

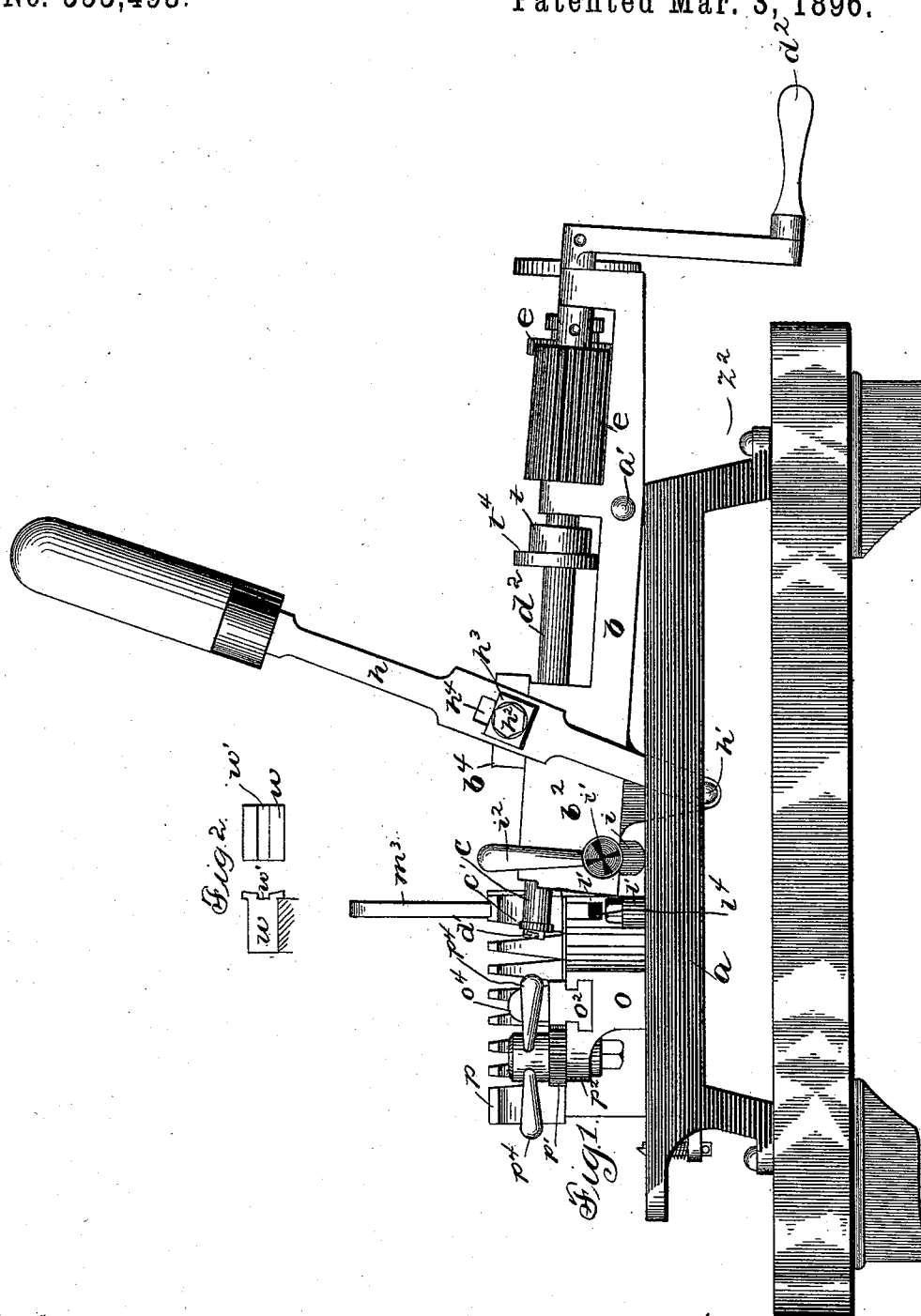
(No Model.)

5 Sheets—Sheet 1.

O. P. BRIGGS.
ELBOW MAKING MACHINE.

No. 555,493.

Patented Mar. 3, 1896.



Witnesses:

George L. Bragg
George S. Buell

Inventor.
Orlando P. Briggs.
By Barton & Brown
Attys

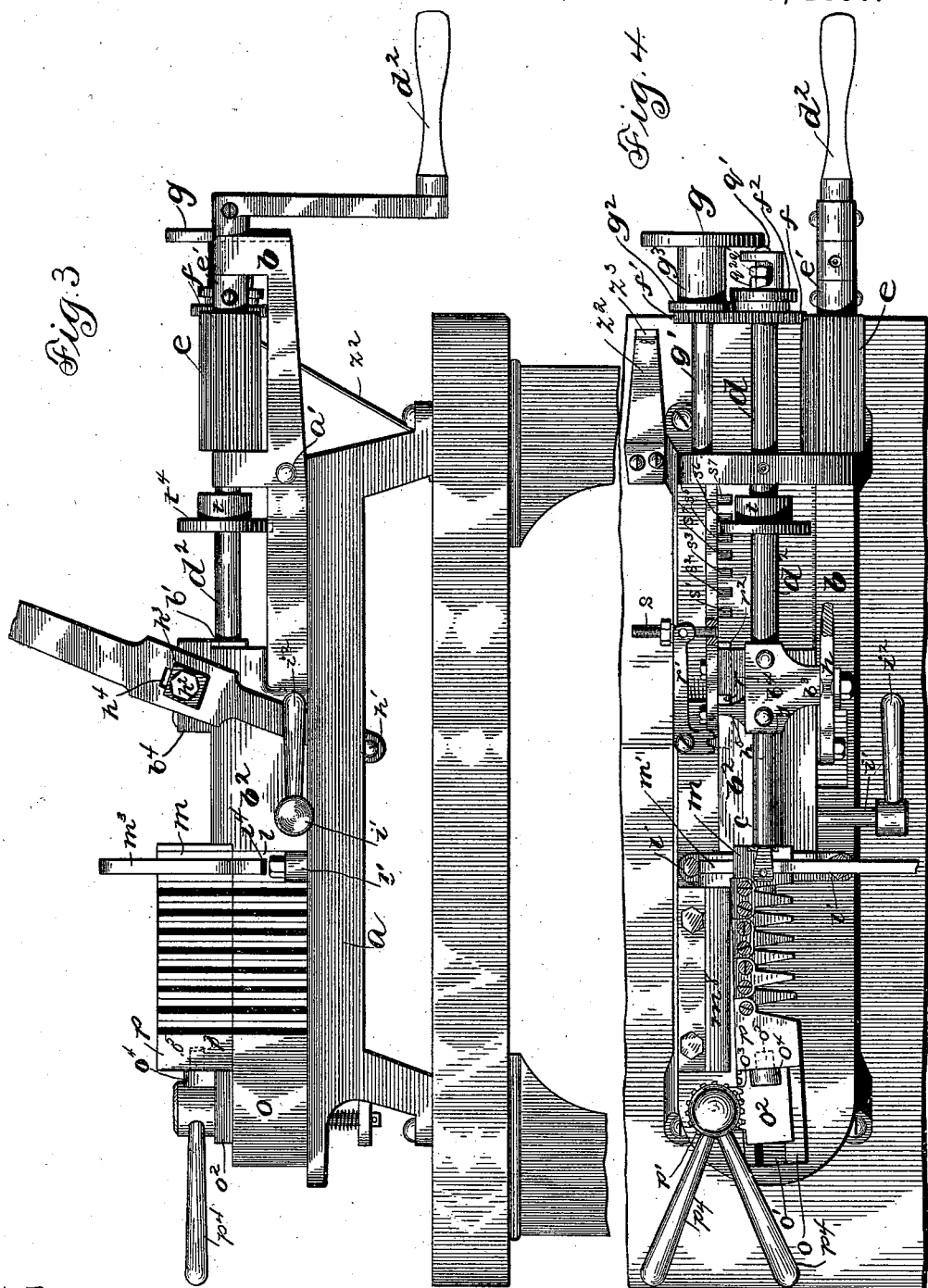
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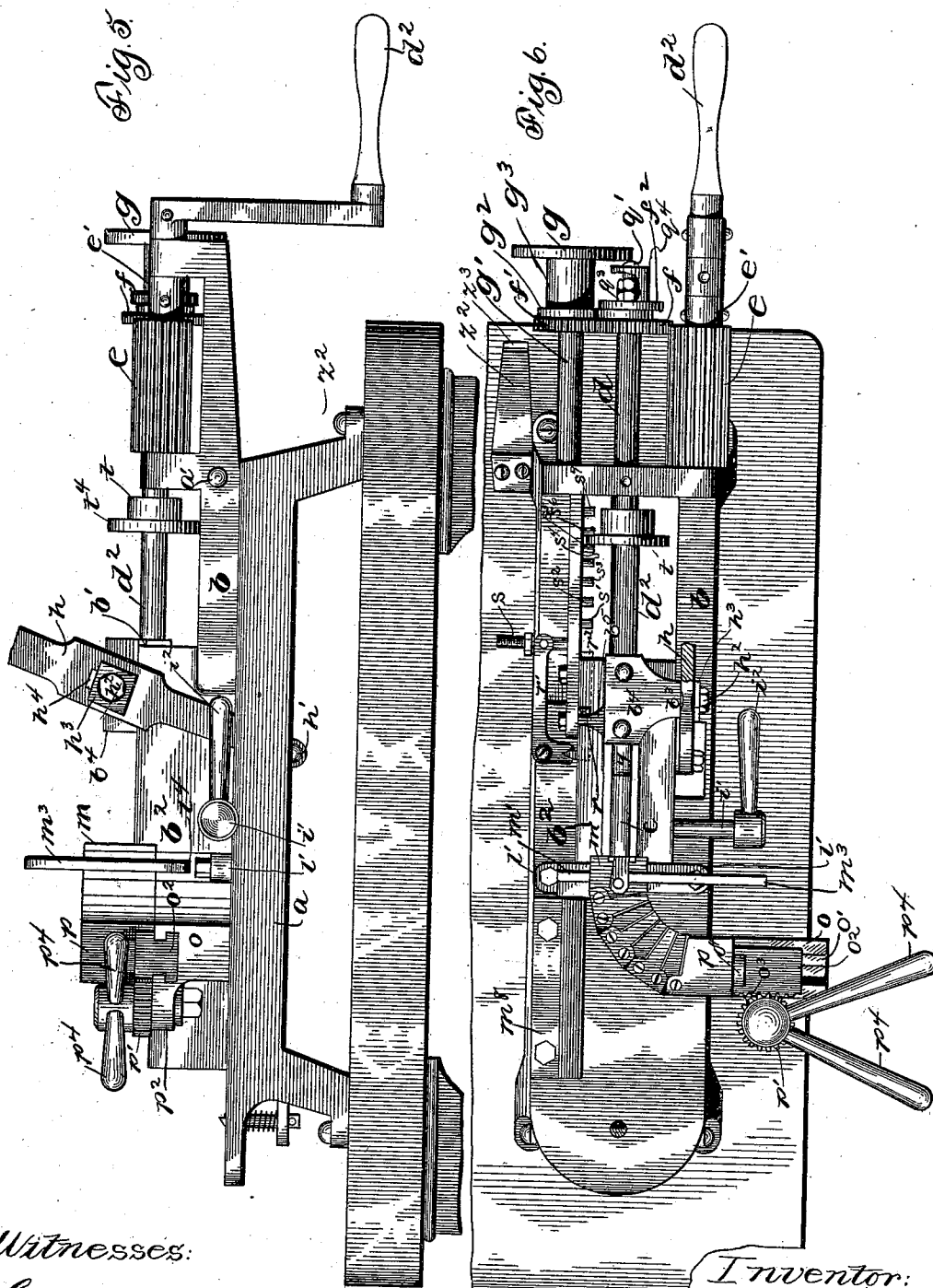
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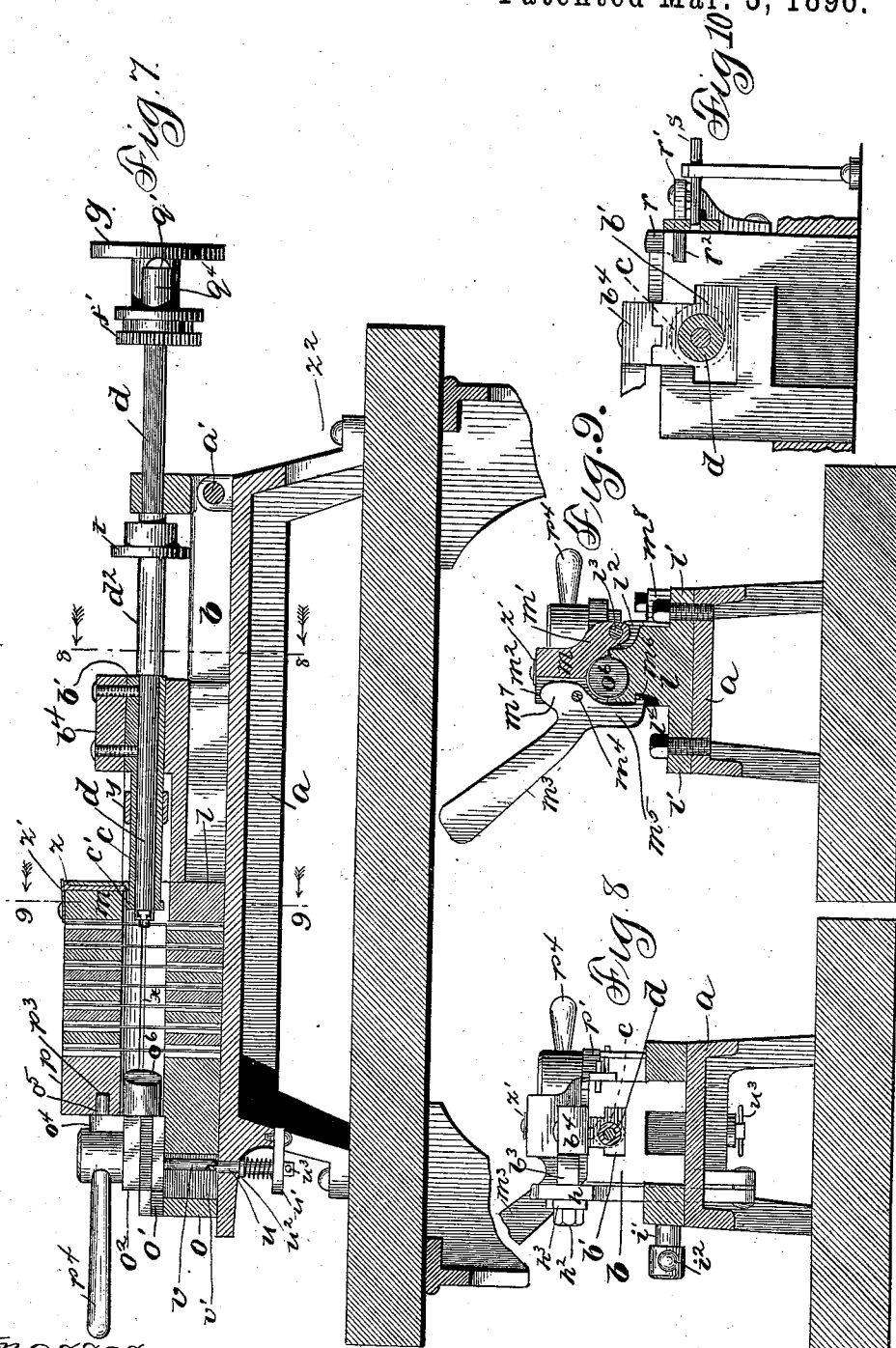
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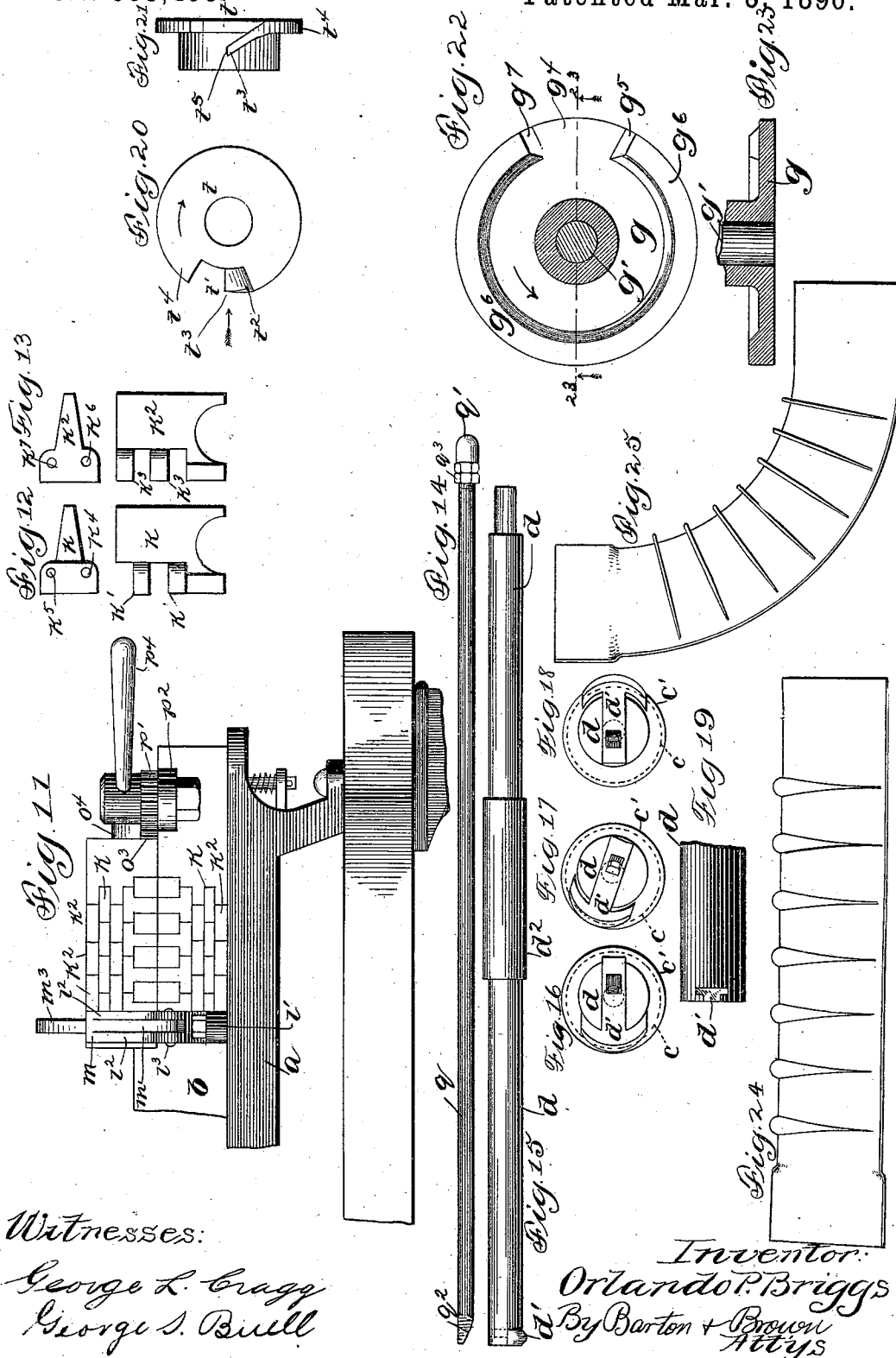
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UNITED STATES PATENT OFFICE.

ORLANDO P. BRIGGS, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE WESTERN ELECTRIC COMPANY, OF SAME PLACE.

ELBOW-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 555,493, dated March 3, 1896.

Application filed October 11, 1893. Serial No. 487,806. (No model.)

To all whom it may concern:

Be it known that I, ORLANDO P. BRIGGS, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Elbow-Making Machines, (Case No. 4,) of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to machines for the manufacture of sheet-metal elbows.

The machine of my invention may be generally described as consisting of a mandrel upon which may be slipped a straight piece or blank of sheet-metal tubing, within which mandrel is eccentrically journaled a cylindrical rod which is capable of having rotary motion imparted to it through the medium of a suitable gearing mechanism operated by a manual crank. Upon the end of this rod is mounted a wiper, which rotates with the rod, and which, by virtue of its eccentric position with relation to the mandrel, and, consequently, the blank tube placed thereon, forms eccentric bulges in the blank tube as the wiper is rotated. A cam-wheel is keyed or splined to the wiper-supporting rod, which engages successively with pins placed at regular intervals upon a bar, each successive engagement occurring once upon each revolution of the wiper and its supporting-rod. The engagement of the cam-wheel with the pins serves to withdraw the wiper from within the tube step by step, enabling the wiper to form, throughout the length of the tube, a number of eccentric bulges at regular intervals, said wiper being constantly rotated by the manual crank through the medium of the gearing mechanism. Any suitable number of these eccentric bulges may be made. The bulges formed are broad and shallow. Hence the blank tube at this stage is but slightly curved; but by pressing it flat, so as to form eccentric gathers or folds, the blank tube is contracted into the form of an elbow. For the purpose of thus compressing the eccentric bulges I provide what I term "segmental" dies, arranged in two sets, one above the other. The individual dies of the sets are made with a cross-section of a truncated trian-

gle whose broader bases are hinged together, allowing them to be opened apart in a straight line or closed together in the form of a segment. These dies are arranged in two sets, with the triangular faces of the dies of one set capable of being superimposed upon the triangular faces of the dies of the second set. The opposing faces of the dies of both sets are provided with semicircular recesses to accommodate the blank tube.

The eccentric bulges above described are made between the adjacent segmental dies. By closing the dies upon themselves these eccentric bulges are flattened into thin crescent-shaped folds, thereby completing the blank tube into the form of an elbow. After the elbow is finished the upper set of dies may be removed from the lower to permit of the removal of the finished elbow and the refeeding of the machine.

My invention will be more readily understood by reference to the accompanying drawings, in which—

Figure 1 is a front elevation of my machine in position to be fed with a blank tube. Fig. 2 shows details of a guide for the seam of a blank tube. Fig. 3 is a front elevation of the machine, showing the parts as they appear after the wiper has completed its function. In this figure the segmental dies are shown in position to be closed upon themselves to compress the metal contained in the eccentric bulges previously formed into thin crescent folds, whereby the blank tube is completed into an elbow. Fig. 4 is a plan view of the machine shown in Fig. 3. Fig. 5 is a front elevation of the machine, showing the parts thereof as they appear after the segmental dies have been closed upon themselves to press the metal contained in the eccentric bulges previously formed into thin folds or gathers, whereby the blank tube is formed into the shape of a quadrant or other segment. Fig. 6 is a top view of the machine as shown in Fig. 5. Fig. 7 is a partial longitudinal section taken on a vertical plane through the axis of the wiper-supporting rod. Fig. 8 is a right cross-sectional view taken on line 8 8 of Fig. 7. Fig. 9 is a right cross-sectional view taken on line 9 9 of Fig. 7. Fig. 10 is a detail view showing the method which I pref-

erably employ for mounting the mandrel. Fig. 11 is a rear elevation of the front portion of the machine with a part thereof removed to show the arrangement of the segmental dies. Figs. 12 and 13 are details of two adjacent segmental dies of the upper set. The dies of the lower set are similar in construction, but symmetrically arranged with relation to those of the upper set. Fig. 14 is a detail of the cam-bar which is used in connection with the wiper to further control its position with relation to the blank tubing. Fig. 15 is a longitudinal elevation of the wiper-supporting rod. Fig. 16 is a front elevation of the wiper and wiper-supporting rod, said rod being shown in place within the mandrel. Figs. 17 and 18 are similar views showing the wiper, however, in different positions. Fig. 19 shows a method of supporting the wiper. Fig. 20 is a full face view of the cam-wheel which, by successive engagement with pins, causes the step-by-step recession of the wiper from the blank tube. Fig. 21 is a side elevation thereof looking in the direction indicated by the arrow in Fig. 20. Fig. 22 is a full face view of the cam-wheel which, through the medium of the cam-bar shown in Fig. 14, controls the position of the wiper with relation to its supporting-rod. Fig. 23 is a cross-sectional view thereof on line 23-23 of Fig. 22. Fig. 24 shows the appearance of a blank tube after the eccentric bulges have been formed throughout the length thereof by the wiper. Fig. 25 is a view showing the appearance of a completed elbow.

Like parts are indicated by similar letters of reference throughout the views.

The base *a* of the machine is mounted upon a suitable standard or support. Pivottally mounted upon bearings *a'* is the framework *b* which supports the gearing mechanism, the mandrel *c* and other parts of the machine. In the mandrel *c* is eccentrically journaled the wiper-supporting rod *d*, upon which is movably tongued wiper *d'*, as shown in Fig. 19.

To form the bulges in the blank tube rotary motion is imparted to wiper *d'* through the medium of rod *d* and the gearing mechanism actuating the same, which gearing mechanism is actuated by a manual crank *d²*. The gearing mechanism is composed of a pinion *e* which is keyed or splined upon the shaft *e'*, upon which shaft is directly fastened the manual crank *d²*, spur-wheel *f* keyed or splined upon rod *d* in engagement with pinion *e*, and spur-wheel *f'* in engagement with spur-wheel *f*. A cam-wheel *g*, which controls the initial position of the wiper upon the commencement of each revolution, as hereinafter described, is rigid with relation to spur-wheel *f* and is movable together therewith loosely upon rod *g'*, which is rigidly secured to the framework *b*, the purpose of thus mounting the cam-wheel being to allow it longitudinal excursion with the wiper-supporting rod *d*. To secure the engagement and uniform recession of the cam-wheel *g*

with the bar *d* and wiper *d'*, I mount a collar *g²* fixedly upon extension *g³* of cam-wheel *g*, which collar is engaged between collar *f²* fixedly mounted upon rod *d* and spur-wheel *f*.

The mandrel *c* partakes both of the nature of a mandrel upon which may be placed a blank tube and of a carriage or guide for the wiper-supporting rod *d*. The mandrel is provided with a block-like end, which I term "guide-block" *b'*, which is allowed longitudinal excursion within a T-channel provided in the raised portion *b²* of carriage *b*. The travel of the guide-block *b'* may be controlled manually through the medium of lever *h* pivoted at *h'* and bolted to tongue *b³* of block *b'*, which block is tongued and bolted upon guide-block *b'*. The joint between lever *h* and tongue *b³* is made by a bolt *h²*, between whose head and the lever is interposed a friction-plate *h³*. A slot *h⁴* is provided in lever *h*, in which bolt *h²* is capable of excursion to allow the distance between said bolt and pivot *h'* to vary as the lever is shifted back and forth, a portion of the friction-plate through which said bolt passes being in engagement with slot *h⁴*.

The longitudinal motion of the guide-block *b'* imparts a corresponding motion to the mandrel *c*, and the motion of the mandrel *c* imparts a corresponding motion to the rod *d*, an enlargement *d²* upon said rod *d* being provided to prevent a forward motion of rod *d* with relation to mandrel *c*, while the rearward travel of said rod with relation to said mandrel is prevented by the cam-wheel upon rod *d* and the pins which are in successive engagement with said cam-wheel, which successive engagements control the recession of the wiper, as hereinafter described.

Having thus generally described the mechanism which produces the bulges in the blank tube, I will describe the manipulation of the parts of the machine for the reception of a blank tube and the formation of the elbow, after which I will give a more detailed description of the machine.

Fig. 1 shows the machine arranged for the reception of a blank tube. The carriage *b* is shown in a tilted position to permit the blank tube to be readily slipped upon the mandrel. For the purpose of thus elevating the carriage I provide a rocking cam *i* upon a shaft *i'*, which may be rocked by a handle *i²*. By shifting the handle *i²* to a vertical position, as shown, the cam *i* is rocked to a vertical position, which causes the portion of the carriage *b* in front of its bearings *a'* to be elevated, together with the mandrel *c* and the parts supported thereby. In said figure the lower set of dies is shown closed, while the upper set is thrown back.

In completing the elbow the dies of both sets are closed to press the bulges into thin folds, as hereinafter set forth, the upper set being superimposed upon the lower. To remove the elbow the upper set of dies is thrown back when the carriage *b* is tilted, as described, the mandrel and parts having been

moved to the position shown in Fig. 1 during the process of forming the elbow. The upper set of dies is straightened out when thrown back, and the lower set is preferably kept in its closed position for convenience in removing the finished elbow and refeeding the machine. Upon the mandrel *c* is a collar *c'* which fits the blank tube. Upon this collar the blank tube is directly placed. The lower set of dies is then opened out, and the carriage and the parts carried thereby are lowered to a horizontal position by rocking cam *i*, the lower half of the blank tube being accommodated by the semicircular recesses cut in the upper ends of the lower dies. The upper set of dies is then superimposed upon the lower, semicircular recesses being provided in the lower ends of said dies to accommodate the upper half of the blank tube.

Before proceeding further with the description of the manipulation of the machine I will describe in detail the construction and arrangement of the dies.

Referring now to Figs. 11, 12, and 13, the segmental dies are constructed preferably as therein shown. Each die is made in the form of a truncated triangular prism. The adjacent dies are hinged together, dies *k* being provided with knuckles *k'* *k'*, which mesh with knuckles *k*³ *k*³ of dies *k*². Knuckles *k'* *k'* are provided with apertures *k*⁴ *k*⁵, which are in alignment with apertures *k*⁶ *k*⁷ provided in knuckles *k*³ when the dies are assembled in sets. Pintles are passed through these apertures, completing the hinge-joints between the adjacent dies. When the dies are thus assembled they may readily be opened out in a straight line or closed in the form of a segment.

Semicircular recesses are provided in the opposing ends of the dies to accommodate the blank tube.

In Figs. 12 and 13 I have shown in detail two adjacent dies of the upper set. The dies of the lower set are similar in construction, but symmetrically arranged with relation to the dies of the upper set.

Fig. 11 best illustrates how the dies are assembled together in sets. In this figure the upper set of dies is shown superimposed upon the lower. Referring to said figure, and also more particularly to Figs. 4 and 6, die *l* of the lower set is provided with two projections *l'* *l'*, which are bolted upon the framework *b*. Hinged upon die *l* is die *m* of the upper set, the hinge preferably consisting of two knuckles *l*² *l*² upon die *l*, a pintle *l*³ passing through said knuckles, and a lug *m'* upon die *m* journaled upon said pintle. Referring now also to Fig. 9, die *m* is provided with a recess *m*², within which is mounted the handle *m*³ upon pin *m*⁴, supported between the walls of the recess. To secure the upper set of dies to the lower at one end, I provide an extension *m*⁵ to the handle *m*³, upon which is a catch *m*⁶ adapted to engage with recess *l*⁴ in die *l*. To remove the upper set from the lower, handle *m*³ is

grasped and thrown back, which serves, first, to remove catch *m*⁶ from recess *l*⁴; after which lug *m*⁷ is bottomed in recess *m*², when the upper set may finally be thrown back to rest upon support *m*⁸. Die *o* of the lower set is elongated, as is also die *p* of the upper set. Die *o* is provided with a T-groove *o'*, in which sliding block *o*² is capable of longitudinal excursion. Upon block *o*² is provided a rack *o*³, which is in engagement with pinion *p'*, journaled upon bracket *p*² upon die *p*. Upon block *o*² is mounted a facing-block *o*⁴, upon which is mounted a pin *o*⁵, which is adapted to be brought in engagement with recess *p*³ in die *p* when the upper set of dies is superimposed upon the lower.

Resuming the description of the manipulation of the machine, the tube being in place upon collar *c'* of mandrel *c* and the upper set of dies being superimposed upon the lower, the attendant grasps the handles *p*⁴ *p*⁴, and thereby turns the pinion *p'* to advance the block *o*², thereby bringing pin *o*⁵ in engagement with recess *p*³. The advancement of block *o*² is limited by facing-block *o*⁴. When the block *o*² is thus advanced, plug *o*⁶ is shoved within the opposing end of the blank tube. The next step is to shove the wiper *d'* forward into its initial position in the space between the front dies. To accomplish this the lever *h* is grasped by the attendant and shoved forward. The block *b'* is thus brought forward, which block carries with it the mandrel *c*, integral therewith, and the rod *d* and the parts carried thereby, travel of rod *d* with relation to mandrel *c* being prevented, as before described. Cam-wheel *g*, spur-wheel *f'* and spur-wheel *f* are also brought forward with mandrel *c*, the pinion *e* being of such length as to preserve its engagement with spur-wheel *f*. The initial position of the wiper *d'* with relation to its supporting-rod *d* and the surrounding tube is shown in Fig. 16. In this position sleeve-nut *q'* of cam-bar *q* is in engagement with the recessed surface *g*⁴ of cam-wheel *g*. In this position the cam *q*² is withdrawn from active engagement with wiper *d'*.

When the mandrel is in the forward position above described, the attendant turns manual crank *d*², thereby, through the medium of the gearing mechanism, rotating cam-wheel *g*. As the cam-wheel *g* is rotated sleeve-nut *q'* is brought into engagement with the inclined plane *g*², causing the cam-bar *q* to be gradually shoved forward until said sleeve-nut is in engagement with the raised plane surface *g*⁶. When the engagement of sleeve-nut *q'* with plane surface *g*⁶ is begun the cam-bar *q* is shoved forward and the wiper *d'* is made to assume the extended position with relation to its supporting-rod *d* through the action of cam *q*² upon said wiper, this position being maintained until the sleeve-nut *q'* is in position to be brought into engagement with inclined surface *g*⁷, when by the pressure of the surrounding tube upon the wiper and the pressure of the wiper in turn

upon the sloping surface of cam q^2 the sleeve-nut q' is brought gradually in engagement with surface g^1 , thus allowing the wiper d' to gradually assume the position shown in Fig. 16. During the revolution of the wiper d' , above described, by virtue of the eccentric position of its supporting-rod d with relation to mandrel c , and, consequently, of the eccentric position of the blank tube supported upon said mandrel with relation to said wiper, said wiper d' is caused gradually to come in working contact with said tube and to gradually leave said working contact, whereby an eccentric bulge is formed.

I have thus described one revolution of the wiper d' and its result. The next step is to shift the wiper d' to the next space between the segmental dies, when a second bulge may be formed in a similar manner, which movement is accomplished when the sleeve-nut q' is in engagement with surface g^4 , the wiper being then out of working engagement with the blank tube.

I will now describe how such successive rearward steps of the wiper d' are taken. When the parts assume the position shown in Fig. 1, tongue b^3 comes in contact with post r , thereby actuating the bell-crank lever r' to withdraw pin s pivotally connected thereto through the medium of sliding bar r^2 in engagement therewith. This withdrawn position of the pin s is shown most clearly in Figs. 4 and 6. The object of this will be explained presently. When the lever h is shoved forward the end of the bar r^2 , which projects, as shown in Figs. 4 and 6, extends within the opening t' (referring to Figs. 20 and 21) of cam-wheel t , and as said cam-wheel is rotated the bar engages with the incline t^2 of cam t^3 , thus pushing the arm r^2 gradually in until its end becomes flush with block b^4 . At the same time pin s is brought forward in the same position as the other pins s' s^2 s^3 . The pin s is thus put in engagement with the collar t^4 behind cam t^3 without extra trouble in manipulating the mandrel, which would not be the case if the pin s were stationary, since the wheel t would have to be pushed far enough forward to allow cam t^3 to entirely clear pin s . Then it would have to be turned and shoved back to bring the pin s in snug engagement with collar t^4 behind the cam t^3 .

During the formation of the first bulge in the blank tube—that is, when sleeve-nut q' is in engagement with surface g^6 —pin s is in engagement with collar t^4 ; but when sleeve-nut q' is in engagement with surface g^4 the pin s' is brought into engagement with cam t^3 , whereby the cam-wheel t may be shoved gradually backward one step, its rotation being continued when pin s' is brought into engagement with collar t^4 , such engagement being similar to the engagement between said collar and pin s . This recession of the cam-wheel t moves the wiper d' back one step in position to form the next bulge. When the second bulge is formed pin s^2 is brought into engagement with

collar t^4 in a similar manner, when wiper d' is caused to recede in position to form the third bulge, and so on until the complete number of bulges has been formed. When the complete number of bulges has been formed and an additional revolution is begun by the operator, pin s^7 impinges against the end t^5 of cam t^3 , which arrests further rotation of the cam-wheel and notifies the attendant that the complete number of bulges has been formed, when he grasps the handles p^4 p^4 and closes the dies, thereby compressing the metal contained in the bulges, which finishes the elbow. Having finished the elbow the attendant removes the upper set, as before described, and allows the lower to remain in its closed position for convenience in removing the elbow and refeeding the machine. The carriage b is then tilted, as before described, when the finished elbow may be readily removed and the machine refed.

Having thus given a full general description, I will describe some details of mechanism of the machine.

When the sliding block o^2 is advanced it is desirable to secure it in this position during the formation of the bulges.

Referring now more particularly to Fig. 7, I have provided a rod u which passes through the base of the machine and is encircled by a spring about its lower portion. This spring is placed between a shelf u' , secured to the base of the machine, and collar u^2 , fixed upon the rod u , thereby supporting said rod in the position shown. A second rod, v , is mounted upon the under side of sliding block o^2 , a recess v' being provided to accommodate the travel of said rod. When the sliding block o^2 is brought to the position shown the rod u is first depressed by rod v , opposing sloping surfaces being provided for this purpose, after which the rod u is elevated by its surrounding spring, as shown. In this position a vertical plane surface upon rod u is opposed to a corresponding vertical surface upon rod v . The block o^2 when advanced into its locking position obviously cannot be withdrawn until the rod u is out of the path of rod v , which occurs only when the bulges have been finished.

If it is necessary to remove block o^2 from the position shown before the bulges have been finished, rod u may be withdrawn from the path of rod v , a metal cross-piece u^3 being provided upon rod u for this purpose.

The sheet-metal tubes which I preferably employ for the blanks are made by a machine described in my application, Serial No. 474,023, filed May 12, 1893. The tubes formed by this machine are provided with what I term "double-lock seams." In using blank tubes of this construction the blank should be inserted in place in such a manner that the crescent-shaped bulges will not be formed where the seam occurs. For this purpose I provide in the front end of portion b^2 of carriage b the guide w , (shown in Fig. 2,) which is provided with a recess w' , which accommodates a por-

tion of the seam of the blank tube. A recess x is also provided in the dies to accommodate the seam.

In connecting together lengths of tubing by elbows it is usual to insert an end of one tube within one end of the elbow, and to insert the other end of the elbow within the second tube. One of the ends of the elbow should, consequently, be larger than the other. To this end I mount movably upon the mandrel c an expander y , which is forced within the blank tube when the lever h is shoved forward to bring the wiper in position to form the first bulge in the tube. The surface of the expander which opposes the blank tube is curved to facilitate its entry within said tube. When being thus shoved forward the expander passes the detent z , said detent being raised by the expander during its passage and falling behind the expander when clear of the same, a spring z' being provided to insure the return of said detent to its lower position. The detent is provided to prevent the withdrawal of the expander during the formation of the elbow, whereby the blank tube is more firmly held in position during the formation of the elbow and its collapse prevented.

To lubricate the surfaces of cam-wheel g which are in frictional engagement with sleeve-nut q' , I provide an oiler, which consists of a strip of metal z^2 mounted upon the machine-support, upon which is fastened a pad z^3 of some absorptive material, preferably felt, which is kept constantly saturated with oil. When the mandrel c is shoved forward the surfaces g^4 , g^5 , and g^6 of cam-wheel g are lubricated. The initial position of the cam-bar q may be adjusted by the sleeve-nut q' , and such adjustment made secure by jam-nut q^3 . I provide a bearing q^4 to prevent the end of cam-bar q , which extends beyond rod d , from being broken.

In constructing my machine it is made preferably to form elbows in the forms of quadrants. Other shapes may be made which will connect lengths of tubing at greater angles—as, for instance, by proper manipulation wiper d' may be caused to form bulges in every other space or in the end spaces between the segmental dies, which bulges may be pressed into thin folds, as before. Another form of elbow may be made by wiping out the complete number of bulges, and then, by means of pliers or other suitable tool, closing some of the dies to press certain bulges into thin folds.

My machine admits of many modifications without departing from the spirit of my invention—as, for instance, in place of employing expander y , I may so shape plug o^6 as to make it serve the purpose of an expander. I therefore do not desire to limit myself to the precise construction shown, nor to the precise combination of elements used, except as hereinafter claimed.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In an elbow-making machine, the combination with means for supporting and creasing from within the tube from which the elbow is to be made, of segmental dies adapted to hold said tube to fold the creases therein and to bend the tube, whereby the elbow is formed, substantially as described.

2. In an elbow-making machine, segmental dies adapted to surround a blank tube, and a wiper adapted to form eccentric bulges in said blank tube, means for imparting rotary motion to said wiper, and a step-by-step receding motion thereto, means for closing and opening said dies, and a guide w for the seam of said blank tube, substantially as and for the purposes set forth.

3. The combination with a number of clamps, of a wiper adapted to be moved step by step to form folds or bulges in the tube, and means for simultaneously moving the clamps together and folding the same to form the elbow; substantially as described.

4. In an elbow-making machine, segmental dies, adapted to surround a blank tube, a wiper adapted to form eccentric bulges in said blank tube, means for imparting rotary motion to said wiper and for gradually withdrawing said wiper, means for closing said dies in the form of a segment and opening them in a straight line, substantially as and for the purposes set forth.

5. In an elbow-making machine, a mandrel, a wiper supported thereon in such a position with relation thereto that as said wiper is rotated eccentric bulges are formed in the blank tube placed upon the mandrel, means for imparting rotary motion to said wiper and causing the same to recede step by step, segmental dies adapted to be placed in position about said mandrel, means for closing said dies in the form of a segment or opening them in a straight line, substantially as and for the purposes set forth.

6. In an elbow-making machine, a mandrel, a rod eccentrically journaled thereon, a wiper movably supported upon said rod, means for controlling the position of said wiper with relation to said rod, means for imparting rotary motion to said wiper and to cause it to recede step by step, segmental dies arranged in two sets, means for closing said sets of dies in the form of segments and opening them in straight lines, and means for superimposing upon and removing the upper set of dies from the lower, substantially as and for the purposes set forth.

7. In an elbow-making machine, a mandrel, a rod d eccentrically journaled within said mandrel, a wiper d' movably supported upon rod d , means for imparting rotary motion to said wiper d' and controlling its position with relation to rod d , segmental dies arranged in

two sets, means for closing said sets of dies in the form of segments or opening them out in straight lines, means for superimposing upon and removing the upper set of dies from the lower, and means for receding wiper *d'* step by step, substantially as and for the purposes set forth.

8. In an elbow-making machine, a mandrel *c*, a rod *d* eccentrically journaled within said mandrel, a wiper *d'* movably supported upon said rod *d*, means for imparting rotary motion to said wiper and said rod, a cam-wheel *g* and a cam-bar *q* adapted to control the position of said wiper with relation to its supporting-rod *d*, means for shifting the mandrel *c* and parts carried thereby, segmental dies arranged in two sets, means for closing said sets of dies in the form of segments and of opening them out in straight lines, and means for superimposing upon and removing the upper set of dies from the lower, means for receding the wiper *d'*, mandrel *c* and parts carried thereby step by step, substantially as and for the purposes set forth.

9. In an elbow-making machine, a mandrel *c*, a rod *d* eccentrically journaled within said mandrel, a wiper *d'* movably supported upon said rod *d*, means for imparting rotary motion to said wiper and said rod, a cam-wheel *g* and a cam-bar *q* adapted to control the position of the aforesaid wiper with relation to its supporting-rod *d*, a lever *h* adapted to shift the mandrel *c* and parts carried thereby longitudinally, segmental dies arranged in two sets, means for closing said sets of dies in the form of segments and opening them out in straight lines, means for superimposing upon and removing the upper set of dies from the lower, a pin *s* adapted to be withdrawn from and brought in engagement with cam-wheel *t* secured to rod *d*, and means for causing said cam-wheel *t*, mandrel *c* and parts

carried thereby, to recede step by step, all substantially as and for the purposes set forth.

10. In an elbow-making machine, a mandrel *c*, a rod *d* eccentrically journaled within said mandrel, a wiper *d'* movably supported upon said rod *d*, means for imparting rotary motion to said wiper and said rod, a cam-wheel *g* and a cam-bar *q* adapted to control the position of the aforesaid wiper with relation to its supporting-rod *d*, a lever *h* adapted to shift the mandrel *c* and parts carried thereby longitudinally, segmental dies arranged in two sets, means for closing said sets of dies in the form of segments, means for superimposing upon and removing the upper set of dies from the lower, means for securing the upper set of dies upon the lower, a pin *s* adapted to be withdrawn from and brought in engagement with cam-wheel *t* secured upon rod *d*, said cam-wheel *t* adapted to be brought in successive engagements with pins, whereby the wiper may be receded step by step, all substantially as and for the purposes set forth.

11. The combination with a mandrel, of an expanding collar loosely mounted thereon, and means for forming folds in the tube and bending the same into an elbow; whereby the collar remains in the end of the tube during bending to prevent the collapse thereof; substantially as described.

12. The combination with a mandrel, of a wiper carried thereon, means for receding the mandrel from the tube step by step during the wiping process, and means for bending the tube into an elbow upon the final recession of the mandrel: substantially as described.

In witness whereof I hereunto subscribe my name this 18th day of July, A. D. 1893.

ORLANDO P. BRIGGS.

Witnesses:

GEORGE L. CRAGG,
FLOYD T. SHORT.