No. 757,593. PATENTED APR. 19, 1904.

G. F. ATWOOD.

MACHINE FOR BENDING TUBES.

APPLICATION FILED JULY 11, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

Fig. 1.

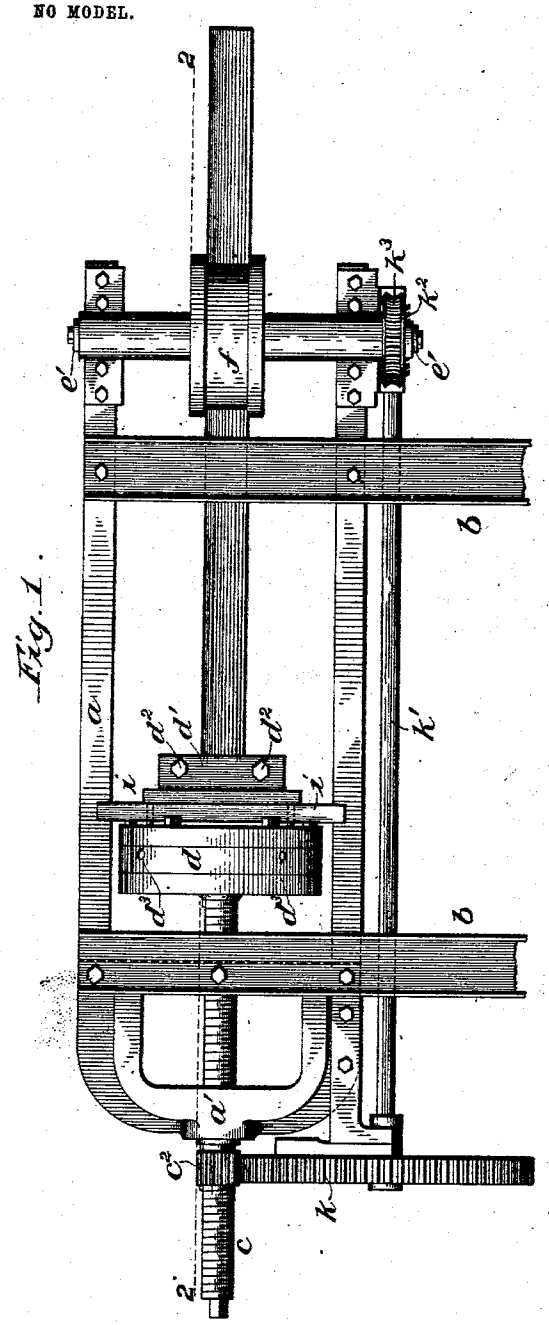
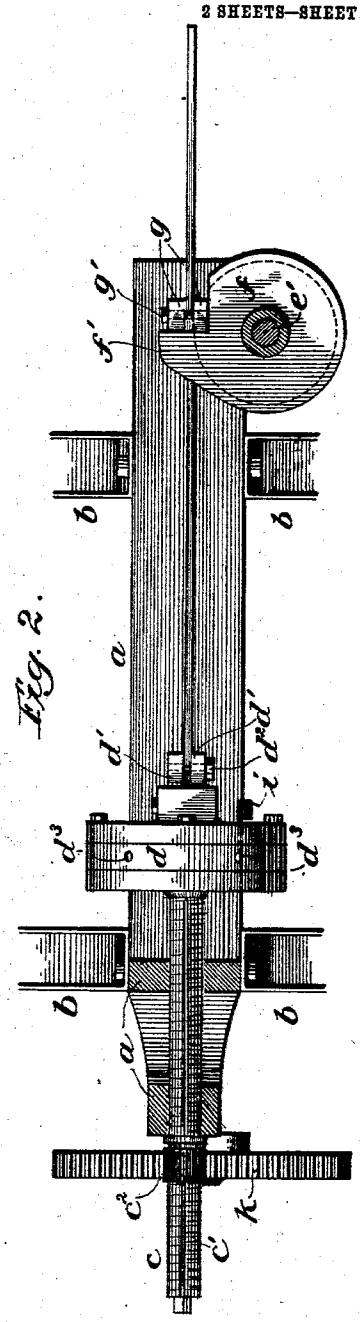


Fig. 2.



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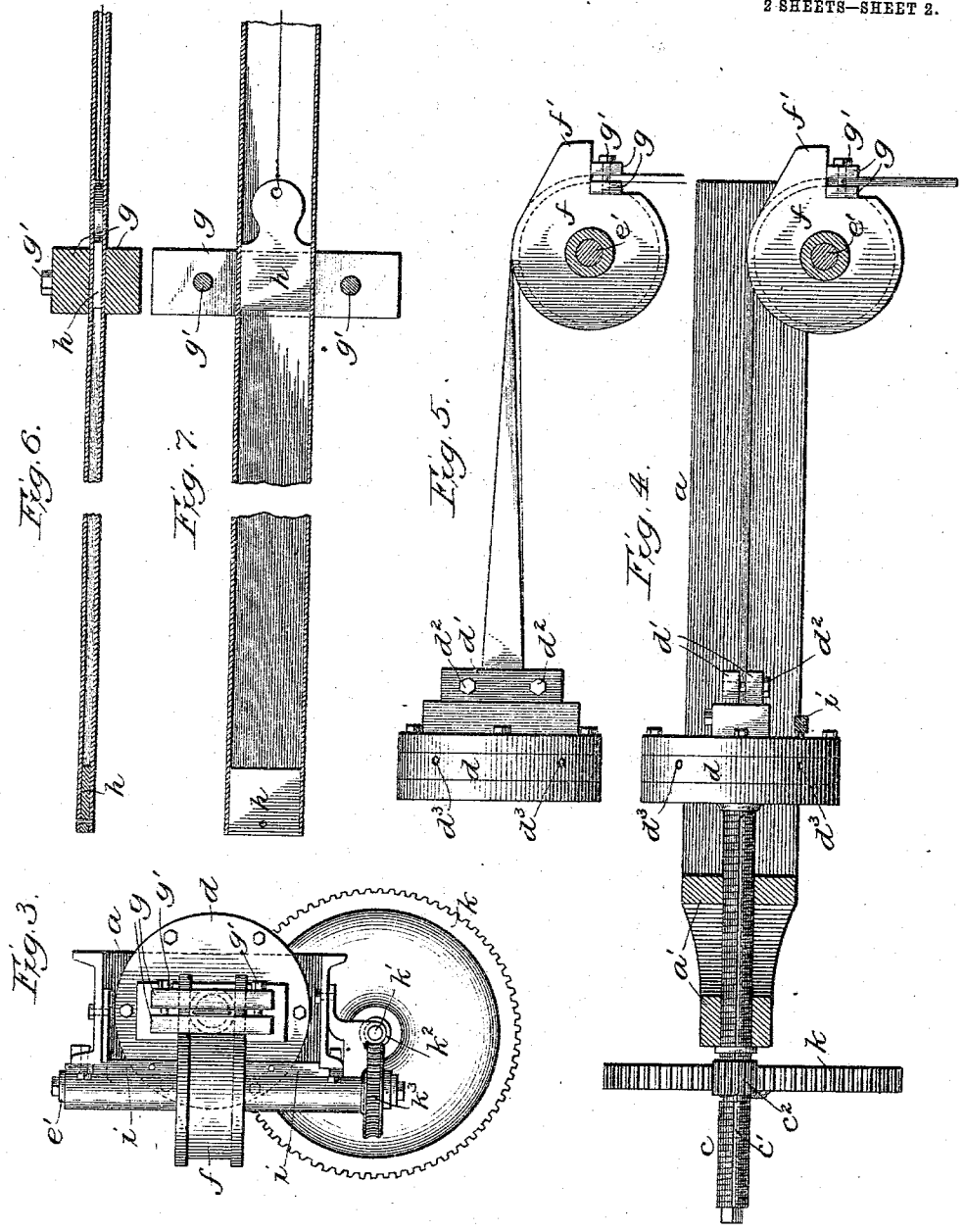

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No. 757,593. Patented April 19, 1904.

UNITED STATES PATENT OFFICE.

GEORGE F. ATWOOD, OF HOBOKEN, NEW JERSEY, ASSIGNOR TO WESTERN ELECTRIC COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

MACHINE FOR BENDING TUBES.

SPECIFICATION forming part of Letters Patent No. 757,593, dated April 19, 1904.

Application filed July 11, 1902. Serial No. 115,108. (No model.)

To all whom it may concern:

Be it known that I, GEORGE F. ATWOOD, a citizen of the United States, residing at Hoboken, in the county of Hudson and State of New Jersey, have invented a certain new and useful Improvement in Machines for Bending Tubes, of which the following is a full, clear, concise, and exact description.

My invention relates to a machine for bending tubes, and has for its object to provide improved mechanism by which a tube may be bent or twisted smoothly and regularly without wrinkles or distortion.

The problem of bending a rectangular tube presents much greater difficulties than the bending of round tubes, and it has been found that the methods heretofore employed for the latter will not attain the desired results with rectangular tubing. It is frequently required to bend the rectangular tube on a radius of three or four inches without distortion or wrinkles, and in such a case the outer wall and the two edges must stretch a very considerable distance more than the inner wall. In attempting to bend a thin rectangular tube by the methods heretofore employed it is found that before the outer wall will stretch the required amount the inner wall will be buckled and distorted. The filling of sand ordinarily used may prevent the metal from buckling inward, but it will then buckle outward, which no filling will effectually prevent. I have invented a new process for bending tubes, which is described in my patent application Serial No. 115,107, filed July 11, 1902, and which consists, briefly, in first subjecting the tube to a longitudinal tensile stress sufficient to stretch the metal and then bending the tube while such tensile stress is maintained. Preferably the tube is stretched to approximately the elastic limit of the metal, and this stress is gradually increased as the tube is bent. I have found that by this process I can produce a perfectly regular and symmetrical curve or twist without any appreciable distortion or wrinkle.

The present invention is a machine adapted to manipulate a tube in the manner above indicated, and I will describe the same in detail by reference to the accompanying drawings, in which—

Figure 1 is a view of the machine in elevation. Fig. 2 is a sectional plan view thereof on line 2 2 of Fig. 1. Fig. 3 is an end elevation. Fig. 4 is a sectional plan view similar to Fig. 2 but showing the parts in an alternative position. Fig. 5 is a detail view showing how the tube may be given a twist or quarter-turn. Figs. 6 and 7 are detail views showing how the tube is plugged at the points where it is clamped, so that it will not collapse.

The same letters of reference designate the same parts wherever they are shown.

The rigid framework a, which may be supported on legs or standards b, has a threaded bearing a' at one end through which the longitudinal screw c is passed. The inner end of said screw carries a head or chuck d, which is mounted thereon so that the screw can rotate independently thereof. A removable cross-bar i is fitted upon pins carried by the chuck d and projects above and below the same alongside the horizontal bars of the framework, so that when said cross-bar is in place the chuck cannot rotate, but will merely slide forward or backward as the screw is turned. When the cross-bar is removed, the chuck may be rotated by the aid of a wrench-bar thrust into one of the holes d^3 in its periphery. At the other end of the framework a is mounted a vertical shaft e', which carries the bending-mandrel f, the shaft being so disposed that the curve of the mandrel will be approximately tangent to a line projected along the longitudinal axis of the screw.

The head or chuck d is provided with jaws d' d', which are adapted to grasp one end of the tubing, said jaws being tightened by means of bolts d^2 d^2. Clamps g g, tightened by bolts g' g', are placed upon the other end of the tubing, and these clamps are seated against lugs f' f', which project from the top and bottom of the bending-mandrel. Plugs h h are inserted in the tube at the points where it is clamped to prevent collapse. The tube

is also filled with sand or other filling in accordance with the usual practice.

The screw c has a long keyway c', along which a pinion c^2 is adapted to slide, said pinion being thus thrown into or out of mesh with a spur-gear k, as may be desired. The spur-gear k is fixed upon one end of the shaft k', the other end whereof carries a worm k^2, which engages a worm-wheel k^3, fixed upon the vertical shaft e' of the bending-mandrel.

The operation of the machine is as follows: A tube of suitable length is plugged and filled with sand and one end clamped between the jaws d' d' of the chuck d, while the clamps g g, which are placed on the other end, are supported upon the lugs f' f' of the bending-mandrel, as shown in Figs. 1 and 2. The pinion c^2 is now removed from mesh with the spur-gear k and the screw c is turned backward by a crank or other means to put a longitudinal tensile stress on the tube, the mandrel f being held immovable by the worm-gear and the head or chuck d being retracted by the screw. When this stress is sufficient to elongate the tube, the pinion c^2 is thrown into mesh with the spur-gear k and the screw c is then turned forward. Now as the screw is rotated the pinion c^2 drives the bending-mandrel f through the gearing before described, which is preferably so proportioned that the periphery of the mandrel will move slightly faster than the chuck d, which is advanced by the screw. By this means not only the initial stress on the tube is kept up, but the stress is gradually increased as the bend is made. Fig. 4 shows the position of the mandrel in finishing a bend of ninety degrees. The stress upon the tube is so great that the inner wall cannot buckle while the outer wall is stretched, and a perfectly regular and smooth bend is thus secured.

When desired, the tubes may be given a twist, as shown in Fig. 5. This may be done by removing the cross-bar i from the chuck d, so leaving the latter free to turn, and then rotating said chuck through the required arc by means of a wrench-bar thrust into one of the holes d^3.

I claim as my invention—

1. In a tube-bending machine, the combination with clamps adapted to unyieldingly hold the tubing, of a mandrel and mechanism for moving the clamped tube to bend the same over the mandrel, and mechanism for initially retracting one of said clamps to stretch the tubing, the clamps being held relatively in position to maintain the tubing under a longitudinal tensile stress as the bend is made.

2. In a tube-bending machine, the combination with a rotating mandrel and clamps for holding one end of the tube, supported by said mandrel, of a screw c carrying a chuck for holding the other end of the tube, a pinion mounted to rotate with the screw, a spur-gear meshing with the pinion, and a shaft and worm-gear connecting said spur-gear with the rotating mandrel, said spur-gear and pinion being arranged to be thrown into and out of mesh with each other.

3. In a machine for bending tubes, the combination with a rotating mandrel and clamps for holding one end of the tube, supported by said mandrel, of a chuck for holding the other end of the tube, a screw for retracting the chuck to stretch the tube, and gearing arranged to simultaneously rotate the mandrel and advance the chuck, whereby the tube is bent around the mandrel while subjected to a longitudinal tensile stress.

4. The combination with the clamps g g adapted to hold one end of the tube to be twisted, of a movable chuck adapted to hold the other end of the tube, and a screw c for retracting the chuck whereby the tube is stretched longitudinally, the chuck being rotatably mounted; whereby the tube may be twisted under a longitudinal tensile stress.

5. In a tube-bending machine, the combination with a rotating mandrel carrying a clamp adapted to hold one end of a tube, of a reciprocating chuck for holding the other end of the tube, means for initially retracting the chuck to stretch the tube, and mechanism adapted to rotate the mandrel and advance the chuck while maintaining the longitudinal strain upon the tube.

In witness whereof I hereunto subscribe my name this 21st day of May, A. D. 1902.

GEORGE F. ATWOOD.

Witnesses:

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ARTHUR G. F. LOCKWOOD.