No. 709,081. Patented Sept. 16, 1902.

W. A. DUNN.

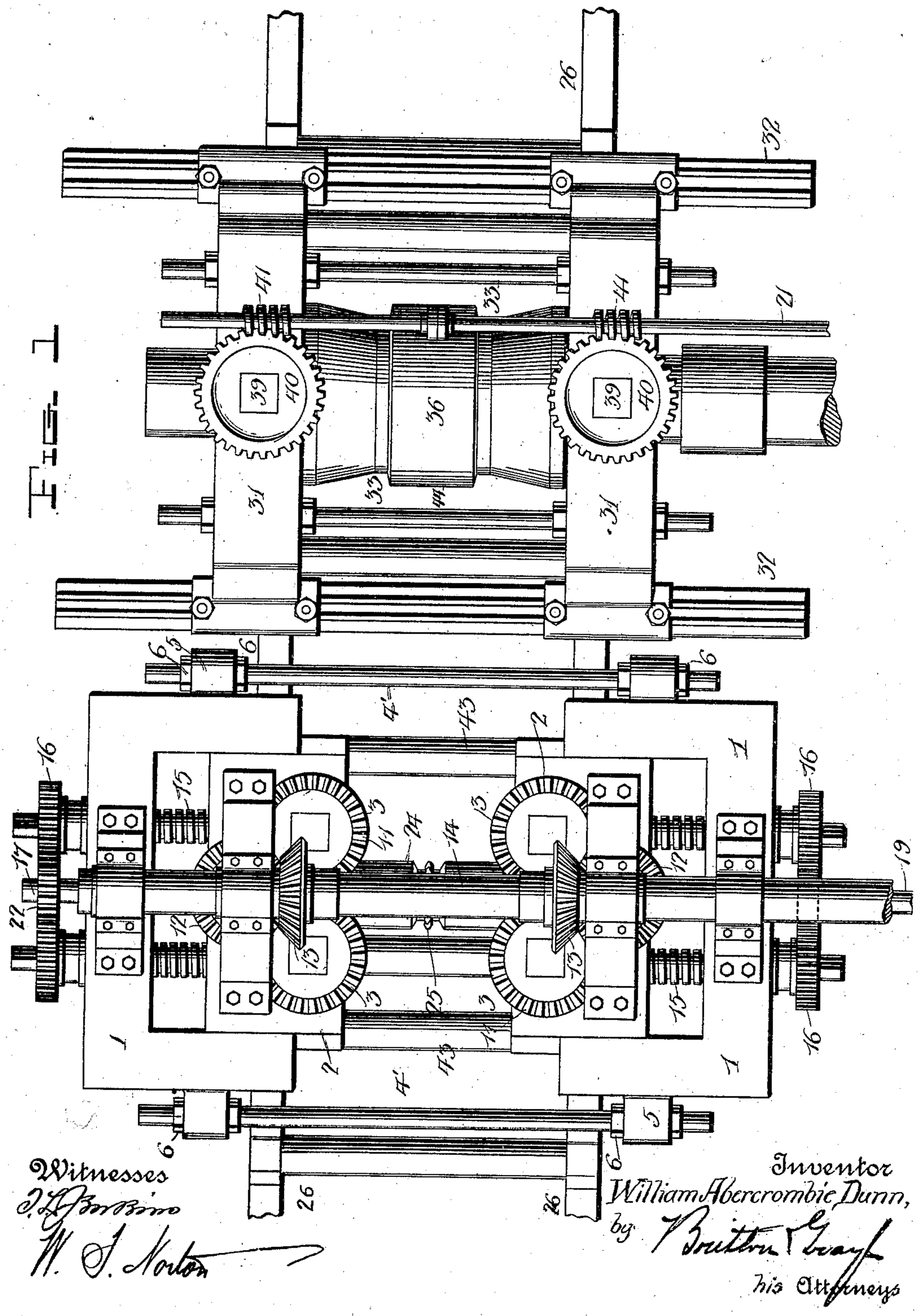
MACHINE FOR SHAPING METAL I-BEAMS, CHANNEL BEAMS, &c.

(Application filed Jan. 3, 1902.)

(No Model.)

6 Sheets—Sheet 1.

FIG. 1



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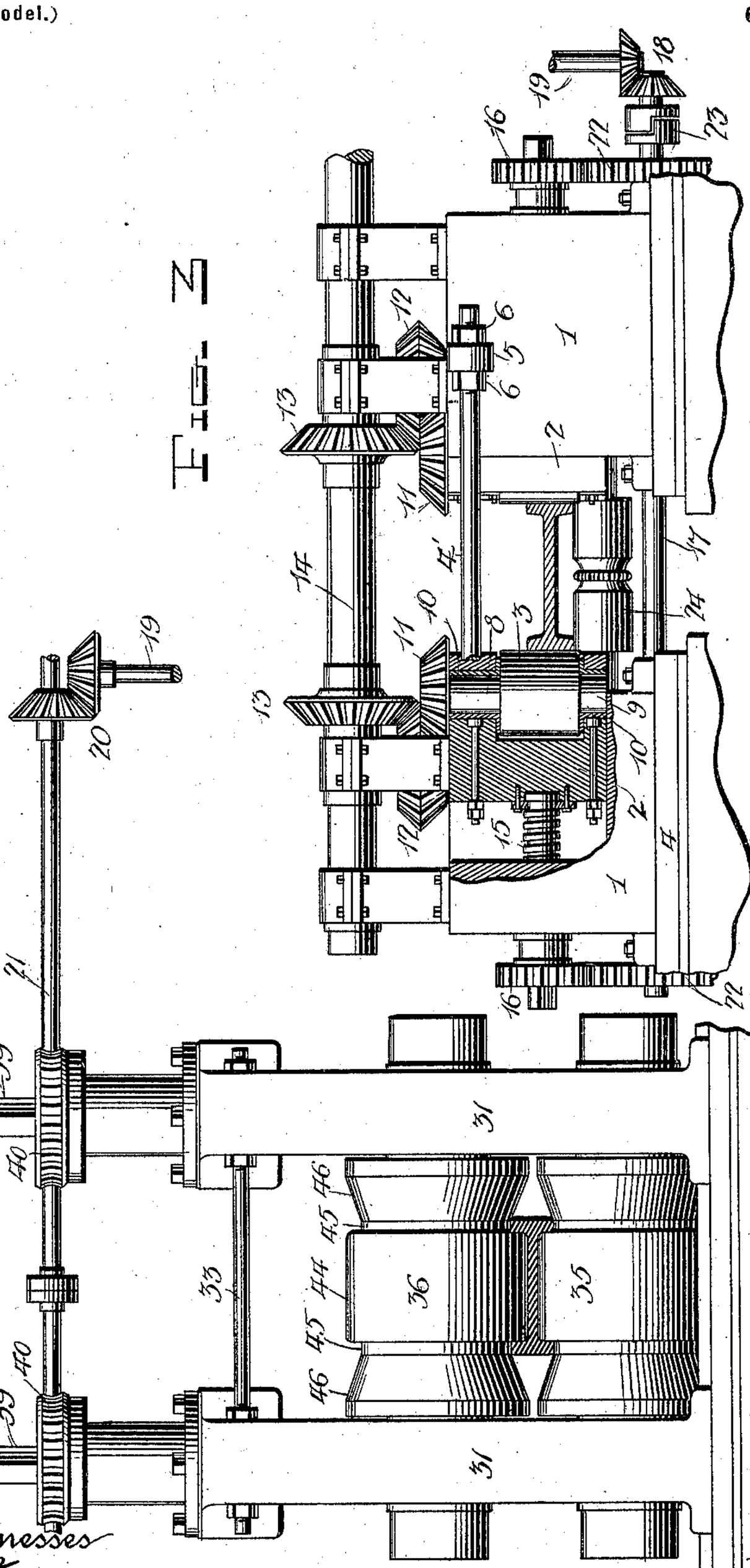
(No Model.) 6 Sheets—Sheet 2.

FIG. 2



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(No Model.) 6 Sheets—Sheet 3.

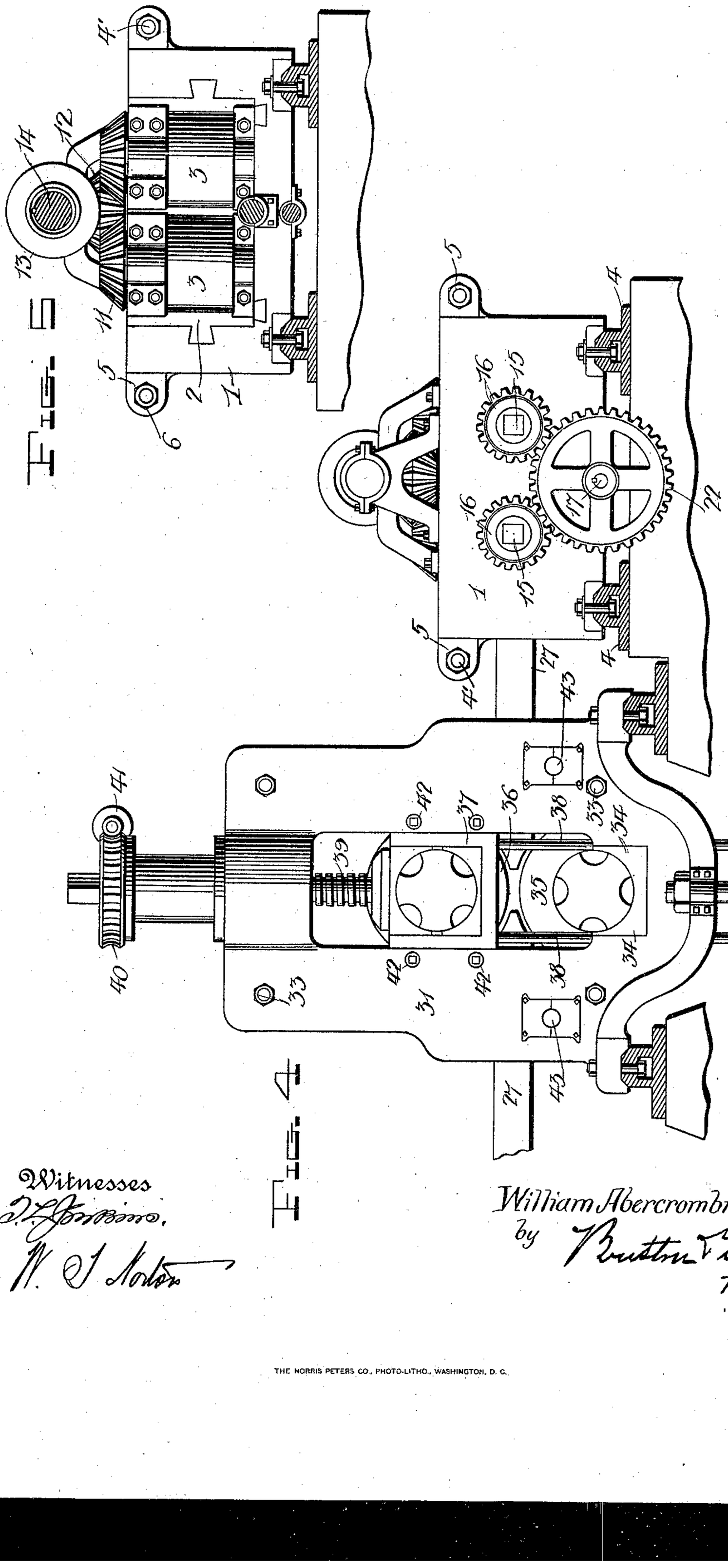

FIG. 4.

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(No Model.) 6 Sheets—Sheet 4.

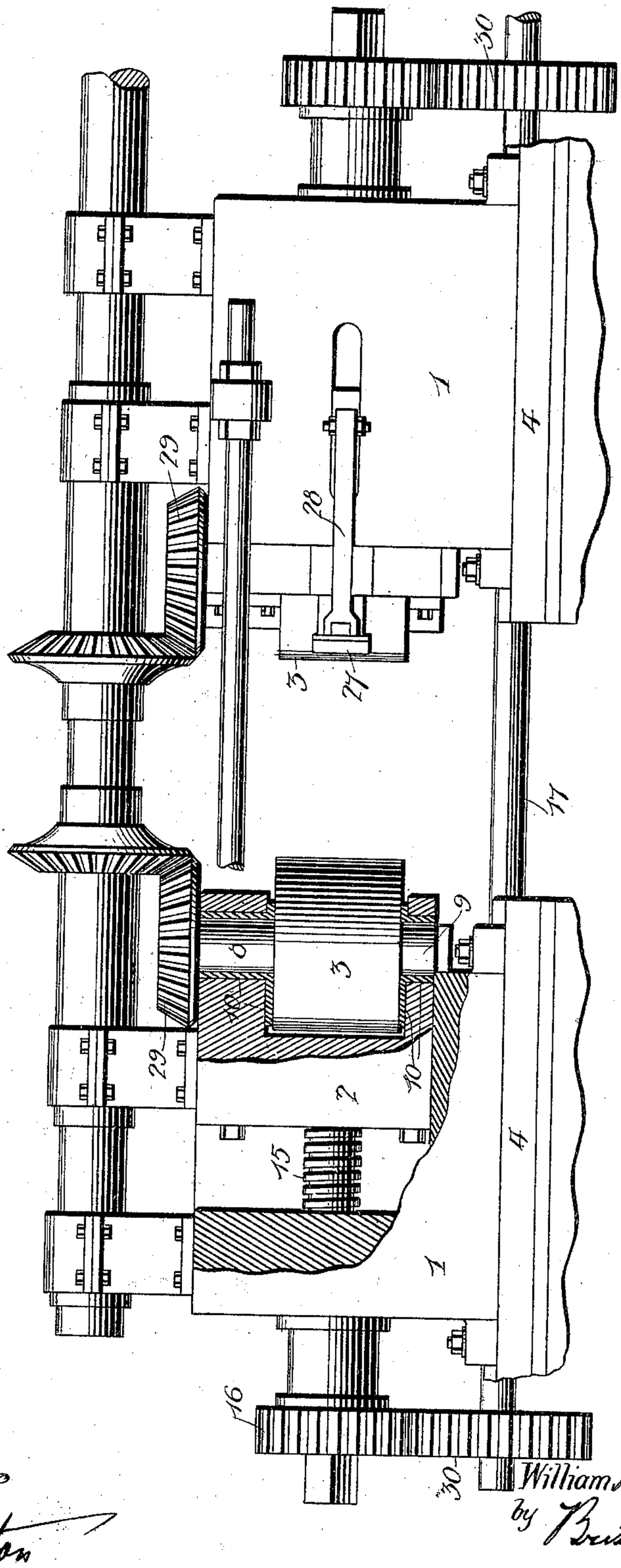

FIG. 5

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MACHINE FOR SHAPING METAL I-BEAMS, CHANNEL BEAMS, &c.

(Application filed Jan. 3, 1902.)

(No Model.) 6 Sheets—Sheet 5.

FIG. 8

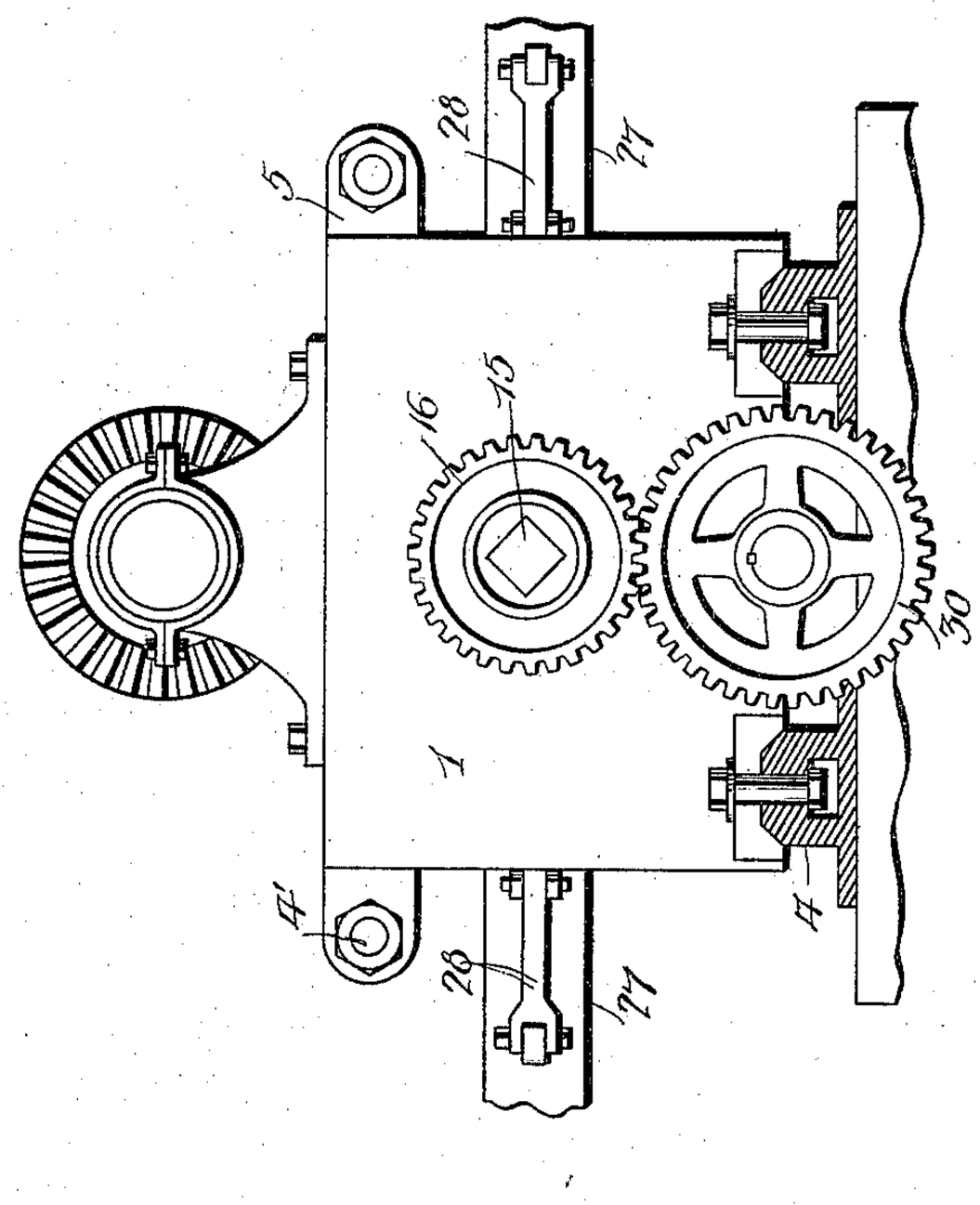
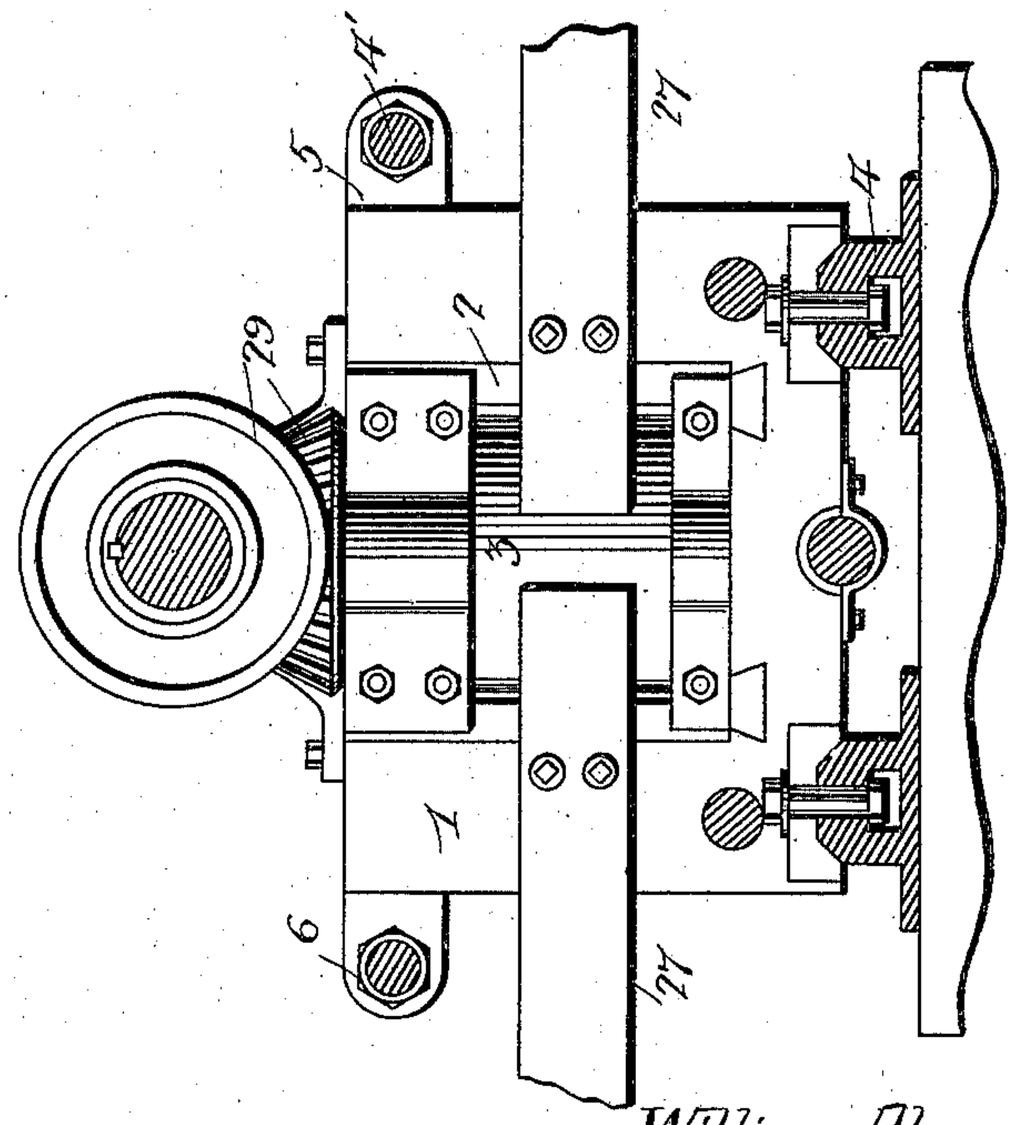


FIG. 7



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(Application filed Jan. 3, 1902.)

(No Model.) 6 Sheets—Sheet 6.

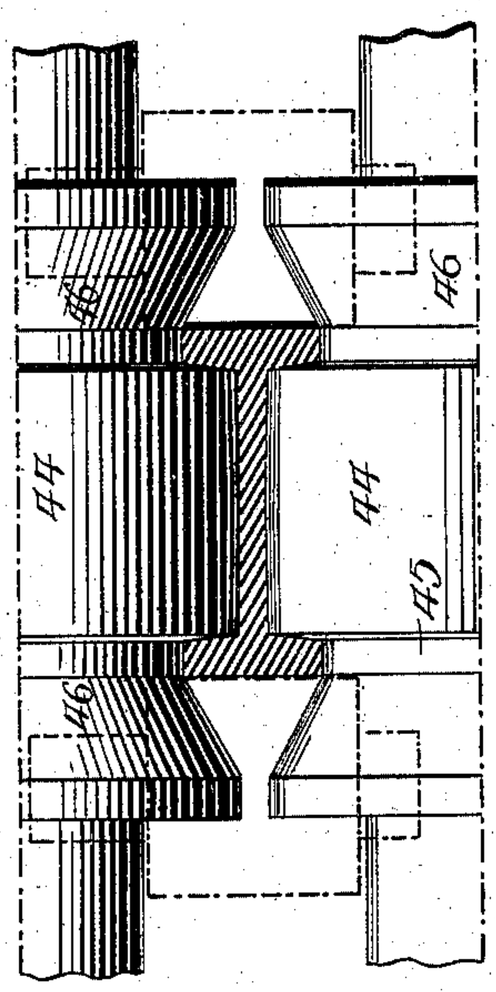

FIG. 11.

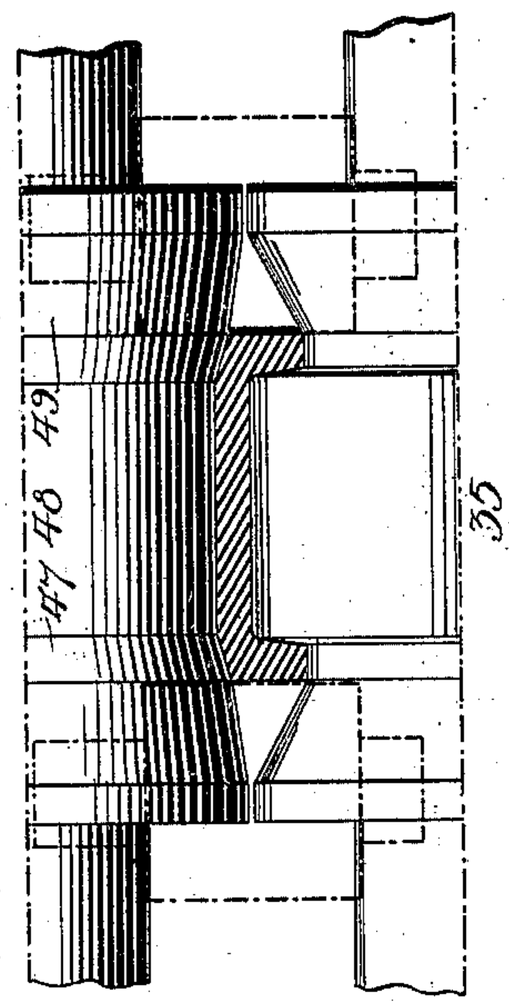

FIG. 12.

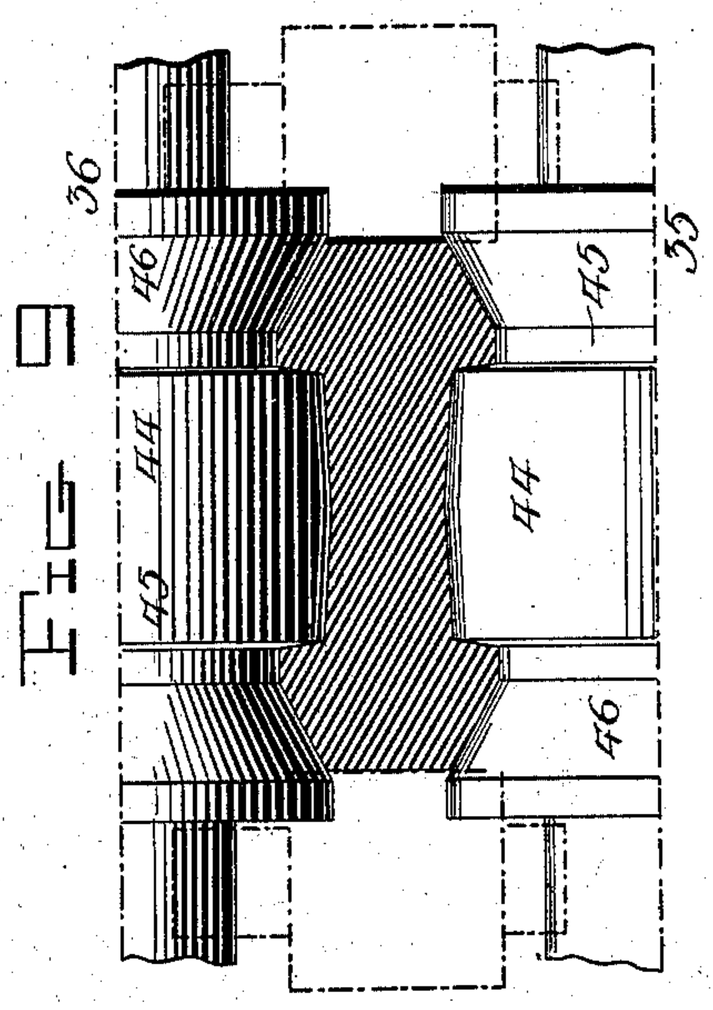

FIG. 9.

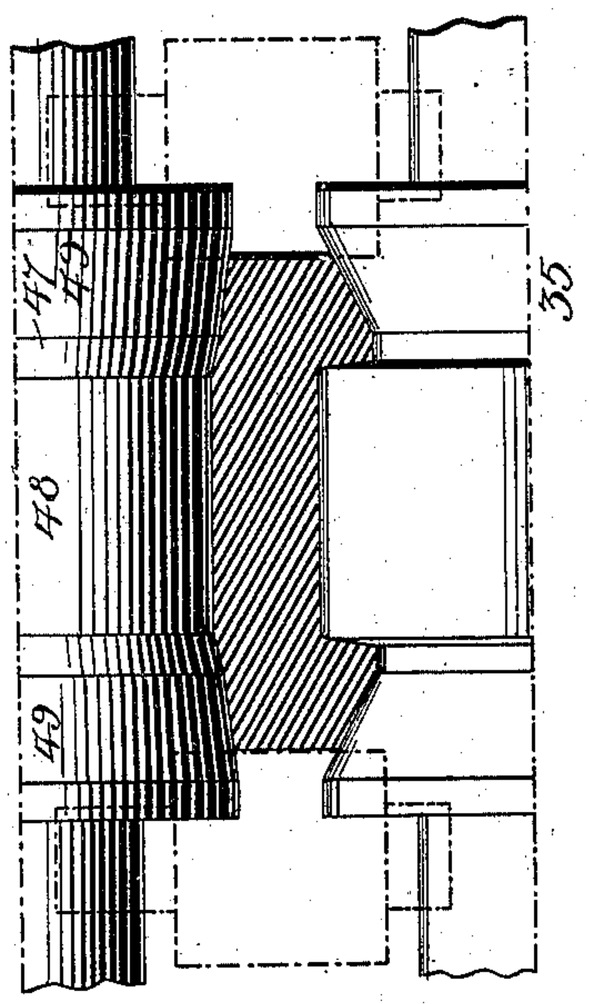

FIG. 10.

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UNITED STATES PATENT OFFICE.

WILLIAM ABERCROMBIE DUNN, OF SMITHVILLE, MINNESOTA, ASSIGNOR OF ONE-HALF TO ATHOL MORTON MILLER, OF DULUTH, MINNESOTA.

MACHINE FOR SHAPING METAL I-BEAMS, CHANNEL-BEAMS, &c.

SPECIFICATION forming part of Letters Patent No. 709,081, dated September 16, 1902.

Application filed January 3, 1902. Serial No. 88,302. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM ABERCROMBIE DUNN, a citizen of the United States, residing at Smithville, in the county of St. Louis and State of Minnesota, have invented certain new and useful Improvements in Machines for Shaping Metal I-Beams, Channel-Beams, &c.; and I do hereby 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.

In an application for patent filed by me January 3, 1902, Serial No. 88,301, I have described and claimed an improved process for the manufacture of rolled metal I-beams, channel-beams, and the like, which process consists in subjecting an ingot or slab to roller-pressures exerted in a manner to produce economically a beam having flanges the width and finish of which greatly exceed what has heretofore been obtainable, so far as I am aware.

The invention which forms the subject-matter of this application is directed to an improved machine designed to practice my process above set forth, which machine I have termed a "shaping-mill," inasmuch as the ingot or slab receives therefrom such a shape as enables it subsequently to be readily acted upon or "worked" in a mill arranged in advance of the final or finishing mill.

In two other applications filed my me, respectively, January 3, 1902, Serial No. 88,304, and June 23, 1902, Serial No. 112,862, I have shown, described, and claimed an "intermediate mill" adapted to successfully work the shaped beam, though it will be understood that any suitable construction of intermediate mill may be employed in connection with the shaping-mill which forms the subject-matter of this application.

The nature of this invention will be readily understood, reference being had to the following detailed description and to the accompanying drawings, in which—

Figure 1 is a plan view of a shaping-mill embodying my invention. Fig. 2 is a front elevation of that portion of the mill in which are mounted the horizontal rolls. Fig. 3 is a front elevation of that portion of the mill in which are mounted the vertical rolls. Fig. 4 is a side elevation of the mill. Fig. 5 is a longitudinal sectional view of that portion of the mill in which are mounted the vertical rolls. Fig. 6 is a side elevation, partly in section, of a form of vertical roll-mill portion embodying a single pair of rolls. Figs. 7 and 8 are respectively side and longitudinal sectional views of the same. Figs. 9 and 10 are enlarged views of the horizontal I-beam rolls, showing the form which the metal receives in the first and last passes. Figs. 11 and 12 are similar views of the horizontal channel-beam rolls.

Referring to the drawings by numerals, 1 1 denote the housings or frames for the vertical rolls, which are erected on suitable foundations and are of U form in cross-section and form supporting-guides for horizontally-movable carriages 2 2, on which are mounted the vertical rolls 3 3. The housings are adjustably bolted at their base to channel-plates 4 4 and are rigidly connected together by rods 4′ 4′, which are passed through lugs 5 5 on the housings and threaded for binding-nuts 6 6. Each of the vertical rolls, of which there are four, is provided with upper and lower necks 8 9, journaled in bearings in the carriage 2, brasses 10 10 being interposed around the necks and between the top and bottom of the roll and the bearings. On the upper neck 8 is fixed a bevel gear-wheel 11, which meshes with a double bevel gear-wheel 12, the latter being mounted on the carriage and meshing with a bevel gear-wheel 13, keyed to but slidable on a shaft 14. By reference more particularly to Fig. 1 it will be observed that the two pairs of rolls are simultaneously driven by the shaft 14 through the two bevel gear-wheels 13 13 and the intermediate gearing 12 11. The shaft 14 is connected with a source of power. (Not shown.) The carriages on which the rolls are mounted are movable to advance and to retract the rolls, the means employed consisting of screw-rods 15 15, engaging threaded openings in the housings and having swivel connection at their inner ends with the carriage and provided with polygonal outer ends, on which are gear-wheels 16, the latter being slidable on the rods, but rotatable therewith. There

are employed two screw-rods for each carriage, each disposed in line with the center of a roll, whereby the rolls are firmly held in proper relative position.

17 is a shaft journaled in bearings on the housing and receiving motion through bevel-gearing 18, a shaft 19, and bevel-gearing 20 with the shaft 21, which operates to adjust the horizontal rolls, presently to be described. On the shaft 17 are fixed gear-wheels 22, each of which meshes with the gear-wheels 16 16 on the screw-rods 15 15, which move each carriage. By reference to Fig. 4 it will be observed that the gear-wheels 22 are of relatively large diameter and operate through the described connections to move the vertical rolls their proper distance apart at a rate of speed slightly greater than the rate at which the horizontal rolls move, thereby preventing any possible buckling or displacement of the metal when the latter has been thinly rolled. When the vertical rolls have been advanced the proper distance, it becomes necessary to check their movement during the balance of feed of the horizontal rolls. To accomplish this, the shaft 17 is divided and connected by a clutch 23, which is disengaged when the vertical rolls have been properly adjusted. By throwing out the clutch 23, which is accomplished by hand at any point in the operation of the mill, I am enabled to so control the operation as to vary the thickness of the flange or of the web, dependent upon the use to which the finished beam is to be put. By adjusting the vertical rolls at a rate of speed in excess of that of the adjustment of the horizontal rolls I obtain the desired height of beam, while the web is of sufficient thickness to resist the pressure exerted by the vertical rolls. When the desired height of beam is obtained, I check the adjustment of the vertical rolls by throwing out the clutch 23, as previously stated.

Intermediately of and below the vertical rolls is a feed-roller 24, having teeth 25, engaged by a sprocket-chain receiving motion from a movable part of the mill. The roller forms a continuation of the table 26 and supports the metal in its passage between the vertical rolls. 27 27 denote side guide-bars for the metal, supported from the carriages to move therewith by arms 28 28.

In Figs. 6, 7, and 8 is shown a form of mill employing a single pair of vertical rolls which are rotated through the bevel gear-wheel 29 and adjusted through the gear-wheel 30.

Referring now to that portion of the mill in which are mounted the horizontal rolls and which, as shown in Fig. 1, is preferably arranged immediately to the rear of the vertical rolls, whereby to insure the proper guidance of the metal to the intermediate mill, 31 31 denote housings adjustably bolted at their base to channel-plates 32 32 and braced by rods 33 33. In the base of openings in the housings are bearings 34, in which are journaled the necks of the lower horizontal roll 35. The necks of the upper roll 36 are journaled in bearings 37, vertically movable in the housing-openings, and said upper roll and bearings are counterbalanced by the weighted device 38. The upper roll is moved vertically with reference to the lower roll by screw-rods 39 39, which engage threaded openings in the tops of the housings and which have polygonal upper ends on which are fitted gear-wheels 40 40. Meshing with said gear-wheels are worm-wheels 41 41, fixed to the shaft 21, which latter is operated from a suitable source of power and which, as before stated, is connected by gearing with the means for adjusting the vertical rolls. The brasses of the upper bearing 37 are adjustable by set-bolts 42 42 to secure proper alinement of the rolls.

43 43 are rollers forming a continuation of the table.

The guide-bars 27 are bolted to the inner sides of the housings and terminate closely adjacent to the rolls.

The upper and lower horizontal rolls for shaping I-beams are of similar form and size. Centrally of each roll is a cylindrical portion 44, the slightly-rounded sides of which extend inwardly to narrow cylindrical portions 45 45, and from the latter extend outwardly beveled portions 46 46. Preferably the ends of the roll are of cylindrical form. In forming I-beams from ingots or slabs the metal is preferably first passed between the vertical rolls, which are, as before stated, in advance, and thence between the horizontal rolls, by which the metal is shaped to the form shown approximately in Fig. 9, and by repeated passes through the vertical and horizontal rolls the metal is caused to assume the form shown in Fig. 10. The beveled portions 46 46 operate, as described in the process case above referred to, to press the metal readily into the roll-grooves to form the flanges, the outer sides of the metal being reduced and formed by the vertical rolls. For forming channel-beams I employ an upper roll of different form, the narrow portions 47 47, flanking the central cylindrical portion 48, being of slightly-beveled form and the outer portions 49 49 having a bevel slightly less than that of the portions 47. Figs. 11 and 12 illustrate, respectively, the forms of the channel-beam at the first and last passes.

I claim as my invention—

1. In a mill of the class described, the combination of horizontal shaping-rolls mounted in a frame, vertical shaping-rolls mounted in a frame independent of the aforesaid frame, adjusting-screws for the horizontal rolls, a shaft having gear connection with said screws to rotate them, adjusting-screws for the vertical rolls, a shaft connected by multiplying-gearing with the screws of the vertical rolls for effecting the adjustment of the latter at a rate of speed in excess of that of the horizontal rolls, gearing between the said shafts, and a single hand-operated clutch in the vertical-

rolls-adjusting shaft for checking the adjustment of the vertical rolls at any point during the operation of the mill for the purpose specified.

2. In a mill of the class described, the combination of vertical shaping-rolls, laterally-adjustable housings, frames movable in said housings and carrying said vertical rolls, screws for adjusting said frames, a shaft extending transversely of the frames, multiplying-gearing between the shaft and screws, a single hand-operated clutch in the shaft beyond the gearing for checking the adjustment of said vertical rolls at any point during the operation of the mill, horizontal shaping-rolls, a laterally-adjustable frame for the horizontal rolls arranged in longitudinal alinement with and independent of the vertical roll-frame, adjusting-screws for the horizontal rolls, and a shaft having gear connection with said screws and with the aforesaid shaft.

3. In a mill of the class described, horizontal rolls for shaping a flanged beam from a metal ingot or slab, one of said rolls having intermediate of its ends an approximately cylindrical roller-surface exerting pressure in a vertical direction against the ingot or slab to shape the web, grooves flanking the cylindrical surface the outer wall of each groove inclining from the groove-base at an abrupt angle to the horizontal and maintaining pressure against the side edges of the ingot or slab inwardly toward the center to force the metal into the groove to shape the flange, and vertical rolls exerting pressures in a horizontal direction against the sides of the ingot or slab to reduce the height of the beam, said vertical rolls being arranged in advance of the horizontal rolls.

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

WILLIAM ABERCROMBIE DUNN.

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F. L. BROWNE.