

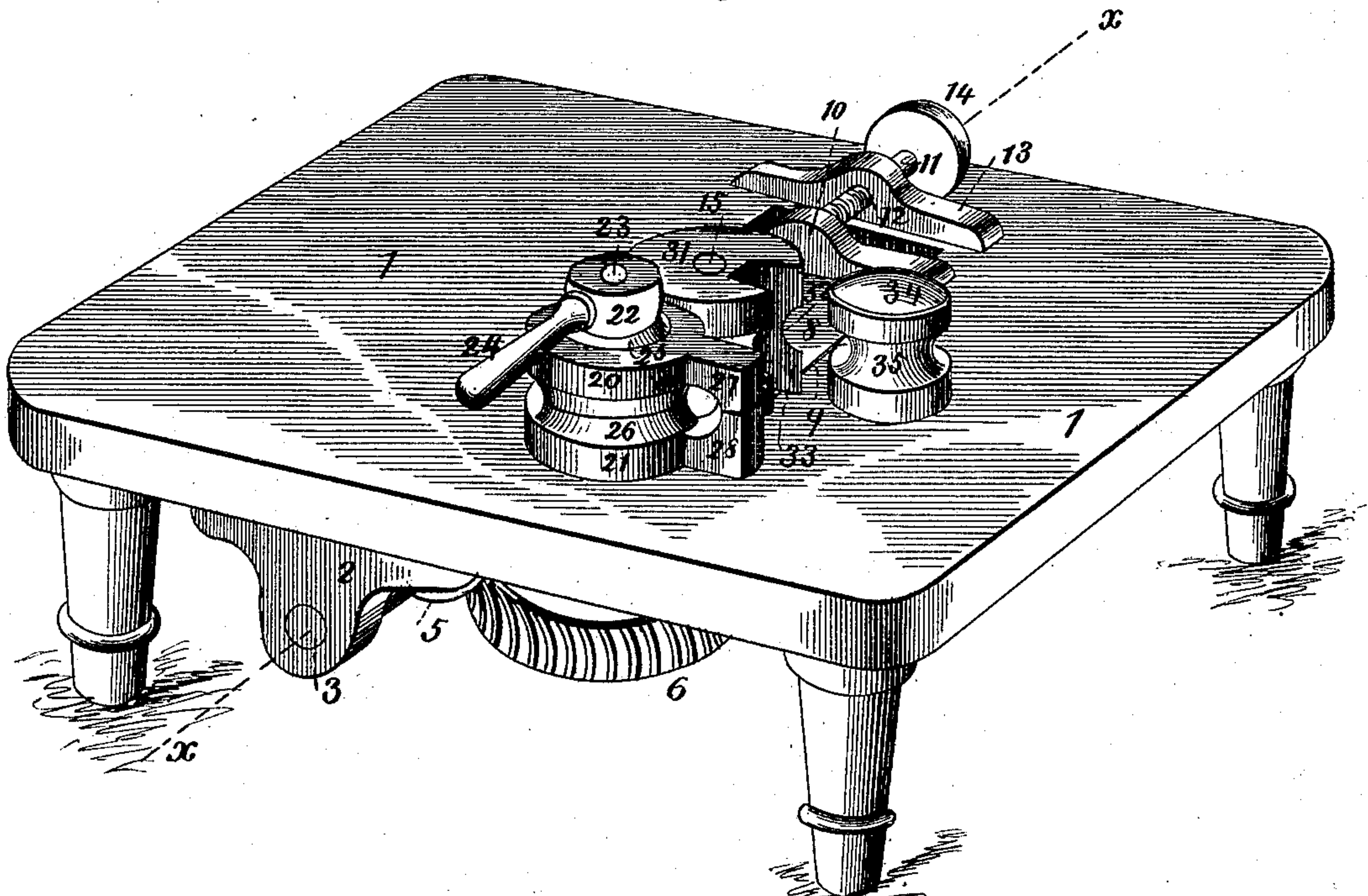
(No Model.)

H. E. FOWLER.  
MACHINE FOR BENDING PIPE.

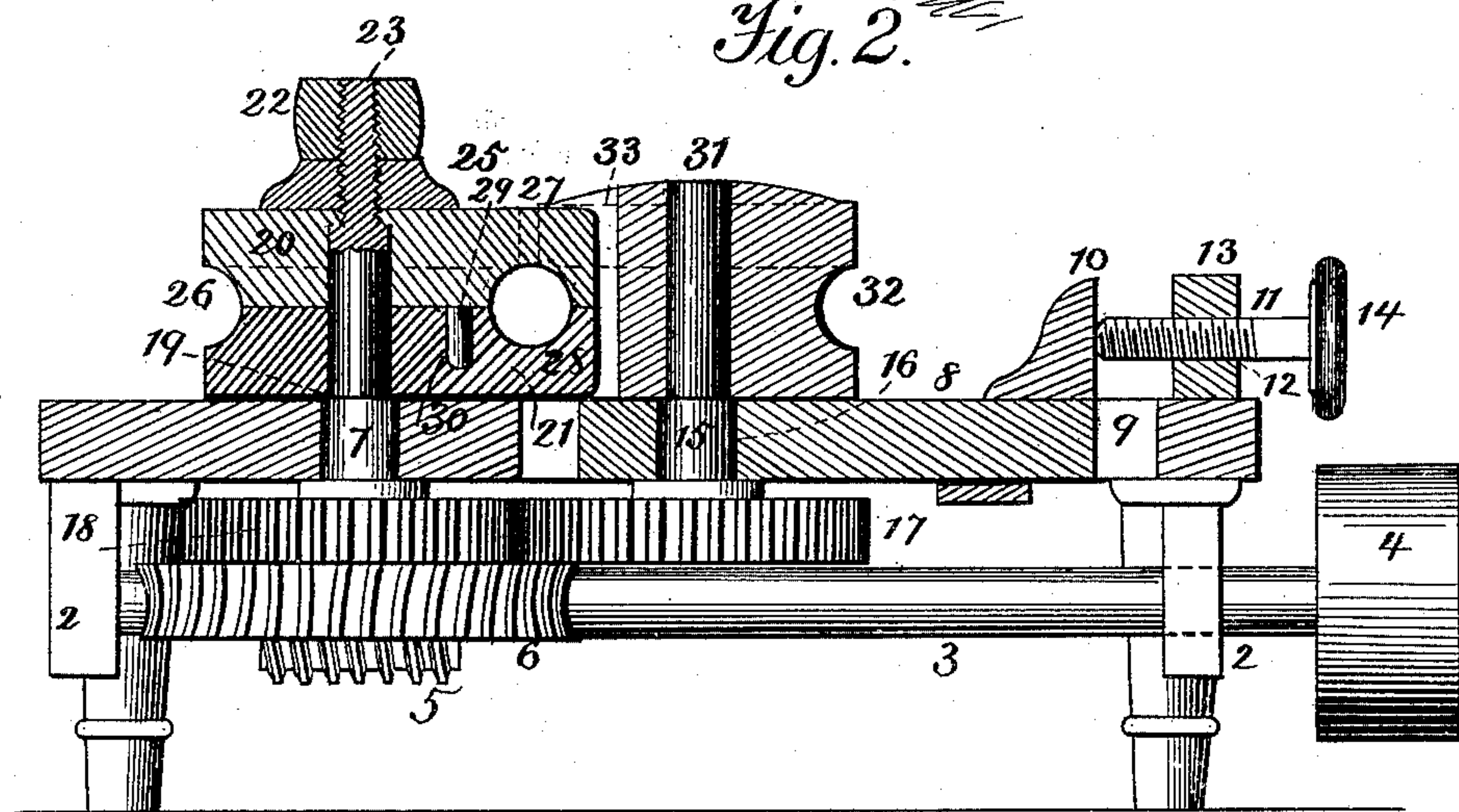
No. 397,712.

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*Fig. 1.*



*Fig. 2.*



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# UNITED STATES PATENT OFFICE.

HERBERT E. FOWLER, OF NEW HAVEN, CONNECTICUT.

## MACHINE FOR BENDING PIPE.

SPECIFICATION forming part of Letters Patent No. 397,712, dated February 12, 1889.

Application filed May 12, 1888. Serial No. 273,733. (No model.)

*To all whom it may concern:*

Be it known that I, HERBERT E. FOWLER, a citizen of the United States, residing at New Haven, in the county of New Haven and State of Connecticut, having invented certain new and useful Improvements in Machines for Bending Pipe; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to machines for bending metal pipe or tubing, and more especially for bending or doubling metal pipe into flat zigzag coils—such as for ice-machines, cooling apparatus, steam-heating apparatus, or similar pipe having bent or doubled portions at intervals; and it consists in the improved construction and arrangement or combination of parts hereinafter fully disclosed in the description, drawings, and claims.

The objects of my invention are, first, to provide the periphery of a bending-roller in a machine for bending pipe with an adjustable grip or clamp for clamping the pipe and carrying it around the periphery of said roller; second, to provide a two-part bending-roller with radially-projecting clamping or gripping jaws in the peripheries of said parts, and with means for forcing said parts firmly against each other; third, to provide the periphery of one bending-roller with a clamp or grip for holding the pipe, and the periphery of the opposite bending-roller with a corresponding and registering notch or recess for said clamp; fourth, to provide means for adjusting the shafts or spindles for the bending-rollers at varying distances from each other, according to the diameter of said rollers; fifth, to provide a pipe-bending machine with two bending-rollers, one of which is provided with means for clamping the pipe and carrying it around with it upon its periphery and with one guide-roller, and, sixth, to provide a machine by means of which pipe may be bent or doubled at one point, thereupon slid forward to have a straight portion, again bent or doubled in the opposite direction, and so forth, to form a flat zigzag-shaped coil or a flat coil with straight parallel, or nearly parallel, portions.

In the accompanying drawings, forming a

part of this specification, and in which the same reference-numerals indicate the same parts, Figure 1 represents a perspective view of my improved machine for bending pipe, and Fig. 2 a vertical section on the line *x x* of Fig. 1.

In the drawings, the numeral 1 indicates the machine table or frame, which is provided upon its under side with bearings 2 for the drive-shaft 3. Said drive-shaft 3 is provided with a suitable drive-pulley, 4, at its outer end, and, preferably, with a suitable reversing-gear (not shown) for reversing the revolutions of said shaft whenever desired. The inner end of said drive-shaft 3 is provided with a worm, 5, which meshes with a worm-wheel, 6, which is secured upon the lower end of a shaft or spindle, 7, journaled in the machine frame or table.

A slide or block, 8, slides in a slot, 9, in the machine table or frame, and has an upwardly-projecting lip or shoulder, 10, at its outer end, against which the inner end of a screw, 11, which fits and turns in a corresponding perforation, 12, in a lip, 13, upon the edge of a machine frame or table, and is provided with a suitable hand-wheel, 14, at its outer end, may bear. A shaft or spindle, 15, is journaled in a bearing, 16, in the inner end of said slide or block, and has a cog-wheel, 17, upon its lower end, which meshes with a cog-wheel, 18, upon the shaft or spindle 7 below said table or frame, but above the worm-wheel upon said shaft. Said shaft or spindle 7 is formed with a shoulder, 19, which is flush with the machine frame or table, and two halves, 20 and 21, of a bending roller or disk fit upon the shaft or spindle, and are clamped against said shoulder by means of a nut, 22, which fits upon the upper reduced and screw-threaded end, 23, of said shaft or spindle, and is provided with a handle, 24, or hand-wheel or other means for turning it. A washer, 25, is placed between said nut and the upper half, 20, of the roller. Said roller-halves 20 and 21 are formed with circumferential grooves or recesses, which form one circumferential groove, 26, nearly semicircular in cross-section, and at registering points of their peripheries said roller-halves are provided, respectively, with a downwardly and an upwardly hooked clamping or gripping



jaw, 27 and 28, which jaws have their hooked ends meeting and form a circular eye, clamp, or grip. A pin, 29, projects from the face of one of said roller-halves and into a registering hole, 30, in the meeting face of the other roller-half, said pin and hole serving to keep said clamping or gripping jaws registering with each other.

A roller, 31, is detachably secured upon the shaft or spindle 15 in the slide 8, and has the same height and diameter as the divided roller 20 21, and is provided with a nearly semi-cylindrical circumferential groove, 32, which registers with the groove 26 in the opposite roller. Said roller 31 is formed with a notch or recess, 33, which extends from the periphery, and is sufficiently deep and wide to receive the clamping or gripping jaws of the opposite roller, which jaws may register with said notch or recess and project into the same whenever said rollers are revolved.

A guide-roller, 34, formed with a nearly-cylindrical circumferential groove, 35, of the same size as the grooves in the bending-rollers, is journaled with its short shaft upon the face of the machine table or frame, and with its groove in a line with the groove in the notched or recessed roller 31, and in a line at right angles to a line drawn between the centers of said rollers.

In practice the nut 22, which clamps the two roller-halves 20 and 21 together, is loosened sufficiently to admit of the end of the pipe to be bent to be inserted and slid between the clamping or gripping jaws 27 and 28 up to the place at which it is to be bent. The nut is thereupon tightened, so as to give said jaws a firm hold upon the end of the pipe, whereupon the rollers are started to revolve, the divided roller carrying the pipe around with it until it has been bent sufficiently. The pipe will bear against the guide-roller, and the grooved roller 31 will bear against the side of the pipe opposite to the divided roller, so that the pipe will retain its shape in the bend without being flattened. The notch or recess 33 will admit of the pipe remaining in the clamping-jaws during the entire process of bending, as it allows the jaws to pass around between the two rollers, and there will consequently be no necessity for loosening the clamping-jaws and shifting them during the process of bending the pipe, as is necessary in bending-machines in which there is a removable clamp upon one roller and no notch or recess in the opposite roller, which shifting of the clamp or clamping-jaws is liable to cause a straight or imperfectly-bent portion in the bend of the pipe at the place which is bent while the clamp is removed. After one bend has been formed and more bends are desired, as in a flat zigzag coil, the clamping-nut 22 is loosened, when the rollers may be reversed, the jaws sliding upon the bend of the pipe back to their starting-point in the recess or notch of the opposite roller. The pipe may now be slid between the clamping-jaws until

it arrives at the point where the next bend is to be, when the pipe is turned within the jaws, if the bend is to be in the opposite direction of the former bend, and clamped in said jaws by the clamping-nut, whereupon the rollers are again revolved and another bend is formed. This bending may be continued for the entire length of the pipe, and as many bends as desired may be formed at any desired distances from each other without removing the pipe from the clamping-jaws or the jaws from the pipe.

If it is desired to form all the bends in the same direction, the pipe is not turned in the jaws, but the jaws are merely slid back upon the bend of the pipe to the starting-point in the recess or notch in the opposite roller. The pipe is slid forward between the jaws to the next bending-point and bent by the revolving rollers.

As the diameter of the bend or elbow formed in the pipe depends upon the diameter of the bending-rollers, said rollers must be changed and substituted by rollers of suitable diameter when bends of a different diameter are to be formed, and the size of the circumferential grooves in said rollers must correspond to the size of pipe bent by them, as said pipe must fit snugly in the grooves and in the clamping-jaws.

The cogs of the two cog-wheels 17 and 18 upon the shafts of the bending-rollers are of a sufficient length to admit of their meshing with each other under various adjustments of the shaft 15 in the adjustable slide at various distances from the shaft 7, said distances depending upon the diameters of the bending-rollers, the function of said adjustable slide or block 8 being to adjust said shafts or spindles at their proper distances from each other, according to the diameters of the bending-rollers.

From the foregoing it will be obvious that pipe may be bent or doubled by this machine without loss of time in stopping the machine while making one bend, and without any irregularities or straight or imperfectly-bent portions in the bends or elbows, on account of its being provided with the divided roller and clamping-jaws and with the notch or recess in the other bending-roller; that the bending-rollers will travel together on account of their being geared together by the cog-wheels, and will consequently prevent all drawing or flattening of the pipe, as would be liable to take place if the rollers were not geared, and that bends or elbows of various diameters and at various distances from each other may be made from various sizes of pipe by the same machine on account of the rollers being interchangeable.

Having thus fully described the construction and arrangement or combination of parts of my improved pipe-bending machine, its operation and advantages, what I claim as new is—

1. In a machine for bending pipe, a roller



provided with a gripping clamp or eye projecting radially from its periphery, in combination with an opposite roller having a groove or recess to receive the said gripping clamp or eye, substantially as specified.

2. In a machine for bending pipe, a bending-roller comprising two separable sections, each carrying a part to form a gripping clamp or eye, in combination with a bending-roller having a groove or recess adapted to receive the said clamp or eye, substantially as specified.

3. In a machine for bending pipe, a bending-roll formed in two separable sections, and each having a circumferential curvilinear groove at their adjacent sides, and also having respectively a part which forms a gripping clamp or eye, in combination with a bending-roll having a groove or recess to receive the said clamp or eye, and also a circumferential curvilinear groove to match the corresponding groove in the opposite roll, substantially as specified.

4. In a machine for bending pipe, the combination of a shaft formed with a shoulder and with a reduced and screw-threaded upper end, a roller which consists of two halves, formed with grooved or recessed edges, which form a nearly semi-cylindrical groove in the periphery of said roller, provided with two registering hook-shaped clamping-jaws in their peripheries, which form a projecting eye, and with a registering pin and hole in their facing sides, a washer upon said shaft and supported upon the top of said roller, and a nut upon the screw-threaded end of said shaft and clamping said washer and roller-halves against the shoulder upon said shaft, substantially as described.

5. In a machine for bending pipe, the combination, with a bending-roller provided with a projecting eye at its periphery, of an opposite bending-roller formed in its periphery with a notch or recess which registers with and receives said eye, substantially as described.

6. In a machine for bending pipe, the combination, with a bending-roller provided with a projecting and adjustable clamp or grip at its periphery, of an opposite bending-roller formed in its periphery with a notch or recess which registers with and receives said eye, substantially as described.

7. In a machine for bending pipe, the combination, with a bending-roller formed with a slightly less than semi-cylindrical and circumferential groove and provided with projecting

and adjustable clamping-jaws at its periphery, of an opposite bending-roller formed with a similar circumferential groove and in its periphery with a notch or recess which registers with and receives said eye, substantially as described.

8. In a machine for bending pipe, the combination of a frame or table formed with a transverse slot and with a bearing at the inner end of said slot, a spindle or shaft journaled in said bearing, a block which slides in said slot, and is formed with a lip at its outer end and a bearing at its inner end, a screw which fits through a screw-threaded perforation in a lip upon said table at the outer end of said slot and bears against the lip upon said sliding block, a shaft or spindle journaled in the bearing in said sliding block, two meshing cog-wheels which are of the same diameter, provided with long cogs and secured upon said spindles or shafts, means for revolving one of said spindles or shafts, and interchangeable bending-rollers upon said spindles or shafts, substantially as described.

9. In a machine for bending pipe, the combination of a circumferentially-grooved bending-roller provided with a projecting clamping or gripping eye, a circumferentially-grooved bending-roller formed with a notch or recess in its periphery which registers with said eye, and a circumferentially-grooved guide-roller arranged in a line with the space between the bending-rollers and at right angles to a line drawn through the centers of said rollers, substantially as described.

10. In a machine for bending pipe, the combination of the machine frame or table formed with the slot 9, the drive-shaft 3, formed with the worm 4, the shaft or spindle 7, formed with the threaded end 23 and with the worm-wheel 6 and cog-wheel 18, and journaled in said frame or table, the divided and grooved roller 20 21, formed with the jaws 27 and 28, the washer 25 and handled nuts 23 24, the sliding block 8, having the adjusting-screw 11, the shaft or spindle 15, journaled in said sliding block and provided with cog-wheel 17, the roller 31 upon said shaft and formed with the groove 32 and notch or recess 33, and the guide-roller 34, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

HERBERT E. FOWLER.

Witnesses:

C. H. HAYDEN,  
S. M. HOYE.