

March 21, 1950

J. D. CUMMINGS
PIPE-BENDING MACHINE

2,500,980

Original Filed Nov. 3, 1945

4 Sheets-Sheet 1

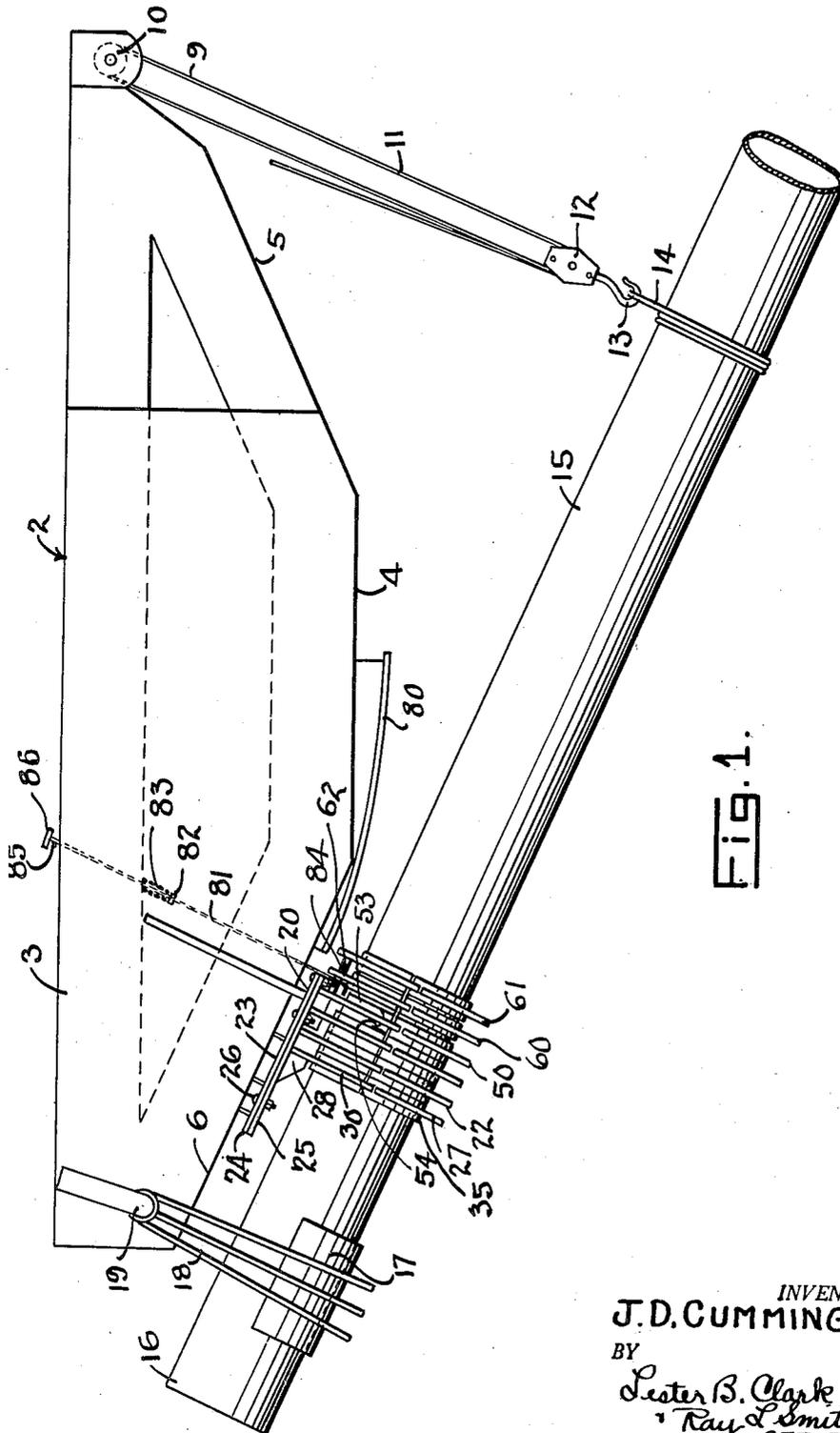


FIG. 1.

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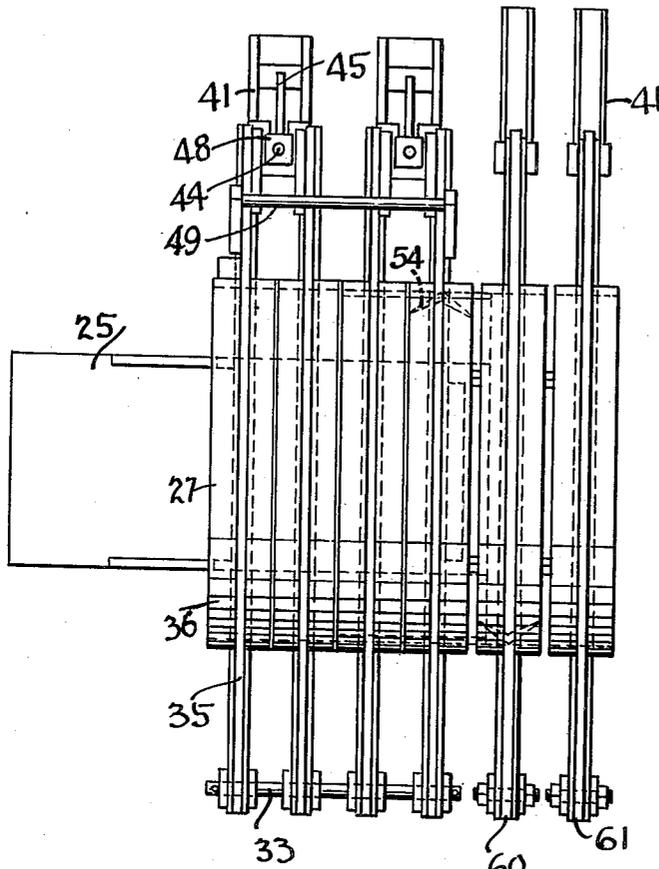


Fig. 2.

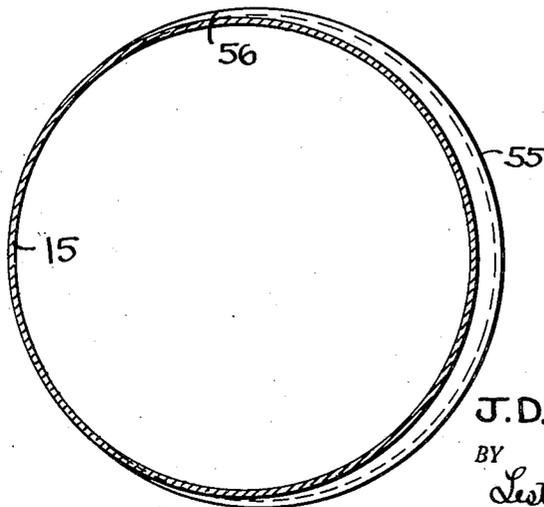


Fig. 7.

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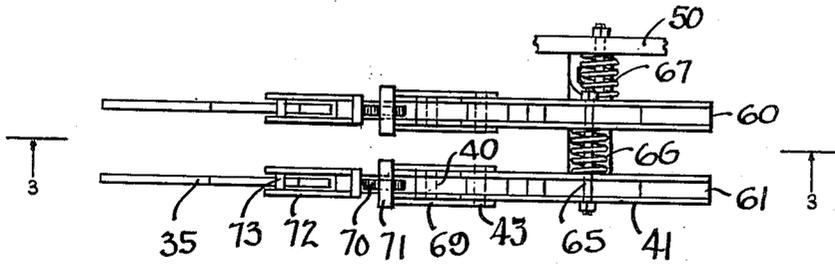


Fig. 4.

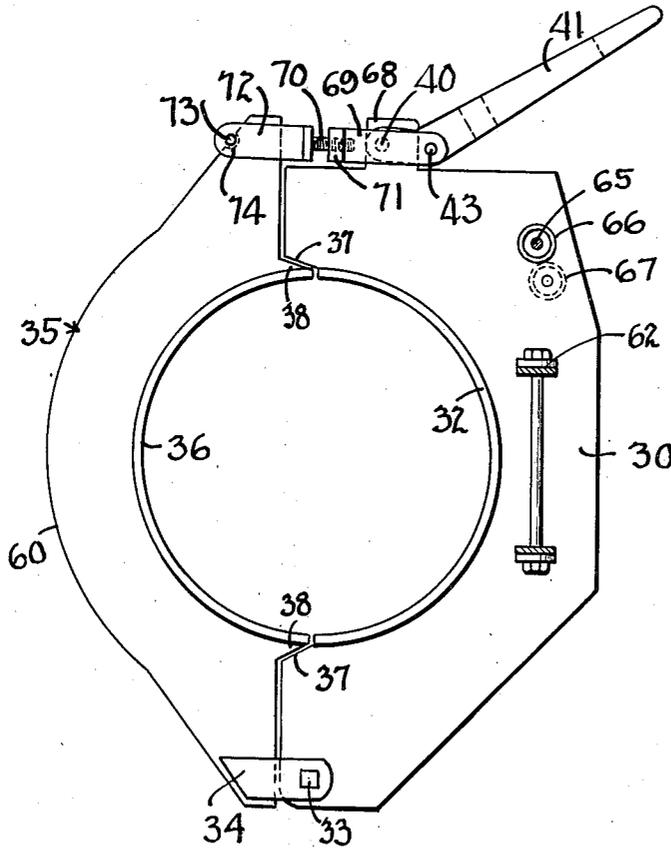


Fig. 3.

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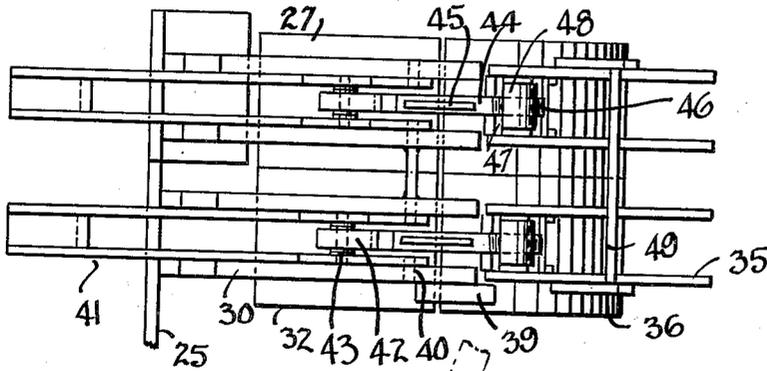


Fig. 6.

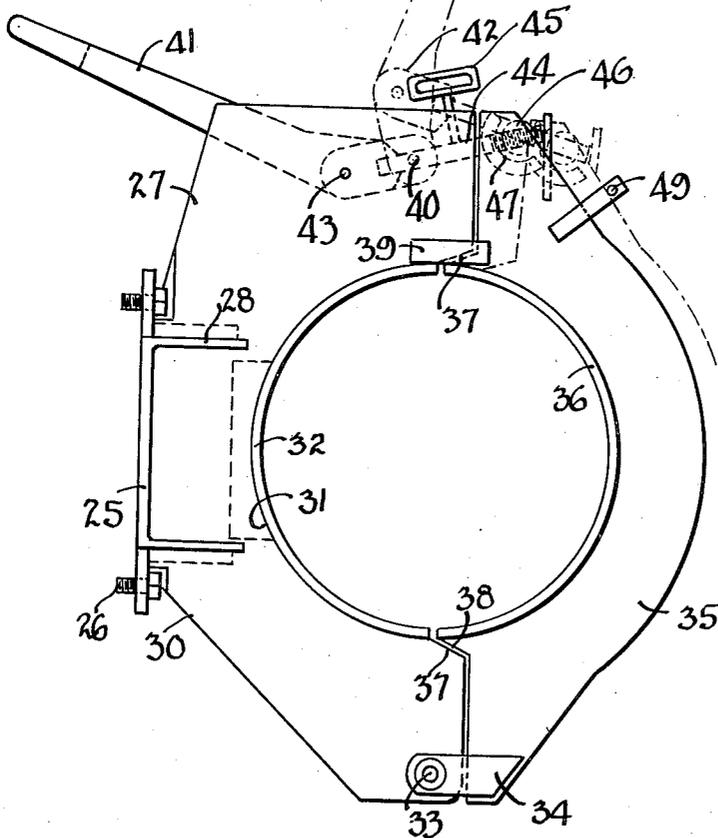


Fig. 5.

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UNITED STATES PATENT OFFICE

2,500,980

PIPE-BENDING MACHINE

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Continuation of application Serial No. 626,483,
November 3, 1945. This application November
15, 1948, Serial No. 60,067

4 Claims. (Cl. 153—32)

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The present invention relates to a pipe bending machine which is particularly adapted for the cold bending of large diameter pipe. This application is a continuation of my co-pending application, Serial No. 626,483, filed November 3, 1945, and subsequently abandoned for a Pipe bending machine.

In the cold bending of large diameter pipe, it is desirable to obtain a pipe which retains its rounded configuration after the bending operation and in which no excessive strains or stresses reside. In order to accomplish these objectives, the present invention contemplates that the portion of the pipe to be bent will be completely enclosed in a circular clamp or die so as to maintain its round configuration and if any substantial bend is to be made, permit a wrinkle to be formed on the inside of the pipe so as to remove the strains and stresses of the material in the finished pipe.

It is therefore one of the objects of the invention to provide a pipe bending machine where the pipe is enclosed in a circular clamp adjacent the area being bent so as to retain the circular configuration of the pipe.

Another object of the invention is to provide a clamp for a pipe bending machine which can be latched around a pipe prior to bending so as to retain the pipe in the circular configuration of the clamp during the bending operation.

It is also an object of the invention to provide a pipe clamp which is hinged to open up along substantially vertical lines so as to permit the insertion and clamping of the pipe for the bending operation.

Another object of the invention is to provide a support structure in a pipe bending machine for a pipe clamp which encircles the pipe.

Another object of the invention is to provide a pipe bending machine where clamps are positioned about the pipe and are adapted to change position with the pipe during the bending operation.

A still further object of the invention is to provide a pipe bending machine wherein one or more of the pipe supporting clamps are cut away to permit the excess material of the pipe on the inside of the bend to be formed into a wrinkle while maintaining the pipe round.

Other and further objects of the invention will be readily apparent when the following description is considered in connection with the accompanying drawings, wherein:

Fig. 1 is a top plan view looking down on the

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pipe bending machine with a pipe in position ready to be bent.

Fig. 2 is a front elevation looking at the pipe retaining clamps.

Fig. 3 is a side elevation of one of the floating pipe clamps.

Fig. 4 is a top plan view looking down on a pair of floating pipe clamps and illustrating the manner of the connection thereof.

Fig. 5 is a side elevation of one of the stationary pipe clamps supported upon the machine frame and illustrating the manner of connecting and releasing the clamp.

Fig. 6 is a top plan view looking down on the stationary clamps affixed to the machine frame.

Fig. 7 is a sectional view through the pipe which has been bent and illustrates the wrinkle which has been formed thereon.

In Fig. 1 the machine 2 is preferably made up of a frame 3 which is quite massive and preferably made of structural steel members. Such a machine is shown generally in my Patent No. 2,428,764, issued on October 7, 1947, for Apparatus for cold bending of large diameter thin walled pipe.

This frame generally has a central front section 4 which is flanked by the tapered portions 5 and 6 at each end thereof. The end 5 may be provided with the block and tackle 9 made up of a pulley 10, cable 11, and the snatch block, or pulley, 12 having a hook 13 to engage a cable or sling 14 which is positioned about the pipe 15, which is to be bent. Of course any power mechanism may be connected to the end of the cable 11 so as to exert the desired pull on the pipe 15 to effect the bending thereof.

The end 16 of the pipe is arranged to be received in a cradle 17 carried by the bracket 18 and pivotally mounted at 19 on the end 6 of the frame. This cradle holds the end 16 of the pipe stationary so as to resist the stresses exerted by pulling on the sling 14.

The pipe 15 will be longitudinally positioned in the cradle 17 in such a manner that the portion of the pipe to be bent will be disposed within the pipe bending assembly 20. This assembly is of peculiar construction in that it has a plurality of pipe clamps 22, some of which are affixed to the supporting structure 23. This supporting structure is in the form of a structural member 24 spaced outwardly and affixed to the frame portion 6. A pipe clamp supporting plate 25 is arranged to be fastened to the support 24 by means of the bolts 26, a plurality of which have been shown. This plate 25 has a plurality

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of fixed pipe clamps 27 extending radially therefrom and braced by the gusset plates 28 so as to hold them rigidly with respect to the support plate 25. This structure is best seen in Fig. 5 where the support plate 25 is in the form of a channel affixed to the flange plate 30 forming a portion of each of the clamps 27.

The plate 30 is cut away to provide a substantially semi-circular opening 31 therein at the elevation where the pipe is to be received and affixed in this opening so as to provide a larger bending area upon the pipe is the pipe contacting band 32 best seen in Fig. 6 as being of such width so that the edges of the adjacent bands will substantially abut against each other when they are engaging the pipe.

The plate 30 has the pivot pin 33 adjacent the base which is arranged to receive the plates of a hinge 34 affixed on the gate portion 35 of the pipe clamp. The gate portion carries a similar pipe contacting band 36 so that the two bands 32 and 36 form a complete closure about the pipe. The base plate 30 is tapered inwardly at 37 at both the top and bottom while the gate piece has an extension 38 which is complementary therewith. This permits each of the pipe contacting bands 32 and 36 to be semi-circular and to provide sufficient reinforcement at the top and bottom of the pipe where the greatest stresses occur when the pipe is bent. In order to align the pivoted gate 35 relative to the base plate, the straps 39 are affixed to the base plate and adapted to receive the gate.

The latching mechanism to clamp the gate 35 in pipe retaining position upon the base plate 30 includes a pivot pin 40 mounted in the base plate 30 and a handle 41 pivoted on said pin 40. This handle is in the form of two spaced arms fixed together and arranged to receive between them a head 42 which is pivoted at 43 in the handle at a position spaced from the pivot pin 40. This head 42 has a rod 44 affixed therein with a handle 45 on the rod so as to lift the outer end 46 from the socket 47 in the gate or cap plate 35. The end 46 has a cylinder 48 positioned thereon to be received in the socket 47 and this cylinder can be adjusted due to the threaded area on the rod. By this adjustment it is possible to insure that the gate 35 will be drawn tightly into position due to leverage of the handle 41 and the positioning of the pin 43.

A handle to lift the gate 35 is shown at 49 as spanning the gate plates for at least two of the clamps.

It seems obvious that after the pipe has been positioned against the contact portion 32 that the gate may be grasped by the handle 49 and moved to the position of Fig. 5. The latch handle 41 will be moved to the dotted line position of Fig. 5 and the handle 45 on the rod 44 grasped so as to drop the cylinder 46 into the socket 47. The handle 41 is then moved to the full line position of Fig. 5, and the pipe will then be clamped securely in position.

One of the particular advantages of this construction is that the cylindrical pipe is securely confined at the time it is subjected to the bending operation. If the pipe were unconfined during the bending operation, of course the inside of the bend would be subjected to compression, the outside of the bend subjected to tension and the top and bottom portions would tend to raise and lower respectively so as to elongate the vertical diameter of the pipe. With the clamps just described, however, the pipe is confined in the

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cylindrical clamp so that the vertical axis cannot elongate as a true and accurate bending of the pipe is accomplished.

In the bending operation as stated, the material of the pipe on the inside of the bend will be subjected to compression and in order to allow for such compression the inside portion of the clamp 50 is best seen in Fig. 1 as having been cut away so as to leave a blank space 53 for the width of one of the clamps as a space on the inside of the pipe. The base plate has been cut away somewhat and the contact plate 32 has been beveled or tapered at 54 so as to provide for a curved wrinkle to be formed on the inner bend portion of the pipe. Fig. 7 shows the pipe 15 with the wrinkle 55 formed thereon in a gradually diminishing size from the inside of the bend toward the top and bottom where the wrinkle gradually merges into the pipe as at 56.

In order to confine the pipe on the right hand side as found in Fig. 1 from the wrinkle which is being formed and in order to allow the clamps which thus confine the pipe to move, the two clamps 60 and 61 are shown. These clamps are like the previous clamps 27 except that they are movable to a limited extent and the base plates thereof are not mounted on the support plate 25 as were the previous clamps. In order to support these clamps, however, a pin and slot type of hinge 62 has been arranged on the back of the base plate 30 so that the clamp 60 is hinged or pivoted on the last clamp 50 and the clamp 61 is in turn hinged to the clamp 60 as best seen in Figs. 1 and 3.

In order to urge the two movable clamps 60 and 61 apart, a pin 65 is passed through the base members 30 of the two clamps and a spring 66 disposed between them. This spring permits relative flexing of the clamps as the pipe is bent so that the clamps confining the pipe will be permitted to tilt as the pipe bends. A similar spring 67 is disposed between the plates 30 of clamps 50 and 60 to hold the plates apart. The latching mechanism for the movable gates of the clamps 60 and 61 is slightly different than shown in Fig. 5 and is best seen in Fig. 3, where the pivot pin 40 is mounted in an upstanding lug 68 on the base member and the head 69 of the latch carries a threaded rod 70 which can be locked into position by a lock 71. The rod 70 has the grip 72 carrying a retainer pin 73 mounted thereon which pin is arranged to be dropped into the recess 74 in the gate portion 35 of the clamp so that as the handle is moved backward the leverage of the handle 41 will cause the head 69 to be drawn over the base member to clamp the gate in position.

In some instances just a bend by a straight pull is desired, and if so, a number of additional movable clamps such as 60 and 61 may be placed on the pipe and the bases thereof will abut against a template 80 which is rigidly mounted on a frame.

It is desirable to know the size of the wrinkle being formed in the space 53 and to accomplish this, the push rod 81 is slidably arranged across the frame 3 and has a collar 82 thereon to confine a spring 83 which will normally urge the feeler rod 81 into the space 53 so that it may abut the pipe as at 84. This rod projects at 85 from the back side of the frame adjacent where the operator is positioned. The nut 86 on the rod may be adjusted when the pipe is placed in the machine so that it is in a known position. As the pipe is bent and the bulge or wrinkle 55 is

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formed, it will cause the rod 81 to slide so that movement of the nut 86 relative to the frame 3 may be observed by the operator. In this manner he knows that a wrinkle is being formed and the height or amount of projection of the wrinkle from the pipe may be readily observed even though the wrinkle is being formed below the operator's line of vision.

Broadly, the invention contemplates a large diameter pipe bending machine where the pipe will be confined and the size, shape, and depth of the wrinkle controlled.

What is claimed is:

1. A pipe bending machine for large diameter pipe comprising a frame, means at one end to anchor a pipe against pulling away from said frame, means at the other end to exert a lateral pull on said other end of the pipe toward the frame, a pipe bending assembly comprising a plurality of clamps on said frame intermediate the ends to substantially clamp about and rigidly confine the circular periphery of the pipe being bent so as to maintain the pipe circular, said clamps being flexibly interconnected and at least two clamps being movable to form the pipe bend when the pipe is pulled.

2. A pipe bending machine for large diameter pipe comprising a frame, means at one end to anchor a pipe against pulling away from said frame, means at the other end to exert a lateral pull on said other end of the pipe toward the frame, a pipe bending assembly comprising a plurality of clamps on said frame intermediate the ends to substantially clamp about and rigidly confine the circular periphery of the pipe being bent so as to maintain the pipe circular, said clamps being flexibly interconnected and at least two clamps being movable to form the pipe bend when the pipe is pulled, said pipe bending assembly being adapted to provide a space along the inside of the bend of the pipe so as to encourage the formation of a wrinkle in the pipe for excess metal.

3. A pipe bending machine for large diameter pipe comprising a frame, means at one end to anchor a pipe against pulling away from said frame, means at the other end to exert a lateral pull on said other end of the pipe toward the frame, a pipe bending assembly comprising a plu-

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rality of clamps on said frame intermediate the ends to substantially clamp about and rigidly confine the circular periphery of the pipe being bent so as to maintain the pipe circular, said clamps being flexibly interconnected and at least two clamps being movable to form the pipe bend when the pipe is pulled, said pipe bending assembly being adapted to provide a space along the inside of the bend of the pipe so as to encourage the formation of a wrinkle in the pipe for excess metal, and means for visually indicating to the machine operator the forming of the wrinkle.

4. A machine for the cold bending of large diameter relatively thin walled pipe comprising, a frame, means to anchor one end of the pipe adjacent one end of said frame, means adjacent the other end of said frame to exert a lateral force on the pipe to effect the bending thereof, a fulcrum on the machine intermediate said means, a pipe bending assembly comprising a plurality of pipe receiving clamps, said clamp assembly being adapted to provide a space along the inside of the bend of the pipe so as to encourage the formation of a wrinkle in the pipe for excess metal, means supporting said clamps to determine the amount of bending of the pipe, said clamps including a portion substantially enclosing the pipe to retain the pipe round.

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