

R. WRIGHT.

MACHINE FOR BENDING TUBING.

No. 174,609.

Patented March 7, 1876.

Fig. 1.

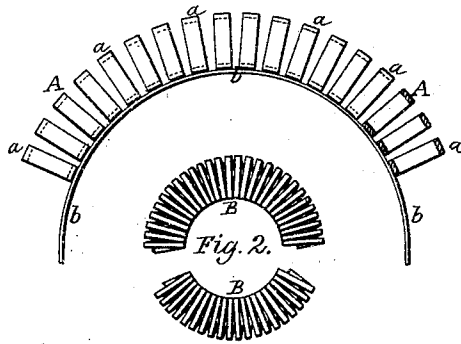
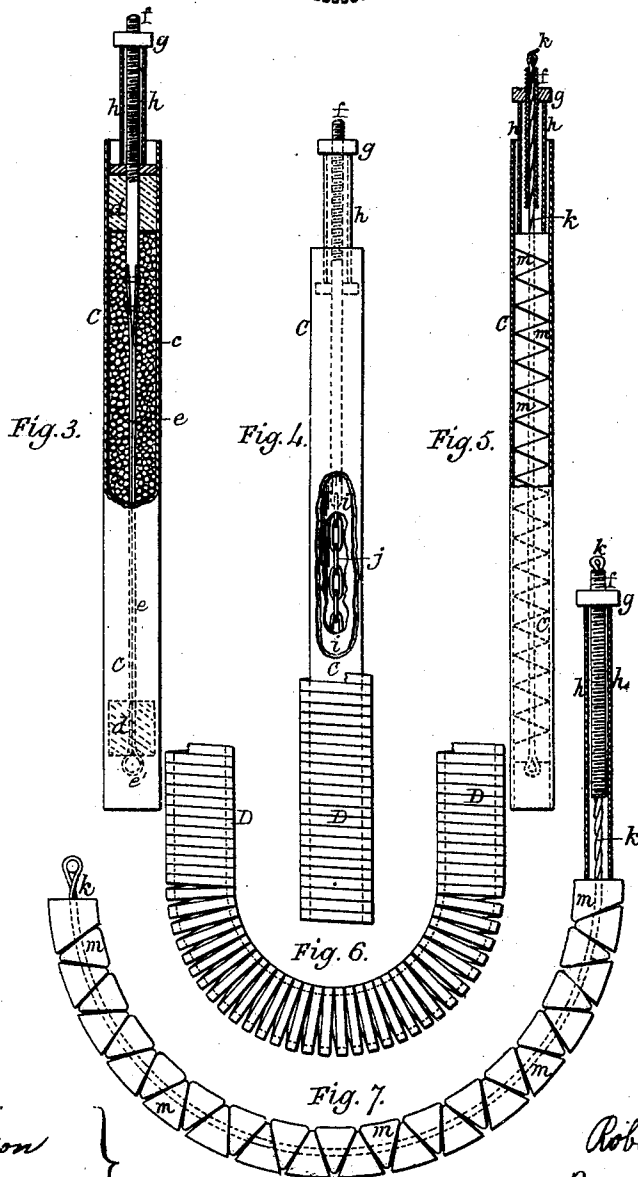


Fig. 2.



Witnesses.
W. B. Masson
Edmund Masson

Inventor:
Robert Wright.
By Atty. A. B. Stoughton.

R. WRIGHT.
MACHINE FOR BENDING TUBING.
No. 174,609. Patented March 7, 1876.

Fig. 8.

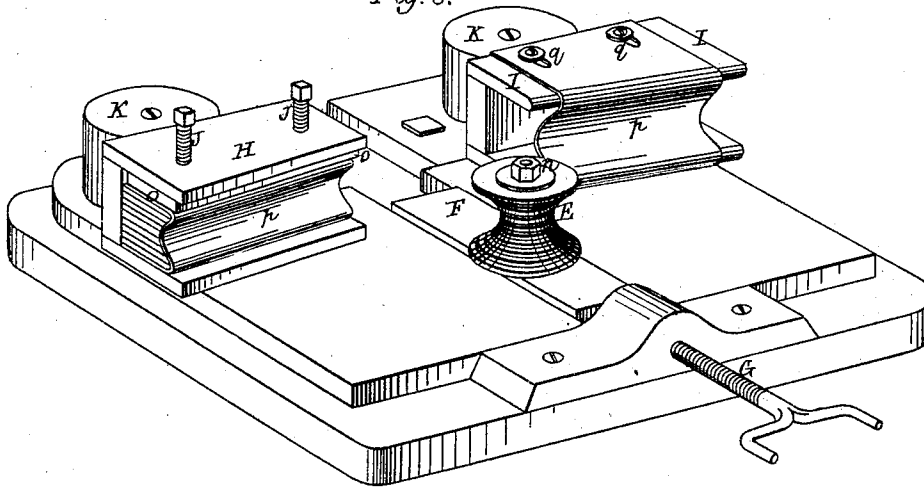


Fig. 9.

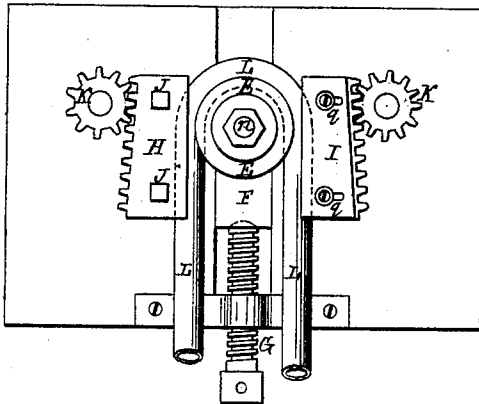


Fig. 10.

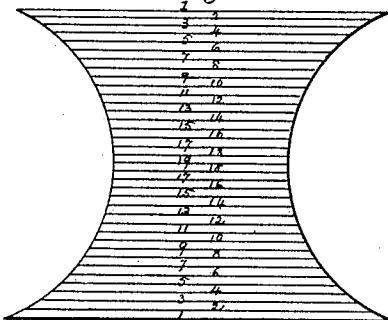


Fig. 11.

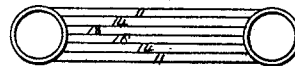


Fig. 12.

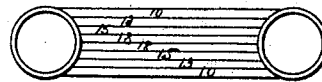


Fig. 13.

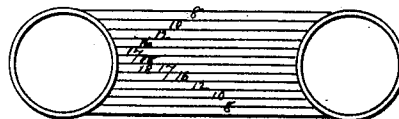
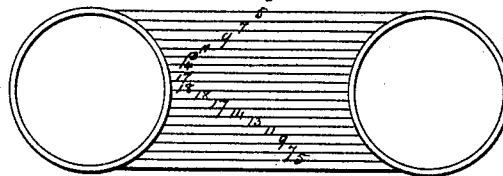


Fig. 14.



Witnesses.
W. B. Masson
Edmund Masson

Inventor.
Robert Wright
By atty. A. B. Stoughton.

UNITED STATES PATENT OFFICE.

ROBERT WRIGHT, OF PHILADELPHIA, PENNSYLVANIA.

IMPROVEMENT IN MACHINES FOR BENDING TUBING.

Specification forming part of Letters Patent No. **174,609**, dated March 7, 1876; application filed November 1, 1875.

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 Apparatus or Mechanisms for Bending Pipes, Tubes, &c., made of Metal; and I do 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—

Figures 1 to 7, inclusive, represent the plan of preparing the pipes or tubes with interior and exterior supports, so as to preserve their original sectional form in the process of being bent. Figs. 8 to 14, inclusive, represent the appliances for bending the pipes or tubes.

In bending gas and other pipes they are liable to rupture or collapse in the bent portions, or to crimp on the inner curve or bend, and, in either case, destroy the original sectional area of the pipe; and one of the objects of my invention is to completely restrain the pipe both in its interior and upon its exterior, so that in being bent it shall retain its original sectional form. So, also, in bending gas and other pipes, owing to the many sizes of such pipes, as many different "formers" and "shoes" were required as there were sizes of pipe to be bent, and these formers and shoes were quite expensive and troublesome to construct. The object and purpose of this part of my invention is to avoid the making of a former and shoes for each special size of pipe, and to build up such formers and shoes out of a series of disks or pieces of suitable material and form, as will be explained.

My invention consists, first, in supporting that part of the pipe or tube that is to be bent upon its exterior by a flexible metallic sleeve, to prevent rupture, buckling, or distortion in that direction.

My invention further consists in an elastic or yielding packing within the pipe or tube, that is capable of being forced out rigidly against the pipe interiorly, to prevent collapse or crimping in that direction.

My invention further consists in a former around which the pipes or tubes are to be bent, when said former is built up out of a series of

disks made of vulcanized rubber, card-board paper, leather, or similar material.

My invention further consists in a shoe or shoes for holding the ends or straight part of the pipe at or near the bend, when the portion of said shoe or shoes that bears against the pipe is composed of layers of vulcanized rubber, card-board paper, or leather, or portions of each or either, as may be preferred.

To enable those skilled in the art to make and use my invention, I will proceed to describe the same with reference to the drawings.

At Fig. 1 is represented a metallic flexible sleeve, A, made of a series of rings, *a*, fastened to a metal strip, *b*, so that it can be easily bent into the form shown, the rings *a* being strong enough and near enough together to keep the pipe that is to be bent in its original sectional form while undergoing the bending process. B represents similarly flexible sleeves, made by bending or winding square steel wire spirally around a mandrel, and in this form not requiring the flexible strip *b*. The sleeves at B, like that at A, are shown in a bent form, the former showing how short a bend may be made in the pipe, while its exterior is supported by a continuous metallic surface on the shorter curve, and an almost continuous bearing on the exterior of the longer bend or curve.

At Figs. 3, 4, and 5, C represents a metallic tube or gas-pipe, those at Figs. 3 and 4 being round, and that at Fig. 5 being square. In Fig. 3 the pipe or tube is filled at the portion that is to be bent with sand or other granular substance, *c*, which is held in place by rubber or other elastic (by preference) packing, *d*, at or near each end of the pipe or bend to be put in it. Through the pipe, packing, and filling passes a flexible metallic strip, (one or more,) *e*, which has a head, *e'*, of any suitable kind, upon one end of it, so that it will bear against the packing without being drawn through it, and upon the opposite end of the strip or strips is attached a screw, *f*, upon which a nut, *g*, works. Between the nut *g* and the packing *d* there is a washer or tube, *h*, the lower end of which, or the follower thereon, rests upon the packing *d*, while the nut *g* bears against the top of the washer or tube *h*. By this con-

struction the turning of the nut tends to draw the two packages *d* together with great force, and this force, coming upon the sand or other filling, *c*, expands said filling and forces it against the metal of the tube with sufficient compactness to prevent the tube in process of being bent from collapse or crimping on its interior. When the tube is thus prepared an elastic sleeve, such as is shown at A B D, is slipped over the tube and onto the portion to be bent, and this sleeve prevents rupture or crimping on the exterior of the tube, so that a tube thus restrained and supported inside and outside can be readily and easily bent, as will be hereinafter described, without injury to or change of the original sectional area of the pipe.

At Fig. 4 the same general plan is shown as at Fig. 3, the only difference being that, instead of the sand or other granular substance and the metal strips, a filling or packing of vulcanized rubber, *i*, is shown, through the center of which passes a chain, *j*. The packing or filling *i* is expanded by a nut, screw, and washer or tube, in the same way and for the same purpose as that described of Fig. 3. The sleeve D is put on in the same way and for the same purpose.

At Fig. 5 is shown a square tube or pipe. Such pipe I fill with a packing composed of V-shaped blocks or pieces strung upon a wire-rope, *k*. This rope is furnished with a screw, nut, and washer or tube, and the blocks or pieces *m* are drawn up by the screw for the same purpose as those, *d i*, in Figs. 3 and 4—viz., to completely fill the bore of the tube, particularly those sides of it which form the outer and inner curve of the bend. When this block packing or filling is in a straight tube, they will appear as seen in Fig. 5. When the pipe is bent this filling will assume the form shown at Fig. 7. When the pipe is bent the slacking of the nut upon the screw frees the filling from the tube sufficiently to withdraw it. A square pipe may be bent with a filling such as shown and described at Figs. 3 and 4, but I have found that described at Figs. 5 and 7 to answer well.

While I have only described a screw, nut, and washer or tube as devices for applying longitudinal pressure to the filling or packing through the flexible strips, chain, or wire-rope, the same result can be attained by other devices well known, so that I do not limit myself to these devices, but mean to claim their mechanical substitutes for expanding the filling.

When the pipe is prepared or supported on its interior and exterior, as hereinabove set forth, it is bent around a former, E, Fig. 8, as will be now described. The former E is built up out of a series of disks made of vulcanized rubber, card-paper board, leather, iron, or other similar material, these disks being clamped and held tightly together by a screw-bolt and nut, as shown at *n*. The former is placed upon a slide or frame, F, that can be moved by a

screw, G, or by a lever or other powerful appliance.

The shoes are shown at H I. That at H is built up out of pieces of vulcanized rubber, card-board paper, leather, or other similar material, clamped in the shoe-frame by screws J and a follower, *o*, and the concave face of the shoe may be covered by a rubber or leather apron, *p*. The shoe at I has only the apron, and that made of sheet metal, fastened permanently to one side of the shoe, and connected by set-screws and slots *q* to the other side of the shoe, so that it may be adjusted to the shoe. These shoes are made slightly tapering, and the backs of them rest against circular supports K K, around which they can move when the pipe is being bent. In Fig. 8 the backs of the shoes and the perimeters of the supports K are represented as plain-surfaced. They are less liable to slip when the backs of the shoes are in the form of a cogged or toothed rack, and the perimeters of the supports are formed like a cogged gear, as seen in Fig. 9. The supports in both cases are stationary, and the shoes roll around them.

When a pipe or tube is to be bent, the bending mechanism is arranged as in Fig. 8, and the pipe or tube is placed between the former E and the shoes H I, and lying in or against the concave surfaces of each. The former is then run up against the pipe by means of the screw G, or otherwise, and as it bends the pipe by passing through the space between the shoes, said shoes turn against their back supports, still bearing the pressure of the pipe against them, until finally, when the pipe I, Fig. 9, is bent as therein shown, the shoes have assumed a position at right angles to that they occupied before the bending commenced. The pipe, of course, can be bent to any desired angle, and is shown as bent to a full right angle in Fig. 9 to show the capacity of the bending mechanism.

The manner of preparing the disks out of which a former of many different sizes can be built up is shown at Fig. 10. The disks of rubber, paper-board, or leather are tightly clamped between heads or chucks, and then in a lathe turned to the shape or form as shown in said Fig. 10. Out of this series of disks may be built up not only the sized formers shown at Figs. 11, 12, 13, and 14, but also any intermediate sizes, so that one set of disks may serve to build up a former for almost any and every sized pipe that is bent, or capable of being bent, and so save the expense of solid formers of wood or metal—as, for instance, (the disks being numbered as shown in Fig. 10,) two eighTEENS, two fourTEENS, and two ELEVENS would make a former for a pipe or tube of the diameter shown at Fig. 11; two eighTEENS, two fifTEENS, two thirTEENS, and two TENS make a former for a pipe or tube of the diameter shown at Fig. 12; and twos of the numbers shown at Figs. 13 and 14 would make formers for the respective pipes or tubes of the diam-

eters shown at said Figs. 13 and 14, respectively. The vulcanized rubber, paper-board, or leather is sufficiently rigid to resist the pressure upon them caused by the bending, and the pinching of the shoes on the exterior of the bend tends to stretch the metal of the pipe, and so enable it the better to be bent without danger of fracture.

Having thus fully described my invention, I would state that I am aware that a flexible mandrel has been used in a gas or other pipe or tube to facilitate its bending without collapse. This I do not claim irrespective of my plan of straining up the packing or filling; but

What I do claim is—

1. In combination with a packing or filling for gas or other pipes that are to be bent, a metallic strip or strips, chain or wire rope passing through said filling, and a nut and screw, or their mechanical equivalent, for ex-

panding said filling against the pipe by longitudinal pressure, as and for the purpose described and represented.

2. A flexible metallic sleeve formed of the rings *a*, attached to the flexible band *b*, when applied to the exterior of the pipe or tube that is to be bent, to prevent rupture or crimping of the pipe in the act of bending, substantially as described.

3. The former built up out of a series of disks of sheet vulcanite rubber, paper cardboard, leather, iron, or other similar material, as and for the purpose described.

4. The shoes *H I*, in combination with their back supports *K*, as and for the purpose described and represented.

ROBERT WRIGHT.

Witnesses:

J. PLANKINTON,

H. H. GREENMAN.