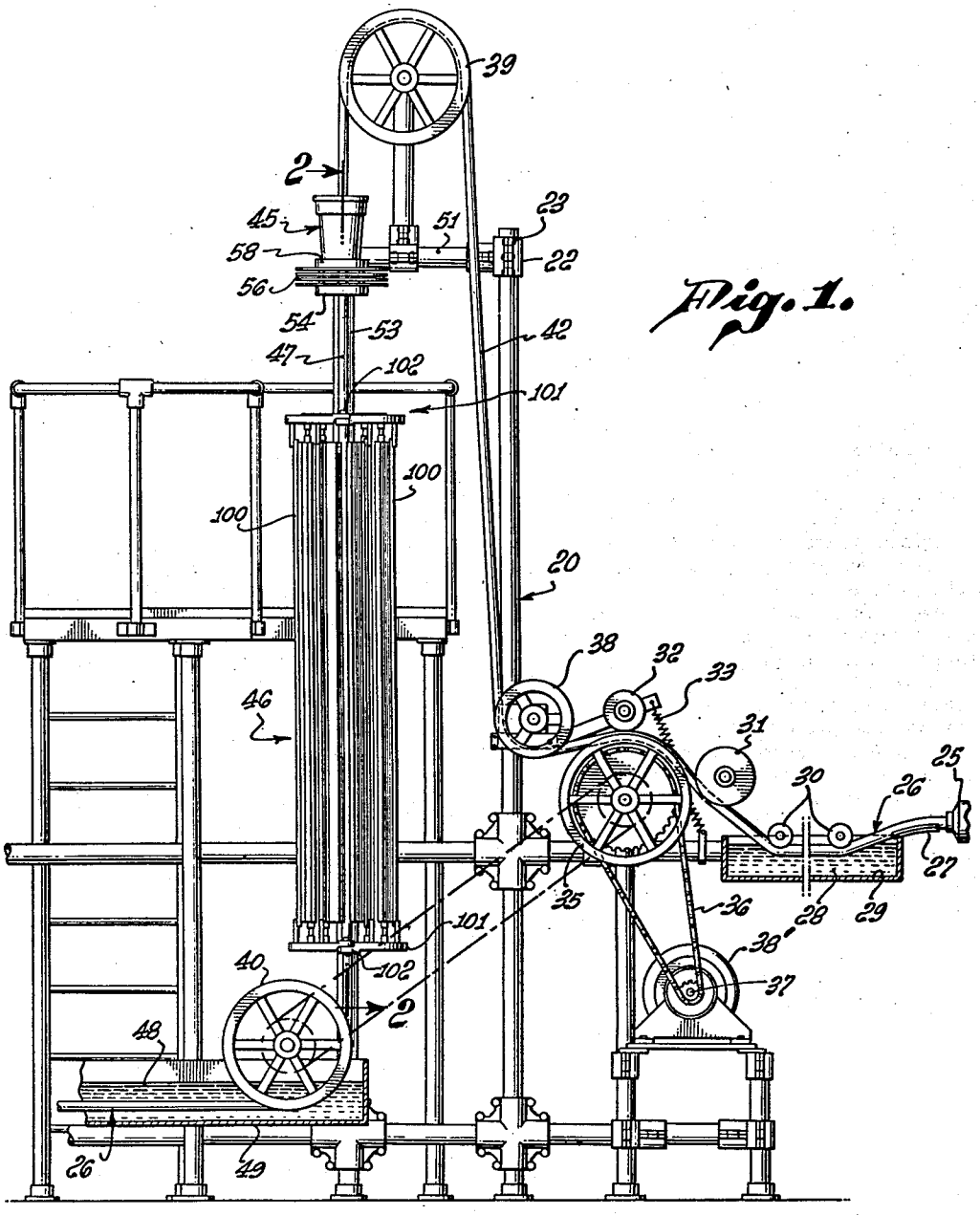

Fig. 1.

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Fig. 2.

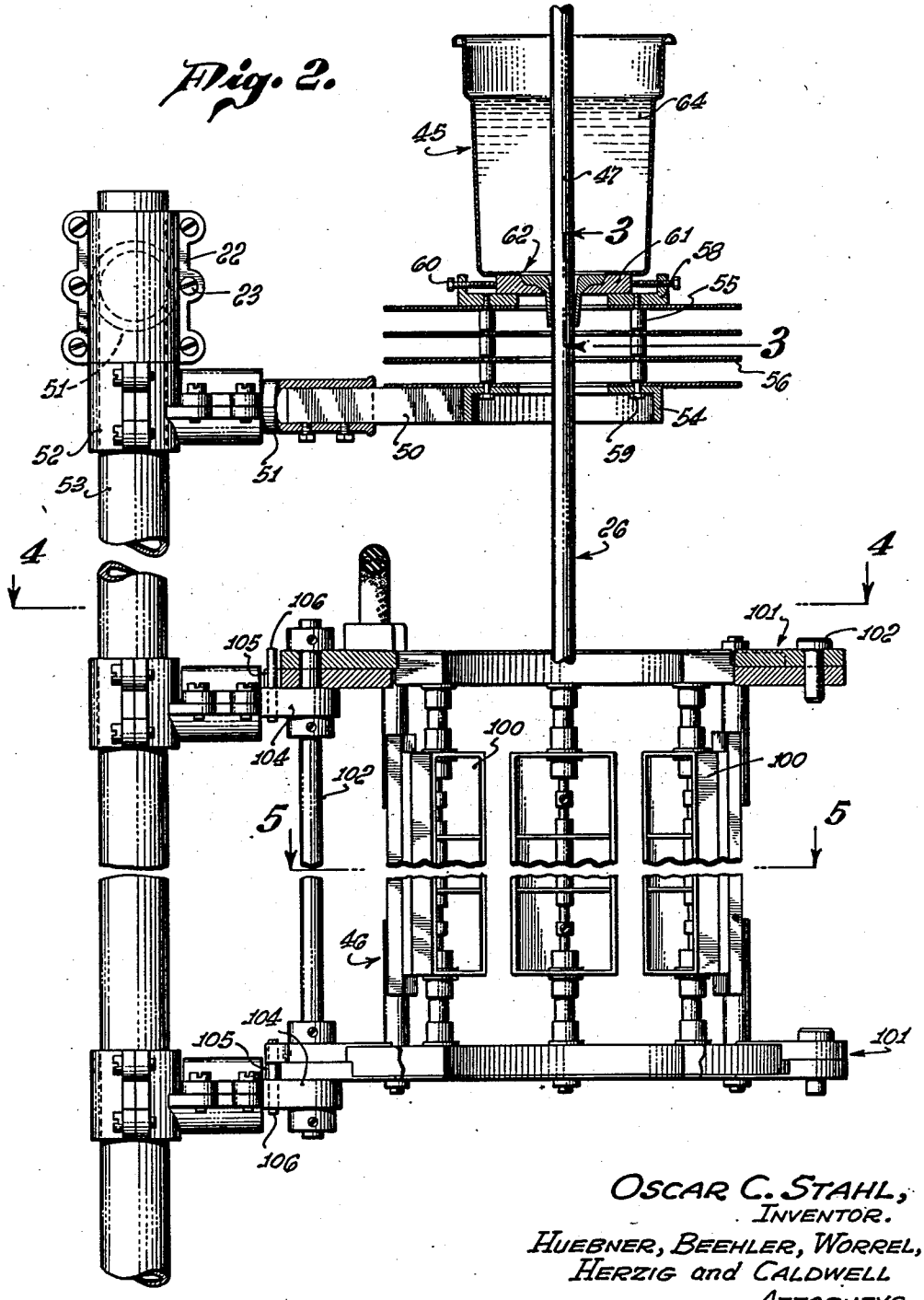

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Fig. 3.

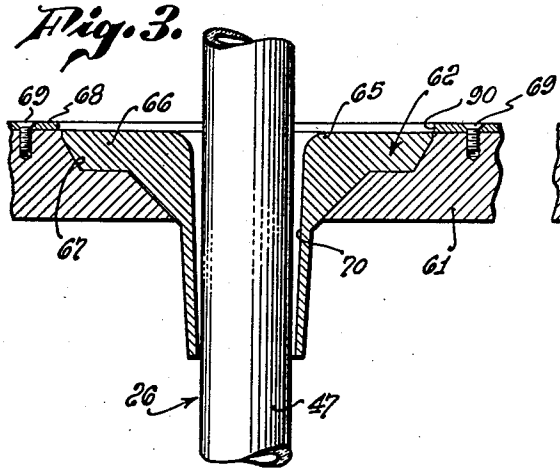


Fig. 6.

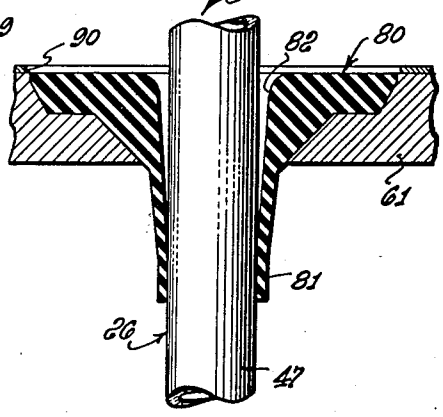
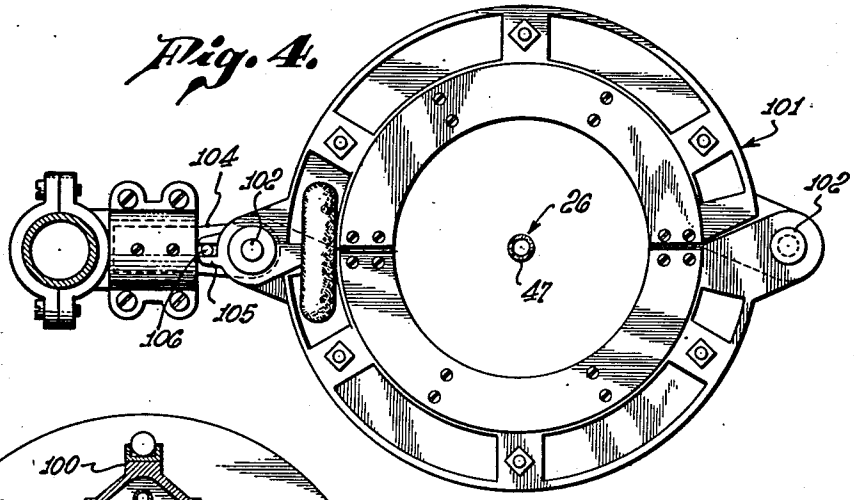


Fig. 4.



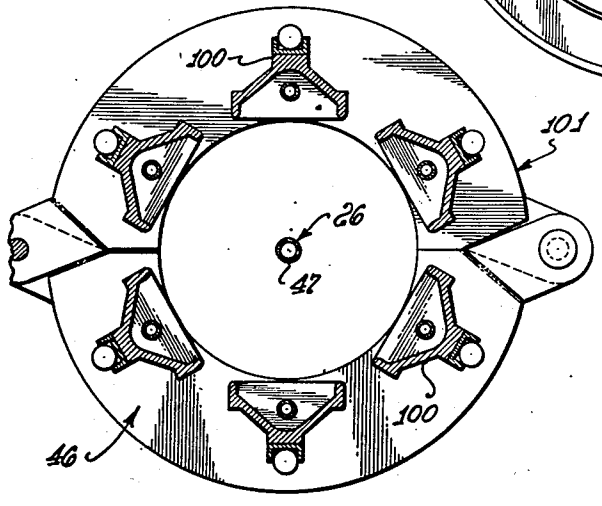


Fig. 5.

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Patented Jan. 27, 1953 2,626,426

UNITED STATES PATENT OFFICE

2,626,426

COATING METHOD AND APPARATUS FOR PLASTIC TUBING AND THE LIKE

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Application April 29, 1950, Serial No. 158,956

12 Claims. (Cl. 18—4)

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This invention relates to coating apparatus for automatically and continuously coating a hose, as of a vinyl plastic type, with a smooth and uniform layer of material or paint-like substance, the preferable ingredients and nature of which is more specifically set forth in the copending application of applicant and Elbert Davis, Serial No. 90,667. For purposes of convenience of nomenclature the words "paint, coating or layer" will be employed although it will be understood that any appropriate coating material is intended and that reference to preferred forms of such coating and the ingredients thereof will be had to said copending application.

It is intended by the instant invention to provide, alone or in combination with an extrusion device, an apparatus which will convey a continuous plastic extrusion or the like through a painting or coating device without distortion, with uniform application of pressure and tension thereto, assisted preferably by gravitational forces and by uniformly operating conveying means.

It is likewise intended to provide new and improved means and methods for coating vinyl plastic tubing to finish and cure the same, together with said coating.

In view of the above considerations, among others, this invention has among its objects the provision of new and improved apparatus of the desired character described for obtaining a superior coating and total product.

It is also among the objects of the invention to provide a new and improved hose-conveying apparatus for the purpose intended. Likewise among the objects of the invention is the provision of a new and improved painting method.

A further object of the invention is the provision of new and improved painting means.

Another further object of the invention is the provision of improved non-tensioning means whereby more uniform products are obtained and a more nearly circular cross-section is achieved for the tubing or hose during the coating operation and/or thereafter.

Yet another object of the invention is the provision, alone and in combination with other desired apparatus and means, of new and improved methods and specific apparatus for achieving an improved and continuous coating and curing process.

This invention also contemplates among its objects provision of improvements over prior art methods and apparatus heretofore intended to accomplish generally similar purposes, including

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provision of new and improved preliminary tensioning, stretching and cooling means and methods by which a truly round tube is obtained.

Other and more specific objects and advantages will appear and be brought out more fully in the following specification considered with reference to the accompanying drawings throughout which like parts are designated by like numerals.

In the drawings—

Figure 1 is an elevational view of a preferred form of coating apparatus embodying this invention;

Figure 2 is an enlarged sectional view taken as on a line 2—2 of Figure 1, parts being cut away;

Figure 3 is a further enlarged detailed sectional view taken as on a line 3—3 of Figure 2;

Figure 4 is a horizontal sectional view taken as on a line 4—4 of Figure 2;

Figure 5 is a plan sectional view taken as on a line 5—5 of Figure 2;

Figure 6 is a view similar to Figure 3 and illustrating a modified form of coating element embodying this invention.

Referring more particularly to the drawings, there is shown by way of example, but not of limitation, a frame structure generally designated by the numeral 20 and comprising vertical and horizontal bars having adjustable sleeves 22 thereon, said sleeves being slit longitudinally and being clampingly associated with the bars as by means of screws or the like 23. By this construction, a delicate balance and desired inter-relationship of the other parts to be described may be readily maintained or compensated for, withal providing a readily adjustable and transportable construction capable of ready assembly or disassembly.

Any conventional continuous extruder or the like 25 is positioned adjacent the frame 20 in a position such that any extruded tubing or the like 26 is carried as over a glide 27 and through a cooling bath 28, in a trough 29, under uniform tension and as guided and supported by rollers 30 or the like.

Thence the tubing 26 is drawn by a gear and/or pulley train, as under any suitable idling pulleys 31 and 32 gravitationally bearing upon the tubing 26 or optionally yieldably held thereagainst as by springs 33.

Thereby the tubing obtains traction over a driven wheel 35 drivenly connected, as by a sprocket chain drive 36, to the drive gear 37 of a constant speed motor 38' of electrical or equivalent type. Such motor 38' is also optionally mounted upon the frame 20.

In the initial forming of the tube, the extruding die is preferably made oversize relative to the desired ultimate diameter of the tubing. The rim speeds, therefore, of the wheel 35 and hence its associated wheels 30, 31, 32 and 33, is greater than the lineal speed of extrusion of the tubing from the extruder 25.

As a practical matter such speed differential is like the diameter of the extrusion relative to the ultimate desired diameter of the tubing, not ordinarily over 25%.

Thereby the tubing in its more fluid or plastic state is drawn out and elongated; the resultant tension serving to pull and hold the tubing to a desired true circular cross section.

In such condition of initial tension, the tubing is directed from the extruder into the cooling bath 28 wherein the temperature of the tubing is brought down to control and stop the elongation and to "fix" the tubing in its rounded condition of tension.

Thereafter the tubing should be conveyed without distortion or undue stress; accordingly during curing hereinafter mentioned, the curing temperature will not be such as to render the tubing again plastic to an extent which would disturb its round shape.

Other wheels 38, 39 and 40 are commonly driven (as by gear and sprocket means not shown) at a uniform rim speed so that their circumferential peripheries in engaging the tubing 26 at spaced stations therealong acts upon said tubing with a minimum of distortion, tension and/or friction.

By means of the illustrated and described arrangement a portion 42 of the tubing 26 is moved upwardly over the wheel 39, all wheels or pulleys engaging the tubing 26 being appropriately rounded and grooved in a complementary manner to the desired curvature of the tubing.

After passing over the wheel 39, the tubing is passed vertically downwardly through a pot 45, and battery of curing lamps or other elements 46. The descending portion 47 of the tubing 26 is then passed horizontally around the driven wheel 40, thence through a second cooling bath 48 contained as in a trough 49 whence the tubing is conveyed toward the left as illustrated in Figure 1 to a place of storage or use.

It will be noted that the vertically descending portion 47 of the tubing is longer than the ascending portion 42. Thus, in addition to the nontensioned conveying of the tubing on the wheels aforesaid, the weight of the descending portion 47 tends, without outside power, to move the tubing gravitationally in the desired downward direction through the coating pot 45 and the curing elements 46.

The truly round, substantially relaxed tubing retains a condition of desired optimum unstressed fullness in its descent through the pot 45.

Such pot 45 is preferably adjustably mounted as upon a support 50 adapted to telescope as within a frame member 51, the latter being capable of angular adjustment in a horizontal plane as by means of a sleeve 52 clampable upon a supporting frame member 53.

An annulus 54 may support rods or the like 55 to which cooling fins 56 are optionally secured in vertical spaced relationship.

A retaining ring 58 is supported as by means of bolts 59 upon the base 54 and preferably includes radially directed set-screws positioned in

circumferential spaced relationship for centering an annulus 61 within which an internally tapered painting nipple 62 is disposed.

Said painting nipple 62 is accurately centered about the descending tubing portion 47 and—depending upon the viscosity of the paint 64 and upon the thickness of the ultimate coating desired upon the tubing 26—may maintain a clearance, of, for example, $^{2}/_{1000}$ to $^{4}/_{1000}$ of an inch over the tubing diameter.

The base 65 of the nipple preferably includes a flange 66 adapted to nest within a correspondingly shaped recess 67 formed in the annulus 61, and seats accurately thereagainst, preferably floatingly without the forced axial confinement thereof by the bottom 68 of the pot, the latter being preferably bolted as by screws 69 to the annulus 61. A desired more or less free-floating action of the nipple 62 is thereby achieved and the centering of the tube and nipple is assisted by the painting action of the tapered bore 70 through which the descending portion 47 of the tubing passes.

It will be noted that by the present construction, sufficient distance being retained between the uppermost wheel 39 and the nipple 62, the tubing portion 47 is free to move slightly laterally to any required extent necessary to retain a centered position within the nipple. This centering tendency is insured by the fact that any slight movement of the tubing to one or another side of the nipple bore tends to foster an increased flow of the paint on the opposite side of the bore between the bore wall and the tubing, thereby causing a decreased lateral pressure at right angles to such increased flow counteracting any such sidewise movement of the tubing through the bore.

Thus, a combination of forces cooperate in such manner that when the descending tubing portion 47 passes through the paint and pot, a metered and uniform peripheral coating whose thickness may readily be adjusted by the size of the bore in the nipple and by the viscosity of the paint is obtained as aforesaid.

The nipples illustrated in Figures 1 through 3 can be made of any rigid material such as plastic, wood, metal or the like.

It has been found also that a satisfactory nipple 80, or only the tips thereof, may be made, as illustrated in Figure 6, from a resilient material such as rubber, said tip 81 of which retains a normal sliding contact with the descending tubing portion 47, in effect, brushing or wiping the same with a coating of the paint which, as in the previous embodiment, initially is held in the top of the tapered bore 82 from whence it is drawn by adhesion, cohesion or other wetting of the tube 47 downwardly into and past the tip 81.

Just as the thickness of the desired application may be varied and adjusted by increasing the diameter of the tip relative to that of the tubing in the first embodiment under discussion, so the thickness of the coating of the modified tip form of Figure 6 may be adjusted by such factors and also the resilience or degree of constriction of the nipple clip 81 about the descending tube.

As stated heretofore, both forms of nipple are retained in a sufficiently large opening 90 at the bottom of the pot that facile removal and/or replacement of the nipple may be accomplished. In lieu of rigid material or resilient material, the tip 81 may, if desired, be formed of bristles,

cloth, or any other appropriate matted or fibrous substance. It has been found preferable however to utilize a rigid type of substance as herein specified on the one hand (Figures 1–3) or resilient form (Figure 6) on the other.

Now referring to the curing apparatus **46** the same may comprise a plurality of heating elements **100** mounted in circumferential spaced relationship between upper and lower complementary C-frames **101** hingedly secured together at their ends upon pintles **102**. One or both of the opposite ends of the C-frames may be secured as on a frame **104**, and projecting fingers **105** engageable as against a stop **106** on the frame member **51** assure proper centered positioning of the C-frames about the descending tubing portion **47**.

The length of the heating element and its intensity related to the speed of travel of the tubing therethrough will control the curing time. Such curing will be governed by the nature of the material of which the tube is formed and also by the nature of the coating material employed in accordance with said copending application.

After passing through the tubes and being heated and cured, and when the tubing has passed through a cooling bath **48** the cycle of continuous manufacturing process of the tubing per se is substantially complete.

This invention features provision of a new and improved means and apparatus for continuously coating and curing plastic tubing or the like in a preferred, efficient, economical and uniform method resulting in the tubing of maximum smoothness, roundness and uniformity in its outermost layers. It features likewise the provision of new and improved painting means and methods and moreover, but without limitation, new and improved heating procedures and techniques as well as apparatus. A new efficiency and naturalness of product as well as process results. Economy is achieved, manufacturing simplified, and desired uniformity, and therefore superiority of the resultant product is attained. The manner of passing the tubing through the paint results in minimizing distortion and tension of the tube even without the added assistance of the tapered orifice itself.

Although I have herein shown and described my invention in what I have conceived to be the most practical and preferred embodiment, it is recognized that departures may be made therefrom within the scope of my invention, which is not to be limited to the details disclosed herein but is to be accorded the full scope of the claims so as to embrace any and all equivalent structures and methods.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent is:

1. A tubing manufacturing apparatus including: means for continuously forming a plastic tubing; conveyor means adjacent said forming means, said conveyor means including pulley means for lowering said tubing gravitationally in a vertical path to convey said tubing vertically to a level different from that at which said forming means is disposed; coating means disposed below said pulley means on said vertical path for receiving and coating said tubing during its gravitationally induced movement along said vertical path; and means for setting a coating on said tubing disposed immediately below said coating means and along said vertical path.

2. A tubing manufacturing apparatus including: means for continuously forming a plastic tubing; conveyor means adjacent said forming means, said conveyor means including pulley means, means for driving at least the first and last of said pulley means at uniform rim speed, at least two of said pulley means being arranged in a vertical relationship to lift said tubing upwardly, the last of said pulley means being arranged below the uppermost of the lifting pulley means with its axis of rotation spaced outwardly from the axis of rotation of the uppermost lifting pulley means a distance equal to the sum of the radii of the uppermost and last pulley means so that the tubing will follow a vertical path between the uppermost lifting pulley means and the last pulley means; coating means for applying a coating to said tubing positioned between said uppermost lifting pulley means and said last pulley means and disposed adjacent said uppermost pulley means; and setting means for setting a coating on said tubing disposed along said vertical path having its uppermost end adjacent the underside of said coating means and its lowermost end adjacent the last of said pulley means.

3. A tubing manufacturing apparatus including: means for continuously forming a plastic tubing; conveyor means adjacent said forming means, said conveyor means including a plurality of pulley means and means for driving the first and last of said pulley means at uniform rim speed, at least two of said pulley means being arranged in a vertical relationship to lift said tubing upwardly, said lifting pulley means including the first of said pulley means, and at least two of said pulley means being arranged to permit the gravitational descent of said tubing, the lowermost of the pulley means permitting said gravitational descent being the last of said pulley means; coating means disposed between the uppermost of the lifting pulley means and the last of said pulley means for coating said tubing; and setting means disposed between said coating means and the last of said pulley means for setting the coating on said tubing.

4. A tubing manufacturing apparatus including: means for continuously forming a plastic tubing; conveyor means adjacent said forming means, said conveyor means including a plurality of pulley means and means for driving the first and last of said pulley means at uniform rim speed, at least two of said pulley means being arranged in a vertical relationship to lift said tubing upwardly, said lifting pulley means including the first of said pulley means, and at least two of said pulley means being arranged to permit the gravitational descent of said tubing, the lowermost of the pulley means permitting said gravitational descent being the last of said pulley means; coating means disposed between the uppermost of the lifting pulley means and the last of said pulley means for coating said tubing, said coating means including a pot containing a fluid coating material therein, said pot having an opening at its top for the axial reception of said tubing and a nipple slidably engageable with the external periphery of said tubing for coating the same; and setting means disposed between said coating means and the last of said pulley means for setting the coating on said tubing.

5. A tubing manufacturing apparatus including: means for continuously forming a plastic tubing; conveyor means positioned adjacent said

forming means, said conveyor means including pulley means, said pulley means including first and last commonly driven pulley means disposed below and at opposite sides of an uppermost intermediate free-wheeling pulley means, said tubing being lifted between said first and uppermost pulley means and gravitationally lowered between said uppermost and last pulley means; coating means for coating said tubing disposed adjacent said uppermost pulley means; and setting means disposed immediately below said coating means for setting said coating on said tubing.

6. An apparatus as characterized in claim 1, said continuous forming means including stretching and cooling means for said tubing.

7. An apparatus as characterized in claim 1, said continuous forming means including stretching and cooling means for said tubing, said stretching means comprising a pulley adjacent the forming means carrying said tubing and having a rim speed less than 25% of the forming speed of said forming means.

8. A method of coating a vinyl plastic tubing or the like comprising the steps of continuously extruding said tubing, continuously stretching and thereby elongating said tubing so extruded to round the same while the same is still plastic from its extrusion, passing said tubing vertically downwardly into and through a body of fluid coating material gravitationally, continuously wiping said coating, setting said coating material on the tubing, curing said coating, and cooling the tubing and coating so cured.

9. A method of coating a vinyl plastic tubing or the like comprising the steps of continuously extruding said tubing, continuously stretching and thereby elongating said tubing so extruded to round the same while the same is still plastic from its extrusion, fixing the tubing while so stretched and rounded, passing said tubing vertically downwardly into and through a body of fluid coating material gravitationally, continuously wiping said coating, setting said coating material on the tubing, curing said coating, and cooling the tubing and coating so cured.

10. A method of coating a vinyl plastic tubing or the like comprising the steps of continuously extruding said tubing, continuously stretching not more than 25% and thereby elongating said tubing so extruded to round the same while the same is still plastic from its extrusion, fixing the tubing while so stretched and rounded, passing said tubing vertically downwardly into and through a body of fluid coating material gravitationally, continuously wiping said coating, setting said coating material on the tubing, curing said coating, and cooling the tubing and coating so cured.

11. A method of coating a vinyl plastic tubing or the like comprising the steps of passing said tubing vertically downwardly solely under a gravity induced tension and applying a vinyl plastic material having distinctly different characteristics from the material of said tubing to said tubing at a station along its downward descent completely therearound, curing said coating, and cooling the tubing and coating so cured.

12. A method of coating a vinyl plastic tubing or the like comprising the steps of conveying said tubing upwardly solely under a gravity induced tension, passing said tubing vertically downwardly into and through a body of vinyl plastic material having distinctly different characteristics from the material of said tubing, gradually restricting the diametrical dimensions of said coating material in the direction of downward travel of said tubing until said diametrical dimensions approximate the desired coating of said tubing, passing the coated tubing continuously through a curing station, and cooling the tubing and coating so cured.

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REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
701,472	Dickey	June 3, 1902
864,123	Cossitt	Aug. 20, 1907
874,287	Bayne et al.	Dec. 17, 1907
1,850,062	Myers et al.	Mar. 15, 1932
2,185,701	Boyle	Jan. 21, 1940
2,412,429	Slingluff et al.	Dec. 10, 1946
2,424,445	Frier	July 22, 1947
2,531,561	Elder et al.	Nov. 28, 1950