Dec. 14, 1965 M. R. COMMANDAY ETAL 3,223,343

APPARATUS FOR FORMING SHEET METAL TREATING PACKS

Filed Oct. 29, 1962 2 Sheets-Sheet 1

FIG. 1.

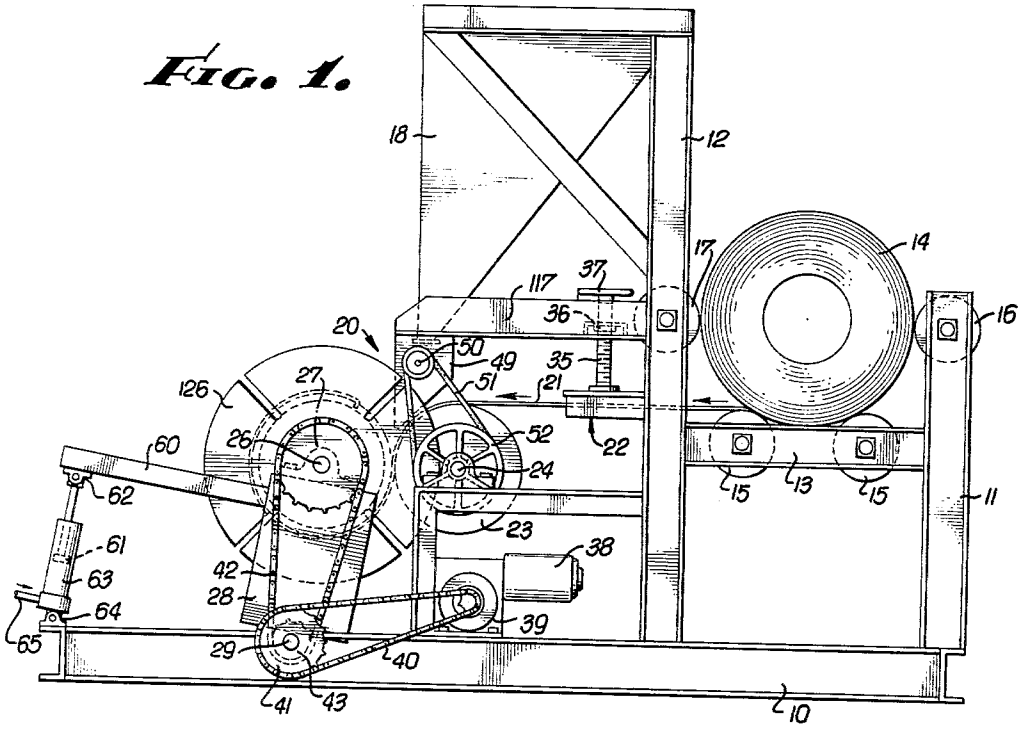
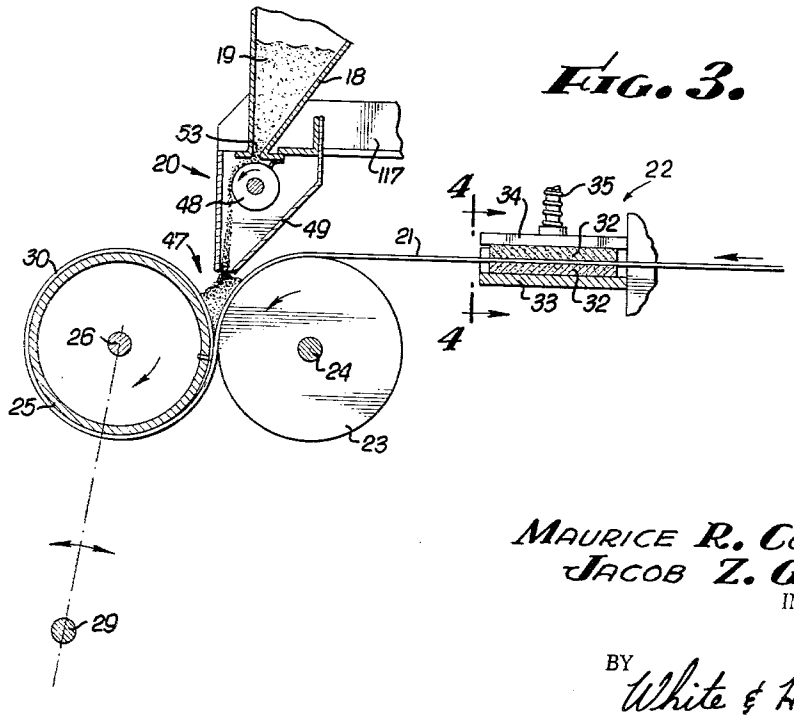


FIG. 3.



MAURICE R. COMMANDAY
JACOB Z. GOLDBERG
INVENTORS.

BY White & Haefliger
ATTORNEYS.

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Filed Oct. 29, 1962 2 Sheets-Sheet 2

FIG. 6.

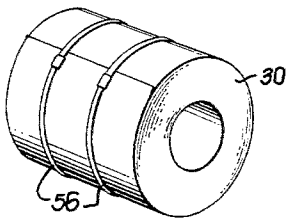


FIG. 2.

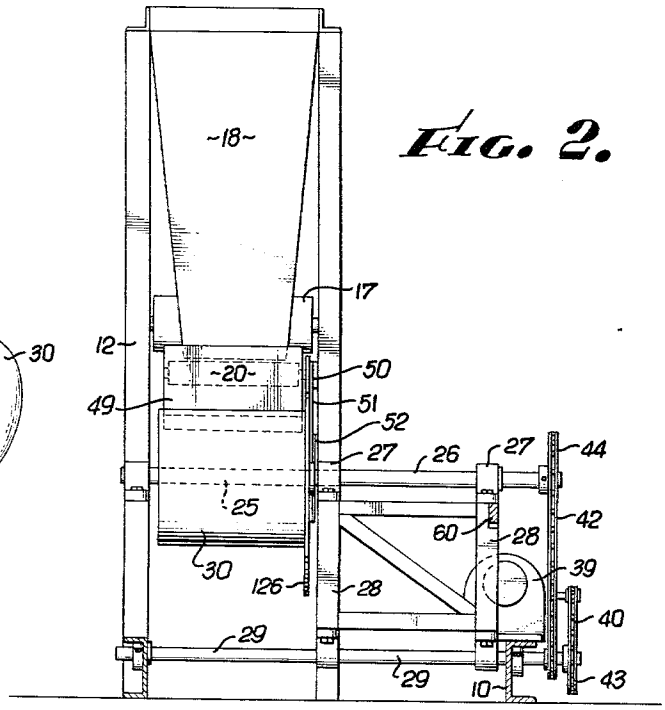


FIG. 4.

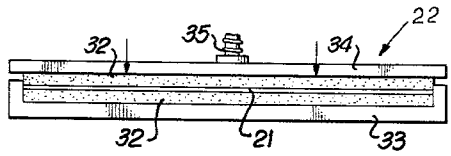
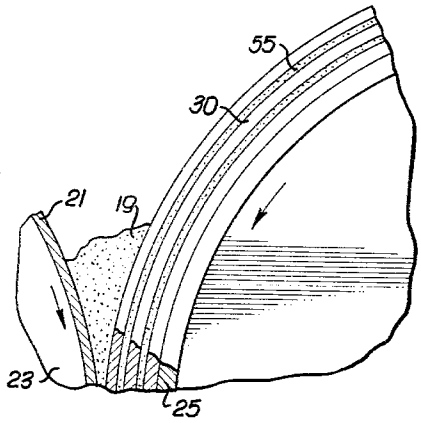


FIG. 5.



MAURICE R. COMMANDAY
JACOB Z. GOLDBERG
INVENTORS.

BY White & Haefliger
ATTORNEYS.

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APPARATUS FOR FORMING SHEET METAL TREATING PACKS

Maurice R. Commanday, Los Angeles, and Jacob Z. Goldberg, Falibrook, Calif., assignors to Chromizing Corporation, Hawthorne, Calif., a corporation of California

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11 Claims. (Cl. 242—78.1)

This invention has to do with apparatus for incorporating comminuted solid materials in convolutely wound sheet metal packs adapted to be heated for surface treatment of the sheet stock by the comminuted material distributed and retained between the pack convolutions.

The invention has been conceived typically as apparatus for producing a roll pack of ferrous or non-ferrous sheet metal, for surface modification by diffusion into the metal surface of one or more components of a pulverulent treating composition, being the aforesaid comminuted solid materials, for any of various purposes such as to increase the resistance of the metal to oxidation, corrosion or surface attacks in general, and particularly under high temperature oxidizing conditions. Generally speaking, the art of diffusing one or more metals into the surface of another, e.g. the chromizing of ferrous metals, is well known and has been practiced mainly by heating plural pieces or sheets of the metal in contact with pulverulent treating mixtures.

The method concepts of departing from the conventional practices by incorporating the treating material in and between the convolutions of a unitized roll pack, are dealt with in a copending application, Serial No. 781,824 filed October 27, 1958, now Patent No. 3,163,553. Our present objects are directed to apparatus for use in efficiently performing that and physically similar methods.

In accordance with the invention, provision is made for winding sheet metal stock onto a mandrel and forming at the sheet approach to the mandrel a throat defined by the outer convolution on the mandrel and the adjacent unwound sheet. The comminuted treating material is fed to the throat at a controlled rate determined primarily by the quantity, or thickness, of the material layer, required for treatment of the metal surface, all in a manner such that progressively with winding on the mandrel, the treating material is distributed uniformly and continuously between the roll convolutions. Upon completion, the composite roll may be suitably bound for heating in a furnace.

A particular object of the invention is to provide for both compaction and retention of the inter-convolute material simply and effectively as a consequence of winding control of the metal sheet. For this purpose we provide resistance to advancement of the sheet under the winding pull of the mandrel, so that the treating material becomes tightly compacted in the wound roll, benefiting both uniformity of distribution and retention between the convolutions.

Another important feature of the invention is provision for a substantially constant relation between the pulverulent feed delivery and the above mentioned throat which tends to shift with buildup on the mandrel. For this purpose, the sheet stock is advanced over a guide, preferably in the form of a roll paralleling the mandrel in direct proximity, and relatively shift the mandrel and guide to increase their spacing as the wound roll accumulates, all in a manner retaining the desired throat location. A further feature in this connection is provision for yieldably resisting such mandrel and guide relative displacement, consistant with initiating compaction of the treating material advancing from the throat to between the wound convolutions.

Other features and objects have to do with assuring

controlled uniform feed of treating material to the throat in timed or quantitive relation with the rate of sheet advancement or winding.

All of the above mentioned as well as additional features and objects of the invention will be more fully understood from the following detailed description of an illustrative apparatus shown by the accompanying drawings, in which:

FIG. 1 is a view showing typical roll winding and compound feeding mechanism in side elevation;

FIG. 2 is an end elevation of FIG. 1;

FIG. 3 is a fragmentary enlarged view showing the compound feeder in relation to the roll being wound;

FIG. 4 is a transverse view of the brake device taken on line 4—4 of FIG. 3;

FIG. 5 is a fragmentary enlargement of the roll being wound, illustrative of the compound delivery thereto and its accommodation between the roll convolutions; and

FIG. 6 is a perspective showing of the wound and bound roll.

First, it is to be understood that any suitable mechanism may be employed for winding the sheet metal stock in convolute roll form, and for feeding the compound between the convolutions in the manner outlined in the foregoing. Accordingly, the apparatus showings in the drawings are to be regarded merely as illustrative of a suitable mechanical means for carrying out the present method and forming the resultant convolute wound pack.

Referring first to FIGS. 1 and 2, the apparatus is shown to comprise a frame structure including a base **10**, uprights **11** and **12** supporting horizontal members **13**, all in a manner such that a roll **14** of the sheet metal to be treated is supported for rotation on the rollers **15** and has its horizontal displacement limited between rolls **16** and **17**. Frame member **12** together with horizontal members **117** support a supply hopper **18** from which the comminuted compound **19** is delivered to the feeder, generally indicated at **20**.

As it is drawn from the rotatably supported roll **14**, the sheet metal stock **21** which typically may be a low carbon steel, passes through a braking device **22** and thence over a roll **23** carried by shaft **24** to be wound on an expanding type (radially collapsible) mandrel **25** projecting centrally from a face plate or disc **126** having a shaft **26** journaled in bearings **27** mounted on oscillatory arms **28** which may be swung on shaft **29**.

Suitable provision is made to serve the dual functions of urging the mandrel **25** and roll **23** together at substantially uniform pressure, and to permit such progressive displacement of mandrel **25** as will accommodate the increasing diameter of the roll pack as it is being wound. Typically such means may comprise an arm **60** projecting laterally from one of the arms **28** and constantly urged upwardly as by piston **61** having its rod pivotally connected at **62** to the arm, the cylinder **63** having a pivotal mounting at **64** and being supplied with air under constant pressure through line **65**. The constantly applied force exerted by the piston swings arms **28** and mandrel **25** toward roll **23** to maintain a constant pressure at their interface below the throat **47**, the piston however being displaceable downwardly within the cylinder to permit movement of roll **25** away from roll **23** in accordance with the progressive increase in diameter of the convolute pack as it is being wound.

The brake **22** is shown to comprise a pair of pressure pads **32** bearing against the sheet **21** passing between them, and confined between support **33** and the head **34** of a press screw **35** extending through a stationarily supported threaded sleeve **36** and rotatable by handle **37** to vary the braking confinement applied to the strip **21** and therefore its resistance to advancement. The brake is so adjusted as to tension the strip **21** in resistance to the winding pull

of the mandrel **25**, sufficiently to assure tracking and progressive compaction of the roll convolutions against the filled-in treating compound.

Mandrel **25** is driven by a variable speed motor **38** through gear box **39**, chain **40** applied to sprocket **41** on shaft **29**, and chain **42** passing over sprockets **43** and **44** respectively on shafts **29** and **26**. The speed of the motor is automatically regulated to maintain constant surface speed of the strip through the unit. The feeder is shown to comprise typically a roller **48** extending within the feeder housing **49** and carrying terminally an external sprocket **50** driven by chain **51** from sprocket **52** on shaft **24**, roll **23** and sprocket **52** being turned by the frictional drive imparted by the sheet **21**. The comminuted compound **19** passes through slot **53** in the bottom of the hopper **18**, onto the roll **48** at a rate governed by the rotative speed of the roll, which in turn is governed to assure delivery of the compound into the throat **47** in a quantity rate required for adequate filling-in between the roll pack convolutions.

The compound **19** is introduced to the throat **37** and distributed across substantially the width of the sheet **21**, in quantity sufficient for treatment of the contacting metal surfaces in the wound roll, the quantity of the compound and therefore the thickness of its layers at **55** in the roll, being variable in accordance with such considerations as the composition of the compound and the particular metals or combinations thereof involved in the diffusion process. The layer thickness at **55** may be in the order of about 0.005 to 0.20 inch. Upon completion of the strip winding into the convolute roll **30**, the latter may be tied and its outside convolutions held in the condition in which they are wound, by any suitable means. Typically, the completed roll pack is shown in FIG. 6 to be held against opening of its convolutions, by externally applied metal bands **56**.

The roll pack thus formed may be heated in any appropriate furnace and in an inert or non-oxidizing atmosphere under temperature and time conditions of the order commonly employed in the conventional diffusion processes. Generally, the temperature of heating will be maintained within the range of about 1200° to 2000° F. over periods of from 4 to 24 hours.

In further reference to the treating compound **19**, the latter typically may comprise a comminuted mixture of a refractory powder serving as a filler or diluent, a source of the treating metal either in elemental or combined condition, and an energizer or halogen source comprising one or more combined or elemental halogens. Suitable refractory fillers include typically tabular calcined alumina, adsorptive alumina, magnesium oxide, calcined or uncalcined kaolin and any of the inert refractory oxides. The treating metal source may consist of the metal, e.g. chromium, in powdered form, or the ferro-metal such as ferrochrome, in powdered form. The energizer, in which the halide may be fluorine, chlorine, bromine, iodine or mixtures of these, chemically may be combined halides such as the ammonium or lithium halides or the elemental halide as in the case of iodine, or mixtures of these. Such compositions and their use by conventional methods in metal surface conditioning, are well known to those familiar with the art.

We claim:

1. Apparatus for incorporating comminuted material in a convolute roll pack, comprising

(A) a winding mandrel,
(B) means for rotating the mandrel,
(C) means for supporting sheet metal extending to the mandrel to be wound thereon in convolute roll form by the rotation of the mandrel,
(D) means for feeding solid comminuted material into a throat formed at and by convergence of the sheet metal with the outer convolution of the roll, and
(E) means resisting winding advancement of the sheet extending to the roll so that said comminuted material is compacted for retention between the roll convolutions.

2. Apparatus according to claim **1**, in which said feeding means (D) operates to deliver the comminuted material to said throat in predetermined quantity relation to advancement of said sheet.

3. Apparatus according to claim **2**, in which said throat extends horizontally and said feed means (D) comprises a metering rotor above and operating to deliver said material downwardly into the throat.

4. Apparatus according to claim **1**, comprising also means for maintaining said throat in substantially constant position relative to the feed means (D) as the convolutions accumulate on the roll.

5. Apparatus according to claim **1**, in which said resisting means (E) comprises a pressure pad urged against the sheet to impose frictional resistance to its advancement.

6. Apparatus according to claim **1**, comprising also means for operating said material feeding means (D) in predetermined timed relation with the operation of said mandrel rotating means (B).

7. Apparatus according to claim **1**, in which said mandrel is horizontally positioned, and comprising guide means deflecting the sheet metal directly at its approach to the mandrel to give essentially vertical V-shape to said throat.

8. Apparatus according to claim **1**, comprising also a guide roll extending parallel with and peripherally adjacent the sheet being wound on the mandrel, the sheet passing over said guide roll to form one side of said throat, and means whereby one of said mandrel and guide roll is movable away from the other as the wound sheet accumulates on the mandrel.

9. Apparatus according to claim **8**, in which said supporting means (C) includes means rotatably supporting a wound stock roll of said sheet metal for passage over said guide roll to the mandrel.

10. Apparatus according to claim **9**, in which said resisting means (E) is interposed between said stock roll and the guide roll.

11. Apparatus according to claim **8**, in which the last mentioned means includes means for yieldably urging the mandrel toward the guide roll.

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MERVIN STEIN, *Primary Examiner.*