

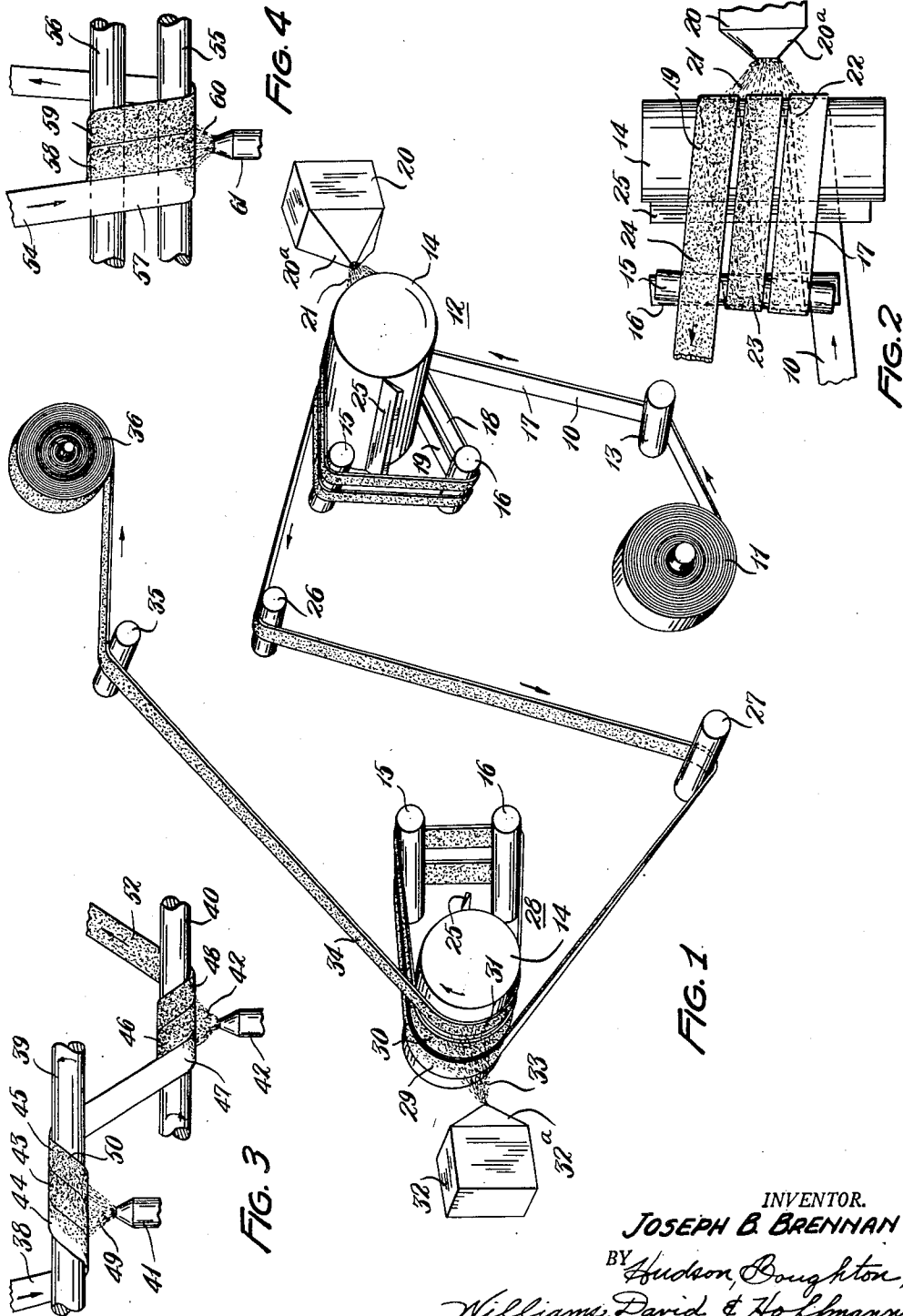
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METHOD OF SPRAY DEPOSITING METAL ON A BASE STRIP

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METHOD OF SPRAY DEPOSITING METAL ON A BASE STRIP

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2 Claims. (Cl. 117—105)

This invention relates to the production of uniform gauge lengthy metal sheets or strips by means of a continuous spraying operation and wherein there is continuous relative movement between a base strip and the spray means.

Heretofore there have been various methods proposed for the production of thin, porous metal sheets or strips such as are used in the production of various types of electrical condensers. Usually, in the production of strips of this type, a porous gauze or paper base strip is used onto which metallic particles are sprayed to deposit metal on the base strip and form therefrom the continuous, elongate porous metal strip that has desirable properties for use in condenser manufacture.

One difficulty in producing the condenser forming strips is that the sprayed metal particles do not deposit uniformly on the base strip because the sprayed particles tend to be more densely distributed in the center part of the spray zone than at the marginal portions of the spray zone. Also, in many instances, the marginal portions of the zone or field of sprayed metal pass outside of or beyond the edges of the base strip and are wasted and only the center portions of the spray zone produce a deposit on the base strip. Even if attempts are made to salvage the sprayed metal that does not deposit upon the base strip, still such metal must be reprocessed, or at least must be sprayed again in order to effect a utilization thereof.

The general object of the present invention is, therefore, to provide a novel method of depositing metal particles so as to efficiently and economically form a metallic strip which is of a substantially uniform thickness gauge transversely of the strip.

Another object of this invention is to provide a novel method of depositing sprayed metal particles on a base strip in which substantially all of the sprayed particles, including those in the marginal portions of the spray zone, are deposited on the base strip and wherein the application of the sprayed metal particles to the base strip is carried out as a substantially continuous operation and produces a deposit which is of a substantially uniform thickness transversely of the strip.

A further object is to provide a novel method of producing a sprayed metal strip of a uniform thickness in which successive passes of a base strip, which component portions thereof in different positionings relative to spray delivered metal having spray zone portions comprising thickly and thinly distributed particles, produce deposits having an aggregate desired uniform thickness transversely of the strip.

Still another object is to provide a novel method of producing a sprayed metal strip of a uniform thickness in which a base strip being advanced is led around a mandrel or the like with a plurality of convolutions thereof constituting strip elements in contiguous relation and in which the strip elements are moved in successive passes through spray delivered metal having spray zone portions comprising thickly and thinly distributed particles, such that sprayed metal deposits applied to the strip elements aggregate a desired substantially uniform-thickness metal layer on the base strip.

As an additional object this invention provides a novel method of producing a sprayed metal strip of a uniform thickness, in which the base strip is moved both longitudinally and edgewise by leading a group of serially connected contiguous convolutions thereof helically around a roll or mandrel and directing against the group of convolutions a molten metal particle spray field of varying

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density and of greater impact width than the base strip, such that portions of the sprayed metal deposit are applied to different convolutions of the group with portions of the deposit in superimposed relation and forming an aggregate spray deposited metal strip of a substantially uniform thickness transversely of the base strip.

The foregoing and other objects and advantages of the invention will be made apparent as the specification proceeds.

This application is a continuation-in-part of application Serial No. 15,474 filed March 17, 1948, and now abandoned.

Reference is made to the accompanying drawing wherein:

Fig. 1 is a perspective view illustrating the method and diagrammatically showing one arrangement of apparatus by which the method can be carried out.

Fig. 2 is a partial plan view of the apparatus further illustrating the spraying operation and the spray-deposited metal strip produced thereby.

Fig. 3 is a fragmentary diagrammatic view showing another way of carrying out the spraying operation; and

Fig. 4 is a fragmentary diagrammatic view showing still another way of carrying out the spraying operation.

Proceeding with a more detailed description, Figs. 1 and 2 show one form of the method and apparatus of the present invention for spraying molten metal particles onto a base strip 10 for producing a sprayed metal strip having a substantially uniform thickness transversely thereof. In the method and apparatus here shown, the base strip 10 is withdrawn from a roll 11 of such material and is supplied to a roll assembly 12 by being led over a tilting roll 13. The roll assembly 12 comprises a main backing roll or mandrel 14 and a pair of guide rolls 15 and 16 adjacent thereto.

The base strip 10 is led around the roll assembly 12 in a helical winding comprising a plurality of serially connected edgewise contiguous turn portions or convolutions, in this instance approximately three such convolutions 17, 18 and 19. The convolution 18 is the center convolution of the group and the convolutions 17 and 19 can be referred to as side convolutions since they are on opposite sides of the center convolution 18. The guide rolls 15 and 16 are disposed with their axes inclined relative to the axis of the main roll 14 so as to resist or prevent creepage of the base strip along the main roll axially thereof.

As already mentioned above, the base strip 10 may be a strip of porous gauze or paper, or it may be any other strip material suitable for use as a base in forming a spray-deposited metal strip or coating.

A spray device 20 including a conventional spray nozzle 20^a is disposed adjacent the roll assembly 12 and creates a spray field 21 of molten metal particles which is of varying density having a maximum density at the central axis of the field and a minimum density at the edges of the field. The spray nozzle 20^a is located relative to the main roll 14 such that it directs the spray field 21 against the group of convolutions of the base strip 10 and such that the spray field will have an impact width which is greater than the width of the base strip.

The spray nozzle 20^a can be located at different points opposite the group of convolutions of the base strip, but as shown in Fig. 2 is preferably located such that the central axis of the spray field 21 intersects the mid-point of the group of convolutions which, in this instance, is the longitudinal center line of the center convolution 18. With the spray nozzle 20^a in this relative location, it will be seen that the spray field 21 will form a sprayed metal deposit on the convolutions with portions of such deposit being applied to the different convolutions. Thus, as shown in Fig. 2, the central portion of the spray field 21 will form a deposit extending across the full width of the center convolution 18 and edge portions of the spray field will form deposits on the adjacent edge portions of the side portions of the side convolutions 17 and 19.

As the base strip 10 is advanced around the roll assembly 12 and through the serially connected convolutions 17, 18 and 19 thereof, the strip has both a longitudinal movement and an edgewise movement through the

spray field 21. The convolutions 17, 18 and 19 constitute strip elements formed by portions of the base strip 10 and, by reason of these longitudinal and edgewise movements, these strip elements are advanced by successive passes through the spray field 21. During the first of these successive passes, the convolution 17 moves through an edge portion of the spray field 21 such that a deposit 22 is formed on the edge portion of this convolution. During the second pass, the center convolution 18 moves in the same direction through the spray field and receives the deposit 23 thereon, with portions of this deposit being applied in superimposed relation to the previously applied deposit 22. The movement of the convolution 19 past the nozzle 20^a represents the third pass through the spray field, during which a deposit is applied to the adjacent edge portion of the convolution 19 in superimposed relation to the relatively thin portion of the deposit then existing on this convolution.

The result of these successive passes of the strip elements through the spray field 21 is to produce a sprayed metal deposit in which different portions of the spray deposit have been applied to the different convolutions or strip elements in superimposed relation to aggregate a spray deposited metal strip or coating 24 on the final convolution. The spray deposited strip thus produced extends across the full width of the base strip 10 and has a substantially uniform thickness transversely thereof.

As shown in Figs. 1 and 2, the base strip 10 can extend around the roll assembly 12 with the contiguous edges of the adjacent convolutions spaced apart more or less so that metal particles of the spray field 21 will be applied to and effectively cover the edges of the base strip. Portions of the spray field 21 which pass between the spaced apart edges of the convolutions, will impinge against the main roll 14 and the metal particles which adhere to this roll are scraped therefrom as by means of a suitable scraping blade 25 embodied in the roll assembly.

Instead of the convolutions of the base strip 10 having their contiguous edges spaced apart, the convolutions may have their contiguous edges in substantially abutting relation. When the convolutions have their contiguous edges in such abutting engagement, substantially all of the metal particles of the spray field 21 will be applied to the group of convolutions for forming the spray deposited metal strip 24 on the base strip and substantially none of the spray delivered metal will be wasted or will constitute scrap metal.

From the roll assembly 12, the base strip 10 passes over guide rollers 26 and 27 in succession and then is led around a roll assembly 28 in a plurality of convolutions 29, 30 and 31. The roll assembly 28 is substantially identical with the roll assembly 12 and the convolutions 29, 30 and 31 form a group similar to the above-described group of convolutions 17, 18 and 19 and present the opposite face or uncoated surface of the base strip 10 to a second conventional spray device 32. A spray field 33, of molten metal particles produced by the nozzle 32^a of the spray device 32, is directed against the group of convolutions in the same relation as has been described above for the spray field 21 to produce a spray deposited metal strip 34 on the opposite surface of the base strip 10 and which spray deposited metal strip will extend across the full width of the base strip and will be of a substantially uniform thickness transversely thereof.

The spray coated base strip being delivered from the roll assembly 28 then passes over a guide roller 35 to a take-up roll 36 on which the sprayed strip can be stored.

Fig. 3 shows another way of carrying out the spraying operation of this invention in which a base strip 38 is led around a pair of rolls or mandrels 39 and 40 in groups of helically disposed convolutions and past a pair of conventional spray nozzles 41 and 42 associated with the respective groups. The group of convolutions on the roll 39 comprises a center convolution 43 and two side convolutions 44 and 45 in edge-abutting relation thereto. Similarly, the group of convolutions on the roll 40 comprise a center convolution 46 and two edge-abutting side convolutions 47 and 48.

The nozzle 41 produces a spray field 49 of molten metal particles which are directed against the first group of convolutions to form a sprayed metal strip 50 of uniform thickness on one surface of the base strip 38. Similarly, the spray nozzle 42 produces a spray field 51 of molten metal particles and directs the same against the

second group of convolutions for producing a sprayed metal strip 52 of substantially uniform thickness on the opposite surface of the base strip. The location of the spray nozzles 41 and 42 relative to the group of convolutions, is similar to that already described above for the nozzle 20^a and is such that portions of the deposits are applied to different convolutions with portions of the deposits in superimposed relation to form an aggregate spray deposited metal strip of uniform thickness.

Fig. 4 of the drawing shows a base strip 54 being led around a pair of adjacently spaced rolls on mandrels 55 and 56 to form a group of convolutions 57, 58 and 59 against which a molten metal particle spray field 60 is directed by a conventional spray nozzle 61. The spray field 60 forms a spray deposited metal strip on the base strip 54 in the same manner as has already been described above.

Metal coated base strips produced in accordance with this invention have greater electrical capacity than corresponding strips produced in conformity with the prior art. For example, coated base strips produced in accordance with the present invention have shown capacities of between 7.8 and 8.1 microfarads per 6 square inches of material, whereas corresponding areas of base strips produced by other known methods have capacities of only between 5 and 6 microfarads. Both base strips were produced by use of the same amount of sprayed material with the difference being that by practice of this novel method, an efficient utilization of the spray material was achieved.

By previous spraying methods much of the metal travels beyond the edges of the base strip and is not utilized in forming the deposit, whereas in the present method this additional metal is deposited on the base strip and is utilized primarily on the edge portions thereof to produce a deposit of uniform thickness. This has appreciably benefited the electrical capacity of the resultant strip material. Electrode sheets made in accordance with the prior art have edge portions which are thinner than their center sections and these thinner edge portions have more resistance than the center sections. A condenser made from an electrode sheet of such variable thickness has a greater power-factor loss than a condenser made from a uniform gauge electrode strip, such as the one produced by the present invention.

Although it has been indicated at a previous point in this application that the base strip may be formed from paper, gauze or other suitable material, the present invention also contemplates depositing the sprayed metal onto a metal tape. The spray deposited metal may be permitted to remain on such tape, or can be stripped therefrom as a sheet after the sprayed metal has solidified. In such latter instances, it may be necessary to treat the metal tape in known manners to prevent adhesion of the deposited metal to the base metal tape. Another possibility in producing a sprayed metal strip in accordance with this invention, is that of forming a spray deposit of metal on a fibrous base strip after which the excess portion, or all exposed material of the fibrous base strip, is burned off or otherwise removed from the resultant strip.

Sprayed metal strips made in accordance with this invention generally are, for example, about two inches in width and have a thickness of about .0035 inch. Similar strips made in accordance with prior spraying practices have varied appreciably (percentage-wise) in thickness at the edges of the strips and have had a thickness of only about .0025 inch at the edge portions. However, by practice of the present invention wherein the edge portions of a base strip are subjected to a principal and to a secondary spraying action, the base strip produced has a substantially uniform thickness laterally of the strip. Furthermore, the strip produced will be uniform in thickness, width and other properties and characteristics at longitudinally spaced portions thereof.

When produced by the present method, the strip can therefore be held to very close tolerances and will be of a uniform gauge both longitudinally and transversely.

From the foregoing detailed description and the accompanying drawing, it will now be readily understood that this invention provides a novel method of spraying metal onto a base strip by which a deposit of metal will be produced efficiently and economically on such base strip having a substantially uniform thickness transversely of the strip. Additionally, it will be seen that

the present invention provides for the carrying out of the novel method as a continuous operation and with an efficient use of the sprayed metal. It will now also be understood that portions of the spray field of metal particles will be applied to portions of different convolutions of a group of contiguous helical convolutions of the base strip, such that during successive passes of the strip portions through the spray field, the superimposed deposits will aggregate a sprayed metal strip of the desired uniform thickness transversely thereof.

Although the drawing shows the strip being treated as comprising a group of three helical convolutions in contiguous relation, the invention applies to and includes all situations regardless of whether the group is formed of a smaller or larger number of such convolutions.

Although the spraying method of the present invention has been illustrated and described herein to a somewhat detailed extent, it will be understood, of course, that the invention is not to be regarded as being limited correspondingly in scope but includes all changes and modifications coming within the terms of the claims hereof.

Having thus described my invention, I claim:

1. In a continuous method of producing spray deposited metal sheet in strip form the steps of, arranging a base strip to form a helical winding comprising serially connected edgewise contiguous turn portions, creating a molten metal particle spray field of different densities laterally thereof and having a maximum density substantially centrally thereof and a minimum density at its lateral edges, substantially continuously advancing the base strip through the successive turn portions of said winding for substantially continuously moving the base strip both longitudinally and edgewise through said spray field, successively forming sprayed metal deposits of varying thickness on the longitudinally and edgewise moving base strip with portions of said deposits on different turn portions of said winding and with portions of said deposits in superimposed relation such that said deposits form an aggregate spray deposited metal strip of substantially uniform thickness trans-

versely of the base strip, and leading the base strip with the spray deposited metal strip thereon substantially continuously and in a substantially straight line away from said winding.

2. In a continuous method of producing particulate metal coated sheet material in strip form the steps of, forming in a base strip a helical winding comprising serially connected edgewise contiguously turn portions comprising a central turn portion and side turn portions on opposite sides of said central turn portion, creating a molten metal particle spray field of an impact width greater than the width of the base strip and of varying intensity and having relatively thickly distributed particles adjacent the central axis of the spray field and relatively thinly distributed particles adjacent the outer edges of the spray field, directing said spray field against said winding substantially continuously with the maximum density central portion impinging against and forming a sprayed metal deposit on said central turn portion and with the minimum density edge portions impinging against and forming sprayed metal deposits on the adjacent edge portions of said side turn portions, substantially continuously advancing said base strip by a progressive longitudinal and edgewise movement through said winding and relative to said spray field such that said sprayed metal deposits form an aggregate sprayed metal deposit layer on the base strip for substantially the full width thereof and of a substantially uniform thickness transversely of the base strip, and leading the base strip with the spray deposited metal thereon substantially continuously and in a substantially straight line away from said winding.

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