(No Model.) 4 Sheets—Sheet 1.

N. W. HOLT.

ROLLER MILL.

No. 440,157. Patented Nov. 11, 1890.

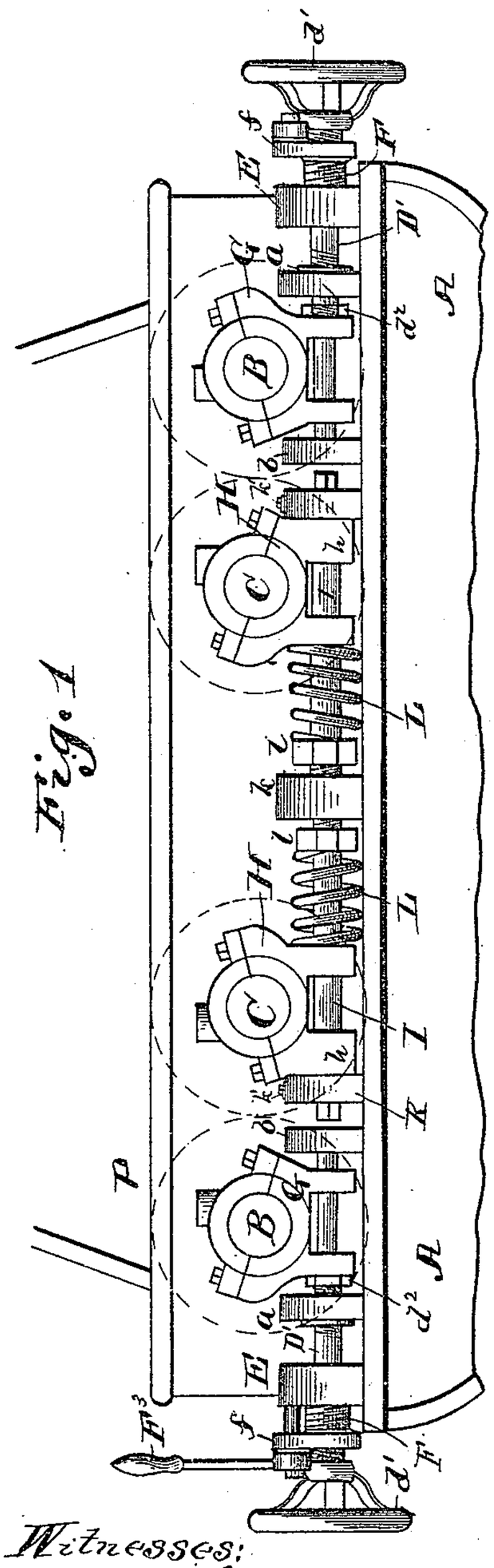

Fig. 1.

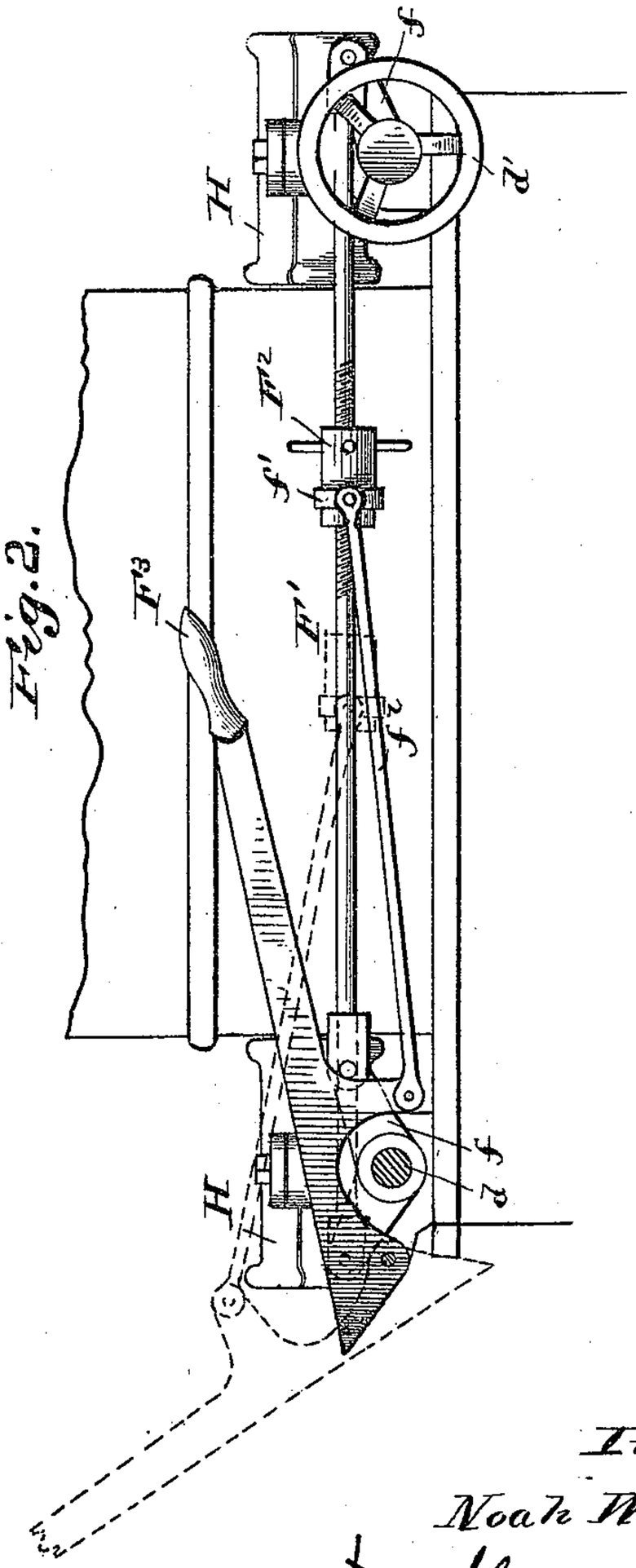

Fig. 2.

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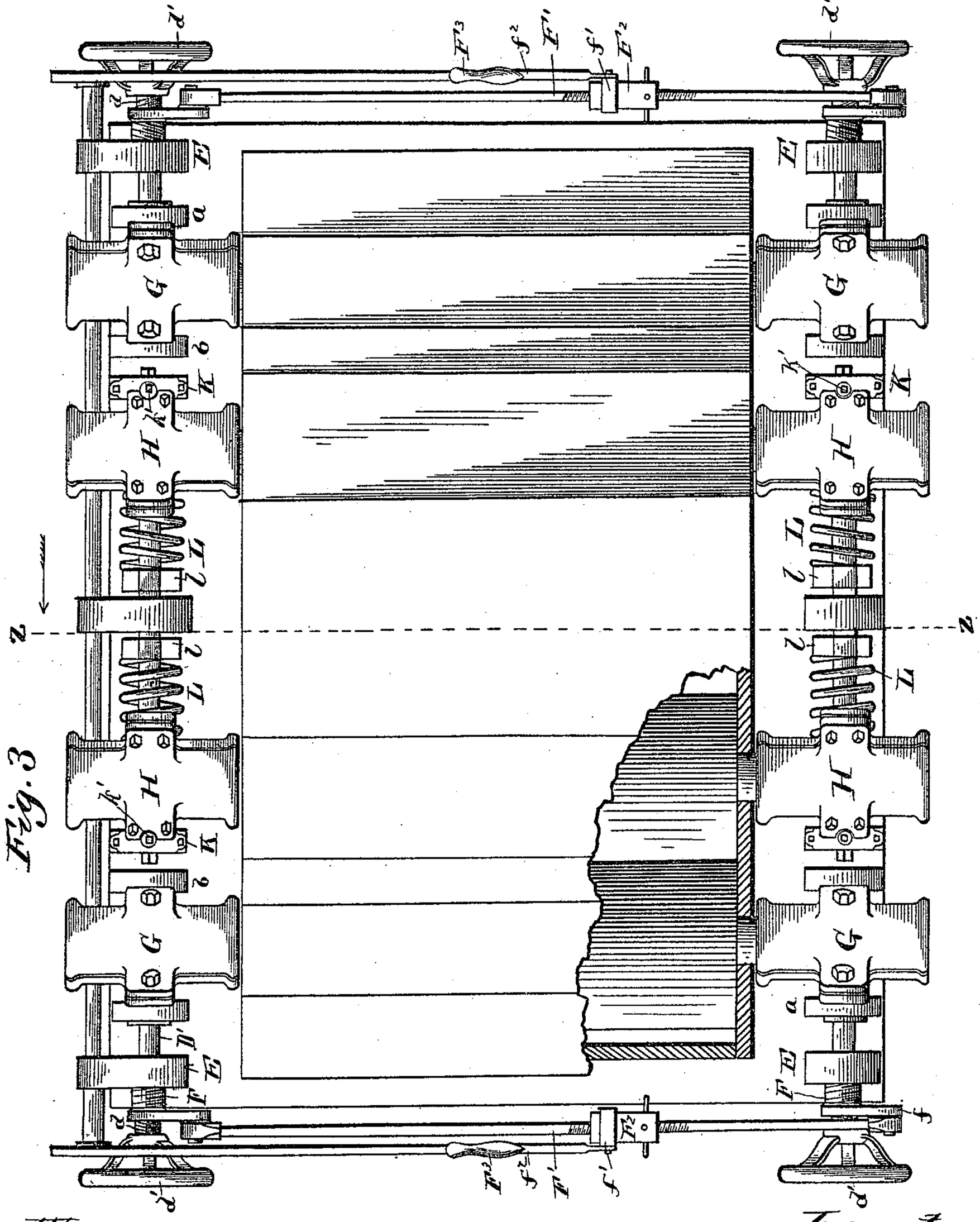
(No Model.) 4 Sheets—Sheet 2.

N. W. HOLT.

ROLLER MILL.

No. 440,157. Patented Nov. 11, 1890.



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N. W. HOLT.

ROLLER MILL.

No. 440,157. Patented Nov. 11, 1890.

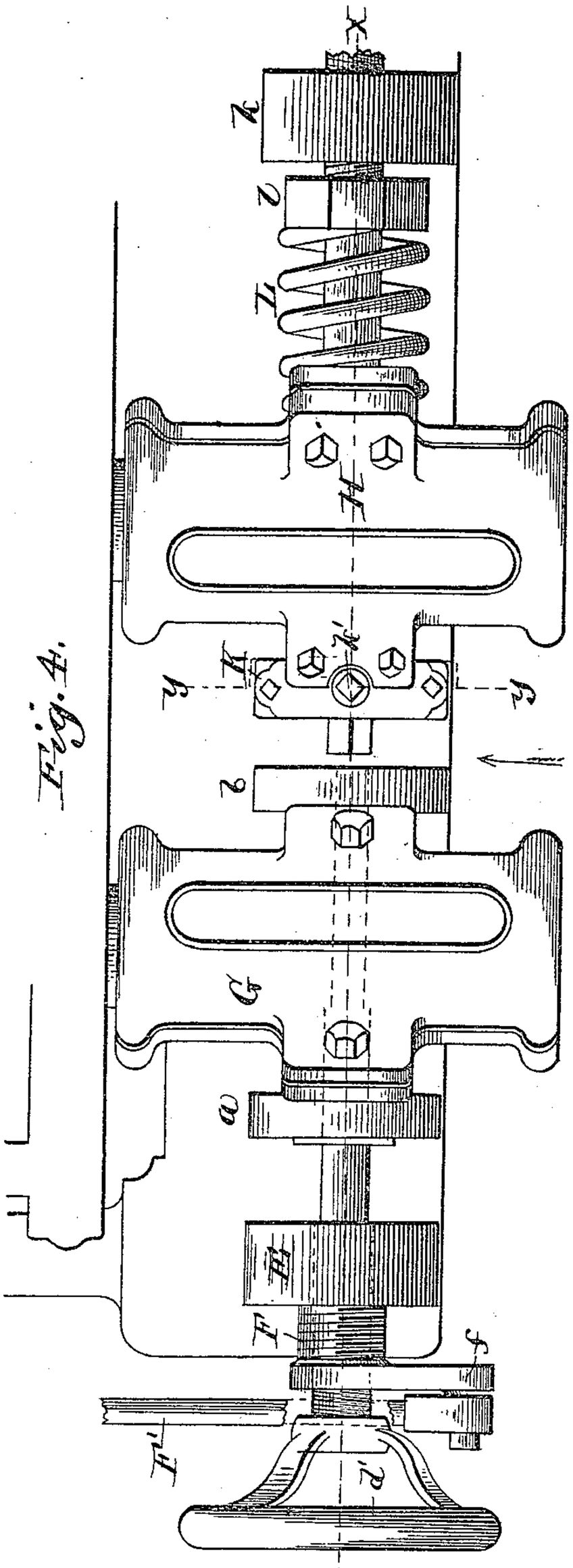

Fig. 4.

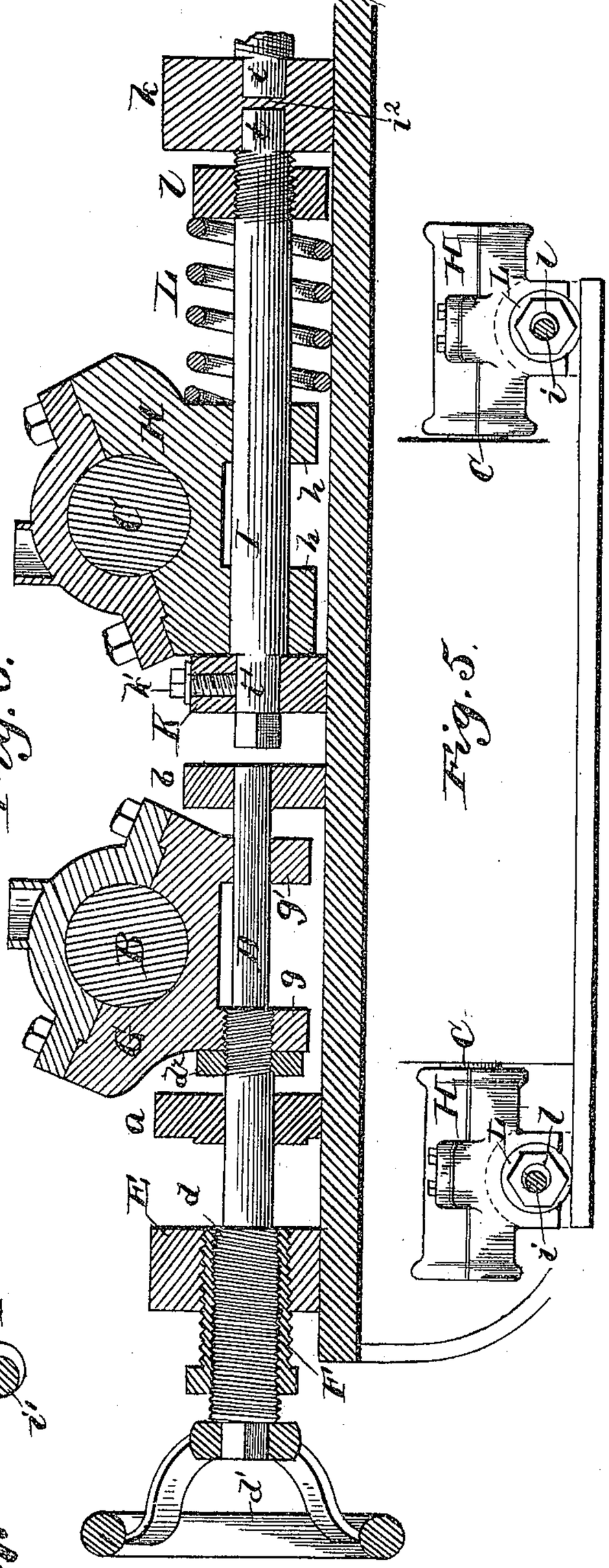

Fig. 6.

Fig. 5.

Fig. 7.

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(No Model.) 4 Sheets—Sheet 4.

N. W. HOLT.
ROLLER MILL.

No. 440,157. Patented Nov. 11, 1890.

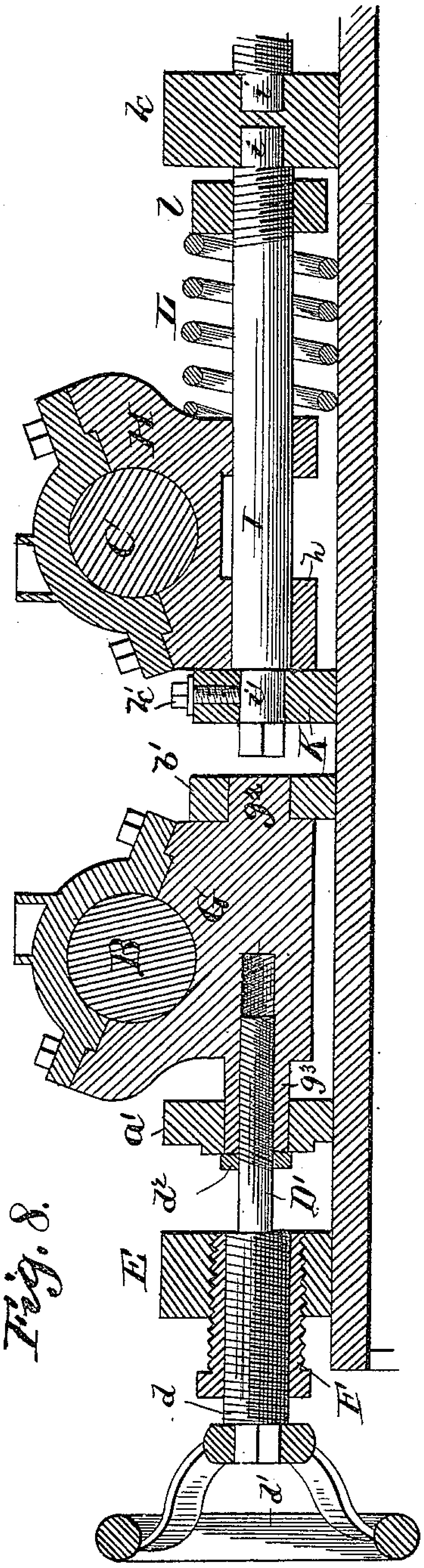

Fig. 8.

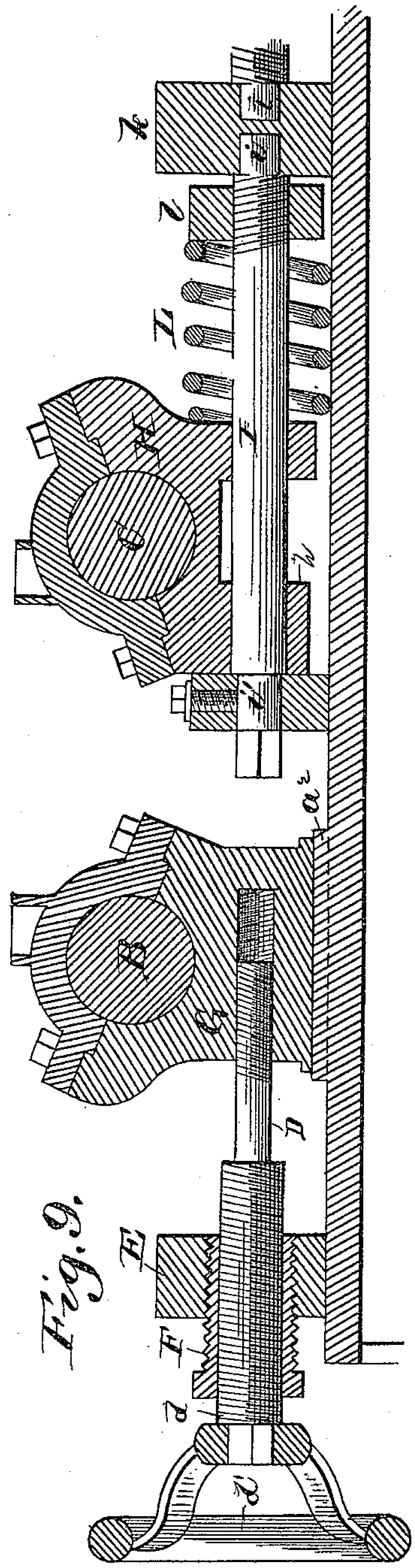

Fig. 9.

Witnesses:
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UNITED STATES PATENT OFFICE.

NOAH W. HOLT, OF MANCHESTER, ASSIGNOR TO THE GEO. T. SMITH MIDDLINGS PURIFIER CO., OF JACKSON, MICHIGAN.

ROLLER-MILL.

SPECIFICATION forming part of Letters Patent No. 440,157, dated November 11, 1890.

Application filed July 3, 1889. Serial No. 316,421. (No model.)

To all whom it may concern:

Be it known that I, NOAH W. HOLT, a citizen of the United States, residing at Manchester, in the county of Washtenaw and State of Michigan, have invented a new and useful Roller-Mill, of which the following is a specification.

My invention relates to the devices for supporting and adjusting the rollers and their bearings, as will be hereinafter pointed out and claimed.

Figure 1 is a side elevation of so much of a roller as is necessary to illustrate my invention. Fig. 2 is an end elevation. Fig. 3 is a top or plan view with part of the casing removed. Fig. 4 is a partial plan view enlarged. Fig. 5 is a vertical section on line *z z*, Fig. 3, looking in the direction of the arrow, Fig. 3. Fig. 6 is a vertical section on line *x x*, Fig. 4, looking in the direction of the arrow, Fig. 4. Fig. 7 is a vertical section of a carrier-bar, taken on line *y y*, Fig. 4. Figs. 8 and 9 show modifications.

In the ordinary use of roller-mills the operator while standing at the front end of the machine examines the chop or break and adjusts the position of the adjustable roller relative to the non-adjustable roller to produce the desired grinding effect upon the material, and as the rolls of a mill are generally arranged in one or more series side by side and in close proximity to each other it is desirable that their construction shall be such that the operator while standing at the front end of each mill, respectively, shall be able to conveniently reach the ground product after it passes between the rolls, and shall also be able to conveniently adjust either end of the adjustable roll separately toward and from the non-adjustable roll to produce a uniform grinding action throughout the entire length of the pair of rolls, and shall also be able to conveniently adjust both ends of the adjustable roll simultaneously and co-ordinately to produce what is commonly known as the "grinding adjustment." So, also, it is desirable that the mechanism for effecting these various adjustments shall be such that the rolls can be separated to stop grinding, and that when the adjustable roll is returned to its work the predetermined grinding adjustment shall not be disturbed, and that the devices for effecting these movements shall be subjected to the least possible strain and consequent wear, and especially that the springs which are ordinarily employed to permit one roller to yield for the passage of non-reducible material shall not be subjected to any increase of tension during the various movements of the adjustable roll which has been referred to. Again, it is desirable that the roll which is not capable of the above-mentioned movements shall be adjustable vertically for the purpose of tramming the rolls, so that their axes shall be in the common plane. In order to attain these desirable conditions and capabilities, I have reorganized a roller-mill to the extent of making the inner roll of the pair adjustable vertically for tramming and movable rearward away from the outer roll, and providing it with springs acting against its bearings to thrust them forward against stops which limit the forward movement of the roll and its bearings, and have provided the outer roll of the pair with adjusting devices which move the roll both forward and rearward to accomplish its above-referred-to adjustments and hold the roll positively up to its work, so that it is non-yielding in its adjusted position, and so that, further, this non-yielding outer roll and its adjusting devices are free from the tension of the springs of the yielding roll.

Whenever in this case I use the words "non-yielding roll" I refer to the outer adjustable roll of the pair, the one which is thrust rearward from the front end of the frame whenever it is moved from its non-grinding position to its grinding position, and whenever I use the words "the yielding roll" I refer to the inner roll of the pair which moves rearward to permit the passage of non-reducible material, and is moved forward by its springs against stops which determine its position relative to the non-yielding roll.

Like reference-letters refer to similar parts in all the figures.

A A denote, generally, the frame-work of the mill, which may be of any usual or approved construction which is adapted for its purpose.

In the illustration shown of my invention

there are four rows arranged in two pairs, of which B B are the front rolls and C C the back rolls; but as the invention is well adapted for use in mills which have but a single pair of rolls I will refer to the roll which is ordinarily adjusted for grinding, and which is moved outward to stop grinding, as the "non-yielding roll," and will refer to the other roll of the pair as the "yielding roll."

As the devices for mounting the bearings of the non-yielding roll are the same at both ends of the roll I will describe them in the singular.

a b are ears or lugs projecting upward from the frame, with bearings or seats for an adjustable carrier shaft or bar D *d*, of which the outer end *d* is of increased diameter and is screw-threaded, its inner end fitting closely its bearings or seats in the lugs *a b*.

E is a lug or post or standard projecting upward from the frame and provided with a screw-threaded seat into which fits a screw-threaded sleeve F, provided with a crank-arm *f*. This sleeve is provided with a screw-threaded seat which fits the screw-threaded part *d*. The threads of the part *d* and of the sleeve F are preferably of different kinds, one being right-handed and the other left-handed, and the external thread of the sleeve is preferably coarser than that of the threaded end *d* of the bar.

The bearing G of the front roller is provided with downward-projecting lugs or ears *g g'*, which are bored to fit closely the inner end D of the bar, so as to oscillate thereon, the connection between these parts being such that while it permits such oscillation there is little or no movement of the bearing G endwise on the bar. This capability of the roller-bearings to oscillate slightly in vertical planes about the carrier-bars practically avoids cramping of the parts and the tendency to heat when in motion, which sometimes arises through imperfections in workmanship, whereby the parts are not in perfect alignment with each other. One of the lugs *g g'*, preferably the front lug *g*, is screw-threaded to fit the thread on that portion of the carrier-bar which enters it.

From the above description it will be readily understood that when the bar D *d* is turned around in the proper direction by means of the hand-wheel *d'* the roller-bearing G and that end of the roller will be moved inward, and will be moved outward by a reverse movement, and is capable of a very fine adjustment. Thus either end of the non-yielding roller may be moved inward or outward independently of the opposite end.

Wherever I use the word "carrier" I refer to a part or device which is made separately from the mill-frame and attached thereto in such position that the roller-bearings are supported thereby, and in the case of the carriers for the roll, which is adjusted toward and from the opposing roll, I prefer that the carriers should be endwise adjustable and that they should be so constructed and mounted that they can be adjusted on right lines in closely-fitting supports, whereby there is insured great accuracy of movement of all the parts with practically no looseness of joints beyond that which is essential to avoid undue friction; and it is evident that by reason of the preferred form of carrier being a rotatory one all the joints or bearing portions may be exceedingly close fitting. I prefer, also, to mount the yielding roll upon rotatory carriers and combine with the carriers and the frame of the mill tramming devices of such character that the yielding roll may be adjusted vertically and independently at each end, and that the bearings of this roll may slide back and forth upon its carriers to permit the passage of non-reducible material between adjacent rolls. I will now describe the preferred construction and arrangement of these above last-referred-to parts, in which the carriers are mounted eccentrically in stationary supports to facilitate tramming, the carriers being provided with nuts which serve as stops to receive one end of each of the springs which at their other ends engage with the roller-bearings.

H is the bearing at the end of the roll, and is provided with one or more downward-projecting lugs *h*, which are bored to fit closely the carrier-bar I, each of the bearings H having a support which is circular in cross-section and about which it can oscillate slightly, so as to avoid liability of cramping of the parts under the various adjustments and movements to which they will be subjected in ordinary use. This carrier-bar has at its ends eccentric bearings *i i'*, which are mounted in ears or lugs K *k*, which project upward from the frame, and are provided with seats which fit the bearings closely. The lug K has a set-screw *k'*, the inner end of which bites the bearing *i'*. The end of the bearing which projects in front of this lug is squared, so that it can be turned by a wrench and thus raise or lower one end of the roll. By preference I so arrange both of these carrier-bars that their longer radii project horizontally to the left or to the right, as the case may be, so that when it is desired to adjust this yielding roll to get it into tram or line with the non-yielding roll it may be advantageously done by turning both these carrier-bars practically simultaneously, thus avoiding undue strain upon any of the parts, it being apparent that if one of these carrier-bars be turned to the right and the other to the left equal distances the tram of the roller will be changed without spreading the bearings H H apart or bring them closer together. After the desired adjustment has been made the parts may be firmly locked into position by means of the set-screws.

Each carrier-bar I has a tension-nut *l* and spring L abutting at its front end against the bearing H, movement of the carrier in an opposite direction being resisted—as, for in-

stance, by a stop i^2. Thus both ends of the yielding roll are thrust forward, their movement in this direction being limited by stops, and in this instance I make use of the upward-projecting lugs $k\,k$ to serve as such stops. The bearings H, like those of the front roll, are free to oscillate about their supports.

F′ is a link pivotally connected at its ends to the crank-arms $f\,f$.

F² is a sleeve-nut mounted on the screw-threaded part of the link and is formed with a groove in which is seated a collar f'.

F³ is a shifting-lever pivoted at one end to the frame and connected with the link F′ by a rod f^2, by means of which devices the non-yielding roll can be adjusted at both ends simultaneously and co-ordinately to secure a proper grinding adjustment. This can be done by turning the sleeve-nut in the proper direction, and by means of the lever the non-yielding roll can be moved away from the yielding roll to stop grinding and be returned without disturbing the grinding adjustment.

From the above description it will be readily understood that each end of the non-yielding roll can be adjusted separately for placing that roll parallel to the yielding roll, that both ends of the non-yielding roll can be simultaneously and co-ordinately moved to place it at proper grinding distance from the yielding roll, and also that the non-yielding roll can be moved bodily away from the yielding roll without disturbing such grinding adjustment, and, further, that adjusting devices are of such character that the non-yielding roll is maintained rigidly in position after it has been moved by any of those devices, while the yielding roll is free to move within reasonable limits to permit the passage of foreign and unyielding substances through the rolls without injuring them, and after such material has passed through the yielding roll is immediately returned into grinding relation with the non-yielding roll through the action of the springs L L. It will also be seen that the lugs K K serve as stops to limit the forward movement of the yielding roll in addition to supporting the forward ends of the carrier-bar, and that those lugs always receive and support the bearings of that yielding roll as they are thrust forward by the springs L L, so that the non-yielding roll, together with its supporting and adjusting devices, are relieved from the thrust of those springs, whereby the non-yielding roll is relieved from outward thrust, except when it is subjected to the impact of the material which is being reduced. Such absence of spring pressure or tension upon the non-yielding roll and its supporting devices greatly facilitates accurate adjustments and relieves those parts from the wear and tear to which they are ordinarily subjected in mills so constructed that the adjustable roll is also the yielding roll. Again, in my invention the adjusting devices are exceedingly simple, compact, and direct in their operation, while all of their parts are within convenient reach of the miller when occupying his ordinary position for examining the character of the reductions which is being made. A suitable drive may be employed with these rolls, the illustration of which I, however, omit for the purpose of securing a clearer illustration of the parts of the machine to which this invention relates.

A modification of the devices for mounting and shifting the non-yielding roll is shown in Fig. 8, in which the bearing G is provided with rearward and forward projecting trunnions $g^2\,g^3$, which are mounted, respectively, in the upward-projecting lugs $a'\,b'$. The trunnion g^3 is screw-threaded internally and receives the inner screw-threaded end D′ of a rod, the outer end d of which is also screw-threaded into the screw-threaded sleeve F. The threads at the ends of the rods differ in pitch.

The roller-bearing G can be moved forward and back by the rod D′ d and locked in position by the jam-nut d^2. This lock-nut also prevents the screw-rod from turning with the sleeve F when the latter is turned; but ordinarily no such jam-nut will be required on the rod D d of the preceding figures, because the friction between such bar and its seat in the lugs or lug of the bearings will hold it from turning, such friction being due in part to the weight of the bearings and the roll.

In Fig. 9 I have shown another modification, in which the non-yielding roll rests upon the main frame, which has horizontal ways a^2, on which the bearing is moved toward and from the yielding roll. While the sleeve F, crank-arm f, link F′, sleeve F², collar f', lever F³, and rod f^2 are substantially the same in construction and operation as are the corresponding parts in my patent, No. 286,440, except that as shown herein, the lever F³ does not rest upon the threaded part d of the carrier nor engage therewith when the adjustable roller is returned to its grinding adjustment after the rollers have been separated to stop grinding, yet there are fewer parts in the present shifting devices, such reduction in number being made possible by the reorganization which I have made, whereby the horizontally-adjustable roller is made non-yielding. This enables me to dispense with the intermediate sleeves marked d in my said earlier patent and combine the threaded sleeves F directly with the threaded parts d of the carrier-shafts, whereby the carrier-shafts are adjusted endwise positively in both directions as the sleeves are rotated, and whereby, also, these carrier-shafts are made to support the outward thrust which is produced upon the adjustable non-yielding roller during the operation of grinding. Again, in my said prior patent the friction produced by the springs $e\,e$ resists the tendency to rotate the threaded sleeves d and horizontal screw-bolts c of that patent, whereas in Figs. 1 to 7 of my present construction the carrier-bars D d are supported against rotation by frictional contact with the lugs $a\,b$,

and may also be locked to the bearings by the jam-nuts d^2. In my said earlier patent the screw-bolts c and their attached roller-bearings are thrust inward by means of springs, whereas in this new mill the carrier-bars are moved inward positively whenever they are to be rotated in the proper direction by the hand-wheels d' or by the rotation of the sleeves F. Of course the lever and rod f^2 when the pivots of the rod and the lever are in line support the sleeve F^2 against endwise movement, so that the roller-bearings can be simultaneously and co-ordinately moved to effect a grinding adjustment, the sole function of these parts (the lever and rod f^2) being to thus support that sleeve. When, however, it is desired to separate the rolls to stop grinding, then the lever and rod perform another and distinct function—to wit, that of moving the sleeve F^2 endwise, carrying with it the screw-threaded link F', rotating the sleeves F, and moving the roller-bearings positively in alternately-opposite directions.

While I have shown and described the best mode now known to me for carrying out my improvement, I do not wish to be limited to the particular construction of parts shown, because many modifications in the details thereof will readily suggest themselves to any one skilled in the art without going outside of my invention.

What I claim is—

1. The combination, with the frame of the mill, of the non-yielding roll, the yielding roll arranged in rear of the non-yielding roll, carriers between the yielding roll and the frame of the mill, roller-bearings sliding on the carriers, springs to thrust the yielding roll forward, and stops which limit its forward movement, substantially as set forth.

2. The combination, with the frame of the mill, of the non-yielding roll, the yielding roll arranged in rear of the non-yielding roll, round carriers between the yielding roll and the frame of the mill, said carriers being eccentric to the frame of the mill, and roller-bearings mounted on the carriers, substantially as set forth.

3. The combination, with the frame of the mill, of the yielding roll, the carriers between the yielding roll and the frame of the mill, the springs for thrusting the yielding roll forward, stops which limit its forward movement, and adjustable stops on the carriers for regulating the tension of the springs, substantially as set forth.

4. The combination, with the frame of the mill, of the non-yielding roll, the yielding roll arranged in rear of the non-yielding roll, springs to thrust the yielding roll forward, stops which limit its forward movement, and means for adjusting the ends of the yielding roll separately and vertically, substantially as set forth.

5. The combination, with the frame of the mill, of the horizontally-adjustable non-yielding roll, the yielding roll, vertically-adjustable carriers below the yielding roll, and roll-bearings sliding on the carrier, substantially as set forth.

6. The combination, with the frame of the mill provided with carrier-supports, of the yielding roll, carriers mounted at their ends in the carrier-supports, roll-bearings sliding on the carriers, springs to thrust the yielding roll toward the non-yielding roll, stops which resist the thrust of the springs, projections on the carriers, which engage with the springs, and stops which support the carrier against the thrust of the springs, substantially as set forth.

7. The combination, with the frame of the mill and the non-yielding roll, of the yielding roll, carriers between the yielding roll and the frame of the mill, and tramming devices for the yielding roll, substantially as set forth.

8. The combination, with the frame of the mill, of the yielding roll, carriers mounted at their ends on the frame of the mill, roll-bearings mounted on the carriers and adapted to slide endwise thereon, and fixed stops which limit the movement of the roll-bearings toward the opposing roll, substantially as set forth.

9. The combination, with the frame of the mill, of carriers mounted upon the frame, roll-bearings sliding upon the carriers, and springs and stops upon opposite sides of the roll-bearings, substantially as set forth.

10. The combination, with the frame of the mill provided with carrier-supports, of carriers mounted at the ends in the carrier-supports, roll-bearings sliding on the carriers, and springs which thrust the roll-bearings against carrier-supports, whereby said supports serve as stops to limit the movement of the roll-bearings.

11. The combination, with the frame of the mill, of the non-yielding roll, the yielding roll arranged in rear of the non-yielding roll, springs to thrust the yielding roll forward, stops which limit its forward movement, horizontal carriers below the yielding roll and arranged transversely to its axis, roll-bearings sliding on the carriers, and horizontal carriers below the non-yielding roll and arranged at right angles to its axis, substantially as described.

12. The combination, with the frame of the mill, of the non-yielding roll, the yielding roll arranged in rear of the non-yielding roll, horizontal carriers below the yielding roll and arranged transversely to its axis, roll-bearings sliding on the carriers, horizontal carriers below the non-yielding roll and arranged at right angles to its axis, and sliding bearings between the non-yielding roll and its carriers, substantially as set forth.

13. The combination, with the frame of the mill, of the non-yielding roll, sliding bearings at its ends, stationary supports for the bearings, screw-threaded shafts for moving the bearings forward and backward and support-

ing them rigidly in their adjusted positions, and a yielding roll arranged in rear of the non-yielding roll and provided with springs to thrust said yielding roll forward, substantially as described.

14. The combination, with the frame of the mill, of the non-yielding roll, carrier-shafts mounted in stationary supports projecting upward from the frame of the mill, and the threaded bearings connecting the roll ends with the carrier-shafts, substantially as described.

15. The combination, with the frame of the mill provided with stationary carrier-supports, of a roll, endwise-adjustable carrier-shafts mounted in the stationary supports, and roll-bearings connected with and supported by the endwise-adjustable carrier-shafts, substantially as described.

16. The combination, with the frame of the mill provided with carrier-supports, part of which are internally screw-threaded, of a roll, endwise-adjustable screw-threaded carriers mounted in the stationary supports, and roll-bearings provided with internal screw-threads and mounted on the carriers, substantially as described.

17. The combination, with a roller and its bearings, of the carrier-supports projecting from the frame of the mill, and carriers mounted eccentrically in the carrier-supports, substantially as described.

18. The combination, with the frame, of the mill provided with carrier-supports, carrier-bars mounted at their ends in the carrier-supports and provided with stops to prevent their backward movement, roll-bearings sliding on the carrier-bars, and springs adapted to move the roll-bearings forward upon the carrier-bars, substantially as described.

19. The combination, with a roll, of supports projecting from the frame of the mill, rotating carrier-bars mounted eccentrically in the supports and transverse to the roller-axes, and roll-bearings mounted on the carrier-bars and adapted to oscillate thereon, substantially as described.

20. The combination, with a roll, of supports projecting from the frame of the mill, rotating carrier-bars mounted eccentrically in the supports and transverse to the roller-axes and constructed to receive a wrench for turning them in their bearings, and roll-bearings mounted on the carrier-bars, whereby the roller can be adjusted vertically, substantially as described.

21. The combination, with a roll, of carrier-bars, roll-bearings sliding on the carrier-bars, springs surrounding the carrier-bars and engaging at one end with the roll-bearings, stops on the carrier-bars to engage with the opposite ends of the springs, and supports on the mill-frame to receive the carrier-bars and support them against the endwise thrusts of the springs, substantially as described.

22. In a roller-mill, the combination, with the frame of the mill and a horizontally-adjustable roll, of endwise-adjustable sleeves mounted on the frame, carrier-bars each mounted at one end within one of the sleeves and connected at its inner end to a roller-bearing, and means for adjusting the bars positively in both directions relatively to the sleeves, substantially as set forth.

23. In a roller-mill, the combination, with the mill-frame and a horizontally-adjustable roll, of endwise-adjustable sleeves mounted on the frame, and bars each mounted at one end within one of the sleeves and adjusted positively in both directions with such sleeve and adjustably connected at its inner end to a roller-bearing, substantially as set forth.

24. In a roller-mill, the combination, with the mill-frame and a horizontally-adjustable roll, of externally and internally threaded sleeves mounted on the frame, and bars each screw-threaded at its outer end and engaging at said outer end with the internal thread of one of the sleeves and connected at its inner end with a roller-bearing, substantially as set forth.

25. In a roller-mill, the combination, with the mill-frame and a horizontally-adjustable roll, of endwise-adjustable sleeves mounted on the frame, bars each mounted at one end within one of the sleeves and positively adjusted in both directions with such sleeve and connected at its inner end by screw-threads with a roller-bearing, and means for locking the bars against rotation, whereby the sleeves may be rotated independently of the bars, substantially as set forth.

NOAH W. HOLT.

In presence of—
JNO. E. WINN,
H. H. DOUBLEDAY.