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Patented Sept. 17, 1901.

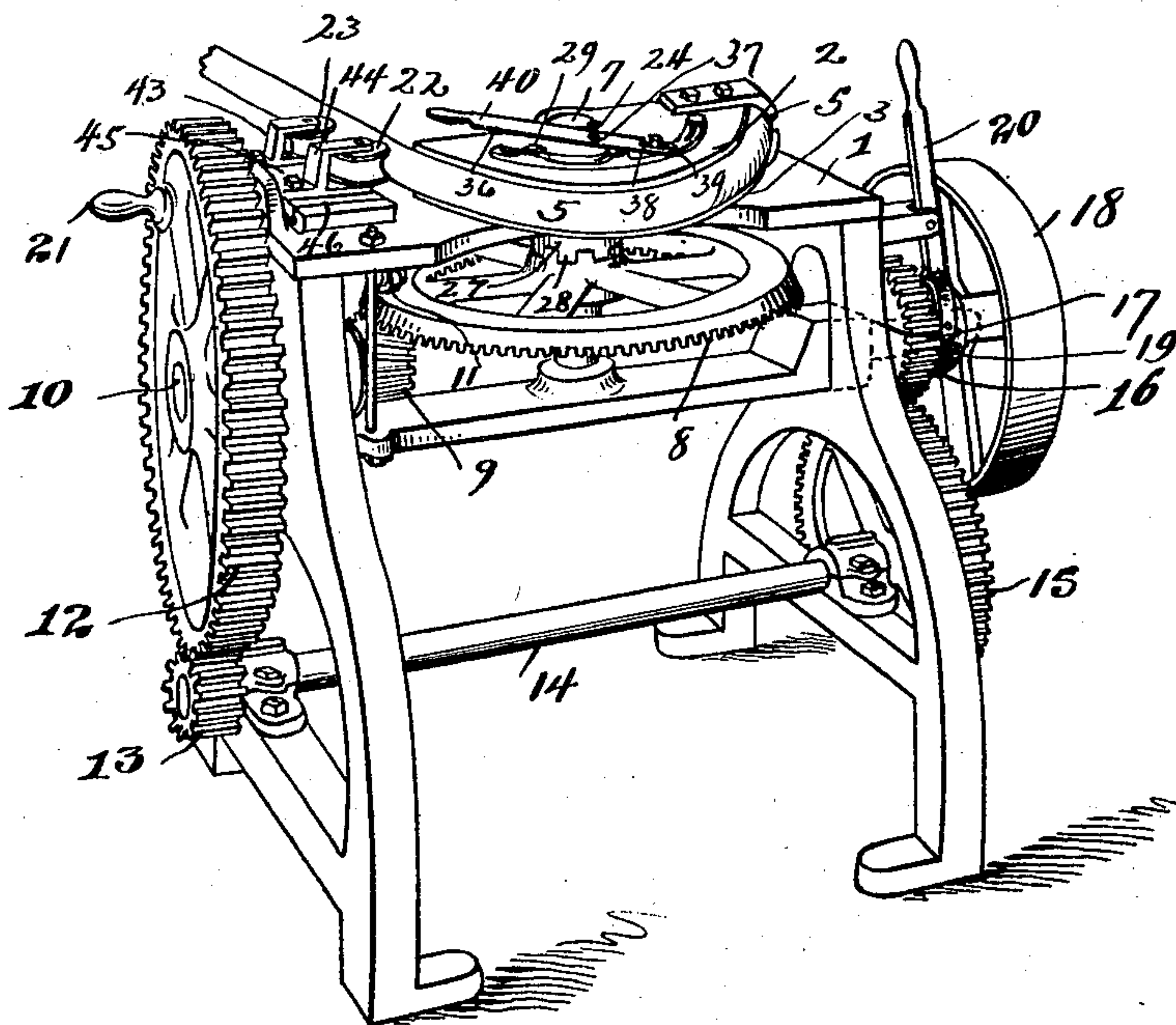
H. F. CONDON.
PIPE BENDING MACHINE.

(Application filed Nov. 5, 1900.)

(No Model.)

2 Sheets—Sheet 1.

Fig. 1.



Witnesses,
J. J. Mann,
Frederick Goodhue

Inventor,
Henry F. Condon,
By Offield Fowler Lenthicum
Atty.

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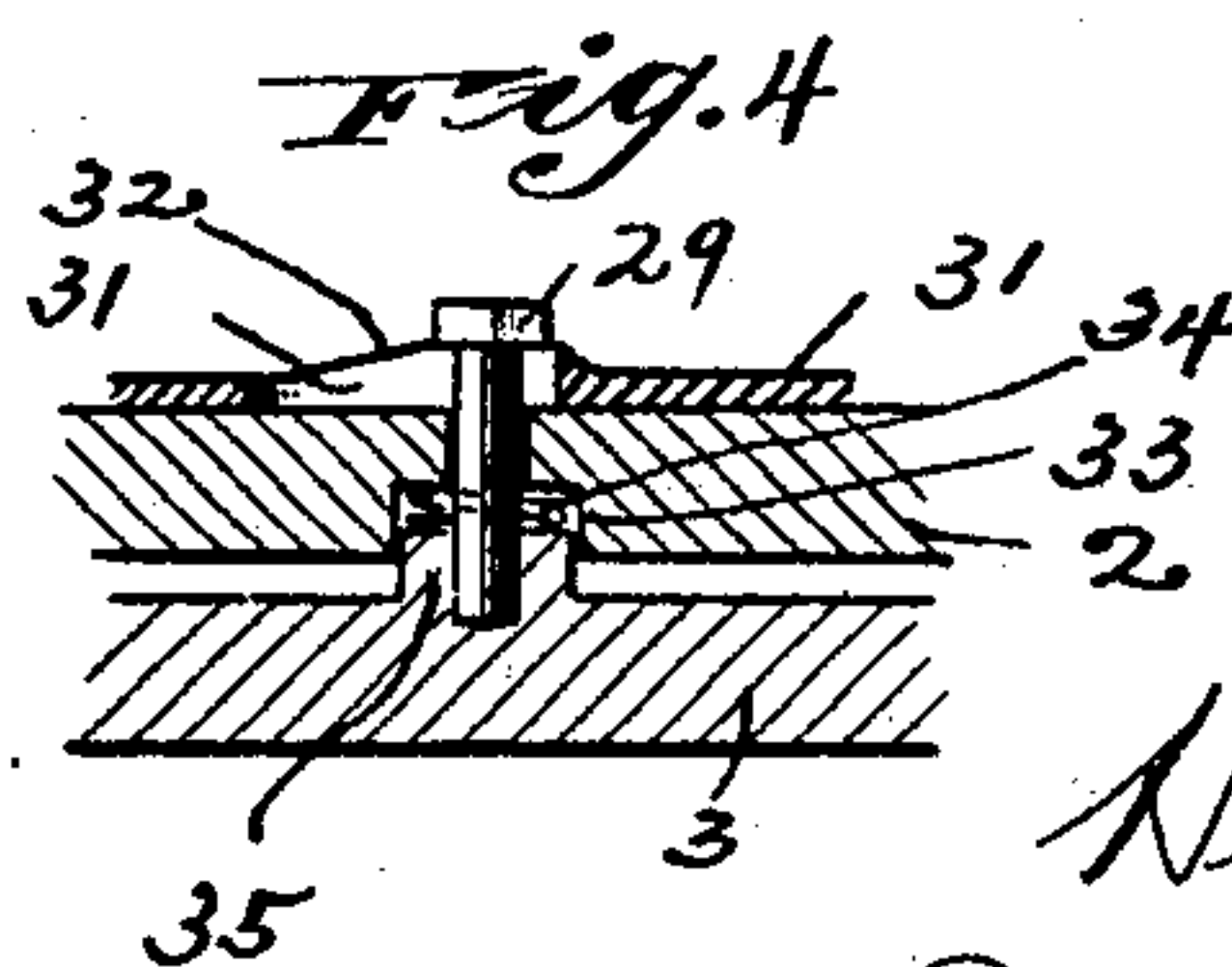
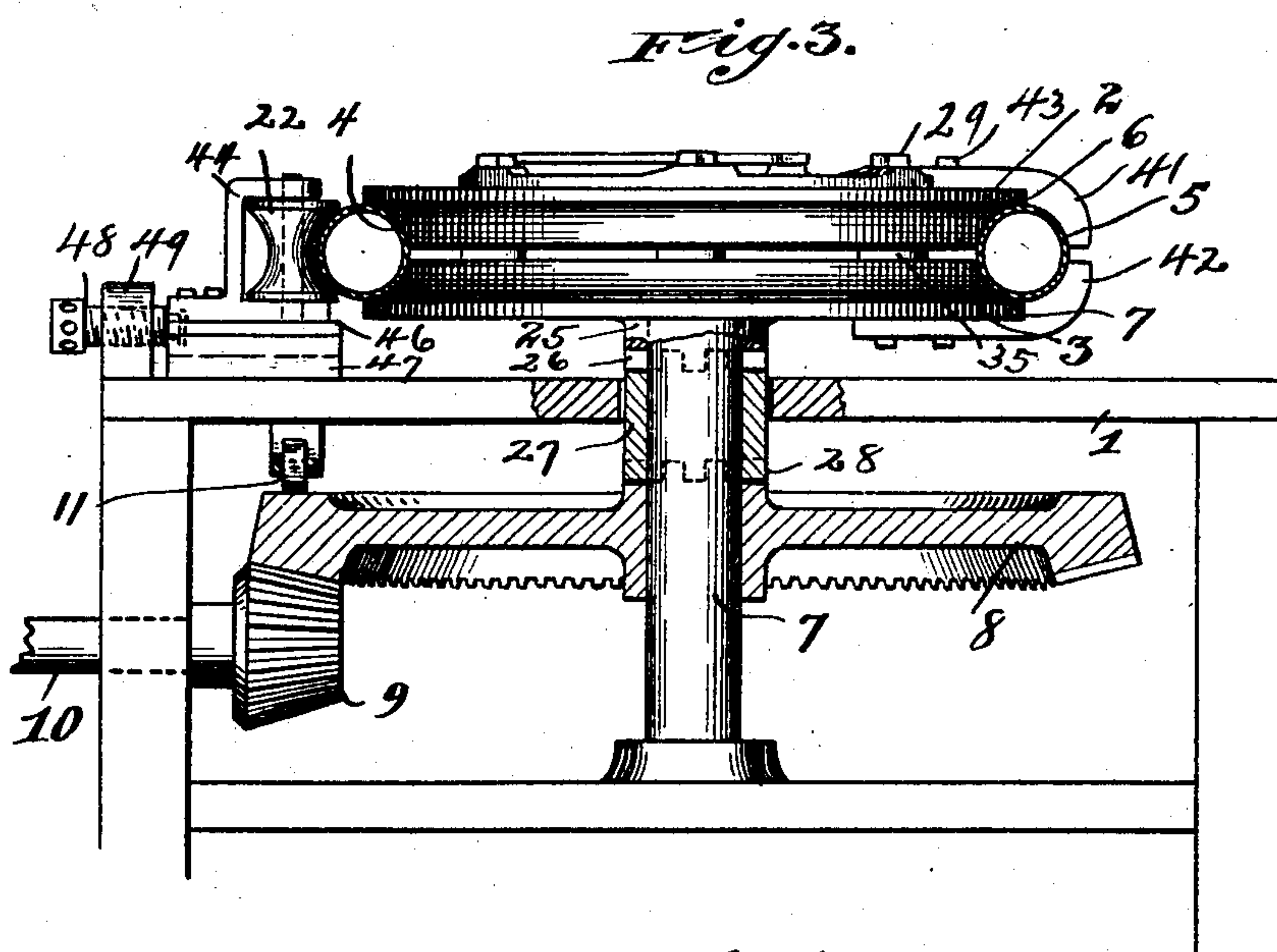
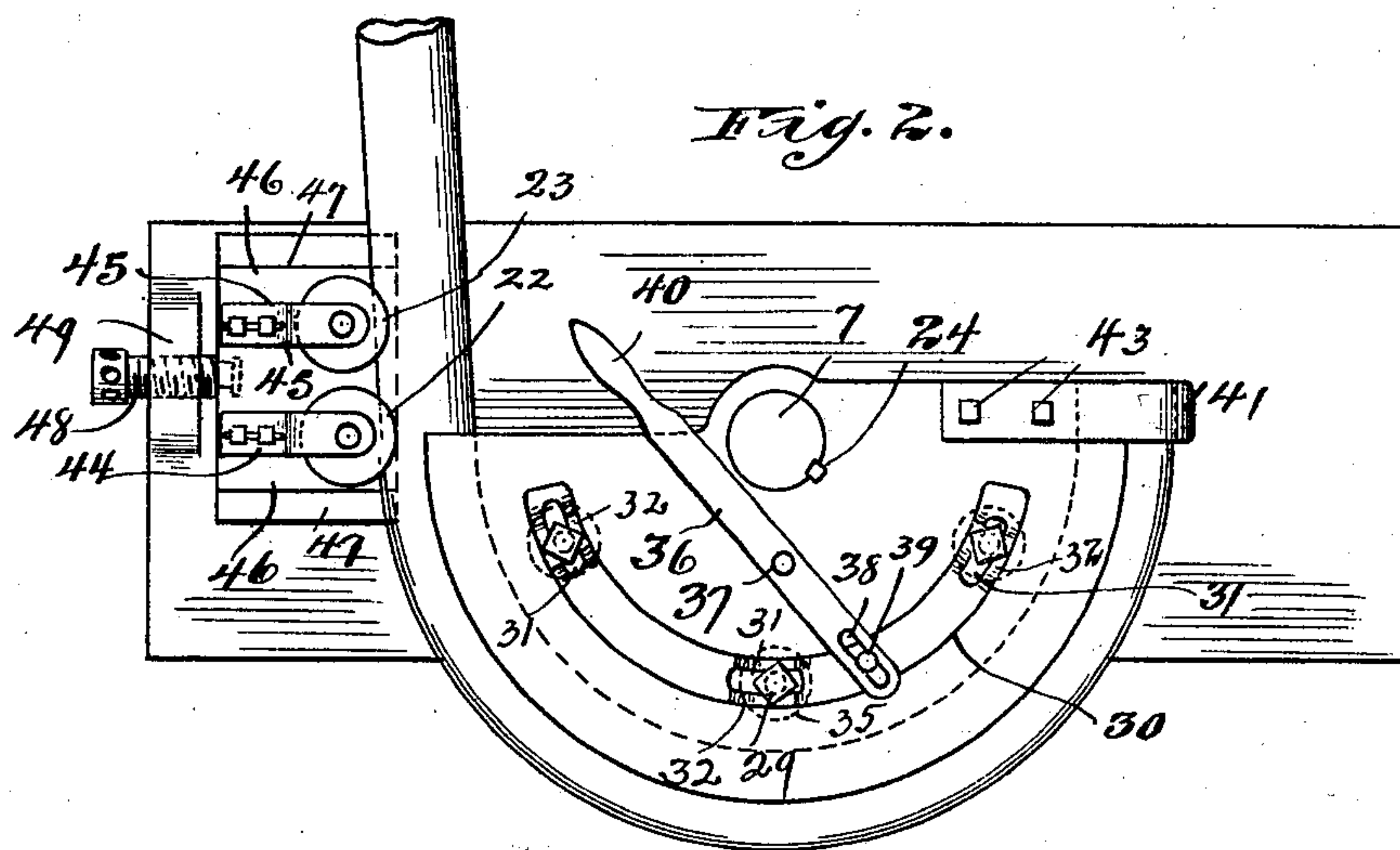
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2 Sheets—Sheet. 2.



Witnesses,
J. E. Mann,
Frederick F. Gordon

Inventor,

Henry F. Condon,

By *Offield Fowler Lenthicum*
Atty.

UNITED STATES PATENT OFFICE.

HENRY F. CONDON, OF DEKALB, ILLINOIS.

PIPE-BENDING MACHINE.

SPECIFICATION forming part of Letters Patent No. 682,671, dated September 17, 1901.

Application filed November 5, 1900. Serial No. 35,492. (No model.)

To all whom it may concern:

Be it known that I, HENRY F. CONDON, a citizen of the United States, residing at Dekalb, in the county of Dekalb and State of Illinois, have invented certain new and useful Improvements in Pipe-Bending Machines, of which the following is a specification.

This invention relates to improvements in pipe-bending machines, and has for its object to provide a simple mechanism whereby iron or analogous pipe may be rapidly, conveniently, and cheaply bent without heating the pipe, without subjecting the latter to undue torture or overstraining of the metal, and without filling the pipe to prevent flattening or crushing during the bending process.

To this end the invention consists in certain novel features which I will now proceed to describe and will then particularly point out in the appended claims.

The invention will be readily understood from the following description, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of a machine embodying my invention in a preferred form. Fig. 2 is a top plan view of the same. Fig. 3 is a front elevation of the machine with parts shown in transverse vertical section; and Fig. 4 is a fragmentary detail view of parts of the mechanism, whereby the two members of the bending-die are held together.

In the said drawings, 1 designates as a whole a suitable supporting-frame, on the top of which is mounted the bending-die, comprising the two parts 2 3. This die is in the form of a segment of a wheel, being shown in the present instance as approximately semicircular in form, and the two parts thereof are so constructed as to form when assembled a periphery-groove or semicircular recess 4 of a form corresponding to that of the pipe to be bent, which pipe is indicated at 5 and fits between the flanges 6 7, which form the upper and lower walls of the groove 4. The die 2 is oscillated or operated in any suitable manner, and in the construction shown it is secured upon a vertical shaft 7, mounted in the frame 1 and provided with a large bevel-gear 8, with which meshes a pinion 9 on a horizontal shaft 10. A roller 11 bears upon the upper face of the bevel-gear 8 immedi-

ately above the point where the latter meshes with the pinion 9 in order to prevent separation of the gears under the strains of work. As a preferred means of driving the shaft 10 the latter is provided with a large spur-gear 12, which meshes with a pinion 13 on a counter-shaft 14, said shaft being provided at its opposite end with a gear-wheel 15, with which meshes a pinion 16, mounted upon a short stub-shaft 17, suitably supported upon the frame 1. On this latter shaft is loosely mounted a driving-pulley 18, and said shaft is provided with a clutch 19, which may be engaged by the pulley 18, so as to cause said shaft to rotate with the driving-pulley. The clutch 19 is adapted to be shifted into and out of engagement by means of a lever 20. It will be seen that when the clutch 19 is thrown into engagement with the wheel 18 a slow movement of rotation will be imparted to the bending-die, which by reason of the strain of gears described will be of very great power. In order to operate the die by hand when desired, the wheel 12 is provided with a handle 21.

22 designates a grooved roller mounted on the frame 1 in a suitable bracket adjacent to the bending-die and coöperating with the latter, said roller having its axis arranged vertically and being located in the same plane with the bending-die, and this groove, like that of the bending-die, being constructed to conform to the shape of the pipe to be bent, the space between the two being just sufficient for the passage of the pipe. A second similar grooved roller 23 is also provided, mounted upon the frame in the same plane, but farther to the rear and slightly outside of a line tangential to a point on the periphery of the die intersected by a radius passing through the advance roller 22. The bending-die is so constructed that the two members thereof are made movable toward and from each other to operatively engage the pipe when it is placed within the die and to release the same after the bending operation has been completed, and for this purpose I construct and arrange the mechanism as follows:

As hereinbefore stated, the die is composed of two main members made separable in the plane of the die. The upper member is op-

eratively connected so as to be driven by the main shaft, while capable of movement endwise of the latter, by means of a suitable key 24, inserted in splines or keyways in the corresponding parts, while the lower die member is operatively connected with the main shaft by being provided at its under side with a short sleeve-section 25, provided in its end face with clutch teeth or projections 26, which engage with the correspondingly notched or recessed upper end of a second sleeve-section 27, loosely mounted upon the main shaft 7. The lower end of the sleeve-section 27 is similarly provided with clutch-teeth 28, which engage corresponding recesses formed in the upper end face of the hub of the main gear 8, thereby imparting from the latter a positive rotary drive to the lower die member, it being understood that the main gear 8 is rigidly mounted upon said main shaft 7.

Means are provided for locking the upper die member in fixed relation to the lower die member or so as to prevent separation of the tube under the pressure exerted thereon during the bending operation, comprising, in the present instance, a series of studs or headed pins 29, arranged downwardly through the upper die member and rigidly seated within or engaged with the lower member, as clearly indicated in the fragmentary view, Fig. 4. Referring more particularly to said Fig. 4, it will be seen that the studs or pins 29 rise some distance above the upper face of the upper die member, and mounted upon said pins between the heads thereof and the upper face of the die member is an arch-shaped bar or slide 30, provided with slots 31, arranged concentric with the axis of the die, so that the said slide may be reciprocated upon said pins. Those portions of the slide 30 which form the side of the curved slides 31 are made thicker than the main body of the bar, the thickest portions being opposite to the end portions of the slots and being joined with the portions of less thickness by inclines 32, which engage the heads of the pins 29 cam fashion as the slide is reciprocated and raise or lower the upper member or cause it to recede from or approach the latter member as the slide-bar is reciprocated in one direction or the other. In order to facilitate the raising of the upper die member, the under side thereof is recessed, as indicated at 33, concentric with each of the pins 29 and a coiled expansion-spring 34 interposed between the meeting faces of the dies within each of said recesses. Preferably, also, the lower member of the die is provided with a circular boss portion 35, concentric with each of the pins 29, adapted to fit within the recesses 33, and thus serve to hold the die members in accurate register with each other, while permitting them to approach and recede in the manner hereinbefore described.

In order to reciprocate the slide-bar 30 for the purpose hereinbefore described, a hand-lever 36 is provided, pivotally mounted be-

tween its ends, as at 37, upon the upper die member and engaging with its slotted end 38 a suitable stud 39 upon said slide, the opposite end of said lever being suitably shaped to form a handle 40.

Describing now the particular means whereby the end of the pipe is positively engaged with the bending-die, upon that side of the die which is in advance during the bending movement is mounted a pair of gripping or clamping jaws (designated 41 42) and mounted, respectively, upon the upper and lower die members in vertical alinement with each other, as indicated clearly in the drawings. Said jaws are shown herein as conveniently united rigidly with their respective die members by means of bolts 43, their outer ends being arranged to overhang the periphery of the die and curved to approach each other and grasp the pipe throughout a substantial part of its outer circumference, as best indicated in Fig. 3. These jaws are so mounted upon the die members that as the latter are caused to approach each other after the end of the pipe has been placed in position between the die and the bending guide-rollers they engage the pipe and clamp it securely to the die, it being understood that the approach of the upper die member to the lower die member in order to thus engage the pipe is caused by shifting the locking-slide 30 by means of the hand-lever 36.

The object of providing the sectional sleeved section, whereby the lower die member is operatively driven from the main shaft, is to enable bending-dies of different sizes—*i. e.*, adapted for pipe of different diameters—to be substituted in the same machine, it being obvious that both of the die members may be disconnected from the main shaft by simply lifting them therefrom and that a larger or smaller lower die member may be supported in exactly the right plane to cooperate properly with the bending-rollers 22 and 23 by simply substituting a shorter or longer sleeve-section 27 to support the same, as may be required. It will of course be understood that when such dies are substituted each pair of die members will include the gripping-jaws thereof and the locking mechanism and hand-lever thereof.

In order that the bending-rollers 22 and 23 may be correspondingly adjusted toward and from the bending-dies to accommodate different sizes of pipe, the brackets 44 45, within which said rollers are journaled, are mounted upon a single slide-block 46, which is mounted to slide in suitable ways 47 toward and from the bending-die, the position of said slide-block being adjusted and controlled by means of an adjusting-screw 48, threaded through a standard 49 upon the main frame and having swivel engagement at its inner end with the slide-block, as indicated clearly in the figures of the drawings.

The operation of bending may be carried out substantially as follows: The bending-

die is first turned to the position the reverse of that shown in the drawings, or, in other words, is moved from an arc of one hundred and eighty degrees, so that the end thereof 5 which carries the clamping-jaws lies immediately adjacent to the roller 22. The end of the pipe is then secured to the die in the manner hereinbefore described, and the machine is started by shifting the lever 20 so as to 10 throw the driving-pulley into gear, whereupon the bending-die rotates, drawing along with it the pipe which is secured thereto. The roller 22 forms an abutment which insures the bending of the pipe in such a man- 15 ner as to conform to the curvature of the die, while the flanges of the latter cooperating with the grooved roller prevent any flattening or crushing of the pipe during the bending operation. That portion of the pipe 20 which lies in rear of the roller 22 remains straight or unbent, but is guided or held in position by the roller 23. When the pipe has been bent to the desired extent, the machine is stopped by means of the lever 20. After 25 the machine is stopped the hand-lever 36 is shifted so as to permit the die members to separate or recede from each other, thereby disengaging the clamping-jaws from the end of the pipe and at the same time separating 30 the die members sufficiently to permit the bent pipe to be readily removed.

It will be seen that by means of an apparatus constructed as hereinbefore described pipe may be bent while cold without undue 35 strain or torture and the expense of heating thus obviated. It will also be observed that the bending is accomplished without inserting any filling material or supporting device into the interior of the pipe. The bending 40 is, moreover, rapidly and conveniently accomplished, thus reducing the expense to a minimum.

I claim—

1. In a pipe-bending machine, the combination of a bending-die having a peripheral 45 groove and divided or made separable in the plane of said groove, a spring acting upon one member of the die to separate it from the other and means for positively advancing one 50 member relatively to the other in opposition to said spring.

2. In a pipe-bending machine, the combination of a segmental bending-die having a peripheral groove substantially conforming to 55 one side of the pipe to be operated upon and divided or made separable in the plane of said groove, clamping-jaws rigidly mounted upon the respective die members in opposing position and adjacent to one of the sides 60 thereof, a spring acting on one die member to separate it from the other and means for drawing said die members together, comprising a locking-pin extending from one member through the other and provided with a shoul-

der and a slide-shoe having a wedging cam- 65 surface adapted to be reciprocated between the shoulder and an opposing part of the movable die member.

3. In a pipe-bending machine, the combination of a bending-die provided with a peripheral groove, and made separable in the plane 70 of said groove, and means for positively advancing one die member relatively to the other, comprising a plurality of fixed studs upon one member arranged to extend through 75 the opposing member, and provided with a headed or shouldered portion, a slide-shoe slotted to fit and reciprocate upon said pins, provided with cam-surfaces interposed between the shouldered portions of the pins 80 and the adjacent face of the die and a pivoted lever operatively engaged with said slide, substantially as described.

4. In a pipe-bending machine, the combination of a main die-shaft, a bending-die mount- 85 ed upon said shaft having a peripheral groove and divided or made separable in the plane of said groove, one member of said die having splined driving engagement with the shaft and the other member having driving engage- 90 ment with said shaft through the medium of a clutch-sleeve, as and for the purpose described.

5. In a pipe-bending machine, the combination with a main die-shaft of a bending-die 95 mounted thereon provided with a peripheral groove and divided or made separable in the plane of said groove, one of said die members having driving engagement with said shaft through the medium of a spline and key and 100 means for driving the other member with said shaft comprising a hub portion upon said die member provided in its end face with clutch projections, a driving member located upon the shaft at a point separated from the 105 die member and likewise provided with clutch projections and a clutch-sleeve provided at its opposite ends with interfitting clutch projections and interposed between said die member and driving member, substantially 110 as described.

6. In a pipe-bending machine, the combination with a bending-die provided with a peripheral groove, of a pair of grooved rollers 115 adapted to cooperate therewith, one of said rollers being located at the bending-point and the other at a short distance in rear thereof, both of said rollers being mounted upon a common base, means for adjusting said base 120 bodily toward and from the bending-die, and means for adjusting said rollers toward and from the bending-die independently of each other, substantially as described.

HENRY F. CONDON.

Witnesses:

FREDERICK C. GOODWIN,
LOUIS T. MANN.