(No Model.)

6 Sheets—Sheet 1.

J. REESE.

UNIVERSAL ROLLING MILL.

No. 272,086. Patented Feb. 13, 1883.

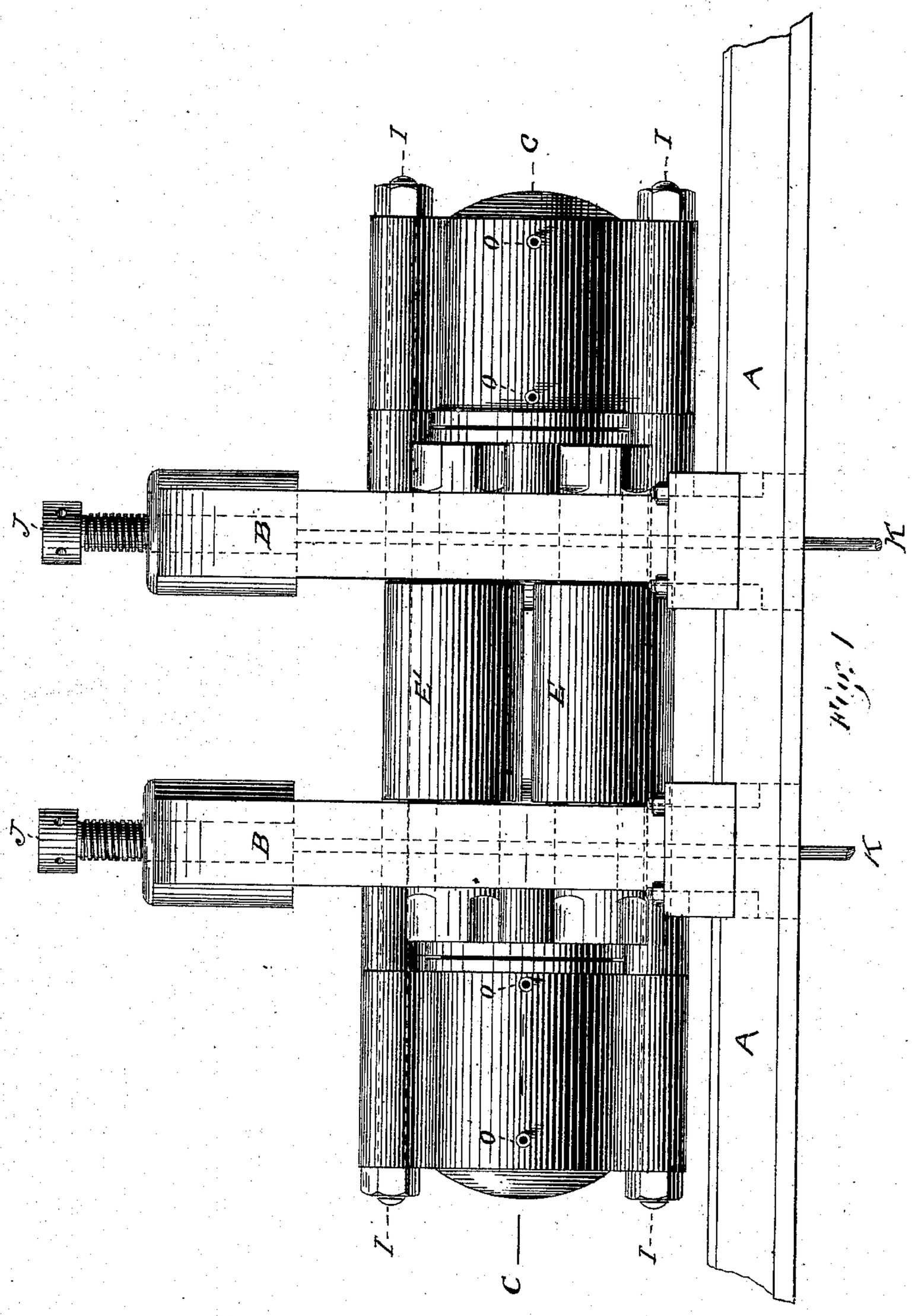

Fig. 1.

Witnesses
Uriah Reese.
Robt. J. Sample.

Inventor Jacob Reese
By Attorney

(No Model.)

6 Sheets—Sheet 2.

J. REESE.

UNIVERSAL ROLLING MILL.

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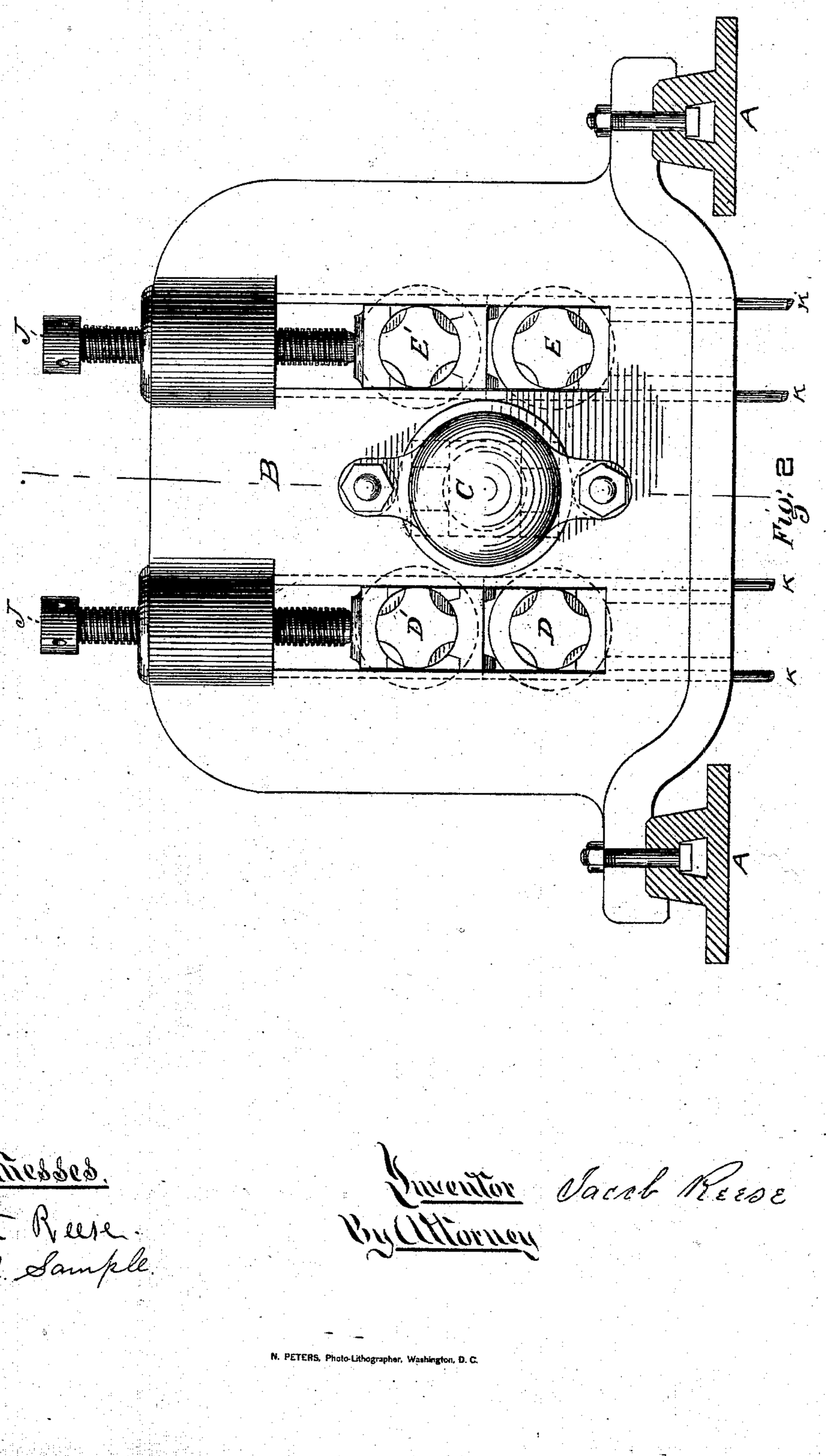

Fig. 2

Witnesses.
Walter Reese.
Robt. J. Sample.

Inventor Jacob Reese
By Attorney

(No Model.)

6 Sheets—Sheet 3.

J. REESE.

UNIVERSAL ROLLING MILL.

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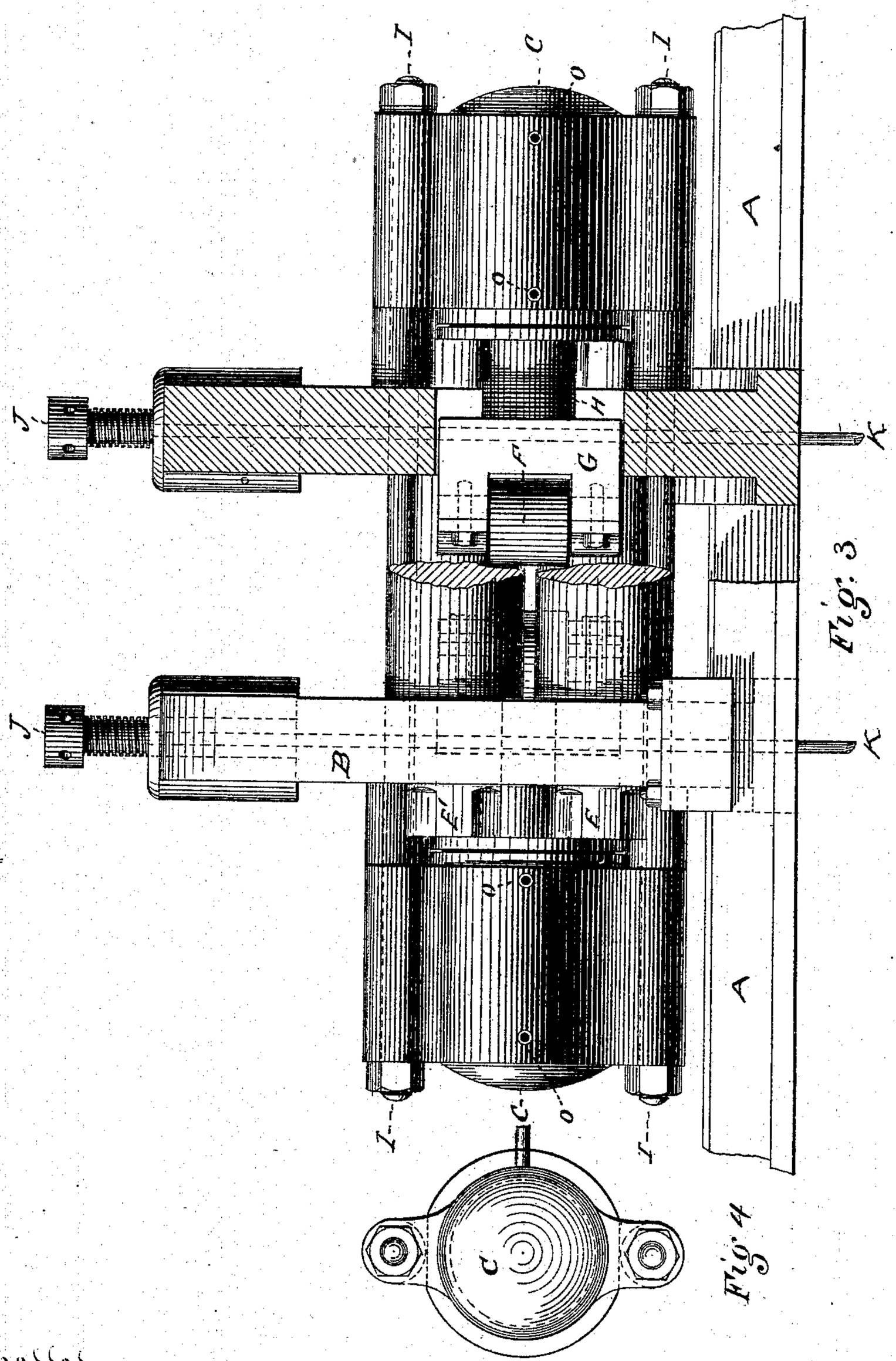

Witnesses
Walter Reese.
Robt J. Sample.

Inventor
By Attorney
Jacob Reese

(No Model.)

6 Sheets—Sheet 4.

J. REESE.

UNIVERSAL ROLLING MILL.

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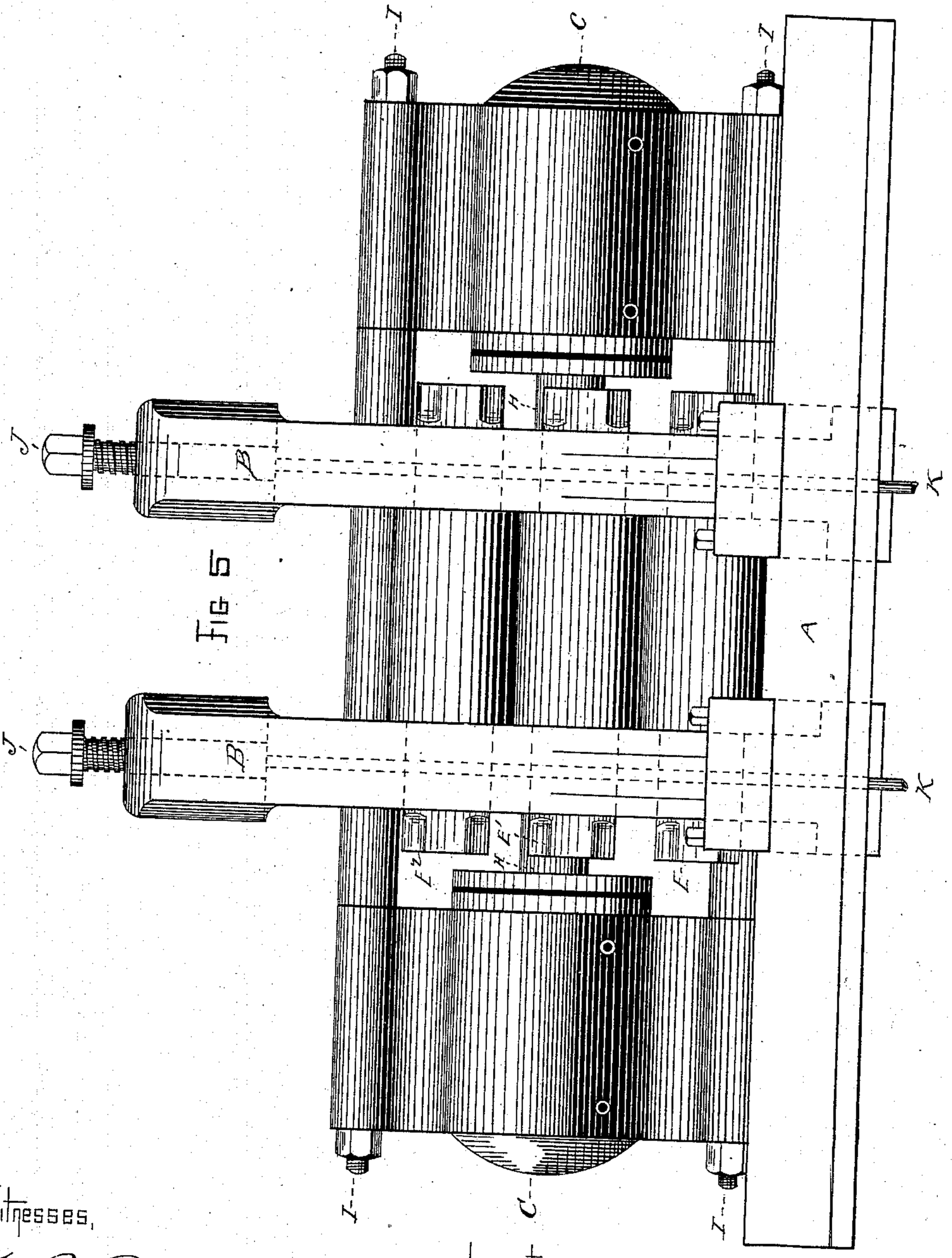


FIG 5

Witnesses,
Hallie Reese.
Robt J. Sample.

Inventor
Jacob Reese

(No Model.)

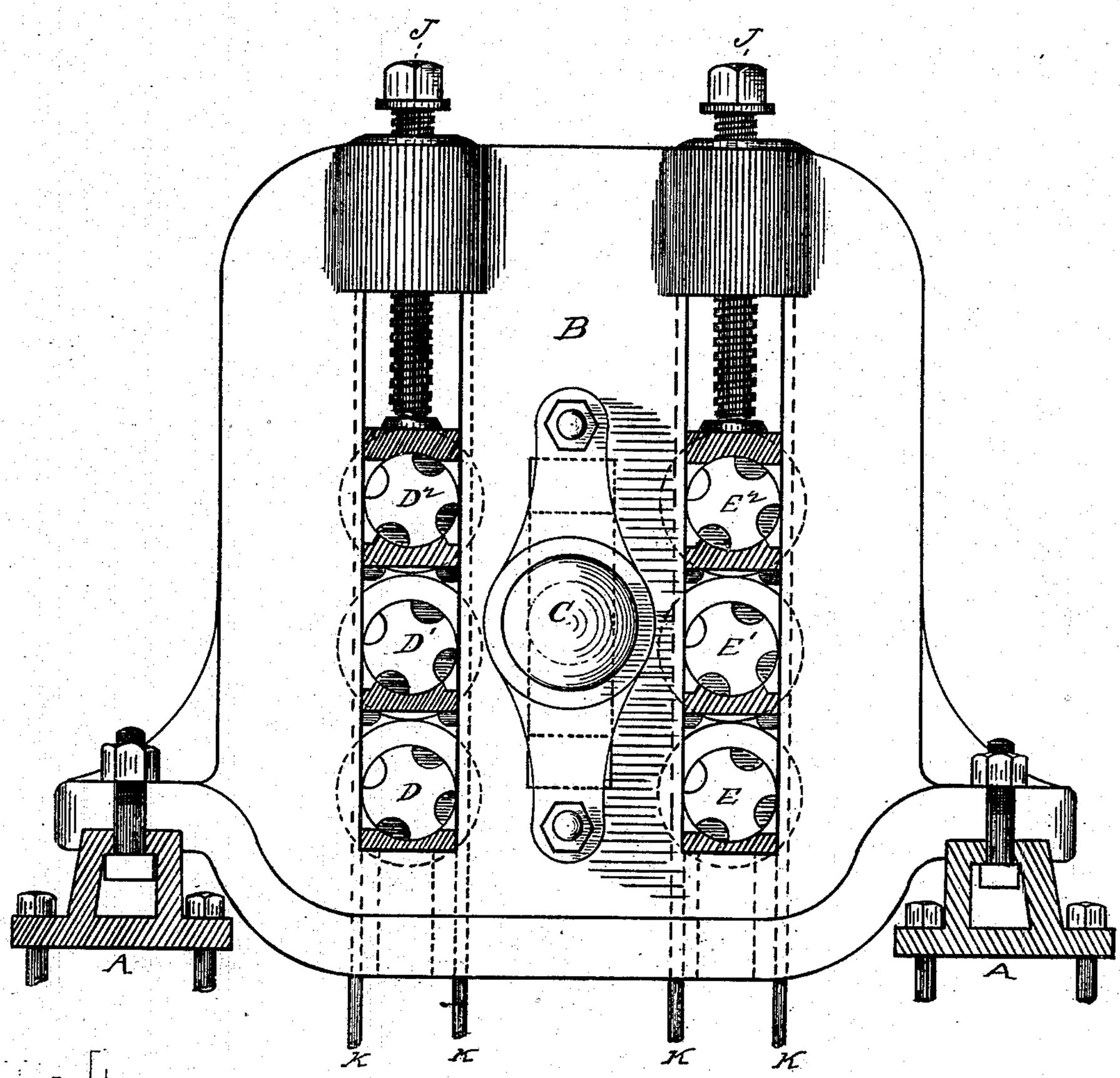
6 Sheets—Sheet 5.

J. REESE.

UNIVERSAL ROLLING MILL.

No. 272,086. Patented Feb. 13, 1883.

FIG 6



Witnesses

Hacker Reese.
Robt J. Sample.

Inventor

Jacob Reese

(No Model.)

6 Sheets—Sheet 6.

J. REESE.

UNIVERSAL ROLLING MILL.

No. 272,086. Patented Feb. 13, 1883.

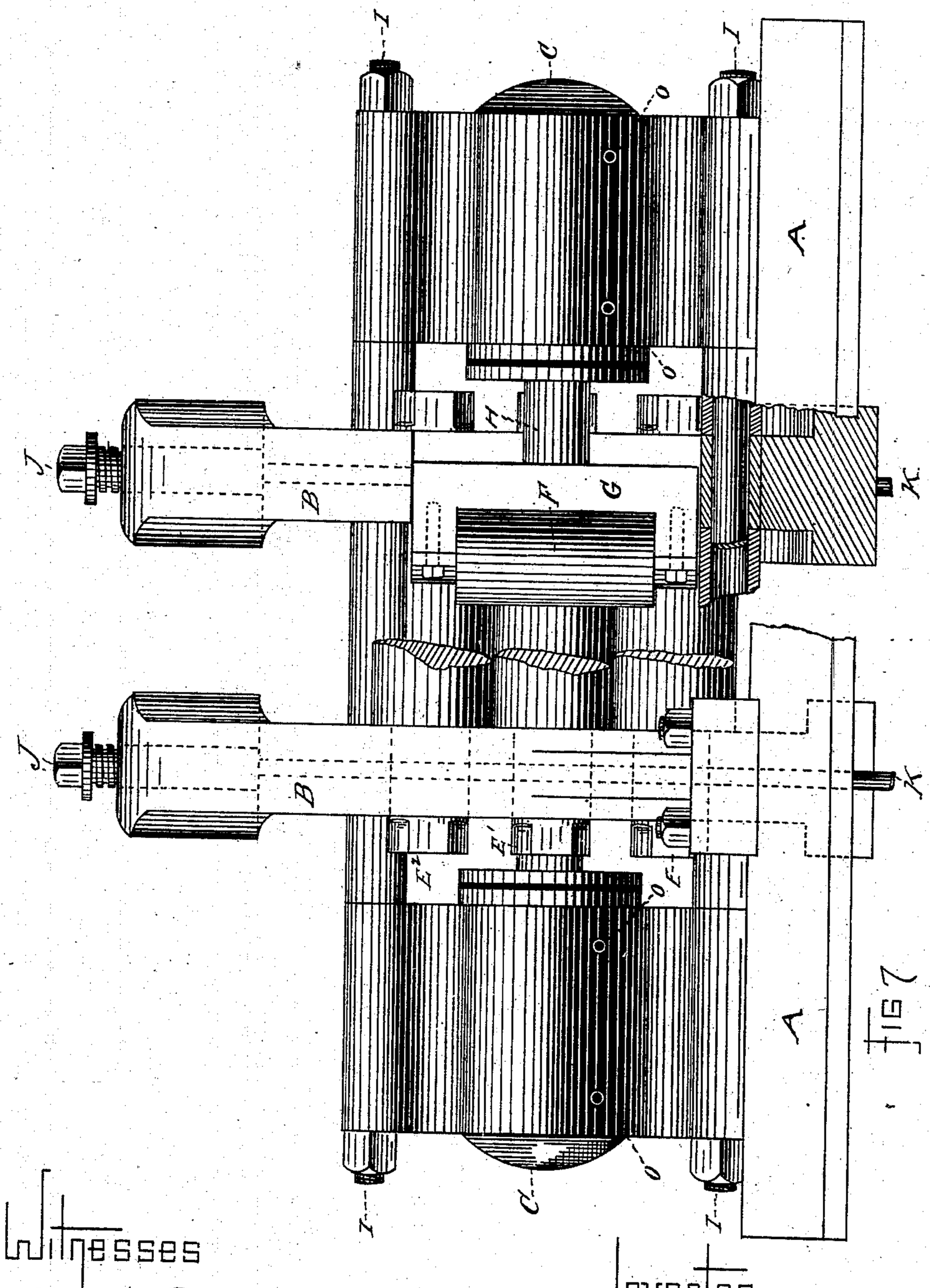


FIG 7.

Witnesses

Hector Reese.

Robt. J. Sample.

Inventor

Jacob Reese

UNITED STATES PATENT OFFICE.

JACOB REESE, OF PITTSBURG, PENNSYLVANIA.

UNIVERSAL ROLLING-MILL.

SPECIFICATION forming part of Letters Patent No. 272,086, dated February 13, 1883.

Application filed September 30, 1882. (No model.)

To all whom it may concern:

Be it known that I, JACOB REESE, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a certain new and useful Improvement in Universal Rolling-Mills; and I do hereby declare the following to be a full, clear, and exact description thereof, reference being had to the accompanying drawings, forming a part thereof.

What is known to the trade as a "universal rolling-mill" is such a machine as described and shown in Letters Patent No. 53,012, granted to John F. Lauth, March 6, 1866, and No. 188,741, granted to Andrew Kloman, March 27, 1877. In these machines the vertical rolls are driven by means of a series of wheels and shafts attached to the power that propels the horizontal rolls. This arrangement for propelling the vertical rolls requires so many wheels, shafts, crabs, &c., that in the practice of the universal rolling-mill, when used for steel, the wheels are continually breaking, especially those known as "bevel-wheels," and in a large machine they take up so much room that the vertical rolls cannot be forced within three (3) inches of each other, and in many cases four (4) inches is the limit.

The object of this invention is the construction and arrangement of a universal rolling-mill in such a manner as to dispense with all gearing for driving the vertical rolls and cause them to rotate as idlers, and to move them toward or from each other by means of hydraulic machinery. These objects I secure by means of the following arrangement, shown in the drawings, in which—

Figure 1, Plate 1, is a side elevation of my improved two-high universal rolling-mill. Fig. 2, Plate 2, is an end view of same. Fig. 3, Plate 3, is a side elevation of same, partly in section, showing one of the vertical rolls with its attachment to the hydraulic ram. Fig. 4, Plate 3, is an end view of the hydraulic ram. Fig. 5, Plate 4, is a front elevation of my improved three-high universal rolling-mill. Fig. 6, Plate 5, is an end view of same. Fig. 7, Plate 6, is a side elevation of same, partly in section, showing one of the vertical rolls with its attachment to the hydraulic ram.

Like letters, when they occur, refer to like parts.

In the construction of this machine for two-high rolls I use the ordinary bed-plates, A A. The housings B B are double, and so constructed as to accommodate two pair of horizontal rolls, *d d'* and *e e'*. For heavy work these rolls will be twenty-six (26) inches in diameter. The rolls will be sixteen inches apart. Opposite to the openings between the rolls there is a rectangular opening in each of the housings of fifteen by thirty-six (15x36) inches, more or less. On the outside of the housings, and opposite to each of these rectangular openings, are placed hydraulic rams, which are held in place by bolts passing through the housings. The forward end of each ram-piston is so constructed as to act as a frame or pillow-block, and in these ram-frames the vertical rolls are placed. The vertical rolls are fifteen (15) inch diameter and sixteen (16) inch face, and having necks twelve (12) inch diameter and ten (10) inches in length. Thus the vertical roll may be attached to the ram-piston frame, and the roll and frame pushed into place from the outside of the housing. By this arrangement the vertical rolls may be drawn back into the housings, so as to utilize the entire length of the horizontal rolls, if desired, thus enabling me to use shorter horizontal rolls than by any other arrangement known to me.

The universal rolling-mills are now being used for rolling bridge and other plates which are required to have round, square, and straight edges, and recently I have had two mills of this class built for blooming steel ingots into slabs, blooms, billets, and plates. The great advantage of a universal blooming-mill is that any desired shape can be produced, whereas all other blooming-mills are restricted to the production of such shapes only as conform to the size of the grooves in the blooming-rolls. In the practice of the old universal blooming-mill the vertical rolls are only used to hold the metal in place while it is being reduced by the horizontal rolls. The metal is then turned over on its side, the vertical rolls closed, and the metal again reduced by the horizontal rolls, thus the work of reducing the metal being done nearly, if not altogether, by the horizontal rolls, the vertical rolls being used only for holding the metal in place and for reducing the spread caused by

the horizontal rolls; but by the use of my improved universal rolling-mill the metal is reduced as much as desired by the vertical rolls, and by this arrangement the necessity of turning the metal over is avoided.

Figs. 5, 6, and 7 show this invention as applied to a three-high universal mill. In this mill the rolls are not reversed; but the metal is rolled between the bottom and middle rolls in one direction and between the middle and top rolls in the other direction. In such case the vertical rolls may have a middle bearing; or they may be made of sufficient length as to accommodate both passes, as shown in Fig. 7. This class of universal mills, however, can only be used to advantage in the manufacture of plates and sheets from flat ingots or slabs, and is not suitable for blooming large ingots.

In securing the objects of this invention I employ two sets of horizontal rolls and only one set of vertical rolls, while in the old method one set of horizontal and two sets of vertical rolls are employed. By the old arrangement the vertical rolls were adjusted by means of screws, while the vertical rolls of my improved universal rolling-mill are adjusted by means of hydraulic rams in order that the rolls may be adjusted quicker and be held in place with sufficient power to reduce the metal passing between them.

I shall now describe the construction of the machine in order that others skilled in the arts may be enabled to build it.

A A are bed-plates. B B are the housings. C C are the hydraulic rams. $d\ d'\ d^2$ and $e\ e'\ e^2$ are the horizontal rolls. $f\ f'$ are the vertical rolls. g is the ram-frame in which the vertical roll is held and operated. H is the ram-piston. I I′ are the bolts which hold the two rams in place. $j\ j$ are the housing-screws for tightening down the horizontal rolls. $k\ k$ are the balance-rods for holding up the top roll. $o\ o'$ are openings through which the fluid is forced for adjusting the vertical rolls.

In the practice of my improved two-high universal rolling-mill the rolls D D′ and E E′ are connected by means of boxes and spindles to suitable pinions, which will drive both pairs of rolls in the same direction. The pinions will be connected with a reversing-engine. The hydraulic rams will be connected with a pump or pressure-reservoir. The horizontal rolls are provided with guides on each side, such as are ordinarily used in reversing rolls—a top and bottom guide between the two pairs of horizontal rolls. The rolls being properly adjusted, the engine is started, and a properly-heated ingot is caused to enter the horizontal rolls D and D′. It is reduced thereby and pushed through between the vertical rolls and caused to enter the horizontal rolls E and E′. When the metal has left the rolls D and D′ it is drawn through the vertical rolls by the horizontal rolls E and E′, and is delivered in a reduced condition, both on its vertical and horizontal lines. The engine is now reversed, the top screws tightened, the vertical rolls closed up by forcing the rams forward, and the metal is again caused to enter the rolls E and E′, and it will be delivered from D and D′ again reduced, and so by closing the rolls together and reversing the engine the rolling operation may be continued back and forward until the metal is reduced to the desired thickness.

When it is desired to roll a fourteen (14) inch square ingot into a plate twelve by one inch (12x1) the vertical rolls are closed about five (5) per cent. after each pass until the distance between them is twelve and one-eighth ($12\frac{1}{8}$) of an inch, after which they should rest at that point, and by closing the horizontal rolls after each pass until the opening between them is full one inch (1) the plate so made, minus the shrinkage, will be twelve by one inch in its cross-section when cold.

In the practice of this mill, when square ingots are being rolled into square blooms, billets, or bars, when the chemical and physical properties of the steel will permit a reduction of ten (10) per cent., the horizontal rolls are so adjusted that the first pair will reduce the metal six (6) per cent. and the second pair of horizontal rolls four (4) per cent. By this method, the horizontal rolls being twenty-six (26) inches in diameter, they will grip the metal with sufficient force (at a reduction of six (6) per cent.) to push it through the vertical rolls of sixteen-inch diameter, making a reduction of ten (10) per cent., and when the last end of the metal has left the first pair of horizontal rolls the forward pair of horizontal rolls will grip the metal with a reduction of four (4) per cent. with sufficient force (added to the momentum of the bar) to draw it through the vertical rolls.

When slabs or plates are desired I prefer to adjust each pair of horizontal and vertical rolls so as to secure a uniform reduction, as in that case the vertical rolls need not reduce more than one-half the aggregate reduction of the two pairs of horizontal rolls.

When the mill is worked on very heavy, dense ingots of high carbon for the production of square blooms or billets, I prefer to adjust all of the rolls to a reduction of five (5) per cent, and as this would make double the reduction one way than the other every four or five passes, the metal should be turned up on its edge, and, the rolls being properly adjusted, the rolling continued until the metal is brought to the desired shape.

The advantages of this invention are, first, all bevel-wheels and other driving-gear for propelling the vertical rolls are dispensed with, and the machine is simplified and made more durable; second, by dispensing with the driving-gear of the vertical rolls I am enabled to close the vertical rolls to any desired degree, whereas when they are driven by gearing it is not practical to force them nearer each other than four inches. Hence I am enabled to make one square inch, if desired, while by the old method four-inch square is the smallest that can be rolled to advantage; third, the

metal can be reduced in two-thirds the time required by the old method; fourth, the labor required in turning the metal over is almost, if not altogether, avoided.

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

1. In a universal rolling-mill, the combination, with two pairs or series of horizontal rolls, of a pair of intermediate vertical idler-rolls provided with means for horizontal adjustment, substantially as set forth, whereby the ingot operated upon is caused to rotate the vertical idler-rolls, and whereby said idler-rolls may be brought into close proximity for the purposes described.

2. In a universal rolling-mill, the combination, with the idler-rolls F, of the frames G, the housings B, provided with openings of like cross-sectional area with that of said frame G, and means for withdrawing the said frame, as set forth, whereby the vertical idler-rolls may be drawn within the housings, and the whole surface of the horizontal rolls be utilized for the purposes described.

3. The combination, with the vertical rolls and the housings provided with openings, of the bifurcated frames G, the piston H, and ram C, all arranged as described, whereby horizontal movement is imparted to the vertical rolls in the manner and for the purposes set forth.

JACOB REESE.

Witnesses:
WALTER REESE,
ROBT. J. SAMPLE.