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L. H. BRINKMAN.

APPARATUS FOR BENDING PIPE.

APPLICATION FILED JULY 6, 1903.

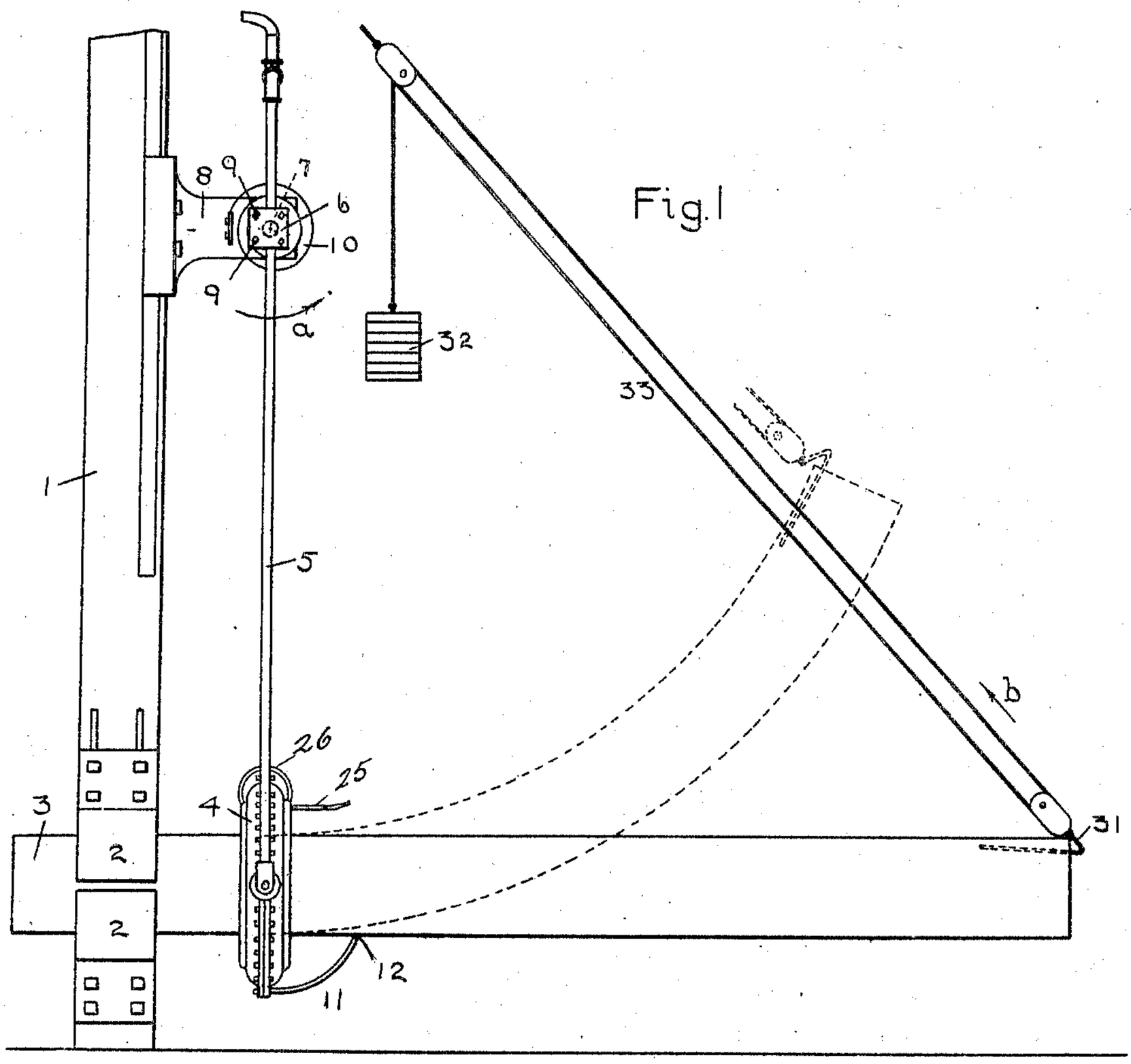

Fig. 1

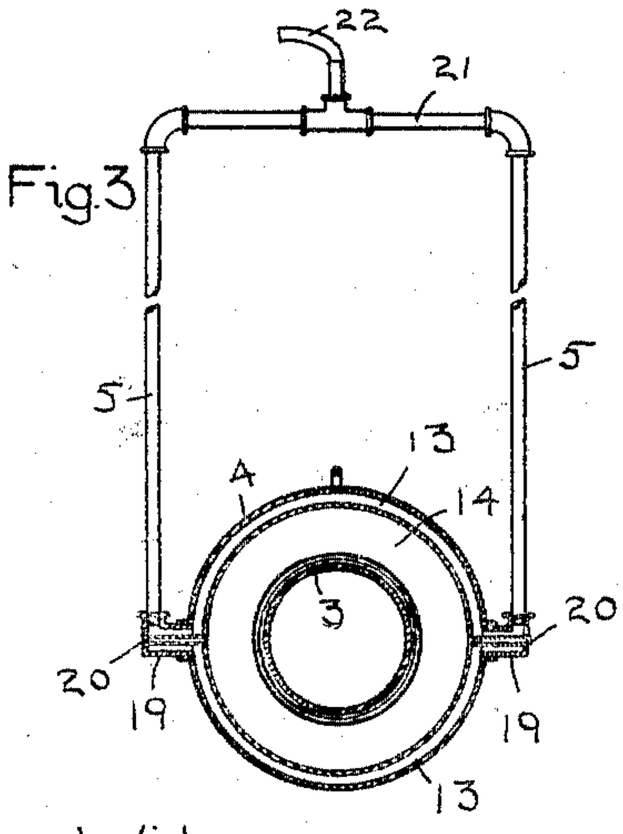

Fig. 3

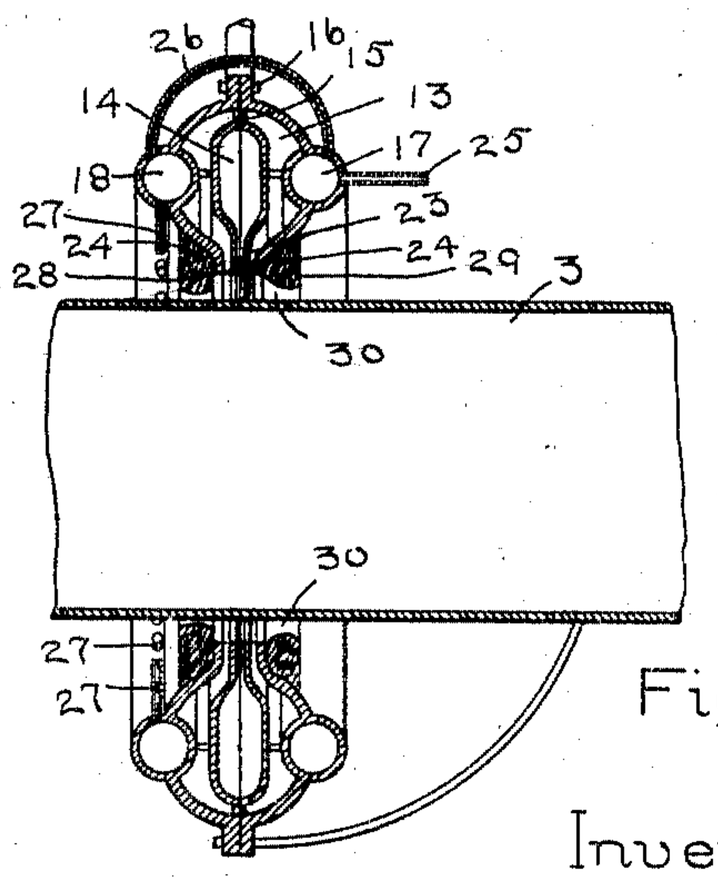

Fig. 2

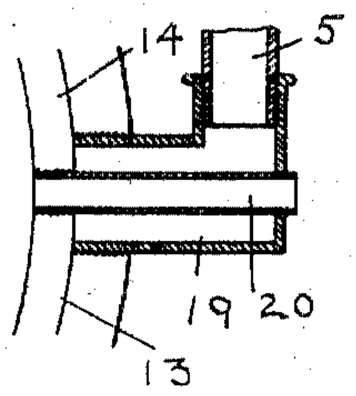

Fig. 4

Witnesses

Roy D. Tolman.

Penelope Bomberbach.

Inventor

Louis H. Brinkman.

By Rufus B. Fowler

Attorney

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UNITED STATES PATENT OFFICE.

LOUIS H. BRINKMAN, OF WEST HARTFORD, CONNECTICUT, ASSIGNOR TO WHITLOCK COIL PIPE COMPANY, OF WEST HARTFORD, CONNECTICUT, A CORPORATION OF CONNECTICUT.

APPARATUS FOR BENDING PIPE.

SPECIFICATION forming part of Letters Patent No. 784,101, dated March 7, 1905.

Application filed July 6, 1903. Serial No. 164,304.

To all whom it may concern:

Be it known that I, LOUIS H. BRINKMAN, a citizen of the United States, residing at West Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in Apparatus for Bending Pipe, of which the following is a specification accompanied by drawings forming a part of the same, in which—

Figure 1 represents a side elevation of an apparatus for bending pipe embodying my invention. Fig. 2 is a central vertical sectional view through the annular burner, on an enlarged scale, in a plane parallel with the axis of a pipe inclosed therein. Fig. 3 is a vertical sectional view through the annular burner in a plane at right angles with the axis of a pipe held therein; and Fig. 4 is an enlarged detail in section, showing the pipes for supplying fuel to the burner.

Similar reference-figures refer to similar parts in the different views.

The object of my present invention is to provide a simple and automatic apparatus for bending metal pipe, and especially pipe of the larger sizes, without requiring that the pipe be filled to resist any crushing strain incident to the process of bending and which will enable the pipe to be uniformly and gradually bent by the automatic action of the bending apparatus; and it consists in the combination of means for applying a constant bending strain to the pipe with means for successively heating limited sections of the pipe to enable them to be curved under the bending strain and with means for successively cooling the bent sections in order to maintain their curvature; and my invention further consists in providing means for automatically determining the curvature of the bent sections.

Referring to the accompanying drawings, 1 denotes a vertical post on which is mounted a pair of clamping-jaws 2 2, adapted to seize and firmly hold in a horizontal position one end of a pipe 3 which is to be bent. Inclosing the pipe 3 is an annular burner 4, suspended upon the lower ends of pipes 5 5, which pass through clamping-blocks, one of which is shown at 6, Fig. 1, on the opposite ends of a short horizontal shaft (indicated by broken lines at 7, Fig. 1) and journaled in a bracket 8, adjustably held upon the upright post 1. The clamping-blocks 6 are tightened on the pipes 5 by bolts 9, allowing the pipes 5 5 and annular burner 4, suspended thereby, to be vertically adjusted to bring the annular burner 4 concentric with the inclosed pipe 3, and the bracket 8 is vertically adjustable on the post 1 in order to vary the distance between the center of the annular burner 4 and the axis of the rocking shaft 7. A torsional spring 10 is applied to the shaft 7, with its tension acting to rotate the shaft in the direction of the arrow *a* and carry the annular burner toward the free end of the pipe 3. The tension of the torsional spring 10 is resisted by a curved brace-rod 11, held by the lower edge of the annular burner with its free end bearing against the under side of the pipe 3 at the point 12. The annular burner, which is represented in cross-section, on a larger scale, in Fig. 2, consists of an outer annular shell 13 and an inclosed annular shell 14, each of said shells being cast in halves and provided with flanges 15 and 16, which are bolted together, and the outer shell 13 is provided on opposite sides with two annular chambers 17 and 18. Attached to diametrically opposite sides of the outer shell 13 are elbows 19, which communicate with the shell 13 and with the pipes 5. Passing through the elbows 19 are short pipes 20, with their outer ends open to the air and their inner ends communicating with the inner shells 14. The pipes 5 are connected at their upper ends by a cross-pipe 21, which is connected by a pipe 22 with a gas-holder or other source of gas-supply under pressure, which flows through the pipes 5 5 and elbows 19 19 into the outer shell 13 of the burner, while air is permitted to flow through the pipes 20 to the inner shell 14. The walls of the shell 14 are brought together and parallel at their inner edge, with a narrow slit or opening 23 between them, through which the air passes in a thin annular sheet and impinges against the outside of the pipe 3.

Likewise the inner edge of the walls of the shell 13 are brought together and inclose the inner edge of the shell 14, with narrow annular slits 24 24 on opposite sides of the shell 14, through which gas is forced in two thin annular sheets against the outer surface of the pipe 3. The force of the gas-current induces a flow of air through the central slit 23 of the inner shell 14, which mingled with the gas-currents forms a gaseous fuel and when ignited impinges against the outer surface of the pipe 3. The annular chamber 17 forms a water-chamber which is filled with water through a pipe 25, having a flexible connection with a source of water-supply, thereby cooling the burner. From the chamber 17 water is conducted through the curved pipe 26 to a similar water-chamber 18 on the opposite side of the burner, which is supplied with a series of short radial pipes 27, through which water is forced in a series of jets. A wall of fire-clay or similar plastic material 28 is built upon the burner between the fuel-slits and water-jets, nearly touching the pipe 3, and a similar wall 29, of fire-clay, is built upon the opposite side of the burner, leaving, however, sufficient space 30 between the surface of the pipe and the wall of fire-clay to permit the escape of flame.

A pulling force is applied to the free end of the pipe in the direction of the arrow *b* by any suitable means, in the present instance by means of a hook 31 and a weight 32, with intervening rope and pulleys 33.

When the parts have been arranged as described and the burner ignited, the operation of the apparatus is as follows: The pipe is securely held in a horizontal position against the pulling force of the weight 32 by the clamping-jaws 2 2, and the application of the heat generated by the annular burner 4 heats a narrow section of the pipe immediately inclosed within the burner until the resistance of the pipe is lessened sufficiently to allow the pulling force of the weight 32 to bend the pipe at its heated section, carrying the pipe away from the brace-rod 11 and allowing the annular burner to be slightly swung in the direction of the arrow *a* by the tension of the torsional spring 10, thereby causing the burner to inclose a new section of pipe, and the water jets flowing through the short radial pipes 27 immediately cool the already-heated section sufficiently to enable it to maintain the curvature already given it. The second section is then heated and bent, allowing the annular burner to advance another step forward by the torsional spring 10, when the heated section is again cooled and a new section heated, and the heating, bending, and cooling progresses along successive sections of pipe, each of which is bent by the pulling strain inserted by the weight 32 as soon as the heated section becomes sufficiently softened. As soon as each of the sections is bent sufficiently to allow the annular burner to be swung by its torsional spring 10 the forward movement of the burner takes place, and cooling of the heated section immediately follows, which causes it to be set or fixed in its curved form. The curvature of the pipe, therefore, will be determined by the radius of the swinging burner 4, or the distance between the center of the annular burner 4 and the axis of the rocking shaft 7 will be the radius of the curvature of the pipe 3 on its axial line. The operation of the apparatus is therefore automatic when once properly adjusted. The wall of fire-clay 28 limits the heating of the pipe toward the water-jets and the space 30 between the wall of fire-clay 29, and the surface of the pipe allows the surplus heat from the burner to be utilized in partially heating the excessive sections of pipe in advance of the forward movement of the burner.

The bending of a pipe by my improved apparatus is not only automatic in its action and obviates the necessity of filling the pipe to prevent its being crushed by the bending strain, but the bending proceeds so gradually and uniformly that I am able to obtain an accurate and uniform curvature of the pipe throughout its entire length, and the curvature is capable of being readily and accurately adjusted by varying the radius of the swinging burner, which is accomplished by adiusting the vertical position of the bracket 8 on the upright post 1.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In an apparatus for bending pipe, the combination of means for applying a bending strain to one end of the pipe and at an angle to the axis of the pipe, means for holding the opposite end of the pipe in a fixed and stationary position capable of resisting said bending strain, and means for heating annular sections of the pipe progressively from the fixed end of the pipe toward its free end, substantially as described.

2. In an apparatus for bending pipe, the combination of means for applying a bending strain to one end of the pipe and at an angle to the axis of the pipe, clamping-jaws for holding the opposite end of the pipe in a fixed and stationary position and capable of resisting said bending strain, means for heating annular sections of the pipe progressively from the fixed end toward the free end of the pipe, and means for progressively cooling the heated sections of the pipe, substantially as described.

3. In an apparatus for bending pipe, the combination of means for holding one end of the pipe in a fixed position, means for progressively heating said pipe in sections, and means for continuously applying a bending strain to the opposite or free end of the pipe.

4. In an apparatus for bending pipe, the combination of means for holding one end of

the pipe in a fixed position, means for progressively heating the pipe in sections, means for continuously applying an axial bending strain to the opposite or free end of the pipe, and means for progressively cooling the pipe in sections and adjacent to a heated section.

5. In an apparatus for bending pipe, the combination with means for holding one end of the pipe in a fixed position and means for continuously applying a bending strain to the opposite or free end of the pipe, of a burner for heating a limited section of the pipe, and means for moving said burner progressively along said pipe.

6. In an apparatus for bending pipe, the combination with means for applying a bending strain to the pipe whereby it is axially curved, of a burner for heating a limited section of said pipe, means for moving said burner along said pipe, and means for controlling the movement of the burner as determined by the curvature of the pipe.

7. In an apparatus for bending pipe, the combination with means for applying a bending strain to the pipe whereby it is axially curved, of a burner for heating a limited section of the pipe, means for moving said burner along the pipe, means for controlling the movement of said burner as determined by the curvature of the pipe, whereby said burner is automatically fed along said pipe as the pipe is bent, and means for successively cooling said pipe behind said burner.

8. In an apparatus for bending pipe, the combination with means for applying a bending strain to the pipe, of a burner for heating a limited section of the pipe, means for moving the burner along the pipe, an annular water-chamber surrounding the pipe, and a series of water-jets leading radially from said water-chamber, substantially as described.

9. In an apparatus for bending pipe, the combination with a pipe having one end held in a fixed position, of means for applying a bending strain to the pipe, an annular burner inclosing the pipe, means for pivotally supporting said burner at a distance from the pipe equal to the radius of the desired curvature of the pipe, and means for swinging said burner on its pivotal support.

10. In an apparatus for bending pipe, the combination with a pipe having one of its ends held in a fixed position, of means for applying a bending strain to the pipe, an annular burner inclosing the pipe, means for pivotally supporting said burner, means for swinging said burner on its pivotal support, and means for controlling the swinging motion of the burner as determined by the curvature of the pipe, substantially as described.

11. In an apparatus for bending pipe, the combination with a pipe having one of its ends held in a fixed position, means for applying a bending strain to the pipe, an annular burner inclosing the pipe, means for pivotally supporting said burner, means for swinging said burner toward the free end of the pipe, and a curved brace-rod carried by said burner with its free end in contact with the pipe, whereby the swinging movement of the burner is controlled by the curvature of the pipe, substantially as described.

12. In an apparatus for bending pipe, the combination with a pipe having one of its ends held in a fixed position, of means for applying a bending pressure to the pipe, an annular burner inclosing the pipe, means for pivotally supporting said burner, a spring applied to said burner to swing it toward the free end of the pipe, and means for controlling the swinging movement of the burner, whereby its position is determined by the curvature of the pipe, substantially as described.

13. In an apparatus for bending pipe, the combination with a pipe having one of its ends held in a fixed and stationary position, of a burner for heating a limited section of the pipe, means for moving said burner from the fixed toward the free end of the pipe, means for controlling the movement of said burner as determined by the curvature of the pipe, and means for applying water to the outside of the heated pipe immediately behind said burner, substantially as described.

14. In an apparatus for bending pipe, the combination with a pipe having one of its ends held in a fixed position, of means for applying a bending strain to the pipe, an annular burner inclosing the pipe by which an annular section is heated, means for changing the position of said burner along the pipe, and means for cooling the heated section as the burner is moved, substantially as described.

15. In an apparatus for bending pipe, the combination with means for holding a pipe with one of its ends in a fixed position, of an annular burner arranged to inclose the pipe, means for pivotally supporting the burner, and means for varying the distance of the pivotal support of the burner from the pipe, whereby the curvature of the pipe is determined, substantially as described.

16. In an apparatus for bending pipe, the combination of means for holding a portion of the pipe in a fixed and stationary position, means for applying a bending strain to the pipe, whereby it is curved in the direction of its length, means for heating annular sections of said pipe progressively from the held section toward one end of the pipe, substantially as described.

17. In an apparatus for bending pipe, the combination of means for applying a bending strain to the pipe, and means for heating an annular section of the pipe and consisting of a burner comprising two annular shells one inclosed within the other, and provided with interior slits, a pipe for feeding gas under pressure to one of said shells, and a pipe for supplying air to the other of said shells, means for

moving said burner along the pipe, and means for applying a bending strain to the pipe.

18. In an apparatus for bending pipe, the combination with a pipe, of means for holding a portion of the pipe in a fixed position, means for applying a bending strain to the pipe, an annular burner inclosing the pipe and comprising an outer and an inner shell, parallel pipes communicating with the outer shell on diametrically opposite sides, a rocking spindle provided with clamping devices at its ends for holding said parallel pipes, a pipe for feeding gas under pressure through said parallel pipes to the outer shell of the burner, an opening for admitting air to the inner shell of the burner, and interior adjacent slits in said shells for the escape of gas and air against the pipe, substantially as described.

19. In an apparatus for bending pipe, the combination of a post or frame, a bracket adjustably held on said post or frame, a rocking spindle journaled in said bracket, a pair of pipes adjustably clamped to the ends of said spindle, an annular burner suspended by said pipes, jaws for holding a pipe to be bent, means for moving said burner from the held section of the pipe toward its free end, and means for applying a bending strain to the pipe, substantially as described.

20. In an apparatus for bending pipe, the combination of a vertical post, a pair of clamping-jaws held on said post, a bracket vertically adjustable on said post, a spindle journaled in said bracket, pipes held by said spindle, an annular burner suspended by said pipes, a spring with its tension applied to rotate said spindle, and means for applying a bending strain to the pipe, substantially as described.

21. In an apparatus for bending pipe, the combination with a supporting post or frame, and a bracket adjustably attached thereto, of a spindle journaled in said bracket, an annular burner adjustably held by said spindle and adapted for burning gaseous fuel, a water-chamber formed in said burner and a series of radial interior openings in said water-chamber, substantially as described.

Dated this 29th day of June, 1903.

LOUIS H. BRINKMAN.

Witnesses:

E. H. TUCKER,

ARTHUR S. MYERS.