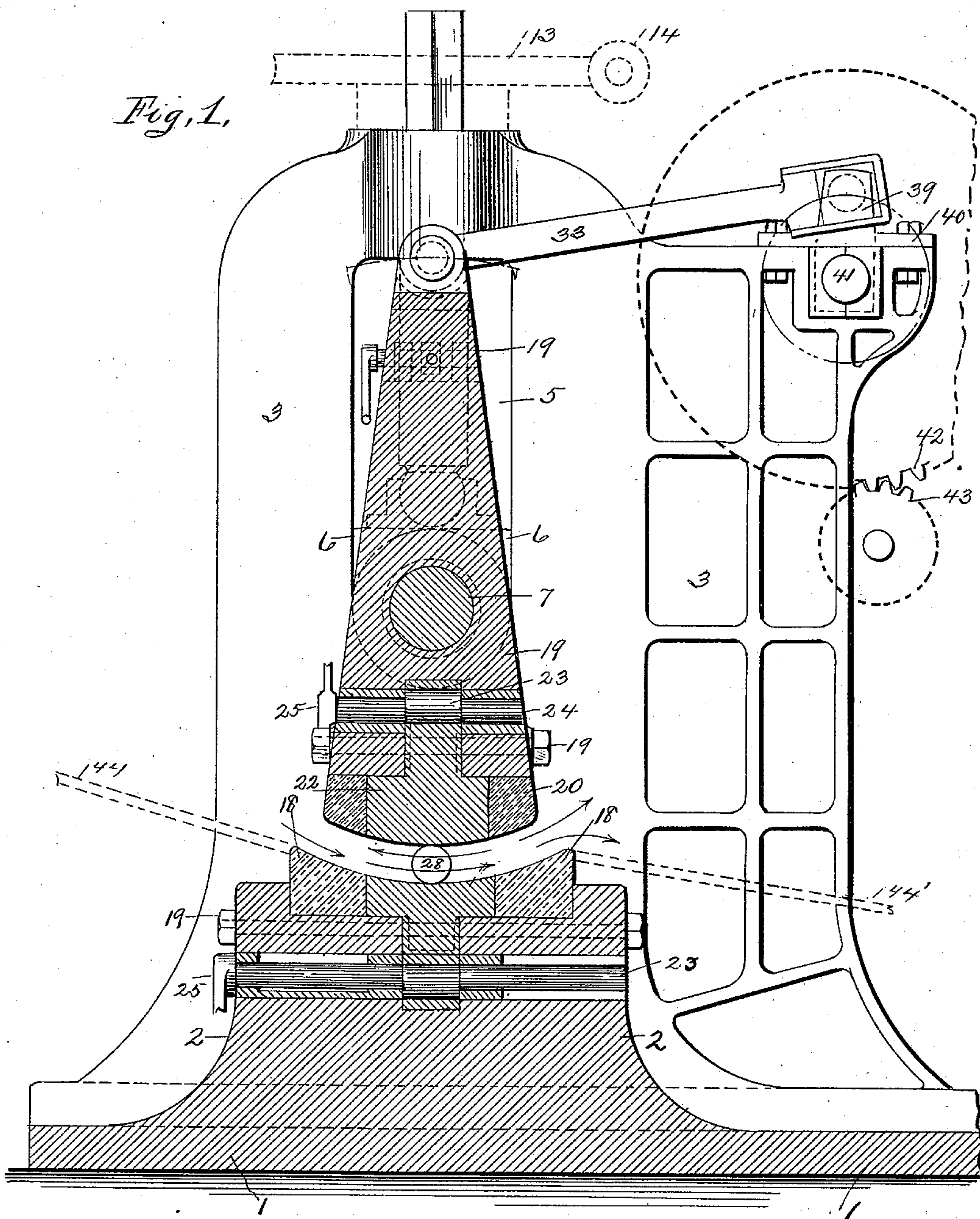


(No Model.)

5 Sheets—Sheet 1.

T. HIGGINS.
APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.
No. 572,204. Patented Dec. 1, 1896.



Witnesses:

Richard D. Barnard
Edward Kaylor

Inventor

Thomas Higgins.
by his attorney
W. E. Harrison.

(No Model.)

5 Sheets—Sheet 2.

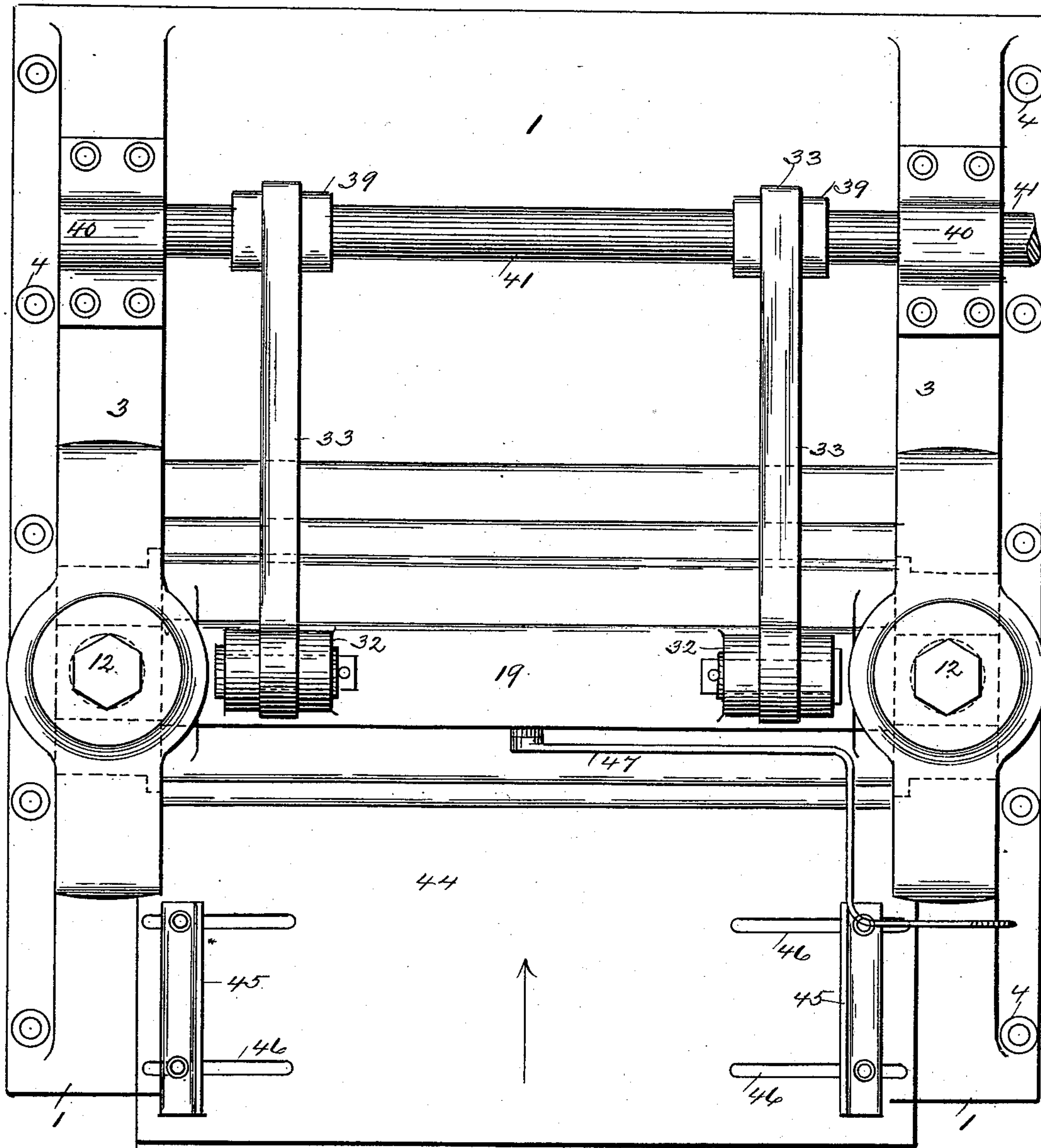
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APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.

No. 572,204.

Patented Dec. 1, 1896.

Fig. 2.



Witnesses:
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(No Model.)

5 Sheets—Sheet 3.

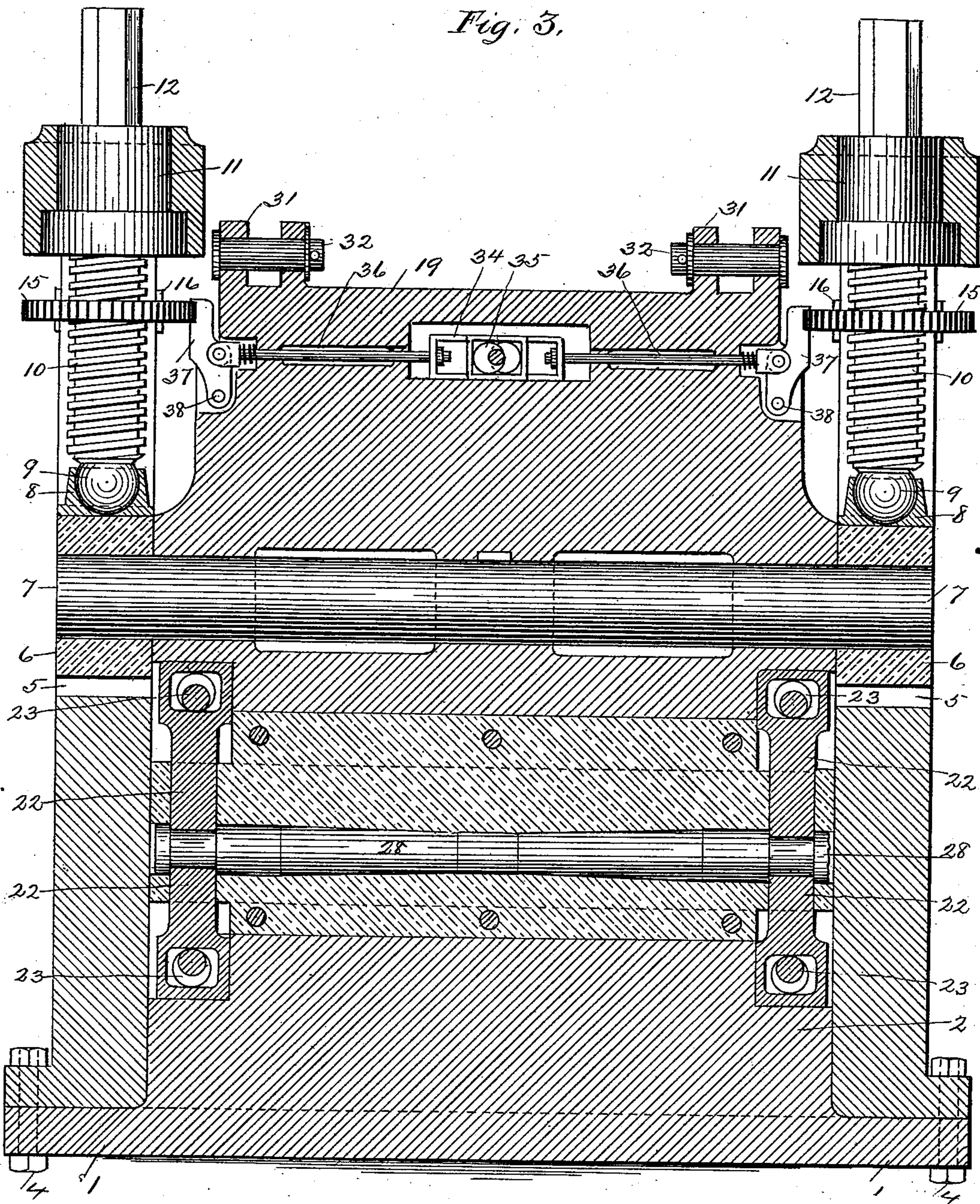
T. HIGGINS.

APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.

No. 572,204.

Patented Dec. 1, 1896.

Fig. 3.



Witnesses:
Richard D. Harrison.
Edward Kaylor

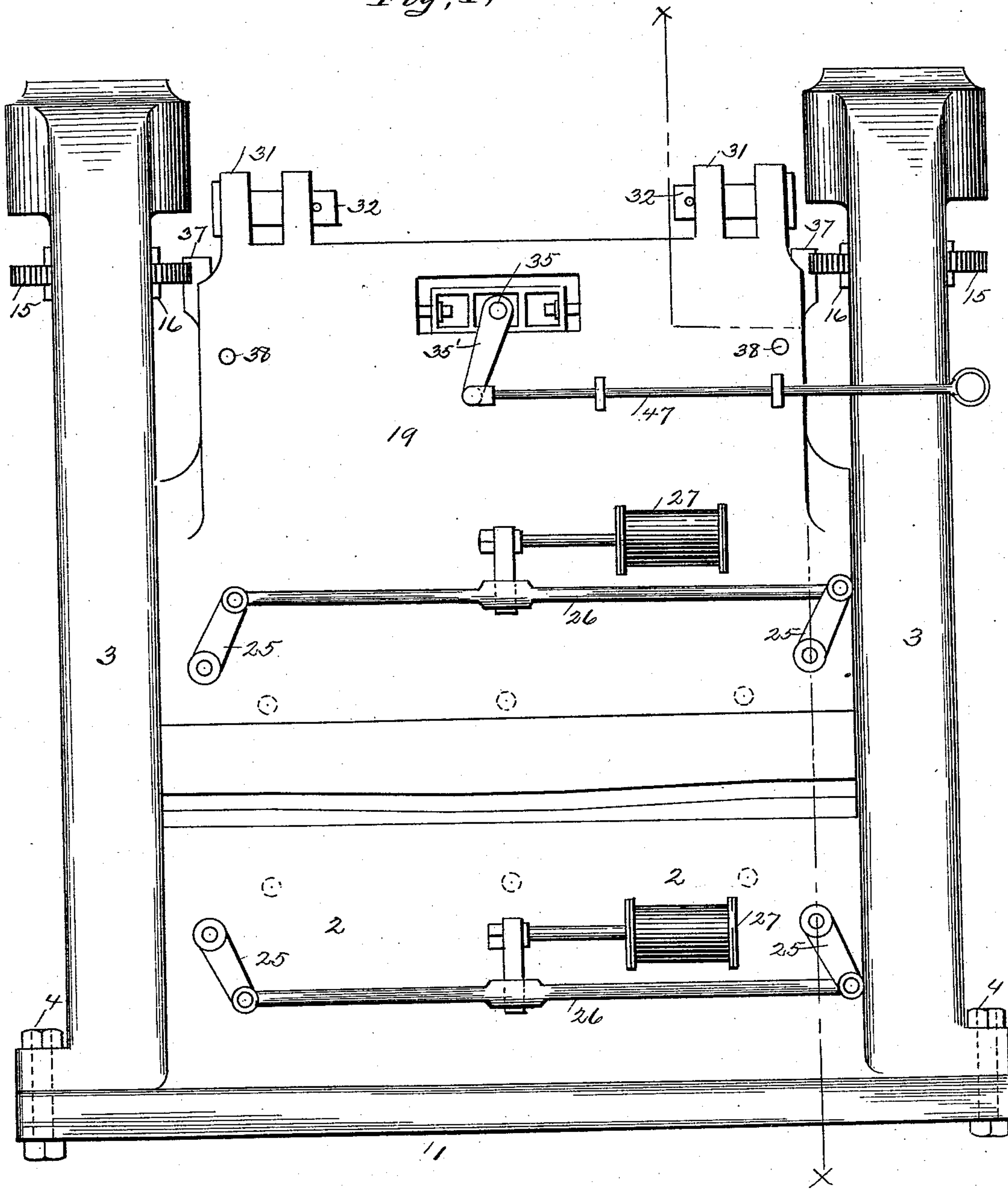
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(No Model.)

5 Sheets—Sheet 4.

T. HIGGINS.
APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.
No. 572,204. Patented Dec. 1, 1896.

Fig. 4.



Witnesses:
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(No Model.)

5 Sheets—Sheet 5.

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APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.

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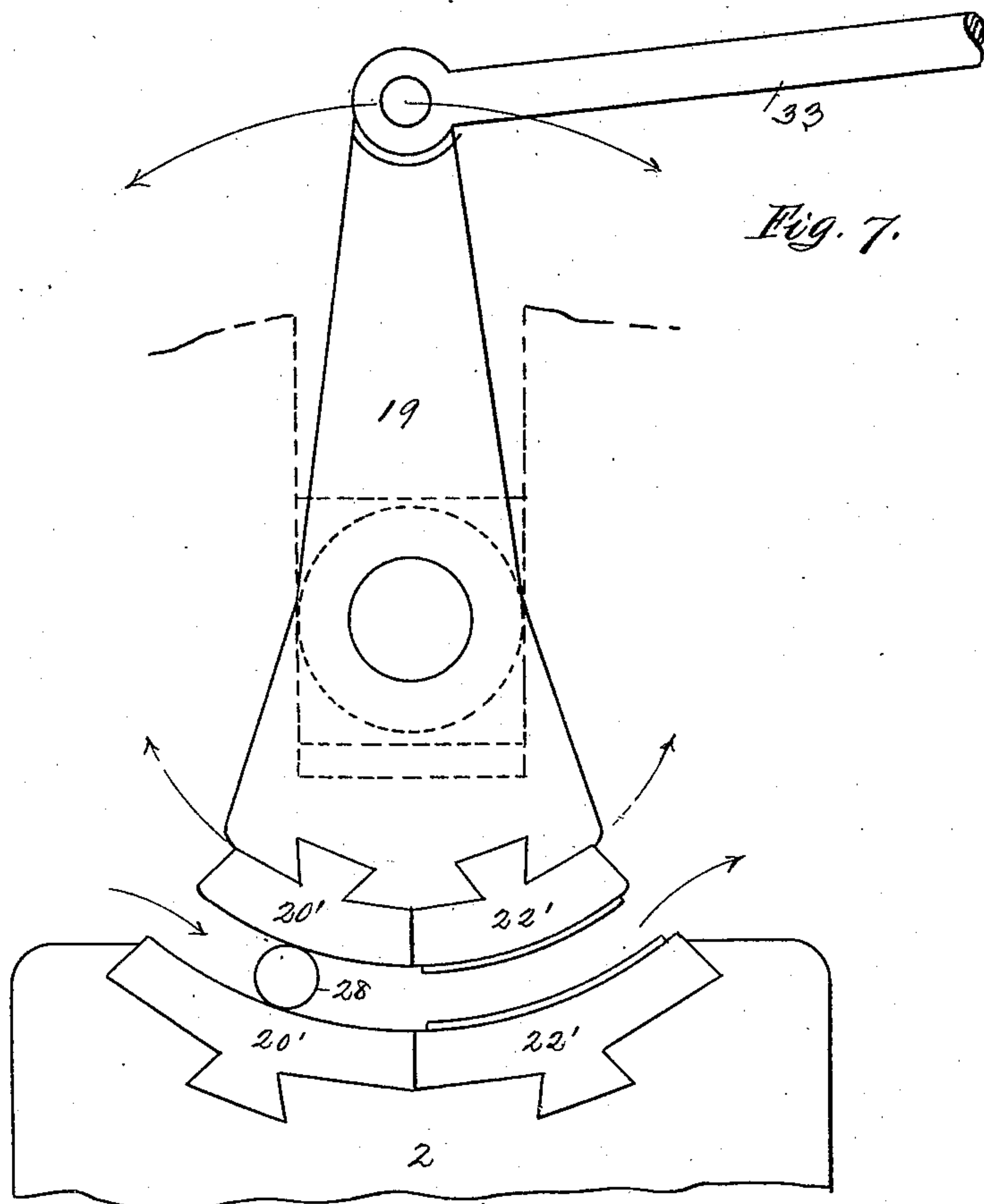


Fig. 5,



Fig. 6,

Witnesses:
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Edward. Kaylor.

Inventor:
Thomas Higgins
by his Attorney.
M. E. Harrison

UNITED STATES PATENT OFFICE.

THOMAS HIGGINS, OF PITTSBURG, PENNSYLVANIA, ASSIGNOR OF ONE-FOURTH TO FREDERICK NORRIS, OF SAME PLACE.

APPARATUS FOR MANUFACTURING AXLES, &c., FROM IRON OR STEEL.

SPECIFICATION forming part of Letters Patent No. 572,204, dated December 1, 1896.

Application filed August 20, 1896. Serial No. 603,337. (No model.)

To all whom it may concern:

Be it known that I, THOMAS HIGGINS, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Manufacturing Axles, &c., from Iron or Steel; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the figures of reference marked thereon, which form a part of this specification.

My invention relates to an improved apparatus for manufacturing car-axles and other analogous articles from iron, steel, or other metals; and it consists in placing a heated blank or bar in an oscillating device operating in conjunction with a stationary die in a manner that the blank will be rolled back and forward until formed into the desired shape, together with the certain details of construction and combination of parts, as will be fully described hereinafter.

In the manufacture of car-axles in accordance with the most improved method it has been the practice to take a square or round billet of iron or steel of a certain length and by repeated hammering draw and shape the axle at one end, then heating the opposite half, and forge that portion in a like manner. This reheating or forging the axle necessitates annealing the same when finished in order that the entire axle may be of the same temper. It has also been attempted to roll axles and other shapes in cylindrical section by means of various apparatus constructed and designed for that purpose, but all such attempts have been unsuccessful. Therefore it is my purpose to discard all such methods as have been heretofore tried or used, and form or shape the article by rolling the heated blank between a stationary die in connection with another having an oscillating movement together with a limited vertical movement to place a pressure upon the blank, and also to use inserted vertically-moving shaping-dies to form the journals or grooves of the axle,

together with suitable means for operating the said journal-formers.

In the accompanying drawings, Figure 1 is a side central sectional elevation of my improved apparatus for forming axles, &c., which is constructed and arranged in accordance with my invention, said section taken on the line X X of Fig. 4. Fig. 2 is a plan view of the same. Fig. 3 is a front sectional elevation of the machine, said section taken at or about the center of the apparatus. Fig. 4 is a front elevation having the receiving-table removed therefrom. Fig. 5 is a side elevation of the blank or billet of iron or steel cut to the proper length. Fig. 6 is a side elevation of the finished product of the machine. Fig. 7 is a modified form of my invention.

To put my invention into practice and thereby construct an apparatus capable of rolling or manufacturing car-axles, I provide a bed-plate 1 of a suitable size and form of construction, and having formed integral therewith an anvil-block or die-holder 2, in which the lower or stationary die is placed. Erected at either side of this anvil-block 2 and held in position by strong bolts 4 are a pair of housings 3, each of which consists of a casting of peculiar form and provided with openings 5 for the reception of sliding heads 6 used for supporting an oscillating die-holder 19, which will be described hereinafter. Arranged in each of these openings 5 of the housing 3 is a journal-bearing 6, capable of a limited vertical movement by means of stout screws 10, extending upward through threaded boxes 11, arranged at the top of the housing, and the said screws 10 loosely connected to the said journal-bearings by means of ball-and-socket joints 8 9, in a manner that the said screws may be freely revolved to elevate or lower the journal 7. This journal consists of a strong bar extending from one housing to the other and is rigidly attached to the oscillating die-holder 19. This oscillating die-holder 19 is triangular-shaped in cross-section and occupies in width the entire space between the housings 3 above the anvil-block 2, and is provided at the base with a recess by means of which a convex die 20 is attached by transverse bolts 19. This convex die 20 is

of a form or contour corresponding to the exact outlines of the axles or shape it is desired to produce. The anvil-block 2 is fitted in a like manner with a die 18, somewhat larger, but having a concave shape or form in cross-section, as will be seen by reference to Figs. 1 and 3 of the drawings. Each of these last-described dies is formed with two vertical openings located near the outer edges, and in which are arranged devices 22 for forming the journal of the axle. Each pair or set of these journal-formers 22 consists of a piece of metal arranged one above the other, and each being provided with a link or opening, in which an eccentric 23 is made to operate for the purpose of moving the formers toward or away from each other. This movement of the journal-formers 22 is accomplished by means of hydraulic cylinders 27, coupled or attached by rods 26 to cranks 25, rigidly secured to the eccentric-shafts 23.

In order that the oscillating die-holder 19 may be given an automatic feed downward, small ratchet-wheels 15 are connected to the screws 10 by means of a spline, and said ratchet-wheels prevented from any vertical movement by means of side clips 16, secured to the housings. Arranged at each side of the oscillating die-holder 19 are spring ratchet-pawls 37, pivoted in recesses and adapted to engage with the ratchet-wheel at each movement of the oscillating die-holder, thereby feeding the screws 10 downward.

To get a quick return of the oscillating die-holder 19 for the purpose of removing the finished axle or replacing another blank, the pawls 37 are connected to double eccentric 34 35 by means of rods 36 and the said eccentric attached to a crank 35' and hand-lever 47. By moving this hand-lever 47 the pawls 37 may be disengaged from the ratchet-wheel 15 and the worm 14 and wheel 13 operated to give a quick rotary movement to the screws 10, (see Fig. 1,) which, being attached to the journal-bearing carrying the oscillating die-holder, will elevate the same. To give the oscillating die-holder the proper movement, a crank-shaft 41 is mounted in bearings 40, said shaft being provided with double cranks 39 and connected by pitmen 33 to pins 32, suitably mounted in lugs 31, formed integral with the top of the oscillating die-holder 19. This crank-shaft 41 is given a rotary motion by means of a spur-wheel 42, attached thereto, and a meshing pinion 43, rotated by suitable power connected thereto. Arranged at the front of the apparatus is a table 44, (see Figs. 1 and 2,) having adjustable guide-pieces 45, which may be moved toward or away from each other by bolts operating in slots 46. This is for the purpose of receiving the blank and properly entering the same between the dies.

In operation the crank-shaft 41 is given a rotary motion, which will transmit the power to the oscillating die-holder 19, giving the same a rocking and oscillating movement, and, as the pawls 37 are engaged with the ratchet-

wheels 16 at every forward movement, the same is gradually and slowly moved downward. The blank, such as shown at Fig. 5 on the drawings, first being heated in any ordinary or usual manner, is now entered between the dies 18 and 20, which will cause the blank to rotate on its axis, and as pressure is applied the same will be gradually reduced in diameter and to the desired shape and size. When the grooves or journals are to be formed, the hydraulic cylinders 27 are put in operation, which will act upon the eccentric 23 through the medium of the connecting-rods 26 and cranks 25 and gradually force the journal-formers 22 to the proper depth into the piece operated upon.

The pawls 37 are now thrown out of gear with the ratchet-wheels 15 by means of the double eccentric 34 35 and the worm and wheel rapidly rotated and the oscillating die-holder 19 rapidly elevated to remove the finished piece from between the dies. Another blank is now entered and the same operation repeated.

The oscillating die-holder 19 may be lowered rapidly until in contact with the blank between the dies until such time as the upper die is in close contact with the piece. Then the power is shut off from the worm and the pawls reengaged with the ratchet-wheels, thereby facilitating the operation of the machine.

It is obvious that the particular mechanism shown to obtain the oscillating movement of the rocking die-holder 19 may be varied and any well-known or special device used, such as a cam, eccentric, shaft, or with direct connection with steam or hydraulic cylinder, and the same would be true with respect to the means shown for operating the journal-formers, which may be operated by screws, wedges, or other mechanism. Therefore I do not wish to confine myself to the particular details shown and described.

The concave and convex dies may be used in a modified form, such as shown at Fig. 7 on the drawings. The dies 20' are for finishing the body of the blank, while the dies 22' are for forming the journals.

In operation of this modified form it is necessary to drop the blank into the center of the dies 20', when the oscillating die-holder 19 would descend. The oscillating motion and feed would rotate the blank in the same manner as before described and reduce it to the proper size. The die and holder 19 would then be raised sufficient to permit the partly-finished piece to drop into the center of the second die 22', which is provided with raised or elevated portions necessary to form the journal-grooves. The oscillating die-holder 19 would now descend and form the grooves by the oscillating movement.

The advantage of using this last-described modification would be that the journal or groove dies can be made the same length or slightly longer than journal. Therefore they

could be adjusted to place the journal in any part of the axle, or, in other words, one set of dies would suit all lengths of axles of the same shape.

5 It is obvious that the concave die may be attached to the oscillating holder and the convex die to the anvil-block without departing from the spirit of my invention, and it is also obvious that the two sets of journal-
10 formers may be used in connection with reciprocating dies. Therefore I claim the latter broadly.

Having thus described my invention, I claim—

15 1. An apparatus for the purpose of shaping or forming car-axles and other cylindrical-shaped bodies of metal, consisting of a stationary concave die, a convex die operating in conjunction therewith, a means for giving
20 said convex die an oscillating movement, and a means for automatically feeding the same downward to place the pressure upon the blank between the dies, as described.

2. An apparatus for shaping or forming
25 axles and other like forms from bars of metal, consisting of a stationary concave die, a convex die operating in conjunction therewith, a means for giving said convex die a rocking or oscillating movement, a device for auto-
30 matically lowering the said convex die, a rocking die-holder carrying said convex die and a means for rapidly elevating and lowering the convex die for the purpose of removing the finished article and replacing the
35 blank between the dies.

3. In combination with a stationary die, and a rocking or oscillating die-holder and means for rocking and oscillating the same, the ratchet-wheels and pawls for giving the
40 said die-holder a limited vertical movement, as described.

4. In combination with an apparatus for the purpose set forth the journal-formers arranged in pairs, each pair consisting of a
45 concave and convex surface arranged the one opposite to the other, a means for moving each set toward and away from each other, and a means for giving the convex formers a rocking or oscillating movement as and for
50 the purpose described.

5. In combination with an apparatus for forming the body of an axle as described, the concave and convex journal or groove formers, arranged in pairs, and means for moving the concave and convex surface of each pair
55 toward or away from each other, as described.

6. In combination with an apparatus for the purpose set forth, a concave die and an oscillating convex die, each die having raised or elevated portions for forming journals or
60 grooves, said elevated portions being adjustable in the direction of the length of the said dies, whereby journals or grooves may be formed in any part of the blank, as described.

7. A means for rolling axles and other like
65 shapes from bars of metal consisting of a stationary concave die an oscillating rocker-arm provided with a convex die at the base, the axis of which is parallel to that of the stationary die, a means for automatically feed-
70 ing the convex die downward, a means for rapidly lowering or raising the same die, the journal-formers arranged in each of the said dies, and means for operating the same toward
75 or away from each other, all arranged and combined for service substantially as set forth.

8. In combination with a stationary concave die, and an oscillating or rocking die-holder for the purpose described, the ratchet-wheels and their engaging pawls, a double
80 eccentric movement connected to the said pawls, whereby the same may be disengaged, and a means substantially as shown for rapidly rotating the screws connected to the said ratchet-wheels, as and for the purpose de-
85 scribed.

9. In combination with an apparatus for forming the body of an axle, as set forth, the adjustable formers arranged in pairs operated toward or away from each other by means
90 of eccentrics, for the purpose of forming journals or grooves in blanks revolving upon their axis between dies or formers, substantially as set forth.

In testimony whereof I affix my signature 95 in presence of two witnesses.

THOMAS HIGGINS.

Witnesses:

GEO. W. LOWEN,
E. R. EDMUNDSON.