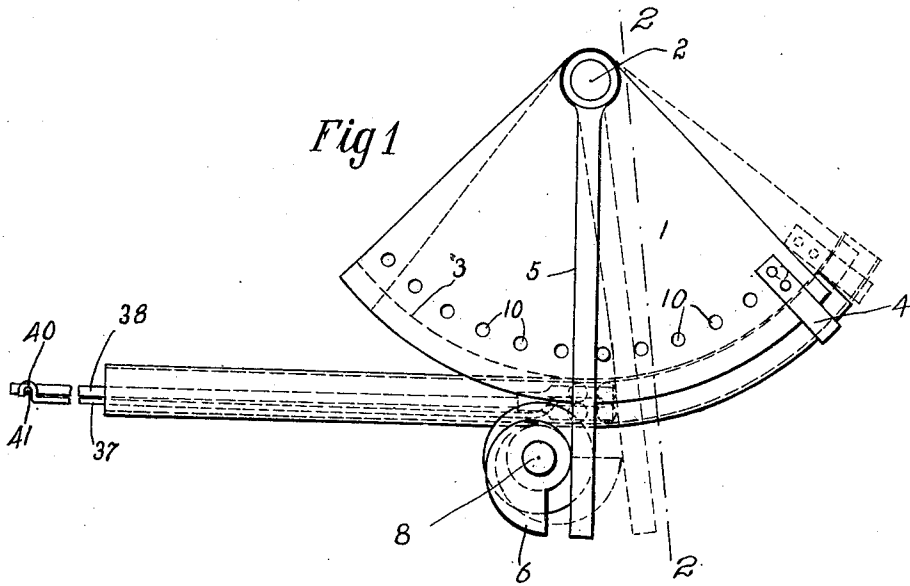
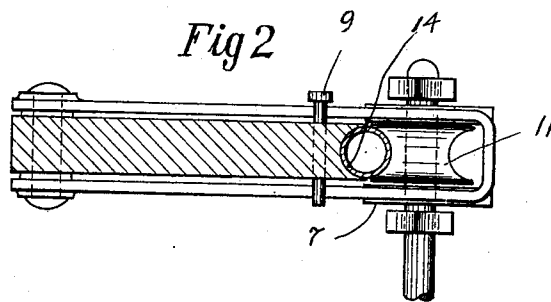


L. H. BRINKMAN.  
PIPE BENDING.  
APPLICATION FILED MAY 23, 1919.

1,389,856.

Patented Sept. 6, 1921.  
2 SHEETS—SHEET 1.

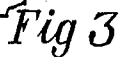
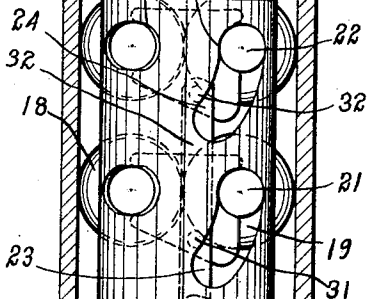
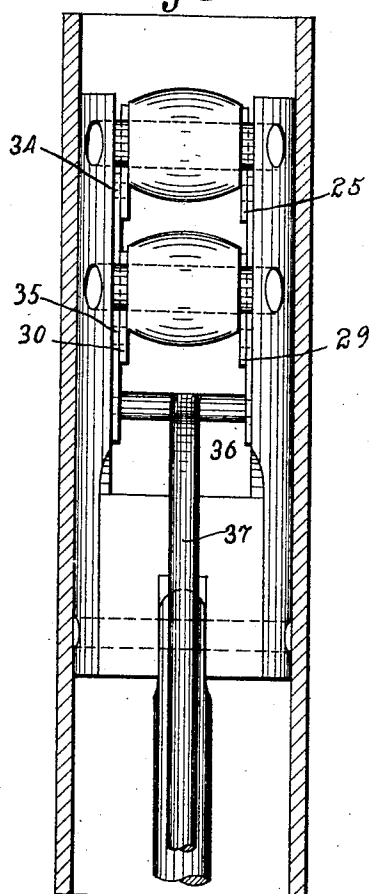


*Louis H Brinkman* INVENTOR.

BY  
*Thomas Howe* ATTORNEY.

1,389,856.

2 SHEETS—SHEET 2.



BY  
Thomas Howe ATTORNEY.

# UNITED STATES PATENT OFFICE.

LOUIS H. BRINKMAN, OF GLENRIDGE, NEW JERSEY.

## PIPE-BENDING.

1,389,856.

Specification of Letters Patent.

Patented Sept. 6, 1921.

Application filed May 23, 1919. Serial No. 299,175.

*To all whom it may concern:*

Be it known that I, LOUIS H. BRINKMAN, a citizen of the United States, residing at Glenridge, Essex county, and State of New Jersey, have invented new and useful Improvements in Pipe-Bending, of which the following is a specification.

This invention relates to the bending of pipes and is especially adapted for bending large pipes when in a cool state.

The main object of the invention is to provide an improved means for sustaining the pipe from the interior during the bending operation.

Other and ancillary objects of the invention will appear hereinafter.

In the accompanying drawings which illustrate the invention,

Figure 1 is a top plan view of the bending apparatus;

Fig. 2 is a section on the line 2—2 of Fig. 1;

Fig. 3 is a side elevation of the interior support or plug for the pipe, the pipe being shown in longitudinal section and also a fragment of the segment about which the pipe is bent, on an enlarged scale;

Fig. 4 is a bottom plan view of the interior support or plug, the pipe being shown in longitudinal section of Fig. 5;

Fig. 5 is an end view of the apparatus in Fig. 3.

Referring to the drawings, the apparatus comprises a segmental table 1, mounted to turn on a supporting shaft 2. In the circumference of the table is formed a grooved or concave channel 3 for receiving the pipe 14 to be bent, the end of the pipe may be secured within this channel by means of a clamp or holding band 4. To turn the segment 1 about its pivot in the bending operation, an arm 5 also pivoted at 2 extends on both sides of the segment 1 and is adapted to have its outer end engaged by cams 6 and 7 fixed upon the power shaft 8, which may be driven in any suitable manner. It will be seen (Fig. 1) that as the cam turns, the arm 5 will be pushed to the right as indicated by the dotted lines. In so doing, it will bear against a pin 9 inserted in one of a series of holes 10 in the segment 1. In moving to the right, therefore, the arm carries with it the segment 1, which by the revolution of the shaft 8 is moved from the position of full lines into the position as shown by the dotted lines. The arm 5 will then be

manually moved to the left into the position as shown by the full lines and the pin moved into the next hole to the left. A succeeding revolution of the cam will then move the segment a corresponding step farther. This operation can be repeated indefinitely until the desired amount of bending is secured.

Also fixed upon the shaft 8 is the grooved roller 11, the groove being of suitable form to cooperate with the pipe 14, as shown most clearly in Fig. 2. This roller is so placed with relation to the segment 1, that it receives the straight pipe and maintains it in a fixed tangent to the segment 1. The shaft 8 being power driven, the roller by its friction upon the pipe tends to force it in to the bending operation.

Within the pipe is an interior support or plug comprising a frame which includes side plates 12 and 13 having their outside surfaces 14 and 15 convex so as to cooperate with the concave walls of the pipe whereby they are prevented from spreading. They are not such a tight fit, however, as to bind upon the pipe.

Rotatably mounted between the plates 12 and 13, are the rollers 16 and 17 forming a pair standing transversely of the pipe, and 18 and 19 forming another pair standing transversely of the pipe, the two pairs being spaced longitudinally of the pipe as is apparent. The rollers of a pair bear upon each other and take up the transverse strains occasioned by the bending operation so that none of these strains is sustained by the frame in which the rollers are mounted. This frame serves merely to hold the rollers in proper positions longitudinally of the pipe. It will be noted that the holes in the plates 12 and 13 in which the gudgeons of the rollers are mounted, have considerable clearance about the gudgeons transversely of the pipe while the gudgeons have a running fit in the plates longitudinally of the pipe so that they are held in suitably spaced longitudinal positions, but transversely the rollers bear upon each other and against the opposite interior walls of the pipe so that any pressure upon a pair of rollers by the pipe is taken up between them. It will be seen that this rolling of a pair of rollers on each other will give the appropriate movement of the various parts as the sides of the two rollers which engage with the pipe will move in the same direction and therefore the sides of the rollers where they come in contact will move

in the same direction which is appropriate to the condition of the rollers rolling upon the pipe and also upon each other.

The face of a roller of each pair, which roller is at the opposite side of the pipe from the segment 1, in other words, is at the outside of the bend, as for instance the roller 16, has its face formed of such convexity that it conforms to the interior concavity of the pipe. The inner rollers, however, such as the roller 17, each has a central circumferential groove 20 in which the center of the outside roller as 16, is adapted to fit as shown most clearly in Fig. 5. This increases the bearing surface between the rollers and avoids wearing flats upon the rollers. The greatest stretch of the pipe in the bending operation, comes at the outside of the bend and consequently the groove is placed upon the inside roller leaving the outside roller of full face so that it supports the side at which the greatest tensile stress comes. On the other hand the inner side of the bend not being subjected to such stress, the support over the full face of the roller is not important.

The rollers are so arranged and constructed that when a pair has its rollers in contact and their axes are on a diameter of the pipe the two rollers will extend entirely across the pipe so as to maintain the bore of the desired diameter. It will be apparent, however, that with the rollers thus tightly fitted within the pipe that it might be difficult to withdraw the plug. Accordingly provision is made for shifting the rollers of a pair with relation to each other so that their over all dimension transversely of the pipe is reduced. The gudgeons 21 and 22 of the inside rollers fit on each side into arc shaped slots as 23 and 24 in the plates 12 and 13 of the frame. On the sides of the pair of rollers 16 and 17 are the plates 25 and 26. The plate 25 has recesses 27 and 28 respectively embracing the gudgeons of the rollers 16 and 17 and similarly the plate 26 has recesses embracing the gudgeons at the other end of those rollers. Similarly the gudgeons of the rollers 18 and 19 are embraced by recesses in plates 29 and 30 between which they are located. Pivoted to the plates 25 and 29 at 31 and 32 is a link 32', while a similar link 33 is pivoted to the plates 26 and 30 at 34 and 35. At their ends the links 32' and 33 are pivoted to a bar 36 to which is secured a rod 37. By pulling the rod 37 to the left (see Fig. 3), the lower ends of the plates 25, 29, 26 and 30 will be drawn to the left, pivoting upon the gudgeons of the upper rollers and will carry with them the gudgeons of the lower rollers in the curved slots as 23 and 24. The rollers of a pair are thus shifted longitudinally of the pipe with relation to each other and the over all transverse dimensions of a pair is reduced so that the plug may be readily withdrawn from the

pipe or inserted therein, by means of the rod 38 which is pivoted at 39 to the frame in which the rollers are mounted. The plug having been inserted to the desired spot within the pipe, a push upon the rod 37, thereby forcing the lower rollers to the right (see Fig. 3) adjusts the pairs with the axes of each pair on a diameter of the pipe, when the over all dimensions are such as to maintain the bore of the pipe during the bending operation. The lower rollers may be secured in this position by fastening the rod 37 to the rod 38 in any desired manner. Thus at its outer end the rod 37 may be provided with a hook 40 hooking over the pin 41 fixed in the rod 38.

The operation of bending a pipe may now be traced. The segment 1 is turned on its pivot until the securing band 4 is adjacent to the roller 11 so that the end of the straight pipe section may enter within this band on passing over the roller 11. The arm 5 is then brought against the cam 6 and the pin 9 inserted in a hole ahead of the arm 5. The plug is then inserted within the pipe and located at a point substantially where the pipe tangentially joins the segment 1, this being where the bending takes place. The rollers of the plug are then adjusted so that the axes of a pair are in a diameter of the pipe and the bar 37 secured as described to hold the rollers in this position. The power shaft 8 now operating, the roller 11 will force the pipe toward the right (see Fig. 1) and meanwhile the cam 6 will cause the segment 1 to turn, bending the pipe about its circumference, the internal diameter of the pipe being maintained by the plug. After each revolution of the cam, the arm 5 and pin 9 will be moved backwardly a step when the pipe and segment will be again moved forward by the succeeding revolution of the shaft 8. In this way the bend in the pipe may be made of any extent desired. It will be observed that all of the bearings between the pipe and other parts with relation to which it moves, are roller bearings and the plug is provided with clearances so that the rollers may readily adjust themselves. Also by reason of the fact that the rollers bear upon each other, they have rolling bearings at all points. The friction is thus greatly reduced and permits the bending of large pipes without heating.

While the invention has been illustrated in what is considered its best embodiment, it may have other embodiments without departing from its spirit and is not therefore, limited to the structure shown in the drawings.

What I claim is—

1. In pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising rotating bodies bearing

upon each other and against the pipe walls and a frame supporting said bodies in proper relative positions longitudinally of the pipe, but having clearances permitting said bodies to adjust themselves transversely of the pipe whereby the pressure is taken up between the bodies without imposing undue strain on said frame.

2. In pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising rotating bodies bearing upon each other and against the pipe walls and a frame supporting said bodies in proper relative positions longitudinally of the pipe, but having clearances permitting said bodies to adjust themselves transversely of the pipe whereby the pressure is taken up between the bodies without imposing undue strain on said frame, said frame having a movable element permitting the bodies to move longitudinally of the pipe relatively to each other so that they may be removed from the pipe.

3. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior, comprising rotating bodies bearing upon each other and against the pipe walls and a frame supporting said bodies in proper relative positions longitudinally of the pipe, but having clearances permitting said bodies to adjust themselves transversely of the pipe whereby the pressure is taken up between the bodies without imposing undue strain on said frame and a rod secured to said frame for positioning the same longitudinally of said pipe.

4. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior, comprising rotating bodies bearing upon each other and against the pipe walls and a frame supporting said bodies in proper relative positions longitudinally of the pipe, but having clearances permitting said bodies to adjust themselves transversely of the pipe whereby the pressure is taken up between the bodies without imposing undue strain on said frame and a rod pivoted to said frame for positioning the same longitudinally of said pipe.

5. In a pipe bending apparatus, the combination with a pivoted segment about the periphery of which the pipe is to be bent, means for securing the pipe to said segment, a roller between which and said segment, said pipe passes, a shaft for said roller, a cam on said roller shaft, a pivoted arm engaging with said cam, said segment having a series of holes, and a pin in one of said holes adapted to be engaged by said arm.

6. In pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its

interior comprising a pair of rotating bodies bearing upon each other and against the pipe walls, one of said pair of bodies having a circumferential groove within which the other body of said pair bears.

7. In pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a pair of rotating bodies bearing upon each other and against the pipe walls, the inside one of said pair of bodies having a circumferential groove within which the other of said bodies bears.

8. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a pair of plates extending longitudinally of said pipe, a plurality of pairs of rotating bodies, said pairs being spaced longitudinally of the pipe and rotatably mounted in said plates, there being one plate on each side of the rotating bodies.

9. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a plurality of plates extending longitudinally of said pipe, a plurality of pairs of rotating bodies, said pairs being spaced longitudinally of the pipe and rotatably mounted in said plates, said plates having their outer sides convex.

10. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a pair of plates extending longitudinally of said pipe, a plurality of pairs of rotating bodies, said pairs being spaced longitudinally of the pipe and rotatably mounted in said plates, there being one plate on each side of the rotating bodies and a rod for longitudinally positioning said supporting means in the pipe, said rod being flexibly connected with said plates.

11. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a pair of plates extending longitudinally of said pipe, a plurality of pairs of rotating bodies, said pairs being spaced longitudinally of the pipe and rotatably mounted in said plates, there being one plate on each side of the rotating bodies, and a rod for longitudinally positioning said supporting means in the pipe, said rod being pivoted to said plates.

12. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising plates extending longitudinally of the pipe, a plurality of longitudinally spaced pairs of rotating bodies mounted in said plates, a rod connected with said plates for longitudinally positioning said supporting means in said pipe and means

extending between said plates and along said rod for relatively adjusting the bodies of a pair.

13. In a pipe bending apparatus, the combination with means for bending the pipe, of means for supporting the pipe on its interior comprising a plurality of plates extending longitudinally of the pipe and a plurality of longitudinally spaced pairs of rotatable bodies mounted in said plates, one of the bodies of each pair having clearance in the plates so as to be movable radially but

not longitudinally of the pipe, the other rotating body of each pair having arc-shaped bearings in said plate to permit its longitudinal adjustment, a rod secured to said plates for longitudinally positioning the said supporting means in the pipe and means for relatively adjusting the bodies of a pair longitudinally with relation to each other.

In testimony whereof I have signed this specification this 7th day of May, 1919.

LOUIS H. BRINKMAN.