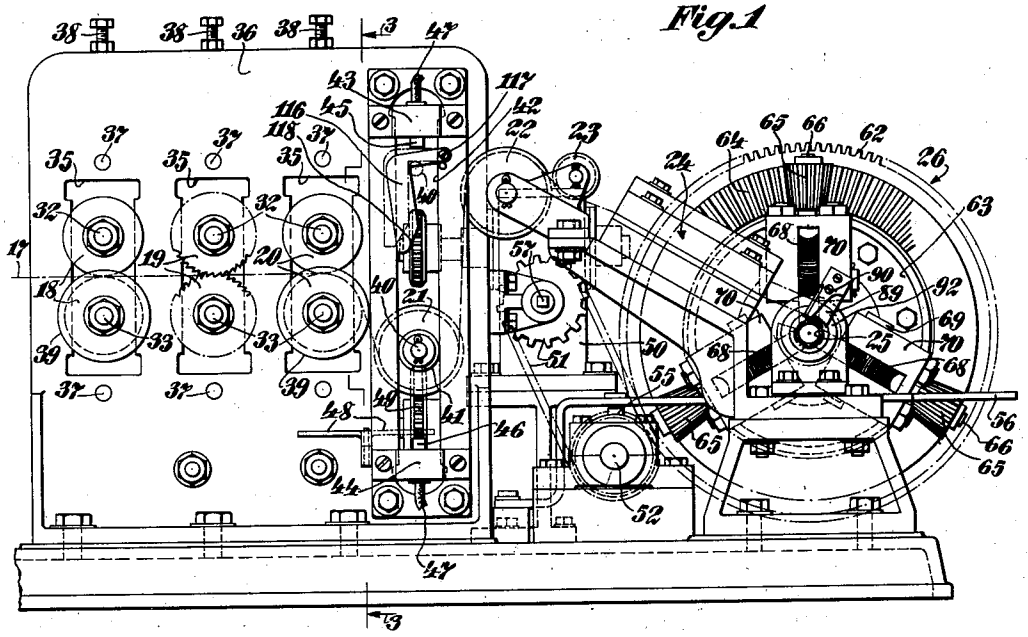
Aug. 5, 1941. E. F. TILLEY 2,251,642

MANUFACTURE OF HEAT EXCHANGE TUBING

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Fig. 1



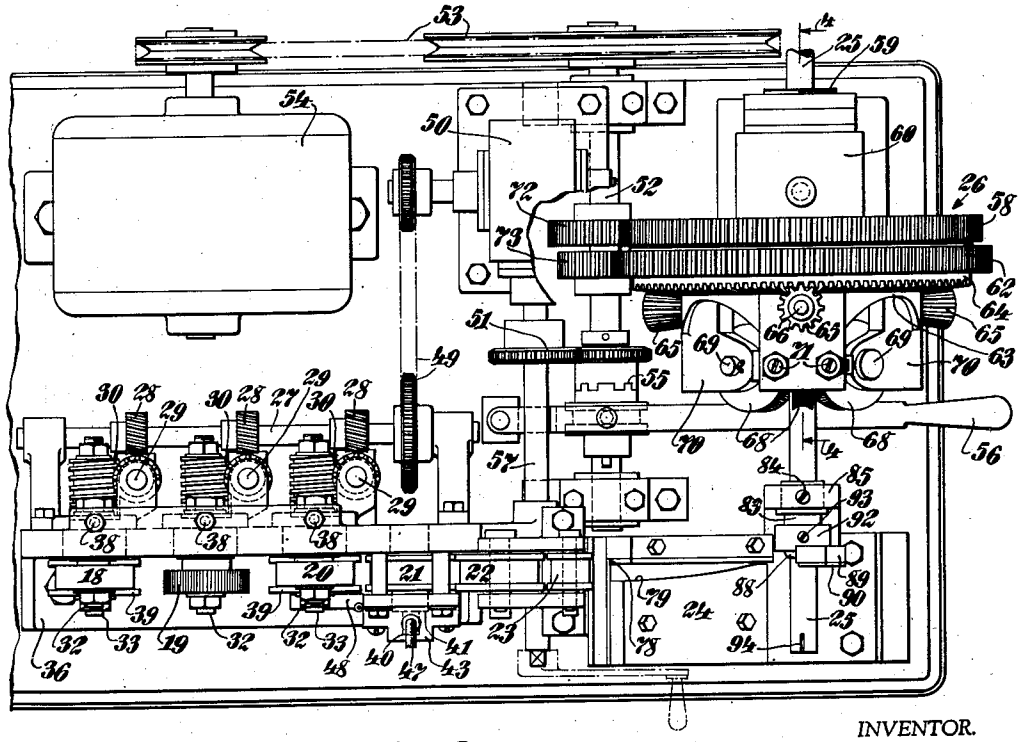


Fig. 2

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MANUFACTURE OF HEAT EXCHANGE TUBING

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Fig. 3

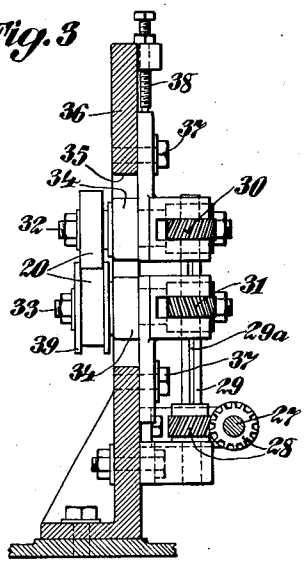


Fig. 4

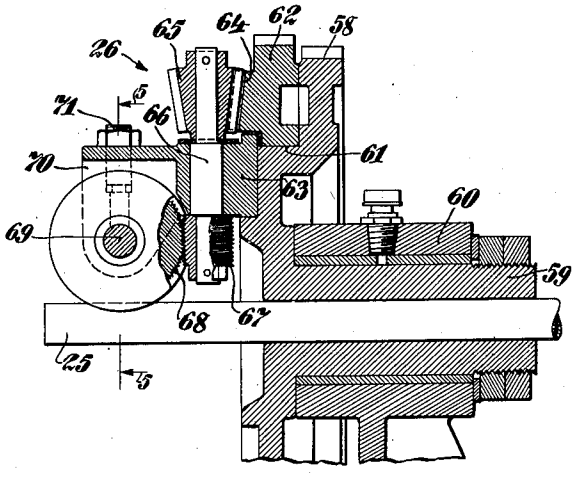


Fig. 5

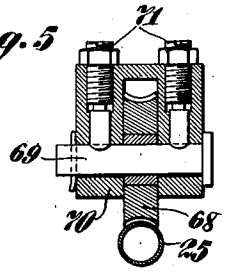


Fig. 6

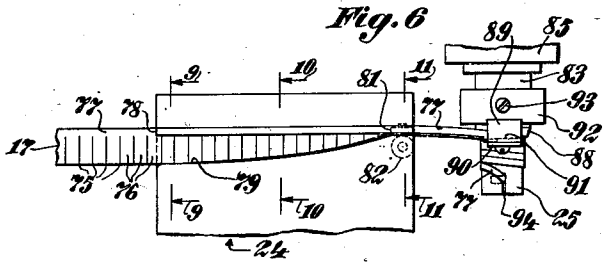


Fig. 7

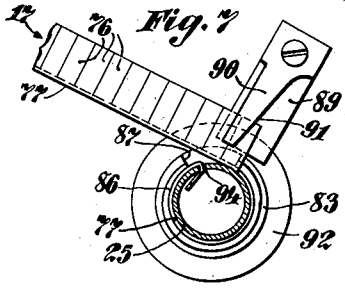


Fig. 9

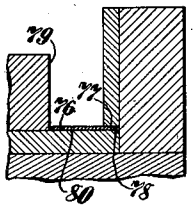


Fig. 8

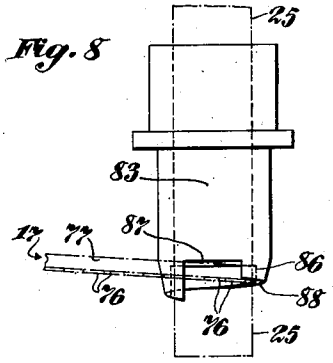


Fig. 10

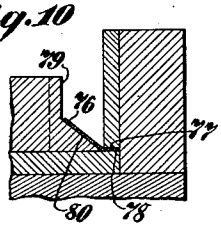
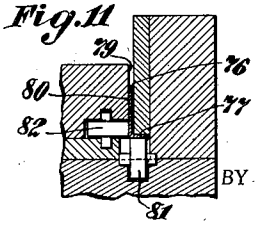


Fig. 11



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Fig. 12

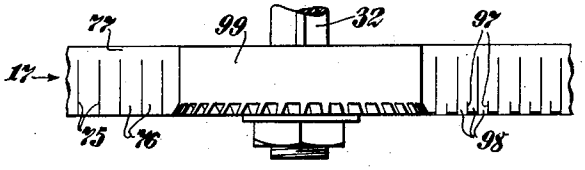


Fig. 14

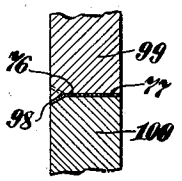


Fig. 13

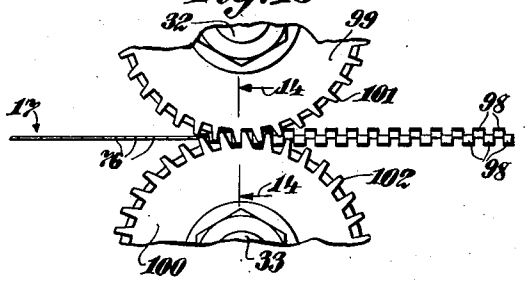


Fig. 15

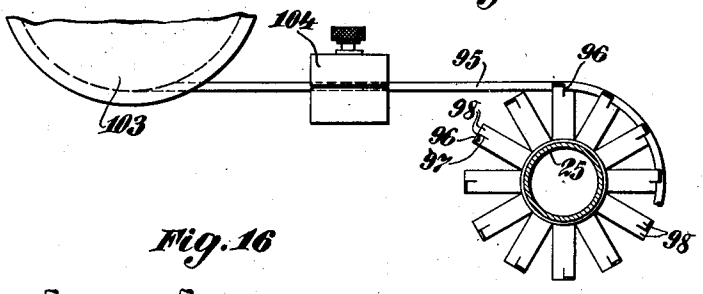
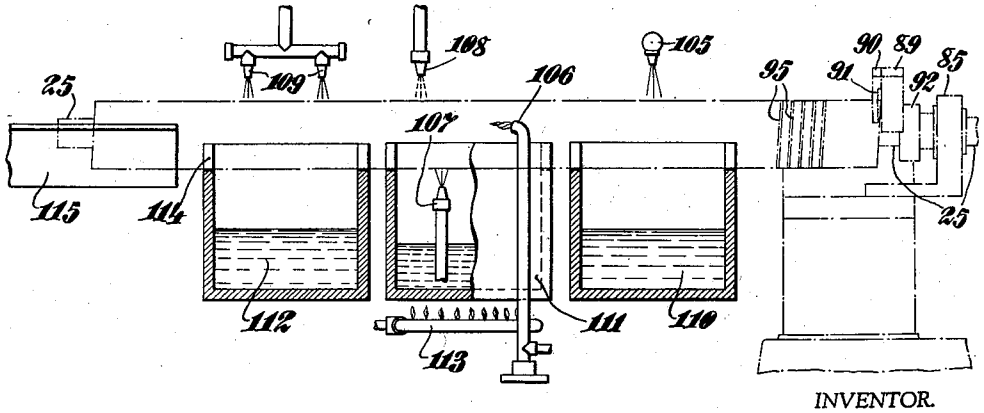


Fig. 16



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UNITED STATES PATENT OFFICE

2,251,642

MANUFACTURE OF HEAT EXCHANGE TUBING

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Application May 21, 1938, Serial No. 209,185

26 Claims. (Cl. 29—33)

The invention herein disclosed relates to the manufacture of tubing employed for heat exchange purposes, particularly such as covered in the Tilley Patent 1,932,610 of October 31, 1933.

Special objects of the invention are to accomplish rapid economical commercial manufacture of radiation tubing by automatically operating means, practical and efficient in character.

Further special objects are to provide a practical method and mechanism for automatically applying a binder to the ends of the radiating fins of the tubing.

Other objects and the novel features of operation, construction, combination and relation of parts by which all objects of the invention are attained are set forth or will appear in the course of the following specification.

The drawings accompanying and forming part of the specification illustrate certain practical embodiments of the invention. Various changes and modifications in structure and mode of operation may be made all within the true intent and scope of the invention as hereinafter defined and broadly claimed.

Fig. 1 is a broken side view of that portion of the machine for rotating and advancing the tubular stock and for slitting the strip material, winding it on the advancing tubing and straightening or angling the slitted portions which form the fins as the strip winds onto the tubing.

Fig. 2 is a broken plan view of the same portion of the machine.

Fig. 3 is a vertical sectional view as on line 3—3 of Fig. 1, showing particularly the last set of strip feeding rolls and part of the mechanism for driving these and the other rolls which act on the strip.

Fig. 4 is a broken enlarged sectional detail as on line 4—4 of Fig. 2, showing one of the tube feeding worm gears.

Fig. 5 is a sectional detail as on line 5—5 of Fig. 4.

Fig. 6 is a broken plan of the strip guiding and fin bending portions of the mechanism.

Fig. 7 is a part sectional end view of the surrounding guide for confining the base portion of the strip to the tubing and the associated guide means for straightening or setting the fins.

Fig. 8 is a plan view of the tubular guide, with the tubing and fin strip indicated in broken lines.

Figs. 9, 10, 11 are enlarged broken sectional details as on lines 9—9, 10—10 and 11—11 respectively of Fig. 6.

Figs. 12 and 13 are broken plan and face views of the rolls for slitting and oppositely offsetting the ends of the fins to form a trough for receiving a binding wire.

Fig. 14 is a broken sectional detail as on line 14—14 of Fig. 13, indicating how the ends are slit and simultaneously separated.

Fig. 15 is a broken part sectional and somewhat diagrammatic illustration of the winding of the wire into the trough at the ends of the radiating fins.

Fig. 16 is a broken sectional and diagrammatic illustration of continuing portions of the machine, which may be associated with the winding on mechanism of Figs. 1 and 2, for soldering the finned structure on the tubing.

In Fig. 1, the strip which forms the fins and the anchorage by which they are attached to the tubing is indicated at 17, passing first between a pair of cooperating feed rolls 18, then between a pair of rolls 19, which slit the strip transversely in from one edge to the attaching or base portion of the strip, then between feed rolls 20, beneath a floating takeup roll 21, up over a guide roll 22, and beneath roller 23, into a guiding and fin bending mechanism 24, to the tubing 25, carried by the tubing rotating and feeding chuck indicated at 26.

Fig. 2 shows how the two sets of feed rolls and intermediate slitter rolls are all driven from a common shaft 27, through gearing consisting in each instance, of coacting spiral gears 28, Fig. 3, on shaft 27, and an upright shaft 29, which latter through spiral gearing at 30, 31, drives the upper and lower shafts 32, 33, carrying the cooperating set of upper and lower rolls. The roll carrying shafts are shown in Fig. 3, as mounted in boxes 34, vertically adjustable in slots 35, on the upright base wall 36, secured in adjusted relation by bolts 37. Further, the upper journal boxes are shown as adapted to be adjusted downwardly by set screws 38, to determine the pressure of the rolls on the strip. The vertical shafts 29, are shown as splined at 29a, for sliding driven engagement with the spiral gears at 30, 31, to allow for vertical adjustments of the rolls. The lower feed rolls of each pair 18 and 20, are shown as flanged at 39, to positively guide the strip and the upper rolls of these pairs are shown as plain and fitting between the flanges of the lower rolls. The strip is thus positively held and controlled and guided for accurate action of the slitting rolls interposed between the two sets of guide rolls. The floating takeup roll 21, and guide rolls 22, 23, also are shown as flanged to engage the edges of and thus positively guide the strip.

The takeup roll 21 is indicated in Fig. 1 as

mounted on a shaft 40, having bushings 41, on the opposite end portions of the same riding in a vertical guide slot 42, in the framing 36.

To provide automatic control of the machine, switches 43, 44, may be located at the upper and lower ends of the guideway 42, having operating buttons 45, 46, positioned to be engaged and actuated by the takeup roll bushings 41, said switches being connected by wiring 47, to stop or otherwise govern the machine if the takeup loop shortens sufficiently to carry the roll to the top of the guide or becomes so slack as to lower the roll to the bottom of the guide. To render the automatic control inoperative at either one or both of the switches, a pivoted stop lug or lugs may be provided, such as indicated at 48, which can be swung into position over the end of the push button to prevent the guide roll from actuating the same.

The common drive shaft 27, for the strip feeding and slitting rolls is shown in Fig. 2, as operated by chain and sprocket connections 49, from a speed reduction gear box 50, actuated by chain and sprocket connections 51, from the main drive shaft 52. The latter is indicated as driven by belt and pulley connections 53, from electric motor 54.

A jaw clutch 55, on shaft 52, Fig. 2, operable by hand lever 56, enables disconnection of the drive to the feed rolls, thus permitting the feed rolls to be disassociated from the rest of the machine for purposes of adjustment, etc. During such time, the feed rolls may be turned by hand through the medium of a suitable hand crank applied to the squared end of the reduction gear drive shaft 57.

The tube rotating and advancing chuck 26 is shown as consisting of a gear 58, having a tubular hub 59, Fig. 4, journalled in bearing 60, and shouldered at 61, to carry a "creeping" ring gear 62, held thereon by a confining ring 63, and provided with a bevel gear face 64, engaging bevel pinions 65, on radial shafts 66, carrying worms 67, driving work engaging worm gears 68.

For the purpose of gripping the tubing, the worm gears 68 may be cut with a relatively sharp screw thread, which to some extent, will bite into the surface of the tubing. To determine the extent of such bite and hence fix the grip of the worm gears on the work, they are shown in Figs. 4 and 5, as mounted on spindles 69, adjustable radially in slotted supporting brackets 70, on the face of the retaining ring 63, said spindles being adjusted and secured in proper position by set screws 71.

The main or supporting gear 58, and the relatively rotatable ring gear 62, which it carries, are separately driven by spur gears 72, 73, Fig. 2, on the main drive shaft 52. The gearing described is preferably proportioned so that with pinion 72, turning the main gear 58, at a desired speed of rotation, the pinion 73 will turn the ring gear 62, at a rate such that the latter, through bevel gear and pinion drive 64, 65, will turn the worms 67, at a speed to cause the worm gears 68, while gripping and rotating the tubing, to advance the same at a rate corresponding to the rate of advance of the pitch angle of the helix of the strip being wound on the tubing. Thus the tubing is rotated and at the same time continuously advanced in exact accordance with the winding of the fin strip.

The details of guiding the slitted strip, turning up the separate fins and winding the strip on the tubing are shown in Figs. 6 to 11. In the first of these views, the strip 17 is shown as having been slitted in from one edge at 75, to provide fins 76, connected by an integral base strip 77.

In passing through guide 24, Figs. 6, 9, 10 and 11, the uncut edge portion 77, of the strip is kept confined within a narrow guide channel 78, while the cut edge portion of the strip is passing through a guide channel 79, which gradually decreases in width, from that of the full width of the stock at the beginning, Fig. 9, to approximately the thickness of the stock at the end, Fig. 11. The floor 80, of this tapering guiding and shaping channel gradually rises from the substantially horizontal at the beginning Fig. 9, through the inclined position of Fig. 10, to the substantially vertical relation of Fig. 11. Thus the fins are gradually brought to upstanding relation substantially at a right angle to the narrow base strip 77.

To reduce friction, rectangularly related rolls 81, 82, may be provided at the leaving end of the strip guiding and shaping channel, these rolls assisting in giving the bent strip a desired "set."

Figs. 7 and 8 illustrate how the strip in its finned form, after leaving the bending guide, passes into the control of a tubular guide 83, adjustably secured at 84, Fig. 2, in a stationary supporting bracket 85. This tubular guide has an annular channel 86, about the tubing, notched at 87, to receive the base of the strip and an end wall 88, inclined helically substantially in accordance with the pitch angle of the strip and in position to act as a guiding abutment for the inner faces of the fins 76.

To give the fins a desired permanent set and particularly to fix them at the angle desired on the finished product, a special guiding and bending fixture may be provided, consisting as shown in Figs. 6 and 7, of cooperating confining fingers 89, 90, forming between them a channel through which the fins must pass. In Fig. 6, this channel represented at 91, is indicated as substantially at right angles to the axis of the tubing and as adapted to twist the fins from the helix angle to a plane substantially transverse to the axis of the tubing. The angle or extent of twist given the fins may be varied by proper design of this fin guide and the same may be made with one, two or more fingers or guides for giving the desired set to the fins. This guide also may be designed to engage one or both sides of only a single row or a number of rows of the fins wound or being wound on the tubing. This guide further may be located and designed to set the fins projecting at a right angle, or at any other desired angle from the side of the tubing.

For purposes of ready removal, replacement and adjustment, the fin guide is shown as having a base collar 92, secured by set screw 93, over the tubular laying on guide 83.

To force the strip to turn with the tubing at the start of operations, one or more turns of the base strip may be wound about the tubing and the end caught in a slot cut in the end of the tubing as indicated at 94, Figs. 6 and 7. To facilitate such attachment, some of the fins may be removed from the end of the base strip, substantially as illustrated.

To brace the fins and hold them in desired angular relations, a special binding may be applied to the ends of the fins, consisting of a wire 95, Fig. 15, laid in V-shaped troughs 96, formed by splitting the ends at 97, and bending the split tabs 98, in opposite directions.

Figs. 12, 13 and 14 illustrate a pair of upper and lower die rolls 99, 100, having intermeshing, flaring, cutting and bending teeth 101, 102, cooperating to slit the ends of the fins and to then bend the resultant tabs in opposite directions as indicated. These end slitting and bending die rolls may be substituted in place of the second set of feed rolls 20, Figs. 1, 2 and 3, so that the end slitting and bending will follow immediately the fin slitting operation, making it easier to maintain proper timing to effect the successive operations. When so arranged, the takeup roll 21 and guide rolls 22, 23, the fin bending guide 24, and the fin setting guides 89, 90, may be relieved to pass the flared tips of the fins.

In Fig. 15, the binding wire 95, is shown as running from a supply spool 103, which may be mounted on top of the fin bending guide 24, or at some other convenient point on the machine. Suitable tension may be applied to the wire as by means of an adjustable clamp indicated at 104.

If desired, the wire receiving tabs 98, may be closed in over the edges of the wire by suitable cooperating bending rolls or dies or the wire may be simply soldered in place or both methods of holding may be employed. The wire however, applied with proper tension, may be retained sufficiently without further fastening.

In the present disclosure, the finned strip is secured on the tubing and the wire is secured in its groove by solder and this may be accomplished automatically as indicated in Fig. 16, where the tubing coming from the fin applying and wire winding machine is indicated as passing first beneath an acid or flux jet 105, then preheated by gas jet 106, subjected to a geyser of molten solder at 107, excess solder being blown off by a jet of hot air at 108, and the structure washed and cooled as by water jets at 109. Suitable tanks are provided at the several stations, a receiving tank 110, at the acid bath station, a solder tank 111, at the tinning station and a water tank 112, at the washing and cooling station. The solder tank is shown as heated by the gas burner 113. Suitable pumps, which may be operated by common shafting driven from the main machine may be provided for the acid or flux spray and for forcing flow of solder up against the underside of the finned and wire bound structure. The tinning mechanism described may be located immediately adjoining the finning and wire binding station, so that the rotating and tubing feeding chuck may furnish the sole power for turning and advancing the product through the timing mechanism. If need be, the rotating and advancing structure may be supported by suitable guides at one or more of the tanks, substantially as indicated at 114, and a receiving trough such as shown at 115, may be provided for taking the finished product from the soldering end of the machine.

Various changes in structure and in the several steps performed may be made all within the true scope of the invention. The binder wire may be round, elliptical, flat or other cross-sectional shapes to suit special requirements. By operating all parts from the same power mechanism, absolute synchronism of operations can be maintained at all times. The machine if desired, may be used for applying fin or other strip to solid as well as to tubular material and the special rotating and advancing chuck may be employed for rotating and feeding other than tubular stock.

In Fig. 1, a special actuating device for the upper control switch 43, is indicated in the form of an angular lever 116, pivoted at 117, in position to actuate the switch button 45, when the shaft 40, of the takeup roll passes upwardly over the cam surface 118, on the lower end of the lever. After thrusting the lever over to one side sufficiently to actuate the switch, the roll may continue upwardly, for such short further movement as the machine may require in coming to a complete stop, the parts being designed so that such further "coasting" movement will be sufficient to prevent tearing or breaking the fin strip.

What is claimed is:

1. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means and means for controlling operation of said machine, including a movable element disposed for engagement with and positioned by the slitted strip at a point between said slitting means and said guide.

2. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means and means adjacent the rotating and advancing tubing for twisting the upstanding fins projecting from the tubing into substantially parallel relation generally transverse to the axis of the tubing.

3. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, means for applying a metallic bending strip to the ends of said fins, common drive mechanism for effecting synchronous operation of said several means and continuously operating means for soldering the connecting edge strip on the tubing and the metallic binding strip on the ends of the fins.

4. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive

mechanism for effecting synchronous operation of said several means and means for applying a binding connecting the ends of the separated fins.

5. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, means for slitting and spreading the ends of the fins and means for laying a continuous binding in said spread end portions of the fins.

6. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, means for applying a binding to the ends of the fins and soldering mechanism for securing said binding in place.

7. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, means for slitting and spreading the ends of the fins into the form of a receiving trough, means for entering a wire in said trough and means for securing the wire in said trough.

8. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, said directing means including a takeup roll riding in a loop of the material and means for guiding said takeup roll for free rising and falling movement in accordance with variations in the loop.

9. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, said directing means including a takeup roll riding in a loop of the material, means for guiding said takeup roll for free rising and falling movement in accordance with variations in the loop and a control device for the machine operable by said takeup roll in the movement of the same in one direction.

10. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, said directing means including a takeup roll riding in a loop of the material, means for guiding said takeup roll for free rising and falling movement in accordance with variations in the loop, a control device for the machine operable by said takeup roll in the movement of the same in one direction and means for rendering said control device inoperable by the takeup roll.

11. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means and means substantially at the point of joinder of the finned strip with the tubing for gripping opposite sides of the fins and twisting them with respect to the axis of the tubing.

12. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, said strip confining and fin bending guide including a narrow confining channel for the edge strip and a co-extensive channel for the fins tapering in width from the original width of the material at one end to substantially the thickness of the material at the opposite end and having a fin bending floor extending on a gradually increasing angle from one end to the opposite end of said tapering channel.

13. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for ef-

fecting synchronous operation of said several means and a tubular guide about the tubing having an annular channel notched to receive the connecting edge portion of the fin strip.

14. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, said tubing rotating and feeding means including worm gears journaled on axes substantially at right angles to the longitudinal axis of the tubing and disposed at different sides of said tubing with the teeth of the same in gripping engagement with the tubing and mounted for bodily rotation about the axis of the tubing and worms operable in said rotation for turning said worm gears on their axes.

15. In a machine of the character disclosed, the combination of means for rotating and advancing tubing, means for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, means for directing the slit material from said slitting means to the tubing rotated and advanced by said first means, including a guide for confining the uncut edge strip and for bending up the separate fins at an angle thereto, common drive mechanism for effecting synchronous operation of said several means, including a clutch for uncoupling the slitting means and said tubing rotating and advancing means and hand operable mechanism for effecting operation of one of said last mentioned means independently of the other.

16. In combination, cooperating die elements for slitting strip material inward from one edge to form separate fins attached by a strip of the material along the opposite edge, a second set of cooperating dies for slitting the ends of said fins and bending the slit portions in opposite directions, means for winding the material in helical form with the separated portions at the ends of the fins forming a discontinuous trough and means for laying a continuous binder in said trough.

17. In combination with a guide for tubing, means at said guide for directing a strip of fin material onto the guided tubing and means for rotating and advancing tubing through said guide, comprising a tubular carrier rotating about the axis of the guided tubing, tubing gripping worm gears on said carrier in substantially radial relation and with the toothed rims of the same in gripping engagement with the guided tubing, worms engaged with said worm gears, bevel pinions connected with said worms, said worms and bevel pinions rotating on axes substantially radial of the carrier, a bevel ring gear engaged with said pinions and rotatably mounted on the carrier in substantially concentric relation to the axis of the tubing and means for effecting differential rotation of said carrier and ring gear.

18. In combination, means for rotating and axially advancing finned tubing, means for automatically applying a continuous binder to the fins of said tubing in said rotation and advancement of the same and including means for slitting and spreading the tips of the fins and wire supporting and guiding means for laying a binder wire in the spread tips of the fins.

19. The method of manufacturing finned tubing, which comprises slitting a fin strip inward from one edge to from separate fins attached along the opposite edge, slitting the ends of the fins and spreading the slit ends in opposite directions, bending the fins at an angle to the uncut edge portion of the strip, winding said edge portion about tubing with the fins outstanding therefrom and then winding a binder in between the slit and spread end portions of the fins.

20. The method of manufacturing finned tubing, which comprises winding a separately finned strip on the tubing, applying a binder to the ends of the separate fins of said strip and soldering both the finned strip to the tubing and the binding to the outer ends of the separated fins.

21. In combination with a chuck for rotating and axially feeding tubing, means for supplying a strip of separate fin forming material to the tubing rotated and advanced by said chuck, means for applying a binding to the outer ends of the separated fins applied to the tubing and associated mechanism for soldering the finned strip to the tubing and the binding to the outer ends of said fins.

22. In combination with strip winding and strip feeding means, a slack takeup movably mounted between said strip winding and said strip feeding means for engagement with the strip operated on by said means, a motor for operating said means, a controller for stopping said motor and an operating device for said controller positioned for actuation by said movable takeup, said operating device and takeup being related to effect operation of said controller a definite period in advance of complete stoppage of the machine.

23. The method of manufacturing finned tubing, which comprises slitting a fin strip inward from one edge to form separate fins continuously attached together along the opposite edge, winding said continuous opposite edge portion of the strip helically about tubing, bending said cut fins angularly outward from said continuous edge portion as the latter approaches the winding-on point at the tubing and twisting the individual outstanding fins substantialy at the winding-on point out of line with the helical outline of the edge portion of the strip wound on the tubing.

24. In combination with a guide for tubing, means at said guide for directing a strip of fin material onto the guided tubing and means for rotating and advancing tubing through said guide, comprising a tubular carrier rotating concentrically in respect to said guide, rollers disposed substantially radially on said carrier and concavely toothed to grip the tubing advancing through the guide, a ring gear rotatably mounted on said carrier, drive connections from said ring gear to said rollers and means for differentially rotating said carrier and said ring gear.

25. A heat transferring device comprising, in combination, a cylindrical body, a strip of metal wound helically thereon which includes a multiplicity of integral, radiating fingers disposed in a helical series, and a continuous helical reenforcing strip secured to the outer ends of the fingers.

26. In a machine of the character disclosed, the combination of means for rotating and advancing tubing and means for directing strip ma-

terial onto the tubing so rotated and advanced by said first means, said rotating and advancing means including a tubular carrier having a passage therethrough for the tubing and mounted for rotation concentrically about the axis of said passage, rollers disposed substantially radially on said carrier and concavely toothed to grip tubing extending through said passage, a ring gear rotatably mounted on said carrier, drive connections from said ring gear to said roller and means for differentially rotating said carrier and ring gear, said means for directing strip material onto the tubing, including a guide in advance of said rollers for directing strip material onto the tubing at a point in advance of said rollers and at an incline in accordance with the pitch angle of the helix produced by rotation of the individual rollers and the bodily rotation of the same by said carrier.

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