Jan. 18, 1944. C. L. DEWEY ET AL 2,339,686

MACHINE FOR CONFIGURING TUBING

Filed Nov. 14, 1941 2 Sheets-Sheet 1

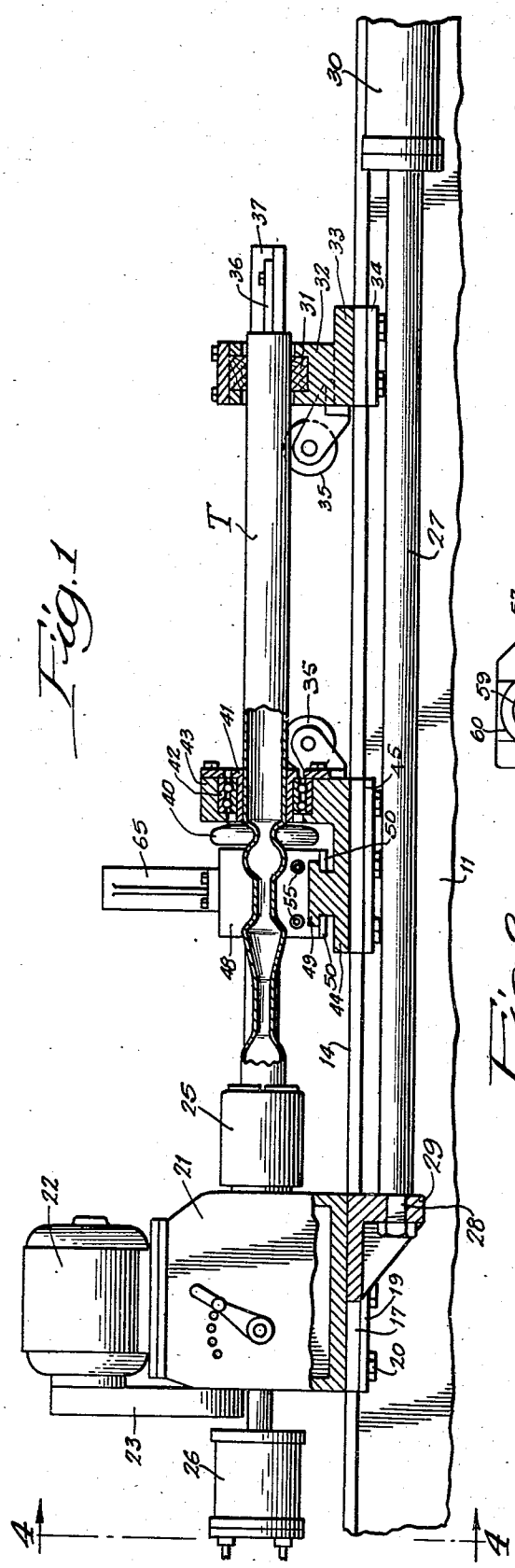


Fig. 1

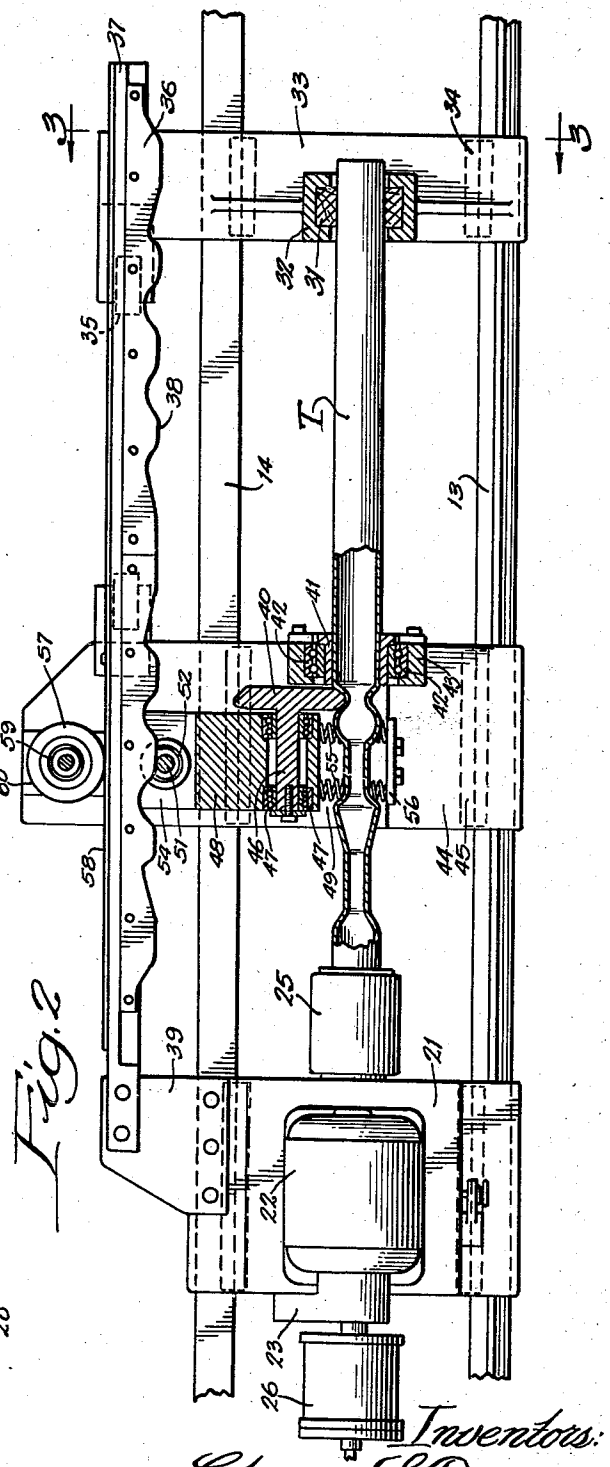


Fig. 2

Inventors:
Clarence L. Dewey
and Sydney L. Dewey,
By Banning & Banning
Attorneys.

Jan. 18, 1944. C. L. DEWEY ET AL 2,339,686

MACHINE FOR CONFIGURING TUBING

Filed Nov. 14, 1941 2 Sheets-Sheet 2

Fig. 3

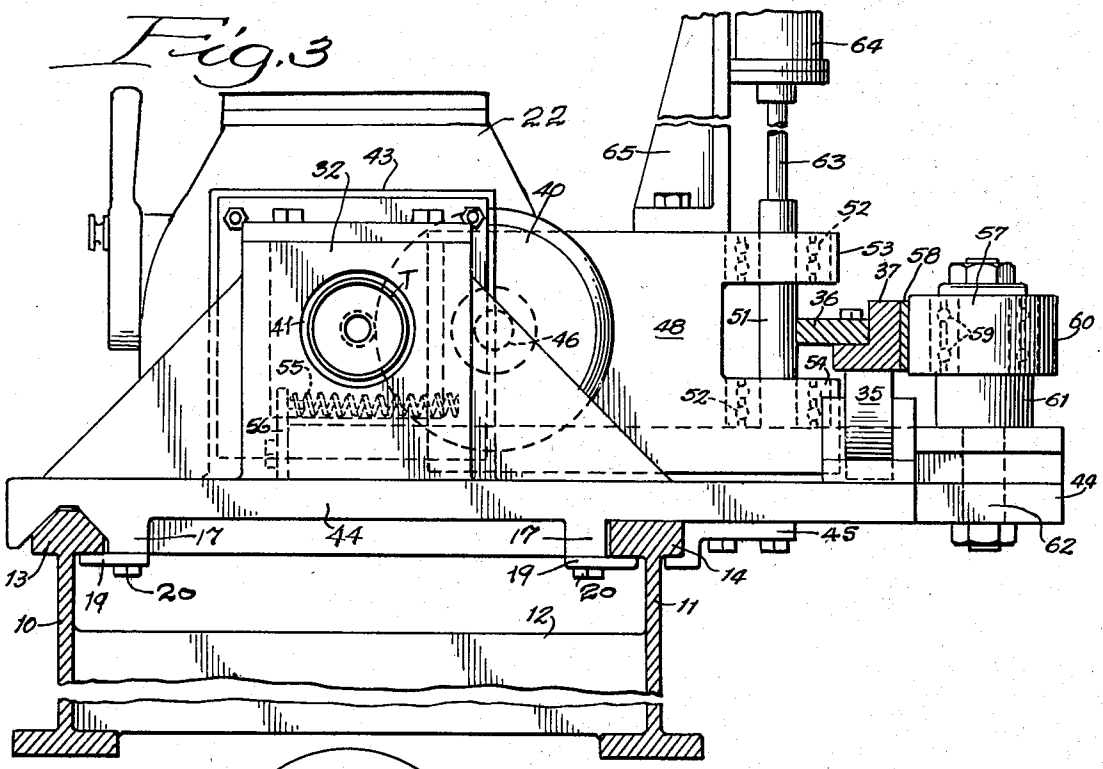
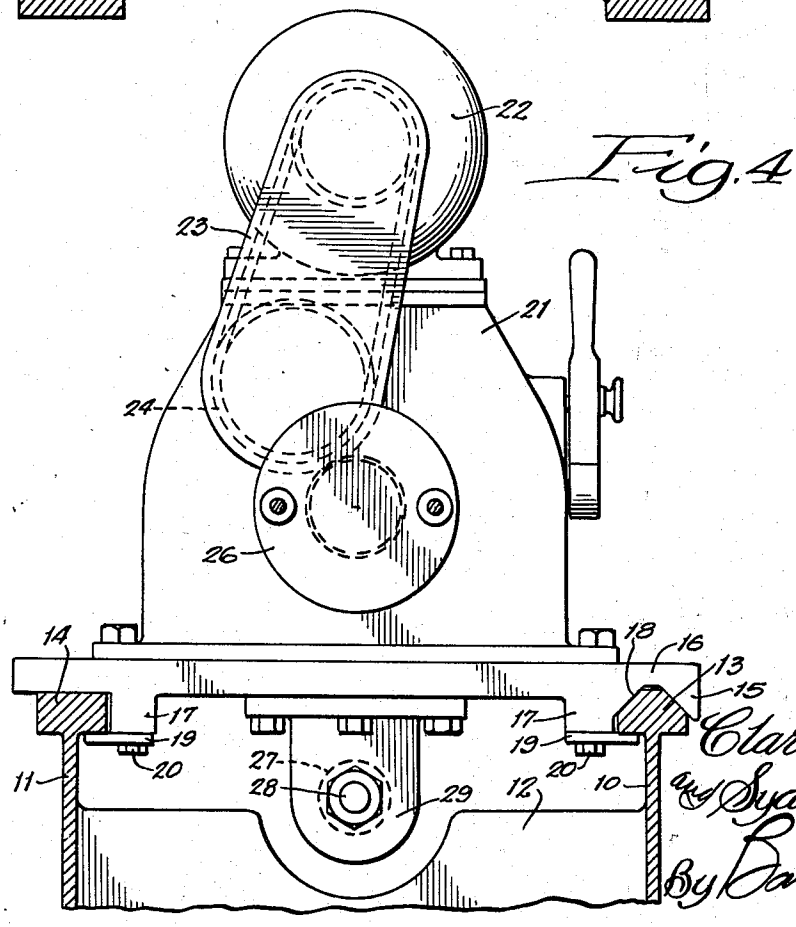


Fig. 4



Inventors
Clarence L. Dewey
and Sydney L. Dewey,
By Banning & Banning
Attorneys.

Patented Jan. 18, 1944 2,339,686

UNITED STATES PATENT OFFICE

2,339,686

MACHINE FOR CONFIGURING TUBING

Clarence L. Dewey, Elkhart, Ind., and Sydney L. Dewey, Cleveland Heights, Ohio, assignors to Metal Tube Shaping Corporation, Elkhart, Ind., a corporation of Indiana

Application November 14, 1941, Serial No. 419,050

4 Claims. (Cl. 113—53)

The machine of the present invention is designed to impart any desired configuration to a metal tube through the action of a forming tool, which is mounted to advance toward or retreat from the axis of the tube in conformity with the configuration or edge pattern of a templet which imparts radial movements to the forming tool concurrently with the advancement and rotation of the tube, which is held and reinforced against collapse or distortion by a surrounding bushing located in close proximity to the region undergoing deformation.

The machine is designed to draw the tube and templet forwardly against the forming tool, which in the present instance is in the form of a roller which is journaled and held against longitudinal movement as contradistinguished from machines in which the rotating tube is held against longitudinal movement while subject to the thrust of an advancing forming tool.

The machine of the present construction, which advances the tube rather than the tool, possesses certain advantages in speed of operation and in the avoidance of waste tube material occasioned by the fact that at the beginning of the operation the chuck which grips the forward end of the tube may be moved inwardly into very close proximity to the forming tool, so that the configuring operation may begin at a point very close to the forward end of the tube, and thereafter the operation may be continued throughout the entire tube save at the extreme rear end thereof, so that short end sections only of the tube need be cut away and discarded as waste material.

The arrangement also is advantageous in that it permits a few section of tubing to be introduced into the machine immediately behind the tail end of the tube undergoing deformation, and while the chuck, carriage and associated parts are being returned to position to engage the newly inserted tube section, which arrangement tends to speed up the operation.

Further objects and details will appear from the description of the invention in conjunction with the accompanying drawings, wherein—

Figure 1 is a longitudinal sectional elevation of the machine of the present invention, showing the base frame partly broken away;

Fig. 2 is a plan view of the machine, showing the deforming roller and associated parts in section;

Fig. 3 is a rear end view of the machine, taken on line 3—3 of Fig. 2; and

Fig. 4 is a sectional view of the front end of the machine, taken on line 4—4 of Fig. 1.

The machine as a whole is mounted upon a base frame of convenient height, comprising side walls 10 and 11, and suitable cross walls 12 spaced to afford a firm and rigid construction for the support of the operating mechanism. The frame may be of any desired length, depending upon the length of the tubing which it is desired to configure upon the machine.

The top edge of the side wall 10 is configured to provide a beveled track rail 13, and the top edge of the side wall 11 is configured to provide a flat rail 14. The track thus provided affords a mounting for the fixed and movable portions of the machine structure.

At the forward end of the machine is mounted a spindle carriage unit 15, comprising a base plate 16 having depending ribs or flanges 17 which lie within the rails 13 and 14. The base plate near its forward edge is grooved to afford a V-shaped channel 18 which receives the beveled rail 13, and on the opposite side, the edge portion of the base plate rests flatwise upon the surface of the rail 14. The base plate is held in sliding relation upon the rails by the provision of clamps 19 held in place by bolts 20, which arrangement permits the base plate with the mechanism carried thereby to travel endwise along the track.

The carriage unit base plate supports a standard 21, which affords a mounting for a motor 22, the shaft of which operates a chain drive 23, which in turn actuates a gear train 24 for imparting rotation to a chuck 25 which engages the forward undeformed end of a section of tubing T. The chuck, which is of the type known as a collet, is preferably actuated by an air cylinder and piston assembly 26 of well known type, which when operated serves to quickly and tightly grip the leading end of the tube. The clutch operating mechanism is of a well known type and need not be described in detail.

Longitudinal movement is imparted to the entire carriage unit, including the motor, chuck, and air cylinder, through the action of a hydraulic feed ram 27, the forward reduced end 28 of which is entered through a bracket lug 29 bolted to the base plate and extending longitudinally at a low level through the center of the machine, and entered within a hydraulic cylinder 30 which is under suitable automatic control, so that a relatively slow speed of advance can be imparted to the carriage assembly during the

deforming operation, with a quick return movement of the parts to starting position after the configured tube has been removed, and in preparation for the gripping of a new section of tubing.

It is not deemed necessary to illustrate or describe the control mechanism for regulating the speed of advance and return of the hydraulic ram, since such mechanism is of standard type and well understood in the art. Furthermore, it will be understood that other equivalent mechanism for imparting longitudinal movements to the carriage assembly may be employed in lieu of the hydraulic mechanism herein illustrated.

The rear or trailing end of the tube is supported within a ring block 31, which is preferably of wood, which closely surrounds the tube but permits sliding of tube therethrough to accommodate the advance of the tube under the pull of the chuck, and also to accommodate the elongation of the tube due to its reduction in diameter. The ring block is supported within a standard 32 which extends upwardly from a bridge bar 33, the ends of which engage the track rails 13 and 14. The bridge bar is held in clamped relation to the track rails by clamps 34—34, which, however, permit adjustment of the bridge bar to accommodate tubing different lengths.

The bridge bar at its outer end is extended to afford a mounting for a roller 35 which supports the under side of a templet beam 37 which is angular in cross section (Fig. 3), and has its forward end connected to a laterally extending bracket plate 39 carried by the base plate 16 of the traveling carriage unit 15. The templet beam affords a mounting for a templet 36, which as shown is formed in units or sections which are bolted to the base flange of the templet beam, so that the templet as a whole will travel with the chuck which advances the tube.

The forming tool, as shown, is in the form of a roller 40, having a beveled or rounded rim which stands immediately adjacent to a reinforcing bushing 41 which closely surrounds the tube at a point immediately adjacent the region of deformation, so that deforming action will be confined to the evolving shoulder of the tube immediately in contact with the forming tool, and so that the distribution of the deformation will not be extended backwardly into the region reinforced by the bushing.

The bushing is mounted within ball bearings 42, so that it will rotate freely with the tube, and the bearings are supported within a bearing block 43 bolted to a bridge plate 44, which extends across the machine and is supported upon the trackway and rigidly clamped thereon by clamping plates 45.

The forming roller 40 is provided with a stem 46 which is journaled at widely separated points within ball bearings 47 carried within a slide block 48 mounted upon a transversely extending T-shaped track 49 formed on the face of the bridge plate 44, the slide block being held in position by flange bars 50, which underlie the head of the T-shaped track and permit transverse movements to be imparted to the slide block and deforming roller carried thereby.

The in and out movements of the slide block 48 are occasioned by the contact of a vertically disposed templet roller 51 which is journaled through ball bearings 52 housed within upper and lower lugs 53 and 54 outwardly projecting from the slide block. The templet roller 51 is held at all times in firm contact with the edge of the templet by the provision of springs 55 which bear at their outer ends against a spring plate 56 and at their inner ends against the slide block, as shown in Fig. 2.

In order to support the templet beam 37 against the thrust occasioned by the in and out movements imparted to the forming tool 40, a backup roll 57 is provided, which bears against the hardened face plate 58 on the rear side of the templet beam. The backup roll is journaled within ball bearings 59 housed within the head 60 of a post 61 upstanding from the far end of the bridge plate 44, which post is held in position by a through bolt 62 and affords a rigid mounting for the backup roll, which thus serves to maintain the line of advance of the templet beam in exact parallelism with the axis of the tube undergoing deformation, so that the configuration imparted to the tube will exactly conform to the patterned edge 38 of the templet 36.

In order to permit a return movement of the spindle unit carriage without imparting in and out movements to the forming roller slide, the templet roll 51 is provided with a stem 63 which terminates in a piston located within a pneumatic cylinder 64 carried by a bracket 65, which permits the templet roll to be lifted to clear the patterned edge of the templet in preparation for the configuring of a new section of tubing.

Operation

In operation, the hydraulic feed ram is actuated to draw back the spindle unit carriage to its rearmost position, which brings the chuck 25 into a position closely adjacent the forming roller 40 and in position to engage the forward end of a tube section which has been shoved through the ring block 31 and through the reinforcing bushing 41, it being understood that the forming roller will at this time be drawn outwardly into a position which permits the tube section to be thrust forward into the chuck. Thereafter, the chuck is clamped about the end of the tube by the operation of the air cylinder 26, and the motor is started, which imparts rotation to the tube. At the same time, the feed ram will be hydraulically actuated at the proper speed to impart a forward thrust to the spindle unit carriage, which thus begins to advance, and to draw forward the templet. The advance of the templet imparts an inward thrust to the templet roll 51, thus causing the forming roller to advance and retreat radially of the tube axis in conformity with the patterned edge of the templet.

The speed of rotation of the tube will be greatly in excess of its speed of advancement, so that each section of the tube will be brought repeatedly into contact with the periphery of the forming roller while passing through the region of deformation. This is necessary in order to prevent appreciable grooving of the tube and to iron out the effect of such grooving as the rapidly rotating tube is drawn under the edge of the forming roller.

The contact of the acting face of the forming roller against the constantly evolving shouldered surface of the tube causes the metal by minute increments to flow down from the crest of the shoulder, which is surrounded and reinforced by the bushing, so that the deforming stress is at all times confined to the restricted region immediately in contact with the rounded edge of the forming roller 40, thereby preventing any buckling or collapse of the tube, which would otherwise occur. The configuring of the tube will con-

tinue until the tube is advanced sufficiently to draw it out of the supporting ring block and thereafter until the end of the tube has been drawn up to or within the reinforcing bushing, so that very little if any waste will be occasioned, and the configured tube will be completed by cutting off the short stub ends which are held in the chuck and in the bushing respectively.

The supporting ring block 31 is provided primarily for the purpose of preventing the rear end of an elongated tube from whipping, and to maintain it in a straight line of advance, so that after the configuring operation has progressed to a considerable extent, it will no longer be necessary to afford support for the rear or trailing end of the tube, which during the terminal portion of the operation may be drawn free from the ring block without developing any appreciable tendency toward lateral displacement. Furthermore, the position of the ring block support may be adjusted to any desired distance behind the reinforcing bushing to fit the apparatus for operation on tubes of different lengths or different degrees of flexibility.

As the trailing end of the tube undergoing deformation is drawn away from the supporting ring block, the advanced end of another tube section may be thrust through the ring block either manually or by suitable feeding mechanism operated either by fluid pressure or by mechanical appliances, so that, as soon as the previously configured tube has been released from the reinforcing bushing and the tube removed, the next tube section may be advanced sufficiently to bring it into the bite of the chuck as it is being returned to its starting position in immediate proximity to the forming roller. In order to insure an outward retraction of the forming roller at the beginning and ending of a deforming operation, the templet is sloped back at its ends to permit the forming roller to assume its outermost position under the thrust of the springs 55.

The bridge plate 44 which carries the forming roller and associated parts is adjustable longitudinally, and this fact, in conjunction with the adjustability of the rear supporting ring block, permits of any desired spacing of the operating mechanisms to best accommodate tube sections of the desired length.

Although we have shown but a single forming roller for acting upon the tube section, the structure of the machine is one which permits duplicate rollers to be provided with a duplication of the slides, templet and associated parts, so that if desired the tube may be acted upon from opposite sides, which duplicate arrangement is sometimes desirable in speeding up the operation and in affording contact on opposite sides of the tube. Where duplicate rollers are employed, it may be desirable to adjust one of the rollers slightly in advance of the other and adjust its templet to provide a slightly deeper thrust, so that the deforming action of the roller immediately adjacent the reinforcing bushing and bearing directly against the evolving shoulder will be supplemented to a slight degree by the companion roller occupying a slightly more advanced position.

In the present machine the power for both rotating and advancing the tube section is applied through the chuck which grips the leading end of the tube section at a point beyond the area which has undergone reduction in the configuring operation so that the tube is drawn or dragged forward against the resistance of the forming roll leaving the trailing or undeformed end, of uniform diameter, free to slide through the ring block 31 to the extent necessary to compensate for the reduction in diameter.

This method of feeding the tubing possesses certain advantages in the simplification of the structure and in the ease with which the tube sections may be fed into the machine as the work progresses. Furthermore, by fixedly positioning the mounting for the in and out movements of the forming tool, these portions of the structure, together with the adjacent reenforcing bushing, can be very firmly held in position and adequately reenforced to perform their work without danger of displacement which might occur if they were moved longitudinally while under the heavy stress occasioned by contact with the advancing tubing.

The machine as a whole is of simple and rugged construction to accommodate tube sections of any desired length or to permit the trackways upon which the working parts are supported to be extended if it is deemed desirable to increase the range of action of the machine.

Although the invention has been described with particularity as to detail, it is not the intention, unless otherwise specified in the claims, to limit the invention to the details shown, which may be modified without departing from the spirit of the invention.

We claim:

1. In a machine for configuring tubing, the combination of a frame, a spindle carriage mounted on the frame and longitudinally movable with respect thereto, a chuck carried by the spindle carriage and adapted to fixedly grip the leading end of a section of tubing, means for advancing and returning the carriage, means for imparting rotation through the chuck to the tube concurrently with the forward advance thereof, a forming tool against the rim of which the tubing wall is drawn by the advance of the chuck and a mounting therefor fixed against longitudinal movement on the frame but adapted for in and out radial movements relative to the section of tubing to vary the position of the forming tool with respect to the axis of the tube, a reinforcing member fixedly mounted on the frame in position to closely surround the tube immediately adjacent the forming tool, and means for imparting said radial movements to the forming tool concurrently with the advance of the spindle carriage.

2. In a machine for configuring tubing, the combination of a frame, a spindle carriage mounted on the frame and longitudinally movable with respect thereto, a chuck carried by the spindle carriage and adapted to fixedly grip the leading end of a section of tubing, means for advancing and returning the carriage, means for imparting rotation through the chuck to the tube concurrently with the forward advance thereof, a forming tool against the rim of which the tubing wall is drawn by the advance of the chuck and a mounting therefor fixed against longitudinal movement on the frame but adapted for in and out radial movements relative to the tube to vary the position of the forming tool with respect to the axis of the tube, a reinforcing member fixedly mounted on the frame in position to closely surround the tube immediately adjacent the forming tool a ring block carried by the frame for slidably supporting the trailing end of the section of tubing, and a templet secured to and movable with the carriage and operatively engaged with the forming tool mount-

ing for imparting in and out radial movements thereto concurrently with the advance of the spindle carriage and the tube carried thereby.

3. In a machine for configuring tubing, the combination of a frame provided with a trackway, a spindle carriage mounted on the trackway and longitudinally movable thereon, a chuck carried by the spindle carriage and adapted to fixedly grip the leading end of a section of tubing in advance of the area undergoing configuring, a motor and gear reduction train mounted on the carriage for imparting rotation to the chuck, a hydraulic cylinder and ram connected with the carriage for advancing and returning the same, a forming roller against the rim of which the tubing wall is drawn by the advance of the chuck and a transversely movable slide upon which the roller is mounted, said slide being fixed against longitudinal movement and adapted for in and out radial movements to vary the position of the forming roller with respect to the axis of the tube, a templet secured to and movable with the carriage and operatively engaged with the forming roller slide for imparting in and out radial movements thereto concurrently with the advance of the spindle carriage and the tube carried thereby a ring block carried by the frame for slidably supporting the trailing end of the section of tubing, and a reinforcing member fixedly mounted in position to closely surround the tube immediately adjacent the forming roller.

4. In a machine for configuring tubing, the combination of a frame, a spindle carriage mounted on the frame and longitudinally movable with respect thereto, a chuck carried by the spindle carriage and adapted to fixedly grip the leading end of a section of tubing, means for advancing and returning the carriage, means mounted upon the carriage for imparting rotation through the chuck to the tube concurrently with the forward advance thereof, a slide mounted for in and out radial movements relative to the tubing and a forming roller journalled thereon and against the rim of which the wall of a section of tubing is drawn by the advance of the chuck, the slide being fixed against longitudinal movement on the frame, a templet secured to and movable with the carriage, a templet roller carried by the slide and positioned to engage the patterned edge of the templet, said roller being adjustable to clear the patterned edge of the templet to facilitate return movements of the carriage, and a reinforcing bushing fixedly mounted in position to closely surround the tube immediately adjacent the forming roller.

CLARENCE L. DEWEY.
SYDNEY L. DEWEY.