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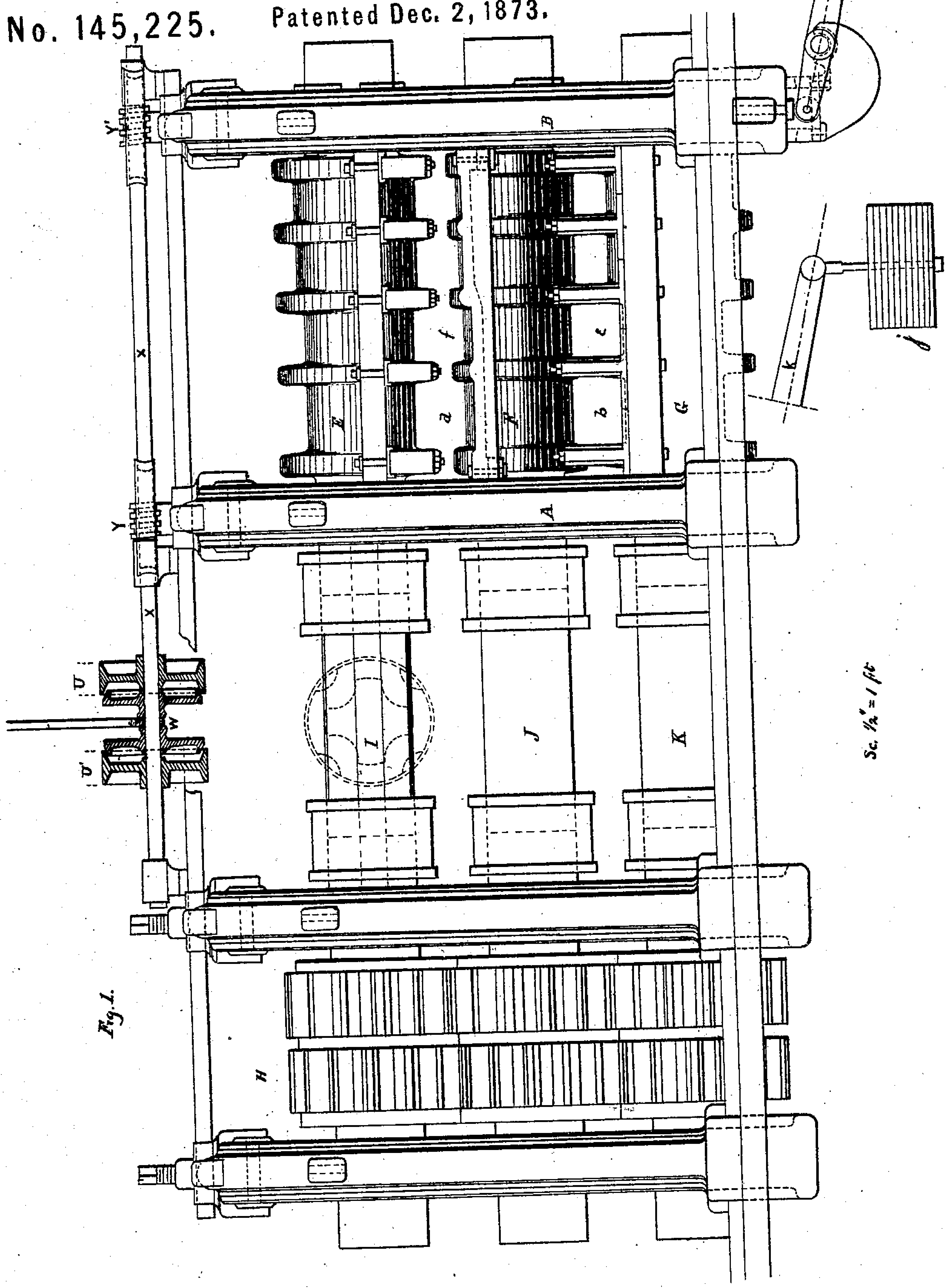
Rolling-Mills.

No. 145,225. Patented Dec. 2, 1873.



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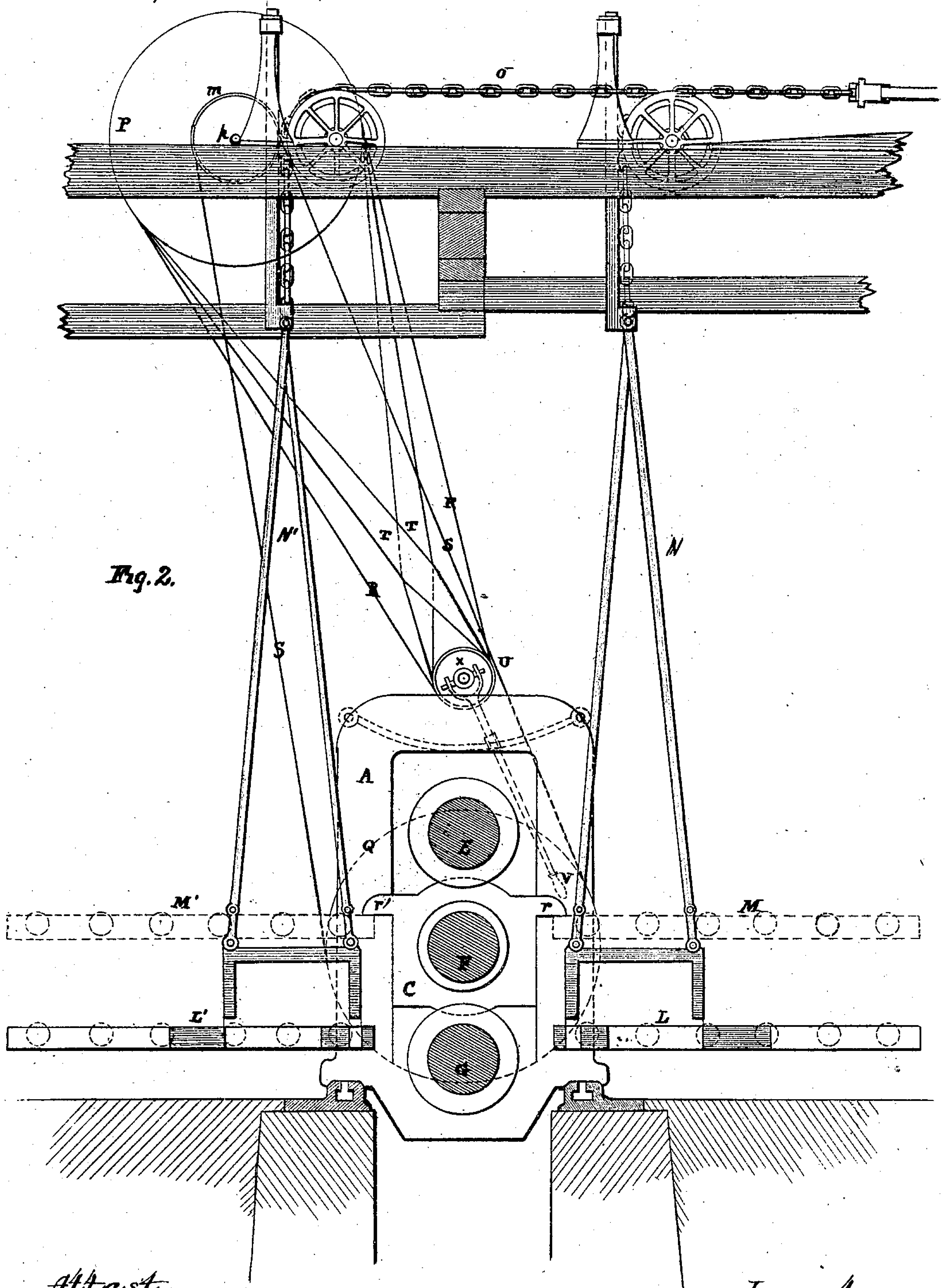

Fig. 2.

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Fig. 5

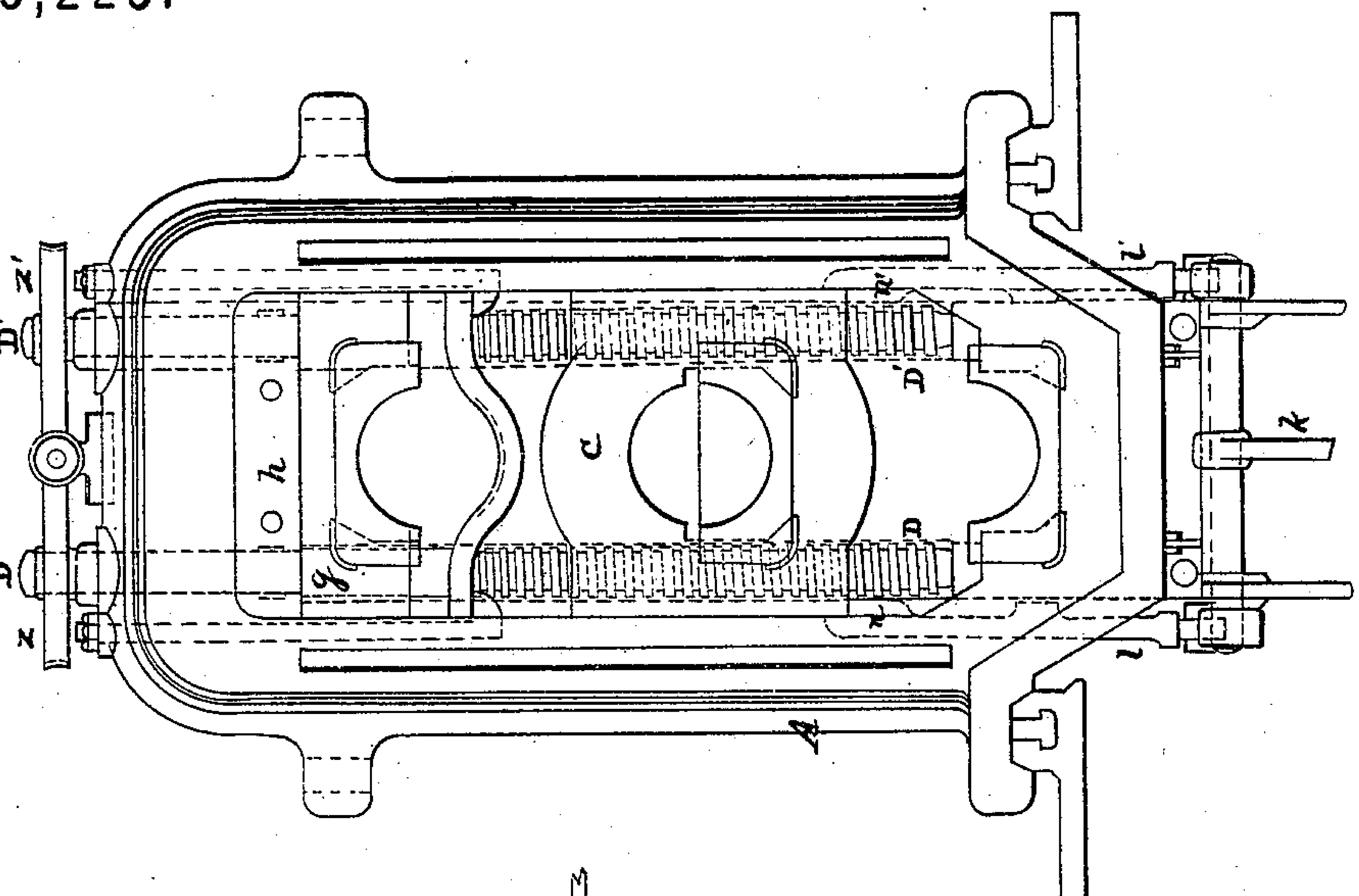

Fig. 4

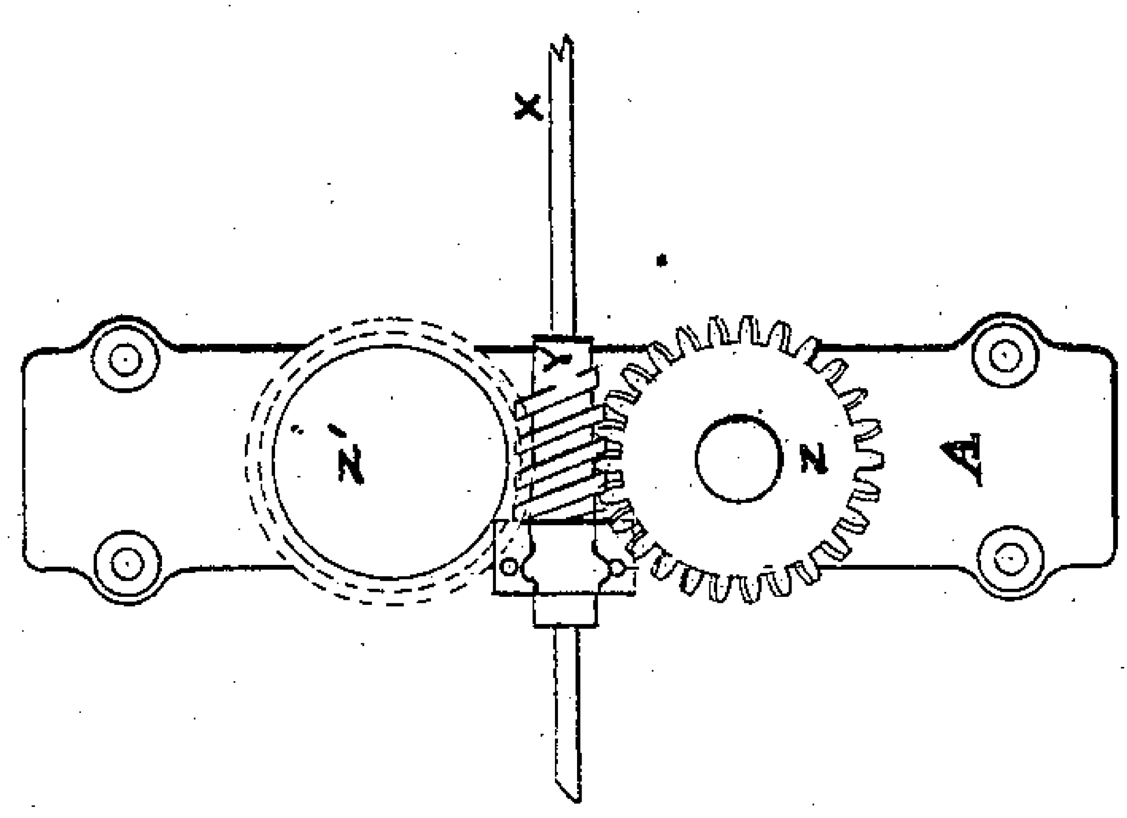

Fig. 3

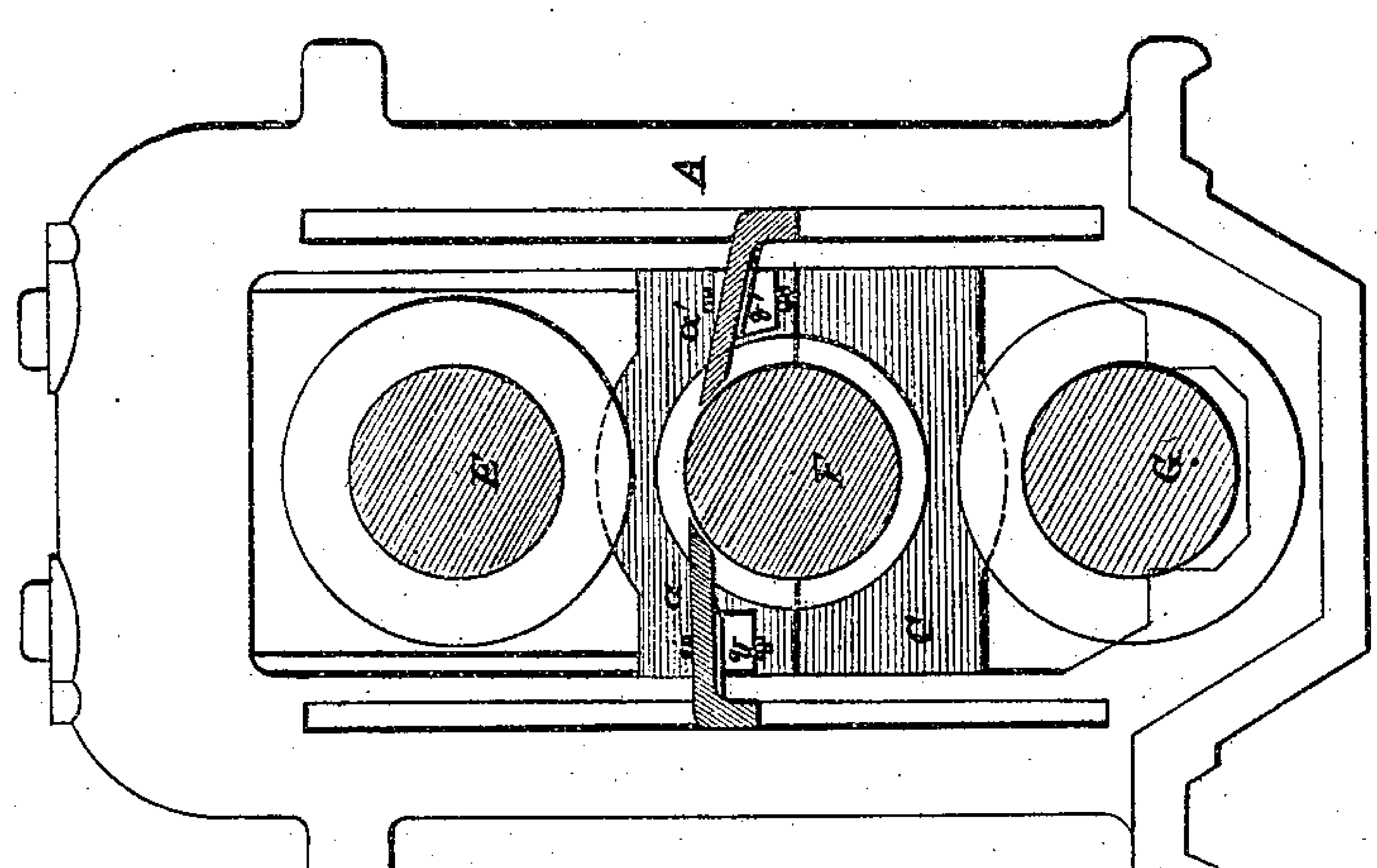

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Fig. 6

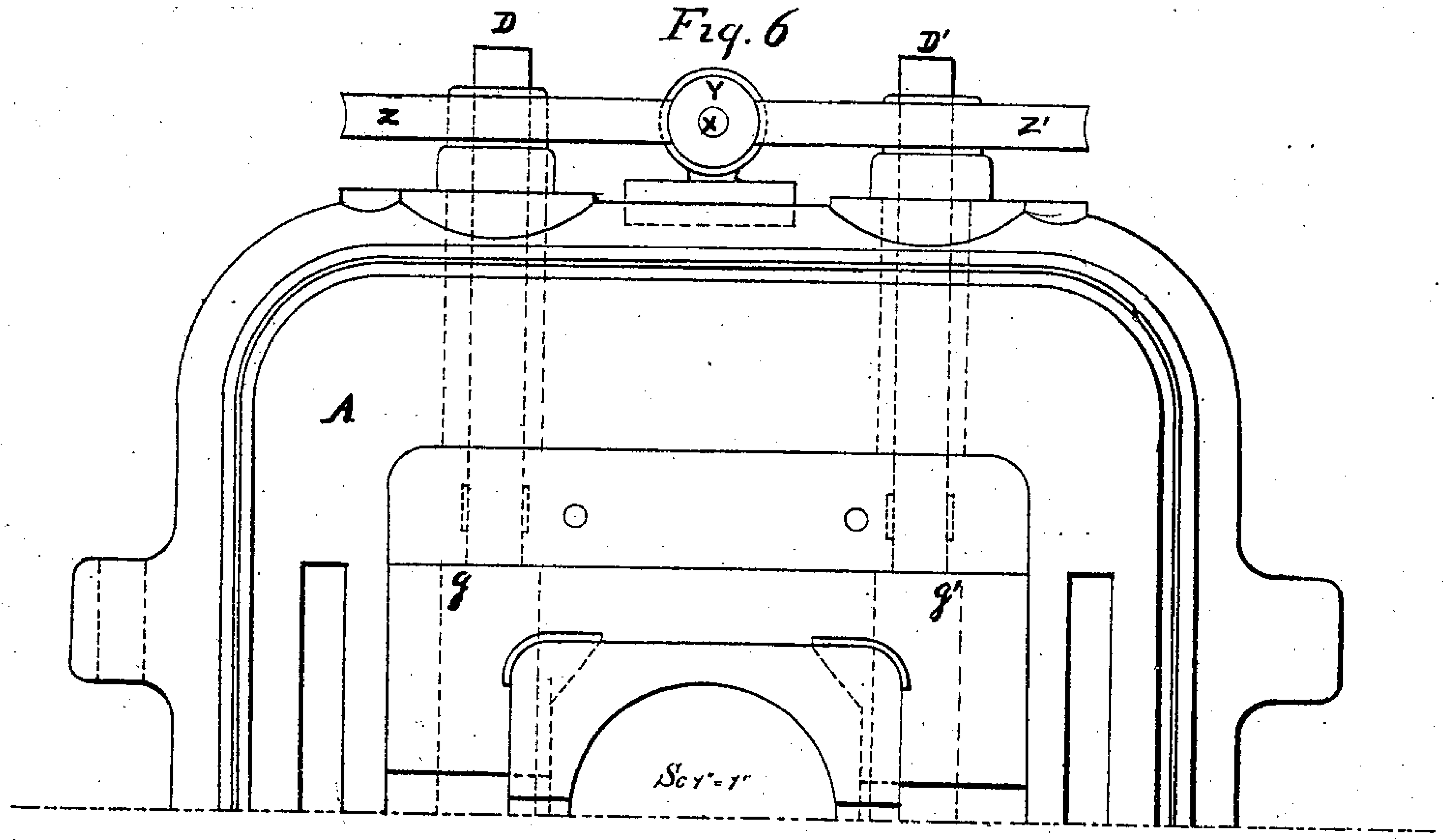


Fig. 7.

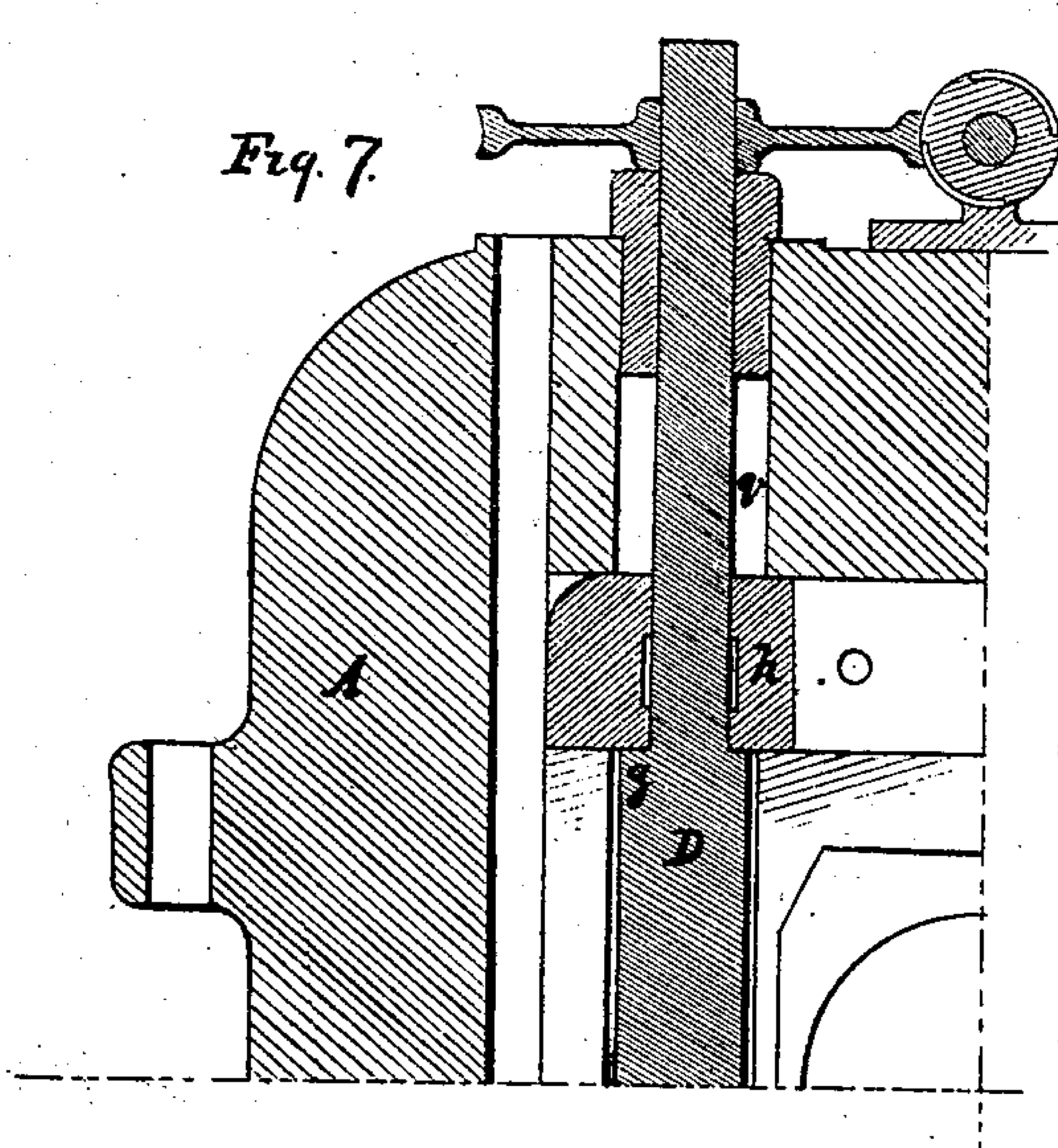


Fig. 8.

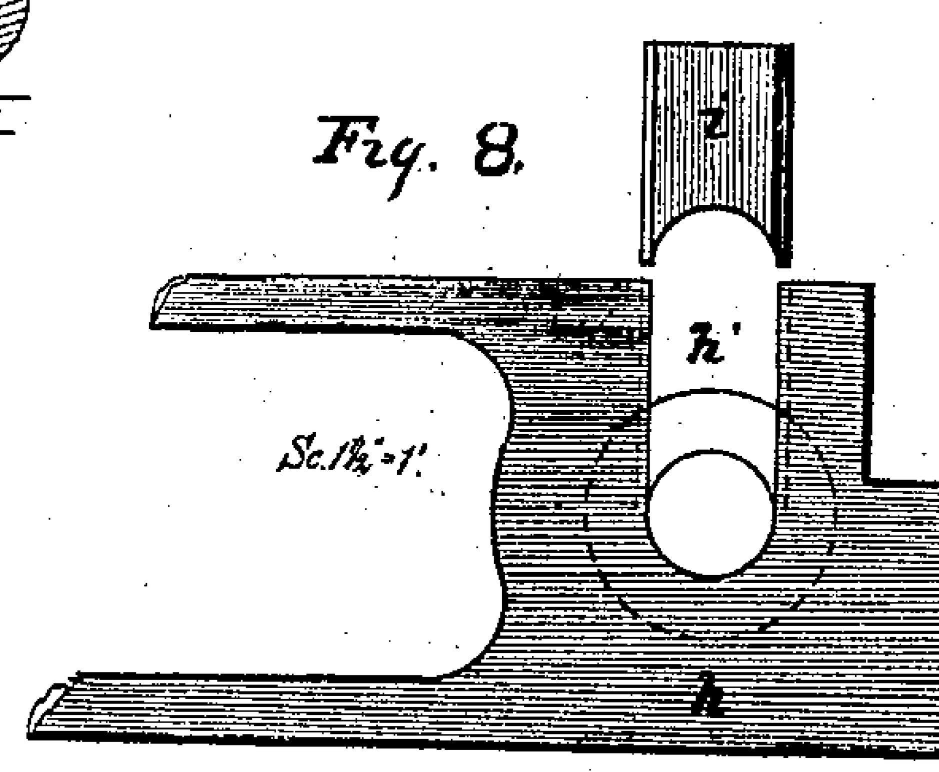
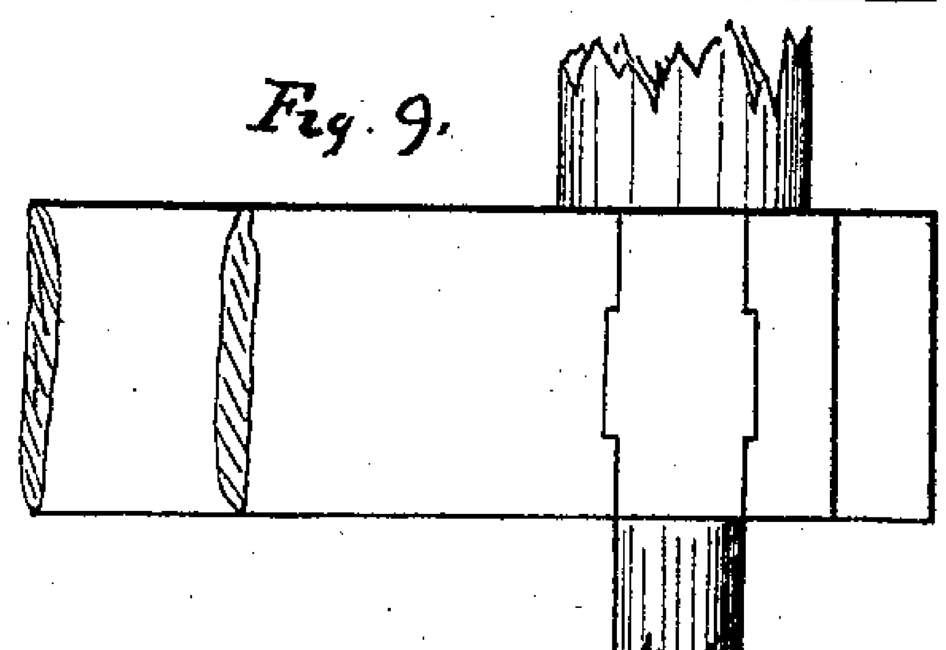


Fig. 9.



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UNITED STATES PATENT OFFICE.

JAMES MOORE AND WILLIAM GEORGE, OF PHILADELPHIA, PENNSYLVANIA, AND ALEXANDER L. HOLLEY, OF BROOKLYN, NEW YORK.

IMPROVEMENT IN ROLLING-MILLS.

Specification forming part of Letters Patent No. **145,225**, dated December 2, 1873; application filed October 26, 1872.

To all whom it may concern:

Be it known that we, JAMES MOORE and WILLIAM GEORGE, of the city of Philadelphia and State of Pennsylvania, and ALEXANDER L. HOLLEY, of the city of Brooklyn and State of New York, have jointly invented certain Improvements in Rolling-Mills, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing.

Figure 1 is a front elevation of a three-high rolling-mill with its housings A B, rolls E F G, couplings I J K, and its pinions and their housings H. The general features of this mill will be understood by persons skilled in the art.

Fig. 2 shows a cross-section of the mill through the rolls; also, the tables L L′ for raising and lowering the piece of metal to be rolled. The tables are shown in their lower positions at L L′, and at their upper positions at M M′. They may be raised by means of hangers N N′ and the chains O, operated by a hydraulic cylinder, or by any suitable means. The arrangement of these tables forms no part of our present invention. Fig. 2 shows pulleys and belts for changing the position of the middle roll, which will be further referred to.

Fig. 3 is a cross-section through the rolls, showing the bolster C, which holds one journal of the middle roll, (a similar bolster holding the other end;) also, the guides *a a′*.

Fig. 4 is a plan of one of the roll-housings.

Fig. 5 is a side elevation of one of the roll-housings, showing the bolster C that holds the middle roll, the screws D D′ that hold and raise and lower the bolster, and other parts to be referred to.

Figs. 6, 7, 8, and 9 are details of parts for supporting the rolls in the housings.

The subject of our invention is a three-high rolling-mill, with a middle roll adapted to be moved up and down and fixed in any desired position relatively to the other rolls. To this end the said middle roll has its bearings in bolsters, each supported by a pair of screws provided at top with worm-wheels and rotated by a worm-shaft common to both. The worm-shaft is rotated in either direction, when required, by means of a friction-clutch, which, while capable of imparting any necessary and proper force to the worm-shaft, will slip in the event of meeting with undue resistance, which might otherwise cause the destruction of some part of the mill. The fore-plate and catching-plate are arranged to rise and fall with the movable roll, so as to maintain a uniform height relatively thereto. The bolsters of the middle roll are further provided with stops, which limit the vertical movement of the tables by which the plates are elevated for feeding, so as to cause the said plates to be brought to a uniform position relatively to the middle roll.

In the ordinary three-high mill all the rolls are fixed at definite distances apart. In order to reduce a piece of metal it is passed between the bottom and middle rolls, as at *b*, Fig. 1; then returned between the middle and top rolls, as at *d;* then turned half over and passed through *e;* then returned through *f*, and so on, each time receiving the reduction due to the fixed sizes of the grooves. There must be a groove for each pass.

Our improvement consists, first, in making the middle roll movable, and in apparatus for moving the middle roll, for the purpose of changing the sizes of the spaces between the rolls, so that a piece of metal may be passed twice or more through each groove, receiving a regulated reduction at each pass through the same groove. By these means the number of grooves for a given reduction may be decreased. The top and bottom rolls bear, respectively, against the top and bottom of the housing, and are secured as shown, or in any suitable manner. One journal of the middle roll is held by the bolster C, Figs. 3 and 5, which is fitted to slide vertically in the housing, and which forms the nut of the two screws D and D′. The other journal of the middle roll is held by a similar bolster. The bottoms of the screws D D′ rest on the bottom of the housing. The shoulders *g g′* of the screws, Figs. 6, 7, and 8, bear against the top of the housing by means of the bearing-pieces *h i*. The screws are therefore fixed vertically, but by revolving them in one direction the bolster C, carrying the middle roll with it, will be screwed up, and by revolving them in the opposite direction the bolster C and the middle roll will be screwed down. The screws are made heavy enough to resist the upward and downward thrust of the roll. We prefer to counterweight the middle roll, so that the screws will have less work and wear in moving it. The arrangement for this purpose is shown by Figs. 1 and 5. The counter-weight *j*, by means of the lever *k* and the rods *l* and *l′*, which are notched under the bolster at *n n′*, balances, as far as may be desired, the weight of the bolster and middle roll.

The following device may be employed for holding down the screws D D′: In order to get the screw D, Fig. 7, into its position in the housing, the hole *q* in the housing must be as large as the greatest diameter of the screw. In order to prevent the screw from rising in this hole, the above-mentioned shoulder *g* bears on the bearing-piece *h*, which is shown in plan by Fig. 8. In order that the bearing-piece may be slipped laterally in place after the screw is inserted, the notch *h′* is formed in it. The notch *h′* is then filled and a complete bearing is made for the shoulder of the screw by the insertion of the block *i*.

The operation of rolling is as follows: Fig. 1 represents rolls for reducing twelve-inch steel ingots to six-and-one-half-inch blooms. Our improvement is obviously applicable to rolling plates, bars, and many other shapes. The middle roll having been screwed up by the means described, so that the groove *b*, which is twelve inches wide, shall be eleven and one-half inches deep, the twelve-inch ingot is passed through and reduced to eleven and one-half by twelve inches. The middle roll is then set by the screws, so that the groove *d* shall be eleven inches deep, and the ingot is returned through it and reduced to eleven by twelve inches. The middle roll is then set so that the groove *b* shall be ten and one-half inches, and the piece is passed through it and reduced to ten and one-half by twelve inches. The groove *d* is then set to ten inches depth, and delivers the piece ten by twelve inches. The piece is then turned on edge, the groove *e* is set to eleven and one-half inches in depth, and the foregoing operations are repeated till the piece is reduced to ten by ten inches. Similar operations reduce the piece to any desired depth in the remaining grooves. The amount of the reduction and the number of grooves may obviously be varied indefinitely to suit the material and shape required.

Plain rolls may be employed for producing plates, and closed grooves may be used for bars of various shapes.

Our improvement further consists in the combination of paired screws, with a bolster at each end, for moving the middle roll vertically. Upon the top of each screw D D′ there are fixed the worm-wheels Z Z′, Figs. 4, 5, and 6. These worm-wheels are engaged by a worm, Y, Fig. 4, which is fastened to the horizontal shaft X, Figs. 1 and 4. A worm-wheel, Y′, on the same shaft (Fig. 1) engages the worm-wheels at the other end of the middle roll. The screws D and D′ are cut right and left, respectively. By revolving the shaft Y in one direction, all the four screws are thus so rotated that the bolsters and middle roll rise. By revolving the shaft Y in the other direction, the bolsters and the roll fall. A pulley, Q, Fig. 2, on the engine-shaft drives the counter-shaft *p* by means of the belts S S and pulley *m*. Two pulleys, P, on this counter-shaft drive the pulleys U and U′, Figs. 1 and 2, (which revolve freely on the shaft X,) by means of the straight belt R R, Fig. 2, and the cross-belt T T, so that the pulleys U U′, Fig. 2, are constantly revolved on the shaft X in opposite directions, but without moving the shaft X.

In order to revolve the shaft X in one direction, so as to move the middle roll up, the friction-clutch W, Fig. 1, which is fastened by a spline on the shaft X, is pressed against the pulley U. The constantly-moving pulley U thus rotates the friction-clutch W and the shaft X, and the screws D D′, and so raises the middle roll.

To lower the middle roll, the clutch W is thrown against the other pulley, U′, which constantly revolves in the opposite direction, and thus rotates the shaft X and the screws in the opposite direction. The clutch W is moved laterally on the shaft for this purpose by a lever, V, Fig. 2, or by any convenient means. A workman can thus, by the movement of his hand, rapidly set the middle roll in any required position, and the various-required positions may be designated by an index-plate fastened to the housing, and a pointer fastened to the bolster.

The shaft X may obviously be rotated and reversed by belts and fast and loose pulleys, as used in planers and other machine tools, or by other equivalents of the friction-clutch.

Our improvement further consists in a device for adjusting the fore plate and catching plate or guides *a a′*, Fig. 3, where they are shown fastened to the lugs *q q′* on the bolster C, by which means they rise and fall with the middle roll, and thus preserve a uniform position with reference to the middle roll. If these plates were fastened to the housing in the usual manner, the roll would, at its highest and lowest positions, be too far above or below them for the best entrance and delivery of the piece that was being rolled.

Our improvement further consists in the combination of stops with the bolsters that hold the middle roll and the tables, Fig. 2, that raise and lower the piece being rolled, whereby the tables always rise to a uniform position with reference to the middle roll.

If the tables M M′, Fig. 2, always rose to a fixed height, suitable to deliver the piece to the rolls or receive it from the rolls when the middle roll was in an intermediate position, then the tables would be too high or too low to receive or deliver the piece to the best advantage when the middle roll was in its lowest or highest positions, respectively. We therefore make projections *r r′* on the bolster C, Fig. 2, heavy enough and in suitable positions to stop the table in its upward motion. When the roll F is in its highest position the tables will rise to their highest position, and the tables will always rise to the same position relatively to the position of the middle roll.

We claim as our invention—

1. In a three-high rolling-mill, a movable middle roll, adapted to be moved into and set at various positions, with reference to the top and bottom rolls, while the mill is running, for the purpose set forth.

2. The combination of the paired screws D D′ and bolster C with each end of the roll F, for the purpose of moving and holding the said roll, as described.

3. In a rolling-mill having a movable roll, the fore plate and catching-plate *a a′*, secured to lugs *q q′* on the movable bolster C, so as to move therewith, as herein described.

4. In a rolling-mill having a movable roll, the combination of the bolster with a lug, stop, or other means adapted to arrest the movement of the table at a uniform position with reference to the said roll, substantially as described.

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Witnesses:
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