July 20, 1937. W. W. McCORD 2,087,723

MACHINE FOR MAKING HEAT TRANSFER DEVICES

Filed July 29, 1935 2 Sheets-Sheet 1

Fig. 1.

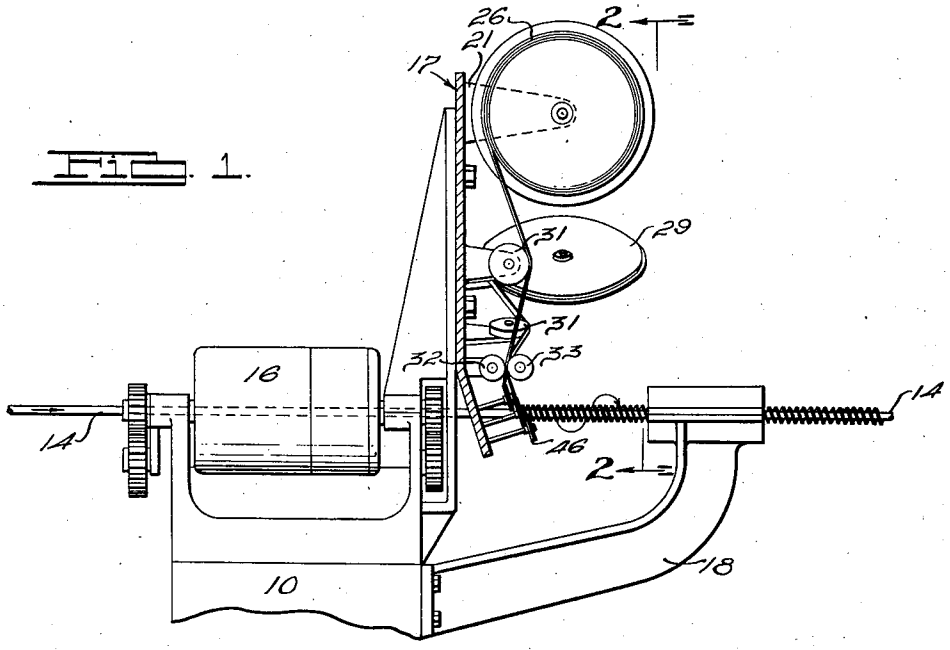
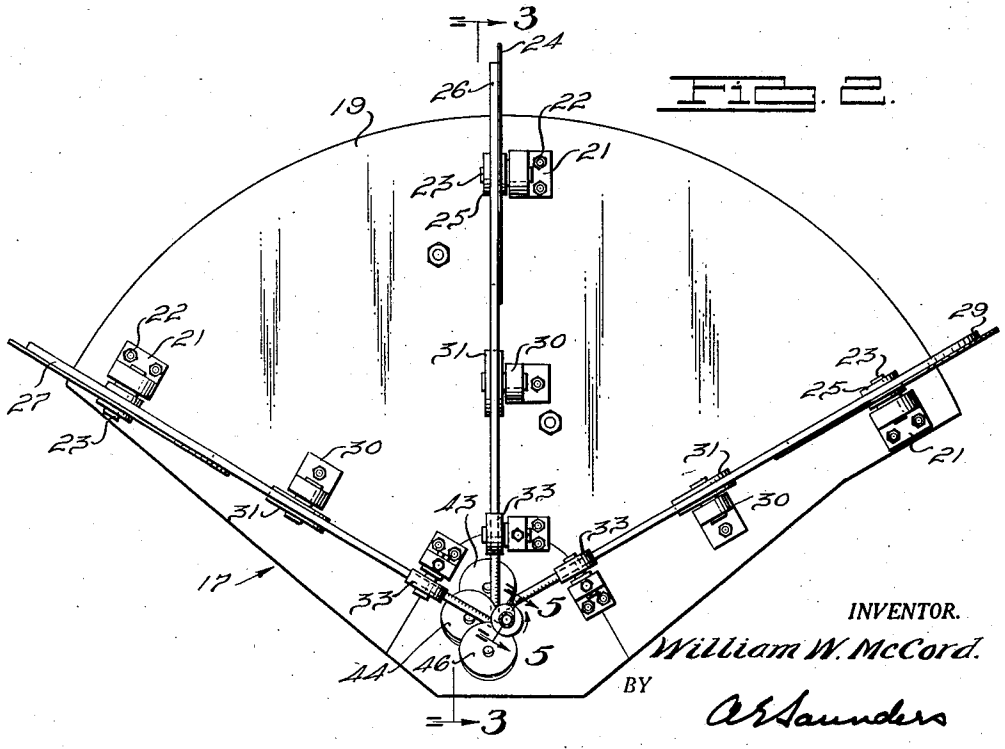


Fig. 2.



INVENTOR.
William W. McCord.
BY
A. R. Saunders
ATTORNEY.

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FIG. 3.

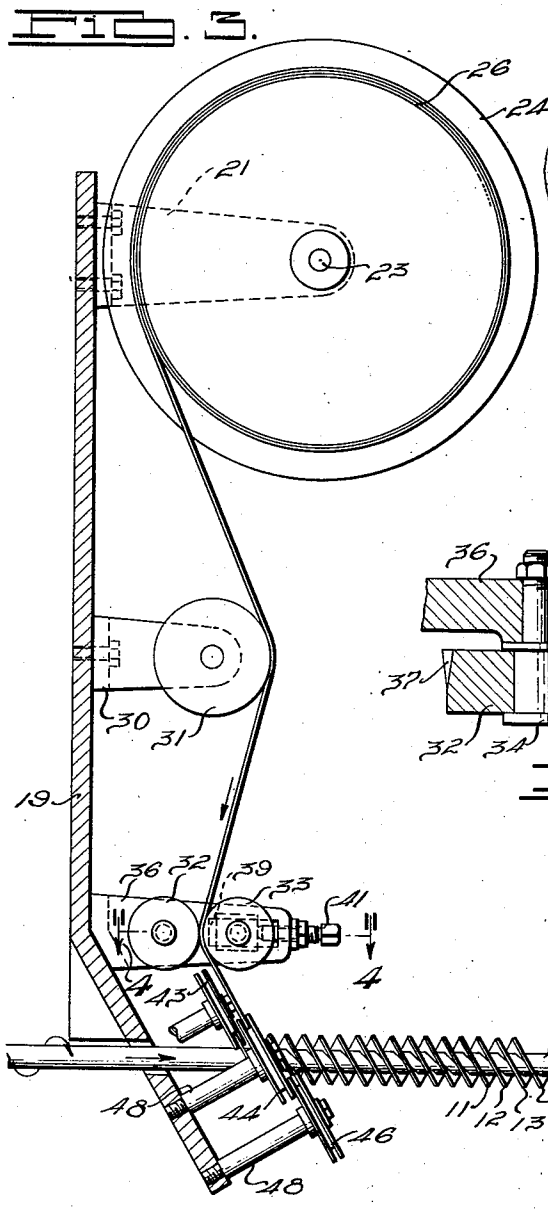
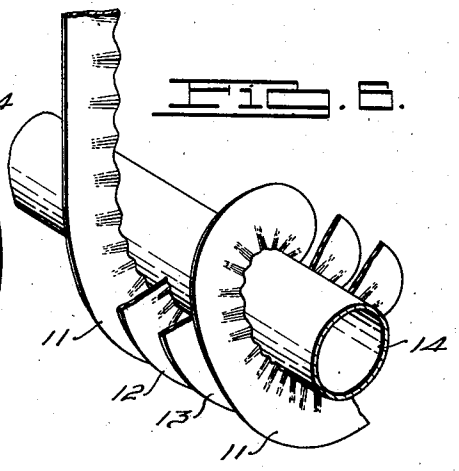


FIG. 6.



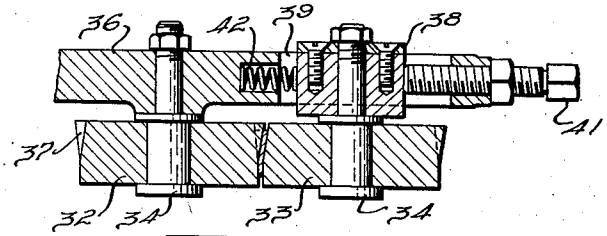


FIG. 4.

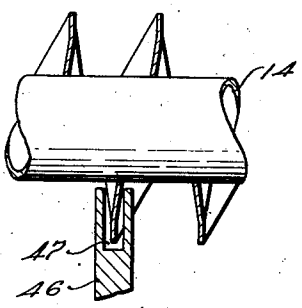


FIG. 5.

INVENTOR.
William W. McCord.
BY
Alexanders
ATTORNEY.

Patented July 20, 1937 2,087,723

UNITED STATES PATENT OFFICE

2,087,723

MACHINE FOR MAKING HEAT TRANSFER DEVICES

William W. McCord, Detroit, Mich., assignor to McCord Radiator & Mfg. Co., Detroit, Mich., a corporation of Maine

Application July 29, 1935, Serial No. 33,673

19 Claims. (Cl. 153—64.5)

This invention relates to heat transfer devices and more particularly to a machine for manufacturing such devices.

In transferring heat from or to the air by means of a finned tube containing a liquid or gas heating or cooling medium, it is essential that the air thoroughly wash all the surfaces of the fin and tube. This requirement necessitates the presence of a certain amount of turbulence but since turbulence creates an undesirable resistance to the air flow, it becomes a considerable task to balance the turbulence and the resistance in order to obtain efficient utilization of the materials present.

I have found that a tube wrapped with a plurality of co-extensive or overlapping spirally wound fins is more efficient than a single finned tube.

Machines for making multiple spiral finned tubing of this sort are expensive and very often fail to accomplish the result in a manner satisfactory to the production department, because in such machines there are several problems of considerable magnitude.

It is advantageous for example to supply the fins from individual rolls of fin stock, the rolls being in the form supplied by the rolling mill. It is undesirable to reroll the fins, as required by some types of machinery. The spiral rolls generally contain differing lengths of fins and this makes it desirable to have these rolls so located on the machine as to be readily accessible for inspection, preferably from the side of the roll, in order to predetermine the time when a new roll must be inserted. Some of the prior art machines, for example, enclose the rolls in rotating casings and it is impossible to determine the quantity of fin material remaining in each roll without stopping the machine. Unnecessary stopping of the machine thus sometimes results. If, however, the operator fails to stop the machine in time and insert a new roll, one of the fins may be used up and the tubing emerge from the machine before the operator is aware of the conditions, thus spoiling a length of tubing.

The above requirements must be fulfilled and yet, in order to form a spiral outline, relative rotation must occur between the tube and the supplies of fin stock.

One of the objects of my invention is to provide a machine which will embody each of the requirements above enumerated.

Another object of my invention is to provide a machine for forming a plurality of fins on a rotating tube, the spirals of fin stock being stationary and each being exposed to view, whereby they may be inspected without stopping the machine.

A further object of my invention is to provide a machine of the aforementioned type in which the supplies or rolls of fin stock are all carried above the axis of the tube, whereby rolls may be inspected without interfering with the base of the machine or the progress of the tube.

Other objects of the invention will appear from the following description taken in connection with the drawings which form a part of this specification, and in which:

Fig. 1 is a side view, partly in elevation and partly in section, of my improved machine;

Fig. 2 is a partially enlarged elevational view of a portion of my machine taken on the line 2—2 of Fig. 1;

Fig. 3 is an enlarged view of a portion of Fig. 1, also representing a view taken on the line 3—3 of Fig. 2;

Fig. 4 is a sectional view of a portion of my machine taken on the line 4—4 of Fig. 3;

Fig. 5 is an enlarged sectional view of the tube in position in my machine, taken on the line 5—5 of Fig. 2; and

Fig. 6 is a perspective view of the product of my machine, parts thereof being cut away to show the spiral form.

Referring to the drawings, 10 illustrates the base of a machine for forming three co-extensive spiral fins 11, 12 and 13 about a tube 14.

A suitable mechanism, indicated generally at 16, rotates the tube, preferably about its own axis, and simultaneously feeds the tube axially from the supply end at the left towards the fin supply mechanism indicated generally at 17 which is carried on an arm attached to the base 10. A further arm 18, also attached to the base, may support the finished spirally wound tubing.

The rotating and axial feeding means per se is not my invention, except as it is used in combination with other portions of my machine. This means may be any of the well known devices for performing these operations. United States Letters Patent, No. 1,472,719, issued to Geza Horvath on October 30, 1923, illustrates one form of such mechanism.

My fin-applying mechanism 17 comprises a series of devices, one series for each of the fins to be applied. As shown, each series is carried by a supporting plate 19, the supporting plate being replaceable, whereby, upon failure of any portion of the feeding devices, a new supporting plate may be installed and the old one removed

for servicing. It will be noted that the supporting plate can be removed without interfering with any other portion of the machine.

Each series of devices begins with a roll of fin stock as it comes from the mill and includes a guide means, a crimping, stretching, or deforming means, and a second guide means for locating the crimped fin in place on the tube and for holding it in an erect position until the tube has rotated sufficiently to overcome the tendency to tilt.

The supply means comprises a bracket member 21 fixed as by bolts 22 to the supporting plate 19. Each bracket carries a suitable pivot 23 on which is mounted a roll-supporting disk 24 having a central hub of a size to fit the hole in the center of a roll 26. The disk abuts one side of the roll leaving the other side open for inspection. A washer 25 holds the roll in place on the supporting disk 24, this assembly being adapted to permit withdrawal of the fin strip from the outer side of the roller adjacent the support plate 19.

Any number of brackets 21 may be used. As shown, I have provided, in addition to the roll 26, a second roll 27, and a third roll 29, the supporting disk 24 being arranged on the lower sides of the rolls 27 and 29.

The first guiding means previously referred to may be a roller 31 pivotally mounted on a bracket 30, in turn carried by the supporting plate 19. The purpose of this roller is to prevent flapping and to feed the fin material to the crimping means at a fixed angle regardless of the amount of material remaining in the roll 26.

The crimping means comprises a pair of rollers 32 and 33 mounted on studs 34 carried by a bracket 36 in turn attached to the supporting plate 19 in such a manner as to cause the rollers 32 and 33 to rotate in a plane perpendicular to the supporting plate 19, and substantially coplanar with the plane of rotation of the roll of fin stock 26 and the guide roller 31.

The engaging surfaces of the rollers are suitably formed as at 37 to produce corrugations extending from one edge of the fin in the well known manner so that the fin may readily be wrapped about the tube 14. If desired, the rollers may be adjustably spaced, as by mounting one of the studs 34 in a bearing block 38 carried in a slot 39 in the bracket 36. An adjusting nut 41 and a spring 42 may be used to regulate the position of the roller 33 in the manner shown.

Guide means, which together with the rollers 32 and 33 form a means of applying the fins 11, 12 and 13, may comprise rollers 43, 44 and 46 having grooves 47 arranged circumferentially therein. These rollers are mounted on the supporting plate 19 by means of studs 48. It will be noted that the rollers 43, 44 and 46 are arranged successively circumferentially of the tube 14 and are also axially spaced therealong in order to apply the fins equidistantly. As shown, the rollers are not symmetrically arranged about the tube 19, nor are the rolls of fin stock 26, 27 and 29 symmetrically arranged, and yet, by suitably arranging the rollers 43, 44 and 46, as shown, it is possible to produce equidistantly spaced fins arranged in overlapping or co-extensive spiral form. This spacing is produced instantly without re-handling of the fins, and is independent of the arrangement of the rolls about the tube.

The arrangement of the three or more supplies of fin stock at the top of the machine makes it possible for the operator thereof readily to inspect and service them.

It will be noted further that the grooves 47 of the guide rollers engage a substantial portion of the height of each fin and are located with respect to the axis of the tube at the same angle that the spiral makes with the axis of the tube.

The path of the fin is substantially co-planar with the roll of fin material from the time the fin leaves the roll until it engages the surface of the tube 14. Thus uneven motion of the fin and possible rupture thereof are minimized. Another useful feature of the arrangement shown is that the rolls of fin stock rotate about axes which are substantially co-planar but which lie at an angle to each other. Furthermore, the planes of rotation of each of the supplies of fin stock 26, 27 and 29 are substantially co-planar with successive tangents to the tube 14.

In the operation of my machine the tube is projected through the feeding means 16 in the well known manner and each fin strip is at first fed by hand to the tube where the end may be soldered in place. The machine is then energized and the axial feeding of the tube, coupled with the rotation thereof, pulls the fins from the rolls past the guiding means 31, the crimping rolls 32, 33, through the grooves 47 in the rolls 43, 44 and 46, and onto the tube, the initial soldering of the fin to the tube serving to produce this pull, and the grooves 47 serving to maintain the fin erect during the instant of stretching or deforming movement which occurs as the fin begins to assume their spiral shapes.

After this operation has been completed the fins may be soldered in place in any well known manner.

Although the invention has been described in connection with a specific embodiment, the principles involved are susceptible of numerous other applications which will readily occur to persons skilled in the art. The invention is, therefore, to be limited only as indicated by the scope of the appended claims.

I claim:

1. In a machine for applying fins to a tube, means for rotating the tube and for feeding the tube in a direction substantially parallel to its axis, and means including a plurality of rolls provided with fin stock, each rotatable about a stationary axis for applying to said tube during rotation and feeding thereof a plurality of overlapping equidistantly spaced spirals of fin stock.

2. In a machine for applying fins to a tube, means for rotating the tube and for feeding it axially, and means including a plurality of rolls provided with fin stock carried on fixed pivots for applying to said tube a plurality of overlapping spirals of fin stock.

3. In a machine for applying fins to a tube, means for rotating the tube and for feeding it axially, and means including a plurality of rolls provided with fin stock carried on fixed pivots for applying to said tube a plurality of overlapping spirals of fin stock, said pivots being so located that said rolls lie above a horizontal line passing through the axis of rotation of said tube.

4. In a machine for applying fins to a tube, a support, means for rotating the tube and for moving the tube axially past said support, means carried by said support for applying a plurality of overlapping spirals of fin stock to the tube as it passes said support, and a rest for said fin-surrounded tube associated in fixed relationship with said support.

5. In a machine for applying fins to a rotating tube moving axially of said machine, means for applying to said tube a plurality of overlapping spirals of fin stock, said means including a plurality of elements each engageable with one of said spirals at its point of formation on said tube, said elements being arranged about said tube and being relatively spaced axially of said tube.

6. In a machine for applying fins to a tube, means for applying a plurality of overlapping spirals of fin stock to said tube, said means including a roll provided with fin stock for each spiral, and means for feeding the stock from each roll onto said tube in a direction substantially co-planar with the plane of rotation of said roll and substantially tangent to said tube.

7. In a machine for applying fins to a tube, means for rotating said tube, means for applying to said tube, while rotating, a plurality of overlapping spirals of fin stock, and means for supplying said stock from a plurality of spaced, non-coaxial rolls provided with fin stock.

8. In an apparatus for applying a plurality of overlapping spirals of fin stock to a tube, a plurality of rolls provided with fin stock each rotatable about an axis lying at an angle to the axes about which the other rolls are rotatable.

9. In an apparatus for applying a plurality of overlapping spirals of fin stock to a tube, a plurality of rolls provided with fin stock each rotatable about an axis lying at an angle to the axes about which the other rolls are rotatable, said axes remaining fixed during operation of said apparatus.

10. In a machine for forming a plurality of overlapping spirals of fin stock on a tube, a plurality of spaced rolls provided with fin stock, means for presenting a fin strip from each of said rolls to said tube, and means for moving said tube past said presenting means in a manner to form said strips into substantially equidistantly spaced spirals on said tube.

11. In a tube finning machine, a plurality of spaced rolls provided with fin stock, and means for applying a fin from each of said rolls to the tube in overlapped equidistantly spaced spiral form, said rolls being mounted to revolve about fixed stationary axes, whereby the operator of said machine may inspect said rolls during operation of said machine.

12. In a fin-applying machine, means for simultaneously rotating and feeding the article to which the fin is to be applied, and means including rollers fixedly located adjacent the path of travel of said article for applying a plurality of fins thereto.

13. In a machine for applying a plurality of overlapping spirals of fin stock to a tube, a separate roll provided with fin stock for each fin, a stationary pivot for each of said rolls, means for deforming and locating each fin strip, and means for moving a tube past said deforming means in a manner to produce on said tube a plurality of equidistantly spaced overlapping spirals of fin stock.

14. In a machine for applying a plurality of fins to a moving article, means for deforming and locating said fins comprising cooperating crimping rolls and guide rolls, said rolls being arranged in spaced relationship non-symmetrically about the path of travel of said article.

15. In a machine for applying a plurality of fins to a moving article, means for deforming and locating said fins on said article comprising cooperating crimping rolls and guide rolls, said rolls being arranged non-symmetrically about the path of travel of said article, and means for moving said article to form equidistantly spaced overlapping fin spirals on said article.

16. In a machine for applying a plurality of fins to a moving article, means for deforming and locating said fins on said article comprising cooperating crimping rolls and guide rolls, said rolls being arranged in groups, said groups being spaced unequally circumferentially of the path of travel of said article, and means for moving said article past said first mentioned means, both of said means cooperating to form spaced overlapping fin spirals on said article.

17. The method of applying a plurality of fins to an article which includes the steps of moving the article past a plurality of rolls provided with fin stock spaced unevenly about the path of movement of the article, and applying the fins to the article during such movement in a manner such that the fins form equidistantly spaced overlapping spirals.

18. In a machine for applying fins to a tube, a battery of rolls provided with fin stock supported and arranged to rotate in separate planes, said rolls being so arranged with respect to the path of movement of said tube that their planes of rotation lie substantially parallel to the axis of said tube.

19. The method of applying a plurality of fins to an article which includes the steps of moving the article past a plurality of rolls provided with fin stock fixedly located and arranged circumferentially about the path of movement of said article, and rotating the article during such movement whereby to produce a plurality of equidistantly spaced overlapping spirals of fin stock on said article.

WILLIAM W. McCORD.