2 Sheets—Sheet 1.

R. WRIGHT.

MACHINE FOR BENDING TUBING.

No. 174,607. Patented March 7, 1876.

Fig. 1.

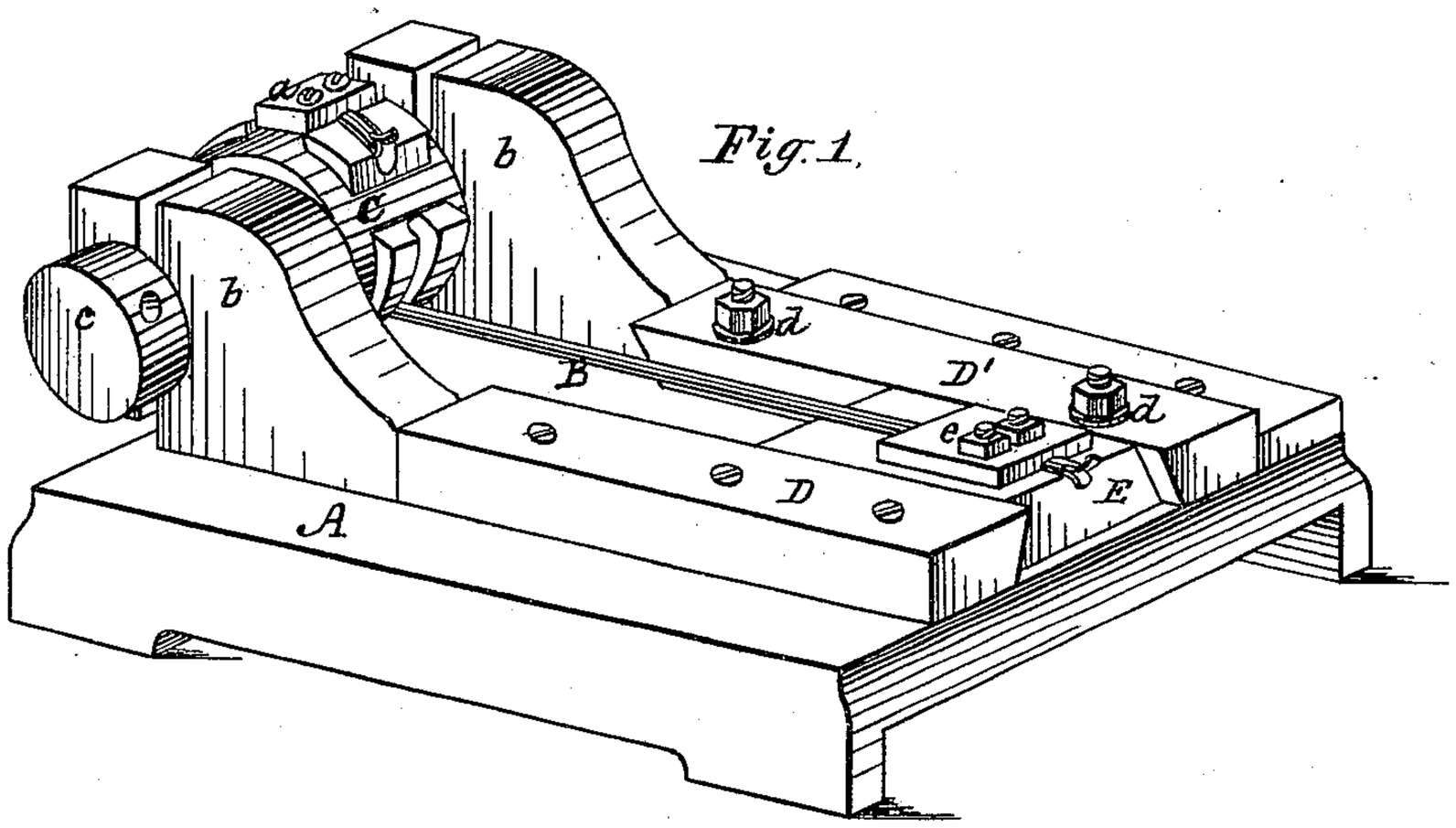


Fig. 2.

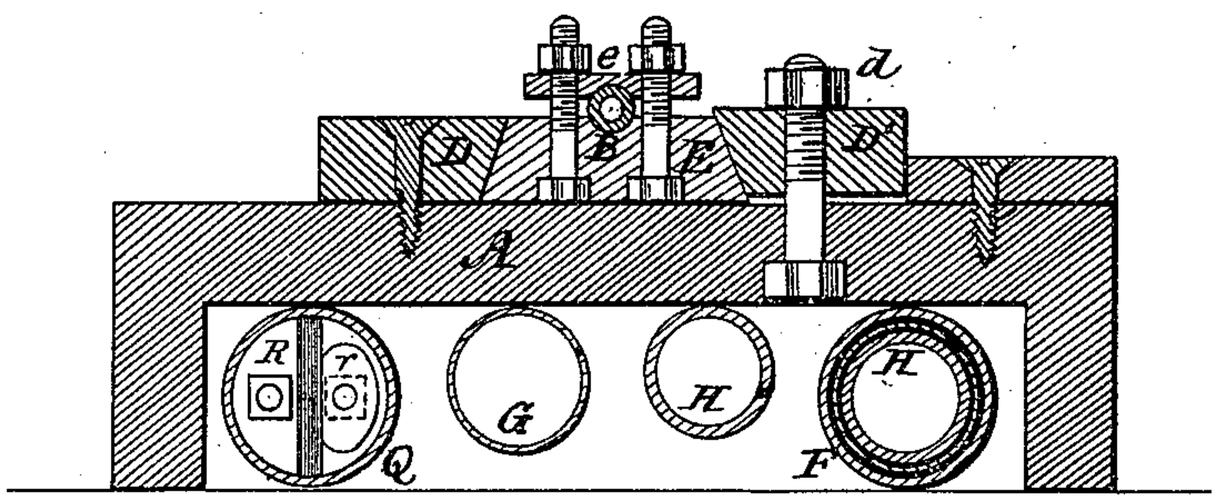


Fig. 3.

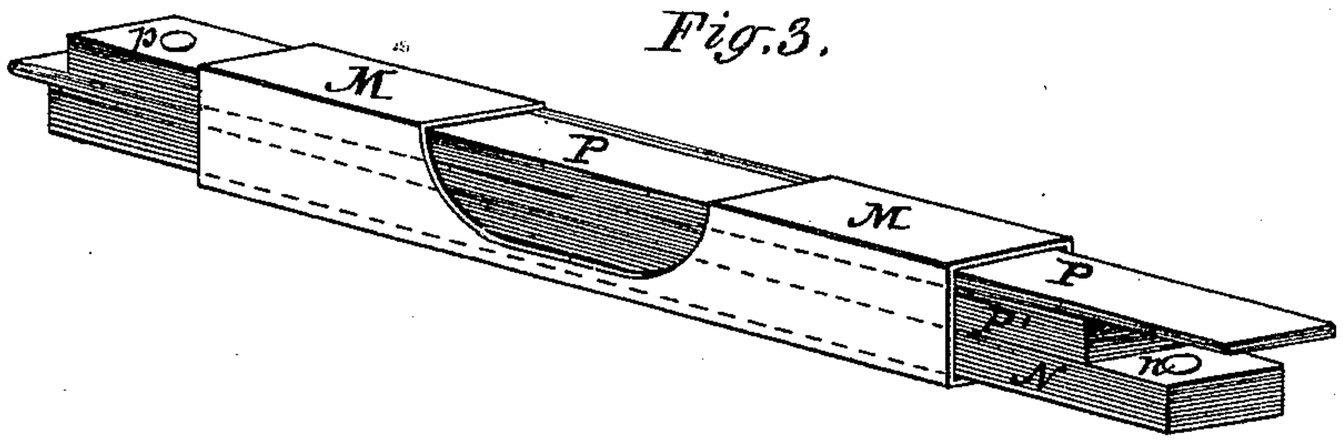
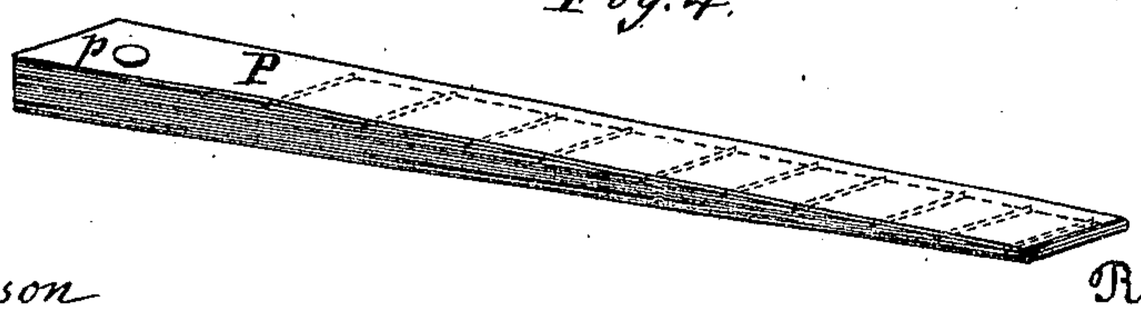


Fig. 4.



Witnesses
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Inventor.
Robert Wright
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2 Sheets—Sheet 2.

R. WRIGHT.

MACHINE FOR BENDING TUBING.

No. 174,607. Patented March 7, 1876.

Fig. 5

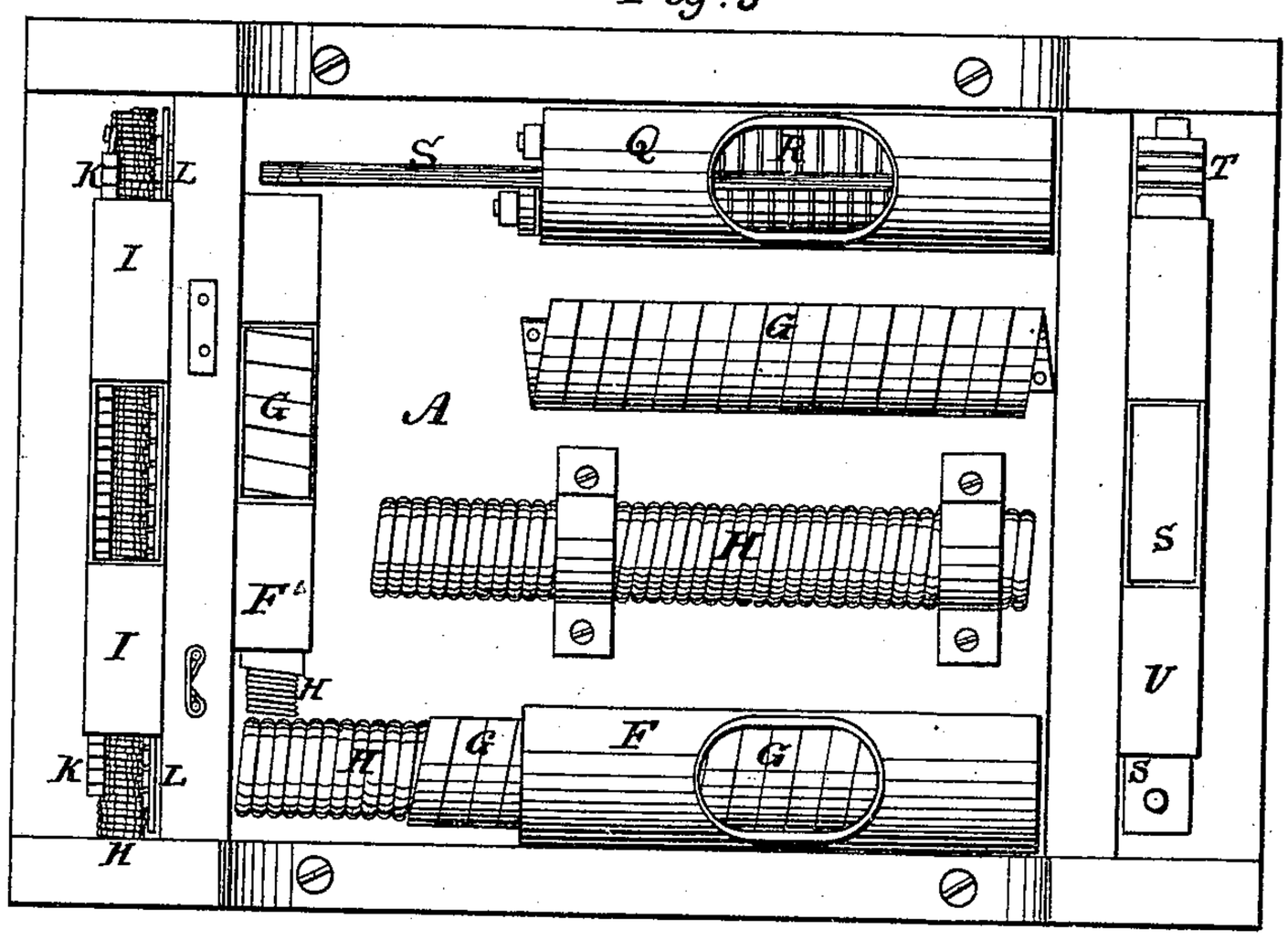


Fig. 6.

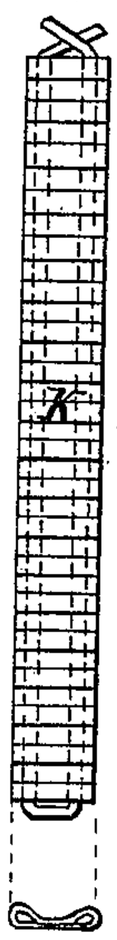


Fig. 7.

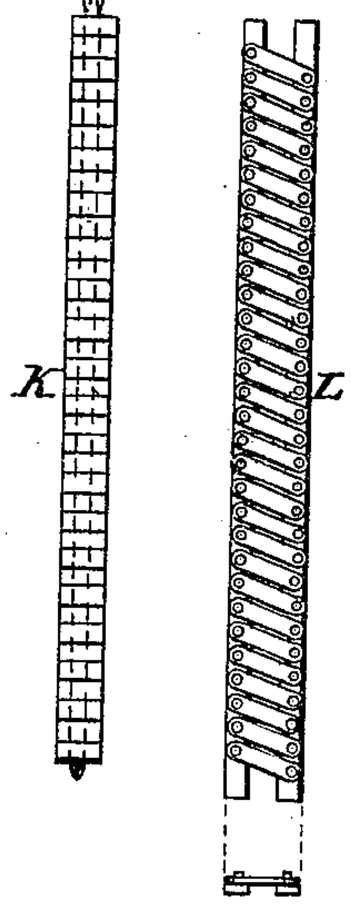


Fig. 8.

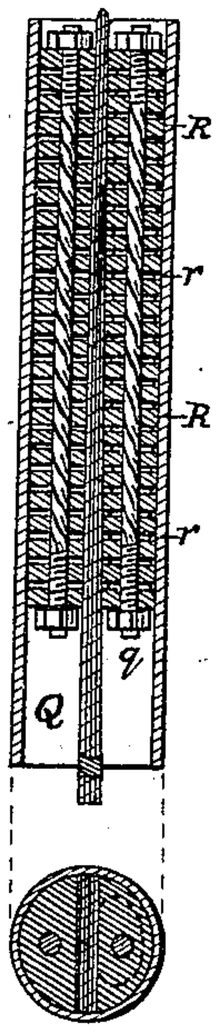
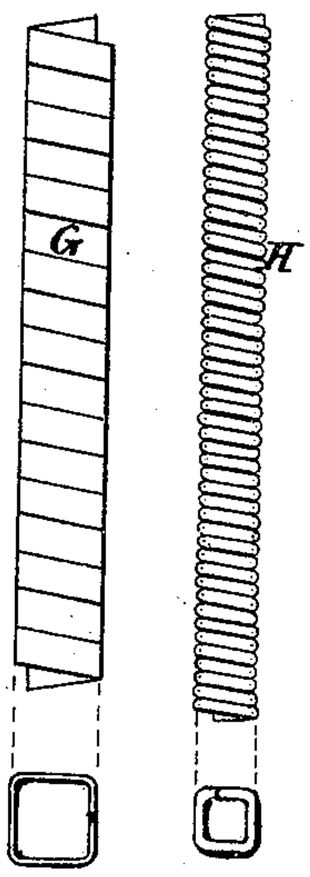


Fig. 9.

Fig. 10.



Witnesses.

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UNITED STATES PATENT OFFICE.

ROBERT WRIGHT, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN MACHINES FOR BENDING TUBING.

Specification forming part of Letters Patent No. **174,607**, dated March 7, 1876; application filed January 7, 1876.

To all whom it may concern:

Be it known that I, ROBERT WRIGHT, of the city of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Bending Metallic Pipes or Tubes; and do I hereby declare the following to be a full, clear, and exact description of the same, reference being had to the accompanying drawings, making a part of this specification, in which—

Figure 1 represents a perspective view of a machine used to subject the pipe to a longitudinal strain while being bent. Fig. 2 represents a transverse vertical section of the same, and also a transverse section of pipes and their packings. Fig. 3 represents, in perspective, a piece of square pipe, partially in section, showing the packing formed of a series of thin, flat spring-plates, held in position by wedges formed of flat spring-plates of different length. Fig. 4 represents, in perspective, one of the wedges formed of flat spring-plates of different lengths, and a bent spring-plate to inclose them, the whole being connected by rivets or screws. Fig. 5 represents, in plan view, the under side of the machine, shown in Fig. 1, with pieces of pipes attached to it, and the packing employed in bending the pipes. Figs. 6, 7, 8, 9, and 10 represent more clearly and in detail the forms of packing shown in Fig. 5.

In bending gas and other pipes, the metal on the inner curve is ordinarily compressed and liable to crimp or bend and thus reduce the original sectional area of the pipe. The object of my invention is to completely support the pipe in its interior, so that while being bent it shall retain its original sectional form; and my invention relates to a machine for clamping and holding the pipe, while being bent, so as to produce a longitudinal strain upon it and reduce the tendency to crimping on the inner curve or bend.

My invention further relates to an elastic metallic support placed within the pipe that is to be bent, said support being composed of a thin, flat steel ribbon wound spirally, and inclosing a strong mandrel made of round wire, also wound spirally, the cross-section of the mandrel and steel-ribbon sleeve being round, square, or of any other form similar to the pipe that is to be bent.

My invention further relates to an elastic metallic support placed outside of the pipe that is to be bent, said support being composed of a thin, flat, steel ribbon wound spirally and inclosed in a strong sleeve made of round wire, also wound spirally, the cross-section of the strong sleeve and steel ribbon being round, square, or of any other form suitable to the pipe that is to be bent.

In the drawings, A represents the bed-plate of the machine used to produce a longitudinal strain on the pipe B, that is to be bent to a curve corresponding with the former C. This former is a short cylinder, having a circular or other shaped groove on its periphery for the reception of the pipe, into which it is kept by the clamp *a* bolted to the cylinder C. This cylinder is mounted upon a shaft revolving into suitable bearings *b* attached to the bed-plate A, and on the shaft a head, *c*, is formed, so as to be revolved by means of levers or otherwise. To the top of the bed-plate A are attached two guide-plates D and D′, to direct the sliding clamp E, to which one end of the pipe B is attached by the clamping-plate and bolts *e*. The guide-plate D is fastened permanently to the bed-plate A, but the guide-plate D′ is connected to the bed-plate by means of bolts and nuts *d*, by which the friction produced by the guide-plates on the sliding clamp E can be regulated; the latter being dovetailed or beveled on the side next to the guide-plate D′, the said plate can, by means of the nuts *d*, be brought very tightly against the side of the sliding clamp and produce much friction, thus exerting a great longitudinal strain upon the pipe B during the operation of bending around the form or cylinder C, and thus preventing the pipe from crimping on the inner curve.

In Fig. 5 is shown, at F, a piece of round pipe, with a portion represented as broken away to show the thin steel ribbon G wound spirally in the interior, thus forming a sleeve to preserve the pipe F from abrasion by coming into contact with the strong spring-mandrel H, made of round steel wire, fitting into the interior of the sleeve G. A similar pro-

tection may be applied to the outside of the pipe F by placing a thin steel-ribbon sleeve next to the pipe, and a strong steel spring-mandrel of round wire on the outside of the latter, but I much prefer the first arrangement as above described. In Fig. 5 is also shown, at G, the thin steel ribbon or sleeve, and at H the round spring-mandrel, each one by itself and independently of the pipe F. And in Fig. 10, or at F′, Fig. 5, a similar thin steel ribbon G and spring-mandrel H are shown so formed as to be readily applied to the bending of pipes the cross-section of which is a square.

In Fig. 5 is shown, at I, a piece of square pipe, with a portion represented as broken away so as to exhibit the strong mandrel H in the center, bearing on one side against a series of links, K, strung upon a flexible wire, and shown more clearly in Fig. 6, while on the opposite side the mandrel H is bearing against a series of links, L, attached to two flexible strips by means of rivets, as shown also in Fig. 7. The same links K and L can be used in bending pipes of different sizes, as they are capable of expansion or contraction, as seen in Fig. 7, at the same time forming a flexible protection against injury to the walls of the pipe by the round spiral mandrel H.

In Fig. 3 is shown, at M, a piece of square pipe, with a portion represented as broken away to exhibit the internal packing, formed of a series of thin, flat spring-plates, N, retained together by a rivet, *n*, and two wedges P P′ to press the plates N against one of the walls of the pipe M. Said wedges P P′ are also composed of thin and flexible plates of different length, connected together by a rivet, *p*, and inclosed by a thin plate folded over, so as to remove the inequalities or steps produced by the different lengths of the thin plates forming each wedge.

In Fig. 5 is shown, at Q, a piece of round pipe partially in section, and also in Fig. 8, so as to exhibit the transverse plates R that fill the interior of the pipe. These plates are retained in position by being strung upon wire ropes *q*, and between each of them there is an elastic washer, *r*, of india-rubber, or other elastic substance, to allow the mandrel R to assume the requisite curve. Each plate R represents the half of a disk, and the two series of plates are forced apart by the wedge S, formed out of thin plates, as previously described, and support the pipe while it is bent. At T, Fig. 5, a similarly-constructed mandrel is applied into the interior of a square pipe, U, with the wedge S applied on one side of the mandrel, each plate being then made square, as shown in side view, and also in section in Fig. 9, and in either case, after bending the pipe, the mandrel can readily be removed by first withdrawing the wedge S.

I am aware that a flexible mandrel, consisting of a spiral coil of wire with a flattened exterior surface, is not new, and I am also aware that a flexible mandrel, consisting of a spiral coil of round wire with flexible plates running lengthwise of the pipe, between the spiral coil and the pipe, has been used before, but this mode cannot be used in bending round pipes, and I do not claim either of these devices.

What I claim is—

1. In a machine for bending pipes, the application of a longitudinal strain upon the pipe during the operation of bending, by means of the cylinder or former C and clamp *a*, in combination with the sliding clamp E and guide-plates D and D′, arranged substantially as shown and described.

2. In combination with a strong mandrel, H, made of round wire wound spirally, the thin, flat steel ribbon wound spirally upon the mandrel H, and between it and the pipe that is to be bent, to protect the latter from abrasion, substantially as described and represented.

3. In combination with a strong sleeve, H, made of round wire wound spirally, the thin, flat steel ribbon wound spirally within the sleeve H, and between it and the pipe that is to be bent, to protect the latter from abrasion, substantially as described.

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