C. GORDON.

MACHINE FOR BENDING PIPE.

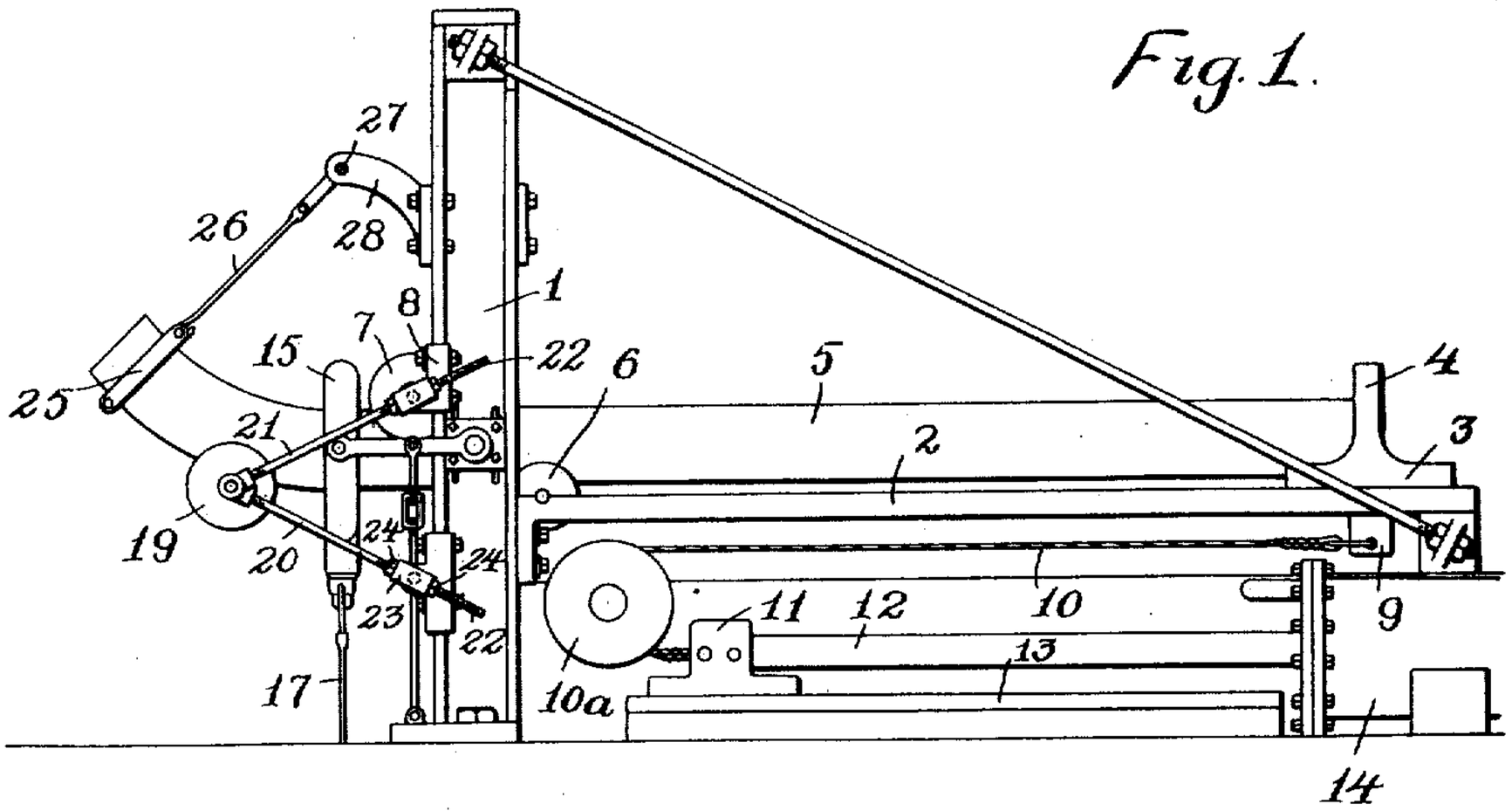
APPLICATION FILED OCT. 28, 1907.

913,004.

Patented Feb. 23, 1909.

2 SHEETS—SHEET 1.

Fig. 1.



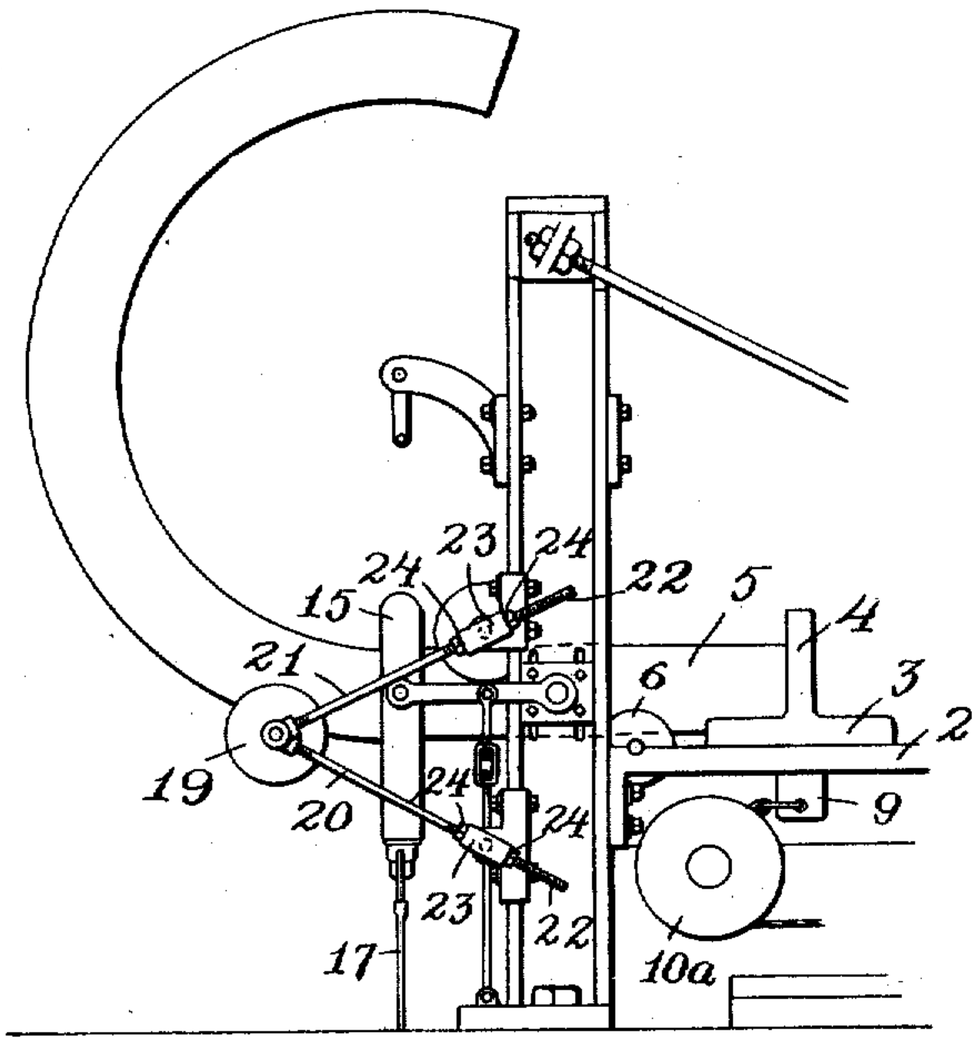


Fig. 3.

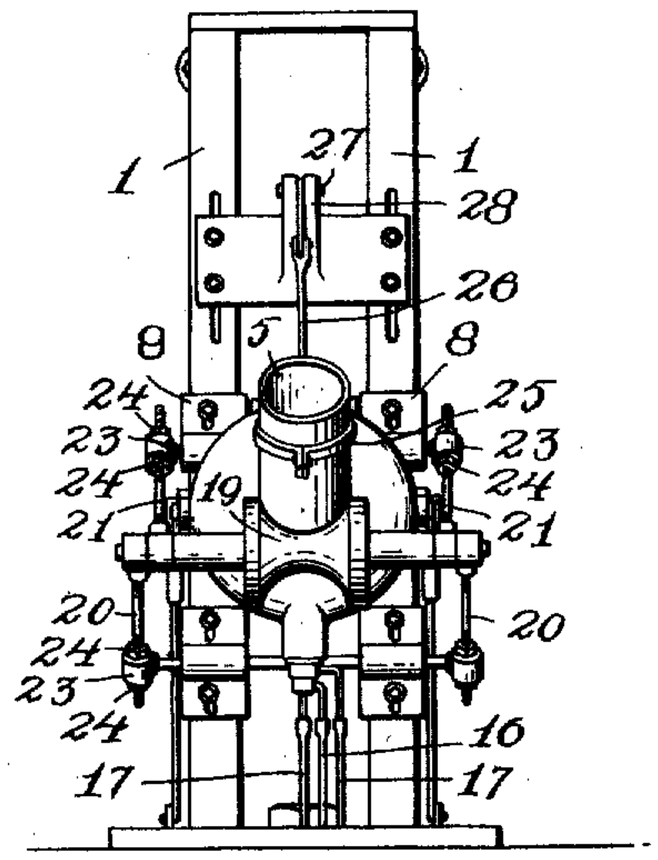


Fig. 2.

Witnesses.

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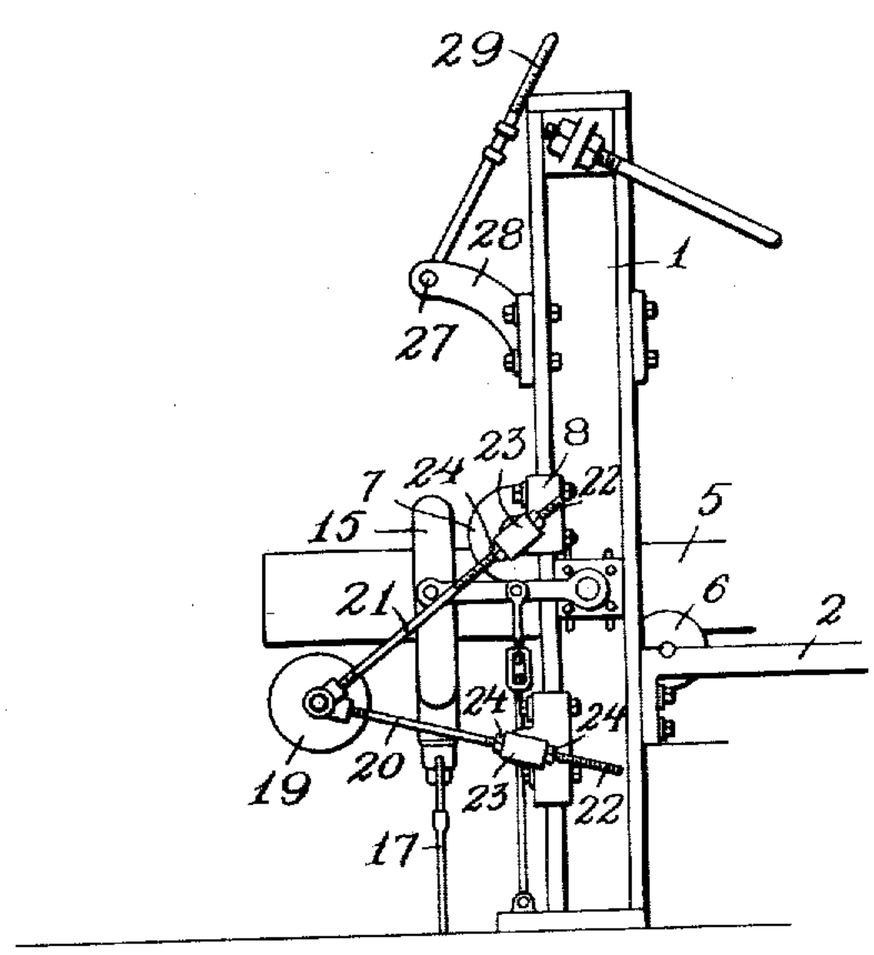

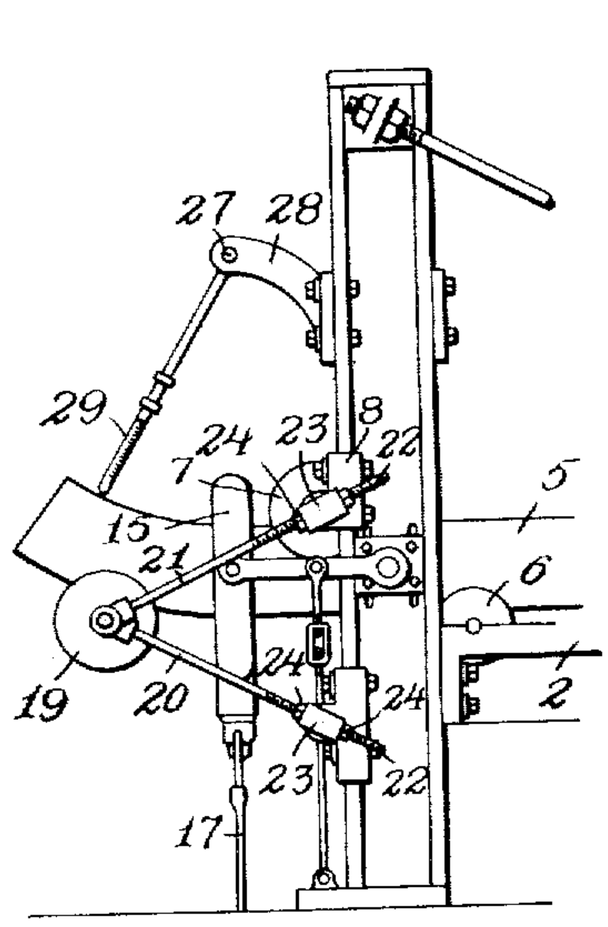

Fig. 4.

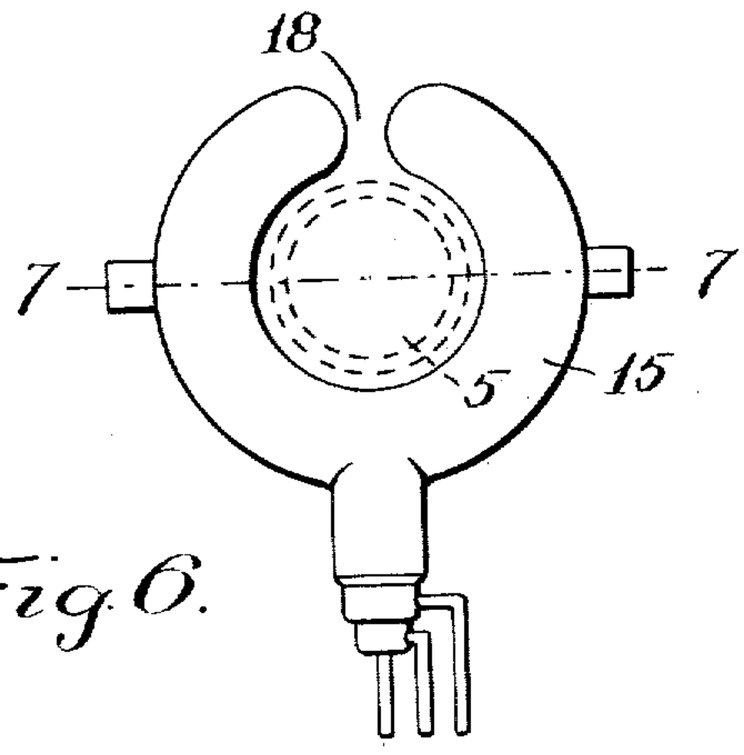

Fig. 6.

Fig. 5.

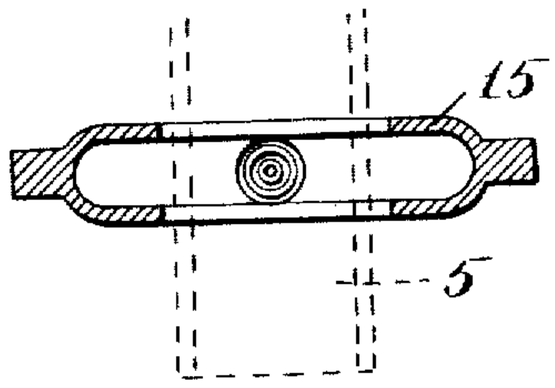

Fig. 7.

Witnesses

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UNITED STATES PATENT OFFICE.

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MACHINE FOR BENDING PIPE.

No. 913,004. Specification of Letters Patent. Patented Feb. 23, 1909.

Application filed October 28, 1907. Serial No. 399,582.

To all whom it may concern:

Be it known that I, CHARLES GORDON, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented a new and useful Improvement in a Machine 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 my improved apparatus. Fig. 2 represents a front view. Fig. 3 is a side view of a portion of the apparatus showing a piece of pipe to which a semicircular bend has been given by the operation of the machine. Fig. 4 is a side view of a portion of the apparatus showing the position of the bending roll preparatory to the operation of bending the pipe, Fig. 5 is a side view of the same, with the bending roll moved into effective position to accomplish the bending of the pipe. Figs. 4 and 5 also show a modification of the means for determining the curvature of the pipe. Fig. 6 is a front view of the burner, and Fig. 7 is a sectional view of the burner on line 7—7, Fig. 6.

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

The object of my present invention is to provide a mechanism for automatically bending pipe, especially of the larger sizes, and it relates to certain improvements in the pipe bending machine as shown and described in United States Letters Patent No. 785,083, issued March 21, 1905.

By means of my present improvement I apply the bending strain to the pipe throughout the entire operation at a constant distance from the heated section of the pipe, and at a constant angle to the axis of the pipe, thereby rendering the bending strain uniform and rendering the action of the apparatus continuous and automatic from one end of the operation to the other.

The machine embodying my present invention comprises an upright framework 1, 1, and a horizontal table 2, provided with ways for a traveling carriage 3, upon which is mounted a vertical pushing plate 4 adapted to bear against one end of the pipe 5 to be bent. Journaled in suitable bearings at the rear of the upright frame 1 is a pipe supporting roll 6, and at the front of the upright frame 1 is a fulcrum roll 7 journaled in bearings supported by plates 8 which are adjustably attached to the upright framework 1, enabling the fulcrum roll to be raised and lowered according to the diameter of the pipe to be bent so it will bear against the upper surface of the pipe. The carriage 3 is provided with a depending lug 9 which is connected by a cable 10 with a sliding crosshead 11, attached to the outer end of a piston rod 12 and capable of sliding along a horizontal track 13 as it is moved by a piston equipped hydraulic cylinder 14, the direction of the motion of the cable 10 being changed by means of the pulley 10^a.

In front of and contiguous to the fulcrum roll 7 is a burner 15 supported concentrically with the pipe to be bent. The burner 15 may consist of a Bunsen burner or any suitable type adapted to the use of gaseous fuel which may be supplied through a gas pipe 16 and air pipes 17 in the ordinary method of burners of this class.

The construction of my improved bending machine, as above described, is substantially like that described in the Letters Patent aforesaid No. 785,083. The pipe to be bent is supported with one end upon the carriage 3 and with the opposite end entered between the supporting roll 6 and fulcrum roll 7, and projecting a short distance through the burner 15, as shown in Fig. 4, and the bending of the pipe is accomplished as short sections of the pipe are successively heated by the burner 15, while the pipe is being longitudinally pushed forward by the hydraulic cylinder 14 against the resistance of a bending strain applied to the pipe in front of the burner 15. My present machine, however, differs materially from that described in Letters Patent No. 785,083, in the application of heat to the pipe, and in the method of applying a bending strain to the pipe. Instead of extending the burner entirely around the pipe and applying heat uniformly to its entire circumference, I provide a narrow gap 18 at the upper side of the burner, thereby leaving a narrow strip on the upper side of the pipe to which the flame of the burner is not directly applied, and in consequence has a lower temperature than that portion of the pipe which is inclosed within the burner. By heating the upper surface of the pipe less than the sides and lower surface of the pipe a sort of backbone is provided on the inside of its curvature, which, while not materially impeding the bending

of the pipe, effectually prevents the undue upsetting of the pipe on its concave or inner side.

In front of the burner 15 I provide a bending roll 19 which is journaled in eye bolts 20 and 21. The eye bolts are provided with screw threaded sections 22 and are longitudinally adjustable in blocks 23 by means of nuts 24. The blocks 23 have a swivel connection with the framework, and by the longitudinal adjustment of the eye bolts 20 and 21 the position of the bending roll 19 may be varied relatively to the pipe. When the pipe is first inserted in the machine the bending roll is lowered to clear the pipe, as shown in Fig. 4, and a bending strain is applied to the advancing end of the roll by raising the bending roll by means of the longitudinal adjustment of the eye bolts into the position shown in Fig. 5. The higher the bending roll 19 is raised, the shorter will be the radius of curvature imparted to the pipe, and the position of the bending roll to secure the desired curvature may be determined by either one of two methods.

One method of determining the curvature of the pipe consists in applying a collar 25 to the end of the pipe and connecting the collar by means of a link 26 to a rocking shaft 27 journaled in brackets 28 directly over the heated portion of the pipe, when the length of the link 26 will determine the radius of curvature as the pipe is pushed forward through the burner 15. The curvature being thus established, the bending roll is then brought up into close contact with the under side of the pipe by the adjustment of the eye bolts 20, 21, as shown in Fig. 1. The collar 25 and link 26 are then removed and a bending strain is applied to the pipe by the pressure of the bending roll 19. By another method of determining the curvature of the pipe, an initial bend is imparted to the pipe by raising the bending roll 19, as shown in Fig. 5, and the desired curvature is determined by means of a measuring bar or gage rod 29 which is adjustable in length and is suspended from the rocking shaft 27, the axis of said shaft in both cases being the center of curvature. When the gage bar 29 is no longer in use it may be swung upward against the upright frame, as shown in Fig. 4.

By my improved machine the bending strain is applied during the whole operation at a single fixed point at a uniform distance from the heated section of the pipe, so that the force applied to the pipe is constant both in amount and direction, which is not the case when the bending is accomplished by the collar 25 and link 26, as shown in Fig. 1, for the reason that the collar is continually moving away from the burner as the pipe 5 advances. In fact, the collar 25 would soon be moved into a position where it would prevent instead of produce the desired curvature of the pipe, either requiring its position to be changed or additional collars and links to be employed.

The bracket 28 carrying the rocking shaft 27 is vertically adjustable upon the upright frame 1, in order to enable the radius of curvature of the pipe to be varied.

I claim,

1. In an apparatus for bending pipe, the combination of a pipe supporting roll, a fulcrum roll arranged to contact with the opposite side of the pipe, a bending roll arranged to contact with the side of the pipe opposite said fulcrum roll, means for adjusting said bending roll relatively to the pipe, means for heating a section of the pipe between said fulcrum roll and said bending roll, and means for longitudinally moving the pipe between said rolls.

2. In an apparatus for bending pipe, the combination of a pair of rolls arranged to contact with one side of the pipe, means for adjusting one of said rolls relatively to the pipe, a fulcrum roll arranged to contact with the opposite side of the pipe and in a plane between said pair of rolls, means for heating the pipe between said fulcrum roll and the adjustable roll of said pair of rolls, and means for moving the pipe longitudinally between said rolls.

3. In a machine for bending pipe, the combination of means for applying a bending strain to the pipe, means for applying heat to a limited longitudinal section of the pipe, and means for maintaining said bending means in a fixed relation to said heating means.

4. In a machine for bending pipe, the combination of means for applying a bending strain to the pipe, means for heating a limited longitudinal section of the pipe, means for maintaining said bending means in a fixed relation to said heating means, and means for imparting a positive predetermined pushing force to the pipe.

5. In a machine for bending pipe, the combination of means for applying a bending strain to the pipe, means for adjustably varying said bending strain, means for heating a limited longitudinal section of the pipe, means for maintaining said bending means in a fixed relation to said heating means, and means for applying a predetermined positive pushing force to the end of the pipe.

6. In a pipe bending machine, the combination with a bending roll for applying a bending strain to the pipe, and means for supporting the pipe against a bending strain, of a burner for heating a limited longitudinal section of the pipe, and means for holding said bending roll in fixed relation to said burner.

7. In a pipe bending machine, the combination of means for supporting a pipe against a bending strain, means for applying heat to

a limited longitudinal section of the pipe, a bending roll for applying a bending strain to the pipe, and means for adjusting said bending roll relatively to the pipe and also to said heating means.

8. In a pipe bending machine, the combination of means for applying a bending strain to the pipe, means for heating a limited longitudinal section of the pipe, means for maintaining said bending means in a fixed relation to said heating means, and means for imparting a longitudinal movement to the pipe relatively to said bending means.

9. In a pipe bending machine, the combination of means for supporting a pipe against a bending strain, means for applying heat to a limited longitudinal section and to a limited peripheral section of the pipe, a bending roll for applying a bending strain to the pipe, and means for holding said bending roll in a fixed relation to the heated section of the pipe.

10. In a machine for bending pipe, the combination with bending means, of means for heating a limited longitudinal section of the pipe throughout a portion of its periphery, and comprising a burner inclosing a portion of the pipe and having an open space on the side of the pipe having the least bend, whereby the periphery of the pipe is unequally heated.

Dated this 23rd day of October 1907.

CHARLES GORDON.

Witnesses:

E. H. TUCKER,

E. D. REDFIELD.