

Dec. 2, 1958

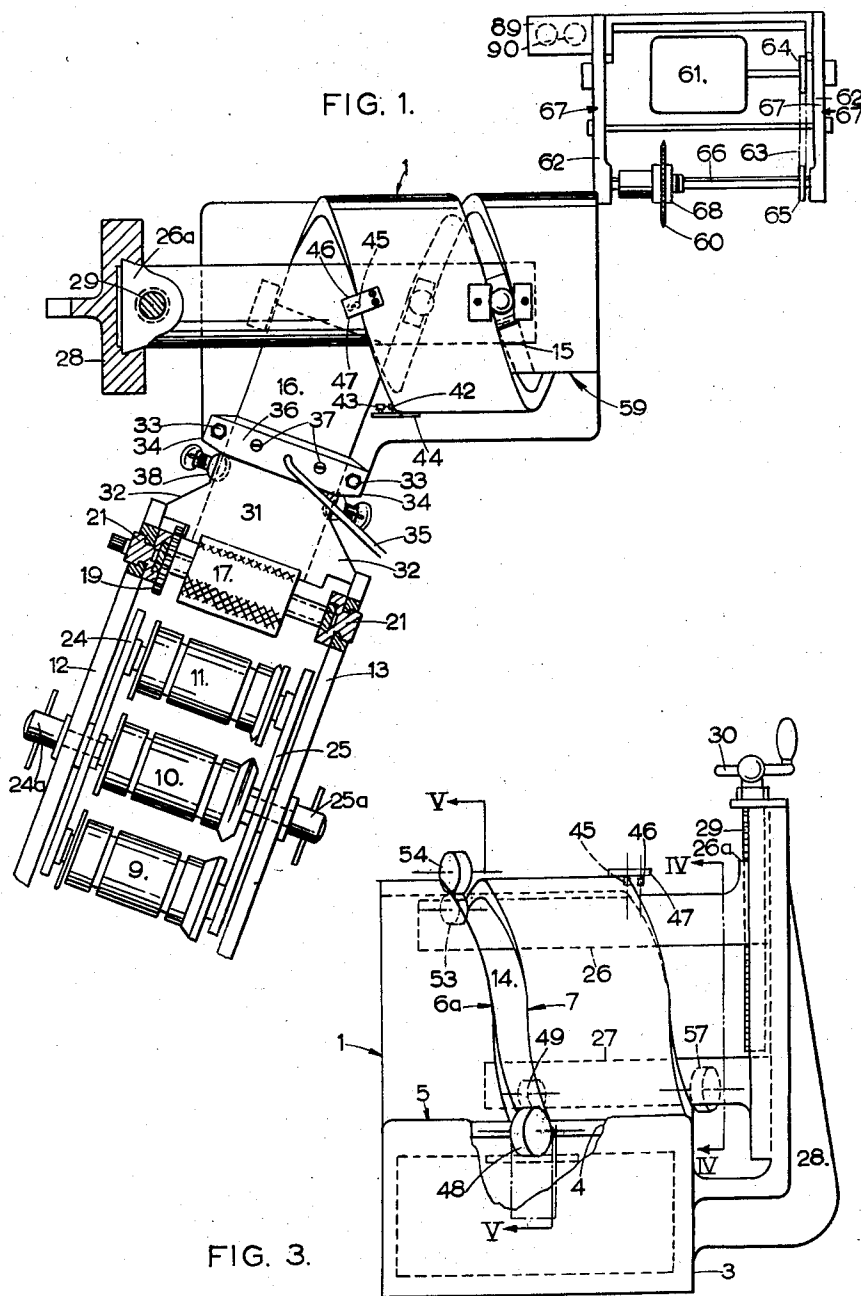
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2,862,469

MACHINES FOR PRODUCING TUBING FROM CONTINUOUS STRIP METAL

Filed March 1, 1956

4 Sheets-Sheet 1



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4 Sheets-Sheet 2

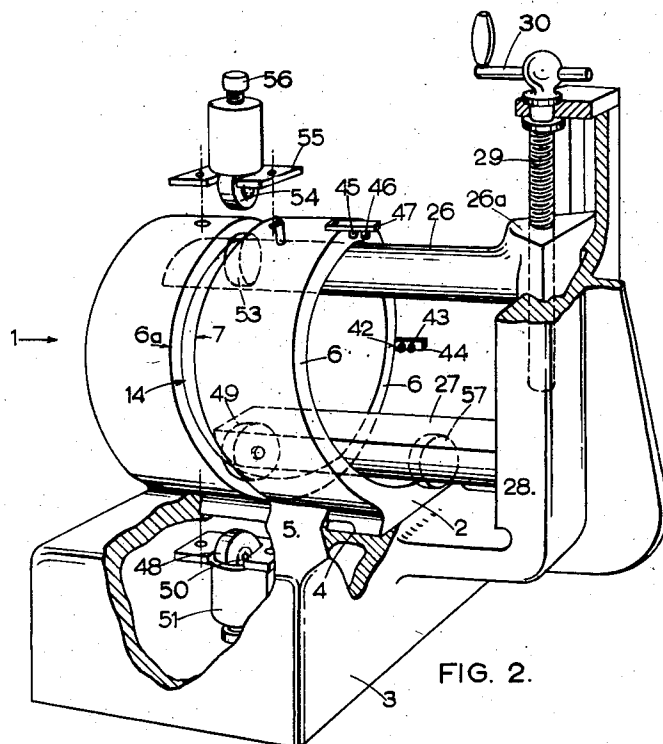


FIG. 2.

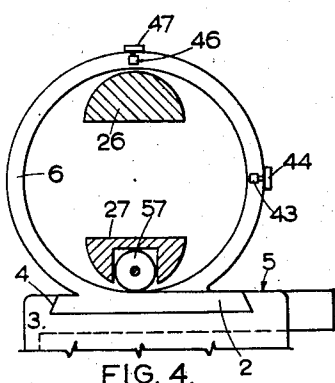


FIG. 4.

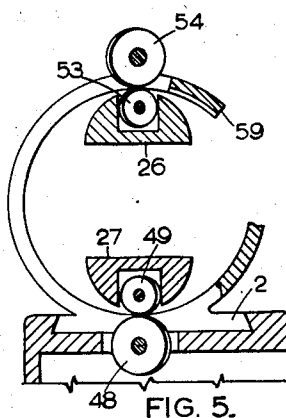


FIG. 5.

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4 Sheets-Sheet 3

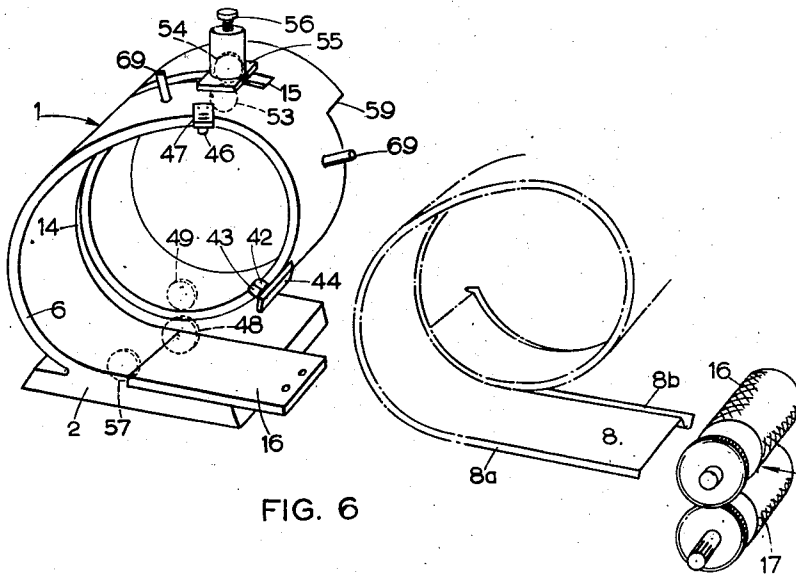


FIG. 6

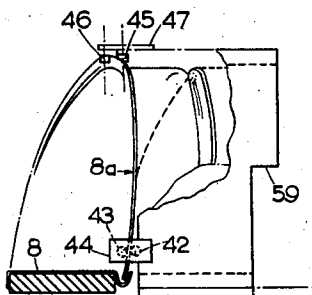


FIG. 7.

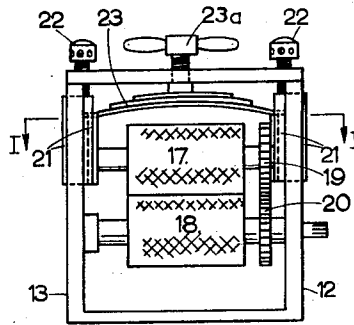


FIG. 8.

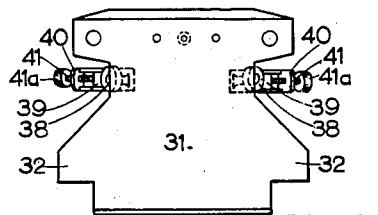


FIG. 9.



FIG. 10.

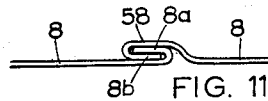


FIG. 11.

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4 Sheets-Sheet 4

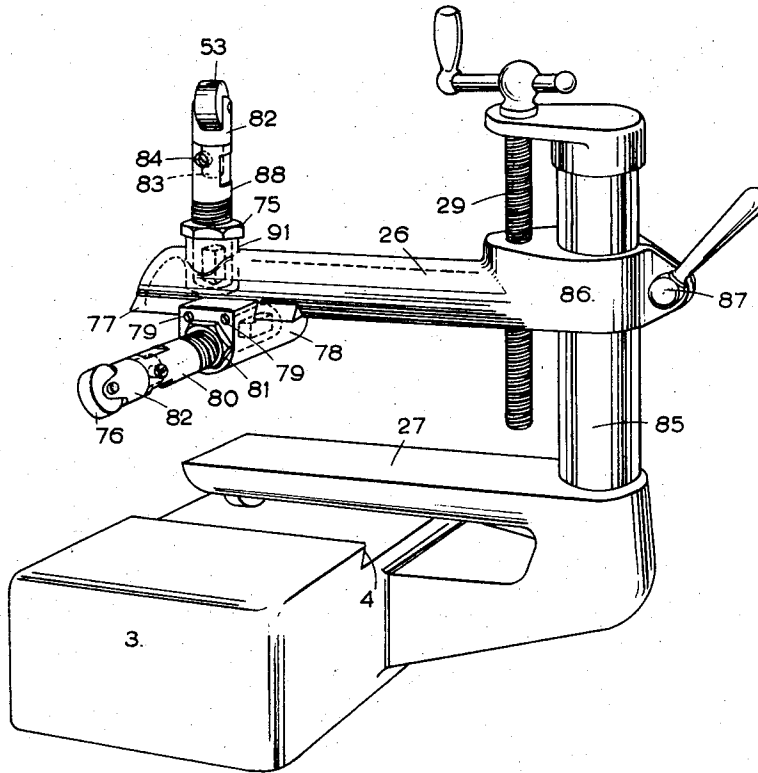


FIG. 12.

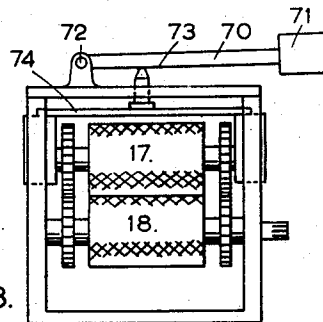


FIG. 13.

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MACHINES FOR PRODUCING TUBING FROM CONTINUOUS STRIP METAL

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Application March 1, 1956, Serial No. 568,799

Claims priority, application Switzerland
December 20, 1955

8 Claims. (Cl. 113—35)

This invention relates to tube producing machines of the type adapted to produce the tubing from continuous strip material such as sheet metal which is of a nature which lends itself to deformation from continuous strip form into helical form and with which means is provided to interlock marginal parts of the strip material into a helical seam, and in which a head is provided having an helically shaped guide along which the interengaging pre-formed edges of the strip material are caused to negotiate a helical path and in so doing are pinched or pressed into locking interengagement so that as the material issues from the head it takes the form of a tube having a continuous helical rib comprising the said seam.

In previously proposed machines of the aforesaid type the head having the helically shaped guide for the interengaging edges of the continuous strip material is of circular cross section with an internal diameter defining the diameter of the finished work and disposed concentrically within it is a mandrel which is rotated to assist in carrying the work from the means which deform the marginal parts of the strip material into a flange along one edge and a channel or fluting along the other edge, and in association with the head are rollers which pinch the work at a position where the flanges are received in the channel or fluting. Hitherto it has been found necessary to provide a separate mandrel for each head having a distinctive bore to receive the work and this adds considerably to the cost and maintenance of the machine and takes up an undesirable amount of storage space for spare mandrels. The chief object of the present invention is to avoid having to provide a plurality of mandrels for producing tubes of different diameters.

Also, in the aforesaid types of machines as at present in use a plurality of pairs of rollers which feed the continuous strip material towards the head are driven in unison through the medium of gearing and this involves an expensive and complicated arrangement of gearing which is now rendered unnecessary by the present invention.

According to the present invention a machine of the type first set forth is characterised in that the mandrel extending axially through the head is adjustable for different diameters of work.

Further, in accordance with the present invention a machine for forming from continuous strip material tubing having a helical seam constituted by interlocking the deformed marginal parts of the strip material, comprises a forming head of hollow circular internal cross section defining the diameter of the work and with its wall formed with a helical profile along which are guided the interlocking marginal edge parts of the material, a mandrel projecting in the axial direction through the head being constituted by laterally displaceable longitudinal parts between which and the interior surface of the head the work is guided, means to effect relative displacement of said parts to compensate for different diameters of work, means to guide the strip material substantially tangentially into the head at a non-normal angle rela-

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tively to the axis of the head, and opposed pairs of rollers with said guiding means adjustable for different widths of strip material and having profile parts to pre-form the marginal parts of the strip material into mutually co-operating parts which are interlocked in said forming head to form said seam, a pair of said rollers acting on the strip material as drivers against both faces of the strip material to assist it into the head.

In order that the invention may be clearly understood and readily carried into effect, drawings are appended hereto illustrating an embodiment thereof and wherein,

Figure 1 is a plan view of the tube forming head and part of the means feeding the strip material into the head.

Figure 2 is a perspective view of the forming head with part broken away to show one of the rollers in the base part of the head structure and with an upper roller detached from and immediately adjacent to the part of the head carrying it.

Figure 3 is a rear elevation of the forming head.

Figure 4 is a section on the line IV—IV of Figure 3.

Figure 5 is a section on the line V—V of Figure 3.

Figure 6 is a somewhat diagrammatic perspective view looking at the forming head from its strip receiving end and with a part of the strip material detached therefrom and showing the curvilinear path it follows when traversing the interior of the head, and also showing the last pair of rollers between which the strip material passes before it flows into the head, this pair of rollers being detached away from the head a greater distance than applies in practice as is evident by reference to Figure 1.

Figure 7 is a detail broken front elevation view showing part of the head and the lead-in end of the strip material in the former head showing how a marginal flange along one side of the strip engages in the marginal channel along the other side.

Figure 8 is a detail front end elevation view showing the pair of rollers which act as frictional drivers in assisting the strip material into the former head.

Figure 9 is a detail plan view of a plate element comprising the connection across the feeding rollers and the former head.

Figure 10 is a section through the inter-engaging flanged and channelled or fluted edges of the strip-material immediately after passing rollers in the former head which operate firstly on the work.

Figure 11 is a similar section but showing the condition of the interlocking marginal parts of the strip material after passing the last rollers of the forming head.

Figure 12 shows a mandrel adapted for large diameter work, and

Figure 13 shows a manner of adapting the mandrel for larger diameter work.

Referring to the drawings in the forming head is indicated generally by the reference numeral 1 and is replaceably secured by a dove-tail base 2 to a hollow box-like base casting 3 suitably fixed on a pedestal (not shown) by the provision of a dove-tail channel 4 in the top 5 of the base 3, which top is preferably made much thicker than the side and end walls of the base.

The forming head is made of a high quality durable steel and is of cylindrical cross section having a lead-in edge 6 which merges from a relatively tangential horizontal plate 16 also of high quality steel secured by counter sink screws or other suitable means to the dove-tail flange 2, and this lead-in edge 6 is profiled to form the commencement of a helical guiding edge for a flange 8a of the strip metal 8 which flange 8a in common with a channel 8b is formed along the opposed marginal parts of the strip metal by pre-forming rollers 9, 10, and 11 arranged in successive pairs between a pair of fixed side frame members 12 and 13 extending away from the base 3 at the desired angle which will enable the strip material

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8 to be fed between the rollers in a direction which will cause it to flow smoothly into the forming head.

By reference to Figures 1 to 6 inclusive it will be seen that the forming head is shaped to the desired helical pitch by a helical slot 14 having one edge 7 parallel with the lead-in edge 6 and the other edge 6a being in helical continuity with the lead-in edge 6, this slot having a terminal 15 beyond which the finished work travels whilst rotating on the axis of the forming head. Thus the finished work appears to be extruded axially beyond the end of the forming head remote from the lead-in edge 6.

The work 8 is fed into the forming head over the horizontal guide plate 16, the feed of the work being effected by a pair of grooved feeding rollers 17 and 18 (see Figure 8), the shaft of one of which is positively driven from a motor, the two shafts carrying gear wheels 19 and 20 constantly in mesh and the desired compression upon the work between the two feeding rollers being obtained by mounting the shaft of the upper roller 17 in journal blocks slidable in slides 21 set to the desired thickness of work by adjusting screws 22 in well known manner, the actual journal blocks being loaded by a bowed laminated spring 23 set to apply the desired compression by a centre screw 23a, as an alternative (see Figure 13) there can be provided a counter-balance lever arm 70 with an adjustable weight 71, the arm 70 being fulcrumed at 72 and at 73 bearing down upon a cross bar 74 which rests upon the slidable journal blocks. This has the advantage of the load on the journal blocks being properly distributed at all times. In either case it is also preferred to provide gear wheels 19 and 20 on both sides of the rollers as shown in Figure 13.

The pre-forming rollers 9, 10 and 11 are idler rollers with their ends shaped in a well known manner so that the upper one of each pair is complementary with the lower to form on one side of the strip the flange 8a and on the other side the channel 8b, and the completion of this pre-forming operation can be effected progressively by the successive pairs of rollers. The rollers are each divided into two end parts and an intermediate part, with the outer parts fixed on their spindles journaled in bearings in two side housings 24 and 25 which are adjustable towards and away from each other by means of adjusting screws with heads 24a and 25a to change the width of the flange 8a and correspondingly the depth of the channel 8b. This is important because some materials require a wider seam than others, and also sometimes it might be necessary to adjust the width of the flange 8a relatively to the channel 8b to enable a sealing strip or substance to be laid in the channel 8b. Thus the work gripping rollers 17 and 18 drag the strip material through the pre-forming rollers and push the pre-formed strip material over the plate 16 into the forming head 1, when the material is forced to follow the radius and the profile edges of the helical head by reason of being pushed between a mandrel and the inner surface of the head.

The mandrel is an important feature of the present invention as it is adjustable to different diameters of forming heads, and for this purpose in its preferred form it comprises two parallel semi-circular cross section steel bars 26 and 27 with opposed flat horizontal faces which, when abutted together, produce a two-part cylinder the diameter of which would be appropriate to the internal diameter of the smallest diameter one of a set of forming heads which can be selected from a quantity of different heads in the use of the machine. Thus only one mandrel is necessary for a plurality of distinctive heads.

The lower mandrel bar 27 is fixed rigidly to a stout bracket 28 fixed to the base 3 and the upper bar 26 is formed as a nut 26a adjacent to the bracket 28 to receive a traversing screw 29 rotatable by means of a handle 30. The nut end 26a of the bar 26 is of dove-tail

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form sliding in a corresponding channel in the upright of the bracket 28.

As the pre-formed strip material issues from between the two feed rollers 17 and 18 it passes between the guide plate 16 and an upper guide plate 31 (see Figure 9) which is secured detachably in position by engaging a pair of wings 32 thereof in locating grooves or slots in the side frame members 12 and 13 and by a pair of bolts or studs 33 passed through lateral lugs 34 into corresponding lugs on the guide plate 16, and a suitable lubricant is circulated between the two plates via a pipe line 35 connected in a header plate 36 secured on top of the upper guide plate 31 by a pair of studs or screws 37. The final pre-forming of the downwardly bent side flange 8a and channel 8b is effected by a pair of rollers 38 rotating idly on spindles fixed in a pair of adjustable slides 39 supported on brackets 40 and adjusted by means of set screws 41 with heads 41a. The axes of the rollers 38 are approximately at 45° to the plane of the plate 31 so that their peripheries press in the one case against the flange 8a and in the other case against the channel 8b, the latter producing a "pinching-in" of the channel 8b so that the channel now has a cross section such that the flange 8a will slide smoothly into it on the appropriate part of the forming head 1.

The leading end of the preformed strip material is trimmed off diagonally so that when the leading end of the flange 8a approaches the channel or slot 14 it will mate in the channel 8b, and in order to ensure proper guidance of the flange into the channel 8b a pair of small rollers 42 and 43 are carried by a plate or bracket 44 secured to the forming head so that the roller 42 lies opposite the slot 14, the flange 8a passing between these two rollers. Likewise, in order to maintain proper guidance of the strip material towards the rollers 42 and 43 an additional pair of similar rollers 45 and 46 are carried by a bracket 47 secured to the uppermost part of the forming head so that the roller 46 closely overhangs the profile edge 6.

By the continued pushing action of the rollers 17 and 18 the inter-engaging flange 8a and channel 8b of the work is carried between a roller 48 carried by the top 5 of the base 3 and a roller 49 supported for rotation within a recess in the lower bar 27, it being understood that the roller 48 projects within the slot 14, this roller being carried in the bifurcated end of the cylindrical plug 50 rotatable within a cylindrical boss 51 of a plate 52 secured to the under face of the top plate 5 of the base 3. Thus, the roller 43 will adapt itself to the pitch of the appropriate slot 14. In this connection, the roller 49 is mounted so that it rotates on an axis which will ensure that such roller engages the inner face of the work in direct opposition to the roller 48. This initial pinching of the inter-engaging flanged and channelled edges of the work produces an initial or partial locking such as shown in Figure 10, and the final locking action is obtained by pinching the work in the upper part of the former between a roller 53 mounted in a stepped part of the free end of the bar 26 and a roller 54 carried in the same manner as the roller 48 in a bracket 55 secured to the upper part of the forming head. The bifurcated plug in each case can be adjustably pressed towards the work by an adjusting screw 56.

In addition to the aforesaid rollers there is provided close alongside the leading end of the profile 6 a roller 57 supported for rotation in a recess in the arcuate face of the lower bar 27 and having its axis so arranged that the periphery of the roller 57 will tend to press the flange 8a hard against the profile 6.

After the work leaves the rollers 53 and 54 the completely flattened seam 58 (see Figure 11) thereof slides along the inner face of the upper part of the former and issues beyond a step 59 formed at the outlet end of the former, and the space between the end of the slot

14 and this step 59 may, if desired, be provided with a channel to accommodate the seam 58.

To enable any desired length of finished work to be cut off readily, there is provided, close to the exit end of the forming head, a rotary cutter 60 driven from an electric motor 61 mounted in a frame 62, the drive being by means of a chain 63 and sprocket wheels 64 and 65, the latter being fixed on a shaft 66 journaled in bearings in the ends of a pair of side arms 67 pivoted in the bracket 62, the rotary cutter 60 being fixed in a collar 68 which slides axially along the shaft 66 which is formed with a spline or groove co-operating with a key on the collar 68. It would be apparent that once the cutter 60 is pressed by the pivoted arms 67 against the work, the work will drag it axially along the shaft 66 during a complete cutting operation, whereupon the cutter 60 can be swung away from the work. The cutting off of a predetermined length of tube can be effected by the leading end of the tube engaging a switch which energises a solenoid 90 in a housing 89 the armature being on the adjacent arm 67.

Oil lubricating unions 69 receive pipes for feeding lubricant to the work travelling through the forming head 1.

To cater for the production of tubing of the larger diameter class, e. g. above ten inches in diameter the upper member 26 of the mandrel is adapted to carry a plurality of rollers to track the inside of the tube along the seam in opposition to a corresponding number of rollers tracking the outside of the locking seam, i. e. a multiple of the rollers 54 disposed at intervals along the slot 14 and carried by supports similar to those carrying the rollers 48 and 54. Also this plurality of rollers can be adjustable substantially radially relatively to the mandrel for different diameters and thickness of work.

In Figure 12 is shown a simple version of this modified mandrel in which the roller 53 is carried by the outer end of a radial rod 88 threaded into a boss 91 formed on the mandrel member 26, or alternatively a boss on a plate detachably fixed in a channel in the mandrel member 26 which channel can be adapted to receive the roller 53 when the mandrel is being used for the smaller diameter work as previously described, the rod 88 being locked by one or a pair of suitable lock nuts 75 once the position of the roller 53 has been selected.

In addition at least one extra roller 76 with a co-operating external opposed roller 54 is provided to engage the work, and for this purpose the sides of the mandrel member 26 are provided with guides 77 for a slide 78 locked in position by screws 79 and having threaded for axial adjustment therein a rod 80 similar to the rod 88 and carrying the roller 76 and being locked by one or more lock nuts 81. The slide 78 can be long enough to take two rods 80 projecting from opposite sides thereof or a pair of slides 78 can be provided each carrying its own rod 80 thus enabling positional adjustment of one rod 80 relatively to the other to be effected to provide for different pitches of the helical seam. The rollers 53 and 76 are preferably carried in forked supports 82 with spigots 83 rotatable in axial sockets in the rods 88 and 80 and locked by grub screws 84 to enable the rollers to be set for proper roller contact with the work. As shown in Figure 12 it is preferred to carry the mandrel member 26 by a rigid column 85 and to provide the member 26 with a split collar 86 clamped to the column 85 by a screw 87 once the member 26 has been set by the screw 29 to the desired position.

I claim:

1. In a helical lock seam tubing forming machine in which the continuous strip metal is fed continuously from a supply source to the tube shaping means, idler

rollers between which the continuous strip metal is drawn to form marginal parts to be interlocked to form the helical seam, a tube forming hollow head with a cylindrical bore defining the curvature radius of the helical path of travel for the strip metal and through which head the strip material passes from the rollers, guiding means incorporated with the head and which causes the strip material to traverse a helical path concentric with and inside the head with its complementary seam forming marginal parts interengaged, opposed co-operating members carried between the ends of the head and located to engage the tubular shaped strip metal both internally and externally as it negotiates the circular path of travel inside the head to fold over and pinch the interengaging marginal parts into the lock seam, and feeding rollers for the strip metal located between said idler rollers and said head and which draw the strip material between the said idler rollers and pushes the strip metal into and through the said head and between said opposed folding over and pinching members.

2. A machine as claimed in claim 1 in which the said head is formed with a helical guide in alignment with which are located the said opposed members between which the interengaging marginal parts of the strip metal are pinched in the radial direction relatively to the axis of the head.

3. In a helical lock seam tubing forming machine in which the continuous strip metal is fed continuously from a supply source to the tube shaping means, idler rollers between which the continuous strip metal is drawn to form marginal parts to be interlocked to form the helical seam, a tube forming hollow head with a cylindrical bore defining the curvature radius of the helical path of travel for the strip metal and through which head the strip material passes from the rollers, guiding means incorporated with the head and which causes the strip material to traverse a helical path concentric with and inside the head with its complementary seam forming marginal parts interengaged opposed cooperating members carried between the ends of the head and located to engage the tubular shaped strip metal both internally and externally as it negotiates the circular path of travel inside the head to fold over and pinch the interengaging marginal parts into the lock seam, and feeding rollers for the strip metal located between said idler rollers and said head and which draw the strip material between the said idler rollers and pushes the strip metal into and through the said head and between said opposed folding over and pinching members, a rotary cutter located adjacent to the end of the head from which the tubing issues, means to offer the cutter up to the tubing without arresting the travel of the tubing from said head, and means when the cutter bites into the thickness of the wall of the tubing to guide the rotary cutter axially parallel with the tubing until the cutter has been negotiated by the circumference of the tubing.

4. A machine for producing helical lock seam tubing from continuous strip metal and in which means is provided to preform and interlock marginal parts of the strip material into a helical seam, comprising a forming head, a guide with said head along which the interengaging pre-formed edges of the strip material are caused to negotiate a helical path, opposed helical seam pinching members with said guide supported inside and also from outside the head to pinch into locking interengagement said pre-formed edges so that as the material issues from the head it takes the form of a tube having a continuous helical rib comprising the said seam, a stationary mandrel inside the head and between which and the head the strip metal negotiates its curvilinear path of travel during pinching of said pre-formed edges, said mandrel embodying the inside part of said pinching members, means by which said stationary mandrel is adjustable to engage different diameters of work and friction drive

rollers to push-feed the work into and through the forming head and to draw the strip metal through said means to preform the marginal parts of the strip metal to be interlocked.

5. A machine for producing helical lock seam tubing from continuous strip material such as e. g. sheet metal, and in which means is provided to preform and interlock marginal parts of the strip material into a helical seam, comprising a hollow head with a cylindrical bore, a helical guide in said bore along which the interengaging preformed edges of the strip material are caused to negotiate a helical path, means with said guide pressing into locking interengagement said preformed edges so that as the material issues from the head it takes the form of a tube having a continuous helical rib comprising the said seam, means to support the work internally, pressing means carried by the outside of the said head and between which and said support means the interengaging marginal parts of the work are pinched to flatten them into the helical seam, said support means comprising rigid members extending axially through the head and adjustable apart to suit different diameters of work.

6. A machine for forming from continuous strip material tubing having a helical seam constituted by interlocking the marginal complementary channel and flange parts of the strip material comprising a forming head of hollow circular internal cross section defining the diameter of the work and with its wall formed with a helical profile along which are guided the interlocking marginal edge parts of the material, a mandrel projecting in the axial direction through the head being constituted by laterally separable longitudinal parts between which and the interior surface of the head the work is guided, means to effect relative displacement of said parts of the mandrel to compensate for different diameters of work, a pair of friction drive rollers to feed the strip metal into and through the head, a pair of opposed parallel guide plates between which the work is pushed from said friction drive rollers into the head, rollers shaped to impart to the strip metal the complementary channel and flange and between which the strip metal is drawn by the traction of said friction drive rollers, said pair of plates and the direction of the axes of said friction drive rollers being arranged to guide the strip material substantially tangentially into the head at a non-normal angle relatively to the axis of the head, rollers supported from outside the forming head for engaging the interengaging marginal parts of the exterior of the work in the forming head, further rollers carried by the mandrel in direct opposition to the aforesaid rollers so that the said marginal parts of the work are pinched and flattened to form the helical seam, and guide members for a flanged edge of the work, said guide members being close to the profile of the forming head at a position in advance of the position of interengagement of the marginal parts of the material.

7. A machine according to claim 6 wherein said

mandrel comprises a pair of opposed rigid bars extending through the forming head from supporting means at one end thereof, said supporting means being provided with means to effect adjustments in the separation of the two bars to set them for contact with the interior of the work.

8. A machine for forming from continuous strip material tubing having a helical seam constituted by interlocking the marginal complementary channel and flange parts of the strip material comprising a forming head of hollow circular internal cross section defining the diameter of the work and with its wall formed with a helical profile along which are guided the interlocking marginal edge parts of the material, a mandrel projecting in the axial direction through the head being constituted by laterally separable longitudinal parts between which and the interior surface of the head the work is guided, means to effect relative displacement of said parts of the mandrel to compensate for different diameters of work, a pair of friction drive rollers to feed the strip metal into and through the head, a pair of opposed parallel guide plates between which the work is pushed from said friction drive rollers into the head, rollers shaped to impart to the strip metal the complementary channel and flange and between which the strip metal is drawn by the traction of said friction drive rollers, said pair of plates and the direction of the axes of said friction drive rollers being arranged to guide the strip material substantially tangentially into the head at a non-normal angle relatively to the axis of the head, rollers supported from outside the forming head for engaging the interengaging marginal parts of the exterior of the work in the forming head, further rollers carried by the mandrel in direct opposition to the aforesaid rollers so that the said marginal parts of the work are pinched and flattened to form the helical seam, guide members for a flanged edge of the work, said guide members being close to the profile of the forming head at a position in advance of the position of interengagement of the marginal parts of the material, a rotary cutter located adjacent to the end of the head from which the tubing issues, means to offer the cutter up to the tubing without arresting the travel of the tubing from said head, and means when the cutter bites into the thickness of the wall of the tubing to guide the rotary cutter axially parallel with the tubing until the cutter has been negotiated by the circumference of the tubing.

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