(No Model.)

J. H. KELLY & C. H. BROAD.

ART OF BENDING TUBES AND PIPES.

No. 369,013. Patented Aug. 30, 1887.

Fig. 1.

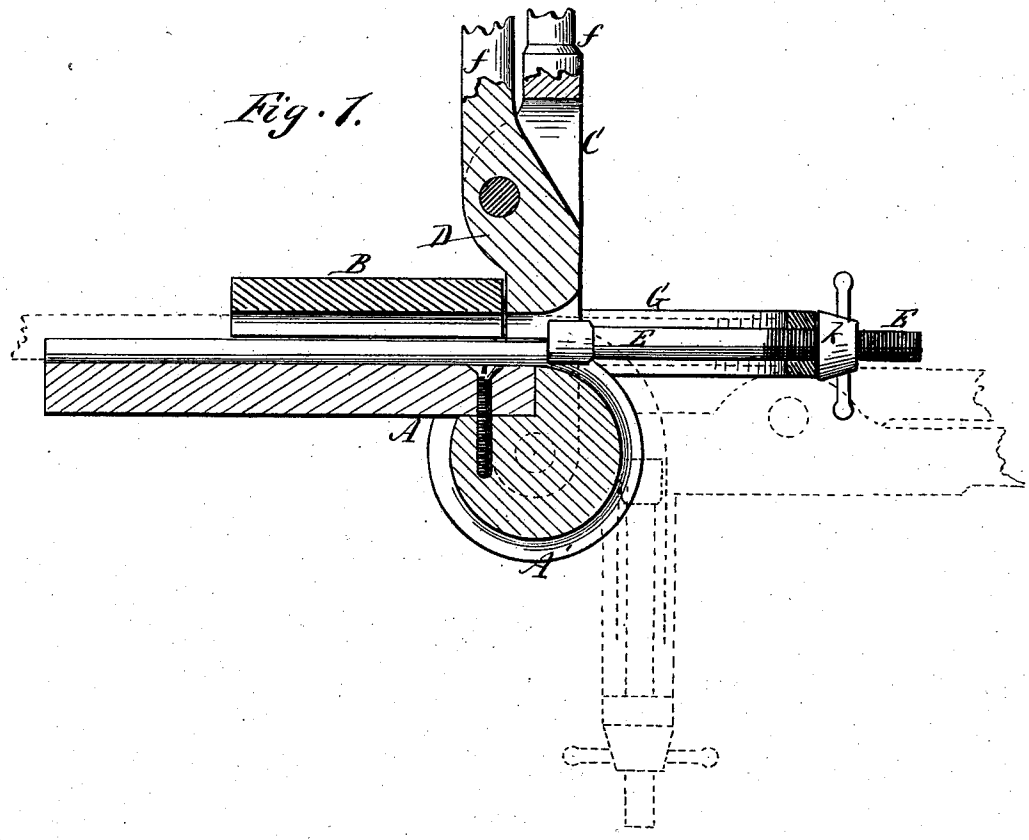


Fig. 2.

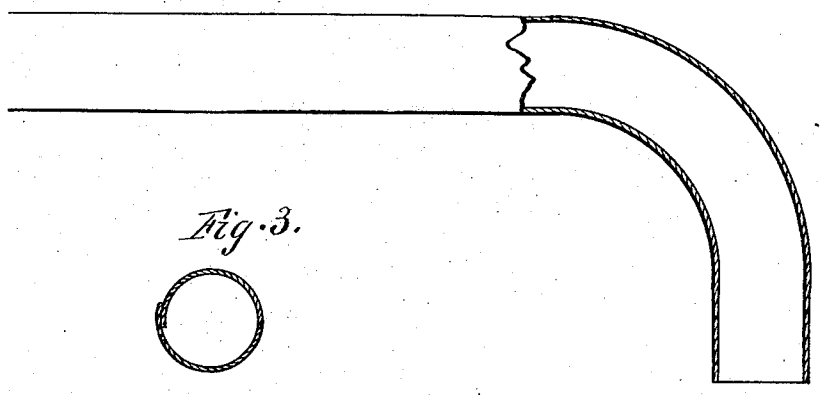


Fig. 3.

Attest.

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UNITED STATES PATENT OFFICE.

JAMES H. KELLY AND CHARLES H. BROAD, OF ROCHESTER, NEW YORK; SAID BROAD ASSIGNOR TO SAID KELLY.

ART OF BENDING TUBES AND PIPES.

SPECIFICATION forming part of Letters Patent No. 369,013, dated August 30, 1887.

Application filed April 27, 1887. Serial No. 236,296. (No model.)

To all whom it may concern:

Be it known that we, JAMES H. KELLY and CHARLES H. BROAD, both citizens of the United States, residing at the city of Rochester, in the county of Monroe and State of New York, have invented a certain new Improvement in the Art of Bending Tubes and Pipes; and we do hereby declare that the following is a full, clear, and exact description of the same.

Our improvement relates to tubes and pipes in which the bend is made after the tube or pipe has been formed. Such work has before been done; but the usual practice has been to fill the tube or pipe with sand or other filling, hold the same tightly in place, and then produce the bending, either around a form or by hand. The difficulty is that the filling will yield more or less, and the tube will flatten when bent and will frequently break.

The object of our invention is to bend tubes and pipes so that the bend will not be flattened, but will present substantially a true circle in cross-section, and so that the exterior surface will be smooth and well finished, and so that in the process of manufacture there will be the minimum of loss by breakage.

To this end our invention consists in the method of bending tubes and pipes hereinafter described, which consists in securing the same on a form having substantially the shape to which it is desired to have the tube or pipe conform when bent, then inserting a rod or mandrel in the end of the tube or pipe, and then drawing the rod or mandrel around the form, said rod or mandrel producing the bend as it is being drawn around the form, and the circular end preserving the circle of the tube or pipe in cross-section as the bending progresses.

In carrying out this invention any suitable apparatus may be used. The drawings show one form of apparatus adapted to the purpose.

In said drawings, Figure 1 is a central longitudinal vertical section of the machine. Fig. 2 is a longitudinal sectional view of a tube or pipe after being bent. Fig. 3 is a cross-section of the same.

A indicates the "form," the same having a curved head, A′, of the shape to which it is desired to have the tube or pipe conform when bent. Said form is grooved to receive the tube or pipe, and said tube or pipe is securely held in place in the straight groove, while the bending action takes place, by means of a clamp, B, or any other suitable means.

C is a yoke pivoted on the axis of the forming head A′, and D is a die pivoted in the yoke, each of said parts C and D having a lever or handle, *f*, by which it is operated. The lower end of the die is grooved to fit the top of the tube or pipe.

G is a stirrup attached to the yoke and moving with it.

E is the rod or mandrel through the medium of which the bending is done. This rod may either be straight and of the same diameter its whole length, or it may have an enlargement forming a head at the inner end, as shown in the drawings. The outer end of the rod rests in the stirrup, and is held to it by any desired means, that shown in the drawings being a nut, *k*, which screws upon a thread on the rod, and thus serves as a gage to adjust the rod forward or back.

To bend the tube or pipe, the same is secured on the form, the rod is inserted in the projecting end of the tube or pipe, its end resting over the form, and the yoke, carrying the die, the stirrup, and the rod, is then swung around the form, the rod in that case causing a simultaneous drawing and bending movement of the tube around the form, and making the bend as it progresses, and the circular end or head, resting at the point where the bending takes place, forms a core, preserves the circle of the tube, and leaves the tube practically circular in cross-section in all parts of the bend and its entire length, and differs materially from tubes bent in the ordinary way by having also a smooth exterior and being of the same diameter the whole extent.

The above illustrates one form of apparatus, others of which may be used, the necessary elements being the form around which the tube is bent and the rod for bending it. In some cases an upper die may be necessary where considerable pressure is required to overcome the crimping action of the metal.

The advantages of this method are, that no filling is required. The bending is made coincident with the motion of the rod around the form, and is produced by the rod. The tube is practically circular in cross-section at all parts

of the bend, and is smooth on the exterior surface, and therefore stronger, and also of the same diameter its whole extent. The work is more rapidly done, and there is less loss from breakage.

All kinds of tubes and pipes which are capable of being bent can be bent by this method, the only limit being the strength and stiffness of the rod or mandrel.

A plain straight rod will do the work practically and well; but to facilitate the operation the rod is preferably made with an enlarged head at the inner end, where the bending takes place.

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

1. The improvement in the art herein described of bending tubes and pipes, which consists in securing the tube or pipe on a form of the shape to which it is desired to have the tube or pipe conform when bent, then inserting a mandrel in the tube or pipe, and finally giving a simultaneous drawing and lateral movement to the mandrel around the form, as and for the purpose specified.

2. The improvement in the art herein described of bending tubes and pipes, which consists in securing the tube or pipe on a form of the shape to which it is desired to have the tube or pipe conform when bent, inserting a mandrel in the tube or pipe and resting a die upon the tube or pipe, and finally carrying the mandrel and die around the form, as and for the purpose specified.

In witness whereof we have hereunto signed our names in the presence of two subscribing witnesses.

JAMES H. KELLY.
CHARLES H. BROAD.

Witnesses:
H. C. BREWSTER,
G. N. HOPKINS.