

Dec. 15, 1936.

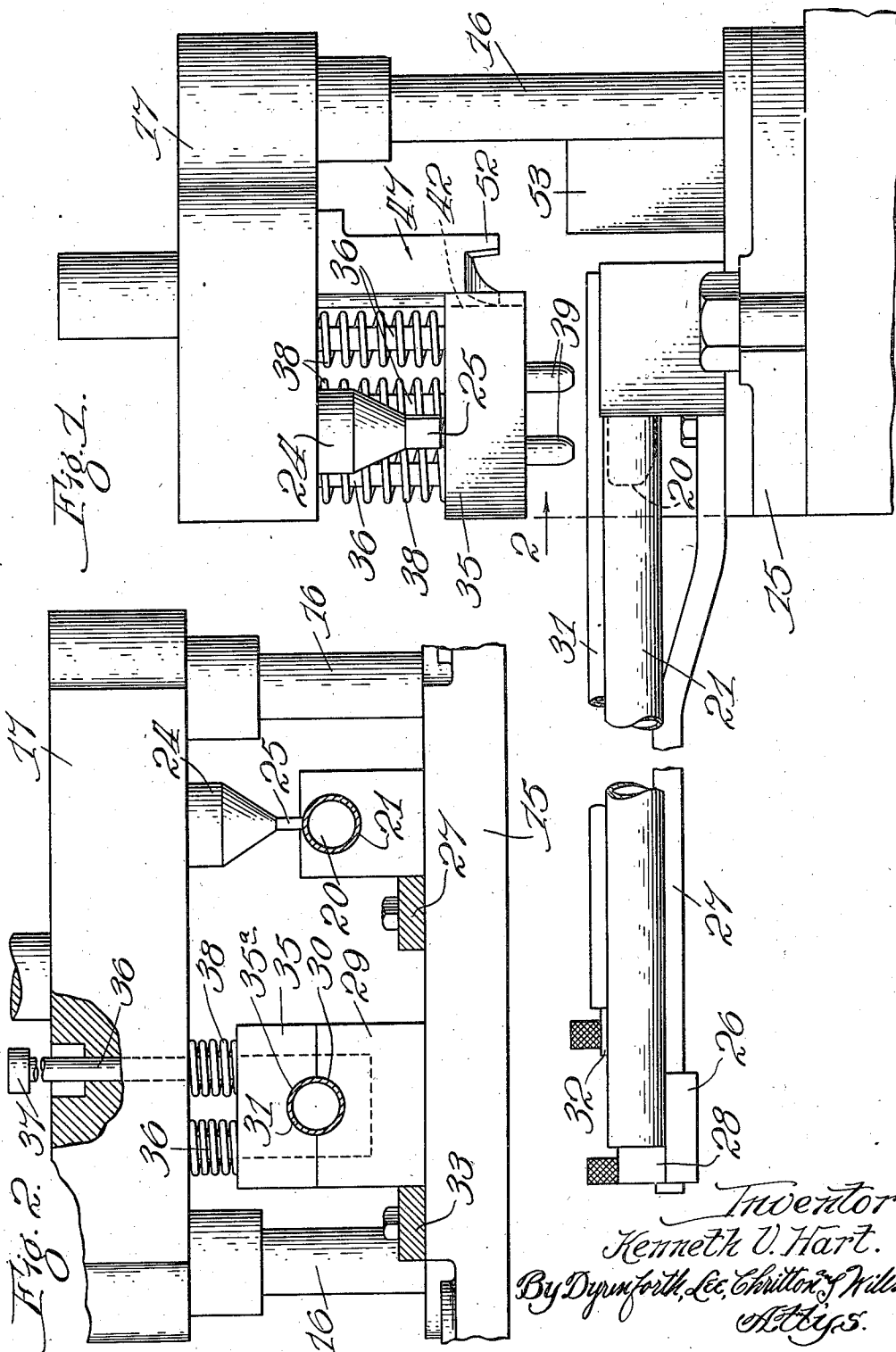
K. V. HART

2,064,539

METHOD OF AND MEANS FOR SHAPING THE ENDS OF TUBES

Filed Jan. 18, 1934

3 Sheets-Sheet 1



Inventor:
 Kenneth V. Hart.
 By Dupuyfort, Lee, Chittor & Niles.
 Attys.

Dec. 15, 1936.

K. V. HART

2,064,539

METHOD OF AND MEANS FOR SHAPING THE ENDS OF TUBES

Filed Jan. 18, 1934

3 Sheets-Sheet 2

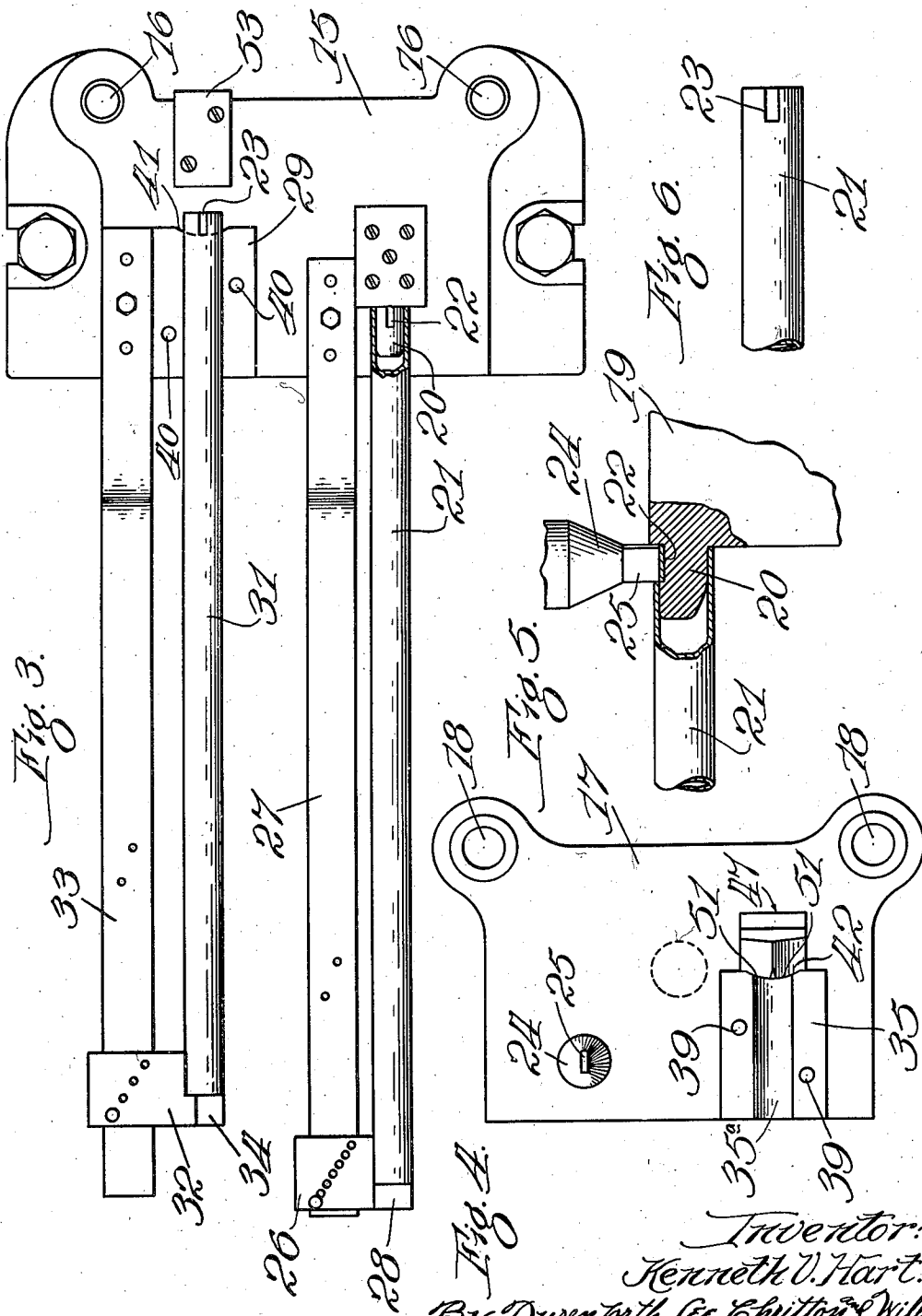


Fig. 3.

Fig. 4.

Fig. 5.

Inventor:
Kenneth V. Hart.
By Dymond, Sec. Chilton & Wills.
Attys.

Dec. 15, 1936.

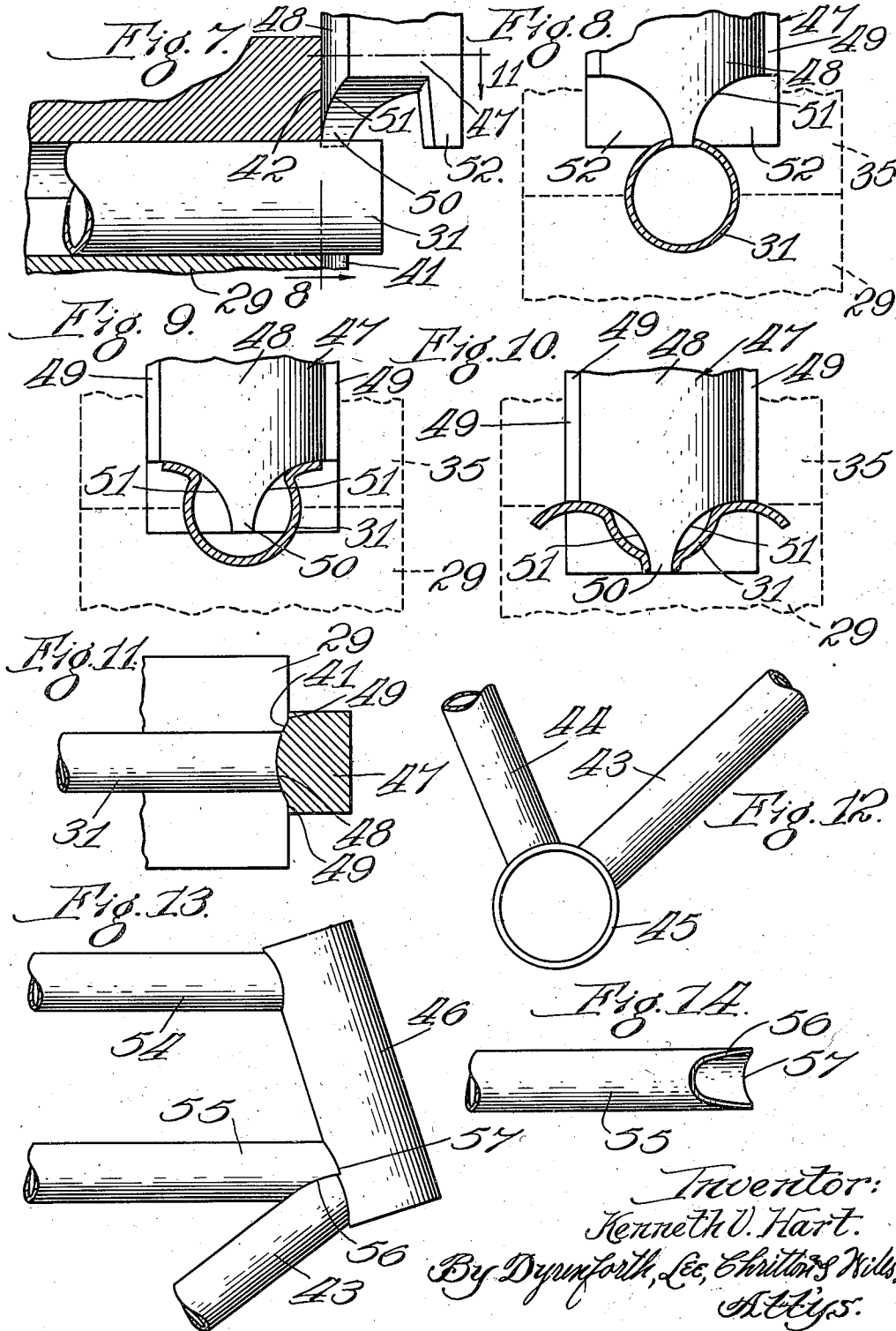
K. V. HART

2,064,539

METHOD OF AND MEANS FOR SHAPING THE ENDS OF TUBES

Filed Jan. 18, 1934

3 Sheets-Sheet 3



Inventor:
Kenneth V. Hart.

By *Dunsmuir, Lee, Chittenden & Niles,*
Attys.

UNITED STATES PATENT OFFICE

2,064,539

METHOD OF AND MEANS FOR SHAPING THE
ENDS OF TUBESKenneth V. Hart, South Bend, Ind., assignor to
Arnold Schwinn & Co., Chicago, Ill., a corpo-
ration of Illinois

Application January 18, 1934, Serial No. 707,208

24 Claims. (Cl. 153—48)

My invention relates to the shaping of the ends of tubes more particularly comparatively thin walled tubes, such as those of which tubular frames, especially bicycle frames and the like structures, are made.

In the manufacture of such frames the ends of certain of the tubes are endwise disposed relative to others thereof and are thus required to be so shaped at their ends as to cause them to conform to the sides of the tubes which they oppose, the shape required of such ends depending on the particular angle at which the tubes extend relative to each other.

As the walls of these tubes are comparatively thin the shaping of their ends economically and by a rapid operation has presented a considerable problem in practice due to the tendency of the tubes to crush and distort under pressure.

My object, which is attained by the method and means hereinafter described, is to provide for the shaping of the ends of the tubes economically and rapidly without danger of crushing or distorting the tubes.

Referring to the accompanying drawings:

Figure 1 is a view in side elevation, with certain parts broken away, of a machine embodying my invention and suitable for practicing my novel method.

Figure 2 is a broken section taken at the line 2 on Fig. 1 and viewed in the direction of the arrow.

Figure 3 is a plan view of the machine with the upper die portion thereof removed.

Figure 4 is a bottom plan view of the upper die portion of the machine.

Figure 5 is a fragmentary partly sectional view of the slotting die of the press and the mandrel-forming member cooperating therewith, showing a tube in the process of having a slot formed therein.

Figure 6 is a view in side elevation of the slotted end of the tube slotted by the mechanism shown in Fig. 5.

Figure 7 is an enlarged fragmentary view of the movable element for shearing the end of the tube, together with the sectional tube-holding die-member cooperating therewith, showing the movable shearing element about to start the shearing operation.

Figure 8 is a section taken at the line 8 on Fig. 7 and viewed in the direction of the arrow.

Figures 9 and 10 are similar views, but showing the movable shearing element actuated to progressively advanced positions in the performance of its shearing function.

Figure 11 is a plan sectional view taken at the line 11 on Fig. 7 and viewed in the direction of the arrow, the upper movable one of the sections of the sectional tube-holding die-member, being removed.

Figure 12 is a view of the crank-hanger portion of the frame of a bicycle and comprising tubes certain of which extend endwise relative to the sides of the crank hanger tube, and constituting an example of a structure involving tubes the ends of which are shaped in accordance with my invention.

Figure 13 is a broken view of the steering-post portion of a tubular bicycle frame, and illustrating the joining of tubes to the sides of another tube at oblique angles and the shaping of the abutting ends of which may be effected in accordance with my invention; and

Figure 14, a view in side elevation of the shaped end of the lower one of the two parallel cross-tubes of Fig. 13.

The particular machine shown and which may be utilized in practicing my novel method, comprises a lower stationary bed member 15 having upwardly extending guide rods 16 and forming a part of the die press to which the tubes, the ends of which are to be sheared, are to be applied; and an upper movable die carrying member 17 having openings 18 at which it is slidable on the rods 16 and also forming a part of the die press and reciprocable in any suitable manner, as for example, as in the case of die presses as commonly provided.

In the particular illustrated machine provision is made, not only for shearing the ends of the tubes to the desired contour but also, and in accordance with one way of practicing my new method, for preliminarily longitudinally slotting the end of the tube to be sheared, the slotting means and the end-shearing means being provided for performing those operations simultaneously, but in succession, on a plurality of tubes to expedite and facilitate the shaping of the ends of the tubes.

Thus while one tube is being slotted preliminarily to the end-shearing thereof, the previously-slotted tube is being operated on by the shearing means to shape its end.

Referring first to the means for slotting the ends of the tubes, these means comprise a block 19 on the base section 15 having a mandrel-forming projection 20 to enter (as shown in Figs. 1, 2, 3 and 5) the end of the tube to be slotted such as that represented at 21, the mandrel 20 containing a rectangular shaped groove 22 in

its upper face extending lengthwise thereof and corresponding with the shape of the slot to be cut in the tube, and indicated at 23.

Co-operating with the grooved portion 22 of the mandrel which constitutes the female portion of a die, is a punch 23 carried by the vertically movable section 17 and the punch-portion 25 of which, in vertical alinement with the groove 22 in the mandrel, forms the male element of the die.

The rear end of the tube remote from the die just described is supported on a block 26 carried on, and adjustable longitudinally of, the outer end of an arm 27 adjustably connected at its opposite end with the base member 15, the block 26 having a stop portion 28 opposing the outer end of the tube as shown in Figs. 1 and 3.

Referring to the means for shearing the end of the tube to the desired end contour, they comprise a stationary block 29 containing in its upper face a semi-cylindrical groove 30 in which the end of the tube to be sheared and represented at 31 conformably fits, the outer end of the tube 31 being supported on a block 32 adjustable lengthwise on an arm 33 on the base member 15 and having a stop-portion 34 co-operating with the outer end of the tube 31.

These shearing means also comprise a block 35 having upwardly extending pins 36 slidable in the member 17 and headed at 37, as represented of one of the pins, to limit downward movement of the pins and block, coiled springs 38 being interposed between the member 15 and the block 35 and tending to hold this block in the position shown in Fig. 1.

The block 35 has a semi-cylindrical groove 35^a of the same size as the groove 30 with which it is vertically alined, whereby when the block 35 is lowered to the position shown, by lowering the member 17, the tube 31 will be closely housed within the co-operating grooves 30 and 35^a, as shown, the block 35 being shown as provided with dowels 39 which enter registering openings 40 in the block 29, when the block 35 is lowered, to insure proper registration of the grooves 30 and 35^a.

The blocks 29 and 35 together form one element of a shearing die and to this end the surfaces thereof adjacent to which the tube-end to be cut would be positioned, are recessed to form therein vertically alined grooves 41 and 42, respectively, of arcuate shape in cross-section and symmetrically disposed relative to the longitudinal axis of the tube-receiving opening formed by the co-operating grooves 30 and 35^a, the curvature presented by the walls of the grooves 41 and 42 being the same as that desired of the shaped end of the tube and corresponding with the curvature of the side wall of the tube against which the end of the tube to be sheared, is to conformably fit.

In the particular illustrated example the tubes shaped by the machine are those represented at 43 in Figs. 12 and 13 and at 44 in Fig. 12 and forming parts of a bicycle frame, the tube 43 extending diagonally forwardly and upwardly from the crank-hanger tube 45 to the steering-post tube 46 and the tube 44, which extends diagonally upwardly and rearwardly, constituting the seat-post tube. The tubes 43 and 44 in such an arrangement are of considerably smaller diameter than the tube 45 and thus the ends of the tubes 43 and 44 which abut the side of the tube 45 describe a curvature of much less length than a semi-circle and consequently the

grooves 41 and 42 provided in the blocks 29 and 35 in the particular machine shown are relatively shallow.

These shearing means also comprise a shearing die section represented at 47 for co-operation with the die section comprising the blocks 29 and 35. The die section 47 is carried by the movable member 17 to slide lengthwise along the surfaces of the grooves 41 and 42 on the blocks 29 and 35, the surface of this die section which extends into the grooves 41 and 42 and which is represented at 48 being curved cross-wise to conform to the curvature of the walls of these grooves. The die section 47 extends laterally beyond the grooves 41 and 42 and presents flat surfaces 49 which slide along the correspondingly shaped rear surfaces of the blocks 29 and 35.

The lower end of the die section 47 is shaped, as shown, to present at its curved surface 48, midway between the longitudinal edges of these surfaces, a depending shearing projection 50 the side walls of which curve upwardly, outwardly, and rearwardly as shown to present the similarly curved shearing edges represented at 51 which extend to the longitudinal edges of the curved surface of the die section 47.

The side of the die section opposite the projection 50 is shown as extending solidly downwardly to about the same elevation as the bottom of the projection 50, as represented at 52, to co-operate with a block 53 rigid on the base member 15, the die section 47 in operating as hereinafter described sliding at its rear face along the front face of the block 53 which latter resists any tendency of the die section 47 to spring rearwardly under the stress to which it is subjected in performing the shearing function.

As will be understood from the foregoing, the lowering of the member 17 causes the block 35 to become positioned on the block 29 and on the tube 31 seated therein and the shearing projection 50 to enter the slot 23 in the tube and exert at its shearing edges 51 shearing action on the tube to shear it to the desired contour, the lower edge of the projection 50 shearing through the bottom of the tube as shown in Fig. 10 during the shearing operation. The backing of the block 35 by the springs 38 permits the member 17, together with the shearing projection 50, to continue its descent after the block 35 has reached its lowermost position.

In the shearing operation the upper half of the tube is sheared by the progressive action of the cutting edges 51 from the lower end of the projection 50 to the upper terminal portions of these edges and the lower half of the tube is sheared both from the bottom of the projection 50 toward the upper terminal portions of these cutting edges and from these terminal portions toward the bottom of the projection 50.

As will be clearly understood from Figs. 8, 9 and 10, the provision of the shearing edges 51, as shown and described, causes the shearing stresses to be exerted on the tube only in a direction outwardly therefrom, tending to deflect the tube radially outwardly but which tendency is resisted by the closely surrounding walls of the grooves 41 and 42 at their juncture with the grooves 30 and 35^a in the blocks 29 and 35, respectively, the absence of stress on the tube, in the shearing operation, in a direction tending to collapse the tube, being of great practical advantage, especially in the case of the shaped

ing of the ends of comparatively thin-walled tubes.

It is also within the scope of my invention in its broader aspect, to omit the above described preliminary slotting of the end of the tube to be sheared, in which case the lower end of the projection 50 instead of being blunt as shown (its form as illustrated being triangular), would be of substantially knife edge form to adapt it to cut through the tube without collapsibly distorting it.

Where the ends of the tubes are to be sheared at an angle oblique to the longitudinal axis of the tube, as distinguished from shearing them at a right angle thereto as illustrated in Fig. 12, the tubes to be sheared, as will be readily understood, would be presented to the slot-punching die in the event that the latter is used, and to the shearing die, at an angle to the plane of reciprocation of the shearing die element 47 corresponding with the angle at which the tube to be sheared is to extend relative to the tube against the side of which the end-shaped tube is to be positioned. Such oblique angular position of the tubes relative to the dies would be necessary as for example in the shaping of the upper end of the tube 43 and the forward end of the upper tube 54 of the frame shown in Fig. 13 inasmuch as both of these tubes extend at oblique angles to the steering post tube 46.

Where the shape desired of the end of the tube is such that it cannot be produced by a single operation of a shearing die as described above, as for example in the case of the end of the tube 55 shown in Figs. 13 and 14 wherein it extends into the interior angle between the tubes 43 and 46 and thus must be shaped at different portions of its end and represented at 56 and 57 to conformingly fit the sides of the tubes which they oppose, the shaping would be performed by two successive operations performed, respectively, from opposite sides of the tube, employing shearing dies operating in accordance with the shearing die as above described, but shaped appropriately for the desired contouring of the end of the tube.

While I have disclosed a certain particular way in which my new method may be practiced and have disclosed a particular machine for carrying out the method, and furthermore have shown a particular construction of machine embodying my invention, I do not wish to be understood as intending to limit it thereto as the method may be practiced in other ways, the particular procedure above described variously modified and altered and the method practiced by the use of other machines and, furthermore, the machine shown may be variously modified and altered, all without departing from the spirit of my invention.

What I claim as new, and desire to secure by Letters Patent, is:

1. A machine for the purpose set forth comprising a support for a tube the end of which is to be shaped, and a shaping and shearing die having a face curved crosswise thereof and extending substantially parallel to its longitudinal axis terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said die, said support and die being relatively movable to shear a tube on said support.

2. A machine for the purpose set forth comprising a die member forming one section of a

shaping and shearing die mechanism apertured to receive the tube to be shaped with a face of said member extending crosswise of the aperture therein and having a groove of arcuate cross section, and a second die member forming another section of said shaping and shearing die mechanism, said members being relatively movable in the direction of the length of said groove, said second member having a curved face of substantially the same curvature as said groove and said second-named member being slidable at said curved face in said groove, said curved face of said second-named member terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said second-named member.

3. A machine for the purpose set forth, comprising a support for a tube the end of which is to be shaped, an end surface of said support having a groove of arcuate cross-section intersecting the plane in which the tube is supported, and a shaping and shearing die member having a face extending lengthwise of said groove and curved crosswise thereof, said face having substantially the same curvature as said groove and said shaping and shearing die member being so disposed that its curved face may enter said groove and be lengthwise slidable therein, said face terminating in a shearing projection the sides of which diverge along said face in a direction toward the opposite end of said member.

4. A machine for the purpose set forth comprising a die member forming one section of a shaping and shearing die mechanism apertured to receive the tube to be shaped with a face of said member extending crosswise of the aperture therein and having a groove of arcuate cross section, and a second die member forming another section of said shaping and shearing die mechanism, said second member having a curved face of substantially the same curvature as said groove and said second-named member being slidable at said curved face in said groove, said curved face of said second-named member terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said second-named member, said first-named die member being formed of separable parts and said members being relatively movable in the direction of the length of said groove.

5. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shearing die mechanism apertured to receive the tube to be shaped with a face of said member extending crosswise of the aperture therein and having a groove of arcuate cross section, a second die member forming another part of said shaping and shearing die mechanism, said second die member having a curved face of substantially the same curvature as said groove and said second-named member being slidable at said curved face in said groove, said curved face of said second-named member terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said second-named member, and a member carrying one of the sections of said first-named die member and said second die member, said last-named member and the other section of said first-named die member being relatively movable in the direction of the length of said groove.

6. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shearing

ing die mechanism apertured to receive the tube to be shaped with a face of said member extending crosswise of the aperture therein and having a groove of arcuate cross section, a second die member forming another part of said shaping and shearing die mechanism, said second die member having a curved face of substantially the same curvature as said groove and said second-named member being slidable at said curved face in said groove, said curved face of said second-named member terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said second-named member, a member carrying one of the sections of said first-named die member and said second die member, said last-named member and the other section of said first-named die member being relatively movable in the direction of the length of said groove, and the one of said die-member-sections carried by said last-named member and the structure comprising said last-named member and said second die member being relatively movable.

7. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shearing die mechanism apertured to receive the tube to be shaped with a face of said member extending crosswise of the aperture therein and having a groove of arcuate cross section, a second die member forming another section of said shaping and shearing die mechanism, said second die member having a curved face of substantially the same curvature as said groove and said second-named member being slidable at said curved face in said groove, said curved face of said second-named member terminating in a shearing projection the sides of which diverge along said face toward the opposite end of said second-named member, a member carrying one of the sections of said first-named die-member and said second die member, said last-named members and the other section of said first-named member being relatively movable in the direction of the length of said groove, and the one of said die-member-sections carried by said last-named member and the structure comprising said last-named member and said second die member being relatively movable, and means yieldingly urging the one of said die-member-sections on said last-named member toward the other of said die-member sections.

8. A shaping and shearing die comprising a member having an outwardly curved face extending longitudinally thereof substantially parallel to its axis and terminating in a shearing projection the sides of which diverge along said face in a direction toward the opposite end of said member.

9. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shearing die mechanism apertured to receive the tube to be shaped, a second die member forming another part of said shaping and shearing die mechanism and slidable relative to said die member, and a member carrying one of the sections of said first-named die member and said second die member, said last-named member and the other section of said first-named die member being relatively movable in a path at an angle to said die member.

10. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shear-

ing die mechanism apertured to receive the tube to be shaped, a second die member forming another part of said shaping and shearing die mechanism and slidable relative to said first-named die member, a member carrying one of the sections of said first-named die member and said second die member, said last named member and the other section of said first-named die member being relatively movable in a path at an angle to said first-named die member, and the one of said die-member-sections carried by said last-named member and the structure comprising said last-named member and said second die member being relatively movable.

11. A machine for the purpose set forth comprising a die member formed of separable sections and forming parts of a shaping and shearing die mechanism apertured to receive the tube to be shaped, a second die member forming another part of said shaping and shearing die mechanism and slidable relative to said first-named die member, a member carrying one of the sections of said first-named die member and said second die member, said last-named member and the other section of said first named die member being relatively movable in a path at an angle to said first-named die member, the one of said die-member-sections carried by said last-named member and the structure comprising said last-named member and said second die member being relatively movable, and means yieldingly urging the one of said die-member-sections on said last-named member toward the other of said die-member-sections.

12. The method of shaping a terminally free end portion of a tube which consists in providing a longitudinally extending aperture in said terminally free end portion open at the adjacent end edge of the tube, and in thereafter exerting a shearing force against the said terminally free end portion in opposite outward directions in substantially a single plane, initiated at its aperture.

13. The method of shaping a terminally free end portion of a tube which consists in providing a longitudinally extending aperture in said terminally free end portion open at the adjacent end edge of the tube, and in thereafter exerting a shearing force against the said terminally free end portion in opposite outward directions in substantially a single plane, initiated at its aperture, with a die applicable to said aperture and having a central blunt portion and concaved portions extending from opposite sides thereof on arcs of substantially 90°.

14. A machine for the purpose set forth comprising a support for a tube the end of which is to be shaped, and a shaping and shearing die having a face curved crosswise thereof and extending substantially parallel to its longitudinal axis terminating in a shearing projection, the operating end of said projection being centrally blunt and the sides of said projections diverging along said face on arcs of substantially 90° toward the opposite end of said die, said support and die being relatively movable to shear a tube on said support.

15. The method of shaping the ends of tubes which consists in preliminarily providing an aperture in the tube open at the end thereof to be shaped and thereafter exerting a shearing force against the tube initiated at its apertured portion substantially in line with the inner end of the aperture, in a direction outwardly from the tube, thereby to avoid collapsing the tube.

16. The method of shaping the ends of tubes which consists in stamping out a portion of the tube at the end thereof to be shaped to form an aperture therein open at said end, and thereafter exerting a shearing force against the tube in a single plane, initiated at its apertured portion, in a direction outwardly from the tube thereby to avoid collapsing the tube.

17. The method of shaping the ends of tubes which consists in stamping out a portion of the tube adjacent the end thereof to be shaped to form an aperture therein, and thereafter exerting shearing force against the tube in a single plane initiated at its apertured portion, in a direction outwardly from the tube thereby to avoid collapsing the tube.

18. The method of shaping an end portion of a tube which consists in preliminarily aperturing the tube at the said portion and thereafter shaping the said portion by exerting a shearing force against the said portion initiated at the aperture, in a direction outwardly from the tube, thereby to avoid collapsing the tube.

19. The method of shaping an end portion of a tube which consists in stamping out part of the tube at said portion to form an aperture therein, and thereafter shaping the said portion by exerting a shearing force against the tube initiated at said aperture, in a direction outwardly from the tube, thereby to avoid collapsing the tube.

20. The method of shaping a terminally free end portion of a tube which consists in introducing means through the wall of the tube from the exterior thereof, and initiating a shaping operation after entry of said means by shearing

and forcing outwardly with said means the material of the terminally free end portion in opposite outward directions in substantially a single plane.

21. The method of shaping a terminally free end portion of a tube with means entering the wall of the tube from the exterior thereof, which consists in initiating the shearing against the terminally free end portion at spaced points, and continuing the shearing in opposite outward directions in substantially a single plane.

22. The method of shaping a terminally free end portion of a tube which consists in introducing means through the wall of the tube from the exterior thereof, and initiating a shaping operation after entry of said means by exerting a shearing force against the terminally free end portion in opposite outward directions, throughout the operation of the shearing, in substantially a single plane.

23. The method of shaping an end portion of a tube which consists in preliminarily aperturing the tube at the said portion and thereafter shaping the said portion by exerting a shearing force against the said portion initiated at the aperture in opposite directions outwardly from the tube, thereby to avoid collapsing the tube.

24. The method of shaping an end portion of a tube which consists in stamping out part of the tube at said portion to form an aperture therein, and thereafter shaping the said portion by exerting a shearing force against the tube initiated at said aperture in opposite directions outwardly from the tube, thereby to avoid collapsing the tube.

KENNETH V. HART.