June 4, 1957 I. H. MARANTZ 2,794,448

ART OF SPRAY COATING OF TUBES

Original Filed April 9, 1949 2 Sheets-Sheet 1

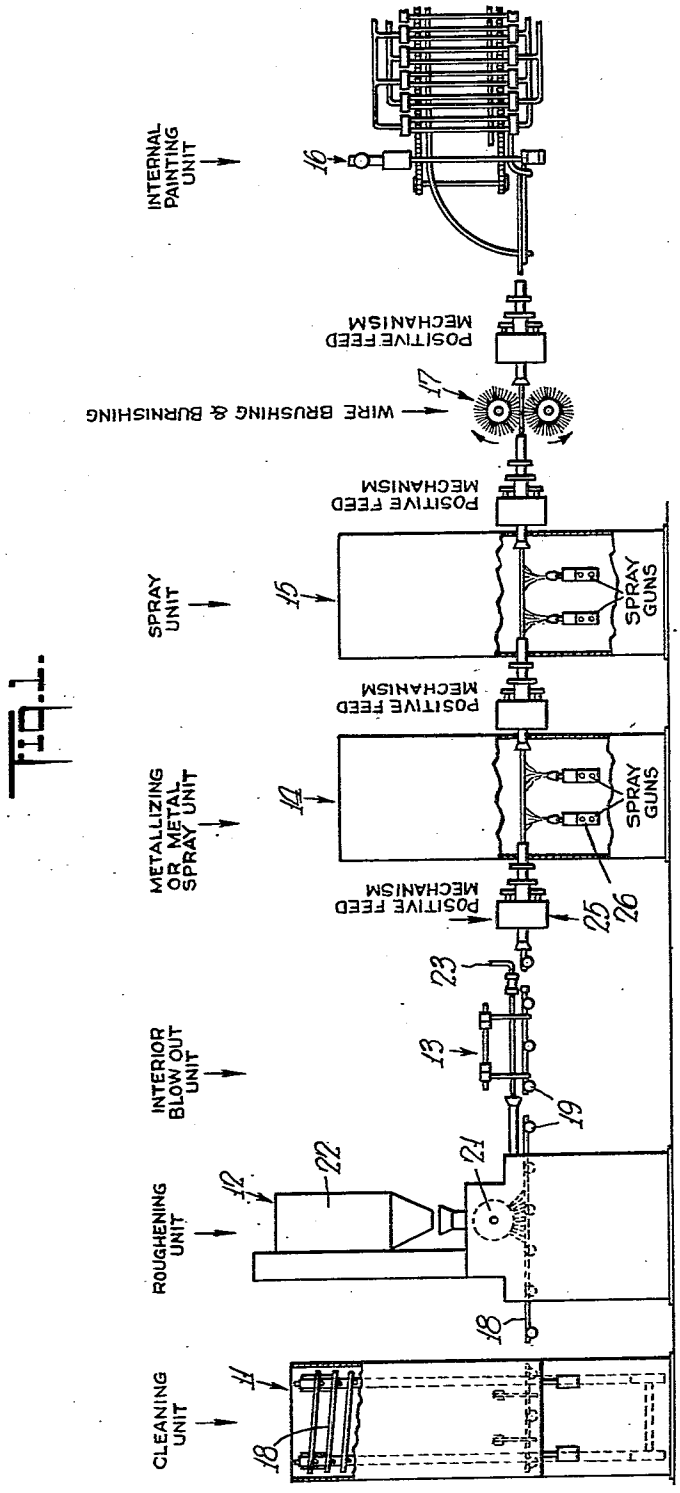


Fig. 1.

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FIG. 2.

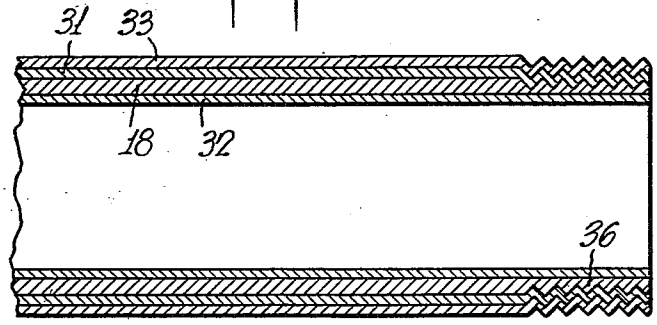


FIG. 3.

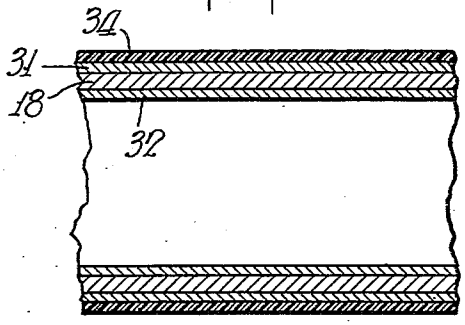
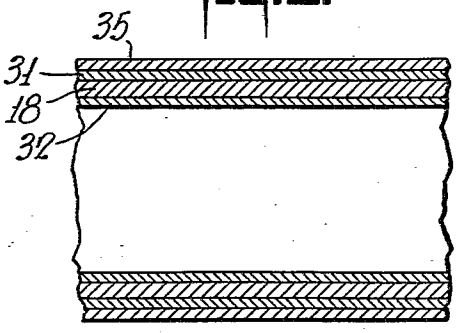


FIG. 4.



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ART OF SPRAY COATING OF TUBES

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Original application April 9, 1949, Serial No. 86,532, now Patent No. 2,683,438, dated July 13, 1954. Divided and this application January 18, 1952, Serial No. 267,156

2 Claims. (Cl. 138—68)

Unless metal tubes such as the type used in electrical installations, as they come from the forming mill, are first cleaned by removing the adherent lubricating grease and oils, scales, rust and grit, from the outer and bore surfaces of the tube, and unless the tubes are dried before coating with the required corrosion resistant metal, plastic or paint, such coatings may not adhere adequately and unless the cleaning and coating processes can be performed at a relatively high rate of speed without manual labor or waste of material, the cost of manufacture of the finished product may be excessive and not justified by the price at which such tubes may be sold.

Where high temperature for long periods is resorted to for application of the metal outer coating, such as where the hot dip galvanizing or Sherardizing processes are used, the outer surface of the tube may harden unduly and tend to crack or split, upon the bending frequently required in installation and the tube may warp due to the application of such heat which would require an additional straightening process. Where such two processes are used to apply a zinc coating to the tubes, a non-ferrous metal coating such as an iron zinc alloy coating will be alloyed with the tube, and as such alloy is less ductile and pliable than the tube itself, it will tend to crack or peel off especially in bending.

While a pure non-ferrous metal coating may be applied by electroplating, the cost of the equipment for such process, the installation cost thereof, the cost of maintenance and the power costs are high while the operation is relatively slow with consequent relatively low output thereby resulting in an inefficient operation.

Where it is desired to provide a relatively thick zinc coating on the metal tubing, if the Sherardising process is used, as the coating applied by such process becomes more and more brittle as the thickness of the coating is increased, such coating is likely to crack and peel upon bending of the tube.

If it is desired to apply such thick coating by electroplating, the operation is extremely time-consuming and costly with resultant high cost of the finished product.

Where the metal coated surface of the tube is relatively smooth, it slips too readily in the hand and affords insufficient friction for application of the field bending tool. Moreover, an outer coaitng which may be of metal, plastic or paint will have inadequate adhesion upon such smooth metal coating and will readily crack or peel off such smooth tube, especially when bent.

Where the metal conduit has a threaded end, if the coating should be applied in such a manner as to fill the threads, the latter would have to be recut and a new coating applied to such recut threads. Such procedure is time-consuming and costly.

It is accordingly among the objects of the invention to provide a method expeditiously and reliably to convert the steel tube as originally formed with lubricating grease, oil, scale, rust and grit adhering thereto into a finished, interiorly and exteriorly degreased and cleaned and exteriorly roughened and metal sprayed and interiorly painted tube.

Another object is to provide a method for metal coating the outer surface of metal tubes with a layer of any desired thickness without the use of high temperature for long periods of time and with consequent avoidance of the objections above pointed out, to the surface hardening of the tube under heat; which coat is not of alloy character and avoids the objections of peeling or cracking off especially when the tube is bent and which coating is not so smooth that a coating of metal, plastic or paint thereon will tend to peel or crack off therefrom especially in bending the tube.

Another object is to provide a method expeditiously and reliably to convert a smooth steel tube having a threaded end, into a finished interiorly and exteriorly degreased and cleaned and exteriorly roughened and metal sprayed tube in which the threaded end will be coated and does not require rethreading.

Another object is to provide a metal tube having a non-ferrous metal coating on the entire outer roughened surface thereof having a substantially porous mat finish, which coating is of ductility and pliability no less than that of the metal tube covered thereby so that the tube may be bent without cracking or peeling off of the coating thereon.

Another object is to provide a metal tube having a non-ferrous metal coating on the entire roughened outer surface thereof to which a second coating will securely bond so that the tube may be bent without cracking or peeling off of the coating thereon.

This application is a division of co-pending application Serial No. 86,532, filed April 9, 1949, now Patent No. 2,683,438, July 13, 1954.

In the accompanying drawings in which are shown one or more of various possible embodiments of the several features of the invention,

Fig. 1 is a diagrammatic view of one type of equipment, with parts broken away, for practicing the invention, and

Figs. 2, 3 and 4 are longitudinal sectional views of coated tubes according to various embodiments of the invention.

Although the invention may be practiced by the use of any one of a number of types of equipment, it is preferred to utilize the equipment shown in co-pending patent application, Serial No. 86,532, filed April 9, 1949.

Referring now to the drawings, as diagrammatically shown in Fig. 1, the installation desirably comprises a plurality of operating units which successively act upon the tubes to form the completed product.

These operating units may include a cleaning unit **11** for removing lubricating grease, oils, scales, rust or grit from the surface of the tube, a roughening unit **12** for roughening and cleaning the outer surface of the tube, a blowout unit **13** for removing grit or dirt from the bore of the tube, a metal spraying unit **14** for applying a basic metal coating to the exterior of the tube, a second spraying unit **15** for applying a second coating and a painting unit **16** for coating the interior of the tube, suitable mechanism such as the type shown in such co-pending patent application above described, being provided at each of said units to perform the required operation. If desired, a burnishing unit **17** may be interposed between the second spray unit **15** and the painting unit **16** slightly to smoothen the pipe in the event a metal coating is applied to the basic coating.

In the operation of the installation shown in Fig. 1, desirably the following sequence is effected; lengths of metal tubes **18** are passed through the cleaning unit **11** to be acted upon by some suitable liquid for removing such grease, oil, scale, rust or grit and discharged in spaced

relation upon a conveyor system **19** which may comprise a plurality of skew rollers which function in conventional manner simultaneously to rotate the tubes while advancing them lengthwise through the roughening unit **12**. Although the roughening unit **12** may be of any suitable type, it desirably comprises a centrifugal rotor **21** supplied with abrasive material from a hopper **22** and which, upon rotation, hurls such abrasive material against the tubes to clean off carbon, rust and scale deposits therefrom and roughens the outer surface of such tubes. The roughened tubes are thereupon advanced in sequence by said conveyor system **19** to a blowout unit **13** at which the tubes are removed from the conveyor system **19** as in the manner described in said patent application above described and presented to an air nozzle **23** which discharges a jet of air therethrough and thereupon replaces such tubes upon the conveyor system **19** to be advanced thereby to the first metal spraying unit **14**.

In order that the metal spray be equally distributed in a uniform layer over the entire outer surface of the tubes and that no area of the tube is exposed to the heated metal spray for any excessive length of time, it is desirable that the tubes be simultaneously advanced and rotated at uniform speed as they are moved through the spray unit. To this end, for the metal spraying operation, a feed mechanism **25**, which may be of the type shown in said patent application, positively grips the tubes and simultaneously rotates and advances the latter at a controlled rate of speed past metal spray means. Such means may comprise guns **26** of the "Schori" type which deposit a uniform coating of any desired thickness on the tubes, such coating preferably being of some non-ferrous metal such as zinc which has an anodic protection for steel, another coating metal well known to those skilled in the art to be equivalent to zinc in its anodic protection for steel, being aluminum. The sprayed tubes may then be conveyed to another spray unit **15** which may deposit another metal coating such as zinc, a plastic coating or a paint coating on the basic metal coating. The sprayed tubes are thereupon desirably conveyed to a painting unit **16** preferably being presented thereto at an incline, and the painting unit injects a quantity of paint into the bores of the tubes, the latter thereupon being rotated to distribute such paint upon the entire inner surface thereof. It is of course to be understood that the burnishing means **17** are only provided where metal coatings are applied, slightly to smooth the roughened outer surface of the tube.

With the method herein described, metal tubes may be roughened and cleaned, particles removed from the bore thereof, a metal coating of uniform thickness sprayed on the exterior of the tubes and a second coating of metal, plastic or paint may be sprayed on the basic coating and the tube may be painted on the interior thereof and dried all in a speedy, continuous operation without manual handling. As the heated metal particles from the spray guns are sprayed on the tube while it is being rapidly rotated and advanced, the particles will congeal rapidly and although the tube will become sufficiently heated to aid in the drying of the paint subsequently injected therein, no portion of the tube will be exposed to high temperature for any considerable period of time.

The resultant product shown in Fig. 2 thus has a roughened outer coating of pure non-ferrous metal **31**, illustratively of zinc formed from the discrete particles sprayed thereon, which congeal to completely cover the outer surface thereof with a substantially porous mat finish and forming substantially an integral part of the metal tube **18**, and in interior coating **32** of paint. In addition, as shown in Fig. 2, a second zinc coating **33** may be bonded to the basic coating **31** the porosity of the latter permitting the second coating to penetrate thereinto for effective bonding action. Instead of such second coating being of zinc as shown in Fig. 2, it may be of plastic **34** as shown in Fig. 3 or of paint **35** as shown in Fig. 4. In all cases

the coatings securely bond to the basic substantially porous metal coating **31**. As the coatings are ductile and pliable, the tubes may be bent without cracking of such coatings which might cause rusting of the metal tube therebeneath.

The method above described will also permit the coating of tubes having threaded ends **36** without filling up such threads, which would require recutting. This is by virtue of the fact that the tube is continuously advancing during the spraying operation and insufficient time will elapse to permit filling of the threads.

By congealing is meant the conversion to the firm or relatively rigid non-flowable condition of the particles which emerge from the spray guns in flowable or plastic state.

Although the method above described has been shown as applied to relatively thin walled metal tubing, it is of course to be understood that it could just as readily be applied to metal tubing having regular pipe wall thickness.

As many changes could be made in the above method and article, and many apparently widely different embodiments of this invention could be made without departing from the scope of the claims, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

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

1. The method of coating a metal tube which comprises the successive steps of cleaning and roughening the tube, simultaneously and continuously rotating the tube in one direction and advancing the latter past continuously operating metal spray means for discharge of heated metal particles on the cleaned and roughened outer surface of the tube and while the tube is still in heated condition as a result of such metal spraying, injecting paint into the bore of the tube and rotating the tube for distribution of such paint over the entire inner surface thereof, the residual heat in the metal tube effecting rapid setting and drying of such paint to insure that the entire inner surface of the tube will be uniformly coated with such paint.

2. As an article of manufacture, a steel conduit having a cleaned, roughened outer surface having a hot-sprayed coating of all-metallic non-ferrous particles thereon of the type affording anodic protection for steel and completely covering and in contact with said cleaned, roughened outer surface to provide a substantially porous mat finish thereon, said hot sprayed coating metal being selected from the group consisting of zinc and aluminum, whereby said non-ferrous metal coating constitutes substantially an integral part of the conduit and is of ductility and pliability no less than that of the conduit which it covers so that said conduit may be bent without cracking of the coating thereon or separation of the coating therefrom.

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