

May 2, 1939.

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2,156,337

MACHINE AND METHOD FOR MANUFACTURING BUSHINGS

Original Filed June 17, 1935

4 Sheets-Sheet 1

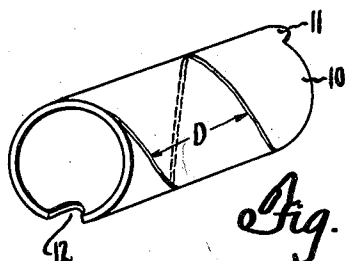


Fig. 1

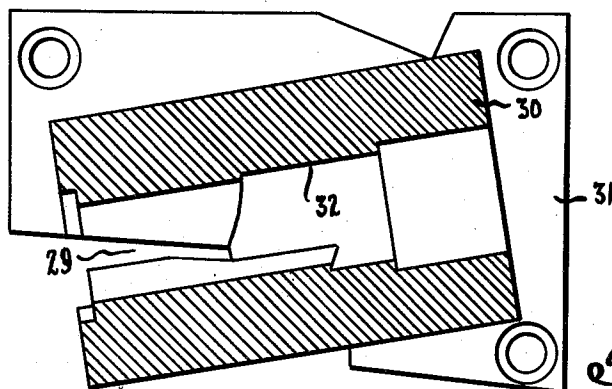


Fig. 9

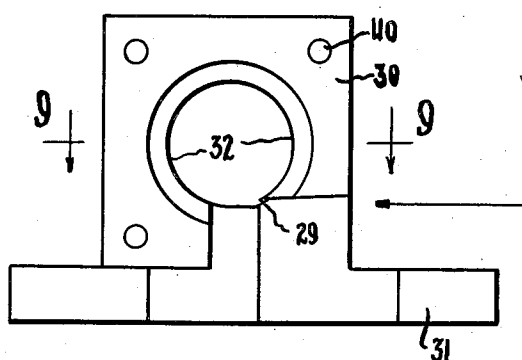


Fig. 8

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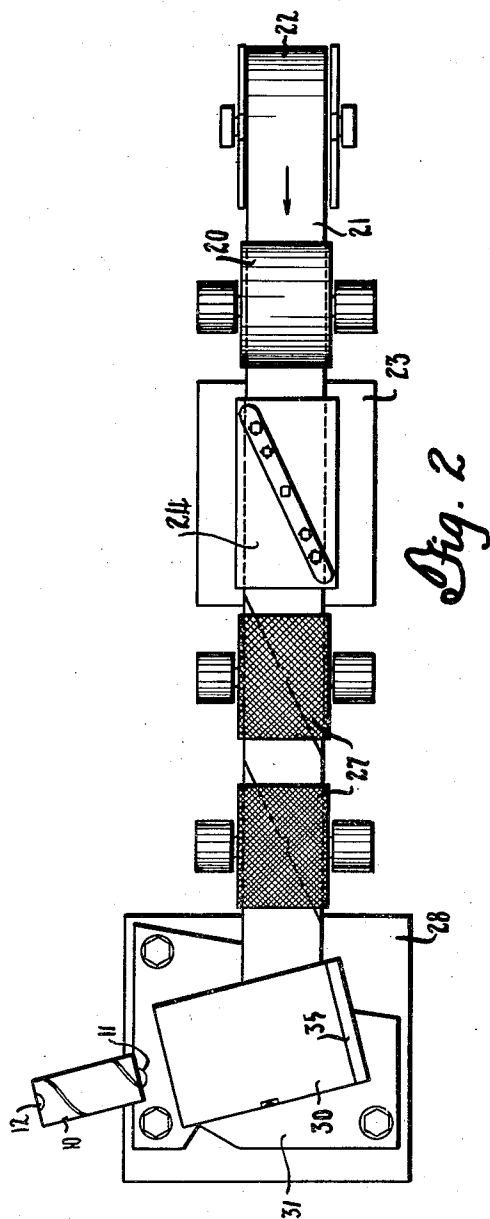
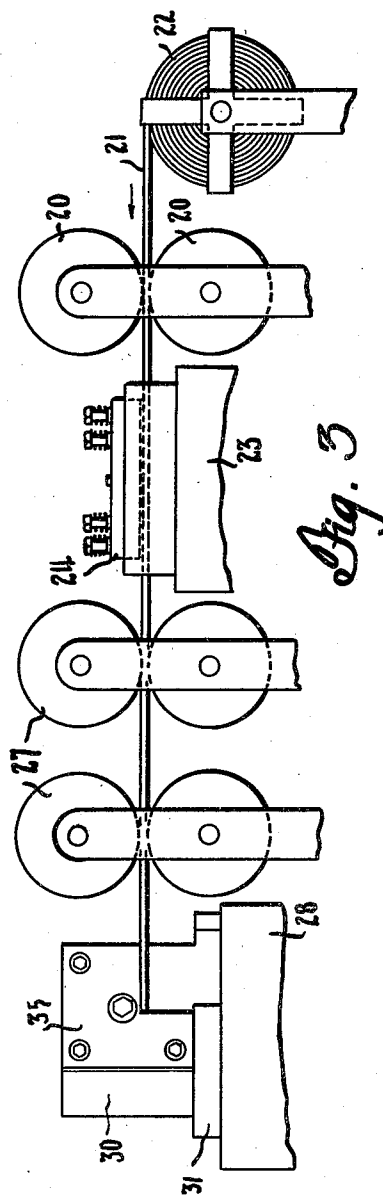
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MACHINE AND METHOD FOR MANUFACTURING BUSHINGS

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MACHINE AND METHOD FOR MANUFACTURING BUSHINGS

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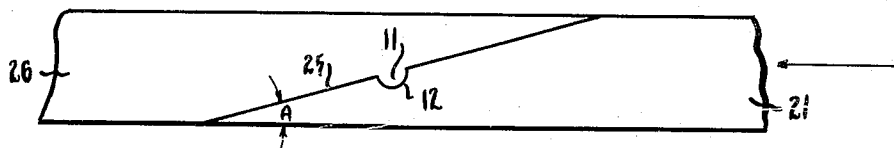


Fig. 4

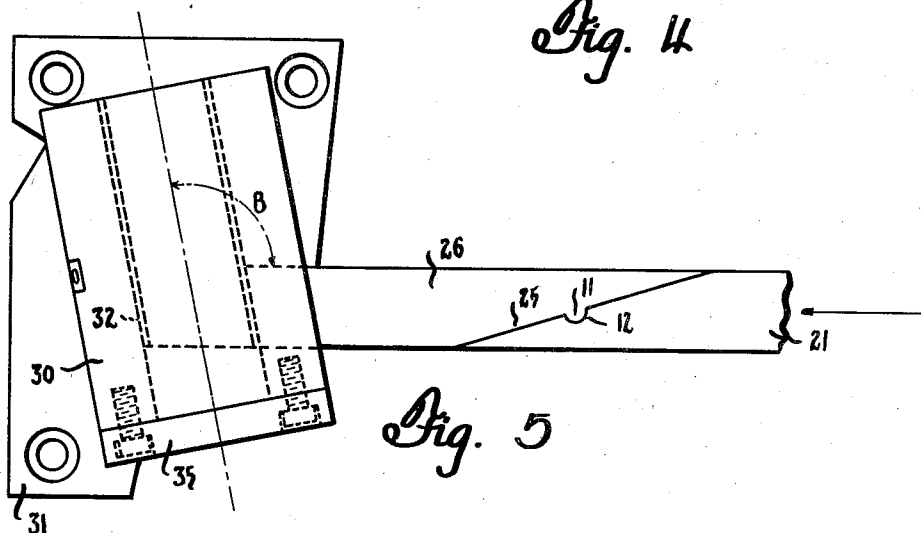


Fig. 5

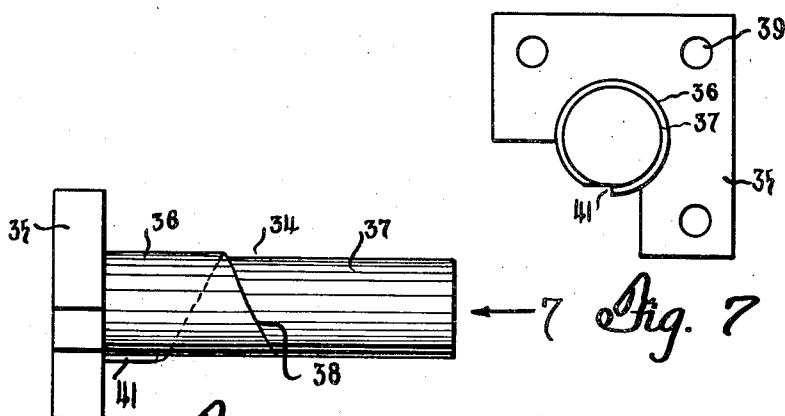


Fig. 6

Fig. 7

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MACHINE AND METHOD FOR MANUFACTURING BUSHINGS

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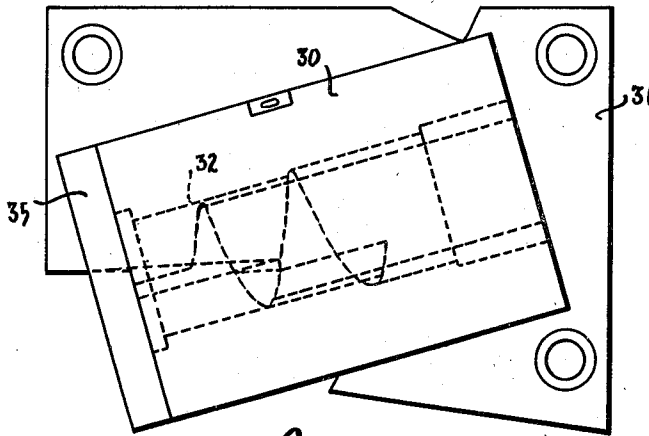


Fig. 10

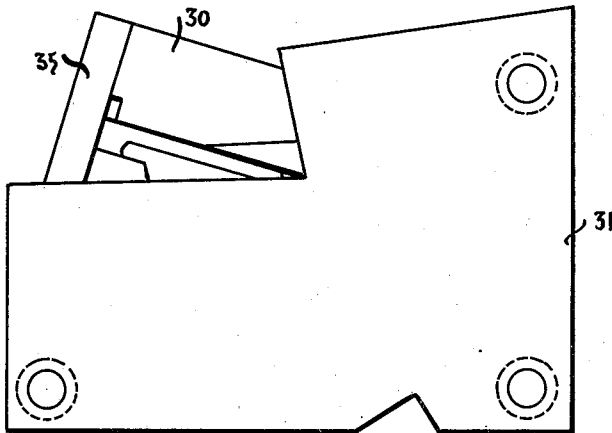


Fig. 11

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UNITED STATES PATENT OFFICE

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MACHINE AND METHOD FOR MANUFACTURING BUSHINGS

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Application June 17, 1935, Serial No. 27,038

Renewed November 12, 1938

20 Claims. (Cl. 153—66)

This application relates to machines and methods for manufacturing bushings, particularly those of the spirally rolled cylindrical type illustrated herein and in the patent to Virgil Oldberg 1,938,974, December 12, 1933, Figs. 4 and 5.

The principal object of the present invention is to provide a machine and a method for manufacturing a spirally rolled cylindrical bushing from a ribbon of metal or the like economically and expeditiously.

In general the method may be described substantially as follows: A flat ribbon of stock is fed into a cutting die which cuts the ribbon into lengths suitable for producing the finished bushing, the line of cut being across the edges of the ribbon and at an acute angle to these edges and to the direction of feed of the stock. The lengths are fed into a stationary spiraling die which rolls and draws the lengths into spirally rolled cylindrical bushings, and as each length is pushed towards the spiraling die it pushes the preceding length through the spiraling die, and as each length is rolled in the spiraling die it pushes the preceding length, already rolled into a bushing, out of the spiraling die and into a receiver for finished bushings.

The spiraling die includes a stationary sleeve having a bore whose inside diameter is substantially equal to the outside diameter of the finished bushing, and supported within the sleeve is a mandrel having a cylindrical part whose outside diameter is substantially equal to the inside diameter of the finished bushing. The lengths are rolled on this mandrel part and against the wall of the bore of the sleeve in the space between this mandrel part and the bore into finished spirally rolled cylindrical bushings.

The spiraling die is so positioned with respect to the direction of feed of the stock that its axis of rolling, namely the common axis of its mandrel and bore, is at an obtuse angle to the direction of feed, and the mandrel of the spiraling die is provided with a spirally formed shoulder which by a combined rolling and drawing action causes the lengths fed into the spiraling die to be rolled and drawn, due to the pressure of the lengths behind them, into a spirally rolled bushing.

The machine in general may be characterized as comprising a cutting die, and a spiraling die, means for feeding ribbon stock into the cutting die, and means for feeding lengths of stock positively and with adequate pressure into the spiraling die. It is observed that the blade of the

cutting die and the rollers of the feed means are the only moving parts of the machine, and that the spiraling die is a stationary part of the machine and contains no moving parts.

For an understanding of the method and machine here disclosed, reference will be had to the appended drawings and the accompanying specification.

In these drawings:

Fig. 1 shows a spirally rolled bushing representing the finished product of the method and the machine;

Fig. 2 is a top plan view of a horizontally arranged machine;

Fig. 3 is an elevation view of the machine of Fig. 2;

Fig. 4 illustrates the cutting operation which cuts ribbon into lengths;

Fig. 5 illustrates the relation of the spiraling die to the direction of feed of the lengths;

Fig. 6 shows the mandrel of the spiraling die;

Fig. 7 is a view of the mandrel as if from the direction of the arrow 7 of Fig. 6;

Fig. 8 shows the sleeve of the spiraling die and the arrow thereof illustrates the direction of feed thereinto of lengths of stock;

Fig. 9 is a section as if on the line 9—9 of Fig. 8;

Fig. 10 is a top plan view of the sleeve; and

Fig. 11 is a bottom plan view of the sleeve.

The finished product (Fig. 1) is in the nature of a spirally rolled cylindrical bushing 10, preferably of steel or the like, and having at one end a lug 11 and at the other end a notch 12; as illustrated, these are of complementary form and diametrically opposed.

For manufacturing bushings of the character of Fig. 1 in quantities, economically and expeditiously, there is provided a machine whose arrangement of parts is illustrated best in Figs. 2 and 3. Referring to these figures it will be seen that the machine includes a positive drive feed means whose rolls 20 feed a ribbon 21 of stock from a reel 22 into a cutting die, and it is observed that the width of the ribbon of stock from edge to edge is equal to the distance D between the turns of the spiral line of Fig. 1. The feeding rolls are actuated to feed the ribbon positively and intermittently into a cutting die having a stationary base 23 and a vertically reciprocating cutting head 24 whose blade is positioned to cut the ribbon on a line 25 from edge to edge of the ribbon 21, thus forming lengths of stock 26. The cut line is at an acute angle "A" (Fig. 4) to the edges of the ribbon and to the

direction of feed as illustrated, and the blade is formed so that the cut line has a scallop which provides in the leading end of the ribbon a notch which forms the notch 12 of the bushing and in the trailing end of a length 26 a complementary projection which forms the projection 11 of the bushing. In the preferred embodiment the scallop is in the form of a semi-circle whose center is on the cut line 25, and midway between the edges of the ribbon.

For different sizes or diameters of bushings different cutting dies will be used, and the angle "A" which determines the relation of the cut line 25 to the direction of feed, while generally the same for all sizes or diameters of bushings, will be specifically different, the angle being most acute in the case of small sizes and progressively increasing as the size or diameter of the bushings increases. It is preferred, however, in all cases to have the scallop of the cutting blade midway between the edges of the ribbon with its center on the cut line 25.

The cutting die is actuated by means (not illustrated) properly timed to the means for causing rotation of the positive drive feed rolls so that the cutting die is at rest when the feed rolls actuate for feeding and vice versa; in other words, the feeding means and the cutting die operate intermittently and successively in properly timed relation.

Cut lengths are forced out of the cutting die by the ribbon being fed into the cutting die and are forced into the positive drive knurled rolls so that the feeding means 27 which, with tremendous pressure, and intermittently, force cut lengths into the spiraling die referenced generically 28, and the cooperation of the lugs and the projections formed by the scallops at the cut lines interlocks the lengths and prevents relative shifting of the same preceding and during such feeding. The positive drive feeding means 27 are actuated intermittently and in synchronism with the feeding means 20 so that no jamming of the parts in the cutting die can take place, for as ribbon is fed into the cutting die, cut lengths are fed into the feeding means 27 and moved away from the cutting die.

As stated above, the spiraling die is positioned to receive the leading ends of cut lengths as these are forced into a slot 29, Fig. 8, of the sleeve 30 which is formed with a base 31 securely attached to the bed of the machine. The sleeve has a cylindrical bore 32 substantially of the diameter of the finished bushing and is buttressed by being made of square section.

The slot 29 is at an acute angle with respect to the axis of the bore, and in the case of a horizontal machine as is the machine illustrated, the slot 29 is forward of and below the axis of the bore 32. The relation of the slot to the axis and the relation of the axis to the direction of feed is such that the axis is at an acute angle to the line of the slot, which line is perpendicular to the direction of feed, so that the axis is at an obtuse angle "B" to the direction of feed (Fig. 5).

Disposed within the bore of the sleeve is a mandrel 34 provided with an end block 35 adapted to be secured to the end of the sleeve 30 so that the mandrel can be supported in the bore 32 from one end of the mandrel, or cantilever mounted, the space between the mandrel and the sleeve bore 32 being completely free all the way from the supported end of the mandrel through the entire bore and at the free end of the mandrel

which is the end adjacent the point of emergence of finished bushings.

The mandrel is formed of two parts referenced 36—37. The part 36 adjacent the end block is in the nature of a cylinder whose diameter is substantially equal to the inner diameter of the bore, whereby the mandrel will have a large bearing in the sleeve, and is formed with a spiral shoulder 38. The part 37 of the mandrel is cylindrical and its diameter is considerably less than that of the bore and substantially equal to the inner diameter of the finished bushing.

When the mandrel is positioned within the bore 32 it is so oriented to the bore by the registration of its bolt holes 39 with the tapped holes 40 of the sleeve that the elemental shoulder 41 thereof is positioned adjacent the wide mouth of the slot 29 of the sleeve (Fig. 9) so that that point of the spiral shoulder 38 nearest the end block 35 of the mandrel will be the first point to be engaged by the leading end of a cut length 26 of stock fed into the spiraling die through the slot 29.

Inasmuch as the cut line 25 is at an acute angle to the direction of feed of the ribbon and to the edges of the cut lengths, the leading part of each cut length is in the nature of a sharp point; this leading point will engage the lowest point of the spiral shoulder 38 and will be deflected by such engagement and by the pressure behind the cut length as the cut length is fed to follow the spiral shoulder 38, and this action which is a combined spiral rolling and drawing action serves to form the finished bushing which, by virtue of the fact that it has been rolled upon the mandrel part 37 and in the bore 32, has its inner and outer diameters equal to the outer and inner diameters of the mandrel part 37 and the bore 32. The finished bushing is ejected from the space between the mandrel and the sleeve by the pressure on its trailing end produced by the leading end of the cut length behind it and at the end of the die, the finished bushing drops from the sleeve into a receiver for finished bushings.

It will be observed that at all times until the bushing is completely formed and ejected from the spiraling die that the projection 11 on the trailing end of a bushing is interlocked with the notch 12 on the leading end of a cut length behind it so that relative shifting of the cut lengths even as they pass through the spiraling die is prevented; this action facilitates the accurate manufacture of spirally rolled bushings.

For various sizes of bushings, different spiraling dies are provided and the different spiraling dies are mounted with respect to the direction of feed on different acute angles "B" between the spiraling die axis and the direction of feed; as the diameters of the bushings increase, the angles between the spiraling die axis and the direction of feed will decrease, approaching an angle of ninety degrees.

Similarly, as different sizes of bushings are desired, the diameters of the sleeves and the mandrel parts increase, inasmuch as these diameters determine the size of the bushing to be rolled.

It will be observed that the machine here shown can be contrasted with machines for making similar products wherein the spiraling action is provided by rotating rolls. Here the spiraling action is provided by forcing stock into the space between a mandrel and a sleeve, both of which are stationary parts of a die that is stationarily mounted.

I claim:

1. A method for manufacturing spirally rolled

cylinders of sheet metal or the like which comprises (a) feeding ribbon stock into a cutter which cuts the stock into lengths each having a leading edge at an acute angle to the direction of feed and a trailing edge at an acute angle to the direction of feed, the feeding of the ribbon stock being relied upon to eject cut lengths from the cutter, (b) feeding cut lengths into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die.

2. A method for manufacturing spirally rolled cylinders of sheet metal or the like which comprises (a) feeding ribbon stock into a cutter which cuts the stock into lengths each having a leading edge at an acute angle to the direction of feed and a trailing edge at an acute angle to the direction of feed, the feeding of the ribbon stock being relied upon to eject cut lengths from the cutter, (b) feeding cut lengths into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a spiral shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

3. A method for manufacturing spirally rolled cylinders of sheet metal or the like which comprises feeding cut lengths into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die.

4. A method for manufacturing spirally rolled cylinders of sheet metal or the like which comprises feeding cut lengths into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being pushed into the spiraling die and through the space between the mandrel and sleeve suc-

cessively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a spiral shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

5. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel mounted at one of its ends and having its other end free, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and positioned at an acute angle to said axes.

6. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel mounted at one of its ends and having its other end free, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and positioned at an acute angle to said axes, said mandrel having a spiral shoulder thereon aligned with said slot so as to be engaged by the leading edge of stock fed into the annular space through said stock.

7. A method for manufacturing a spirally rolled cylinder which includes the step of feeding stock into and through a spiraling die having a stationary sleeve containing a cylindrical bore of the outside diameter of the cylinder to be made and containing a stationary cylindrical mandrel of the inside diameter of the cylinder to be made and mounted at one of its ends, with the other end free the axes of the bore and mandrel coinciding and being at an obtuse angle to the direction of feed of the stock, the sleeve having a longitudinally disposed feed entrance slot communicating the annular space between the bore and mandrel with the outside of the sleeve and positioned at an acute angle to the axes of the bore and mandrel.

8. A method for manufacturing a spirally rolled cylinder which includes the step of feeding stock into and through a spiraling die having a stationary sleeve containing a cylindrical bore of the outside diameter of the cylinder to be made and containing a stationary cylindrical mandrel of the inside diameter of the cylinder to be made and mounted at one of its ends, with the other end free, the axes of the bore and mandrel coinciding and being at an obtuse angle to the direction of feed of the stock, the sleeve having a longitudinally disposed feed entrance slot communicating the annular space between the bore and mandrel with the outside of the sleeve and positioned at an acute angle to the axes of the bore and mandrel, the mandrel having a spiral shoulder aligned with the feed slot so as to be engaged by and direct the leading edge of fed stock around and along the mandrel.

9. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and

positioned at an acute angle to said axes, the slot being so positioned with respect to the axes and the annular space that strip stock fed into the space through the slot enters the space tangentially of the mandrel.

10. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and positioned at an acute angle to said axes, the slot being so positioned with respect to the axes and the annular space that strip stock fed into the space through the slot enters the space tangentially of the mandrel, said mandrel having a spiral shoulder thereon aligned with said slot so as to be engaged by the leading edge of stock fed into the annular space through said stock.

11. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel mounted at one of its ends, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and positioned at an acute angle to said axes, the slot being so positioned with respect to the axes and the annular space that strip stock fed into the space through the slot enters the space tangentially of the mandrel.

12. A spiraling die for the purposes described comprising a stationary sleeve having a cylindrical bore containing a cylindrical mandrel mounted at one of its ends, there being a substantial annular space between the bore and mandrel, the axes of the bore and mandrel being coincident, a longitudinally disposed feed entrance slot communicating the annular space with the outside of the sleeve and positioned at an acute angle to said axes, said mandrel having a spiral shoulder thereon aligned with said slot so as to be engaged by the leading edge of stock fed into the annular space through said stock, the slot being so positioned with respect to the axes and the annular space that strip stock fed into the space through the slot enters the space tangentially of the mandrel.

13. A method for manufacturing spirally rolled cylinders of sheet metal or the like which comprises feeding cut lengths of ribbon stock having side edges parallel to the direction of feed and leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die.

14. A method for manufacturing spirally rolled cylinders of sheet metal or the like which com-

prises feeding cut lengths of ribbon stock having side edges parallel to the direction of feed and leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the cylinder and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the cylinder, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a spiral shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

15. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having side edges generally parallel to the direction of feed and leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die.

16. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die.

17. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having side edges generally parallel to the direction of feed and leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths

being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a spiral shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

18. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a spiral shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

19. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having side edges generally parallel to the direction of feed and leading and trailing edges at acute angles to the direction of feed into a spiraling die having

a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

20. A method for manufacturing spiral bushings of sheet material or the like which comprises feeding cut lengths of ribbon stock having leading and trailing edges at acute angles to the direction of feed into a spiraling die having a stationary cylindrically bored sleeve whose bore diameter is the outside diameter of the bushing and containing a stationary cylindrical mandrel whose outside diameter is the inside diameter of the bushing, the cut lengths being entered into the spiraling die through a longitudinal slot thereof which opens into the space between the mandrel and the sleeve so as to enter the die transversely of the axis thereof and pushed into the spiraling die and through the space between the mandrel and sleeve successively by the engagement of a leading length by a trailing length, the axes of the mandrel and bore being approximately coincident and at an obtuse angle to the direction of feed of stock into the die, the mandrel having a shoulder which is engaged by and directs the leading edge of a length around and along the axis of the mandrel.

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