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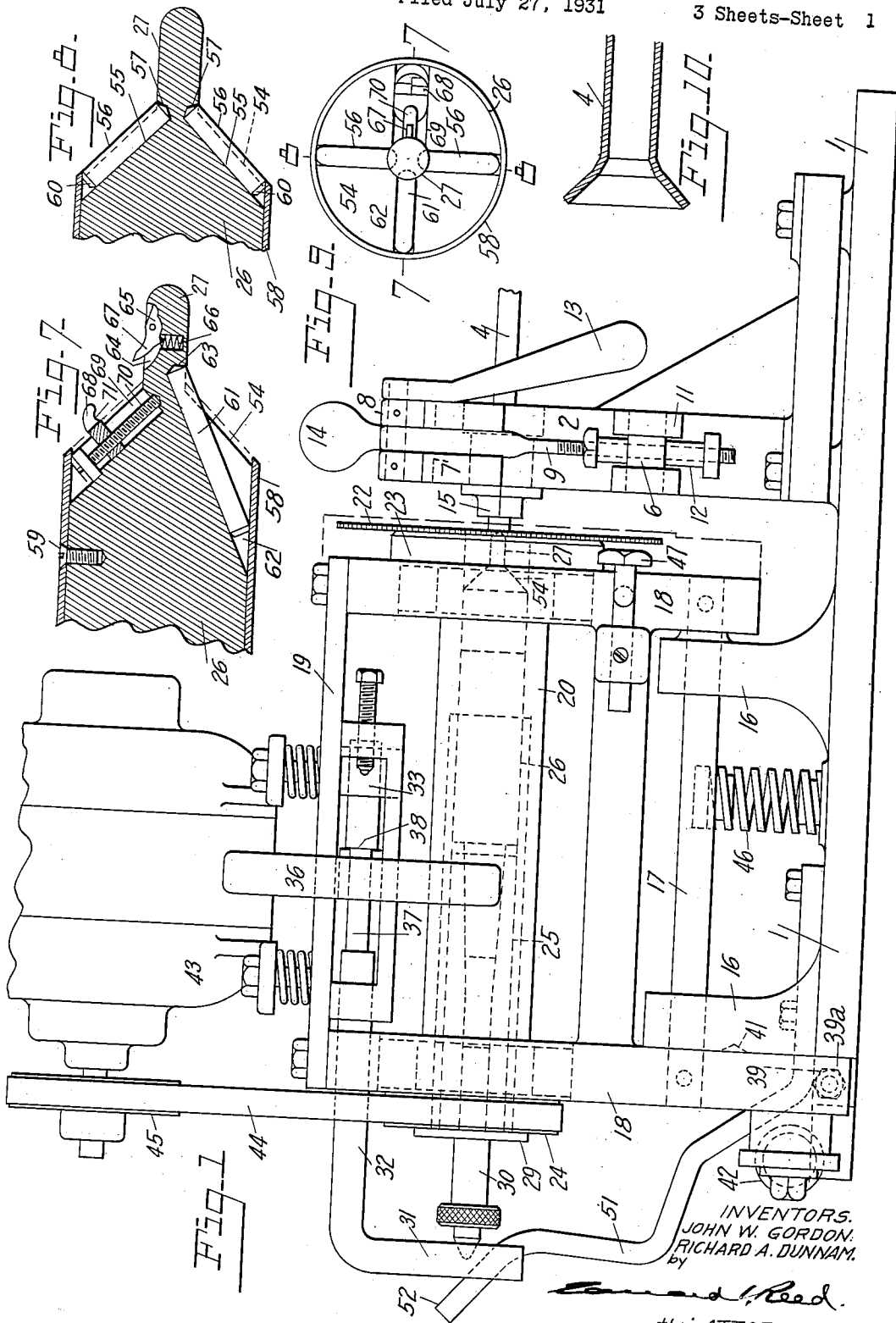
J. W. GORDON ET AL

1,911,186

TUBE FLARING MACHINE

Filed July 27, 1931

3 Sheets-Sheet 1

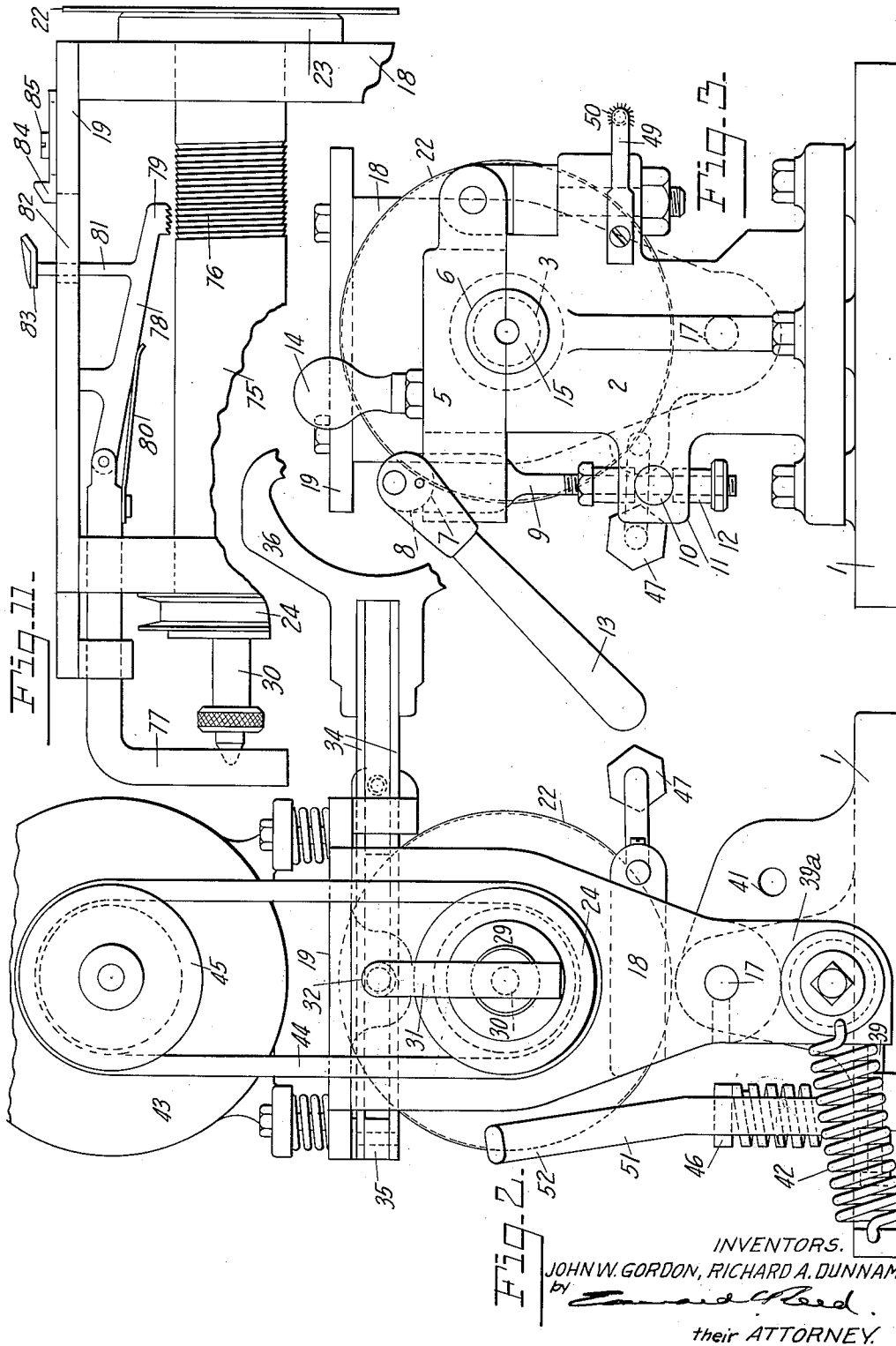


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3 Sheets-Sheet 2



May 30, 1933.

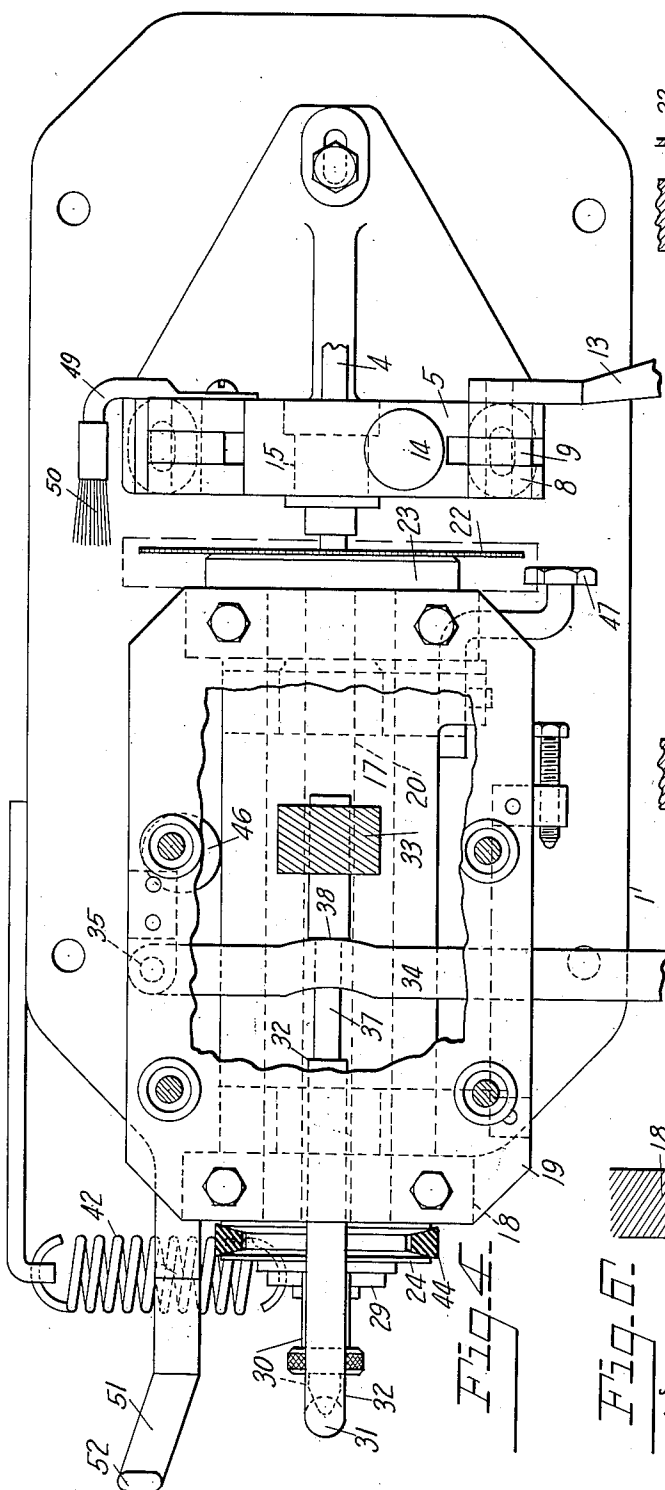
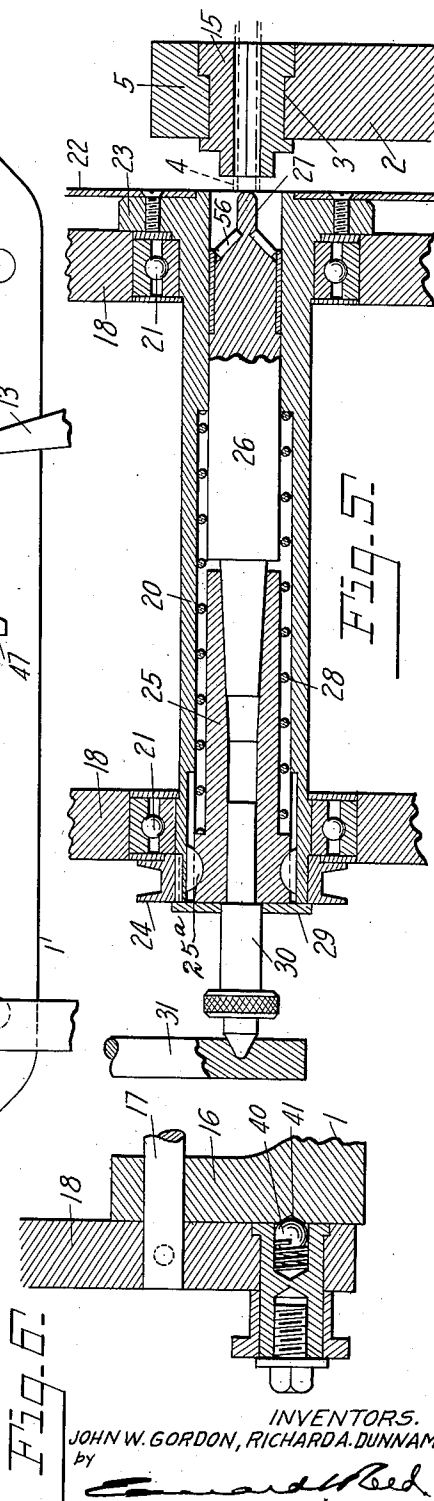
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TUBE FLARING MACHINE

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3 Sheets-Sheet 3



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UNITED STATES PATENT OFFICE

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TUBE FLARING MACHINE

Application filed July 27, 1931. Serial No. 553,257.

This invention relates to a tube flaring machine and is designed more particularly for trimming and flaring the ends of small tubes of relatively soft material, such as copper, although it may be used for tubes of various sizes and of various materials.

One object of the present invention is to provide a simple, compact machine, which will trim the end of the tube and flare the same in an efficient manner.

A further object of the invention is to provide such a machine in which a comparatively short movement of the operating mechanism will cause the end of the tube to be trimmed and the flaring mandrel brought into operative relation to the tube.

A further objection of the invention is to provide a flaring machine with means for automatically cleaning the flaring end of the mandrel.

A further object of the invention is to provide a tube flaring machine with a mandrel which will flare the tube without forming a sharp angle at the inner end of the flare.

A further object of the invention is to provide a tube flaring machine with a mandrel having improved means for removing the rough corners from the flared end of the tube.

A further object of the invention is to provide a mandrel having flaring rollers of such a construction that the rollers can be readily removed and replaced.

Other objects of the invention will appear as the mechanism is described in detail.

In the accompanying drawings Fig. 1 is a side elevation of a machine embodying my invention; Fig. 2 is a rear end elevation of the same; Fig. 3 is a front end elevation of such a machine; Fig. 4 is a top plan view of the machine, partly broken away; Fig. 5 is a longitudinal sectional view taken through the spindle and mandrel; Fig. 6 is a detail view showing the detent for the swinging frame; Fig. 7 is a sectional view of a portion of the mandrel; Fig. 8 is a sectional view of the mandrel taken at right angles to the section of Fig. 7; Fig. 9 is an end elevation of the mandrel; Fig. 10 is a sectional view of the flared end of the tube; and Fig. 11 is a

detail view showing a modified form of feeding mechanism for the mandrel.

In that form of the invention here illustrated the machine comprises a supporting structure for the operating mechanism, which is here shown as a base 1. Mounted in fixed relation to this supporting structure, and in the present instance mounted on the base itself, is a tube supporting device. This device may be of any suitable character but it preferably comprises an upright standard 2 having at its upper edge a recess 3 to receive the tube 4 which is to be flared. Pivotally mounted on the standard, at one side of the recess 3, is a clamping member 5 having a complementary recess 6 to embrace the upper portion of the tube which rests in the lower recess 3. The clamping member 5 extends laterally beyond the standard 2 and is provided in its upper edge with a recess 7 to receive a locking member 8, here shown as an eccentric disk pivotally mounted on the upper end of a rod 9 which is mounted in a stud 10 pivoted in lugs 11 on the standard 2. Preferably the rod is provided above and below the stud 10 with nuts 12 whereby the effective position of the locking member or eccentric 8, with relation to the clamping member 5, may be adjusted. Rigidly secured to the clamping member or eccentric disk 8 is an operating handle 13. It will be apparent that when the handle is moved upwardly the eccentric disk will be rotated out of engagement with the clamping member so that it may be swung out of line therewith, thus permitting the clamping member to be swung about its pivot by means of a handle 14. Preferably the opening through the tube support, formed by the recesses 3 and 6, is of a diameter somewhat larger than the usual tube and is provided with a two-part bushing 15 which is removable, so that by providing a plurality of interchangeable bushings the support may be accommodated to tubes of different sizes.

Mounted on the supporting structure is a frame which carries the trimming and flaring mechanism. This frame is movable transversely to the tube support and preferably is pivotally mounted for swinging

movement. As here shown, the base 1 is provided with upstanding pivot lugs 16 in which is journaled a shaft 17 to which are rigidly secured the end members 18 of the frame, these end members being being connected at their upper ends by a plate 19. Rotatably mounted in the end members 18 of the frame is a hollow spindle 20 which is here shown as mounted in anti-friction bearings 21. Rigidly secured to that end of the spindle adjacent to the tube support is a cutter which is so arranged as to leave the adjacent end of the hollow spindle open and unobstructed. As here shown, this cutter is in the form of a circular saw 22 which is rigidly secured to a flange 23 on the end of the spindle. This flange bears against the adjacent frame member 18 and holds the spindle against axial movement in one direction, while a driving member, such as a pulley 24 which is secured to the other end of the spindle, bears against the other frame member 18 and holds the spindle against axial movement in the other direction. Mounted within the hollow spindle is a chuck 25 which is splined to the spindle, as shown at 25a, so that it will be caused to rotate therewith but may have longitudinal movement with relation thereto. Removably mounted in this chuck is a mandrel 26 having at one end a reduced portion 27 and a tapered flaring portion adapted to enter a tube 4 in the tube support and flare the same. This mandrel is of such length that when the chuck 25 is retracted to its rear-most position the mandrel will lie wholly within the spindle. A spring 28 acts on the chuck to move the same and the mandrel rearwardly. The rearward movement of the chuck is limited by an end plate 29 secured to the spindle and the mandrel has a stud or projection 30 extending through this end plate and adapted to be engaged by the downturned end 31 of a bar 32 which is slidably mounted in suitable bearings 33 carried by the plate 19, so that the longitudinal movement of the bar 32 in one direction will move the chuck and the mandrel against the action of the spring 28 and cause the forward end of the mandrel to be projected beyond the spindle. The bar 32 may be actuated in any suitable manner but we prefer to utilize a single actuating device for swinging the main frame about its axis and for actuating the mandrel. As here shown, this actuating member is in the form of a pair of bars 34 rigidly connected one to the other, pivotally mounted on the main frame at 35, on one side of the spindle, and provided on the other side of the spindle with a handle 36. The two bars are spaced apart to embrace the slide bar 32 and the latter is provided with a suitable stop to be engaged by the actuating device so that the latter may impart movement to

the bar and to the mandrel. In the present instance, the intermediate portion of the bar 32 is of reduced diameter, as shown at 37, and the shoulder formed at one end of this reduced portion constitutes a stop, as shown at 38. One of the frame members 18 has a part 39a extending below the shaft 17 and adapted to engage a suitable stop, such as a screw 39, to limit the movement of the frame in one direction and properly align the mandrel with the tube in the tube support. A spring pressed detent 40 carried by this depending part of the frame is adapted to engage in a recess 41 in the adjacent lug 16 and thus hold the frame against vibratory movement about its axis during the flaring operation. We also prefer to connect with this depending part of the frame a counterbalancing spring 42 which serves to retard the downward movement of the frame about its axis and to assist in the upward movement thereof.

The spindle 20 and chuck 25 may be rotated in any suitable manner but we prefer to mount an electric motor 43 on the plate 19 and to connect this motor with the pulley 24, by means of a belt 44 which embraces a pulley 45 on the motor shaft. A yieldable stop or abutment 46 is arranged in the path of the spindle as the frame swings downwardly and serves to limit the downward movement thereof. It will be apparent that when the frame has been swung to its lower position both the spindle and the saw will have been carried out of line with the opening in the tube support. The tube is then inserted and clamped in the tube support and that portion thereof which is to be removed by the saw projects beyond the plane of the saw. If desired, a stop 47 may be mounted on the frame and so arranged that when the latter is in its lowered position the stop will be in line with the tube opening and when the tube is placed in the opening and moved into engagement with the stop it will be properly positioned for the trimming operation. After the tube has been clamped in the support the frame is swung upwardly to its upright position, thus causing the saw to sever the end of the tube and swinging the spindle into axial alinement with the tube. These movements are accomplished by means of the handle 36 on the actuating member 34 and when the frame has assumed its upright position this handle is moved toward the tube support, thus causing the end of the mandrel to enter the tube and flare the same. When the flaring operation is completed the mandrel is withdrawn either by releasing the handle and permitting the spring to retract the same or by manually restoring the handle to its normal position. The tapered end of the mandrel, which engages and flares the tube, is apt to collect bits of metal and if these re-

main on the mandrel they tend to cut or mar the flared end of the tube. We have therefore provided means for automatically cleaning the end of the mandrel and for that purpose have mounted on the tube support a bracket 49 on which is mounted a brush 50 so arranged that it will be in line with the mandrel when the frame is in its lowered position. This brush is necessarily spaced forwardly of the plane of the saw and in order to move the mandrel into engagement with the brush 50, it is mounted in the rear end of the base 1 and provided with an inclined portion 52 arranged to engage the downturned end 31 of the bar 32 as the frame moves downwardly, thus forcing the mandrel forwardly and into engagement with the brush 50, it being understood that the spindle and mandrel rotate continuously.

The mandrel may be of any suitable character but, as here shown, it is provided with the reduced portion 27 adapted to enter the tube and with a tapered portion 54 which enters that portion of the tube which is to be flared. The tapered portion of the mandrel is provided with a plurality of recesses 55 in which are rotatably mounted rollers 56 which engage and flare the end of the tube. As here shown, the reduced portion 27 of the mandrel is provided with recesses 57 in which the outer ends of the rollers 56 are supported. The rear ends of the rollers are engaged by a sleeve 58 which is removably secured to the mandrel by means of a screw 59, the outer end of which overhangs the rear ends of the rollers, the latter being beveled, as shown at 60, to provide proper bearing surfaces therefor. Thus it will be apparent that the rollers can be readily inserted in and removed from the mandrel. In order to avoid the formation of a sharp angle at the inner end of the flare on the tube the mandrel is provided with a third roller 61 which is arranged at a sharper angle to the axis of the mandrel than are the rollers 56 and extends outwardly beyond those rollers, as shown in Fig. 7, thus in effect imparting a second flare to the tube at the junction of the main flare in the body of the tube and smoothing out the angle which would otherwise be formed at this point. The roller 61 is also mounted in a recess 62 in the end of the mandrel and is seated at its forward end in a recess 63 in the reduced portion 27 and is engaged by the outer end of the sleeve 58 in the same manner as the other rollers.

The operation of the cutter is apt to leave burrs or rough edges on the tube and for the purpose of removing these burrs the mandrel is provided with trimmers. The reduced portion 27 has formed in one side thereof a recess 64 in which is pivotally mounted a trimmer blade 65 which is acted upon by a spring 66 which tends to move the inner portion of the blade beyond the

surface of the mandrel. This blade is of such a character that when depressed against the action of the spring it will lie wholly in the recess. Consequently as the reduced end of the mandrel enters the tube the inner edge of the tube will be engaged by this blade which will remove the burr thereof but the continued movement of the mandrel into the tube will cause the blade to be forced into its recess and the flat surface 67 will engage the inner surface of the tube without cutting or marring the same. For the purpose of trimming the outer corner of the tube a cutter 68 is adjustably mounted in a groove 69 formed in the tapered end of the mandrel and, as here shown, it is mounted on a screw 70 by means of which its position may be adjusted according to the length of the flare. This blade or trimmer 68 has a recess 71 in its cutting edge into which the edge of the tube extends so that the edge of the cutter overhangs the outer corner of the tube.

In some cases, particularly in a machine for flaring large and relatively heavy tubes, it is desirable to provide power operated means for forcing the mandrel into the end of the tube. This may be accomplished in various ways but we have shown in Fig. 11 a simple and effective means for so actuating the mandrel. As there shown, the spindle 75 is provided with an external screw thread 76 which, in the present instance, extends for a part only of its length. The mandrel actuating bar 77 has pivotally connected with one end thereof an arm 78 which is provided at a point adjacent to the thread on the spindle with a toothed head 79, the teeth of which are adapted to mesh with the thread on the spindle. The head 79 is held normally out of engagement with the thread, preferably by a spring 80 acting on the arm 78. A push rod 81 is connected with the arm and extends through a slot 82 in the frame member 19 and has on its outer end a head 83 by means of which it may be manually operated against the action of the spring 80 to establish the operative connection between the mandrel actuating device, consisting of the bar 77 and the arm 78, and the threaded spindle and to maintain that connection during its flaring operation. The thread on the spindle will then impart axial movement to the actuating device and to the mandrel as long as the head 79 is held in engagement with the threads 76. If desired, means may be provided for automatically interrupting the connection between the actuating device of the spindle when the desired movement has been imparted to the mandrel. For this purpose we have shown a trip device 84 adjustably mounted on the frame member 9 in the path of the head 83 on the push rod 81. Preferably either the trip device or the head, or both,

are provided with inclined contact surfaces so that the continued movement of the actuating device will cause the pivoted arm 78 to be positively moved outwardly at the end of a predetermined movement of the mandrel, which movement is determined by the position of the trip device, this device being adjustably secured to the frame by a screw 85 extending through the slot therein.

While we have shown and described one embodiment of my invention, together with a minor modification thereof, we wish it to be understood that we do not desire to be limited to the details thereof as various modifications may occur to a person skilled in the art.

Having now fully described our invention, what we claim as new and desire to secure by Letters Patent, is:

1. In a tube flaring machine, a support for the tube to be flared, a frame mounted for movement transversely to said tube support, a cutter rotatably mounted on said frame, a mandrel mounted on said frame for rotation about an axis substantially coincident with the axis of said cutter and for longitudinal movement to project one end thereof beyond the plane of said cutter, and means for actuating said cutter and said mandrel.

2. In a tube flaring machine, a support for the tube to be flared, a frame mounted for movement transversely to said tube support, a hollow spindle rotatably mounted on said frame, a cutter carried by one end of said spindle and having a central opening, a mandrel mounted in said spindle for rotation therewith and for longitudinal movement with relation thereto through the opening in said cutter, means for rotating said spindle, and means for imparting longitudinal movement to said mandrel.

3. In a tube flaring machine, a support for the tube to be flared, a frame mounted for movement transversely to said tube support, a hollow spindle rotatably mounted on said frame, a cutter carried by one end of said spindle and having a central opening, a mandrel mounted in said spindle for rotation therewith and for longitudinal movement with relation thereto through the opening in said cutter, means for rotating said spindle, and an actuating member for imparting transverse movement to said frame and longitudinal movement to said mandrel.

4. In a tube flaring machine, a support for the tube to be flared, a frame mounted for movement transversely to said tube support, a hollow spindle rotatably mounted on said frame, a cutter carried by one end of said spindle and having a central opening, a chuck mounted in said spindle for rotation therewith and for longitudinal movement with relation thereto, a mandrel mounted in said chuck for movement therewith and

adapted to be projected beyond said cutter, said chuck having a part projecting beyond the rear end of said spindle, means to engage said end of said chuck and impart longitudinal movement thereto, and means for rotating said spindle.

5. In a tube flaring machine, a support for the tube to be flared, a frame mounted for movement transversely to said tube support, a cutter rotatably mounted on said frame, a mandrel mounted on said frame for rotation about an axis substantially coincident with the axis of said cutter and for longitudinal movement to project one end thereof beyond the plane of said cutter, a motor mounted on said frame and operatively connected with said cutter and said mandrel, and means for imparting longitudinal movement to said mandrel.

6. In a tube flaring machine, a supporting structure, a tube support mounted in fixed relation to said structure, a frame mounted on said structure for swinging movement transversely to said tube support, a hollow spindle rotatably mounted on said frame and movable with said frame into and out of alinement with a tube on said tube support, a mandrel slidably supported in said spindle and rotatable therewith, a cutter carried by that end of said spindle adjacent said tube support and arranged to leave the end of said spindle unobstructed, means for rotating said spindle and said mandrel, and means for imparting sliding movement to said mandrel.

7. In a tube flaring machine, a supporting structure, a tube support mounted in fixed relation to said structure, a frame mounted on said structure for swinging movement transversely to said tube support, a hollow spindle rotatably mounted on said frame and movable with said frame into and out of alinement with a tube on said tube support, a mandrel slidably supported in said spindle and rotatable therewith, a cutter carried by that end of said spindle adjacent said tube support and arranged to leave the end of said spindle unobstructed, a motor mounted on said frame and operatively connected with said spindle, and means for imparting sliding movement to said mandrel.

8. In a tube flaring machine, a supporting structure, a tube support mounted in fixed relation to said structure, a frame mounted on said structure for swinging movement transversely to said tube support, a hollow spindle rotatably mounted on said frame and movable with said frame into and out of alinement with a tube on said tube support, a mandrel mounted in said spindle for rotation therewith and for axial movement with relation thereto, a cutter carried by that end of said spindle adjacent to said tube support and arranged to leave the end of said spindle unobstructed, a part con-

5 neated with said mandrel and extending beyond the opposite end of said spindle, a member movably mounted on said frame and arranged to operatively engage said projecting part, means for actuating said member to impart axial movement to said mandrel, and means for rotating said spindle.

10 9. In a tube flaring machine, a supporting structure, a tube support mounted in fixed relation to said structure, a frame mounted on said structure for swinging movement transversely to said tube support, a hollow spindle rotatably mounted on said frame and movable with said frame into and out of alinement with a tube on said tube support, a chuck mounted in said spindle for rotation therewith and for axial movement with relation thereto and having a part extending beyond the rear end of said spindle, a spring acting on said chuck to impart rearward movement thereto, a mandrel mounted in said chuck and arranged to lie wholly within said spindle when said chuck is in its retracted position, a cutter mounted on the forward end of said spindle and arranged to leave the end of said spindle open and unobstructed, a member slidably mounted on said frame and arranged to operatively engage the projecting part of said chuck, and an actuating device operatively connected with said member, and means for rotating said spindle.

15 10. In a tube flaring machine, a base, a tube support mounted on said base, a frame pivotally supported near its lower edge on said base, a hollow spindle rotatably mounted on said frame, a mandrel slidably mounted in said spindle and rotatable therewith, a cutter carried by one end of said spindle, means arranged at the other end of said spindle for imparting longitudinal movement to said mandrel, a motor carried by said frame and operatively connected with said spindle, and a counterbalancing spring connected with said frame.

20 11. In a tube flaring machine, a support for a tube to be flared, a frame mounted for movement transversely to said tube support, a hollow spindle rotatably mounted on said frame, a cutter carried by one end of said spindle and having a central opening, a mandrel mounted in said spindle for rotation therewith and for longitudinal movement with relation thereto through the opening in said cutter, means for rotating said spindle, a spring to retract said mandrel, manually operated means for imparting longitudinal movement to said mandrel when the latter is in operative relation to said tube support, a brush mounted at one side of said tube support, and means for automatically moving said mandrel into en-

gagement with said brush when said frame is actuated to move said mandrel away from said tube support.

25 12. In a tube flaring machine, a supporting structure, a tube support mounted in fixed relation to said structure, a frame mounted on said structure for movement transversely to said tube support, a hollow spindle rotatably mounted on said frame, a mandrel mounted in said spindle for rotation therewith and for axial movement with relation thereto, a cutter carried by that end of said spindle adjacent to said tube support and arranged to permit the end of said mandrel to move beyond the same, means for imparting axial movement to said mandrel, means for rotating said spindle, a mandrel cleaning device arranged at one side of said tube support and beyond the plane of said cutter, and means controlled by the movement of said frame for moving said mandrel into engagement with said cleaning device.

30 13. In a tube flaring machine, a support for a tube to be flared, a frame movable transversely to said tube, a hollow spindle rotatably mounted in said frame, a cutter carried by said spindle, means for rotating said spindle, a mandrel mounted in said spindle for rotation therewith and for axial movement with relation thereto, a plurality of forwardly converging rollers rotatably mounted on one end of said mandrel and adapted to enter the tube which is to be flared, one of said rollers having its outer end extending beyond the outer ends of the other rollers and being arranged at a less angle to the axis of said mandrel than are said other rollers.

35 14. In a tube flaring machine, a mandrel having at one end a reduced portion adapted to enter a tube and having its adjacent portion tapered and provided with grooves, the reduced portion of said mandrel being provided with recesses at the outer ends of said grooves, rollers mounted in the respective grooves and seated in said recesses, and a sleeve secured to said mandrel and overhanging the inner ends of said rollers.

40 15. In a tube flaring machine, a mandrel having at one end a reduced portion adapted to enter a tube and having its adjacent portion tapered and provided with grooves, the reduced portion of said mandrel being provided with recesses at the outer ends of said grooves, rollers mounted in the respective grooves and seated in said recesses, and a sleeve secured to said mandrel and overhanging the inner ends of said rollers, one of said rollers being arranged at a less angle to the mandrel than are the other rollers and having its outer end extending beyond the outer ends of the other rollers.

45 16. In a tube flaring machine, a mandrel

- having a tapered portion adapted to enter a tube to be flared, said tapered portion having a longitudinal groove in the inclined surface thereof, a trimmer blade mounted
 5 in said groove for adjustment lengthwise thereof toward and from the smaller end of said mandrel and having a part to overhang the outer edge of the flared portion of the tube.
- 10 17. In a tube flaring machine, a mandrel having a reduced end portion and having its adjacent portion tapered and provided with grooves spaced about the same, said reduced portion having recesses adjacent the
 15 ends of said grooves, rollers mounted in a part of said grooves and engaging in said recesses, a screw mounted in another of said grooves and engaging the adjacent recess, a trimmer blade mounted on said screw for
 20 movement lengthwise of its recess and having a part to overhang the edge of the flared portion of the tube, and a sleeve removably mounted on said mandrel and overhanging the inner ends of said rollers and of said
 25 screw.
18. In a tube flaring machine, a support for a tube, a frame mounted for movement transversely to a tube on said support, a
 30 hollow spindle rotatably mounted on said frame and having an external screw thread, a mandrel slidably mounted in said spindle and rotatable therewith, means for rotating
 35 said spindle, an actuating device movable lengthwise of said spindle, operatively connected with said mandrel and having a toothed part movable into and out of engagement with the thread on said spindle, and means for actuating said movable part.
- 40 19. In a tube flaring machine, a rotatable hollow spindle having an external screw thread, a mandrel mounted in said spindle for rotation therewith and for axial move-
 45 ment with relation thereto, means for rotating said spindle, an actuating device for imparting axial movement to said mandrel and comprising a toothed part movable into and out of mesh with the thread on said
 50 spindle, means for moving said part into mesh with said thread, and a trip device to positively move said part out of mesh with said thread at the end of a predetermined movement.
- 55 20. In a tube flaring machine, a frame, a rotatable member carried by said frame, a mandrel mounted on said frame and connected with said rotatable member for rota-
 60 tion thereby and for axial movement with relation thereto, means for rotating said rotatable member, an actuating device to impart axial movement to said mandrel, and a device connected with said actuating device and adapted to be connected with and
 65 to be driven by said rotatable member to

cause said actuating device to impart axial movement to said mandrel.

In testimony whereof, we affix our signatures hereto.

JOHN W. GORDON. 70
 RICHARD A. DUNNAM.

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