(No Model.)

# C. B. COOPER.

## PROCESS OF MAKING PIPE ELBOWS.

No. 410,534. Patented Sept. 3, 1889.

Fig. 1.

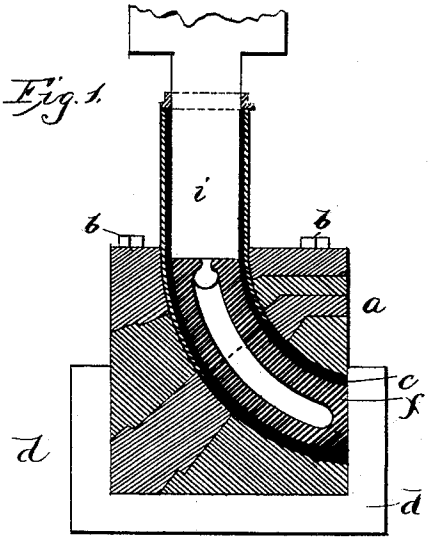



Fig. 2.

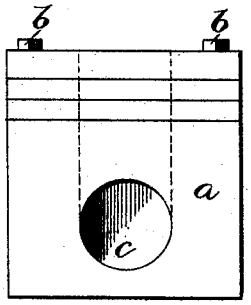
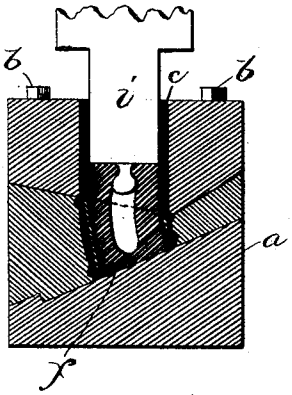



Fig. 3.



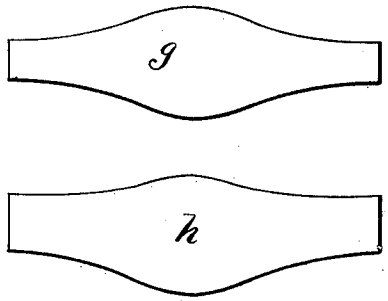
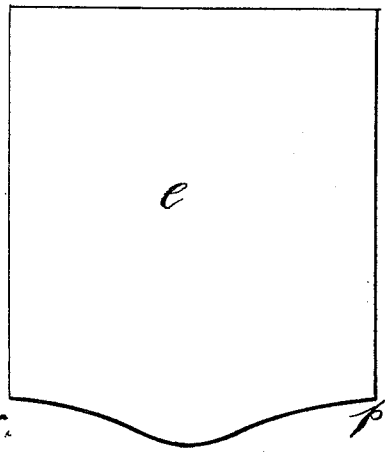




Fig. 4.




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# UNITED STATES PATENT OFFICE.

CHARLES B. COOPER, OF NEW YORK, N. Y., ASSIGNOR TO W. F. WALLACE AND HUGH E. COOPER, OF SAME PLACE.

## PROCESS OF MAKING PIPE-ELBOWS.

SPECIFICATION forming part of Letters Patent No. 410,534, dated September 3, 1889.

Application filed June 15, 1889. Serial No. 314,376. (No model.)

*To all whom it may concern:*

Be it known that I, CHARLES B. COOPER, of New York, in the county of New York and State of New York, have invented certain new and useful Improvements in the Process of Making Pipe-Elbows; and I do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form part of this specification.

My invention relates to certain improvements in the manufacture of pipe-sections, and more particularly to improvements in the manufacture of pipe-elbows or sections thereof.

The object of the invention is to provide an improved method or process whereby pipe-sections of any form or curvature can be easily, quickly, and cheaply constructed and with a minimum amount of machinery and labor.

With these ends in view my invention consists in the peculiar process and method hereinafter set forth, and particularly pointed out in the claims.

Referring to the accompanying drawings, which illustrate an apparatus for carrying out my method, Figure 1 is an elevation, partly in section, showing a blank in the forming-opening of the female die and the flexible expander therein in the act of or just before being expanded by the plunger. Fig. 2 is a front view of the female die or forming-block. Fig. 3 is a view similar to Fig. 1, showing another form of female die or forming-block. Fig. 4 shows several plan views of different forms of blanks for making pipe-sections.

In the drawings, the reference-letter *a* indicates a female die or forming-block, preferably strongly and solidly formed in transverse sections for convenience in casting, and these sections are secured together by the bolts *b*, as shown. This die or block is provided with a transverse shaping bore or opening *c*, extending through the sections and forming a continuous bore of the size and shape of the pipe-section to be made. This bore preferably extends but a portion of the distance through the block, so that one end will be closed by a rigid and solid wall; but if the bore of the block does extend completely through the block is provided with a rest or seat *d*, provided with a flat rigid wall closing the lower end of the bore or forming-opening of the block. The bore or opening is formed to correspond to the exterior surface of the section of tube or pipe to be formed. If a curved elbow or section of a curved elbow is to be made, the bore of the block should have the same degree of curvature and the same length as the pipe-section to be formed, and the interior surface of this bore is provided with annular or longitudinal grooves, if it is desired to form the pipe-section with corresponding corrugations, as where sections of an elbow are being made the end edges of the same are provided with annular corrugations or grooves, by means of which the sections are fastened together to form the completed elbow.

When it is desired to form an elbow from a single piece, a blank *e* is used, which blank is first stamped or cut out of suitable sheet material, and is then bent into the form of a straight tube with its longitudinal end edges loosely overlapping. One end of the tube thus formed is then inserted a short distance into the bore or forming-opening of the die shown in Fig. 1, which bore of this die is of the full length and curvature of a complete elbow, and after the end of the tube has been inserted in the bore a hollow air-tight cylinder *f*, formed of flexible material, is then inserted in the tube-blank and heavy pressure applied to the end of the cylinder, so as to expand the same laterally within and against the inner walls of the tube, and thereby force the same against the inner surface of the forming-opening with sufficient pressure to cause the metal of the tube to permanently conform to the shape and curve of said opening. When the pressure is removed, the flexible cylinder is withdrawn and the tube-blank is pressed a little farther into the forming-opening (this is possible as the edges of the blank merely loosely overlap) and the flexible air-tight cylinder is again inserted and pressure applied, as before. This operation is con-

tinued until the complete elbow is formed. The finished blank is then withdrawn from the opening and its longitudinal edges suitably secured together.

For making sections of curved elbows a die such as shown in Fig. 3 is employed, having an opening of the form of a curved section of pipe, convex on the longer side and concave on the shorter side, the opening from thence extending upwardly in a straight line, so that the flexible expansible cylinder can be used to greater advantage, or to form end sections for the elbows curved half their length and straight the rest of their length. The blanks used for forming curved elbow-sections are indicated by the letters *g* and *h*. The blank indicated by *h* is used to form the end section of an elbow, and these sections are made in the same way as the integral elbow, before described, only the section-blank is bent circular and inserted in the opening and formed by one compression of the internal forming piston or cylinder.

The flexible expander in the present instance consists of a hollow rubber cylinder closed at one end and preferably open at the other, and which, when contracted or in its normal condition, is less in diameter than the internal diameter of the forming-opening of the die and the tube-section to be formed thereby. This internal die or expander is expanded by a plunger *i*, reciprocated by suitable mechanism and having a projection on its lower end to fit in and close the upper open end of the expander. The lower closed end of the expander fits against the closed end of the forming-opening.

In Fig. 3 the internal face or walls of the forming-opening are shown provided with upper and lower grooves to form corresponding circumferential grooves in the section.

It is evident that the confined body in the expander can be either air or fluid.

It is evident that my present invention is not limited to use with the herein-described apparatus, but that any apparatus can be employed to carry out this cheap, simple, quick, and easy method of manufacturing pipe-sections.

What I claim is—

1. The method of manufacturing pipe-elbows, which consists in first forming a flat metal blank and bending the same into cylindrical form with its edges overlapping, then inserting said cylindrical blank into a bore or female die of the shape of the pipe-section to be produced, then inserting a hollow flexible air or fluid tight expander into said cylindrical blank, and then applying heavy pressure to the end of said expander, and thereby expanding the same laterally, for the purpose set forth.

2. The method of forming pipe-sections, which consists in placing a cylindrical sheet-metal blank in a forming-bore, the walls of which conform to the shape of pipe-section to be produced, and which is closed at one end and open at the other end, then inserting an elastic hollow air-tight cylinder loosely into said blank, and then applying sudden heavy pressure to the end of the cylinder, as set forth.

In testimony that I claim the foregoing as my own I affix my signature in presence of two witnesses.

CHARLES B. COOPER.

Witnesses:
B. A. McCLAIN,
W. F. WALLACE.