Dec. 29, 1970 H. T. JARVIS ET AL 3,550,235

METHOD OF MAKING A HEAT EXCHANGER FIN TUBING

Filed May 15, 1968 3 Sheets-Sheet 1

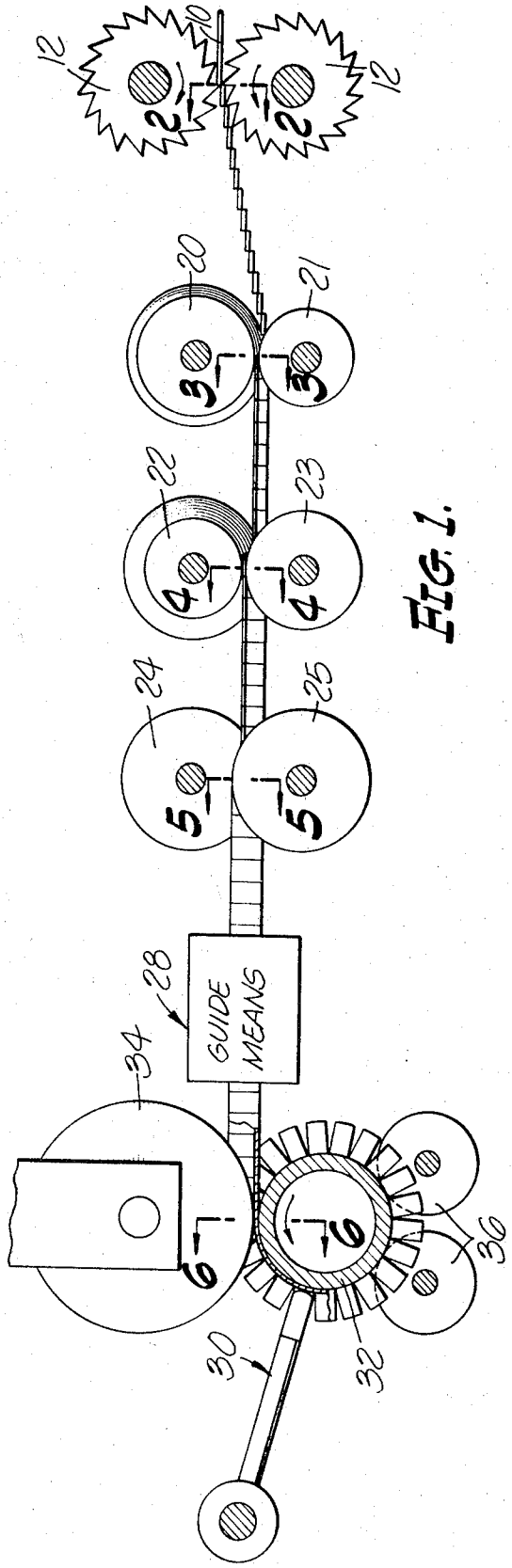


FIG. 1.

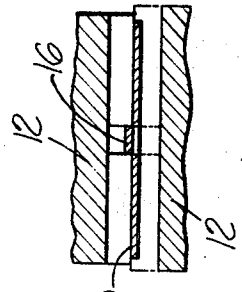


FIG. 2.

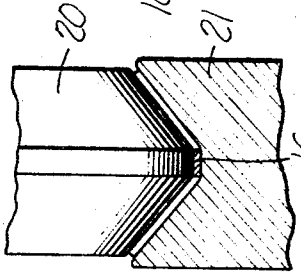


FIG. 3.

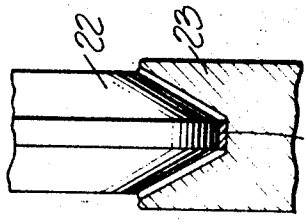


FIG. 4.

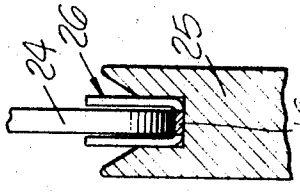


FIG. 5.

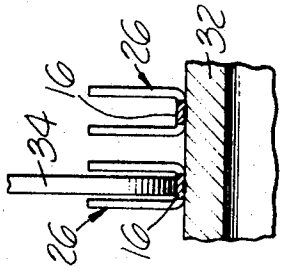


FIG. 6.

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METHOD OF MAKING A HEAT EXCHANGER FIN TUBING

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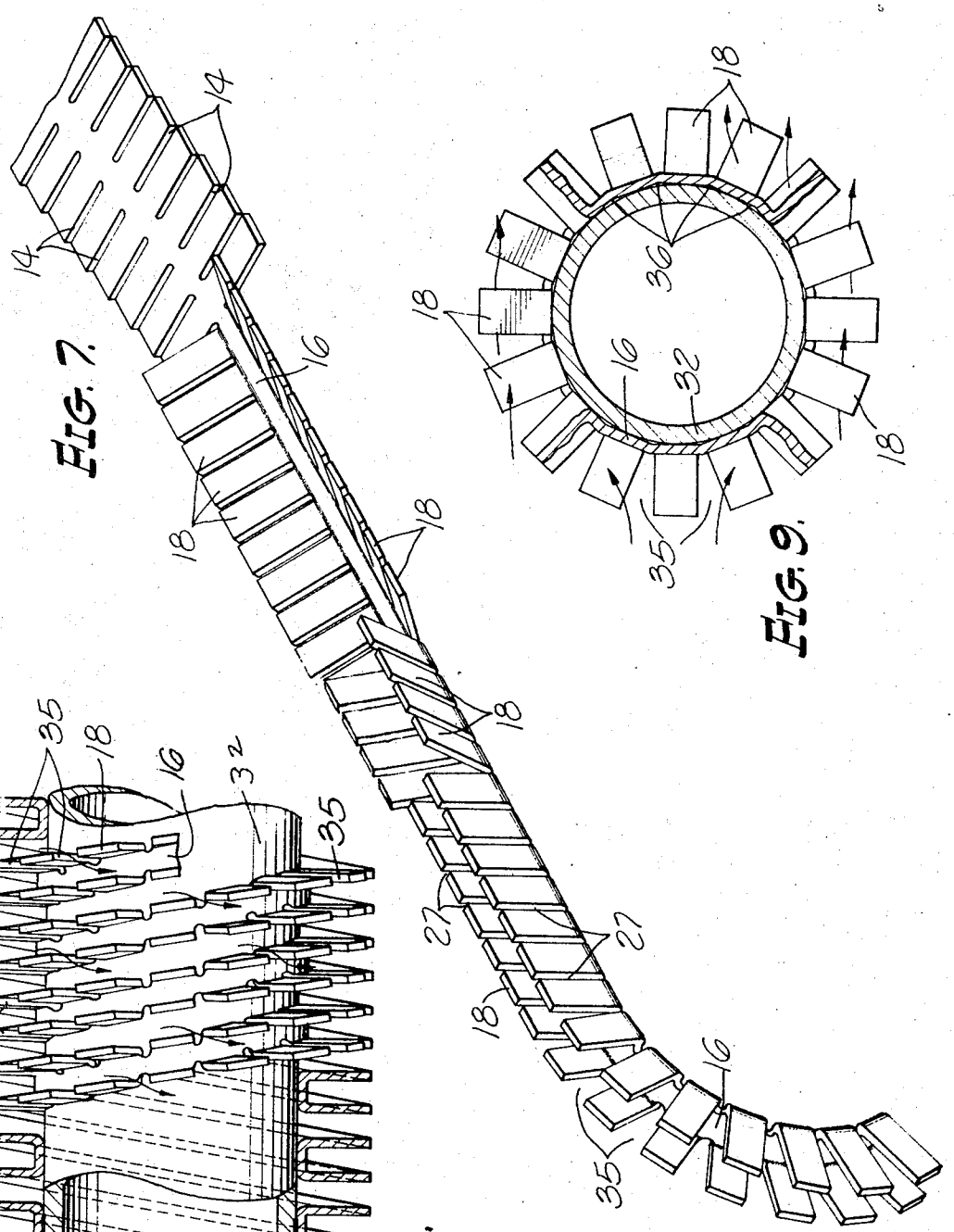


FIG. 7.

FIG. 9.

FIG. 8.

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FIG. 10.

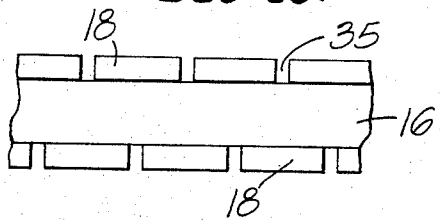


FIG. 11.

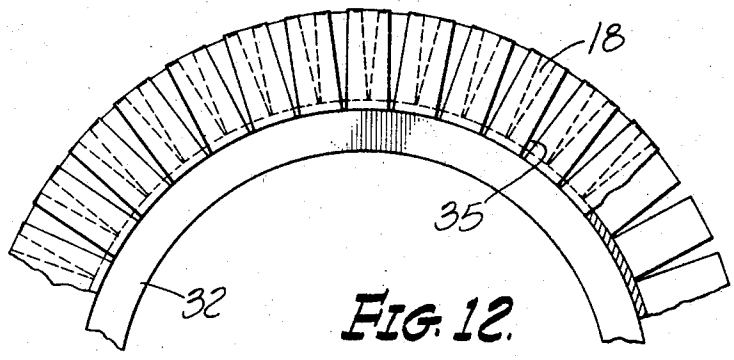


FIG. 12.

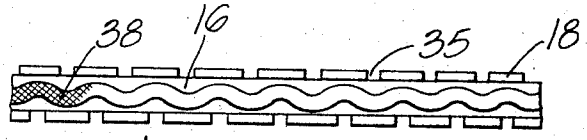


FIG. 13.

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METHOD OF MAKING A HEAT EXCHANGER FIN TUBING

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Int. Cl. B21d 53/02
U.S. Cl. 29—157.3 6 Claims

ABSTRACT OF THE DISCLOSURE

Fin style tubing for heat exchangers wherein a channel-shaped cooling fin is formed by first serrating the blank-stock strip on both lateral edges and then progressively feeding the serrated stock longitudinally through a series of roller dies which fold the serrated portions to form a U-shaped fin and then spiral wrapping the fin on a tube and welding it thereto.

Many forms of finned heat exchanger tubes have been manufactured and used to very effectively increase the rate of heat exchange accomplished. One of the major problems is in economically manufacturing a fin tube that has good overall heat transfer characteristics as well as between the fin and tube itself. One form that has achieved some success employs an L-shaped sheet metal fin spiral wrapped on the tube with the base of the "L" welded to the tube but the assembly is slower and more expensive than the present invention.

A principal object of the present invention is to provide a dual fin which is readily attached to a tube to form an economic and efficient fin tube for heat exchangers.

A further object of the present invention is to provide a fin tube construction wherein spaced U-shaped fins leave the tube exposed between fins for direct heat transfer without sacrificing any of the total area of fins exposed for heat transfer.

A still further object of the present invention is to provide a fin construction on a fin tube which will enhance the eddy currents flowing around the fins to in turn enhance the heat transfer.

Other objects and advantages of the present invention will become apparent from the following detailed description taken with the accompanying drawings, wherein:

FIG. 1 is a schematic elevation illustrating the steps performed in forming the fin and mounting same on a tube.

FIG. 2 is a cross sectional elevation of the cutting die taken on line 2—2 of FIG. 1.

FIG. 3 is a cross sectional elevation of the first folding die taken on line 3—3 of FIG. 1.

FIG. 4 is a cross sectional elevation of the second folding die taken on line 4—4 of FIG. 1.

FIG. 5 is a cross sectional elevation of the final folding die taken on line 5—5 of FIG. 1.

FIG. 6 is a cross sectional elevation of the welding contact wheel attaching the fin to the tube taken on line 6—6 of FIG. 1.

FIG. 7 is a perspective view of the forming and mounting of the blank strip into the fin by the process shown in FIGS. 1–6.

FIG. 8 is a partial cross sectional elevation of a tube with the fins in place.

FIG. 9 is a sectional end view of a tube with the fins in place.

FIG. 10 is a fragmentary top elevation of a modified embodiment of the fin formed with staggered gaps.

FIG. 11 is a perspective view of the forming and mounting of a blank stock into a fin having staggered gaps.

FIG. 12 is a partial end elevation of a tube with the staggered fins in place.

FIG. 13 is a bottom elevation of a fin illustrating the welding configuration.

Referring now to FIG. 1, the blank stock **10** of sheet metal is first fed through cutting wheels **12**, which make laterally extending serrations **14** along each edge of the blank. These cuts or serrations **14** extend from the side of the blank toward the center or backbone **16** to form laterally extending fin segments **18**. After this blank is cut it is fed to a primary set of roller dies **20** and **21** which initiate the first bending of the serrated blank to a wide V-shape with a flat base. A second set of roller dies **22** and **23** further bends the blank into a V-shape and the last set of roller dies **24** and **25** completes the square U-shape of the fin **26**. In forming the fin **26** in this manner the center portion **16** is slightly elongated longitudinally between the die cutting of wheels **12** and the last form rollers **24** and **25** to form small gaps **27** between the fin segments **18** as shown in FIG. 7.

The fin **26** is then fed through a guide means **28** where it is guided into the narrow wheel **34** with the fin segments **18** on either side and onto the surface of the tube **32**. As the fin is wrapped around the tube **32** a guide **30** assists in establishing the alignment. A pair of support rollers **36** are provided to support the tube **32** and also may serve as the electrical contact with the tube for welding. The wheel **34** is the other electrical contact and is urged toward the tube **32** for assuring good direct contact between the fin base portion **16** and the tube. By providing an appropriate electrical potential between wheel **34** and rollers **36** the fin **26** is resistance welded to the tube. The weld may be either a continuous seam weld or in the form of spaced spot welds.

Referring now to FIGS. 8 and 9 which show the tube and the fins, it will be noted that the fins are divided into upright segments **18** which when the fin is wrapped on the tube **32** forms large gaps **35** between segments. This allows the heat to be transferred to and from the tube by the center portion **16** of the fins equally by the upright segments **18** on both sides of the portion **16**. Eddy currents flow through these gaps **35** and in and around these fins to aid the transfer of heat. The fins **26** are spaced along the tube and since there is only a single base portion **16** for each pair of fins the exterior surface of the tube is exposed between adjacent convolutions of the fins **26** for direct heat transfer. Moreover, it is to be noted from FIG. 8 that the preferred embodiment employs two fins **26** spirally wrapped together whereby a double "lead" or "thread" results and the tubing can be formed twice as fast by duplicating the dies, wheels and guides shown in FIGS. 1–6 and simultaneously attaching two U-shaped fins to the tube.

The gaps **35** between the upright segments **18** may be formed in either of two configurations as illustrated by FIG. 7 in which the gaps **35** are directly opposite each other or as illustrated in FIGS. 10–12 in which the gaps **35** are staggered so that the gaps **35** are opposite the opposing upright segments **18**.

The choice of gap placement determines the configuration of the resultant resistance weld. If the gaps **35** are directly opposite each other, a small air space **36** will be formed between the tube and the base portion **16** of the fin. This small air gap interrupts the conductive electrical contact between the base portion **16** and the tube **32**, and thus an intermittent weld will be formed only at those portions of the fin at points where the upright portions are formed.

Normally it has been found that a continuous weld is more desirable and to accomplish this the staggered fin configuration can be used. This configuration causes the

base portion **16** to continually contact the tube **32** at some point which shifts between points adjacent to each of the upright segments **18** and results in a continuous weld line **38** between the tube and fin as illustrated by FIG. 13. It will be understood that the electrical contact wheel **34** need not and does not follow the wavy pattern of the weld **38** to form such weld but merely that the contact between the fin and tube is so shaped.

While the preferred embodiment of the invention is shown and described herein, the invention is not to be construed as limited to the specific details disclosed herein, except as included in the following claims.

We claim:

1. A method of manufacturing fin tube comprising the steps of: forming a plurality of lateral slits along each edge of a blank stock strip to form a plurality of laterally extending fin segments extending outwardly from both sides of a base, the lateral slits on one side of the strip being offset from those on the other side, bending said laterally extending fin segments with respect to said base to form a U-shaped fin, spirally wrapping said base around a tube, said base having a continuous line of contact between the base of the fin and the tube, and welding said base to said tube.

2. The invention of claim **1** wherein the step of welding the base of the fin to the tube includes the steps of applying an electrode to the base of the fin and applying a constant differential welding potential to the electrode to form a continuous weld between the base and the tube.

3. The invention of claim **1** wherein the step of welding the base of the fin to the tube includes the steps of

applying an electrode to the base of the fin and applying an intermittent differential welding potential to the electrode to form a plurality of longitudinally spaced spot welds between the base and the tube.

4. The invention of claim **2** wherein said electrode is a welding wheel having its periphery contacting the base of said U-shaped fin.

5. The invention of claim **3** wherein said electrode is a welding wheel having its periphery contacting the base of said U-shaped fin.

6. The invention of claim **1** further comprising simultaneously wrapping a pair of said formed U-shaped fins on the tube in a double lead of the spiral wrapping and simultaneously welding said pair of U-shaped fins to said tube.

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U.S. Cl. X.R.

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