July 30, 1957 C. J. SCHMELING 2,800,944

METHOD AND MACHINE FOR WINDING A PLURALITY OF NARROW WIDTH FINS SEVERED FROM A RIBBON OF PREDETERMINED WIDTH, ABOUT A TUBE

Filed March 31, 1955 2 Sheets-Sheet 1

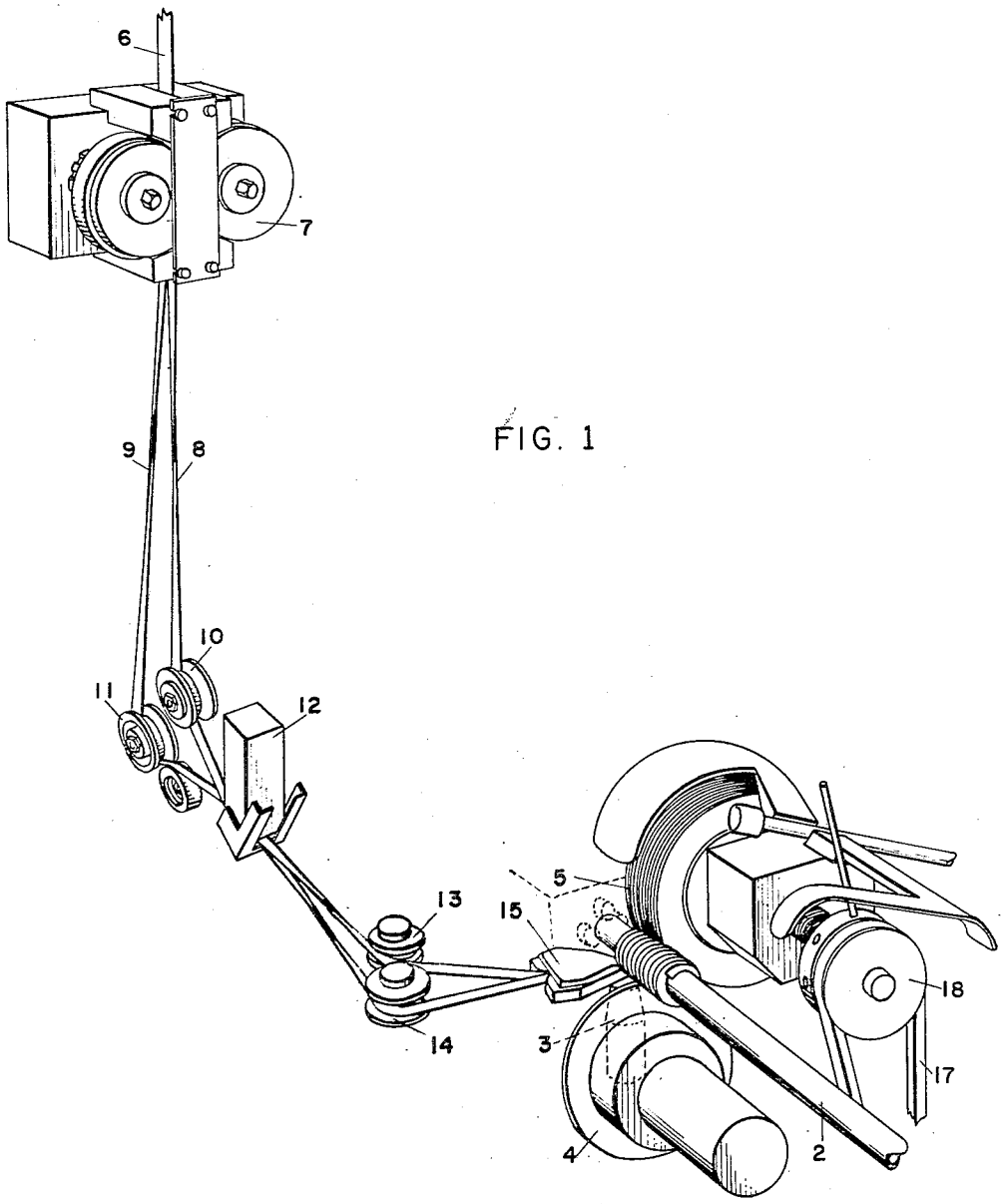


FIG. 1

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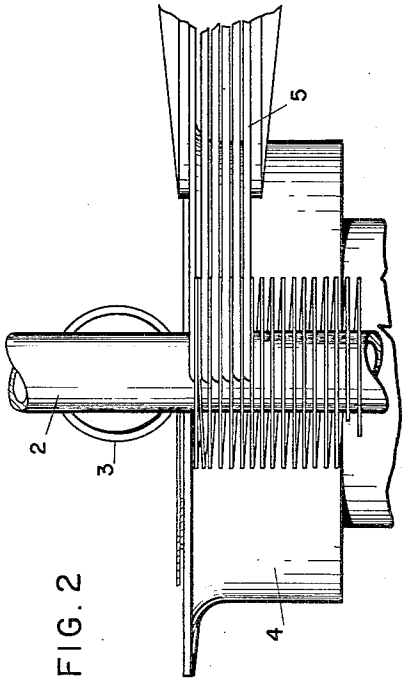


FIG. 2

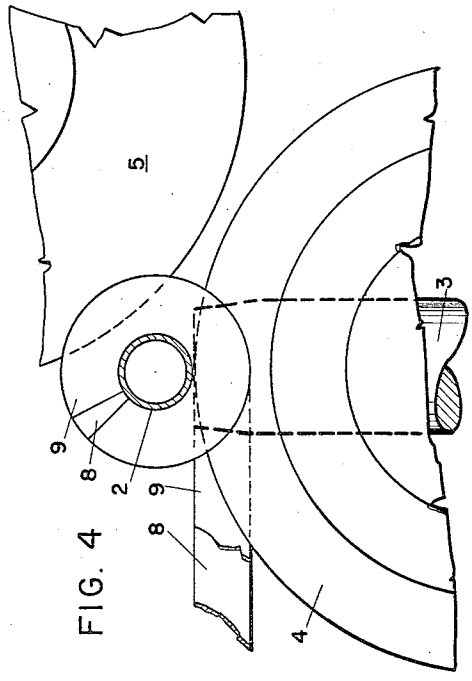


FIG. 4

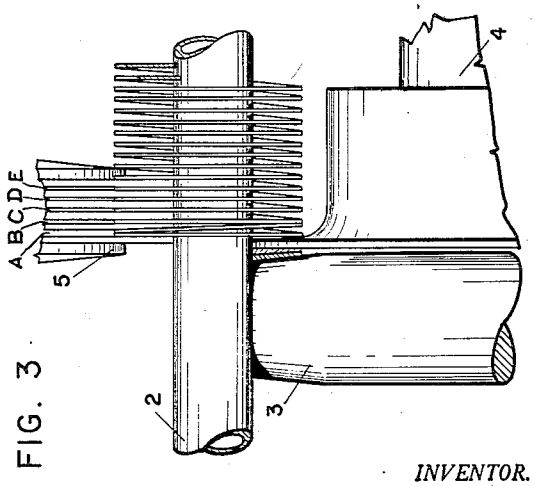


FIG. 3

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2,800,944

METHOD AND MACHINE FOR WINDING A PLURALITY OF NARROW WIDTH FINS SEVERED FROM A RIBBON OF PREDETERMINED WIDTH, ABOUT A TUBE

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Application March 31, 1955, Serial No. 498,161

4 Claims. (Cl. 153—64.5)

This invention relates to finning machines and a method of forming a plurality of helically extending fins about a rotating and advancing tube and, more particularly, to a method and machine by which a plurality of thin strips of material, preferably metal, may be helically wound around a tube and secured thereon in one operation.

In Stikeleather application, Serial No. 189,854, filed October 12, 1950, issued July 19, 1955, as Patent No. 2,713,375, there is disclosed a machine for forming a smooth surface fin about a tube. The smooth finned tubes formed by this machine are highly satisfactory when used as heat exchange surfaces. The machines, however, are expensive in initial cost so that large sums of money may be required for capital investment if it is desired to employ a number of machines.

The present invention is concerned with improvements in this type of machine and the method of operation thereof which permit increased production of finned tubing formed thereon in the order of 50% to 100% with only a relatively minor increase in the cost of the machine.

This invention relates to apparatus for forming a plurality of smooth fins about a rotating and advancing tube in which two ribbons may be wound simultaneously about the tube to form alternate fins thereon thereby greatly increasing the production of the machine.

An object of the present invention is to provide a machine for forming a plurality of fins about a tube in which spacing members are provided to space the separate helices upon the tube.

This invention further relates to a method of winding a plurality of fins about a rotating and advancing tube in which overlapped ribbons are formed into helices about a tube, the helices being separated and spaced longitudinally of the tube and attached thereto. Other objects of the invention will be readily perceived from the following description.

This invention relates to a method of winding a plurality of fins about a rotating and advancing tube in which the steps consist in feeding a ribbon of predetermined width to a tube, severing the ribbon during its passage to the tube into sections of smaller width, overlapping the sections in substantially face-to-face engagement, passing the overlapped sections through forming rolls to wind the sections into helices about the tube, passing the overlapped helices together through the first pass of a series of spacing members, separating the helices longitudinally of the tube, and passing the separated helices through alternate passes in the series of spacing members to secure the helices upon the tube.

This invention further relates to apparatus for winding a plurality of fins about a rotating and advancing tube comprising, in combination, means for supplying a ribbon of predetermined width to a tube, means to sever the ribbon into sections of smaller width during its passage to the tube, means to place the severed sections in substantially face-to-face engagement, forming rolls for winding the sections while in face-to-face engagement helically

about the tube and a series of spacing members for separating and spacing the helices longitudinally of the tube.

The attached drawings illustrate a preferred embodiment of the invention, in which

Figure 1 is a diagrammatic view illustrating the finning machine of the present invention;

Figure 2 is a plan view illustrating the manner in which the fins on the tube are separated and spaced by the spacing members;

Figure 3 is a view in elevation of the arrangement shown in Figure 2; and

Figure 4 is a view in end elevation of the arrangement shown in Figures 2 and 3.

Referring to the drawings and particularly to Figure 1 thereof, there is shown a modified finning machine of the type shown in Stikeleather Patent No. 2,713,375. This machine includes a head (not shown) for rotating and advancing a tube **2** and suitable support members for the tube during its rotation and advancement. A forming roll **3** cooperates with a disk roll **4** to stretch the peripheral portion of a ribbon or ribbons and to wind the ribbons about the tube **2**. A series of separating and spacing members **5** are provided for a purpose hereinafter explained. Members **5** are rotated preferably at a speed somewhat faster than the speed at which the tube is rotated and advanced. Any suitable means may be provided to rotate members **5**.

A ribbon **6** of aluminum or copper is passed to the tube **2** from any suitable source of supply, such as a reel or a slitting machine of the type shown in Stikeleather Patent No. 2,696,882, granted December 14, 1954. Ribbon **6** during its passage to the tube **2** passes through a set of freely rotatable cutting rolls **7** which severs or slits ribbon **6** into two sections **8** and **9** smaller in width than ribbon **6**.

The sections **8**, **9** of ribbon pass to pulleys **10** and **11**, such as idler rollers, and during their progress from rolls **7** to the idlers **10**, **11** are turned at an angle of approximately 90° to the direction of the ribbon during the slitting operation. Sections **8** and **9**, from pulleys **10**, **11**, are then passed to a guide **12** which places the sections in overlapped, substantially face-to-face engagement with each other. If desired, suitable tensioning means may be applied against one or both sections in order to assure that both sections are fed evenly to the forming rolls. From guide **12** the sections **8**, **9** are passed over idlers **13**, **14** which separate the overlapped sections and place the separated sections in a plane at approximately right angles to the plane of the axis of the tube being provided with fins. The sections while in such plane are passed to a second guide **15** which places the sections again in face-to-face engagement. The sections are then passed to the forming rolls **3**, **4**.

The sections **8**, **9**, pass between forming roll **3** and disk roll **4** while in face-to-face engagement, the rolls stretching the exterior or peripheral portion of the sections to wind the sections about the tube in the form of helices.

Referring now to the series of spacing members **5**, it will be observed that at least six members are provided which cooperate to form a series of five passes through which the helices on the tube must pass. At least one set, that is two adjacent spacing members, are provided with serrations, serrations on one member being placed opposite recesses on the adjacent member. If desired, of course, all of the spacing members may be provided with serrations although this is not generally necessary.

The overlapped helices pass together through the first passage between spacing members. As the helices leave this passage they begin to separate, one helix passing to the second passage in the series of spacing members, while the other helix passes to the third passage in the series of spacing members. Thus, the separated helices pass

through alternate passages in the series of spacing members so that the spacing members serve to space the helices upon the tube as the tube continues to rotate and advance and likewise serve to tighten the helices upon the tube.

While I have stated that the series of spacing members may be driven by any suitable means, it will be appreciated that ordinarily these rolls are driven by the same mechanism which operates the head of the machine and the forming roll of the machine. It may be connected thereto by any suitable means such as the belt 17 and pulley 18, shown in Figure 1.

Considering the operation of the machine, ribbon 6 from any suitable source of supply is drawn by rolls 3 and 4 through freely rotatable cutting rolls 7 which sever the ribbon into two sections of smaller width, 8, 9. Sections 8, 9 are turned at an angle of approximately 90° to the direction of the ribbon during the slitting operation and are passed over pulleys 10, 11 to guide 12 which places the sections in overlapping face-to-face relation. Sections 8, 9 are then separated and passed over idler pulleys 13, 14 to place the separated sections in adjacent planes approximately transverse to the axis of the tube on which the fins are being formed. Sections 8, 9 then pass through guide 15 which serves to feed the sections in parallel face-to-face engagement to forming rolls 3, 4. Forming rolls 3, 4 stretch the peripheral portion of the sections while maintaining them in face-to-face engagement to wind the sections about tube 2 in the form of helices. The overlapped helices pass together through the first pass of the spacing members 5 and, as the helices leave such space, they begin to separate and are passed by the rotation and advancement of the tube through alternate passes in the series of spacing members which serve to space and to secure the helices in desired position upon the tube. These spacing members also serve to remove any curves or waves in the peripheral edges of the fins so formed so that smooth finned tubes may be provided.

For example, both sections 8, 9 of the slit ribbon will pass through the first pass marked "A" of the series of spacing members, as shown in Figures 2 and 3; after leaving the first pass, the sections begin to separate, section 8 passing through passes "B" and "D" of the series of spacing members while section 9 passes through passes "C" and "E" of the series of spacing members. The fins so formed on the tube are properly spaced and secured to the tube.

It will be understood at start-up, the helices are passed through the spacing members manually and then secured in any desired way to the tube. Thereafter the machine is operated manually to form the helices about the tube and to space and separate the helices on the tube.

It will be appreciated the present invention is applicable to other types of finning machines in which, for example, the severed sections may be crimped while in overlapping face-to-face relation and passed separately through ironing rolls to the tube, or if desired, the severed sections may be formed into helices which are then disposed about a tube. The present invention may be employed to space the separate helices in desired spaced position upon the tube. I have found that under some circumstances spacing members may also be employed if desired to rotate and advance the tube itself by tightening the separate helices upon the tube, this tightening action occurring while the fins are upon the tube so that the tube is rotated and advanced indirectly through the fins.

The present invention provides a modified finning machine which permits production of smooth finned tubing to be increased greatly. This increase in production is obtained with only minor increase in initial cost of the machine. Labor expenses encountered during the operation of the machine are substantially decreased since each operator can produce approximately 50% to 100% more smooth finned tubing by the use of the present invention. No more than the usual amount of waste ribbon is created by the use of the present invention.

The present invention provides a relatively simple, inexpensive method of forming smooth finned tubing by winding a plurality of ribbons about a tube simultaneously. While the invention has been described as employing two sections which are wound simultaneously about a tube, it will be understood that three, four or more sections may be supplied to the tube and wound thereabout simultaneously.

While I have described a preferred embodiment of the invention, it will be understood that the invention is not limited thereto since it may be otherwise embodied within the scope of the following claims.

I claim:

1. In a method of winding a plurality of fins about a rotating and advancing tube, the steps which consist in feeding a ribbon of predetermined width to a tube, severing the ribbon during its passage to the tube into sections of smaller width, overlapping the sections in substantially face-to-face engagement, passing the overlapped sections through forming rolls to wind the sections in adjacent planes approximately transverse to the axis of the tube into helices about the tube while maintaining them in face-to-face engagement, passing the overlapped helices together while still in face-to-face engagement through at least the first pass of a series of spacing members, and then separating the helices longitudinally of the tube while passing the separated helices through alternate passes in the series of spacing members to secure the helices upon the tube.

2. In a method of winding a plurality of fins about a rotating and advancing tube, the steps which consist in feeding a ribbon of predetermined width to a tube, severing the ribbon during its passage to the tube into sections of smaller width, turning the severed sections of ribbon, overlapping the turned sections in substantially face-to-face engagement, separating the overlapped sections, placing the separated sections in adjacent planes approximately transverse to the axis of the tube, again placing the separated sections in substantially face-to-face engagement, passing the sections while maintaining them in face-to-face engagement through forming rolls to wind the sections into helices about the tube, passing the overlapped helices together while still in face-to-face engagement through the first pass of a series of spacing members, separating the helices longitudinally of the tube, and then passing the separated helices through alternate passes in a series of spacing members to secure the helices upon the tube while continuing rotation and advance of the tube.

3. In apparatus for winding a plurality of fins about a rotating and advancing tube, the combination of means for supplying a ribbon of predetermined width to a tube, cutting mechanism to sever the ribbon into sections of smaller width during its passage to the tube, a guide member, idler pulleys to direct the sections into overlapping relation during passage through the guide member, idler pulleys to place the overlapped sections approximately transverse to the axis of the tube, a second guide member for guiding the sections while in substantially face-to-face engagement to the tube, forming rolls for winding the sections while in face-to-face engagement helically about the tube, and a series of spacing members for separating and spacing the helices longitudinally of the tube, the helices passing together through the first pass of the series in face-to-face engagement and then separately through alternate passes in the series as the tube rotates and advances.

4. In apparatus for winding a plurality of fins about a rotating and advancing tube, the combination of means for supplying a ribbon of predetermined width to a tube, means to sever the ribbon into sections of smaller width during its passage to the tube, means to place the severed sections in substantially face-to-face engagement, form-

ing rolls for winding the sections while in face-to-face engagement helically about the tube and a series of spacing members for separating and spacing the helices longitudinally of the tube, the space between the spacing members varying so that the helices pass through at least the first pass of the series in face-to-face engagement and then through alternate passes in the series as the tube rotates and advances.

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