March 14, 1933. R. K. HOPKINS 1,901,516

METHOD AND MACHINE FOR ROLLING FINS ON TUBES

Filed Nov. 14, 1929 2 Sheets-Sheet 1

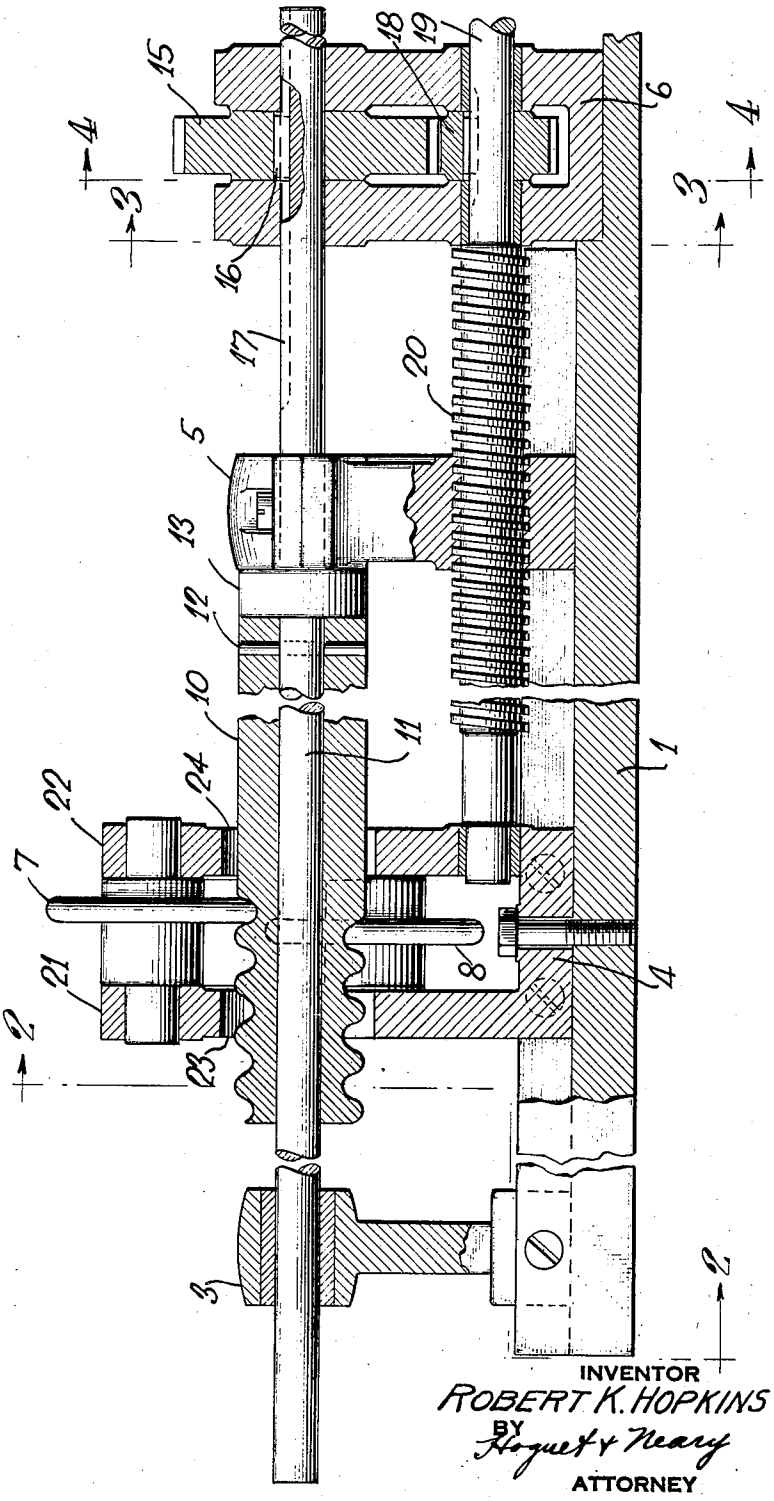


Fig. 1.

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Fig. 3.

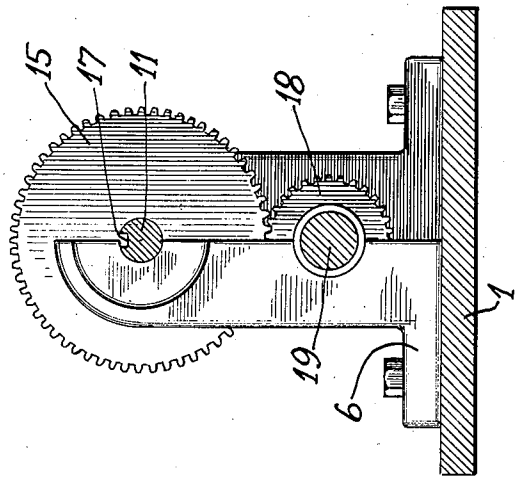
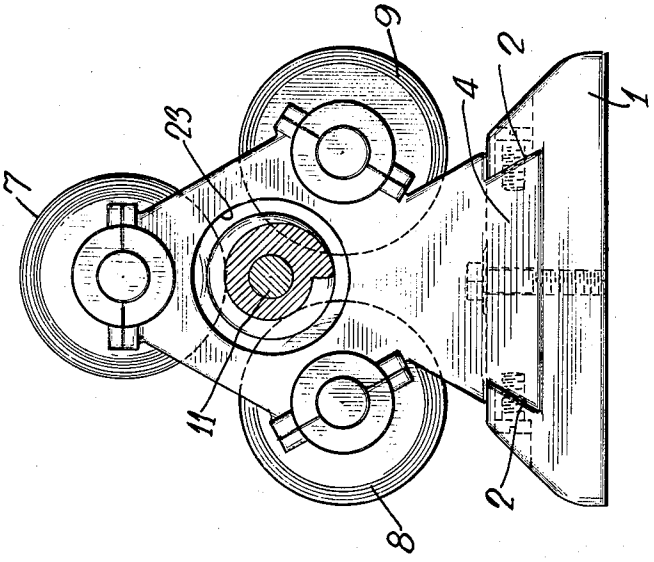


Fig. 2.



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UNITED STATES PATENT OFFICE

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METHOD AND MACHINE FOR ROLLING FINS ON TUBES

Application filed November 14, 1929. Serial No. 407,041.

This invention relates to a method and means for forming tubes or cylinders having integral radiating fins or external flanges of substantial height.

An object of the invention is to provide a machine for forging or displacing the metal of a tube or cylinder to form a fin or fins thereon to increase the radiating surface of the tube or cylinder and also its strength whereby its ability to withstand large pressures is increased.

A feature of the invention resides in feeding a tube blank or cylinder toward a roll or a plurality of rolls, while simultaneously therewith the tube is given a rotary motion. The resultant motion thus imparted to the tube causes the rolls associated therewith to displace the metal of the tube radially to form a spiral fin or flange thereon. The rolls are free to idle upon their axes, and their rotary motion is provided by the rotary motion of the tube with which they are in contact. The rolls are mounted on axes equally spaced about the tube and are progressively spaced along the tube a distance sufficient to permit the second and third rolls to pick up or follow in the groove formed by the first roll. Each roll has but a single transverse flange, so that the metal of the tube may be displaced both longitudinally and radially without being confined in any way by the rolls. As the metal of the tube suffers a certain amount of longitudinal displacement in operations of this character the second and third rolls are allowed a sufficient amount of longitudinal play in order that they may readily enter and not disturb the groove which has already been started by the preceding roll.

A better understanding of the invention may be had by reading the following description together with the accompanying drawings of which Fig. 1 represents a side elevation partly in section of a machine for carrying out the invention.

Fig. 2 is a section on line 2—2 of Fig. 1 showing the manner in which the rolls are spaced about the blank which is being rolled, and

Fig. 3 is a half section on line 3—3 and a half section on line 4—4 of Fig. 1 showing the means for feeding the blank in the machine.

Referring to the drawings, a machine embodying the invention is shown having a base 1, equipped with ways 2 upon which are mounted a plurality of standards 3, 4, 5 and 6. The standards 3, 4 and 6 are fixedly mounted upon the base of the machine while the standard 5 is adapted to move along the base. As the standard 5 must rest firmly upon the base of the machine a dovetail joint may be provided which limits the standard 5 to longitudinal motion. The standard 4 has two uprights 21 and 22 in which the rolls 7, 8 and 9 are journaled, although it is to be understood that the invention is not to be limited to any particular number of rolls.

A hollow blank or tube 10 is supported in the machine upon a mandrel 11 which is supported by and is free to rotate in bearings in the standards 3, 5 and 6.

Some suitable means, as for instance a pin 12, passing through holes in the blank and the mandrel is provided in order that the blank may be rotated integrally with the mandrel. The mandrel is equipped with a collar 13 which butts against the blank 10 and imparts horizontal motion thereto when the standard 5 is moved along the ways by means hereafter described.

A gear 15 is keyed to the mandrel by means of a key 16 seated in a long keyway 17 in the mandrel. Another gear 18, meshing with the gear 15, is keyed on a power shaft 19 which is rotated by means of a suitable source of power as for instance a motor not shown. Upon the shaft 19 are threads 20 extending from the standard 6 a distance equal to the length of the longest blank tube upon which the machine is designed to operate. As the shaft 19 is rotated the screwing action of the thread imparts horizontal motion to the standard 5 which in turn moves the blank tube 10 toward the rolls. Ports 23 and 24 are provided in the uprights 21 and 22 supporting the rolls in order that the tube may pass freely therethrough.

When three rolls are used they are preferably spaced equi-distantly about the tube 10, as shown in Fig. 2, and are also spaced

along the tube, as shown in Fig. 1, so that the roll 8, following roll 7, is in a position to enter the groove which has been already started by the roll 7. The roll 9 is not shown in Fig. 1 but it is the same distance to the left of roll 8 as roll 8 is to the left of roll 7. Between the hubs of the rolls 8 and 9 and the standards 21 and 22 is provided a tolerance for permitting longitudinal movement of the rolls to accommodate for the longitudinal flow of the metal in the tube 10 during the rolling process. The flanges upon the rolls are preferably equal in diameter, although in some instances it may be desirable to increase the size of the successive flange.

The distance between the standards 3 and 5 may be adjusted so that it is sufficiently great to accommodate the tube which is being rolled. At the beginning of the rolling operation the mandrel extends to the right of the standard 6 a distance equal to or greater than the length of the tube so that as the mandrel moves to the left during the rolling operation, the key associated with the gear 15 is always in the keyway 17.

In operation a blank tube is heated to a suitable rolling temperature, placed upon the mandrel and pinned or otherwise fastened thereto. At the beginning of the rolling operation the standard 5 is at its extreme right position. As power is applied to the shaft 19 the standard 5 is moved to the left thus causing the collar 13 to move the blank in the horizontal direction toward the rolls. At the same time the gear 18, which meshes with the gear 15, drives the mandrel which in turn imparts a rotary motion to the tube on account of its connection therewith by the pin 12. The rotary motion of the tube blank as it advances toward the rolls imparts a rotary motion to the latter, thus performing the rolling process. The hot tube first comes in contact with roll 7 which displaces the metal of the tube causing it to flow up the sides of the roll to form the fin. When the tube has rotated through 120° it has been pushed forward by the standard 5 a distance sufficient to pick up the second roll. The second roll is thus positioned beyond the first a distance equivalent to one-third the pitch of the spiral fin.

The height of the fins may be regulated by proportioning the sizes of the flanges upon the rolls and the pitch and thickness of the spiral fin may be regulated by proportioning the sizes of the gears 18 and 15. Of course, it is to be understood that it is not necessary to heat the entire blank at once but the heating may be confined to the portion of the tube being worked and the rolling done in stages.

The invention also is not limited to a case in which the tube is advanced toward the rolls, since if desired the standards upon which the rolls are mounted may be made movable and capable of being advanced toward the tube blank. This could readily be done in the embodiment of my invention shown by eliminating the standard 5 and permitting the threaded portion of the screw 20 to extend through the standard 4. Thus if the screw were of the proper type the rotation of the shaft 19 would cause the tube blank to rotate and the rolls to be advanced toward it. In other words, it is simply the case of relative motion between the rolls and the blank, and a case is still conceivable where the roll housing could be rotated about the tube and advanced with respect thereto or simply rotated about the tube while the latter is advanced toward the rolls.

Thus, although a single embodiment of the invention has been shown it is capable of many modifications by those skilled in the art, and is to be limited therefore only by the prior art and the scope of the appended claims.

I claim:

1. In a machine for forming integral radiating fins of substantial height upon a tube or the like, a plurality of rolls positioned about said tube for forming said fins, all of said rolls forming and operating in the same track, means for rotating said tube about its longitudinal axis, means for providing relative motion between said rolls and said tube longitudinally of the latter and simultaneously with said rotary motion, the rolling action of said rolls being imparted thereto by the movement of said tube.

2. Apparatus for making tubes and the like with integral radiating fins, comprising a mandrel for supporting a hollow blank, a plurality of rolls each having a single transverse flange, said rolls being positioned equidistantly about said blank and further positioned to follow in the same track, means for rotating said tube and advancing it toward said rolls to displace the outer material of said tube radially to form said fins.

3. Apparatus for making tubes or the like with integral radiating fins comprising a mandrel for supporting the hollow blank, a plurality of rolls each having a single transverse flange, said rolls being positioned about said blank and further positioned to follow in the same track, means for rotating said tube, means for providing relative longitudinal motion between said tube and said rolls, the resultant relative movement between said tube and said rolls causing said rolls to displace the outer material of said tube radially to form a spiral fin.

4. In a machine for forming integral radiating fins of substantial height upon a tube or the like, a plurality of rolls positioned about said tube for forming said fins, certain of said rolls having longitudinal axial play, said rolls operating in the same track, means for rotating said tube about its longitudinal

axis, means for providing relative motion between said rolls and said tube longitudinally of the latter and simultaneously with said rotary motion, the rolling action of said rolls being imparted thereto by the movement of said tube.

5. In a machine for forming integral radiating fins of substantial height upon a tube or the like, a plurality of rolls positioned about said blank for forming said fins, said rolls being positioned to operate in the same track, mounting means for said rolls, said mounting means permitting longitudinal movement of certain of said rolls along their axes, means for imparting a rotary and longitudinal movement to said tube toward said rolls to displace the metal of said tube to form a fin, the axial displacement of certain of said rolls providing for the longitudinal flow of the metal in the tube during the rolling process.

6. The method of forming a fin of substantial size upon a tube to increase the radiating area thereof which comprises forming a continuous groove on the tube by a plurality of simultaneous rolling operations which consecutively increase the depth of the groove and the height of the fin between the groove by displacement of the tube material at the sides of the groove.

7. In a machine for forming integral radiating fins upon a tube or the like; a plurality of rolls positioned about the tube for forming said fins, all of said rolls forming and operating in the same track; means for causing relative rotary motion between said tube and rolls; means for causing relative motion between said rolls and tube longitudinally of the latter and simultaneously with said rotary motion, the relative rotary movement between the tube and rolls causing rotation of the latter.

8. In a machine for forming integral radiating fins upon a tube or the like, a plurality of tracking rolls positioned about the tube for forming said fins, and means for imparting motion to the tube, said rolls being actuated by the movement of said tube, one of said rolls operating to form a groove and the other roll or rollers acting in said groove between said fins to progressively increase the depth of said groove and displace the material of said groove for forming said fins.

In testimony whereof, I have signed my name to this specification this 12th day of November, 1929.

ROBERT K. HOPKINS.