(No Model.) 3 Sheets—Sheet 1.

W. LEWIS.

BENDING ROLLS.

No. 500,286. Patented June 27, 1893.

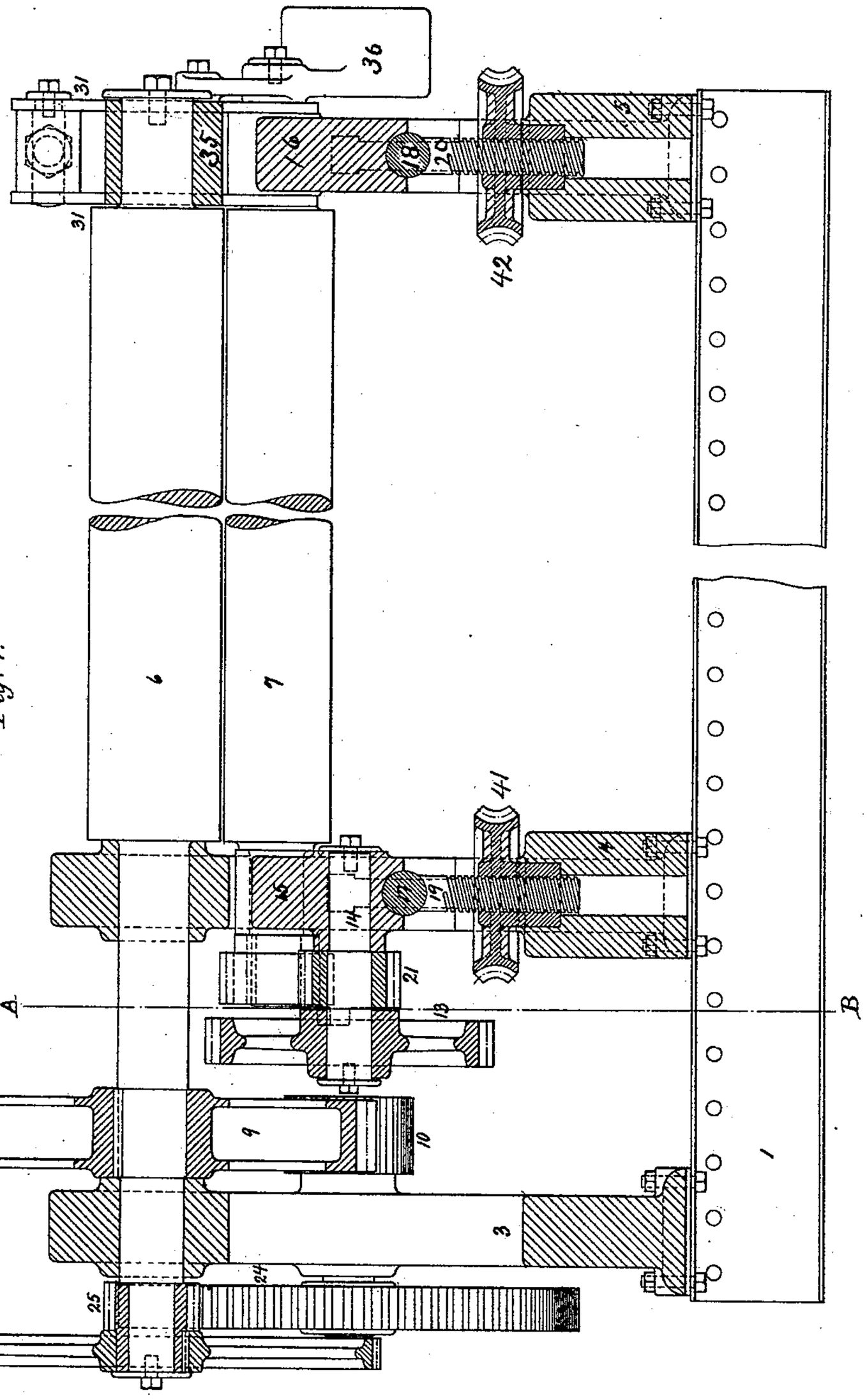

Fig. 1.

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(No Model.) 3 Sheets—Sheet 2.

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Fig. 3.

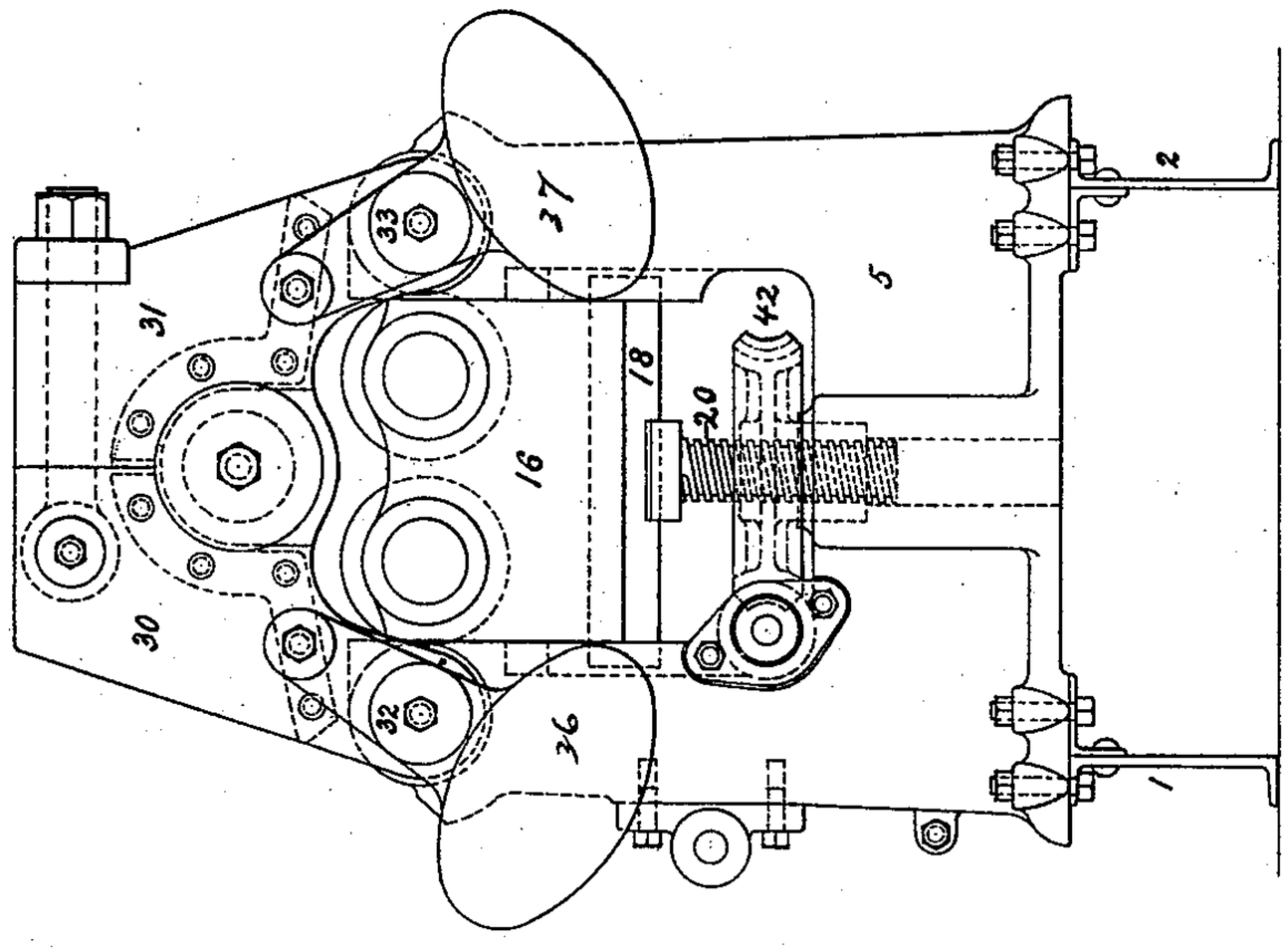
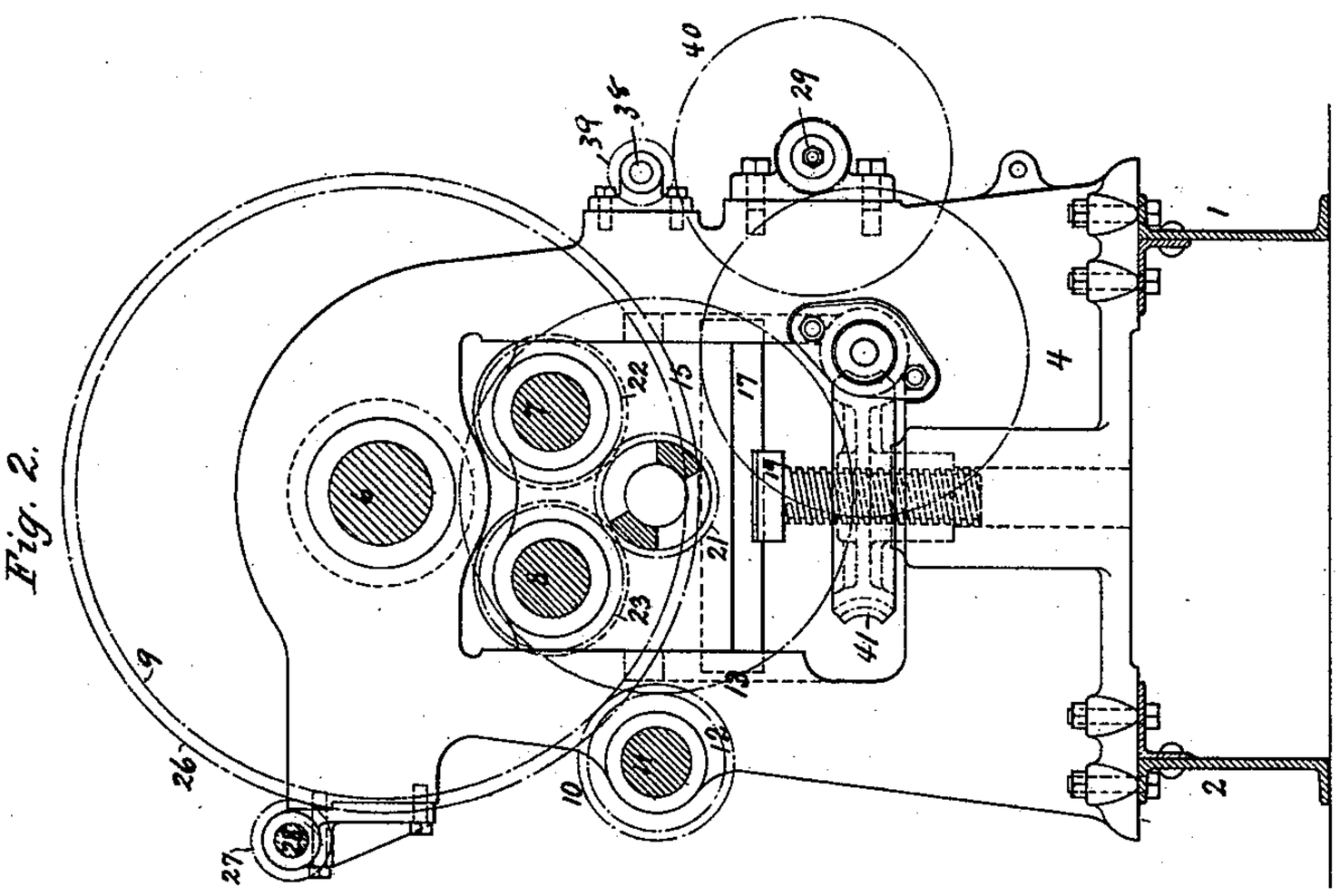


Fig. 2.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 4.

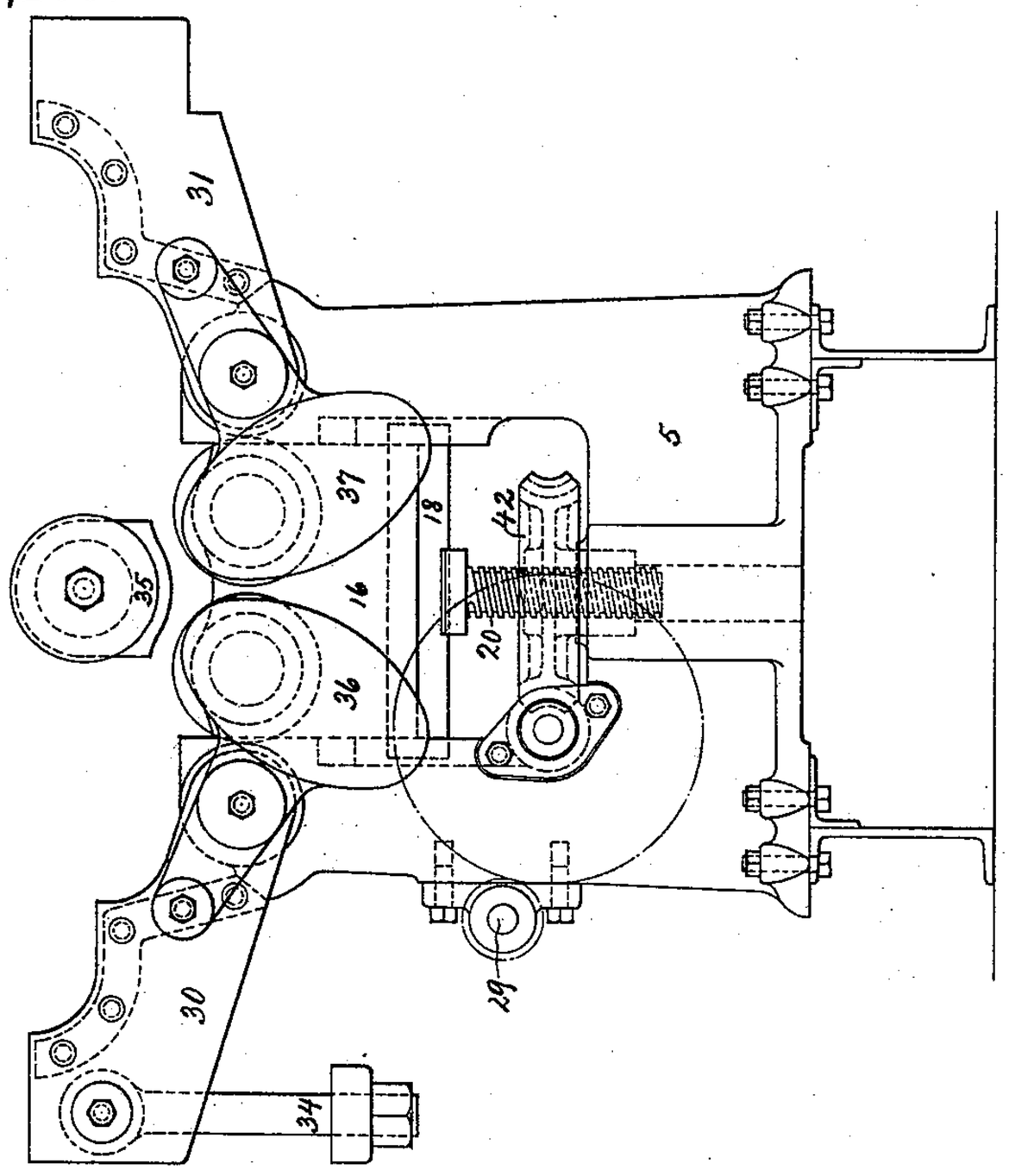


Fig. 5.

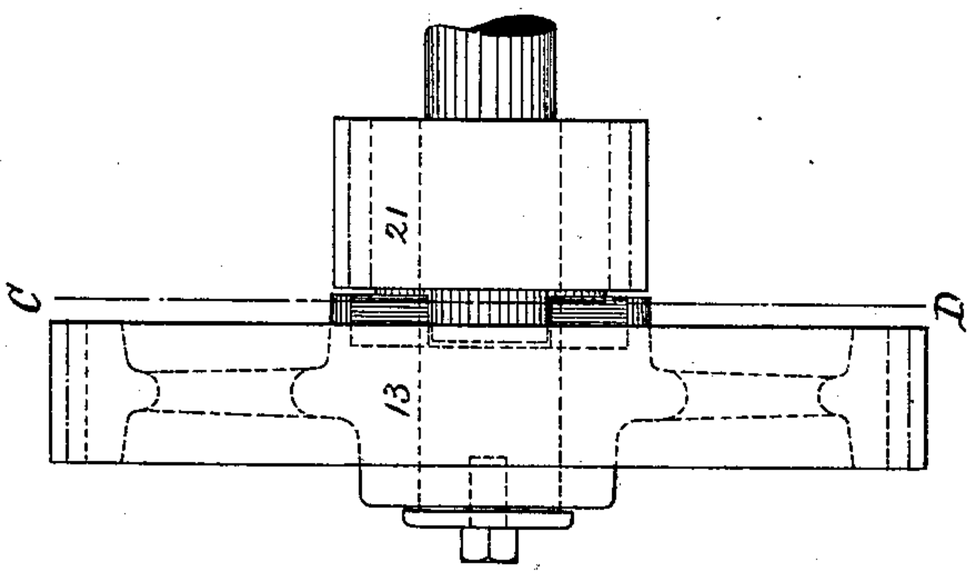
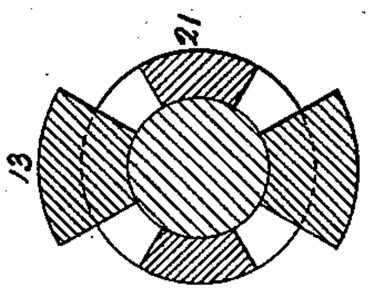


Fig. 6.



WITNESSES:

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UNITED STATES PATENT OFFICE.

WILFRED LEWIS, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE WILLIAM SELLERS & COMPANY, INCORPORATED, OF SAME PLACE.

BENDING-ROLL.

SPECIFICATION forming part of Letters Patent No. 500,286, dated June 27, 1893.

Application filed July 14, 1892. Serial No. 439,993. (No model.)

To all whom it may concern:

Be it known that I, WILFRED LEWIS, of the city and county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Bending-Rolls, of which improvements the following is a specification.

My invention relates to the machinery for driving, supporting and adjusting bending rolls, and more particularly to the method employed for driving the rolls on both sides of the plate so as to avoid as much as possible the action of calendering. Bending rolls differ in the number and arrangement of the rolls employed, some having three rolls, their axes either horizontal or vertical, and others having four rolls arranged with axes horizontal, but in any case, there is always one roll, toward or from which move the other rolls, which are herein designated as pinching or bending rolls. In four roll machines, the main roll acts against an opposing mate directly underneath, known as the pinching roll, between which and the main roll the plate is pinched and driven, while on either side, symmetrically arranged, are the bending rolls which are driven by the plate. By omitting one of the bending rolls in a four roll machine, a three roll machine is produced in which the pinching roll acts also as a bending roll, but the pressure of the main roll is divided unequally between them, and to distinguish between the bending rolls in this arrangement it will be understood that when they are not so located as to divide equally the pressure of the main roll against them, the term pinching roll still refers to the roll intended to carry the heavier load. In three-roll machines, however, the rolls are generally arranged in what is known as the pyramidal form, in which the pressure of the main roll is divided equally between the two bending rolls. When a pinching roll is used, it is the common practice to drive both rolls at alternate ends, but when thus driven, the gearing at one end becomes an obstruction to the removal of flues. In the pyramidal type of machine, the bending rolls are commonly carried in the roll housings and driven by gearing attached to the housings allowing the main roll to be held in adjustable bearings and to be driven by the plate. To permit the removal of flues, it is usual in these machines to drive both bending rolls at the same end, leaving the opposite end free and unobstructed by gearing, but, in doing this, the driving power of the machine is limited by the strength of the gearing attached to the bending rolls. When these rolls are close together, as is customary, the diameter of their driving gears is so restricted that the rolls must be driven by pinions, but little, if any larger than the rolls themselves, and as a result of this the process of plate bending becomes very slow and tedious. To avoid these difficulties and increase the driving power of the machine, attempts have been made to drive the main and pinching rolls or all three of the rolls at one end, but hitherto all attempts to drive the main roll in connection with another roll of a bending machine have been embarrassed by the difficulty of providing for a variable velocity ratio between the surfaces of rolls acting on opposite sides of the plate. It is evident that when a plate is bent to a full circle, the outside circumference is longer than the inside circumference by about six times the thickness of the plate, and that, to avoid calendering, the surface velocity of any roll on the outside of a plate must be proportionately greater than that of the main roll. When the plate is straight, however, no difference in velocity is required, and to avoid the action of calendering on plates of different curvatures and thicknesses, an equalizing gear has sometimes been introduced, but there are serious objections to such an expedient, and usually the bending rolls only are driven, or if the main and bending rolls are both driven, the rolls are forced to slip on the plate thus augmenting unnecessarily the work of driving. This may be said of all machines, but in four-roll machines, it is seldom necessary to make provision for the removal of flues, and, consequently it is possible to drive the main and pinching rolls by large gears at alternate ends, and these gears can always be made heavy and strong enough for the work required of them. It will be understood, therefore, that although it is important and desirable to avoid calendering as much as possible in all bending machines, it becomes a greater

necessity in three roll machines designed for the removal of flues where large gears at alternate ends of the rolls cannot be used. In the latter class of machines, as before mentioned, the rolls may be set horizontally or vertically, and this difference in position gives rise to different arrangements designed to facilitate the removal of flues from the rolls.

To avoid these defects and secure other advantages in the construction and operation of bending rolls, it is an object of my invention to provide ample driving strength for heavy work without introducing at the same time the evil effects of calendering.

It is a further object of my invention to bend straight or tapering and insure an even distribution of pressure on the journals of the bending rolls.

To these ends my invention consists in the introduction of a permanent toothed clutch with lost motion in the train of gearing which drives the pinching roll or bending rolls of a plate bending machine, while the main roll is driven positively from a common driving shaft.

It further consists, in a horizontal main roll, supported at one end in fixed housings, and rotated about its axis from the same end, while the other end is supported by a bearing divided vertically through its axis, each half swinging about a separate pin secured to a housing at that end.

It further consists in a pinching roll or bending rolls mounted in bearings carried on cross pins guided in the housings and supported by adjusting screws.

Figure 1 is a sectional side elevation of a horizontal three roll machine showing the driving machinery adjusting screws and tumbler bearing. Fig. 2, is a sectional end elevation on the line A B, Fig. 1. Fig. 3, is an end elevation showing the tumbler bearing closed. Fig. 4, is an end elevation showing the tumbler bearing open. Fig. 5, is an enlarged view of the lost motion clutch in the train of gearing to drive the side rolls. Fig. 6, is a section of the lost motion clutch on the line C D, Fig. 5.

1 and 2 are floor beams to which the housings are attached.

3, is an end housing which serves to carry the driving machinery and the projecting end of the main roll.

4, is the middle housing adjacent to the opposite end to which the tumbler bearing for the main roll is attached.

5, is a housing at the opposite end to which the tumbler bearing for the main roll is attached.

6, is the main roll supported at one end in the housings 3 and 4.

7 and 8, are the bending rolls supported at each end by the bearing blocks 15 and 16 resting on and guided by the pins 17 and 18 under which the adjusting screws 19 and 20 are fixed. The main roll 6 carries the large spur gear 9 which is driven by the pinion 10 on the driving shaft 11, and this driving shaft carries also the pinion 12 which engages with the clutch wheel 13 on the stud 14 in the bearing block 15. The clutch wheel 13 engages with the clutch pinion 21 on the same stud by teeth having lost motion between them and this pinion drives the wheels 22 and 23 on the bending rolls 7 and 8. From this arrangement, it will be seen that the rolls 6, 7 and 8 are all driven from a common driving shaft 11. This shaft is represented as driven through the wheel 24, pinion 25, wheel 26, and pinion 27, by the pulley shaft 28 on which reversing pulleys are supposed to be mounted. But, it may be driven by reversing engines when preferred, the particular method of driving it being immaterial to my present invention, which has especial reference to the method by which the rolls 6, 7 and 8 are driven from a common driving shaft. When the rolls are running idle, the gearing is such as to give them the same peripheral speed, and, in entering a plate the friction of all the rolls is effective, but when the plate becomes bent, and a difference in peripheral speed is required, the bending rolls may be driven by the plate instead of by the gearing which caused the plate to enter. This is possible by reason of the lost motion provided between the clutch pinion 21 and its driving wheel 13, so that the bending rolls can run ahead until the lost motion is taken up, or until the machine is reversed. The amount of lost motion required depends upon the thickness of plate for which the rolls are intended and can, therefore, be definitely determined so that in no case will there be any danger of calendering while the main roll is able to do the whole work of driving. When the friction of the main roll against the plate is insufficient to carry it through, the roll will slip on the plate, and allow the bending rolls to give the necessary assistance, but the heaviest work of driving must be done by the main roll to which abundant power can be transmitted through the large spur gear 9. The gearing which drives the bending rolls is thus relieved of heavy duty, and, ordinarily, the calendering action on a plate is between the clutch wheels 13 and 21.

The bending rolls 7 and 8 are adjusted by the worm wheels 41 and 42 which are arranged to be operated independently or together so that these rolls may be tilted if desired. With this object in view the bearing blocks 15 and 16 are supported on the pins 17 and 18 which are guided in the housings 4 and 5 and permit the bearings to adjust themselves to the inclination of the rolls. The adjustment of these rolls is effected by power from a countershaft with straight and crossed belts to pulleys on the machine or by independent engine or friction clutches as preferred.

In Fig. 2 a pulley shaft 38 is indicated as driving by the pinion 39 and wheel 40 the shaft 29 which in turn drives the worm wheels 41 and 42 by gearing at each end, to which

the shaft 29 may be coupled or uncoupled. By this means the bending rolls may be adjusted at either end independently or at both ends together. The tumbler-bearing by means of which the main roll may be connected to or disconnected from the end housing, consists of the plates 30—30 and 31—31 united in pairs and pivoted to the housing 5 by the pins 32 and 33. When the bearing is closed as shown in Fig. 3, the two sides of the bearing are coupled by the bolt 34 inclosing the bushing 35 on the end of the main roll.

36 and 37 are counterweights designed to balance the tumbler bearing in any position and render its movement light and easy.

When the bearing is open, as shown in Fig. 4, the sheet which has been rolled to a full circle may be removed by sliding it along the bending rolls. This can be done more easily than is possible by the old method of tilting the main roll and pulling the sheet off obliquely or by dividing the bearing and sliding each half laterally, which requires more power and more movement, to give the same clearance that is obtained, by swinging each half about a separate pin. There is also an advantage in the construction of this bearing over the extension of the main roll beyond the lower bearings to receive a strap pivoted to a projection at the end of the housing. Such a construction tends to distort the housing, while in the present design it will be seen that the bearings are all in the plane of the housing and that the stresses are therefore transmitted directly and to the best advantage.

It will be understood from the above description that the lost motion clutch in the driving train can be equally well applied to the pinching roll in a four-roll machine or to the bending rolls in a vertical machine and it is therefore unnecessary to illustrate its application more particularly than is shown by the accompanying drawings.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In a plate bending machine, the main roll and an opposing roll or rolls, with a train of gearing which connects one with the other, in combination with a lost motion toothed clutch in this train, substantially as and for the purpose set forth.

2. In a plate bending machine, a vertically moving roll bearing block controlled transversely to the rolls, by the roll housing, in combination with a pin, each end of which is embraced and guided by the roll housing, and about which the bearing block can oscillate, while it is supported and guided in its vertical movement by the pin.

WILFRED LEWIS.

Witnesses:
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JOHN L. PHILLIPS.