

March 13, 1945.

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2,371,393

PIPE BENDING EQUIPMENT

Filed Jan. 28, 1944

2 Sheets-Sheet 1

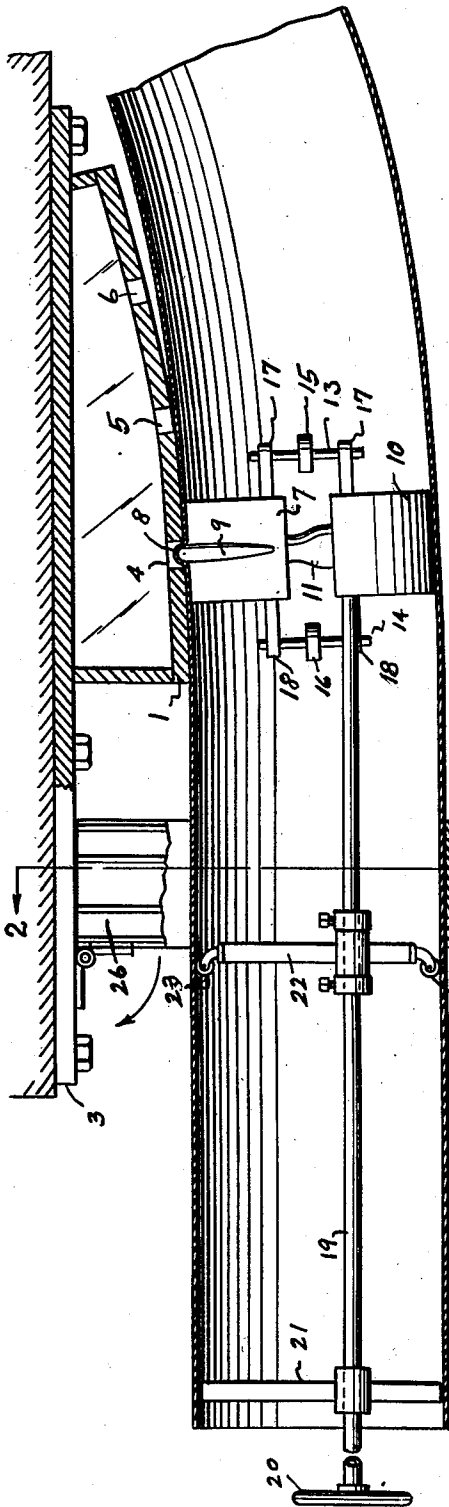


Fig. 1.

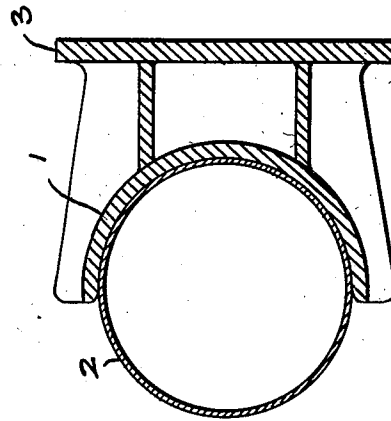


Fig. 3.

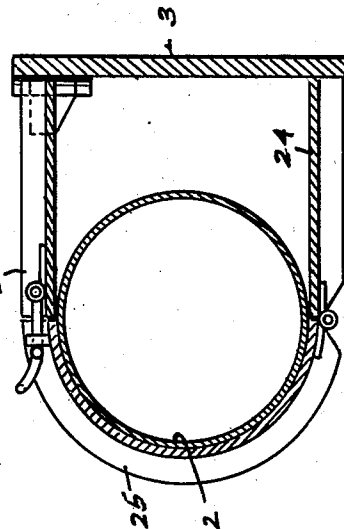


Fig. 2.

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2 Sheets-Sheet 2

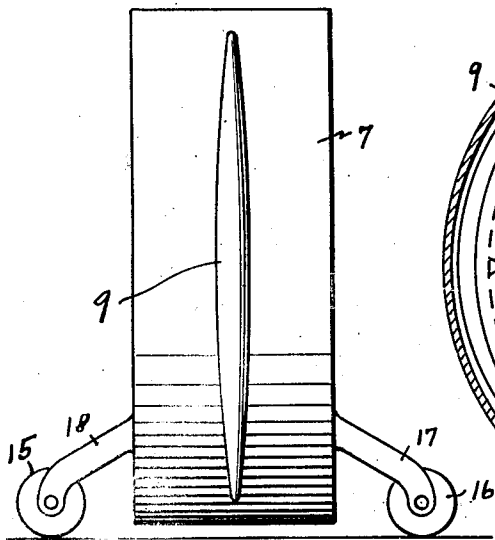


Fig. 4.

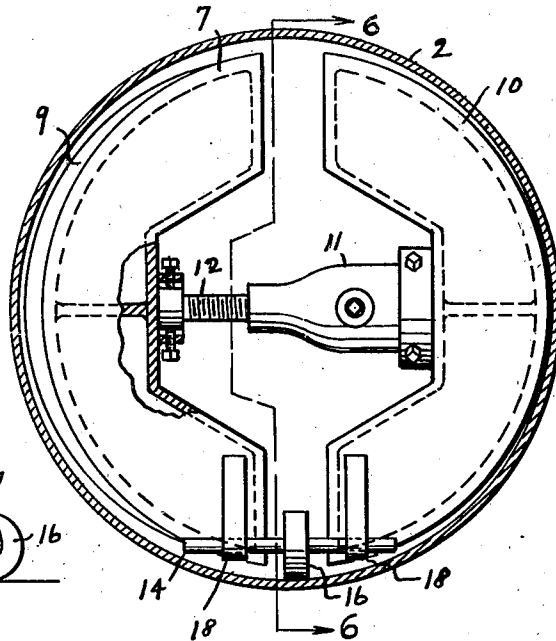


Fig. 5.

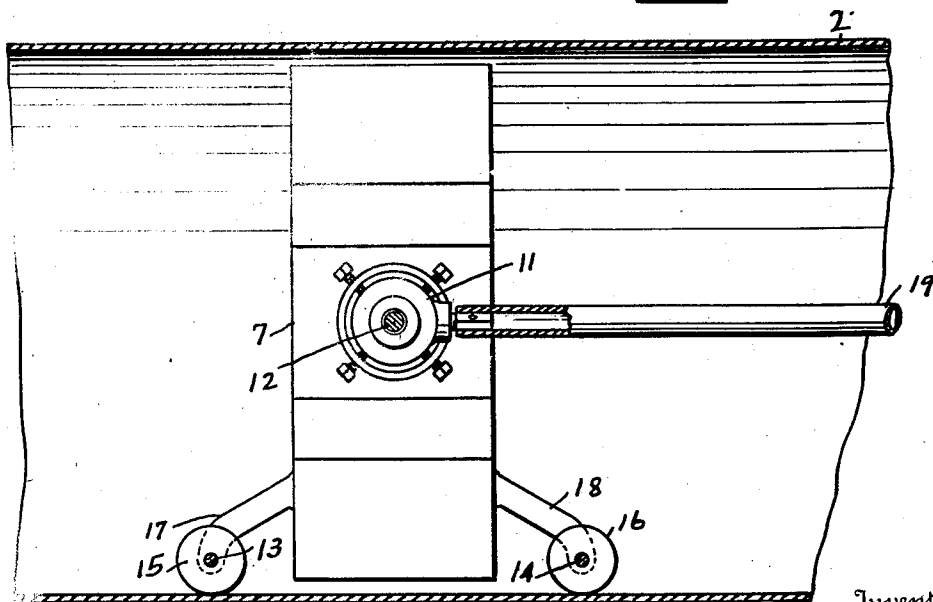


Fig. 6.

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UNITED STATES PATENT OFFICE

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PIPE BENDING EQUIPMENT

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2 Claims. (Cl. 153—32)

This invention relates to pipe bending equipment.

An object of the invention is to provide equipment of the character described designed to be used in the process of bending pipe so that the pipe will not become distorted at the bend but maintain its approximately round contour.

Another object of the present invention is to provide equipment for transversely corrugating the pipe on the inside of the bend, or curvature, to the end that the pipe will not become distorted, at the bend, when it is bent.

More specifically it is an object of the present invention to provide equipment of the character described whereby pressure may be exerted, outwardly, against a limited area of the inside of the pipe and at, or along, the inside of the bend so that an outwardly extended transverse corrugation, or corrugations, may be formed in the pipe at the inside of the bend which will facilitate the bending operation and prevent any substantial distortion of the pipe.

At the present time, pipe is being manufactured having much thinner walls than heretofore and it has been found that when it is attempted to bend or curve pipe having these thin walls that the pipe will become distorted and in some cases collapsed at the bend so as to restrict the capacity of the pipe and the volume of fluid capable of flowing therethrough. This type of pipe is commonly used in the construction of pipe lines for conducting gas, oil or other liquids and it is essential that its full capacity be maintained.

The present invention has been designed so that the pipe can be bent without distortion and without reducing its capacity.

The invention also comprehends a novel process of bending pipe.

With the above and other objects in view the invention has particular relation to certain novel features of construction, operation and arrangement of parts and to a novel method an example of which is given in this specification and illustrated in the accompanying drawings wherein:

Figure 1 shows a side elevation, partly in section, of the equipment as applied to the pipe.

Figure 2 shows a sectional view of the pipe and its clamp before the punch and its operating mechanism have been inserted, and rotated clockwise through an angle of 90 degrees, taken on the line 2—2 of Figure 1.

Figure 3 shows a transverse sectional view, rotated clockwise through an angle of 90 degrees,

of the pipe and matrix after the pipe has been fully bent against the matrix.

Figure 4 shows a side elevation of the punch.

Figure 5 shows a transverse sectional view of the pipe showing the punch and punch operating mechanism therein partly in section and, Figure 6 shows a longitudinal sectional view taken on the line 6—6 of Figure 5.

Referring now more particularly to the drawings wherein like numerals of reference designate the same parts in each of the figures the numeral 1 designates a matrix whose outer side is curved from end to end, having the curvature which it is desired to impart to the pipe 2 to be bent. This matrix is also curved transversely, as shown in Figure 3 to snugly receive said pipe. The matrix may be secured to, or formed integrally with, a plate 3 which, in turn, may be bolted or otherwise secured to a truck or any other suitable available anchorage.

As illustrated the matrix is so mounted that the pipe will be swung in a horizontal plane during the bending operation.

The matrix is provided with a transverse opening 4 through the bottom thereof and if it be desired to form more than one corrugation in the bend of the pipe the matrix may be provided with additional openings as 5 and 6.

It is apparent that the matrix may be provided with mere indentations of suitable depths rather than openings.

The numeral 7 designates a punch designed to cooperate with the matrix to form a corrugation, or corrugations, as 8 in the pipe on the inside of the bend.

This punch 7 has the external arcuate rib 9 thereon which is brought into registration with a corresponding opening in the matrix and when the pressure is applied forces the contacting portion of the pipe into said opening to form the corrugation.

The punch member 7, of the die, may be made of any selected width and is of a general arcuate form. Opposite the punch member and of approximately the same general contour, there is a base member 10 which forms a support for a jack 11. Any type of jack or other expanding and contracting equipment may be employed either hydraulically, mechanically or manually operated. In the present illustration a gear jack is shown. This jack may be secured to the base member 10 and includes the threaded shaft 12 which operates against the punch member 7.

The members 7 and 10 may be mounted on a carriage consisting of the front and rear axles

13, 14, which carry the respective rollers 15, 16, and the axles are mounted in the front and rear arms 17, 17 and 18, 18 carried by the respective members 7 and 10 as shown in Figures 1, 5 and 6. The equipment may accordingly be moved into the pipe traveling on the rollers 15, 16.

The jack illustrated is the conventional type of gear jack and may be inserted into the pipe and operated by the shaft 19 whose outer end may be provided with the hand wheel 20. This shaft is supported by, and rotates in the bearings of, the supporting spiders 21, 22 the latter of which may have the antifriction rollers 23, 23 to roll against the inside of the pipe.

The section of pipe to be bent may be laid in the matrix 1 as shown in Figure 1 and one end of the pipe may be clamped in position by any suitable means and the bending force may be applied to the other end of the pipe by a block and tackle arrangement or by any other means provided so as to cause the pipe to conform to the longitudinal curvature of the matrix at the point where the pipe is to be bent.

The clamp means above referred to may include the lower anchor 24 which may be welded, or otherwise secured, to the plate 3 and may also include the arcuate clamp jaw 25 which is hinged at one end to the anchor 24 and whose other end may be latched around the pipe by the latch mechanism 26 which in turn is hinged to pivot on a vertical axis so that it can be swung horizontally out of the way when it is desired to locate the pipe in the clamp. When the end of the pipe section is secured in the clamp and the pipe section is fitted in the matrix and the bending force is ready to be applied the corrugating equipment may be inserted into the clamped end of the pipe section and moved inwardly until the rib 9 is exactly opposite the opening of the matrix into which the corrugation is to be forced. It is shown opposite the opening 4 in Figure 1. The shaft 19 may then be turned in an appropriate direction to force the punch member 7 outwardly and the rib 9 will force the opposing section of the pipe into said opening forming the transverse rib or corrugation 8 and the bending force should, preferably, be applied just after the formation of the crimp, or corrugation, is started. At the same time the arcuate base member 10 will be forced against the opposite side of the pipe and will hold it to its original round contour.

The pipe fits snugly in the matrix member 1 and will be prevented, by it, from becoming out of round.

If it be desired to form more than one corrugation the rotation of the shaft 19 may be reversed to release the jack and to withdraw the rib 9 from the corrugation just formed and the equipment may be moved further into the pipe until the rib 9 is opposite the opening 5 and another corrugation formed, as before, and so on until the desired number of corrugations have been formed, it being understood that the pipe will gradually be bent to the curved shape of the matrix as the inside of the bend is corrugated.

When the work has been completed, the jack 11 may be released so that the equipment inside

of the pipe will release the walls of the pipe and it may then be withdrawn and the latch 26 and clamp jaw 25 released and the bended section of the pipe removed.

The drawings and description are illustrative merely while the broad principle of the invention will be defined by the appended claims.

What I claim is:

1. Pipe bending equipment comprising a frame, a matrix fixed rigidly on the frame and whose operative face is curved transversely from end to end to receive and embrace one side of the pipe to be bent, said face being convex longitudinally to conform to the curvature of the desired bend in the pipe, an assembly insertable into the pipe to a position opposite the matrix, said assembly comprising a base member whose outer face is curved to conform to the contour of and to fit against the interior of the pipe on the outside of the bend and a complementary punch member whose outer face is curved to conform to the shape of and to fit against the interior of the pipe on the inside of the bend, said face of said punch member having an external arcuate rib thereon positioned transversely with respect to the pipe, said matrix having a transverse arcuate space of sufficient length and depth to substantially receive therein said arcuate rib, and means for expanding said base member and said punch member to force said rib and adjacent pipe area engaged by the rib into said transverse arcuate space to form an outside circumferential crimp in the pipe inside the bend thereof, the face of the punch member engaging the interior of the pipe to limit the elevation of the crimp.
2. Pipe bending equipment comprising a frame, a matrix fixed rigidly on the frame and whose operative face is curved transversely from end to end to receive and embrace one side of the pipe to be bent, said face being convex longitudinally to conform to the curvature of the desired bend in the pipe, an assembly insertable into the pipe to a position opposite the matrix, said assembly comprising a base member whose outer face is curved to conform to the contour of and to fit against the interior of the pipe on the outside of the bend and a complementary punch member whose outer face is curved to conform to the shape of and to fit against the interior of the pipe on the inside of the bend, said face of said punch member having an external arcuate rib thereon positioned transversely with respect to the pipe, said matrix having a plurality of transverse arcuate spaces of sufficient length and depth to substantially receive therein said arcuate rib, said assembly being movable to locate the rib opposite a selected space in the matrix, means for expanding said base member and said punch member successively to force said rib and adjacent pipe area engaged by the rib into said selected transverse arcuate spaces to form successively outside circumferential crimps in the pipe inside the bend thereof, the face of the punch member engaging the interior of the pipe to cause the elevation of the crimps to be approximately uniform.

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