Feb. 25, 1964 T. H. KRINGEL ETAL 3,122,114

CONTINUOUS TUBE FORMING AND GALVANIZING

Filed May 1, 1961 2 Sheets-Sheet 1

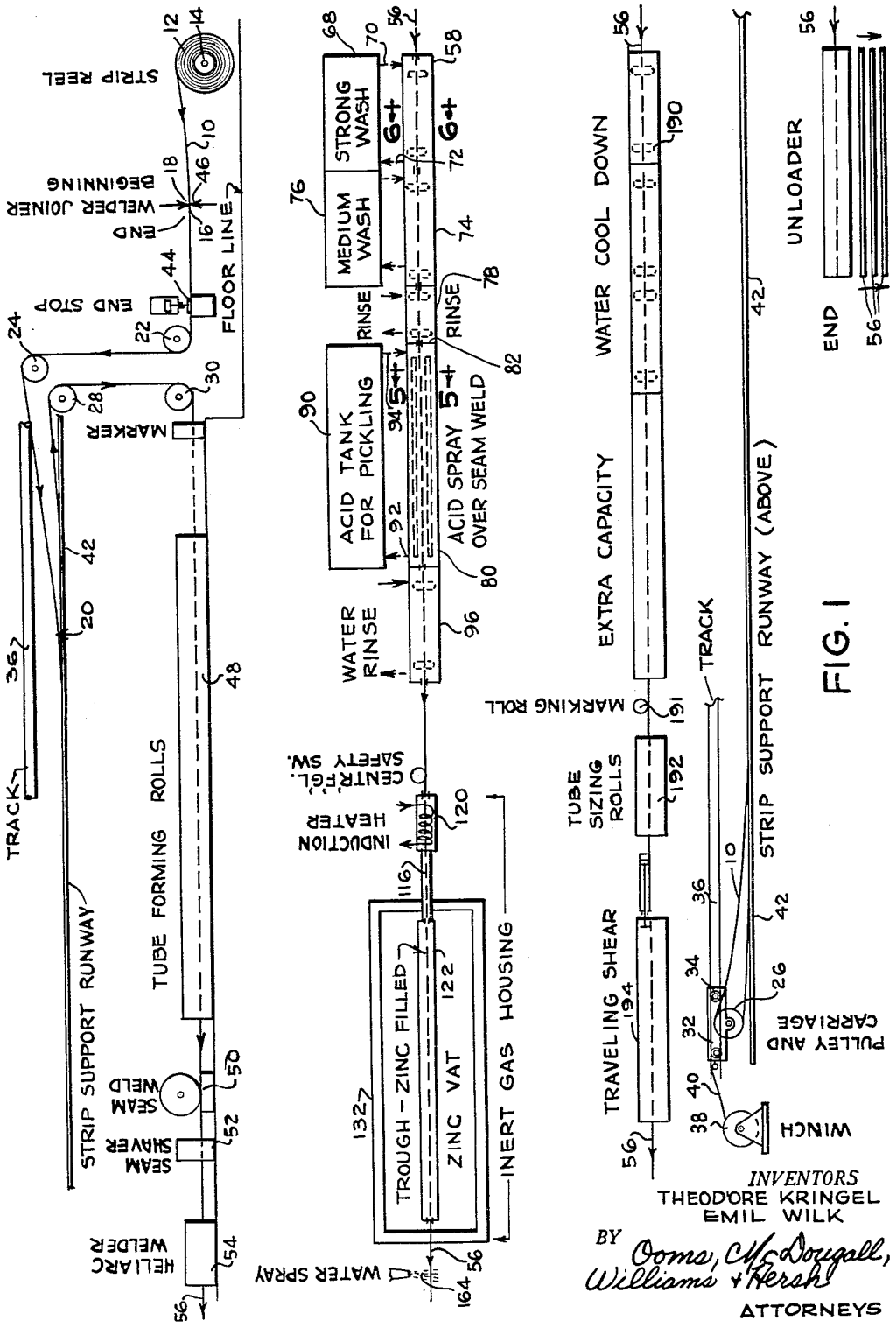


FIG. 1

INVENTORS
THEODORE KRINGEL
EMIL WILK

BY Ooms, McDougall, Williams & Hersh
ATTORNEYS

Feb. 25, 1964 T. H. KRINGEL ETAL 3,122,114

CONTINUOUS TUBE FORMING AND GALVANIZING

Filed May 1, 1961 2 Sheets-Sheet 2

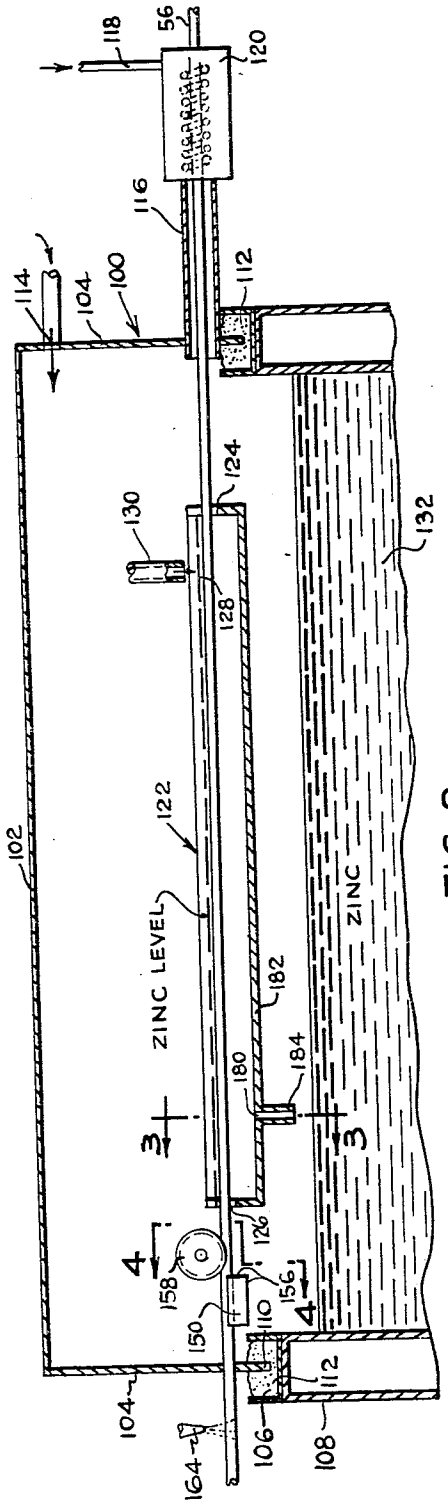


FIG. 2

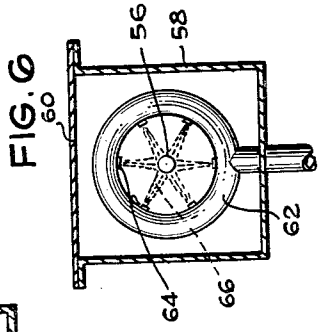


FIG. 6

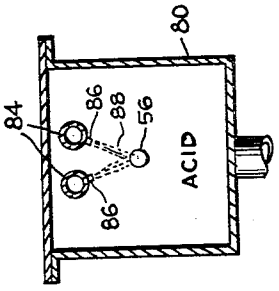


FIG. 5

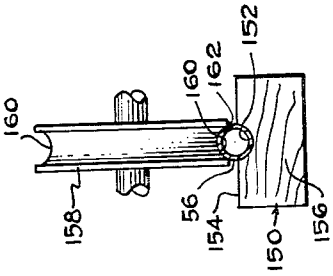


FIG. 4

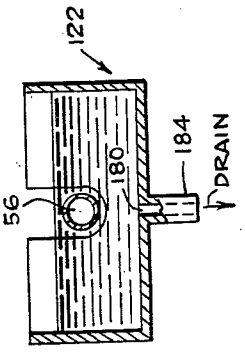


FIG. 3

INVENTORS
THEODORE KRINGEL
EMIL WILK

BY Ooms, McDougall, Williams & Hersh
ATTORNEYS

United States Patent Office 3,122,114 Patented Feb. 25, 1964

3,122,114

CONTINUOUS TUBE FORMING AND GALVANIZING

Theodore H. Kringel, Chicago, and Emil Wilk, Park Forest, Ill., assignors to Allied Tube & Conduit Corporation, Blue Island, Ill., a corporation of Illinois

Filed May 1, 1961, Ser. No. 106,699
9 Claims. (Cl. 113—33)

This invention relates to a continuous process for forming and galvanizing tubing of endless strips of steel and it relates more particularly to the processing of endless strips of steel to form tubing in a continuous operation and in the treatment of the external surfaces of the formed tubing for galvanizing as a continuous operation in combination with tubing formation.

It is an object of this invention to provide a new and improved process for the continuous forming of tubing from endless lengths of strip steel and for continuous galvanizing of the formed tubing as a continuous operation with the formation of the tubing and it is a related object to produce a new and improved machine for use in the practice of same.

Another object is to provide a machine and process for the continuous forming and galvanizing of tubing from sheet steel in a simple and efficient manner to produce a galvanized tubing at less cost from the standpoint of labor, from the standpoint of material utilization and cost, from the standpoint of space requirements, and from the standpoint of heat and power requirements, and it is a related object to produce and to provide a method for producing galvanized tubing having improved characteristics and appearance without substantial variation in such characteristics and appearance between lengths.

These and other objects and advantages of this invention will hereinafter appear and, for purposes of illustration, but not of limitation, an embodiment of the invention is shown in the accompanying drawings in which—

FIG. 1 is a schematic flow diagram of the continuous forming and galvanizing of tubing in accordance with the practice of this invention;

FIG. 2 is a sectional elevational view of the furnace for the continuous galvanizing of the formed tubing in accordance with the practice of this invention;

FIG. 3 is a sectional view taken substantially along the line 3—3 of FIG. 2;

FIG. 4 is a sectional elevational view taken substantially along the line 4—4 of FIG. 3;

FIG. 5 is a sectional view taken substantially along the line 5—5 of FIG. 1, and

FIG. 6 is a sectional view taken substantially along the line 6—6 of FIG. 1.

Since the important concepts of this invention reside in the method and means for the continuous forming and galvanizing of tubing by the processing of endless lengths of strip steel, the invention will be described with reference to a continuous process for forming the metal tubing and in the processing of the formed tubing in a galvanizing, sizing and shearing operation for cutting the finished tubing into desirable lengths.

Referring now to FIG. 1 of the drawings, the tubing forming mill is fed with strip steel 10 supplied in the form of coils 12 mounted on a pay-out reel 14 for free rotational movement to pay out strip steel as it is required by the continuous tube forming mill. In a continuous mill for forming tubing, the strip steel is processed substantially continuously at a relatively constant rate through the mill. Advancement is effected primarily by engagement between the strip steel and the forming and sizing rolls rotating at relatively constant speed whereby the strip steel is drawn into the mill for processing.

Since the lengths of the steel strip in the coils 12 come to an end after a short period of operation of the mill and since strip is taken up continuously by the mill in its continuous operation, it is essential to provide means for splicing the end of one coil 16 with the leading end 18 of another coil for joinder of the strips into continuous lengths without stoppage of the mill in its continuous operation. For this purpose, a loop 20 is taken in the strip of steel dimensioned to have a length sufficient continuously to feed strip to the mill while the trailing end 16 of the strip is stationarily held for splicing, as by welding, onto the leading edge of the new reel which has been displaced into position of use. The loop is formed by feeding the strip 10 under the roller 22 and over the roller 24 to about the roller 26 and back over the roller 28 and under the roller 30 into the mill. The rollers are each mounted for free rotational movement while the roller 26 is carried by a carriage 32 having wheels 34 rotatably positioned upon a track 36 for endwise displacement of the carriage in one direction to make strip available to the mill and in the other direction, responsive to the actuation of the winch 38 through the cable 40, to return the carriage and to reform the loop.

Normally, the carriage is in its retracted position to provide a full loop 20 of strip steel which rests upon a platform 42 overlying the mill and underlying the track. When the end is reached, a portion adjacent the end is locked in a clamping member 44 to hold the end section while the end 16 of the coil is joined, as by welding, to the beginning of the next coil in the joiner 46. The operation takes but a few seconds. In the meantime, the mill continues to draw its requirements of strip from the loop to displace the carriage 32 in the direction away from the winch as the loop is shortened. When the ends of the coils have been joined, the clamping device 44 is inactivated to free the strip whereby strip can thereafter be supplied from the new coil as the winch 38 and cable 40 are effective to return the carriage to normal retracted position and replenish the loop in preparation for the next splicing operation. It will be apparent that the strip 10 feeds from the coil through the loop to the mill for continuous operation.

Hereafter description will be made of the sequence of operations effected in the mill with the elements in the mill longitudinally aligned for the passage of strip and the tubing formed thereof continuously linearly therethrough.

From the tubing forming roll section 48, the formed tubing is advanced directly to the seam welder 50 where the abutting free edges of the strip formed to tubular shape are joined by welding, preferably using a continuous resistance welder in order to keep the upset on the inside of the formed tubing at a minimum. Otherwise, it would require the use of a support within the tubing and/or an upset removing tool employed in combination with a water suction device. Since sufficient space is not available in small diameter tubing for housing such support, upset removal tool and water suctions means, it has been found to be expedient, in accordance with the practice of this invention, to make use of a continuous welder in the form of a roller adjusted to effect the major upset on the outside of the tubing where access is available for removal.

When, as in the practice of this invention, the upset is concentrated on the outside, the upset or flash can be removed by a seam shaving tool 52 which follows immediately after the seam welder. The seam shaver embodies a scarfing tool which shaves the seam to leave a smooth surface on the outer periphery of the formed

tubing and whereby the seam would be concealed except for the presence of a heat line indicated by a dark discoloration of metal oxide formed along the weld surface.

To this point, welded tubing is continuously formed of strip steel with the exception of the possible short lengths of formed tubing which remain with an open seam in the event of skidding of the tubing and the machine when the mill is stopped for one reason or another. As a result, in the described continuous processing for forming tubing, an auxiliary welder 54 in the form of a heliarc welder may be employed, where desired, to take over the welding operatioin whenever the seam welder fails to weld the seam of the formed tubing. When employed, an overlap is effected with the stop and start of the mill continuously to weld the seam and to insure closure of the seam throughout the length of the tubing. In actual practice with good controls, it has been found that the heliarc welder is not essential.

After the tubing has been welded to provide a continuous weld throughout the length thereof, the tubing is advanced from the welders to elements linearly aligned therewith for washing and pickling the outer surfaces of the formed tubing in preparation for continuous galvanizing. The welded tubing 56 is advanced first into a housing 58 having a removable cover 60 for access thereto. The housing is provided with a plurality of axially aligned ring members 62 in the form of headers having a plurality of spray nozzles 64 arranged equally spaced about the inner periphery for directing a spray 66 onto the outer periphery of the tubing 56 advanced axially therebetween. Each spray head is connected to a reservoir 68 of wash water for recirculating the wash water from the reservoir through pipe 70 to the spray head 62 and from the drain in the housing back through pipe 72 for return to the reservoir. In the illustrated modification the reservoir is shown alongside the housing but it may equally be arranged in other positions such as beneath the housing. A pump means is interposed between the reservoir and the spray heads for displacement of wash water forcibly to spray the wash water onto the exposed surfaces of the tubing as it passes through the housing. For purposes of washing to remove grease and the like, use can be made of an alkali wash which may be represented by a solution of 5 ounces of alkali per gallon of water and it is preferred to heat the wash water to a temperature below the boiling point of the alkali solution, such as to a temperature of 200° F. to accelerate removal of grease from the surface.

From the hot alkali wash, the tubing 56 is advanced continuously into the adjacent section of housing 74 in which the tubing is treated with a dilute alkali wash. The housing 74 is similar to that of the housing 58 for the hot alkali wash including spray heads to direct the dilute alkali wash onto the periphery of the tubing and with a separate reservoir 76 connected to the headers to feed dilute alkali from the reservoir to the headers and connected to the drain in the base of the housing for returning the dilute alkali wash from the housing back to the reservoir. The dilute alkali wash is employed for more complete removal of grease and dirt from the surface of the tubing and the use of the dilute alkali wash following immediately after the strong alkali wash operates to save alkali loss since strong alkali carried on the surface of the tubing from the strong alkali wash will be recovered in the wash with dilute alkali to supply some of the alkali for maintaining the desirable concentration thereof. The dilute alkali wash may be formulated to contain about 2 ounces of alkali per gallon and it may also be heated to an elevated temperature such as to a temperature below boiling, or up to 200° F. more effectively to remove grease and other undesirable material from the surface of the welded tubing.

From the alkali washes, the tubing is advanced into a rinse housing 78 aligned endwise with the alkali wash housing and similarly constructed. The rinse housing is

fitted with a number of axially aligned spray heads, similar to the rings employed in the alkali wash systems, from which rinse water is sprayed onto the surface of the tubing as it passes therethrough to rinse remaining alkali from the surface before passing the tubing into the pickling bath. The rinse water is circulated under pressure from a water supply source to the spray heads and the water collected in the bottom of the rinse housing can be released to the drain unless water is at a premium, in which event the water is recirculated with sufficient makeup water to provide for substantial removal of alkali. The rinse water may be used either cold or warm, but it is economically undesirable to invest in warming the water unless the warm water is recirculated between the housing and a water storage reservoir for re-use.

From the rinse, the tubing 56 is advanced directly into a pickling housing 80 of similar construction as the wash and rinse housings and separated therefrom only by a separating wall 82. The pickling housing is provided with a pair of longitudinally arranged, laterally spaced apart spray pipes 84 arranged in the upper portion of the housing to overlie the tubing 56 which passes linearly through an intermediate portion of the housing beneath the spray pipes to face the weld seam in the direction of the pipes. The pipes are each provided with a plurality of spray nozzles 86 in the underside positioned to direct the spray 88 angularly downwardly to converge on the weld seam positioned uppermost in the tubing passing therethrough. Thus the spray is directed forcefully from the spray nozzles onto the seam to react with the oxides on the surface which are formed at the weld. Use can be made of conventional pickling solutions for removal of the metal oxide, such for example as an acid solution containing about 30 percent by volume HCl dissolved in aqueous medium. For best results, it is desirable to make use of a pickling solution heated to an elevated temperature such as at a temperature of 100–120° F., but a heated pickling solution is not essential.

The solution is stored in a suitable reservoir 90 and is connected with the spray heads through lines 92 and 94 and circulation is effected by means of a displacement pump. The reservoir, pump and housing are all provided with a rubber lining to protect the metal parts from the acids of the pickling solution.

From the pickling housing 80, the pickled tubing is advanced into an aligned section of housing 96 for rinsing the pickling solution from the surface of the tubing. The rinse housing following pickling is very similar to the rinse housing 76 wherein water is sprayed from spray rings onto surfaces of the tubing passing therethrough to rinse the pickling solution from the surface.

In the aforementioned alkali washes, rinse, pickling and final rinse, the housings can be of a unitary construction subdivided into separate sections by separating walls each of which is provided with aligned openings dimensioned to enable the tubing to pass lengthwise therethrough in and out of the housings. Instead, the housings can be separated members with aligned openings in the end walls for the continuous passage of the tubing from one to another without bending.

An important concept of this invention resides in the means and method for continuously galvanizing the formed tubing as a continuous operation with the described forming, welding and cleaning operations. For this purpose, it is desirable to contact the cleaned surface of the steel tubing with molten zinc for sufficient time to enable the desired reactions to take place to form the desired thickness of galvanize on the surface and it is important to carry out the reactions under non-oxidizing conditions, otherwise undesirable oxides of the metal will form at the elevated temperatures under which the reactions are carried out.

The desired reducing or non-oxidizing atmosphere can be maintained by the enclosure of the galvanizing zone within a sealed housing into which an inert, or reducing

gas can be introduced for maintenance of a non-oxidizing atmosphere. This can be accomplished by a sealed enclosure but it is preferable to make use of an enclosure which is capable of removal to gain access to the interior of the galvanizing zone but without interfering with the ability to achieve atmospheric control, when in position of use.

The desired characteristics have been achieved in the construction illustrated in FIG. 2 of the drawings by the use of a rectangular hood **100** having a horizontally disposed top wall **102**, side and end walls **104** which depend perpendicularly downwardly from the edges of the top wall into a trough **106** facing upwardly from a frame **108** which extends all about the galvanizing zone. The bottom edges **110** of the side walls are received within the trough for support of the hood on the bottom wall thereof. The trough is at least partially filled with a pulverulent material **112**, such as fine sand, into which the lower edge of the side walls become embedded to effect a sealing relationship all around which militates against the flow of free gases all around for atmospheric control. One or more inlets **114** for the inert or reducing gas are provided in the walls of the hood for introduction of such inert or reducing gases in amounts to maintain a non-oxidizing atmosphere therein.

It has been found that the galavanizing reactions can be carried out more rapidly with greater uniformity when the tubing is preheated to an elevated temperature, such as to a temperature above the melting point temperature for the zinc, such as at 750° F., before being contacted with the molten zinc, although it is not essential to preheat. When preheating is effected, it is again important to achieve the desired preheat without exposure of the metal surface to oxidizing conditions, otherwise the metal oxides that would form at an accelerated rate while the tubing is heated to an elevated temperature would interfere with the formation of a suitable galvanize on the surface. In the illustrated modification, the preheat section comprises a tubular housing **116** which has its center aligned with the line of travel of the formed tubing through the machine and which communicates with the enclosure **100**. Inert gas is introduced into the tubular housing through an inlet **118** in the forward end of the tubular member for the circulation of the inert or reducing gas lengthwise through the housing into the hood or enclosure **100** to maintain non-oxidizing conditions within the tubular housing during passage of the tubing therethrough.

The tubing can be heated to elevated temperature by the introduction of heat from suitable and conventional internal or external heaters but it is preferred to make use of induction heating means **120** within the tubular housing to accelerate the build-up of temperature within the tubing walls in minimum time thereby to minimize the lengths necessary for the tubular housing.

Having described the preheat of the tubing and the introduction of the preheated tubing into the inert galvanizing zone maintained to reducing or non-oxidizing conditions, description will now be made of the new and novel means by which the tubing is maintained in contact with a molten bath of zinc as a continuous operation with the tubing forming process.

Referring now more particularly to FIGS. 2 and 3, the galvanizing means comprises an elongate, horizontally disposed housing **122** in the form of a trough aligned axially with the line of travel of the tubing for passage of the tubing axially through an intermediate section of the housing from an inlet **124** at one end to the outlet **126** at the opposite end. The housing is provided with one or more inlets **128** which are connected by a passage **130** to a reservoir **132** of molten zinc with means for displacement of the molten zinc from the reservoir to the inlets at a rate sufficient to maintain the housing substantially filled wtih molten zinc to cover the tubing advanced therethrough. The inlet **128** is preferably, though not necessarily, located in the portion of the housing adjacent the inlet end **124** through which the tubing is introduced into the housing for concurrent flow of the molten zinc through the housing with the tubing and in position to overlie the tubing so as to direct the stream or streams of molten zinc onto the tubing.

The housing is further provided with a drain opening **180** in the bottom wall **182** of the housing with a downpipe **184** leading from the drain to the reservoir. The drain opening is of small dimension to enable a thin stream of molten zinc constantly to flow therethrough but at a rate that is considerably less than the rate of introduction of molten zinc into the housing less the amount that escapes through the openings so that there will be an overflow of molten zinc over the ends of the trough forming the inlet and outlet to the housing but with an amount of molten zinc in the trough to cover the tubing passing therethrough. The drain opening **180** is effective in the event of some failure in operation or stoppage of the machine thereby to drain molten zinc from the housing before the zinc has cooled to a temperature below its melting point, otherwise the zinc would become solidified within the housing and thereby render the housing unfit for future use until the solidified zinc is passed from the housing or otherwise, with difficulty, removed.

The zinc in the reservoir can be heated by suitable burners or other heating means to maintain the zinc in the bath at a temperature above its melting point temperature of about 750° F. and preferably at a temperature above about 850° F. Access means are provided in the hood **100** for addition of pigs of zinc to the reservoir in amounts corresponding to the zinc that is used or otherwise removed with the tubing.

It is important to provide a sufficient weight of coating of molten zinc onto the surface of the formed tubing but it is undesirable to enable excess molten zinc to be carried off with the tubing thereby to increase the cost of galvanzing and/or prevent bead formation by excess zinc remaining on the outer surface. One means particularly adapted to control the thickness of the zinc coating without bead formation and to provide for removal of excess for return to the reservoir, while in a molten state and while still in a protective atmosphere, comprises an elongate block **150** of stainless steel or the like formed with a groove **152** extending lengthwise across the top wall **154** in which at least the leading edge portion **156** of the block still extends into the trailing end portion of the hood. The groove **152** in the top surface of the block is adapted to correspond in curvature with a hemispherical section of the tubing to engage the lower half thereof during passage of the tubing lengthwise therethrough. In the preferred practice, the groove is formed to a diameter corresponding to that of the tubing or slightly greater.

Cooperating with the block is a roller **158** mounted for rotational movement about an axis crosswise of the line of travel of the tubing with an annular, arcuate recess **160** formed in the periphery of the roller shaped to correspond somewhat to a hemispherical section of the tubing being processed. As in the block, the arcuate recess **160** is dimensioned to have a diameter corresponding to that of the tubing or slightly greater. The roller is positioned with its lower edge **162** in endwise alignment with the top side of the recess **152** to more or less define a circular section therebetween corresponding to the circular section defined by the tubing or slightly greater.

Thus the roller **158** operates to engage the top side of the tubing after it issues from the galvanizing trough to preposition the tubing both in its travel through the galvanizing system and for its subsequent engagement with the grooved block for wiping excess molten zinc from the surface. Some excess zinc will also be removed by the roller upon engagement.

The cooperation between the roller and the block is believed to make the block effective as a wiper for removal of excess molten zinc from the outer wall of the tubing. Such excess zinc is removed while the tubing

is still within the hood thereby to provide premature freezing of the metal while simultaneously protecting the molten metal from oxidation so that the excesses removed can be allowed to flow back into the reservoir for re-use.

The block is effective to still leave a desirable amount of zinc as a coating on the outer wall of the tubing. To prevent flow and bead formation, it is desirable to freeze the metal as soon after wiping as possible. For this purpose, use can be made of a water quench, as in the form of a water spray or flow coat 164 following substantially immediately after the tubing emerges from the hood.

From the galvanizing section, the galvanized tubing is advanced sequentially through a series of water spray sections 190 to cool down the galvanized tubing if the tubing has not otherwise been sufficiently cooled in the freezing step, and, from the cool-down operation, to conventional tube sizing rolls 192, and from the tube sizing rolls to a traveling shear section 194 where the endless tubing is cut into lengths of predetermined dimension for shipping. The water spray sections are similar to the rinse sections which follow alkali cleaning or acid etch and the tube sizing rolls and flying shear are of conventional construction.

As an alternative, the galvanized tubing, after being cooled, may be processed through a spray housing similar to the alkali cleaning, wherein the galvanized surface is wetted with a chromate and nitric acid solution for reaction to form a surface of zinc chromate whereby still greater resistance to oxidation is secured by comparison with a plain zinc galvanized surface. If a section of the spray housing is devoted to the chromate spray, an additional section should be provided for a water rinse to remove excess chromate solution from the surface.

As another innovation, the tubing is marked, as by means of a marking roll, after galvanizing as distinguished from the conventional practice of indenting to mark the tubing before galvanizing or even before the formation of the tubing. This is because the marking applied to the surface of the tubing before galvanizing becomes filled with molten zinc so that it would no longer be visible and the marked depressions appeared also to interfere with the proper galvanizing of the tubing surface. Thus the marking roll precedes tube sizing, as indicated by the position 191.

It will be apparent from the foregoing description that I have provided a simple, efficient and effective means for continuously forming tubing of strip steel and for galvanizing the formed tubing as a continuous operation with the continuous tube forming process.

It will be understood that changes may be made in the details of construction, arrangement and operation, as well as in materials employed, without departing from the spirit of the invention, especially as defined in the following claims.

We claim:

1. In a machine for the continuous forming and galvanizing of tubing, means for galvanizing the formed tubing as a continuous operation with continuous forming of the tubing including a sealed enclosure in linear alignment with the tubing forming elements and interposed between a tubing cleaning means and a tubing sizing means, a heated reservoir of molten zinc, an elongate trough having end walls which extend upwardly beyond the level of the tubing and a bottom wall and which is located within the enclosure in linear alignment with the path of travel of the formed tubing through the machine and having an inlet in the end wall nearest the cleaning means and an outlet in the end wall toward the tubing sizing means and through which the tubing passes from the inlet to the outlet through an intermediate portion of the trough, means for preheating the tubing prior to entrance into the trough and means for maintaining a non-oxidizing atmosphere within the enclosure means for feeding molten zinc from the reservoir into the trough

in an amount in excess of that taken up by the tubing and to cover the tubing during passage through the trough, overflow means at the end portions of the trough for returning excess molten zinc from the trough to the reservoir, and means within the enclosure beyond the trough outlet for wiping excess molten zinc from the surface of the tubing.

2. In a machine for the continuous forming and galvanizing of tubing, means for galvanizing the formed tubing as a continuous operation with continuous forming of the tubing including an enclosure in linear alignment with the tubing forming elements and interposed between a tubing cleaning means and a tubing sizing means, a heated reservoir of molten zinc, an elongate trough having end walls and a bottom wall and which is located within the enclosure in linear alignment with the path of travel of the formed tubing through the machine and having an inlet in the end wall nearest the cleaning means and an outlet in the end wall toward the tubing sizing means and through which the tubing passes from the inlet to the outlet through an intermediate portion of the trough, means for feeding molten zinc from the reservoir into the trough in an amount in excess of that taken up by the tubing and to cover the tubing during passage through the trough, overflow means at the end portions of the trough for returning excess molten zinc from the trough to the reservoir, means within the enclosure beyond the trough outlet for wiping excess molten zinc from the surface of the tubing, said trough including a drain in the bottom wall of the trough to drain molten zinc continuously from the trough but at a rate considerably less than the rate of feed of molten zinc to the trough.

3. A machine as claimed in claim 1 in which the atmosphere is a reducing atmosphere.

4. A machine as claimed in claim 1 in which the preheat means comprises electrical induction means through which the tubing passes prior to entry into the enclosure.

5. A machine as claimed in claim 1 in which the tubing is preheated to a temperature above about 750° F.

6. A machine as claimed in claim 1 in which the preheat means comprises a tubular member aligned with the line of travel of the tubing and in direct communication with one end of the enclosure.

7. A machine as claimed in claim 6 in which an inert gas is introduced into the tubular member to maintain an inert atmosphere therein during preheat.

8. A machine as claimed in claim 6 in which a reducing gas is introduced into the tubular member for flow through the tubular member into the enclosure for maintaining a non-oxidizing atmosphere within the tubular member during preheat.

9. A machine as claimed in claim 1 in which the means for removal of the excess molten zinc from the periphery of the tubing comprises a block having a substantially hemispherical groove in the upper surface thereof in lengthwise alignment with the path of travel of the tubing from the trough and dimensioned to be at least as great as the dimension of the tubing to engage the underside of the tubing during passage thereof through the groove, and a roller mounted for rotational movement about an axis crosswise of the line of travel of the tubing and having its lower end portion in lengthwise alignment with the upper portion of the tubing to engage the upper portion of the tubing during passage for alignment of the tubing with the grooved block.

References Cited in the file of this patent

UNITED STATES PATENTS

582,667	Murphy	May 18, 1897
755,777	Howell	Mar. 29, 1904
1,261,110	Fahrenwald	Apr. 2, 1918
1,350,572	Smith	Aug. 24, 1920
1,480,022	Snodgrass	Jan. 8, 1924

(Other references on following page)

9

UNITED STATES PATENTS

1,531,730	Bundy	Mar. 31, 1925
2,001,688	Paugh	May 14, 1935
2,024,485	Sussman	Dec. 17, 1935
2,093,238	Domm	Sept. 14, 1937
2,142,486	Antisell	Jan. 3, 1939
2,186,788	Olson	Jan. 9, 1940
2,748,734	Kennedy	June 5, 1956
2,771,669	Armstrong et al.	Nov. 27, 1956
2,822,291	Hahn	Feb. 4, 1958
2,876,132	Worden et al.	Mar. 3, 1959
2,927,371	Hays	Mar. 8, 1960
2,976,394	Sonnichsen	Mar. 21, 1961
2,982,312	Caplan et al.	May 2, 1961
3,010,844	Klein et al.	Nov. 28, 1961
3,017,494	Mackey	Jan. 16, 1962

10

FOREIGN PATENTS

701,965	Germany	Jan. 28, 1941
552,126	Great Britain	Mar. 24, 1943

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,122,114 February 25, 1964

Theodore H. Kringel et al.

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 2, after line 45, insert the following:

> The strip enters a series of aligned conventional tube forming rolls, identified by the numeral 48, whereby the strip is deformed from a flat section to a rounded tubing having the freshly cut edges of the strip in abutting relation to form the seam of the tubing.

Signed and sealed this 14th day of July 1964.

(SEAL)

Attest:

ESTON G. JOHNSON
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents