Sept. 13, 1949. F. M. BENNETT ET AL 2,481,490

APPARATUS FOR SPACING AND FIXING FINS ON TUBES

Filed May 5, 1947 3 Sheets-Sheet 1

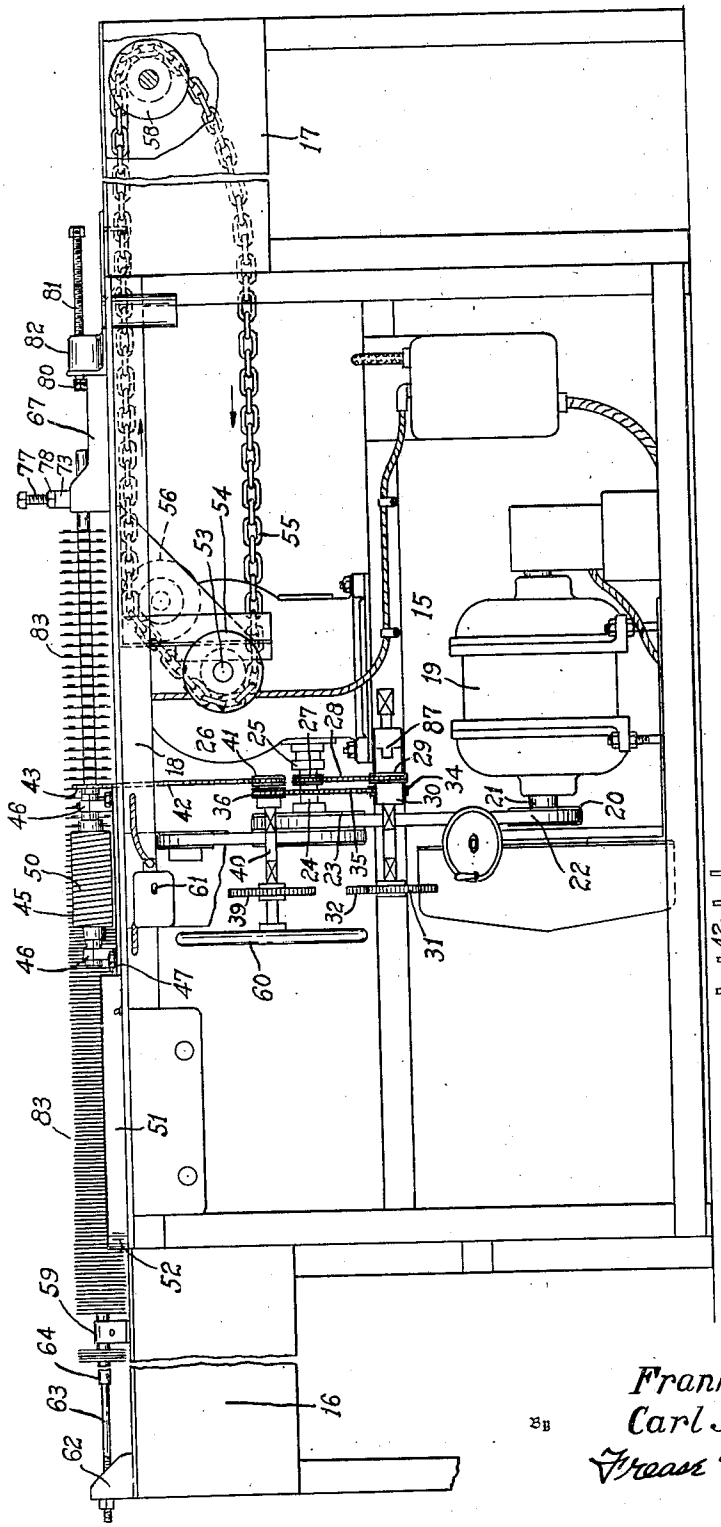


Fig. 1

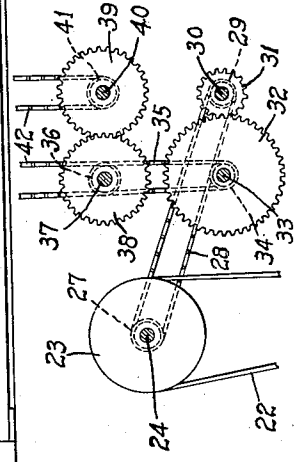


Fig. 2

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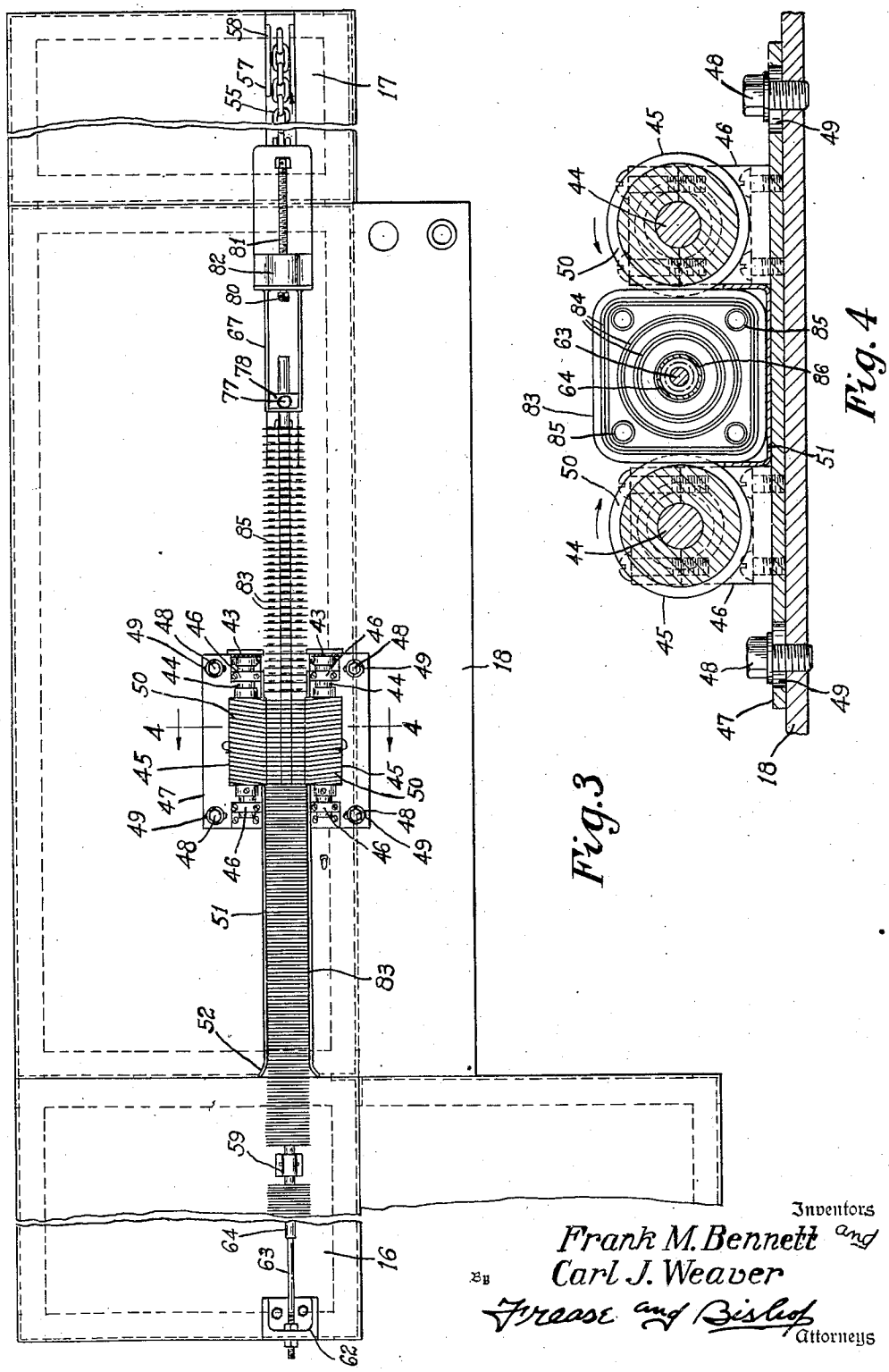


Fig. 3

Fig. 4

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APPARATUS FOR SPACING AND FIXING FINS ON TUBES

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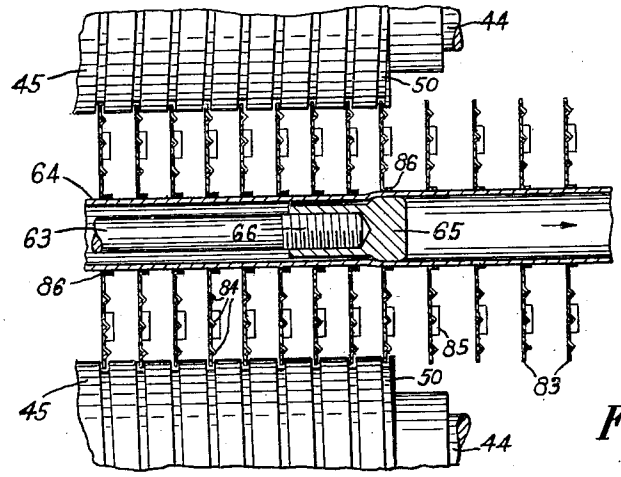


Fig.5

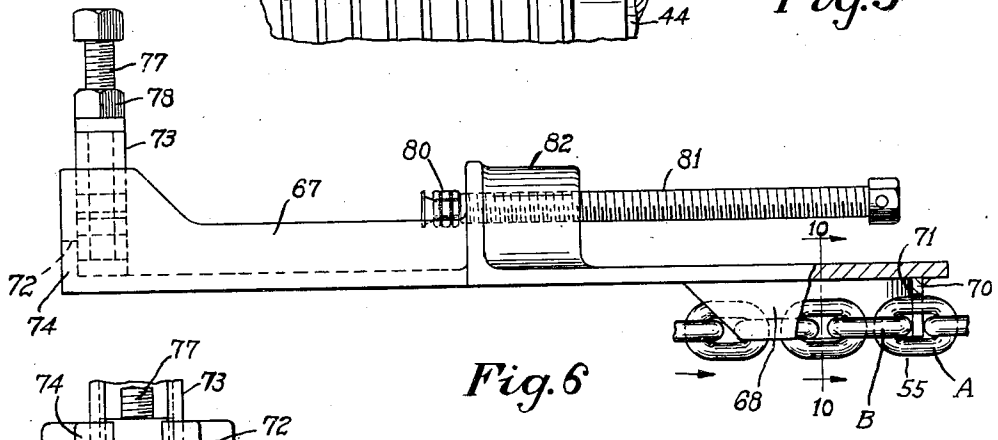


Fig.6

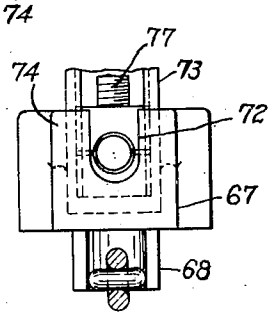


Fig.7

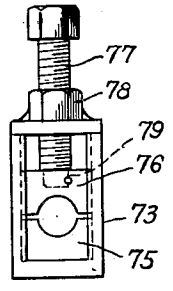


Fig.8

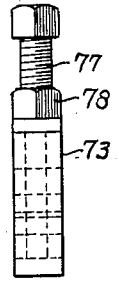


Fig.9

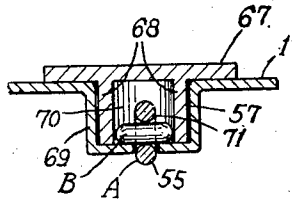


Fig.10

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APPARATUS FOR SPACING AND FIXING FINS ON TUBES

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Application May 5, 1947, Serial No. 745,938

7 Claims. (Cl. 29—202)

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The invention relates to apparatus for attaching fins to tubes or pipes for use as heat exchangers in refrigeration apparatus and the like.

In the manufacture of refrigeration apparatus and the like it is common practice to provide coils of tubing or pipes, through which the refrigerant is circulated, with a great multiplicity of closely spaced, sheet metal fins functioning as heat exchangers.

It is necessaray that these fins fit tightly around the tubing or pipes in order that they will be good conductors of heat to or from the tubing. Various methods have been used in the past for attaching the fins to the tubing, some of which are relatively slow and tedious, costly and none of which is entirely satisfactory.

The present invention contemplates the provision of apparatus for rapidly and securely attaching the fins tightly upon the tubing in such a manner that the cost of this operation is considerably reduced.

Another object is to provide a machine of this character having means for uniformly spacing the fins as they are attached to the tubing.

A further object is to provide such apparatus including means for expanding the tube into a central opening in each fin so as to frictionally hold the fins in fixed position upon the tube.

A still further object is to provide such apparatus in which a pair of helical grooved rolls separate the fins just prior to the expanding operation.

It is another object of the invention to provide a tube finning machine in which the tube is continuously moved through the machine and over an expanding head which expands the tube so as to fit tightly within the fins.

A further object is to provide apparatus of this type in which the relative speeds of the tube and the helical grooved rolls may be varied in order to vary the spacing of the fins upon the tube.

A still further object is to provide a machine of the character referred to in which a rod or mandrel is anchored at one end and holds in position an expanding head at its other end, the tube being slidably moved over the expanding head by means of a draw bench.

It is also an object of the invention to provide such a machine in which one end of the tube is clamped in a box detachably connected to the chain of the draw bench.

Another object is to provide a machine of this type in which the fins are loosely threaded upon the tube in closely spaced position, each fin having means thereon for preventing close packing together of the fins, whereby as the fins approach

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the helical grooved spacing rolls they may be automatically manipulated by the rolls.

A further object of the invention is to provide a tube finning machine of the character referred to in which the rod or mandrel supporting the expanding head is located between the helical grooved rolls with the expanding head upon the rod or mandrel located at the point where the fins pass out of the grooved rolls.

A still further object is to provide means upon the machine for initially expanding the leading end of the tube before it is moved through the helical grooved rolls and over the expanding head.

The above objects together with others which will be apparent from the drawings and following description, or which may be later referred to, may be attained by constructing the improved tube finning machine in the manner hereinafter described in detail and illustrated in the accompanying drawings in which;

Figure 1 is a side elevation of a tube finning machine embodying the invention, showing a tube passing through the machine and fins being fixed thereon;

Fig. 2 a fragmentary, transverse, sectional view through a portion of the driving mechanism of the machine;

Fig. 3 a top plan view of the machine in the position shown in Fig. 1;

Fig. 4 an enlarged, transverse sectional view through the helical grooved rolls, taken on the line 4—4, Fig. 3;

Fig. 5 an enlarged, longitudinal sectional view through the tube showing the expanding head upon the rod or mandrel and the manner in which the same expands the tube into the fins;

Fig. 6 a side elevation of the box detachably connected to the draw bench chain for clamping the leading end of the tube to pull it over the expanding head;

Fig. 7 a fragmentary rear elevation of the draw bench clamping box shown in Fig. 6;

Fig. 8 a front elevation of the tube clamping means within the box;

Fig. 9 a side elevation of the clamping means; and,

Fig. 10 a transverse section through the box and chain of the draw bench, taken on the line 10—10, Fig. 6.

Referring now more particularly to the embodiment of the invention illustrated in the accompanying drawings, in which like numerals refer to similar parts throughout the several views, the apparatus may include the drive mechanism indicated generally at 15 and located substantially at the center of the machine, the support bench

16 of considerable length located at one side thereof, and the draw bench of similar length indicated generally at 17 and located at the other side thereof.

The drive mechanism is located beneath the central table 18 which is of uniform height with the support bench 16 and the draw bench 17. Located beneath this central table 18 is the motor 19, or other prime mover which may furnish power for the machine.

A pulley or sprocket 20 may be fixed upon the motor shaft 21 for conveying the power therefrom, through a belt or chain 22; to the various working parts of the apparatus. The belt 22 may engage the pulley 23 upon a shaft 24, journalled as at 25 and arranged to drive reduction gearing located in the gear housing 26.

A sprocket 27 may be mounted upon the shaft 24 and connected, as by a chain 28, with a sprocket 29 upon the shaft 30, upon which may be removably mounted a change gear 31 of desired diameter arranged to mesh with a change gear 32 removably mounted upon the parallel shaft 33.

A sprocket 34 may be fixed upon the shaft 33 and connected by a chain 35 with a sprocket 36 upon the shaft 37, upon which is mounted a gear 38 meshing with a gear 39 of equal diameter mounted upon the similar shaft 40.

Sprockets 41 are mounted upon the shafts 37 and 40 and connected by chains 42 with sprockets 43 upon the shafts 44 of the spaced, parallel helical grooved rolls 45, journalled in bearings 46 which may be assembled upon a base plate 47 mounted upon the top of the central table 18 as by the bolts 48 located through slots 49 in the base plate 47 so that the helical roll assembly may be accurately positioned upon the table 18.

The rolls 45 have oppositely disposed, uniformly spaced, helical grooves 50 formed therein throughout their lengths. A channel guide 51, outwardly flared at its left end as indicated at 52 in Figs. 1 and 3, may be mounted upon the table 18 and extended over the base plate 47 between the helical grooved rolls 45.

A shaft 53 is driven by the reduction gearing in the housing 26 and a sprocket wheel 54 is mounted thereon for driving the draw bench chain 55 which passes around said sprocket wheel and up over an idler 56 and then forwardly or to the right through a slot 57 extending longitudinally throughout the length of the draw bench 17, then over an idler 58 at the far end of the draw bench, and then back to the drive sprocket 54 so as to continuously move the chain 55 forwardly or in the direction of the arrows shown in Figs. 1 and 3.

The draw bench chain is continuously operated at uniform speed and the speed of the helical grooved rolls 45 may be varied relative to the speed of the draw bench chain by placing any desired relatively proportioned gears 31 and 32 upon the shafts 30 and 33.

A hand wheel 60 may be mounted upon the shaft 40 for manually operating the helical grooved rolls 45 when necessary or desirable during the operation of the machine and a switch 61 is provided for controlling the circuit to the motor 19.

A bracket 62 may be rigidly mounted upon the far end of the support bench 16 for supporting the adjacent end of the rod or mandrel 63 over which the metal tube 64 is slidably located. At the free end of the rod 63 is located the expanding head 65, which may be detachably mounted upon the end of the rod as by the screwthreads 66.

As best shown in Fig. 5 this expanding head is preferably located at the right hand end of the helical grooved rolls 45.

A detachable box 67 is adapted to be engaged with the draw bench chain 55. For this purpose the box has the spaced, longitudinally depending flanges 68 adapted to slidably fit within the channel guide 69 formed in the longitudinal slot 57 of the draw bench 17 and to receive a portion of the chain 55.

These flanges 68 are connected at their forward ends by the transverse flange 70 having a slot 71 therein to receive a link of the chain in vertical position as indicated at A in Figs. 6 and 10, while the next rearward, horizontally disposed link B will abut the end flange 70 so as to move the box 67 with the chain 55.

The rear end of the box 67 is provided at its upper edge with the slot 72 to receive the forward end portion of the tube 64 which is clamped in the clamping device shown in detail in Figs. 8 and 9 and comprising the U-shape frame 73 located in the rear end portion of the box 67 against the rear end wall 74.

A normally stationary, lower clamping jaw 75 is mounted at the bottom of the U-shape frame 73 and the movable, upper clamping jaw 76 is vertically slidably mounted therein and operated by the clamping screw 77 located through the nut 78 at the top of the frame 73 and having a swivel connection with the movable clamping jaw 76 as indicated at 79.

For the purpose of initially expanding the front or leading end portion of the tube 64, in order to start the operation of the machine, a collapsible expanding head 80 may be mounted upon a screw 81 threaded through a stationary nut 82 in the box 67, or any other collapsible expander may be used.

The fins 83, which are to be mounted upon the tube, may be of the form best shown in Figs. 4 and 5 of the drawings, being formed of sheet metal of rectangular shape preferably with rounded corners and reinforcing ribs 84 pressed therein.

Apertures may be punched in the corner portions of these fins surrounded by the outturned flanges 85. These flanges are for the purpose of preventing the fins from packing tightly together when they are placed upon the tube 64.

In the operation of the machine, to fix the fins tightly upon the tube, the proper number of the metal fins 83 are placed upon the tube as shown at the left side of Figs. 1 and 3. Shoes 59 may be located over the tube for sliding contact with the table to support the tube as it is moved through the machine. The forward or leading end of the tube may be expanded for a short distance by locking it between the clamping jaws 75 and 76 in the box 67 and operating the screw 81 to insert the expanding head 80 into the end portion of the tube and to then pull the collapsible expander outward to the end of the tube to expand the same.

The expanding head 65 is then removed from the rod or mandrel 63 and the tube 64 is slidably located over the rod 63 after which the expanding head 65 is replaced upon the rod and the expanded forward end of the tube is pulled over the expanding head 65 and clamped between the jaws 75 and 76 of the box 67 which has been detachably connected to the chain 55 of the draw bench in the manner above described.

The motor 19 is then started moving the draw bench chain forwardly, or to the right as

viewed in Figs. 1 and 3, and rotating the helical grooved rolls **45** in opposite directions as indicated by the arrows in Figs. 3 and 4, drawing the tube with the fins loosely mounted thereon between the helical grooved rolls **45** and over the expanding head **65**.

The side edges of the fins **83** will be received, one at a time, in the helical grooves **50** of the rolls **45** separating the fins and moving them forward, or to the right, and as each fin reaches the point where it leaves the grooves **50** of the rolls **45**, the tube will be expanded so as to tightly fit within the flanged, central opening **86** of the fin as best shown in Fig. 5.

The spacing of the fins is uniform as they are fixed upon the tube and this spacing may be varied as desirable or necessary by varying the speed of rotation of the helical grooved rolls **45** relative to the speed of movement of the tube **64** through the machine.

When it is desired to leave a portion of the tube **64** bare, or without fins mounted thereon, in order to bend the same into a coil, the rotation of the helical grooved rolls **45** may be temporarily stopped by operating the clutch **87**, shown in Fig. 1 to stop rotation of the shaft **30** which drives the helical grooved rolls through the gearing illustrated in Figs. 1 and 2 and above described. At the proper time the clutch **87** may be again operated to cause rotation of the helical grooved rolls **45** and the operation will be continued as above described.

We claim:

1. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position.

2. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for continuously moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position.

3. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position, and means for varying the relative speed of the rolls and the tube to vary the spacing of the fins upon the tube.

4. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for continuously moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position, and means for varying the relative speed of the rolls and the tube to vary the spacing of the fins upon the tube.

5. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position, and means for stopping the rolls for a predetermined time to have a predetermined portion of the tube bare of fins.

6. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for rotating the rolls, and independent means for continuously moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position, and means for stopping the rolls for a predetermined time to have a predetermined portion of the tube bare of fins.

7. Apparatus for fixing fins upon a tube comprising means for supporting a tube with a plurality of perforate fins loosely strung thereon, an expanding head inserted into the tube, a pair of helical grooved rolls adjacent to the expanding head for uniformly spacing the fins upon the tube, means for continuously rotating the rolls, and independent means for continuously moving the tube longitudinally relative to the expanding head and the rolls to expand the tube into each fin as it leaves the rolls so that the fins will fit tightly upon the tube in uniformly spaced position.

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