Oct. 11, 1949. J. L. MARSH 2,484,632

BEADING MACHINE

Filed March 29, 1946 5 Sheets-Sheet 1

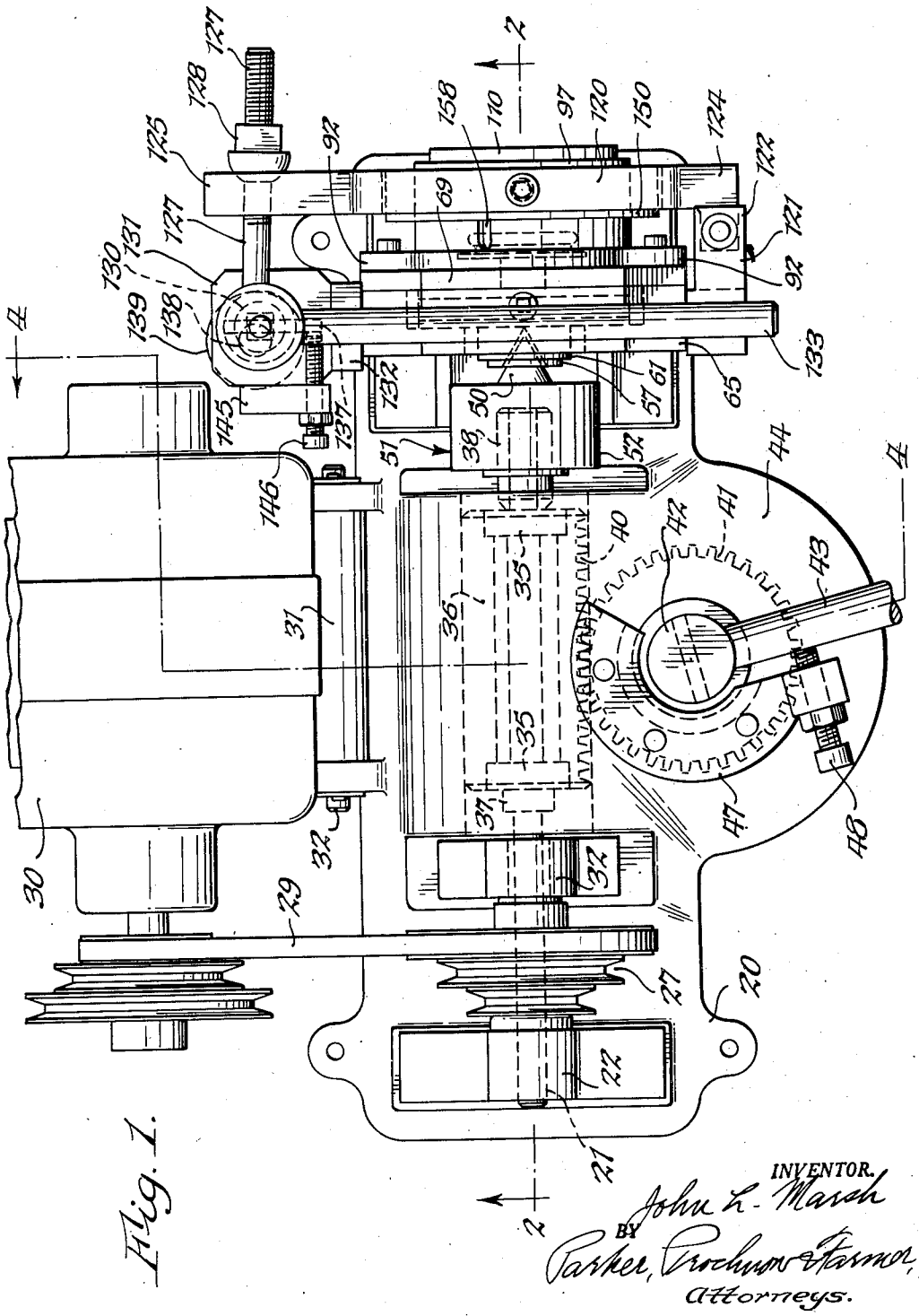


Fig. 1.

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5 Sheets-Sheet 2

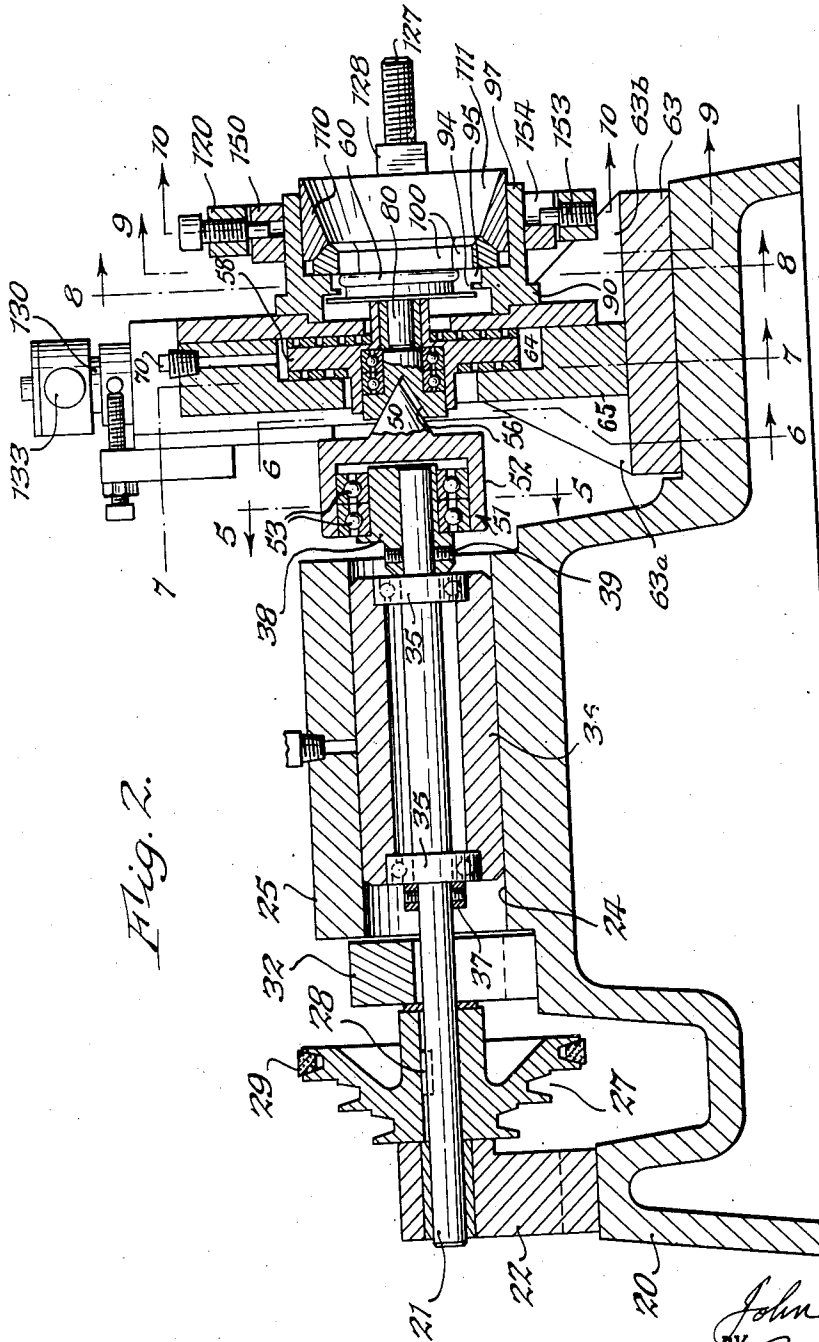


Fig. 2.

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BEADING MACHINE

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Fig. 3.

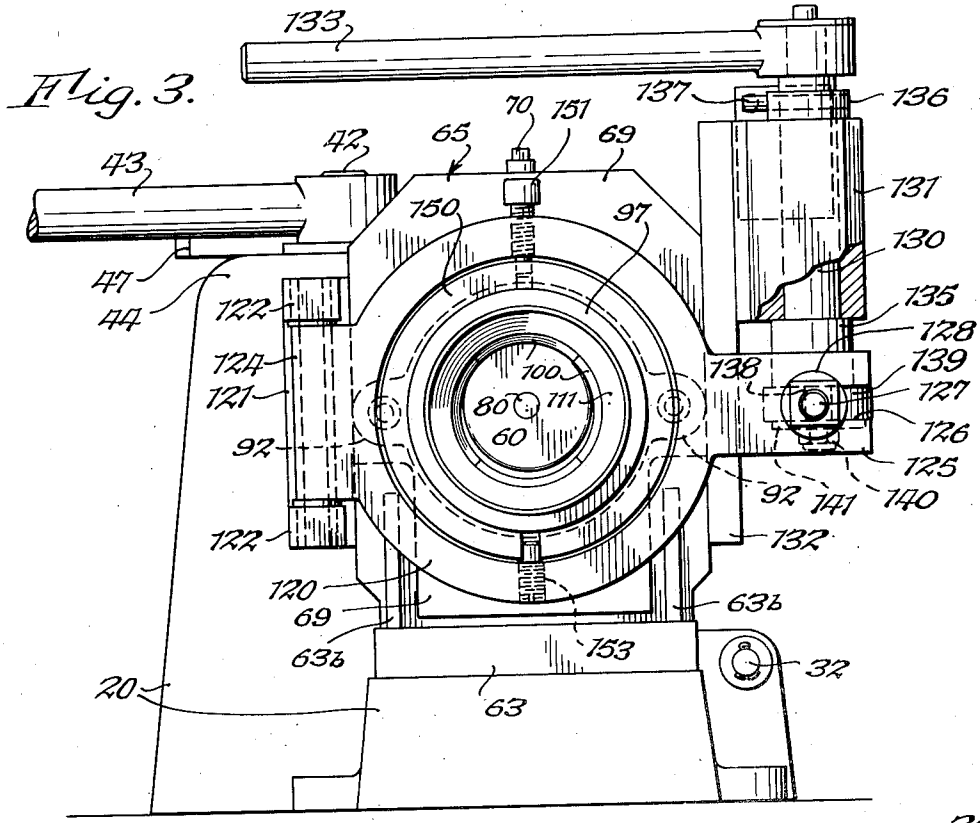
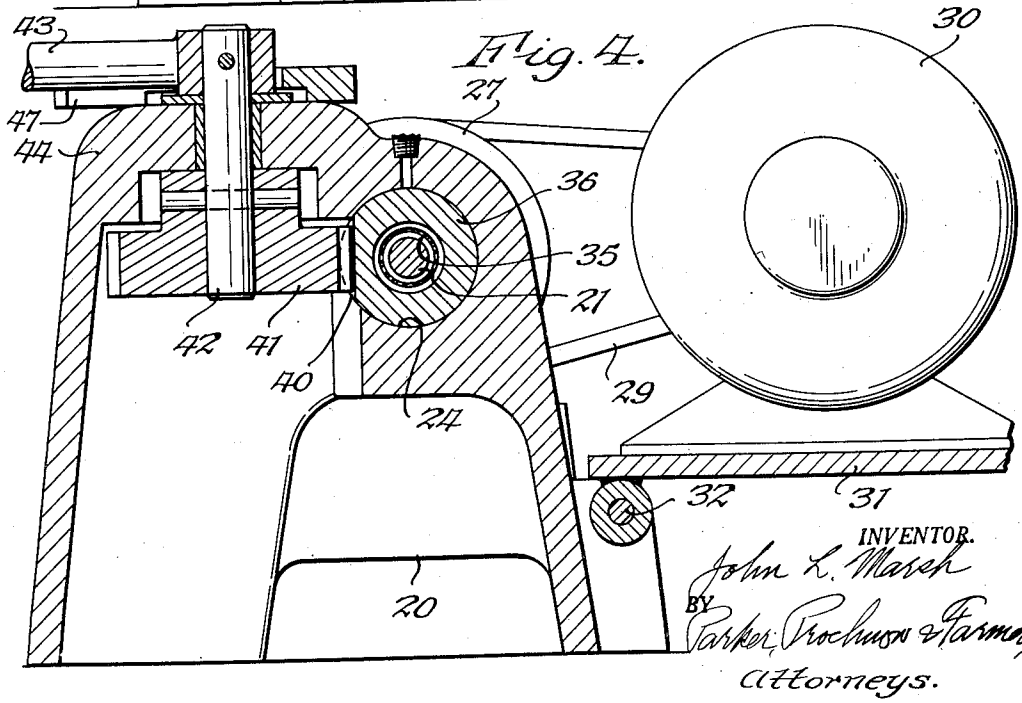


Fig. 4.



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BEADING MACHINE

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Fig. 5.

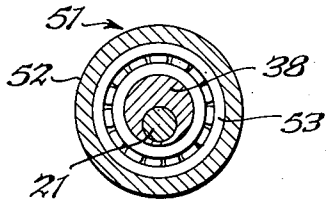


Fig. 8.

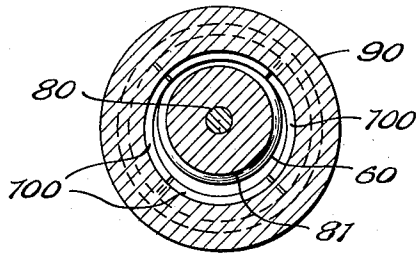


Fig. 6.

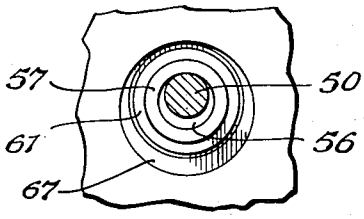
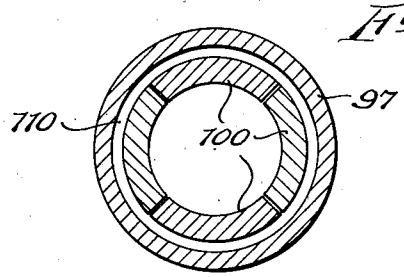


Fig. 9.



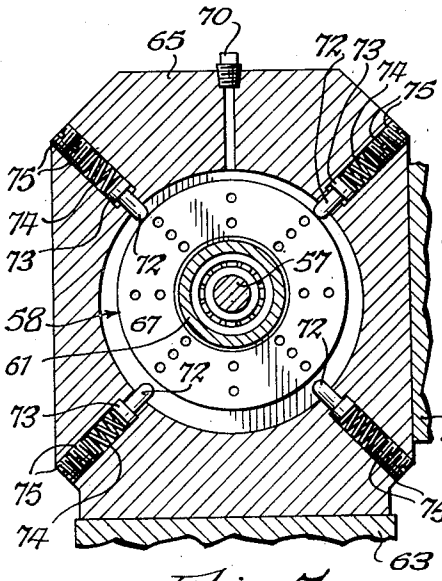


Fig. 7.

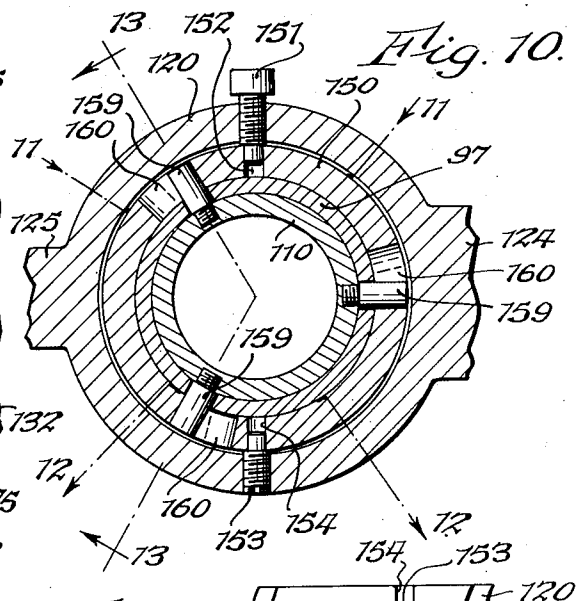


Fig. 10.

Fig. 12.

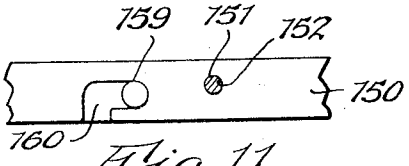


Fig. 11.

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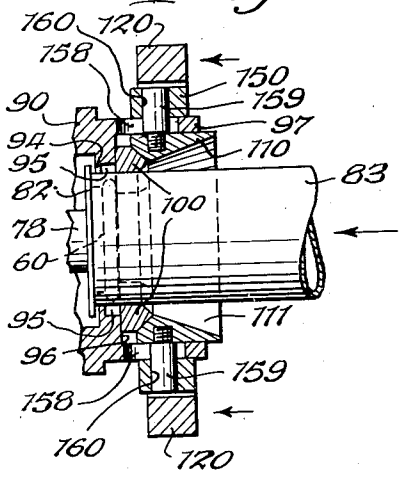
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BEADING MACHINE

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Fig. 13.



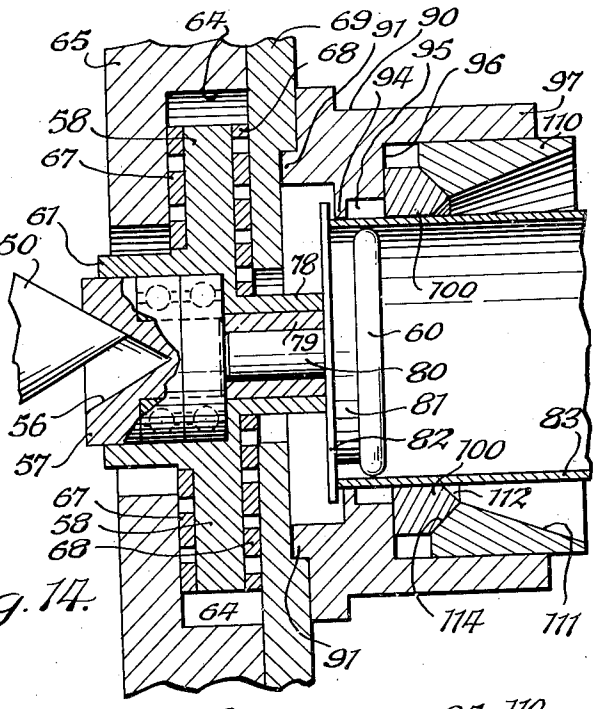


Fig. 14.

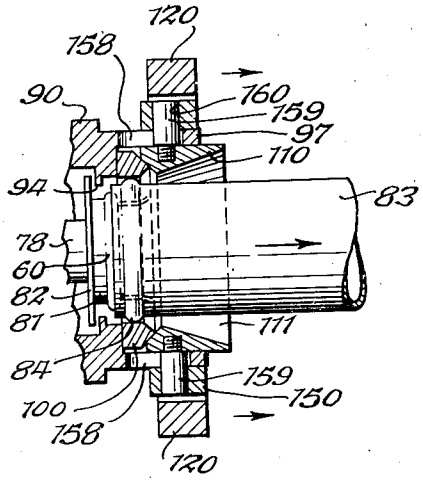


Fig. 16.

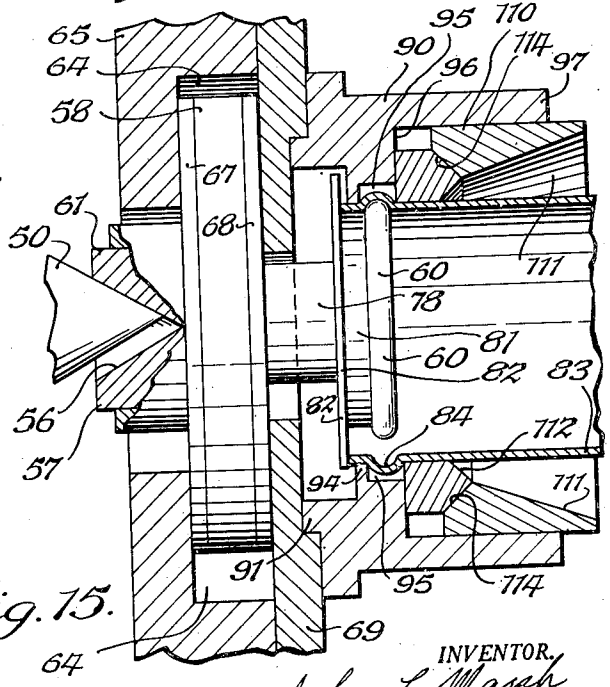


Fig. 15.

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Patented Oct. 11, 1949

2,484,632

UNITED STATES PATENT OFFICE

2,484,632

BEADING MACHINE

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Application March 29, 1946, Serial No. 658,340

15 Claims. (Cl. 153—9)

1

This invention relates to improvements in the forming of beads on tubular members, and particularly to the forming of beads which extend outwardly from the exterior surface of the tubular member.

One of the objects of this invention is to provide a beading machine of improved construction which is capable of operating efficiently and rapidly to form a bead on tubular members. Another object is to provide a machine of this kind with driving means of improved construction for moving a beading roll into engagement with the inner surface of a tubular member so that the axis of the beading roll will move in substantially circular paths of gradually increasing diameters. A further object is to provide driving means of this type which includes a cone part and a part having a conical recess, one of these parts being mounted on an eccentric on the drive shaft and the other part being mounted on a member which supports the beading roll, one of the parts being movable axially toward the other part to vary the diameter of the circular path in which the beading roll travels. Another object of this invention is to provide a machine of this type in which the rotary driving member has a cone eccentrically mounted thereon which is movable into and out of a conical recess or hole formed in the member which supports a beading tool, so that the axis of this tool is moved in substantially circular paths, and in which the eccentricity may be varied by lengthwise movement of the driving member.

It is also an object of this invention to provide a machine with means of improved construction for readily adapting the machine to operate on tubular members of various sizes. Another object of this invention is to provide means of improved construction for clamping a tube in fixed relation to the machine while the beading operation takes place. A further object is to provide a mounting for the dies and the tube clamping means by means of which one set of dies and clamping means can be readily removed and replaced by other dies and clamping means to operate on tubes of different sizes. Another object is to provide a supporting member of improved construction for the beading tool. A further object of the invention is to provide a clamping member for a tube which also forms a part of the die into which the bead of the tube is pressed.

Other objects and advantages of this invention will appear from the following description and claims.

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In the accompanying drawings:

Fig. 1 is a top plan view of a beading machine embodying this invention, the motor for driving the machine being shown as partly broken away.

Fig. 2 is a central sectional elevation thereof, on line 2—2, Fig. 1.

Fig. 3 is an end elevation thereof, showing the tube receiving end of the machine.

Fig. 4. is a transverse sectional elevation thereof, on line 4—4, Fig. 1.

Fig. 5 is a sectional elevation thereof, on line 5—5, Fig. 2.

Fig. 6 is an elevation, partly in section, taken on line 6—6, Fig. 2.

Figs. 7, 8, 9 and 10 are sectional elevations, taken respectively on lines 7—7, 8—8, 9—9 and 10—10, of Fig. 2.

Fig. 11 is a development of a portion of the surface of a cylindrical part of the machine, partly in section, on line 11—11, Fig. 10.

Fig. 12 is a similar development, taken along the line 12—12, Fig. 10.

Fig. 13 is a fragmentary longitudinal sectional elevation, taken on line 13—13, Fig. 10.

Fig. 14 is a fragmentary longitudinal sectional elevation similar to Fig. 2, on a larger scale, showing the parts in position to receive a tube to be beaded.

Fig. 15 is a view similar to Fig. 10, showing the parts in the positions which they occupy during the beading operation.

Fig. 16 is a fragmentary longitudinal central sectional elevation similar to Fig. 13, showing the parts in position to permit removal of the beaded tube on a machine.

The construction shown in the accompanying drawings represents one embodiment of this invention, and it will be understood that it is not intended to limit this invention to the particular construction illustrated.

In the particular machine shown, 20 represents a base or frame of the machine which may be mounted on a bench or other suitable support. 21 represents the drive shaft of the machine which is suitably journalled at one end on a bearing pedestal or support 22 suitably secured on the frame or base 20, and the intermediate portion of the shaft extends through a horizontal cylindrical aperture 24 formed in an upward extension 25 of the base. The drive shaft is mounted for rotation and also limited movement lengthwise of its axis. Any suitable means may be employed for imparting rotary motion to this shaft, such for example as a pulley 27 which is connected to the shaft by means of a spline 28, thus permit-

ting lengthwise movement of the shaft relatively to the pulley. The pulley, in the particular construction illustrated, is driven by means of the belt 29 from an electric motor 30. This motor, in the particular construction illustrated, see particularly Figs. 1 and 4, is mounted on a base 31 pivoted on the base 20 of the machine by a pin or bolt 32 in such manner that the weight of the motor applies the necessary tension to the belt 29. The pulley 27 may be held against movement lengthwise of the axis of rotation in any suitable manner, for example, by means of the bearing pedestal 22 and a bifurcated abutment member 32, the lower end of which is secured to the base 27 and which straddles the shaft 21. Any other means for driving the shaft 21 may, however, be provided.

Lengthwise movement of the drive shaft may be provided in any suitable manner, and in the construction shown, an intermediate part of the shaft is journalled by means of bearings 35 mounted on a slide member 36, that shown being substantially cylindrical in form and mounted to slide lengthwise in the cylindrical aperture 24 of the frame or housing 20. The bearings 35 in the construction shown are in the form of ball bearings and the inner races of the same are held against movement lengthwise of the shaft 21, for example, by means of a collar 37 secured to the shaft 21 by means of set screws and engaging the inner race of the adjacent ball bearing 35. In a similar manner, the inner race of the other bearing 35 is held in place by means of a hub portion or eccentric 38 which is secured to the shaft by means of set screws 39. Consequently, the shaft 21 is freely rotatable relatively to the slide member, but is held against movement lengthwise thereof.

Lengthwise movement may be imparted to the slide member 36 in any suitable or desired manner, and in the construction illustrated, see particularly Figs. 1 and 4, the slide member 36 is provided at one side thereof with rack teeth 40, with which a pinion 41 meshes. This pinion is secured to the lower end of an upright shaft 42 and an arm 43 is secured to the upper end of this shaft, the shaft being journalled in a vertical aperture formed in an upwardly and laterally extending part 44 of the frame or base 20 of the machine. Consequently, it will be obvious that as the arm 43 is swung to turn the shaft 42 and the pinion 41, which is secured thereto by means of a pin 45, movement will be imparted through the rack teeth to the slide member 36 to move the driving shaft 21 in the direction of its axis. Any other suitable or desired means may be employed for imparting lengthwise movement to the drive shaft 21. If desired, a suitable stop member 47 may be mounted on the upper face of the part 44 of the base member 20, to limit the swinging movement of the arm 43. The stop member has a threaded hole in which a stop screw may be adjustably secured in such position that the end of the stop screw may engage the lever 43 to limit the swinging thereof.

In order to form a bead in a tubular member, a gradual rolling out of the bead is preferable and in order to subject the metal of the tubular member to the least possible injurious effect, a single beading roll is preferably employed which may be only slightly smaller in diameter than the internal diameter of the tube. This roll is, consequently, driven by the eccentric 38 of the drive shaft so that its axis travels in substantially circular paths while the roll is in contact with the tubular member and by longitudinal movement of the drive shaft, the circular paths are gradually increased in diameter, thus causing the roll to exert pressure against the tubular member until the bead is completely formed, whereupon, by moving the driving shaft lengthwise in the reverse direction, the beading roll may again be withdrawn from the bead to permit the tube to be withdrawn.

In the construction shown for accomplishing this purpose, a beading roll 60 is mounted on a supporting member or holder 58 which is movable in circular paths of varying diameters, and this supporting member is driven from the eccentric 38. Since the eccentric moves in a circular path of fixed diameter about the axis of the drive shaft, means are provided for producing a variable eccentric motion of translation of the supporting member 58 from the fixed eccentric motion of the eccentric 38. In the construction illustrated by way of example, this is accomplished by using a substantially conical surface or a surface inclined to the axis of rotation of the drive shaft, through which rotation is transmitted from the drive shaft to the supporting member 58, in such manner that the inclined or conical surface during longitudinal movement of the drive shaft will result in changes in diameter of the paths of movement of the supporting member. Such conical or inclined surface may be arranged on the drive shaft or on the supporting member, or on both.

In the particular embodiment of this invention as illustrated in the drawings, the eccentric 38 of the drive shaft is constructed to impart motion in a circular path to a cone 50, and for this purpose, the cone may be mounted on or formed integral with a cone supporting member 51 which is substantially of cup-shape, having a cylindrical part 52 which extends about the eccentric 38. Preferably ball or rolling bearings 53 are interposed between the eccentric 38 and the cone supporting member 51 so that the cone supporting member 51 is free to rotate relatively to the eccentric, but during such rotation, the eccentric will produce a movement of the cone supporting member and the cone 50 in a circular path of fixed diameter. It will be noted in Fig. 2 that the cone is substantially concentric with the cone supporting member 51, so that with each revolution of the shaft 21, the cone 50 will travel in a circle about the axis of the driving shaft 21 and because of the bearings 53, the cone may rotate about its own axis with the eccentric or may be held against such rotation and describe merely a circular path. It is, of course, also possible that the cone may rotate about its own axis at a different speed than the drive shaft or may rotate in a direction opposite to the drive shaft while describing its circular path about the axis of the drive shaft.

The cone 50 extends into a conical hole 56 formed in a plug member 57 which is journalled to rotate freely in the supporting member 58 on which the circular beading tool 60 is mounted. The supporting member 58 is provided at one side thereof with a cylindrical flange or hub 61 within which the plug member 57 is rotatably mounted, for example, by means of suitable ball bearings, as clearly shown in Figs. 2 and 14. This supporting member 58 is mounted for movement in a vertical plane, and for this purpose, it is guided in a recess 64 formed in an upright standard 65 suitably mounted on the frame 20 of the machine. The supporting member 58 and

the recess 64 in which it is mounted may be of circular shape, the recess being of considerably larger diameter than the supporting member, so that the latter may move in the recess in circles of varying diameters, but, as hereinafter described, the supporting member is held against movement in the direction of its axis.

This standard 65, in the particular construction shown, is welded or otherwise secured to a base member 63, which in turn is suitably secured to the frame 20 of the machine, and suitable braces 63a and 63b are provided for holding this standard securely and accurately in upright position. The holding member 58 may be mounted in the recess 64 in any desired manner for movement in a vertical plane, and in the construction shown, the holding member is confined in the recess by a plate or cover member 69 suitably secured to the standard 65, for example, by means of bolts or screws (not shown). A pair of bearing plates 67 and 68 of suitable bearing material and of circular form are arranged at opposite sides of the supporting member 58, and these bearing plates may be provided with holes to facilitate lubrication. The supporting member 58 for the beading roll 60 is, consequently, movable in the recess 64 in accordance with the motion imparted thereto by the cone 50. The beading member may be lubricated through a lubricating aperture closed by a plug 70. Any other suitable means for mounting this supporting member for movement in circles of various diameters in a vertical plane may be provided.

Suitable means are also provided for yieldingly holding the beading roller supporting member in substantially central position within the recess 64, and in the construction shown for this purpose, a plurality of spring pressed fingers 72 are provided which are guided for movement in a direction substantially radially by means of radially extending holes in the standard 65, see particularly Fig. 7. The inner ends of these plugs or fingers engage the periphery of the holder 58 and the outer ends of the fingers have shouldered portions 73 which are formed to bear against corresponding shoulders formed in the holes or apertures in the standard for the purpose of limiting the extent to which these fingers may move inwardly toward the axis of the drive shaft 21. Springs 74 are arranged in these holes, and are confined in place therein by means of a pair of threaded plugs 75 engaging in threads formed in the outer portions of the holes in the standard 65. The inner ends of these springs bear against the fingers 72 to urge them toward the supporting member 58. One of these plugs 75 acts to lock the other plug in place, and the plugs are adjustable to vary the tension of the springs 73. Consequently, when the cone 50 is withdrawn from engagement with the walls of the corresponding conical hole or recess 56 formed in the plug member 57, the spring actuated fingers 72 will urge the supporting member into a central position, substantially concentric with the drive shaft 21. Any other means for yieldingly centering the supporting member for the beading roll 60 may be provided.

The beading tool or roll 60 may be mounted on its supporting member in any suitable or desired manner, and in the construction illustrated, this supporting member has another annular hub or cylindrical extension 78 which is preferably formed integral therewith, and within which is arranged a bearing bushing 79, see particularly Figs. 2 and 14. The beading roll 60 is preferably rigidly mounted on a stub axle or shaft 80. This stub axle extends into the bearing bushing 79 and is rotatable therein, or if desired, the stub axle may be held against rotation relatively to the hub 78, since any rotation of the beading roll 60 relatively to the tube will in that case produce corresponding rotation of the supporting member 58. The beading roll also has a cylindrical portion 81 formed concentric therewith and which spaces the beading roll from a stop plate or disk 82 against which a tube 83 to be beaded may abut. The cylindrical part 81 serves to prevent the end of the tube beyond which the bead 84 extends from becoming deformed during the beading operation, or, if deformation results, to roll this end of the tube back to its former position. Beading rolls or tools of other shapes and sizes may, of course, be employed, and if a beading roll of another size or shape is to be used, it is merely necessary to pull the beading roll to the right in Figs. 14 and 15, so that the stub shaft 80 thereof is removed from its bearing bushing 79, and to replace the beading roll with another one.

The bead 84 is formed by the beading roll 60 in connection with a die including a die member 90 which is suitably mounted on the standard 65. This die member 90 is of substantially annular form and is mounted concentrically with reference to the axis of the drive shaft 21. In order to ensure the mounting of the die member 90 in correct relation to the standard and securely holding it in such relation, this member is provided with an annular projection 91 formed to extend into an annular recess formed in the cover plate 69. The die member 90 also has a pair of outwardly extending lugs 92 shown in Fig. 1, and in broken lines in Fig. 3, which are apertured to receive suitable bolts or screws for removably securing the die member on the cover plate 69.

The die member has a die portion which is shaped to form the bottom and one side wall of the recess into which the bead 84 of a tube may enter. This die member for this purpose is provided with an annular inwardly extending projection or shoulder 94, see Figs. 2 and 13 to 16, which is formed to receive the end of the tube beyond the bead and to cooperate with the cylindrical part 81 of the beading roll 60 to hold the end of the tube beyond the bead in correct position, or to cooperate with the cylindrical part 81 to roll this end of the tube into correct position. The die member is also provided with an annular recess 95 into which the bead may enter. This recess terminates in a radial wall 96, the outer edge of which terminates in an annular hub or cylindrical extension 97.

Suitable means are provided for gripping the tube 83 during the beading operation and for again releasing the same when the formation of the bead is completed. In the construction shown for this purpose, I provide a chuck including jaws 100 of annular form formed in a plurality of equal sections, four such sections being shown in the drawings, see also Figs. 8 and 9. The sections of the jaw 100 are provided with radially extending surfaces formed to slide against the radial surface 96 of the die member 90 into and out of gripping engagement with the tube to be beaded and these jaw members also form the outer side wall of a die recess formed by the parts 94 and 95 of the die member 90. The parts of the jaw member are so formed that when they are moved into

their inner or gripping positions, they will form a substantially unbroken circular wall for the bead recess of the die member.

The parts of the jaw member 100 are movable into their operative positions, as shown in Figs. 13, 14 and 15, by means of a guide member 110 for the tubes. This guide member is of annular form, and the outer periphery has a slidable bearing in the interior of the hub or cylindrical portion 97 of the die member. This guide member has a flaring inner surface 111 which guides the end of a tube to be beaded toward its correct position with reference to the machine, and the sections of the jaw 100 also have inwardly inclined faces 112 with which a tube may engage for properly centering the same with reference to the die member 90.

Means are provided for moving the sections of the jaw 100 toward each other to grip the tubular member to be beaded. In the construction illustrated, the guide member 110 serves this purpose, and consequently, the guide member has an inclined or frusto-conical annular portion 114, which engages similarly inclined faces of the sections of the jaw 100. Consequently, if the guide member 110 is moved inwardly with reference to the hub or cylindrical part 97 of the die member, the sections of the jaw 100 will be moved inwardly into the tube gripping positions.

In the operation of the apparatus as thus far described, a tube to be beaded is inserted into the tube guide member 110 and engages the frusto-conical faces 112 of the sections of the jaw member, and is then inserted into the position shown in Fig. 14, in which the end of the tube engages the stop member or projection 82 of the beading roll. The sections of the jaw 100 are then moved into gripping engagement with the tube for holding the tube in fixed relation to the die member during the beading operation, this being accomplished by moving the guide member 111 into the cylindrical extension 97 of the die member by means of any suitable mechanism, one type of mechanism for this purpose being hereinafter described. The tube is then in position for beading, and assuming that the motor is driving the drive shaft 21 of the machine, the lever 43 is then swung in a clockwise direction in Fig. 1, thus turning the pinion 41 to move the slide member 36 to the right in Fig. 1, by means of the rack teeth formed on this member. This causes the cone 50 to enter into the conical recess 56, and since the cone 50 is mounted on an eccentric, this tends to produce a circular motion of the beading roll 60 and the supporting member 58 therefor. This circular motion will vary according to the extent to which the lever 43 is swung. When the cone 50 first enters into the conical recess, as shown in Fig. 14, there may be no motion whatever of the beading roll 60, but as the cone is forced to enter to a greater extent into the recess 56 by axial movement of the driving shaft 21, the axis of the beading roll will swing in larger circles. Consequently, by applying pressure on the lever 43, the cone 50 through the medium of the mechanism described will wedge the supporting member 58 and the beading roll 60 carried thereby outwardly so that these parts will move in the larger circles, causing the beading roll to be forced against the inner surface of the tube. The metal of the tube is, consequently, gradually expanded outwardly into the recess 95 of the die. The lever 43 is swung until the bead of the desired depth has been formed on the tube 84 and when this depth has been reached, the set screw 48 may be adjusted to stop the lever 43 in this position, so that all tubes of a similar size may be rapidly beaded by swinging the lever to the point at which the lever contacts the stop screw 48. It will be noted that because of the bearings between the plug member 57 and the beading roll supporting member, and because of the further bearing between the stub shaft 80 and its bearing bushing 79, the beading roll 60 receives no rotary motion about its axis from the driving shaft, but its axis is rotated in circles, the diameter of which depends upon the position of the cone 50 with reference to the conical recess 56. Consequently, in forming the bead, the beading roll 60 rolls on the inner surface of the tube and, consequently, no abrasion or rubbing action of the beading roll on the tube results. After the bead has been partly formed, the cylindrical portion 81 of the beading roller will cooperate with the inward projection 94 of the die member so that if the end of the tube beyond the bead has been deformed by the beading operation, the cylindrical member 81 will roll this end of the tube back into its original shape against the projection 94.

At the completion of the beading operation, the parts will occupy the positions shown in Fig. 15, and the guide member 110 for the tube may then be moved to the right in Fig. 15 into the position shown in Fig. 16, whereupon the parts of the jaw are free to move outwardly into the position shown in Fig. 16, so as to permit the bead of the tube to be withdrawn out of the recess in the die member, whereupon another tube may be inserted and the operation repeated.

The machine is so constructed that it may operate on tubes of a number of different diameters, which requires the replacement of the die member, the jaw member 100, the tube guide member 110, and the beading roll 60, by corresponding parts formed to operate on tubes of different sizes, and in the construction illustrated the same mechanism which is used to contract the jaw member 100 also serves to facilitate the removal of those parts necessary to enable the machine to operate on tubes of different sizes or on tubes of the same size to form different beads thereon. This construction includes a swinging member comprising an annular portion 120, one end of which is hinged on the upright standard 65 of the machine. This hinge is formed partly on a bracket 121 which may be welded or otherwise secured on the upright standard 65, and which has a pair of hinge lugs 122 spaced apart to receive a hinge part 124 which may be formed integral with the annular part 120. This annular part also has a projection 125 at the side thereof opposite to the hinge and which is provided with an open ended slot 126, Fig. 3, into which a link 127 may enter. The outer end of the link 127 is threaded and cooperates with a nut 128 formed to engage the projecting part 125 of the hinged annular member 120. Tension may be applied to the link 127 for swinging the hinge member on its hinge in any suitable manner, and in the construction illustrated, this tension may be applied by means of an upright pin or shaft 130 which is journalled in a bearing bracket 131 having an arm or part 132 which may be welded or otherwise secured to the upright standard 65 of the machine. This pin or shaft 130 may be turned in its bearing by means of an arm or handle 133 suitably secured to the upper end of the shaft 130. The shaft has a lower end portion 135 of

larger diameter which limits the extent to which the shaft may be moved upwardly with reference to its bearing 131 and at the upper end of the shaft a stop collar 135 is provided which is held in place on the shaft by means of a pin 137 extending through suitable holes formed in the shaft and stop collar, and the pin extends outwardly beyond the stop collar, for reasons hereinafter more fully explained.

The lower end of the shaft 130 is provided with a crank or eccentric projection 138 shown in broken lines in Fig. 1, and the link 127 has an eye or eccentric strap 139 formed thereon into which the crank or eccentric projection 138 extends. The lower end of the crank or eccentric projection of the shaft may be threaded to receive a nut 140, which together with a washer 141, Fig. 3, holds the link 127 in place on the crank or eccentric projection of the upright shaft 130. Consequently, it will be obvious that when the handle 133 is turned, the link 127 is moved in a direction to swing the hinged member 120 on its hinge toward the middle portion of the machine or to release the link to permit the hinged member to swing in the opposite direction.

It may be desirable to provide a stop for limiting the swinging movement of the handle 133, and for this purpose, a plate or bracket 145 may be welded or otherwise secured to the bearing bracket 131 for the upright shaft 130. A set screw 146 may extend through a threaded hole in the plate or bracket 145 and extend into a position to engage the stop pin 137, and thus stopping further rotation of the eccentric shaft 130. The set screw 146 may be locked in place by means of a lock nut, as shown in Fig. 1.

The annular portion of the swinging or hinged member 120 extends loosely around a ring 150 which is slidably mounted on the outer face of the annular extension 97 of the die member 90 and sliding movement of the ring 150 is effected by the swinging of the hinged member. For this purpose, the hinged member is provided at its upper end with a screw or pin 151 extending radially through a threaded hole in the hinged member 120 and having its lower end formed to enter into a hole 152 formed in the slidable ring 150. The lower end of the hinged member is provided with a screw or pin 153, the inner end of which is formed to fit into a hole or slot 154 formed in the lower portion of the slidable ring 150. It will, consequently, be evident that the swinging of the hinge member about its hinge to a limited extent will result in movement of the slidable ring 150 on the projection 97 of the die member.

Means are provided for transmitting the movement of the slidable ring 150 to the tube guide member 110, and in the construction shown for this purpose, see particularly Figs. 10, 13 and 16, the cylindrical part 97 of the die member is provided with a plurality of longitudinally extending slots 158, and pins 159 are provided which have their inner ends screwed or otherwise fastened to the tube guide member 110. These pins extend through the slots 158 of the cylindrical part 97 and their outer portions extend into suitable holes formed in the slide ring 150. Three such pins and three slots 158 are shown by way of example in the drawings. The holes in the slide ring into which the pins 159 extend are preferably in the form of bayonet slots 160, as shown more clearly in Figs. 11 and 12, so as to facilitate the assembly and dismantling of these parts. Any other suitable means for moving the guide ring 110 lengthwise to actuate the tube gripping jaw member 100 may be provided.

In the operation of this part of the machine, the tube guide member 110 may be moved to actuate the jaw 100 by turning the handle 133 which in turn moves the link 127 in a direction to swing the hinged member 120 about its hinge toward the machine. This swinging motion is transmitted to the slide ring 150 through the medium of the pins or screws 151 and 153, and the slide ring operates the tube guide member 110 through the pins 159 to move the jaw member 100 into the position shown in Figs. 13, 14 and 15 for gripping the tube and holding the same while the bead is being formed thereon. When the arm 133 is swung in the opposite direction to move the link 127 to the right in Fig. 1, the tube guide member 110 will be moved to the right into the position shown in Fig. 16, so that the parts of the jaw 100 may be separated to permit the beaded tube to be withdrawn from the die.

When it is desired to change the machine to operate on different tubes of different sizes, or to form a different type of bead on the same size tube, the tension on the link 127 is released by swinging the handle 133, and the nut 128 on the link 127 may then be turned out of engagement with the projection 125 of the hinge member, whereupon the link 127 may be swung out of engagement with the projection 135 of the hinge member. This member can then be released from the sliding ring 150 by unscrewing the pin or screw 151 sufficiently to enable this screw to disengage the slidable ring, and if desired, the other screw 153 may also be unscrewed, or if the same engages in a slot, such as the slot 154 shown in Fig. 2, the hinge member can then be swung out of the way clear of the sliding ring 150. The sliding ring can readily be disconnected from the tube guide member 110 by turning the sliding ring so that the pins 159 may pass through the open ends of the angle-shaped or bayonet slots 160. The screw-threaded pins 159 can then readily be unscrewed from the tube guide member 110 and moved out of these slots 158 of the cylindrical extension 97 of the die member 90, whereupon the tube guide member 110 and the parts of the jaw 100 can readily be removed from the interior of the tubular extension 97 of the die member 90. If it is also necessary to remove the die member to replace the same by one of a different shape or size, it is merely necessary to release the screws extending through the lugs 92 of the die member. The beading roll 60 can be removed by merely moving the same to the right in Figs. 2, 14 and 15, so that the stub shaft 80 will slide out of its bearing bushing 79. All of the other parts of the machine may be left unchanged to operate on tubes of various sizes. In operating on a tube of relatively small diameter to form a comparatively small bead thereon, the cone 50 will enter the conical opening 56 to a lesser extent by operation of the lever 43.

As will be seen from the foregoing description, the machine is of relatively simple construction and can operate very efficiently on beading tubes. When the parts are all set up for forming beads on a number of tubes of the same size, it is merely necessary for the operator to insert the tubes one at a time into the tube guide 110 and past the jaw 100 into engagement with the stop plate or disk 82. The operator then swings the handle or arm 133 into a pre-adjusted stop position as determined by the stop screw 146, and the operator then swings the lever 43 to cause the cone 50 to

enter the conical recess 56 and thus move the axis of the bead roll in a substantially circular path and to exert a pressure on the bead roll in a direction to urge the same outwardly against the tube. The speed with which the bead is formed may be regulated by the rate of movement of the lever 43 toward the stop screw 48 which has previously been adjusted to determine the extent to which the tube is to be beaded. When the lever 43 contacts the stop screw 48, it is swung in a counterclockwise direction in Fig. 1, and the handle 133 is moved in a direction to release the tube, whereupon the tube is pulled out of the machine and another tube inserted in its place for beading.

Because of the rolling bearings provided, the cone 50 will roll in the recess 56 and will impart to the beading roll supporting member 58 a movement of translation in generally circular paths. The supporting member, however, is free to turn on its axis within the recess 64, so that a rotary movement may be combined with the movement of translation without in any way affecting the operation of the machine. The recess 56 need not be conical in shape, the conical form being employed merely to provide an extended bearing between the cone and the recess. Similarly, if the recess 56 is of conical form, the cone 50 may be replaced by an outwardly extending finger or projection of any other shape to operate in the conical recess.

I claim as my invention:

1. In a machine for beading tubular members, the combination of a rotatable drive shaft mounted to also move axially, an eccentric on said drive shaft, a beading roll, a supporting member on which said beading roll is mounted, said supporting member being mounted for movement only in a plane extending transversely of the axis of said shaft and beading roll, and a driving connection between said eccentric and said supporting member, and including means for imparting circular motion to said supporting member from said eccentric, said means including a wedge-shaped part actuated by the lengthwise movement of said drive shaft for varying the path of movement of said supporting member to urge said beading roll against said tubular member to be beaded when said drive shaft is moved axially.

2. In a machine for beading tubular members, the combination of a rotatable drive shaft mounted to also move axially, an eccentric on said drive shaft, a beading roll, a supporting member on which said beading roll is mounted, said supporting member being mounted for movement only in a plane extending transversely of the axis of said shaft and beading roll, and a driving connection between said eccentric and said supporting member including a part driven by said eccentric in a fixed circular path and connected with a part on said supporting member, at least one of said parts having a wedge-shaped portion to vary the path of movement of said supporting member when said drive shaft is moved axially.

3. In a machine for beading tubular members, the combination of a die for cooperating with a tubular member, a beading roll for cooperation with said tubular member and said die to form a bead on a tubular member, a supporting member on which said beading roll is mounted, said supporting member being mounted for substantially circular motion in a plane parallel to the bead to be formed, a drive shaft for applying circular motion to said supporting member, and means for varying the size of the circles in which said supporting member travels including a cone-shaped part and a part having a conical recess into which said cone-shaped part may enter in eccentric relation thereto, one of said parts being driven by said drive shaft and the other part being on said supporting member.

4. In a machine for beading tubular members, the combination of a die for cooperating with a tubular member, a beading roll for cooperation with said tubular member and said die to form a bead on a tubular member, a supporting member on which said beading roll is mounted, said supporting member being mounted for substantially circular motion in a plane parallel to the bead to be formed, a drive shaft for applying circular motion to said supporting member, a driving connection between said shaft and said supporting member including a part having a substantially conical surface with its axis extending substantially parallel to said drive shaft, and means for producing relative motion between said drive shaft and said supporting member to cause said conical surface to vary the size of the circles in which said supporting member moves.

5. In a machine for beading tubular members, the combination of a die for cooperating with a tubular member, a beading roll for cooperation with said tubular member and said die to form a bead on a tubular member, a supporting member on which said beading roll is mounted, said supporting member being mounted for substantially circular motion in a plane parallel to the bead to be formed, a drive shaft for applying circular motion to said supporting member and mounted to rotate and also to move lengthwise to a limited extent, a drive connection between said drive shaft and said supporting member which includes a substantially conical part eccentrically mounted on said drive shaft and connected with said supporting member for transmitting circular motion thereto, said conical member varying the diameters of circles in which said supporting member moves when said drive shaft and said conical member are moved lengthwise of the axis of said drive shaft.

6. In a machine for beading tubular members, the combination of a die for cooperating with a tubular member, a beading roll for cooperation with said tubular member and said die to form a bead on a tubular member, a supporting member on which said beading roll is mounted, said supporting member being mounted for substantially circular motion in a plane parallel to the bead to be formed, a drive shaft for applying circular motion to said supporting member and mounted to rotate and also to move lengthwise to a limited extent, and a driving connection between said shaft and said supporting member comprising a conical part and a part having a recess of generally circular cross section into which said conical part may enter, one of said parts being eccentrically mounted on said shaft, and the other part being mounted on said supporting member concentric with said beading roll, whereby lengthwise movement of said shaft varies the size of circles in which said supporting member is moved by said drive shaft.

7. In a machine for beading tubular members, the combination of a die for cooperating with a tubular member, a beading roll for cooperation with said tubular member and said die to form a bead on a tubular member, a supporting member on which said beading roll is mounted, said sup-

porting member being mounted for substantially circular motion in a plane parallel to the bead to be formed, a drive shaft for applying circular motion to said supporting member and mounted to rotate and also to move lengthwise to a limited extent, a cone mounted eccentrically on said drive shaft with its axis extending substantially parallel with the axis of said drive shaft, a part mounted on said supporting member and having a conical recess into which said cone may enter for moving said supporting member in circular motion and for varying the size of the circles in which said supporting member moves when said shaft is moved lengthwise.

8. In a machine for beading tubular members having a beading roll arranged with its axis movable in a circular path to form a bead on a tubular member, that improvement which comprises driving means for said beading roll, including a supporting member on which said beading roll is mounted and which is mounted for movement in generally circular paths, a driving shaft, a part eccentrically mounted on said driving shaft and connected with said supporting member for imparting circular motion thereto, and wedge means in said driving connection and actuated by relative axial movement of said supporting member and said drive shaft for varying the size of circles in which said supporting member is moved and for pressing said beading roll against the tubular member.

9. In a machine for beading tubular members having a beading roll arranged with its axis movable in a circular path to form a bead on a tubular member, that improvement which comprises a supporting member on which said beading roll is mounted, a fixed standard having a recess therein extending transversely of said beading roll, and in which said supporting member is arranged for circular motion, a die mounted on said standard and with which said beading roll cooperates to form a bead on a tubular member, and means for imparting circular motion to said supporting member, said means being adjustable to move said supporting member in circles of different diameters.

10. A machine for forming an outwardly extending bead on a tubular member, including a stationary standard, a die member mounted on said standard to receive a tubular member to be beaded and having a recess therein into which the bead may enter, a gripping member for holding the tubular member during the beading operation, a beading roll of a size formed to extend into the tube, a supporting member for said beading roll and mounted for substantially circular movement on said standard, and means for imparting circular movement to said supporting member to move in circles of varying diameters, to enable said beading roll to be pressed into engagement with the inner surface of the tubular member to form a bead thereon.

11. A machine for forming an outwardly extending bead on a tubular member, including a stationary standard, a die member mounted on said standard to receive a tubular member to be beaded and having a recess therein into which the bead may enter, a gripping member for holding the tubular member during the beading operation, a beading roll of a size formed to extend into the tube, a supporting member for said beading roll and mounted for substantially circular movement on said standard, means for imparting circular movement to said supporting member to move in circles of varying diameters, to enable said beading roll to be pressed into engagement with the inner surface of the tubular member to form a bead thereon, said means including a rotatable driving shaft movable lengthwise, and an eccentric driving connection between said shaft and said supporting member including a part having a surface inclined with reference to the axis of said drive shaft, whereby lengthwise movement of said shaft varies the size of the circles in which said supporting member is moved.

12. A beading machine according to claim 11, and which includes resilient means for urging said supporting member into a position in which the beading roll is substantially concentric with the tube to be beaded.

13. In a machine for forming circular outwardly extending beads on a tubular member, including a die within which said tubular member is held for beading, a beading roll arranged to extend into said tubular member and to cooperate with said die for forming a bead on said tubular member, a supporting member on which said beading roll is mounted, means for guiding said supporting member for circular movement in a plane parallel with the bead to be formed, a member rotatably and axially mounted on said supporting member and having a substantially conical recess therein, a drive shaft mounted to rotate and also to move in the direction of its length, an eccentric on said drive shaft, and a part rotatably mounted on said eccentric and having a portion extending eccentrically into said conical recess for imparting circular motion to said supporting member, and means for shifting said drive shaft in the direction of its length to move said portion entering into said conical recess into and out of said recess for varying the size of circles in which said supporting member moves and thereby pressing said beading roll against the inner face of said tubular member to form a bead thereon.

14. In a machine for forming circular outwardly extending beads on a tubular member, including a die within which said tubular member is held for beading, a beading roll arranged to extend into said tubular member and to cooperate with said die for forming a bead on said tubular member, a supporting member on which said beading roll is mounted, means for guiding said supporting member for circular movement in a plane parallel with the bead to be formed, a part rotatably mounted on said supporting member and having an axially extending aperture therein, a drive shaft mounted to rotate and to move in the direction of its length, and eccentric on said shaft, a part rotatably mounted on said eccentric and having a conical portion substantially coaxial with said eccentric and mounted to extend into said recess in eccentric relation thereto to impart rotary movement to said supporting member, and means for moving said shaft lengthwise to cause said conical member to enter to varying extents into said recess to vary the radii of circles in which said supporting member is moved and thereby to press said beading roll against the tubular member to form a bead thereon.

15. In a machine for forming outwardly extending circular beads on tubular members, including a fixed standard, a die member mounted on said standard to receive a tubular member to be beaded, a supporting member mounted for movement in generally circular paths parallel to the bead to be formed, a beading roll mounted on said supporting member in position to extend into the tubular member to be beaded, a tube grip-

ping jaw formed of a plurality of sections movable into and out of gripping relation to a tubular member and forming with said die member a recess into which the bead may enter, means cooperating with said jaw member for urging the sections thereof into gripping engagement with said tube and for releasing said sections to permit the beaded tube to be removed from the machine, and means for imparting circular motion in circles of varying radii to said supporting member for pressing said beading roll against the interior of a tubular member while the axis of said beading roll is moved in a generally circular direction by said supporting member.

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