June 29, 1965 C. L. SPORCK 3,191,415

METAL WORKING

Filed May 2, 1963 2 Sheets-Sheet 1

Fig. 1.

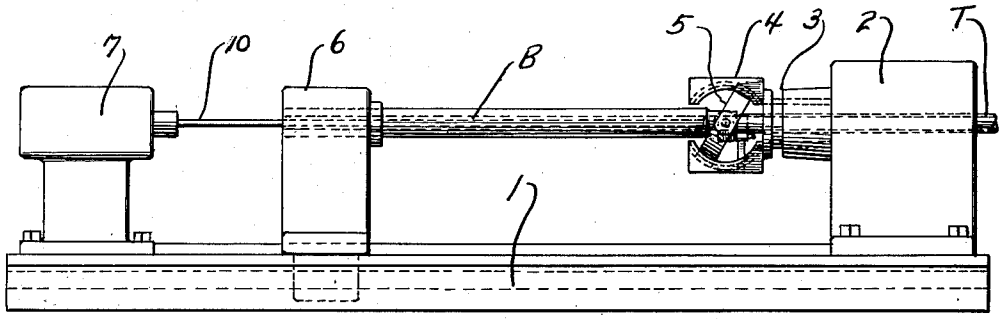


Fig. 2.

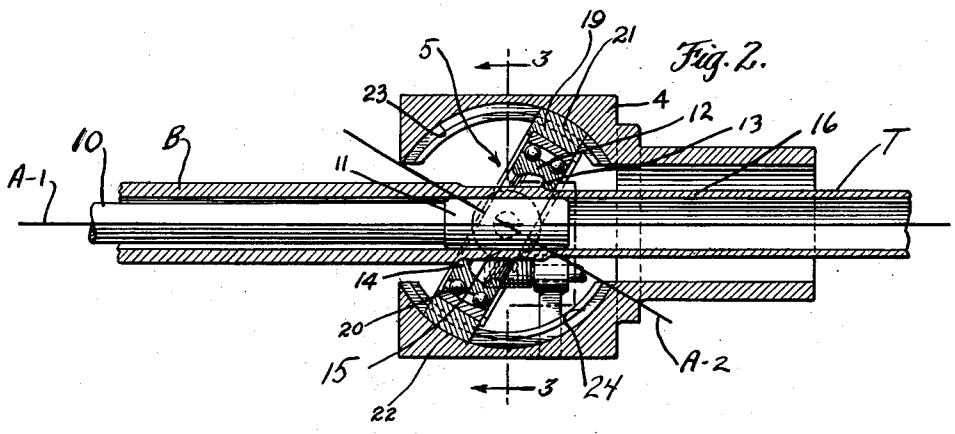


Fig. 3.

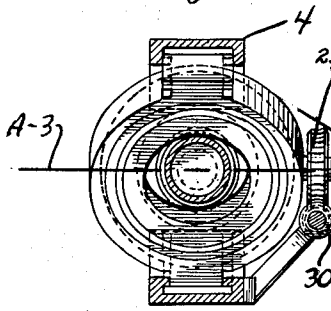


Fig. 4.

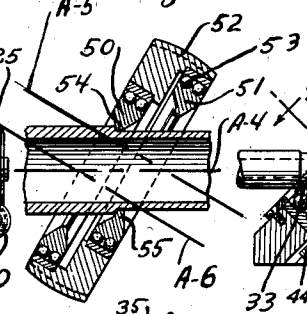


Fig. 5.

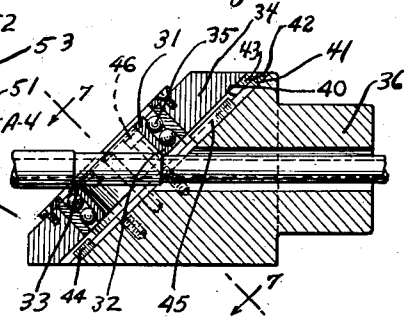


Fig. 6.

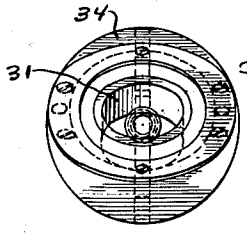
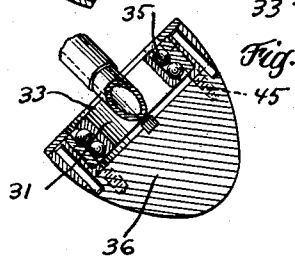


Fig. 7



INVENTOR.
Claus L. Sporck
BY
Szymanski & Lechner
ATTORNEYS

June 29, 1965 C. L. SPORCK 3,191,415

METAL WORKING

Filed May 2, 1963 2 Sheets-Sheet 2

Fig. 8.

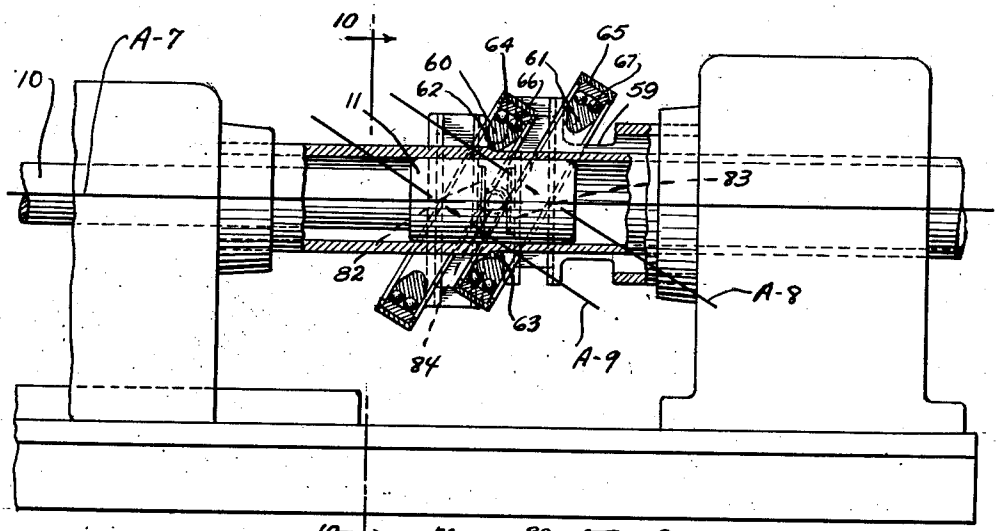
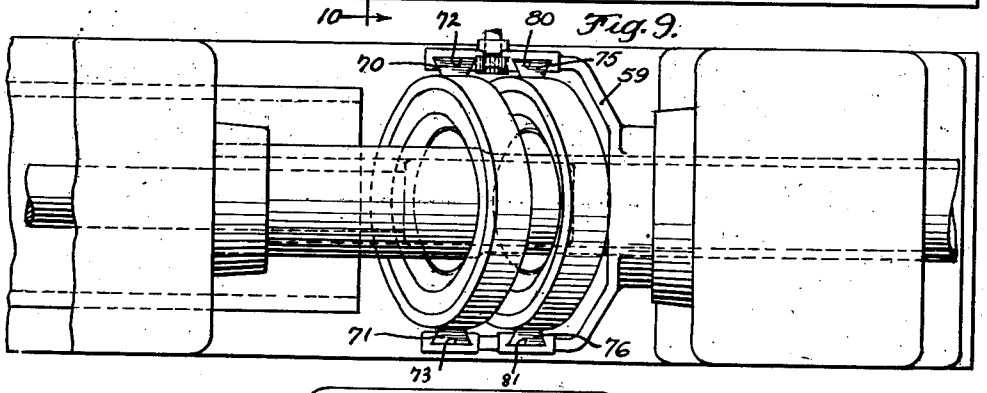


Fig. 9.



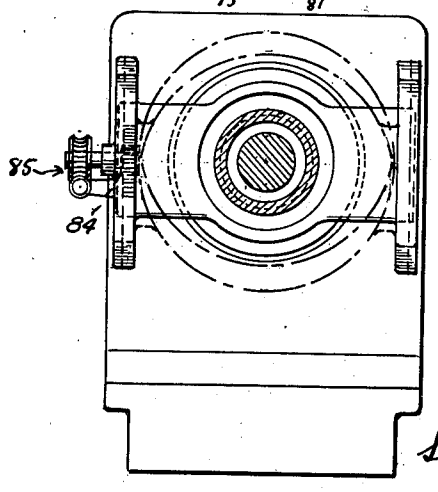


Fig. 10.

INVENTOR.
Claus L. Sporck
BY
Symmestvedt & Lechner
ATTORNEYS

United States Patent Office 3,191,415 Patented June 29, 1965

3,191,415

METAL WORKING

Claus L. Sporck, Cincinnati, Ohio, assignor to The Lodge & Shipley Company, Cincinnati, Ohio, a corporation of Ohio

Filed May 2, 1963, Ser. No. 277,623
4 Claims. (Cl. 72—78)

This invention relates to improvements in tube forming machines of the type wherein the forming tool or roller means is of ring-like shape and surrounds the blank so that the working section of the roller engages the blank in a line of contact concave with respect to the blank axis.

One object of the invention is to provide a machine of the kind described having improved roller means comprising a pair of concave annular working sections which surround the blank and simultaneously engage the outside of the blank respectively on opposite sides of the blank axis.

One particularly important advantage of the invention is that the roller means is arranged to work the blank without imposing unbalanced radial loads. For this purpose, the invention contemplates roller means comprising a pair of rings surrounding the blank with the working sections of the rings operating on diametrically opposed areas of the blank. In this way the working forces of the roller rings counterbalance one another.

Another important and desirable advantage of the invention is that a single ring roller can perform a dual working operation, for example, a double reduction of the blank wall in a single pass. In this regard the invention contemplates the roller means to be comprised of a single ring having a pair of annular working sections which simultaneously engage the blank on opposite sides of the blank axis with the working sections being spaced from the axis so that each will perform a working operation at a different radial position.

The single ring, double working arrangement has another highly desirable advantage in that it lends itself for the working of tubes of a wide variety of diameters. The ring can be pivoted so that working sections move equal distances closer to the blank axis and thereby accommodate a small diameter blank, or move away from the axis to accommodate a large diameter blank.

Typical equipment of the invention will be described below in connection with the following drawings, wherein:

FIGURE 1 is an elevational view of a tube forming machine embodying the invention;

FIGURE 2 is a longitudinal, sectional view showing one form of the roller means;

FIGURE 3 is a cross section taken on the lines 3—3 of FIGURE 2;

FIGURE 4 is a longitudinal, sectional view of another form of the roller means;

FIGURE 5 is a longitudinal section of a roller means of the kind shown in FIGURE 2, but with a different mounting arrangement;

FIGURE 6 is an end view of FIGURE 5;

FIGURE 7 is a cross section on the line 7—7 of FIGURE 5;

FIGURE 8 is an elevational, sectional view of tube forming equipment embodying another form of the roller means;

FIGURE 9 is a plan view of FIGURE 8; and

FIGURE 10 is a cross section taken on the line 10—10 of FIGURE 8.

In FIGURE 1, I have shown a tube forming machine comprising a base 1, having at the right-hand end a head stock 2 carrying a rotatable chuck 3 mounting a roller head 4. The roller head 4 supports roller means generally indicated by 5. The blank B is pushed into the roller means 5 and the rotating roller means works the blank B

into the tubular form T. The head stock 2 is the open center type so as to accommodate the tube T. The working may comprise a reducing operation where the wall of the blank is reduced in thickness or the working may be a squeezing operation where the diameter of the blank is changed so as to form a tapered blank or tube. In the present instance, the machine is set up for a wall reducing operation.

Toward the middle of the bed is a carriage 6 which mounts a blank B to be worked. The carriage is movable along the bed so as to move the blank B into the roller head 4. The carriage 6 supports the blank so that it is non-rotatable. On the left-hand end a tail stock 7 mounts a mandrel support rod 10 which extends through the blank B and carries a mandrel 11 at its outer end (FIGURE 2). As will be noted, the roller head 4 is of open-center construction so as to accommodate the blank B, the mandrel 11 and the tube T. The chuck 3 is rotated and the carriage 6 moved along the bed by conventional drive means.

In a machine of the kind described, the bed, head stock, chuck, carriage and tail stock are of conventional machine construction and the structural details of the same will be well-understood by those skilled in the art.

Referring to FIGURES 2 and 3, it will be noted that the roller means 5 includes a ring 12 which surrounds the blank and has a pair of annular working sections 13 and 14. The sections 13 and 14 make a line contact with the blank, which is concave with respect to the blank axis A–1, and engage the blank on opposite sides of the axis. The working sections 13 and 14 occupy different radial positions with respect to the blank axis A–1. In the instance shown, the working section 14 is at a greater radial distance than the section 13. In this way the section 14 works the blank to reduce its wall thickness as indicated at 15, and the section 13 works on the wall 15 to reduce the same in thickness or as indicated at 16. Also, the sections 13 and 14 are spaced from one another in a direction along the blank axis. The ring 12 is connected with the head by mounting mechanism 19 which includes the bearing structure 20 connected with the shoes 21 and 22 respectively supported in the circular tracks 23 and 24 in the head 4.

As will be apparent, the ring 12 is oriented so that its rotation (provided by bearing structure 20) relative to the head is about an axis A–2 which makes an acute angle with the blank axis and lies in a plane containing the blank axis.

For a working operation, the carriage 6 pushes the blank to the right into engagement with the working sections 13 and 14 and the rotation of the head 4 and ring 12 causes each working section to progressively engage the blank along a helical path around the blank axis. The reduction in wall thickness caused by the roller causes the blank to extrude away to the right into the form of the finished tube T.

The embodiment described not only has the advantage of a single ring performing a dual working operation, but, in addition, the ring can be oriented in the head so as to move the working sections toward or away from the blank axis and thereby accommodate tubes of different sizes. This is done by pivoting the ring about the axis A–3 (see FIGURE 3) which is normal to and intersects axis A–1.

The pivoting motion of the ring is provided by the travel of the shoes 21 and 22 in the tracks 23 and 24. The means for moving the shoes along the tracks comprises (see FIGURE 3) worm wheel 25 mounted on a shaft 26 connected with the mounting mechanism 19, the wheel 25 being operated by a worm 30 connected with the head 4.

The embodiment shown in FIGURE 5 is essentially the same as that described in connection with FIGURE 2,

except that the roller means and head are set up so that the roller means can be quickly replaced.

In FIGURE 5, the roller means includes the ring 31 having working sections 32 and 33. The mounting mechanism 34, which includes the bearing structure 35, rotatably mounts the ring on the head 36. The head 36 has a flat surface 40 and a keyway 41 is formed in the surface. The mounting mechanism has a flat surface 42 and a keyway 43. The keys 44 and 45 are mounted in the ways. The screws 46 hold the surfaces 40 and 42 in tight engagement.

The invention contemplates that the roller means comprise a pair of rings arranged so that the working forces balance one another. A typical form for accomplishing the foregoing is shown in FIGURE 4 where it will be seen that the rings 50 and 51 are supported by the mounting mechanism which includes an annular frame 52 and bearing structure 53. The frame 52 is adapted to be mounted in tracks, such as the tracks 23 and 24 in the roller head 4. The ring 50 has a working surface 54 and the ring 51 has a working surface 55. The working surfaces 54 and 55 each occupy the same radial distance from the blank axis A–4 and lie in the same radial plane. Thus, the working force of one section radially balances the working force of the other section. The ring 50 is supported for rotation relative to the head about an axis A–5 and the ring 51 is supported for rotation about axis A–6. The axes A–5 and A–6 lie in a plane containing axis A–4 and are spaced from one another in said plane. For purposes of clarity the mandrel 11 has not been shown in FIGURE 4.

In FIGURE 8, I have shown another arrangement for using dual rings set up to impose radially balanced working loads. In FIGURE 8 the open-center roller head 59 mounts rings 60 and 61 having working surfaces 62 and 63 which are at the same radial distance from the blank axis A–7 and lie in the same radial plane. The rings are supported in the head by the mounting mechanism which includes the annular frames 64 and 65, together with the bearing structures 66 and 67. The rings rotate relative to the head about axes A–8 and A–9 which lie in a plane containing the blank axis A–7.

The embodiment in FIGURE 8 provides for adjusting the rings 60 and 61 in a radial direction so as to accommodate tubes of differing diameters. For this purpose, the mounting mechanism includes the shoes 70 and 71 which fit into the dovetails 72 and 73 on the roller head 59. The ring 65 has shoes 75 and 76 which fit into the dovetails 80 and 81 on the roller head. The shoe 72 carries a rack 82 and the shoe 75 carries a rack 83. The rack is engaged by a pinion 84. By rotating the pinion, for example, by the worm wheel arrangement 85 (FIGURE 10), the rings can be moved toward and away from the blank axis.

In the embodiment of FIGURES 4 and 8, the rotation of the head and rings causes each working section to progressively engage the blank along a helical path around the blank axis.

I claim:

1. In a tube forming machine:
means for supporting an elongated blank;
a roller head having an open-center configuration to accommodate the blank and a tube made therefrom;
means mounting said roller head for rotation about an axis co-axial with the axis of the blank;
means connected with the blank for moving the blank relative to the head in a direction along the blank axis;
roller means formed in the shape of an annulus disposed on said head, the roller means having a pair of annular working sections surrounding said blank and making simultaneous engagement with the outside of the blank respectively on opposite sides of the blank axis, the engagement areas of the working sections being the same radial distance from the blank axis and lying in the same radial plane so that the working force of one section radially balances the working force of the other section; and
mounting mechanism including means rotatably connecting said annular working sections with the head for rotation relative to the head about axes respectively making an acute angle with said blank axis and lying in a plane containing the blank axis, the axes being spaced from one another in said axial plane, said blank axial motion, said head rotation and said working section rotation causing each said working section to progressively engage the blank along a helical path around the blank axis.

2. In a tube forming machine:
means for supporting an elongated blank including a mandrel inside of the blank;
a roller head having an open-center configuration to accommodate the mandrel, the blank and a tube made therefrom;
means mounting said roller head for rotation about an axis co-axial with the axis of the blank;
means connected with the blank for moving the blank relative to the head in a direction along the blank axis;
roller means formed in the shape of an annulus disposed on said head, the roller means having a pair of annular working sections surrounding said blank and making simultaneous engagement with the outside of the blank respectively on opposite sides of the blank axis and radially outwardly of the mandrel, the engagement areas of the working sections being the same radial distance from the blank axis and lying in the same radial plane so that the working force of one section radially balances the working force of the other section; and
mounting mechanism including means rotatably connecting said annular working sections with the head for rotation relative to the head about axes respectively making an acute angle with said blank axis and lying in a plane containing the blank axis, the axes being spaced from one another in said axial plane, said blank axial motion, said head rotation and said working section rotation causing each said working section to progressively engage the blank along a helical path around the blank axis.

3. In a tube forming machine:
means for supporting an elongated blank;
a roller head having an open-center configuration to accommodate the blank and a tube made therefrom;
means mounting said roller head for rotation about an axis co-axial with the axis of the blank;
means connected with the blank for moving the blank relative to the head in a direction along the blank axis;
roller means disposed on said head, the roller means comprising a pair of rings each having an annular working section surrounding said blank, the working sections making simultaneous engagement with the outside of the blank respectively on opposite sides of the blank axis, the engagement areas of the working sections being the same radial distance from the blank axis and lying in the same radial plane so that the working force of one section radially balances the working force of the other section; and
mounting mechanism including an annular frame rotatably supporting each said ring and its annular working section and connecting the same with the head for rotation relative to the head about axes respectively making an acute angle with said blank axis and lying in a plane containing the blank axis, the axes being spaced from one another in said axial plane, said blank axial motion, said head rotation and said working section rotation causing each said working section to progressively engage the blank along a helical path around the blank axis.

4. In a tube forming machine:

means for supporting an elongated blank including a mandrel inside of the blank;

a roller head having an open-center configuration to accommodate the mandrel, the blank and a tube made therefrom;

means mounting said roller head for rotation about an axis co-axial with the axis of the blank;

means connected with the blank for moving the blank relative to the head in a direction along the blank axis;

roller means disposed on said head, the roller means comprising a pair of rings each having an annular working section surrounding said blank, the working section making simultaneous engagement with the outside of the blank respectively on opposite sides of the blank axis and radially outwardly of the mandrel, the engagement areas of the working sections being the same radial distance from the blank axis and lying in the same radial plane so that the working force of one section radially balances the working force of the other section; and

mounting mechanism including an anular frame means rotatably supporting each said ring and its annular working sections and connecting the same with the head for rotation relative to the head about axes respectively making an acute angle with said blank axis and lying in a plane containing the blank axis, the axes being spaced from one another in said axial plane, said blank axial motion, said head rotation and said working section rotation causing each said working section to progressively engage the blank along a helical path around the blank axis.

References Cited by the Examiner

UNITED STATES PATENTS

3,098,461 7/63 Kinney ..... 113—52

CHARLES W. LANHAM, *Primary Examiner.*

MICHAEL V. BRINDISI, *Examiner.*