D. F. DOMIZI.

TUBING MACHINE.

APPLICATION FILED AUG. 7, 1919.

1,429,328.

Patented Sept. 19, 1922.

4 SHEETS—SHEET 1.

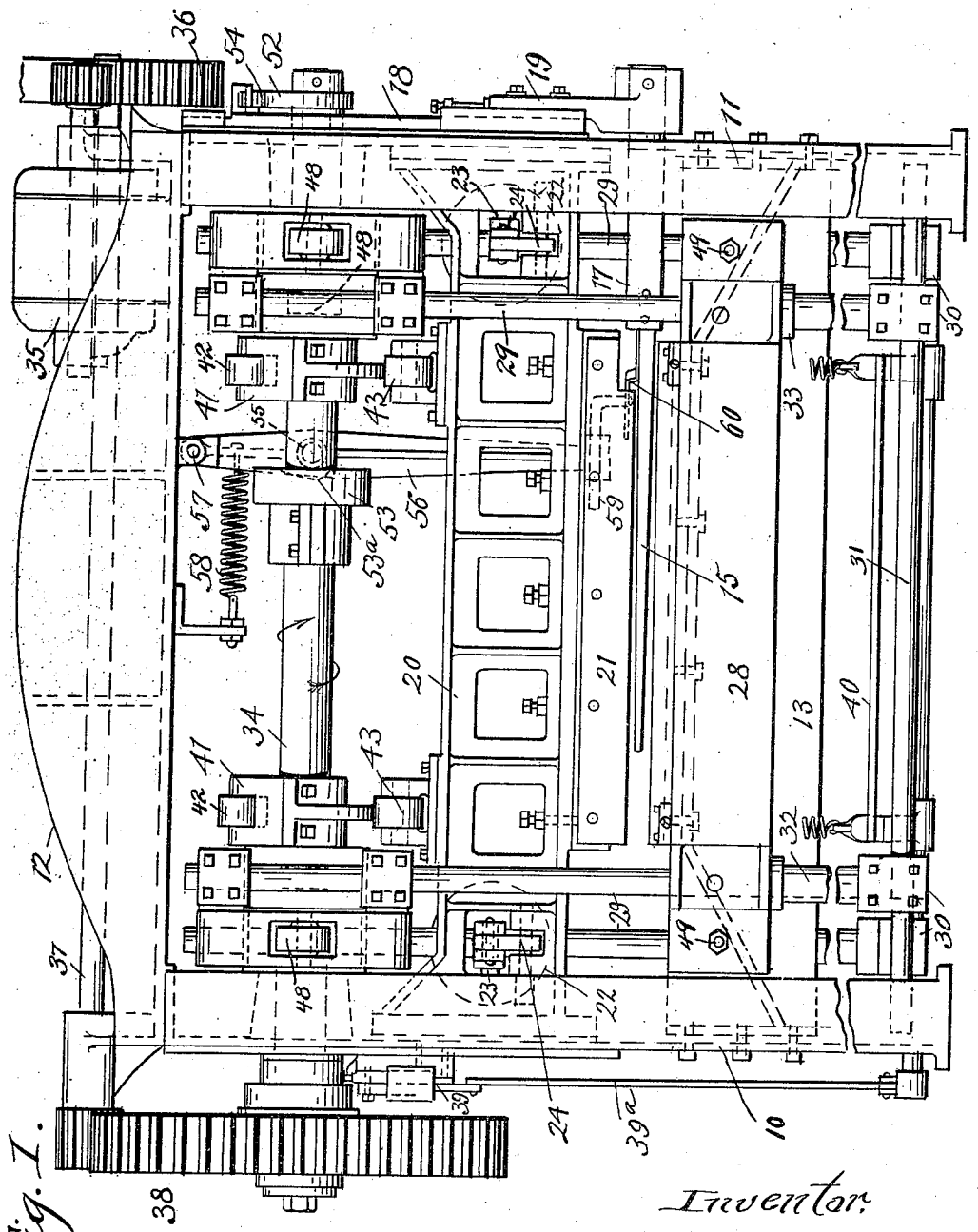

Fig. 1.

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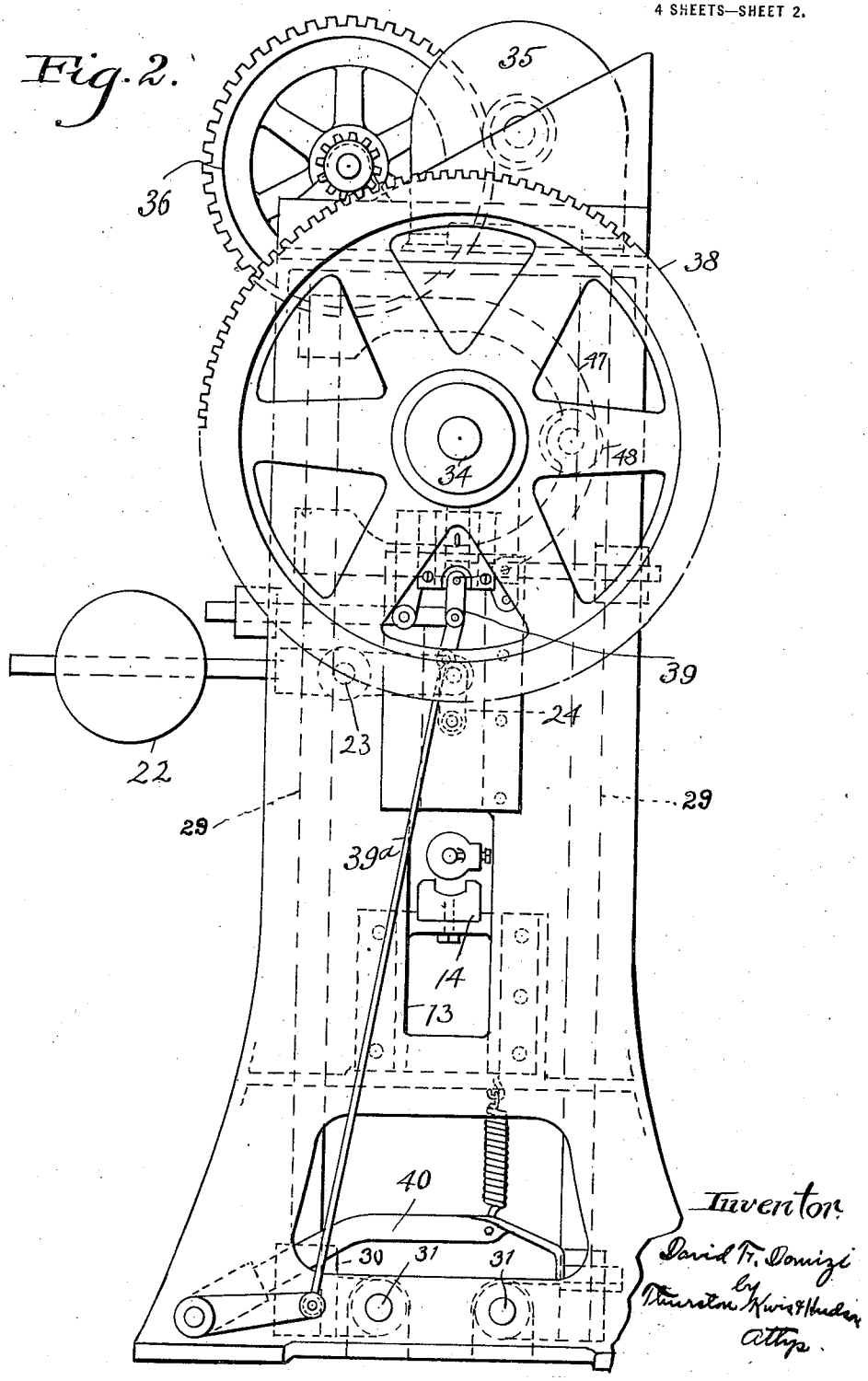
Fig. 2.



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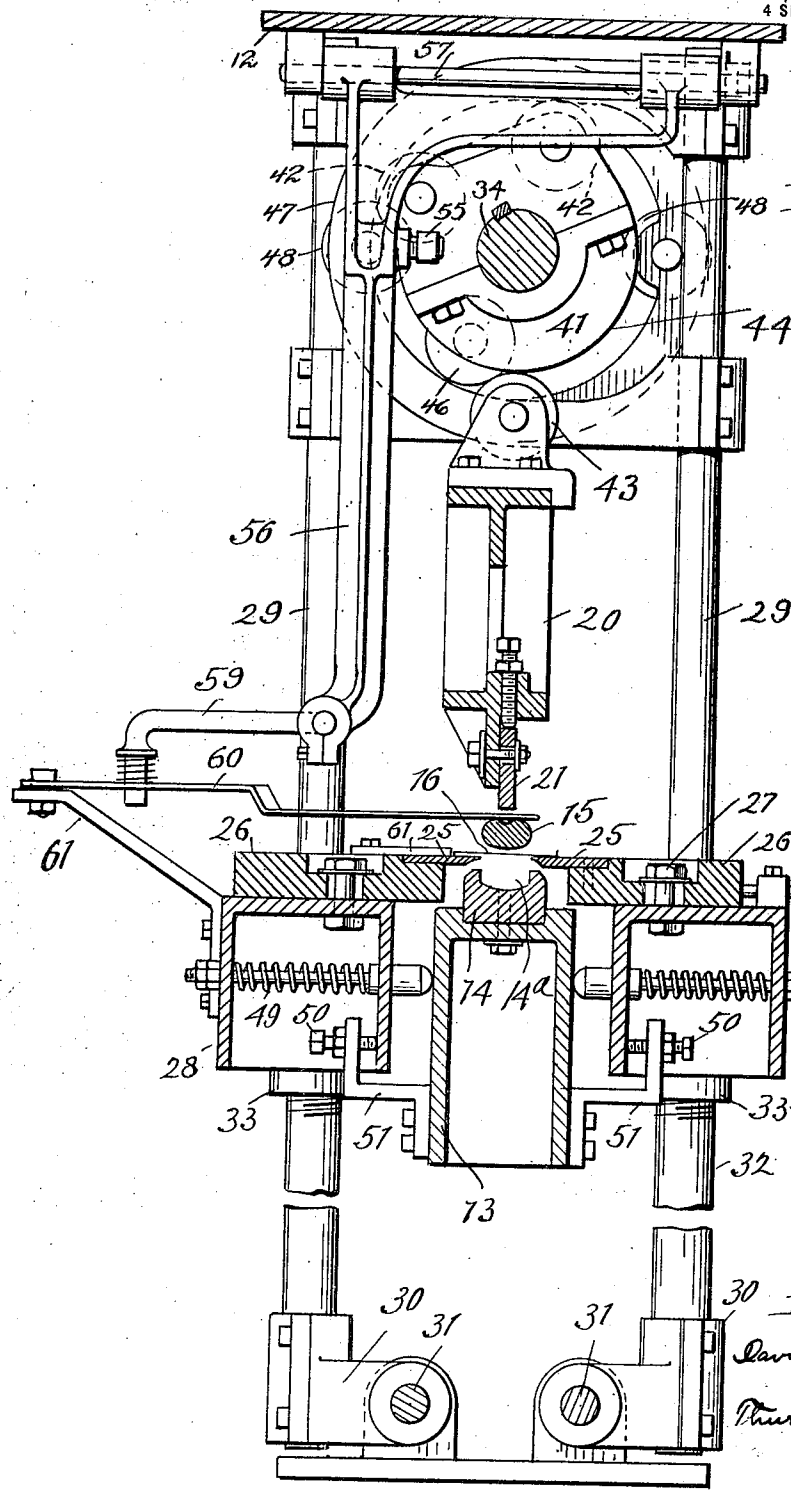

Fig. 3.

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4 SHEETS—SHEET 4.

Fig. 4.

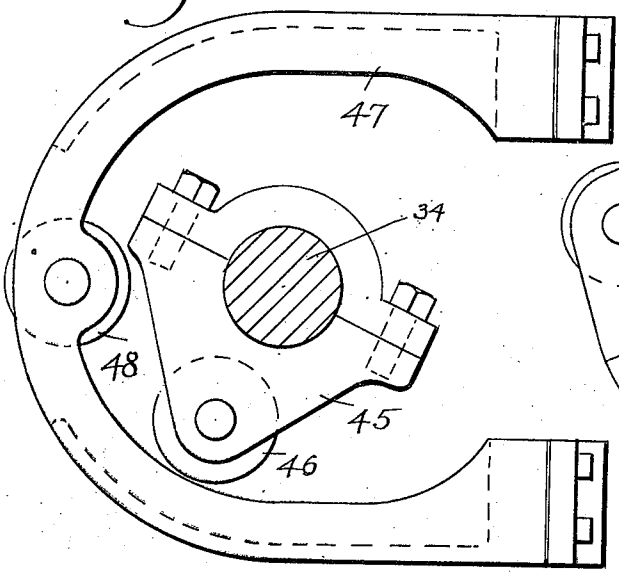


Fig. 4a

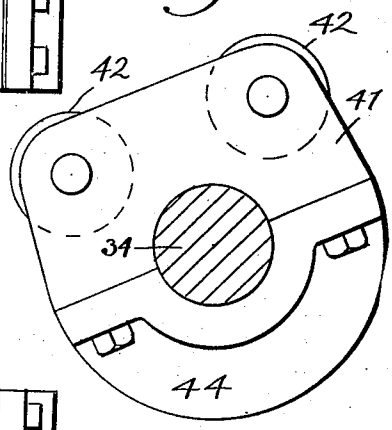


Fig. 5.

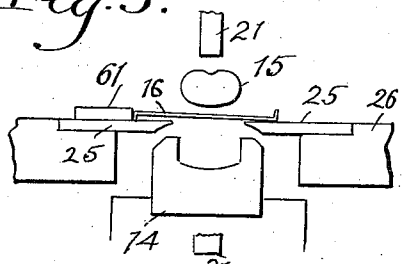
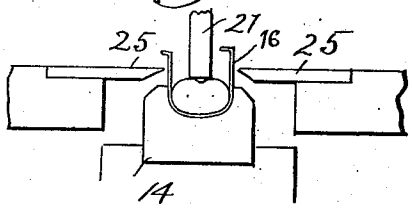


Fig. 6.



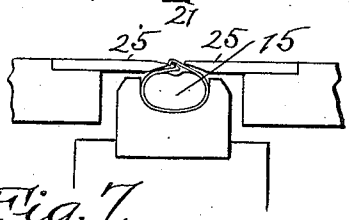
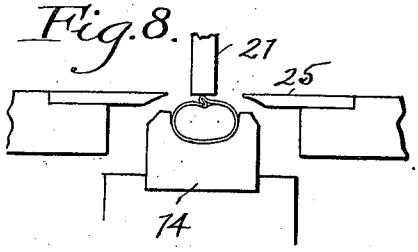


Fig. 7.

Fig. 8.



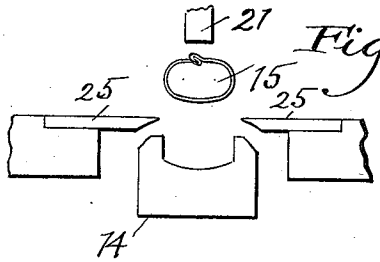


Fig. 9.

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UNITED STATES PATENT OFFICE.

DAVID F. DOMIZI, OF CLEVELAND, OHIO.

TUBING MACHINE.

Application filed August 7, 1919. Serial No. 315,845.

To all whom it may concern:

Be it known that I, DAVID F. DOMIZI, a citizen of the United States, residing at Cleveland, in the county of Cuyahoga and State of Ohio, have invented a certain new and useful Improvement in Tubing Machines, of which the following is a full, clear, and exact description.

This invention relates to a tubing machine for forming tubes from flat sheet metal stock by bending the stock around a mandrel and folding and then pressing the edges into a longitudinally extending seam. The invention has special utility in forming bow sockets though it is not confined in its use to articles of that kind, but may be employed for forming tubes for other purposes, either straight or tapered.

The principal object of this invention is to provide a reliable tubing machine, which works rapidly, and either continuously or intermittently as desired, with all operations with the possible exception of the feeding of the stock performed automatically.

Further the invention aims to provide a machine which does effective and neat work, especially in forming the seam tight and uniform from end to end of the tube.

The invention consists in certain novel details of construction and combinations and arrangements of parts which will be described in the specification and set forth in the appended claims.

In the accompanying sheets of drawings wherein I have shown one embodiment of my invention which operates with high efficiency, Fig. 1 is a side view of the machine; Fig. 2 is an end view looking toward the right of Fig. 1; Fig. 3 is a vertical sectional view; Fig. 4 is an enlarged detail view illustrating certain co-operating cam members which actuate one of the folding jaws; Fig. 4ª is a similar view of a cam which actuates the rail or cross-head carrying the pressing blade; and Figs. 5 to 9 are diagrammatic views illustrating different steps in the cycle of operation in forming the tubes.

Referring now to the drawings it will be observed that the machine includes a heavy frame composed of two vertical end members 10, 11, connected together at the top by a top member 12, and by a lower cross member 13 which extends between, and is secured to the end members 10 and 11, this cross member 13, constituting a die carrier or bed on the upper face of which is secured a die 14, consisting of a bar or block with a longitudinally extending, upwardly facing groove 14ª sufficient in size transversely considered, and in length, to receive a mandrel 15 about which the stock, which is indicated at 16, is bent to form the tube. The mandrel is carried by a vertically movable member 17, (see Fig. 1) which projects laterally outward through a slot in the end frame member 11, and is carried by a vertical slide 18 guided for up and down movement on the outer face of the end frame member 11, and controlled in the manner hereinafter explained. Ordinarily, i. e. prior to the starting of the tube forming operation, the mandrel 15 extends in substantially horizontal position above the slot of the die, as indicated in Fig. 3. In this instance the mandrel is tapered, as the machine here shown is adapted for forming tapered bow sockets, but, of course, the shape of the mandrel will depend upon the character or form of the tube which is to be produced from the flat stock. The mounting of the mandrel in the holder is such that the mandrel can be readily removed or secured in position, thus adapting the machine for quick interchange of mandrels for various sizes or types of tubes. Before leaving the mandrel and its mounting it might be stated that the normal position of the mandrel with respect to the die can be readily varied since the mandrel supporting member 17 includes an extension 19 which is bolted to the slide 18 in such a manner that the relative positions of the parts 18 and 19 can be varied as desired. The part 19 may be provided with bolts such as shown at the right hand side of Fig. 1, which extend through elongated slots of the slide 18.

The tube forming mechanism includes in addition to the die and mandrel above explained, a vertically movable cross-head or rail 20, which is guided at its ends on the inner faces of the end frame members 10 and 11. This cross-head or rail carries what may be termed a presser strip or blade 21 which is directly above the mandrel 15, as clearly shown in Fig. 3. The cross-head is normally held in elevated position by a pair of weights 22 (see particularly Fig. 2) mounted

on inwardly projecting studs 23 on the end frame members and connected by short links 24 to the end portions of the cross-head. As will subsequently appear, the function of this cross-head and blade 21 is to press the mandrel down into the slot of the die so as to fold the flat stock 16 into substantially U-shape, and subsequently to form a seam when the crimped edges of the stock have been interlocked by being bent inwardly by folding jaws.

These folding jaws 25 are in the form of substantially horizontal blades supported and mounted so as to swing toward and from each other just above the die 14, the support and manner of actuating these jaws forming one of the important parts of this invention. The jaws are in this instance carried by a pair of substantially horizontally disposed flat plates or bars 26 adjustably secured by bolts 27, to a pair of cross members 28 disposed on opposite sides of the bed 13. Each of these cross members 28 is clamped to a pair of upright swinging arms or rods 29, one pair being on one side of the machine, and the other pair being on the opposite side, these rods being secured at their lower ends to pivot or hinge members 30 mounted to turn on horizontal rods 31 at the bottom of the machine.

For the purpose of adjusting the height of the cross members 28, and hence of the jaws 25 and jaw supporting blocks 26 which are mounted on the cross members 28, in this instance I provide on the swinging arm 29 between the cross members 28 and the pivoting or hinging members 30, sleeves 32, provided at their upper ends with adjusting nuts 33 on which the cross members rest. I do not regard this detail, however, as essential, since any suitable means may be provided for this purpose.

As will subsequently appear, the folding jaws are designed to be moved inwardly and outwardly, or at least inwardly, by swinging the upright arms 29 through the medium of devices provided at the upper ends of the rods, and cam members carried by the main actuating shaft 34.

It is another important feature of my invention, that the cams or equivalent devices which actuate all the different parts of the machine are carried by this one shaft 34, the machine being designed with this end in view, to bring about correct timing of the operating parts, and to prevent derangement or improper mounting of cams, since all cams can be fastened in place by a single keyway and when once properly designed, are therefore required to function in a predetermined timed relationship.

This shaft 34 is rotatably supported in the end frame members 10 and 11 near the top of the machine, a short distance below the top frame member 12. The shaft is designed to be rotated either continuously or intermittently by a motor 35 mounted on the top frame member 12, near the end frame member 11, and connected by reduction gearing indicated as a whole by the reference character 36, to a horizontal cross shaft 37, in turn connected by reduction gearing including a large gear 38, to the operating shaft 34. This gear is designed to be clutched to, and unclutched from the shaft 34 by any suitable clutch mechanism common in machines of this kind, this clutch mechanism including clutch operating parts 39, shown in Fig. 2, connected by a rod 39a to a foot pedal 40 at the bottom of the machine. If the operator holds the foot pedal depressed, the shaft 34 is rotated continuously, or until the pedal is released, or if the operator desires the shaft to be stopped after one cycle of operations is completed, he will depress the foot pedal and then release it so that the shaft will stop after making one rotation, as is well understood. It might be mentioned, however, at this point, that the design of the present machine is such that the tube is actually formed in only a small part of the revolution of the shaft 34, thus allowing an ample portion of the time consumed in one complete cycle for placing stock in position on the machine. By reason of this feature it has been found that the machine can be operated continuously, rather than intermittently as is the case with all prior machines of this character of which I am aware.

For the purpose of operating the cross-head 20 and presser blade 21, the shaft 34 is provided with two cams 41, one of which is shown in detail in Fig. 4a. Each cam 41 carries two rollers 42, each pair adapted to successively engage a roller 43 mounted on the top of the cross-head 20, these rollers being so disposed that as the shaft 34 is rotated, the rollers of the two cams engage the cross-head rollers 43 with a direct downward thrust so as to lower the cross-head, the cross-head being elevated by the weights 22, as previously explained when the rollers 42 ride off the cross-head rollers 43. The two rollers 42 of each cam 41 are disposed a sufficient distance apart, in this case 90° apart, so as to cause the cross-head to be lowered twice in each cycle of operations with the desired interval of time between the lowering operations to admit of the functioning of other parts instrumental in forming the tube, as will be explained presently. When the cam rollers 42 ride off the cross-head rollers 43, arc-shaped sections 44 of the cam ride over the rollers 43 of the cross-head so as to hold the latter stationary during the major portion of the cycle of the machine.

To operate the folding jaws, the operat-

ing shaft 34 is provided with four cams 45, (a detail of one of which is shown in Fig. 4), each provided with a roller 46, the four cams being arranged in two pairs, each pair being near one end of the shaft, just outside of one of the cross-head lowering cams 41, and the cams of each pair being side by side, as shown in Fig. 1. Co-operating with these cams 45 are C-shaped yokes 47, (a detail of one of which is shown in Fig. 4) each having a roller 48, these yokes being securely bolted to the upper ends of the jaw swinging arms or rods 29. The two yokes carried by the two arms on one side of the machine face in the same direction, but in the opposite direction with respect to the facing of the yokes carried by the pair of arms 29 on the opposite side of the machine. The rollers 46 of the cams 45 co-operating with the yokes carried by the arms on one side of the machine are disposed 180°, or are diametrically opposite from the rollers 46 of the cams 45 co-operating with the yokes of the rods on the opposite side of the machine. It will be apparent, therefore, that since the yokes all face inwardly and since the ends of each yoke are attached to the associated swinging arms 29 on one side of the cam 45, and the yoke roller 48 is at the middle portion of the yoke on the opposite side of the cam, the effect of rotating cam rollers 46 on the yoke rollers 48 is to swing the four arms 29 inwardly, and therefore swing the folding jaws 25 toward each other. It is by this movement that the metal is bent around the mandrel in such a way as to cause the crimped edges of the stock to interlock. As soon as the cam rollers 46 ride off the yoke rollers 48, the swinging arms 29 and the parts carried thereby are swung back to normal position by springs 49 (see Fig. 3) or equivalent means, the springs here shown being carried by the cross members 28 and being compressed by the movement of the cross members toward the fixed bed 13. Adjustable screws 50 inside the cross members 28, and carried by brackets 51 secured to the bed 13 (see Fig. 3) limit the outward movement of the cross members, and hence of the jaws and jaw actuating and carrying arms 29.

In addition to the cross-head operating and jaw swinging cams, six in number, all mounted on the shaft 34, the latter has two additional cams, namely, a cam 52 which controls the lowering the mandrel, and a cam 53 which controls the operations of a stripper, to be referred to, which strips the tubes off the mandrel, these two cams being positioned on the shaft in proper relation to the other cams on the same shaft to produce the desired results. The cam 52 is on one end of the shaft 34 outside the end frame member 11, and this cam is engaged by a roller 54 which is carried by the upper end of the slide 18 carrying the mandrel support 17, the design of this cam being such that the mandrel is lowered at the proper instant in the cycle of operations, and a predetermined time later is elevated.

The stripper cam 53 is located on the shaft between the cross-head cams 41, 41. The side face of this cam is engaged by a roller 55 (see Figs. 1 and 3), which roller is carried by an arm 56 pivoted at its upper end at 57 to the top member 12 of the frame, this arm 56 having connected to it a rather stiff spring 58, the action of which is to at all times hold the roller 55 against the face of the cam and to swing the arm 56 toward the left (as the machine is viewed in Fig. 1) when the roller 55 drops into a depression indicated at 53^a in the face of the cam. As shown in Fig. 3, the stripper arm 56 has at its lower end a rod 59 which projects laterally from one side of the machine and then downwardly. The downwardly turned end of this rod has a loose connection with a stripper blade 60, pivoted at its outer end to bracket 61, in this instance attached to one of the cross members 28 carrying one of the folding jaws. The inner end of this stripper blade 60 rides over the mandrel i. e. over that part of the mandrel next to the mandrel support 17, this blade lying normally on the mandrel just beyond that part thereof on which the tube is formed. The timing of the stripper cam is such that immediately after the mandrel is elevated from the die following the last of the tube forming operations, the roller 55 snaps into the depressed part of the cam permitting the spring 58 to swing the stripper arm 56 to the left as viewed in Fig. 1. This swings the inner free end of the stripper blade 60 over the mandrel so as to strip the tube off the latter and cause it to be discharged through the end frame member 10 into a suitable receptacle which may be provided for that purpose.

In operation the operator places over the bending jaws 25 and between the mandrel and the die, a strip of metal constituting the stock from which the tube is to be formed, which stock is previously cut to proper dimensions, and has its edges crimped in Z fashion, i. e. with the edges bent at right angles to the blank and in opposite directions, as indicated in Figs. 3 and 5. This stock will be tapered, i. e. somewhat wider at one end than the other if a bow socket is to be formed, but will have parallel edges if a tube is to be formed as large at one end as at the other. In placing this stock on the folding jaws the operator positions the stock properly by placing one edge against a gauge plate or stop 61 (see Figs. 3 and 5) which gauge is carried by one of the blocks 26, to which one of the folding jaws 25 is attached. The parts are now in

position shown conventionally in Fig. 5. If the machine is stationary, the operator then starts the machine in operation, whereupon the cam 52 lowers the mandrel, and at or about the same time the cross-head is lowered causing the presser blade 21 to press the mandrel well down into the die and to bend the stock into U-shape as indicated in Fig. 6, the lowering of the cross-head being due to the action of one of the rollers of each of the two cross-head cams. Immediately after the operation just stated, the cross-head and presser blade are elevated, and at or about the same time the yoke cams cause the folding jaws to be swung inwardly so as to bend inward the upstanding edge portions of the stock and to cause the crimped edges to be interlocked substantially as shown in Fig. 7. Immediately after this operation the folding jaws swing outward, and at or about the same time the other two rollers of the cross-head cams again lower the cross-head and presser blade which now descends onto the interlocked crimped edges of the stock and forcibly presses the same downward against the mandrel so as to form a tight seam, the parts being now in the position substantially as shown in Fig. 8. Immediately following this the cross-head and presser blade are elevated, and at or about the same time the mandrel controlling cam 52 elevates the mandrel and the tube formed on it, and as soon as the mandrel is elevated the stripper cam 53 permits the stripper blade to be wiped over the end portion of the mandrel by the action of the stripper spring 58 so as to strip or forcibly kick the tube off the mandrel. This completes the cycle of operations for forming one tube. The operator will then place another piece of stock into the machine and the operations will be repeated.

All the tube forming operations above explained are performed while the shaft is traveling through about one-half a revolution or less, so that the operator can utilize the other half of the revolution of the shaft to place in position on the machine the stock for forming the next tube. Since the operations are performed partly simultaneously and partly successively but with the successive operations following each other with rapidity, the machine can be operated continuously even with a high speed motor since the operator has ample time to handle his stock without stopping the machine between cycles of tube forming operations.

I believe it is entirely new with me to provide among other things, folder blades which are mounted so as to swing inward and outward rather than to slide with straight line movement over supporting surfaces, this improved arrangement having a decided advantage over the sliding movement or action since the movements of the blades are not obstructed or interfered with by dirt or other matter which might obstruct or interfere with the action of sliding blades.

The machine is otherwise very powerful and reliable, and performs very effective work, these results being due to the general design or construction including the single operating shaft carrying all the operating cams.

Having described my invention, I claim—

1. In a tubing machine having a die and a mandrel adapted to be received by the die, and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging members carrying the presser blades, each member being pivoted at one end and carrying the associated folding blade intermediate its ends, and means operating on the free ends of the swinging members to move the free ends inwardly for the folding operation.

2. In a tubing machine having a die and a mandrel adapted to be received by the die, and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends and intermediate their free ends carrying the folding blades, and means operating on the upper ends of the rods for swinging the folding blades inwardly and outwardly.

3. In a tubing machine having a die and a mandrel adapted to be received by the die, and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends and carrying intermediate their ends the folding blades, a shaft at the upper part of the machine having means for operating the presser member and for swinging the upper ends of the rods inwardly and outwardly.

4. In a tubing machine having a die and a mandrel adapted to be received by the die, and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends and intermediate their ends carrying the folding blades, a shaft at the upper part of the machine having cams for shifting the presser member and for swinging the rods.

5. In a tubing machine having a die and a mandrel adapted to be received by the die,

and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends and intermediate their ends carrying the folding blades, a shaft at the upper part of the machine having cams for shifting the mandrel, for shifting the presser member, and for swinging the rods.

6. In a tubing machine having a die and a mandrel adapted to be received by the die and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends, carrying the folding blades, means for actuating the rods comprising a cross shaft having cams, and yokes adapted to be engaged by the cams carried by the upper ends of the rods.

7. In a tubing machine having a die and a mandrel adapted to be received by the die and about which flat stock is adapted to be formed into a tube, folding blades for folding stock about the mandrel, a presser member for pressing the edges of the stock into a seam, swinging rods pivoted at their lower ends, carrying the folding blades, means for actuating the rods comprising a cross shaft having cams, and yokes adapted to be engaged by the cams carried by the upper ends of the rods, the yokes having rollers and the cams having rollers adapted to engage the rollers of the yokes.

In testimony whereof, I hereunto affix my signature.

DAVID F. DOMIZI.