No. 846,497. PATENTED MAR. 12, 1907.

W. J. MUNCASTER.

MACHINE FOR STRAIGHTENING SHAFTING AND THE LIKE.

APPLICATION FILED JAN. 4, 1906.

6 SHEETS—SHEET 1.

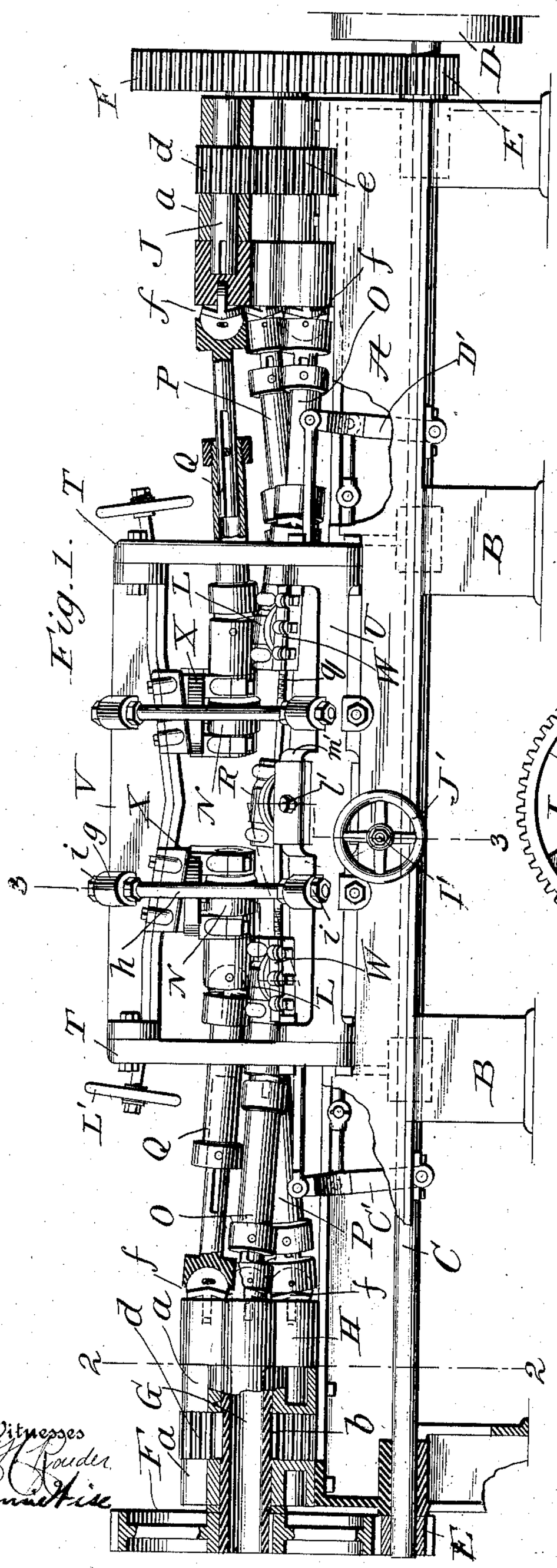

Fig. 1.

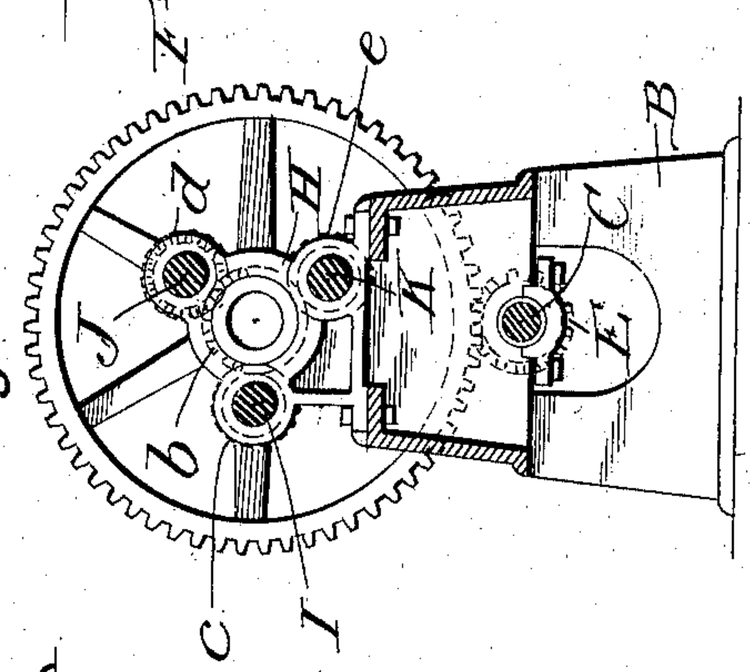

Fig. 2.

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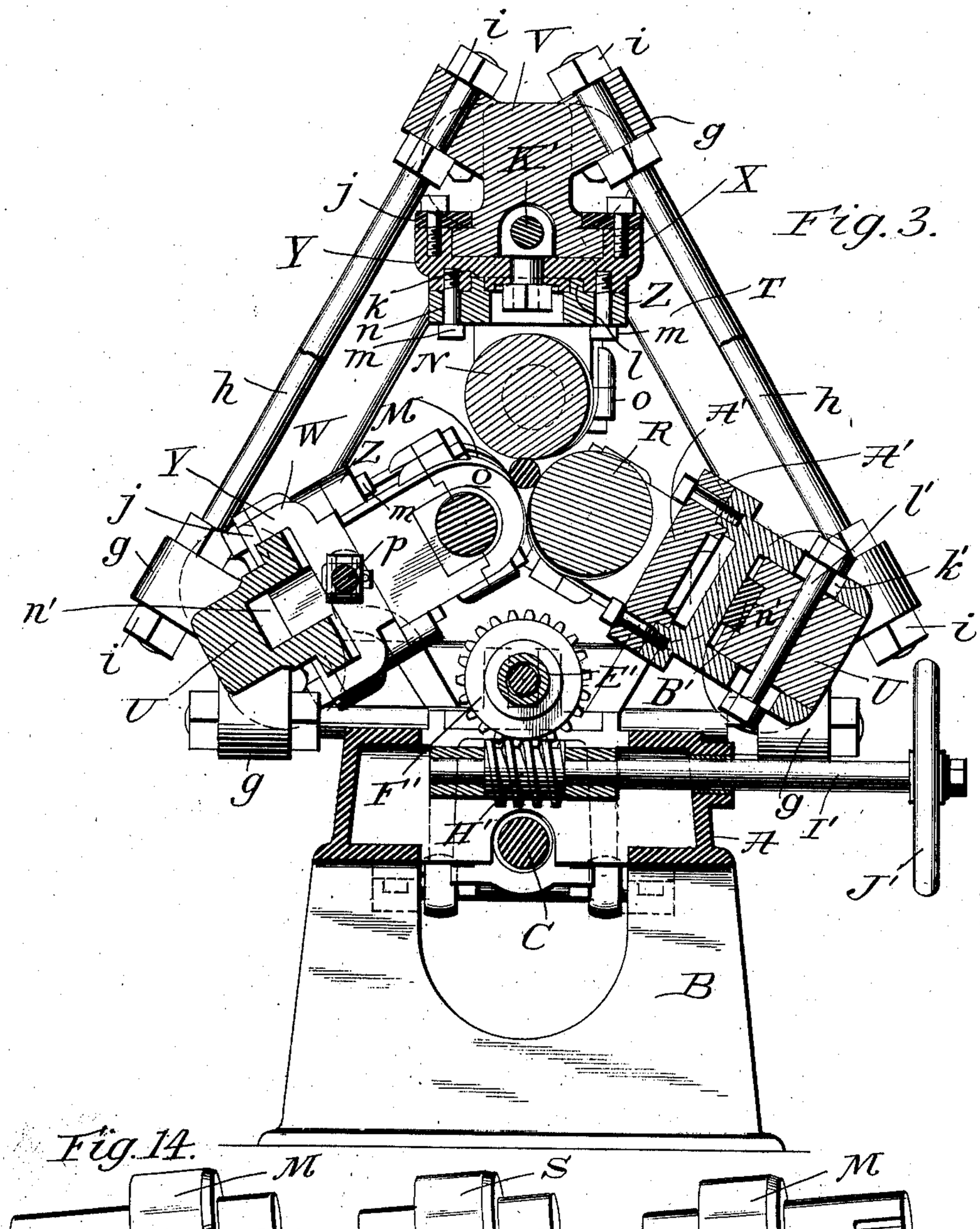
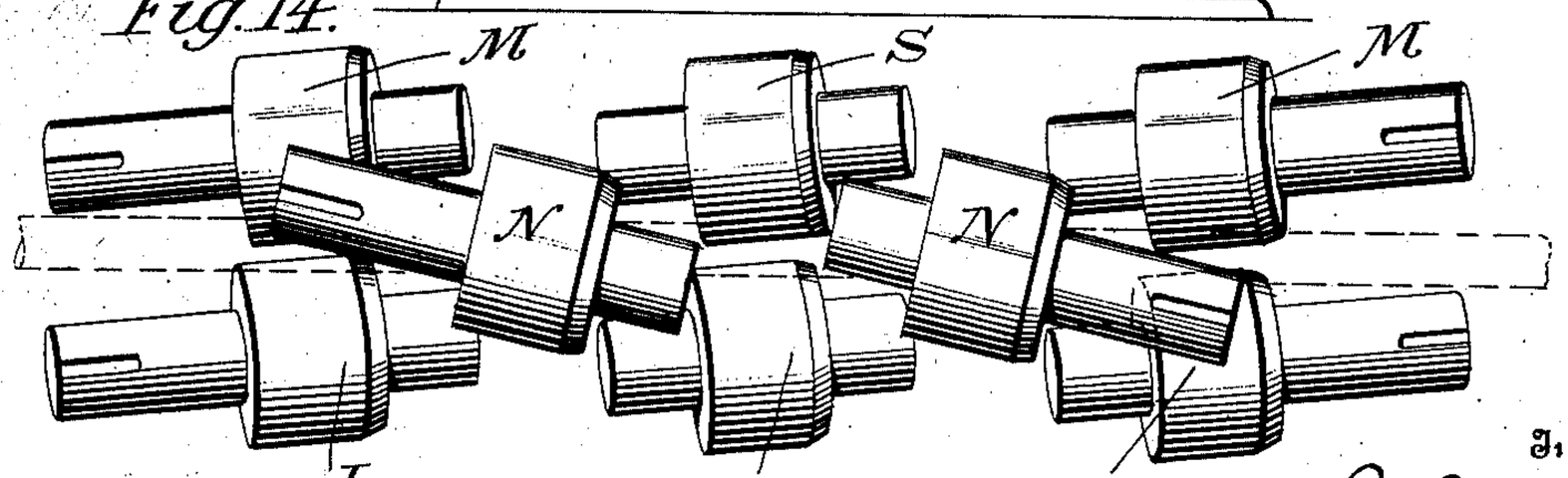


Fig. 3.

Fig. 14.



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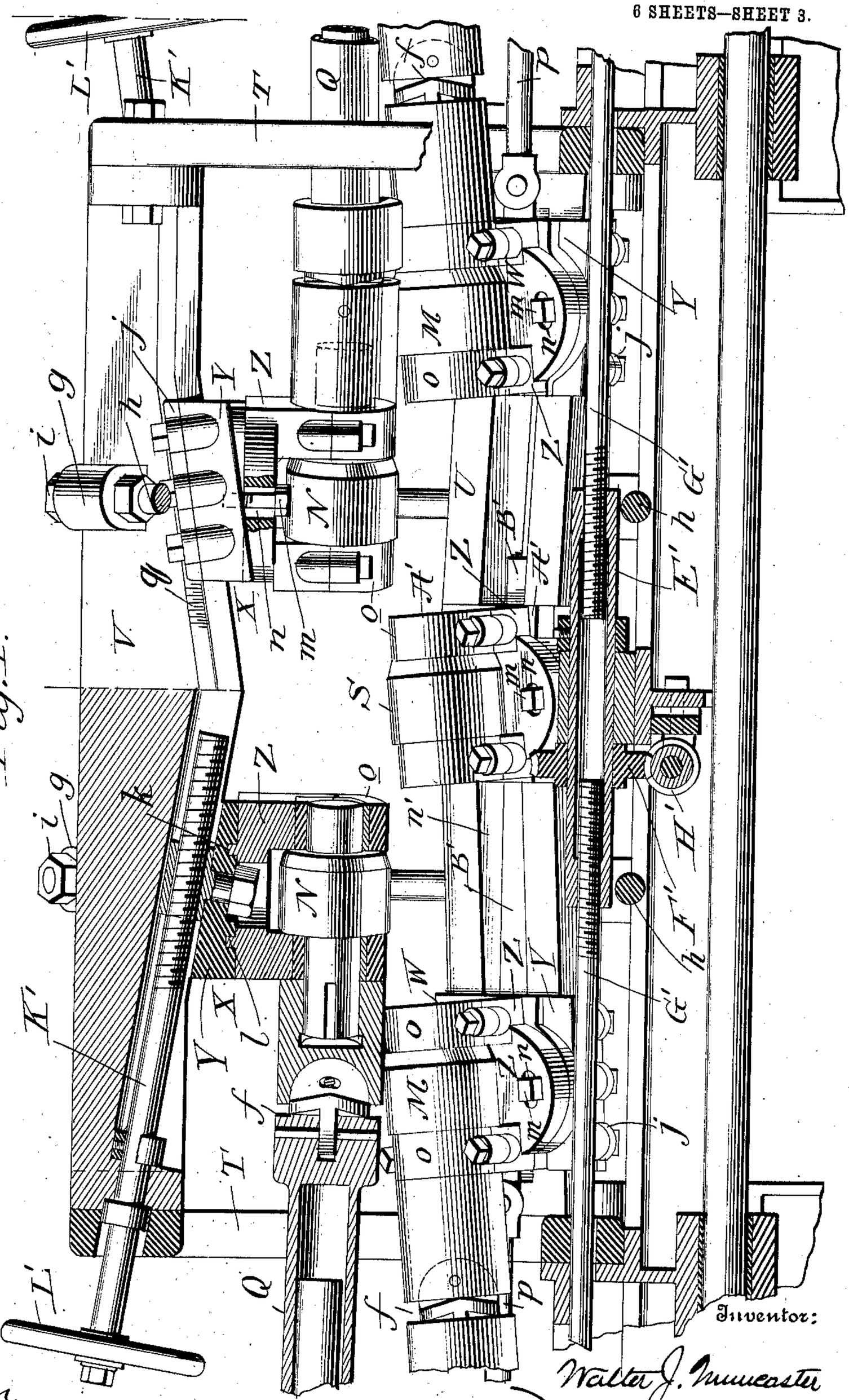

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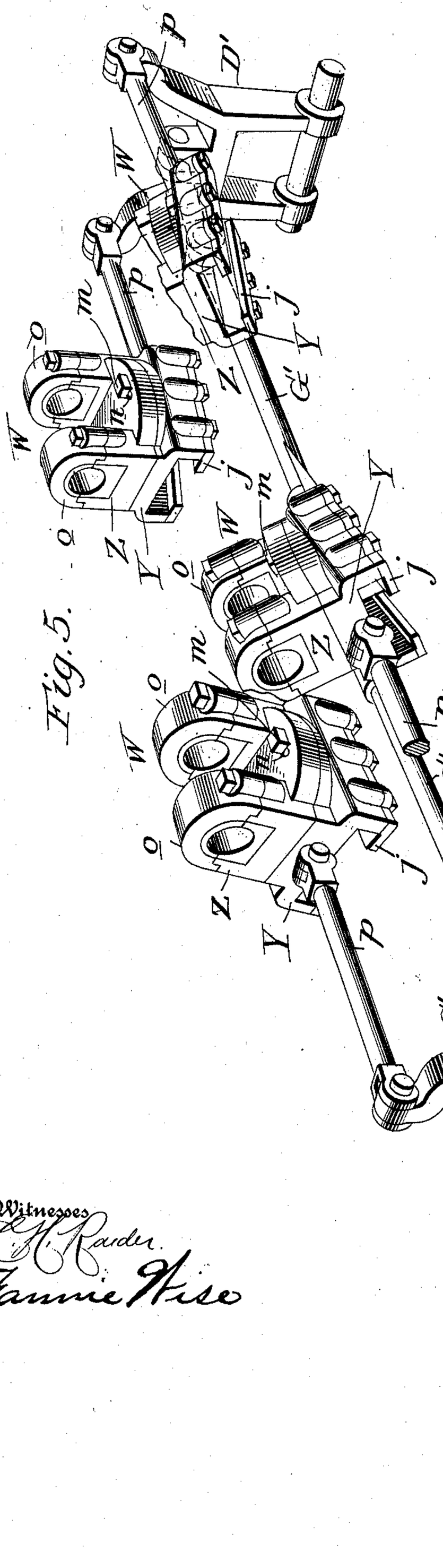

Fig. 5.

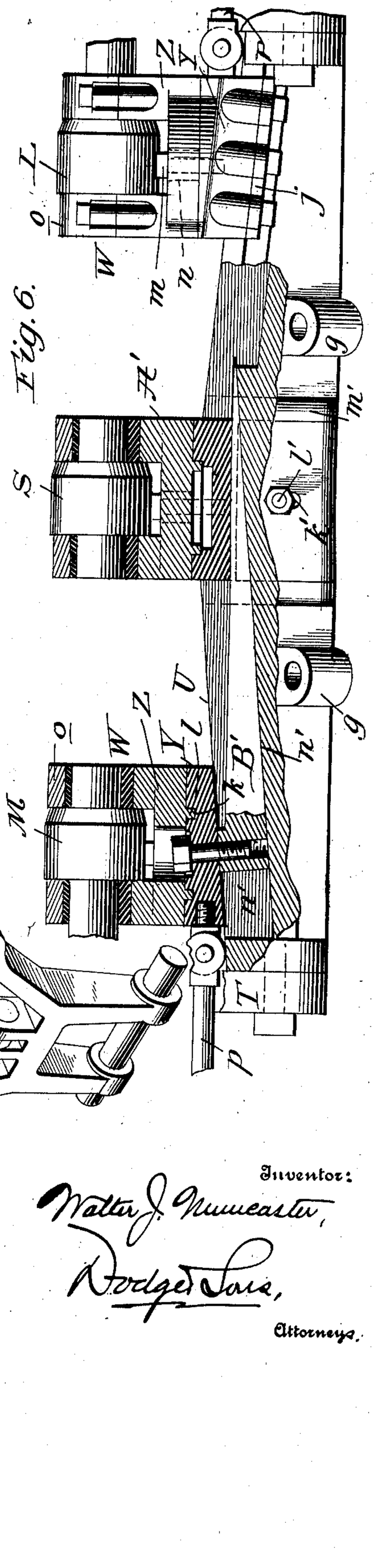

Fig. 6.

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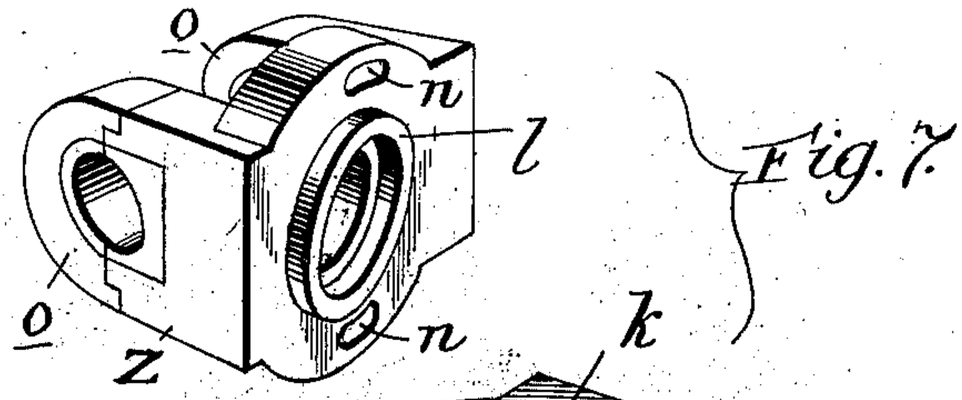


Fig. 7.

Fig. 8.

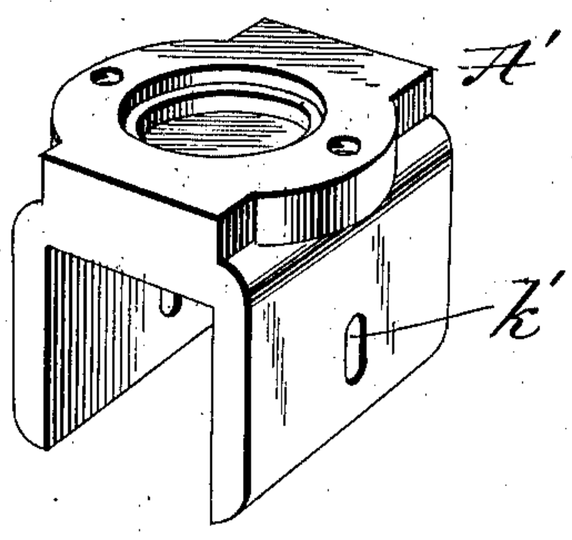


Fig. 9.

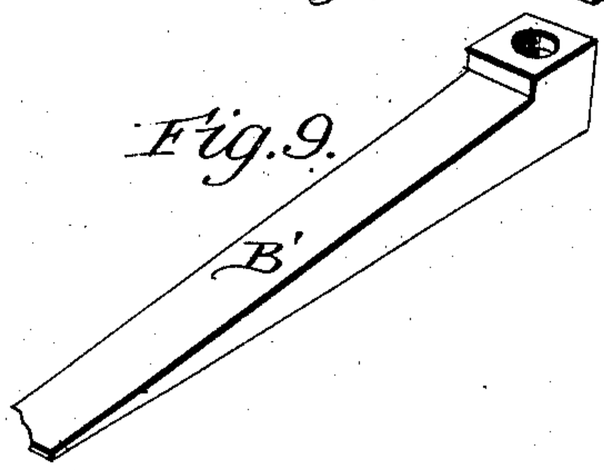
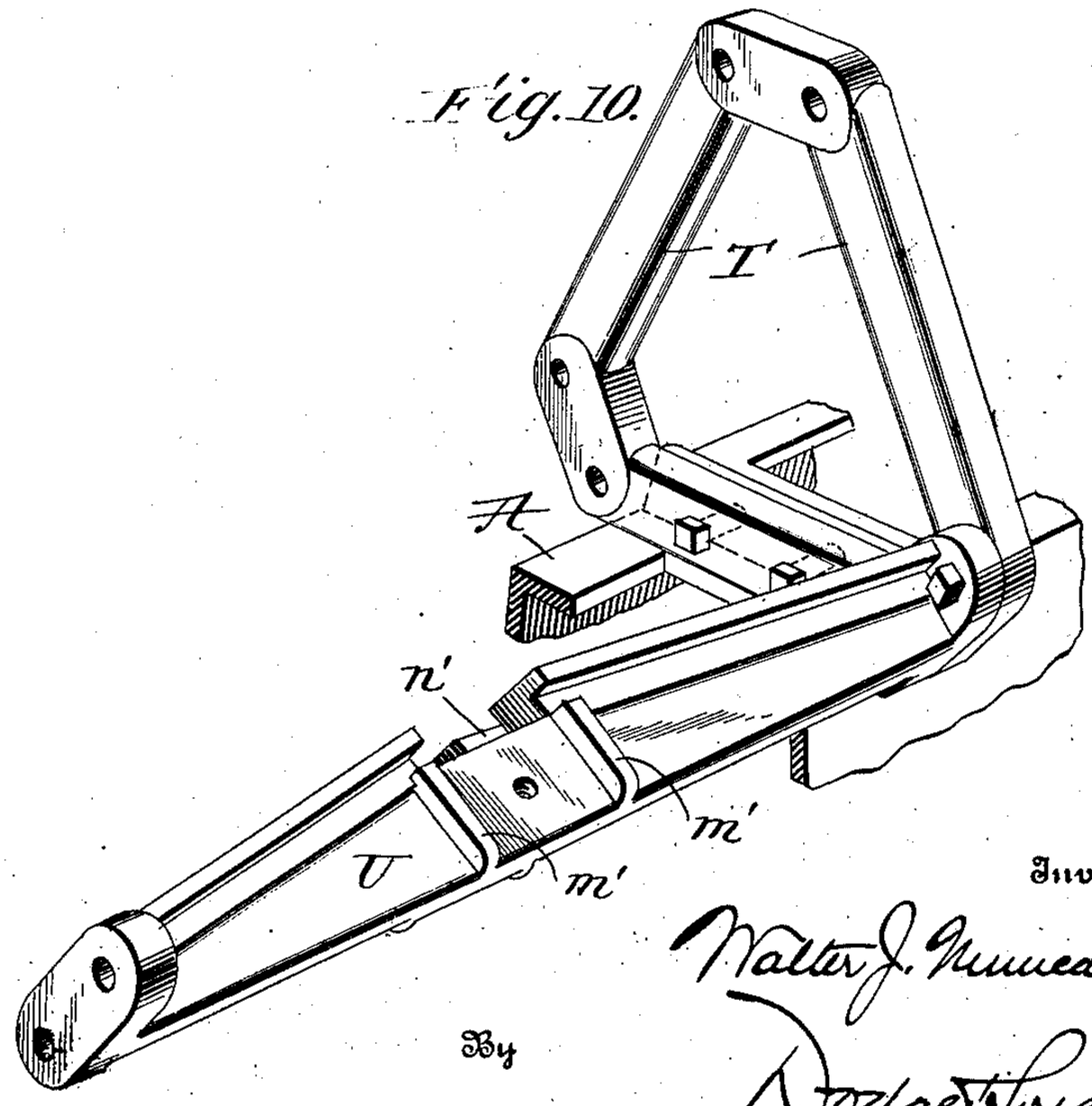


Fig. 10.



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W. J. MUNCASTER.

MACHINE FOR STRAIGHTENING SHAFTING AND THE LIKE.

APPLICATION FILED JAN. 4, 1906.

6 SHEETS—SHEET 6.

Fig. 11.

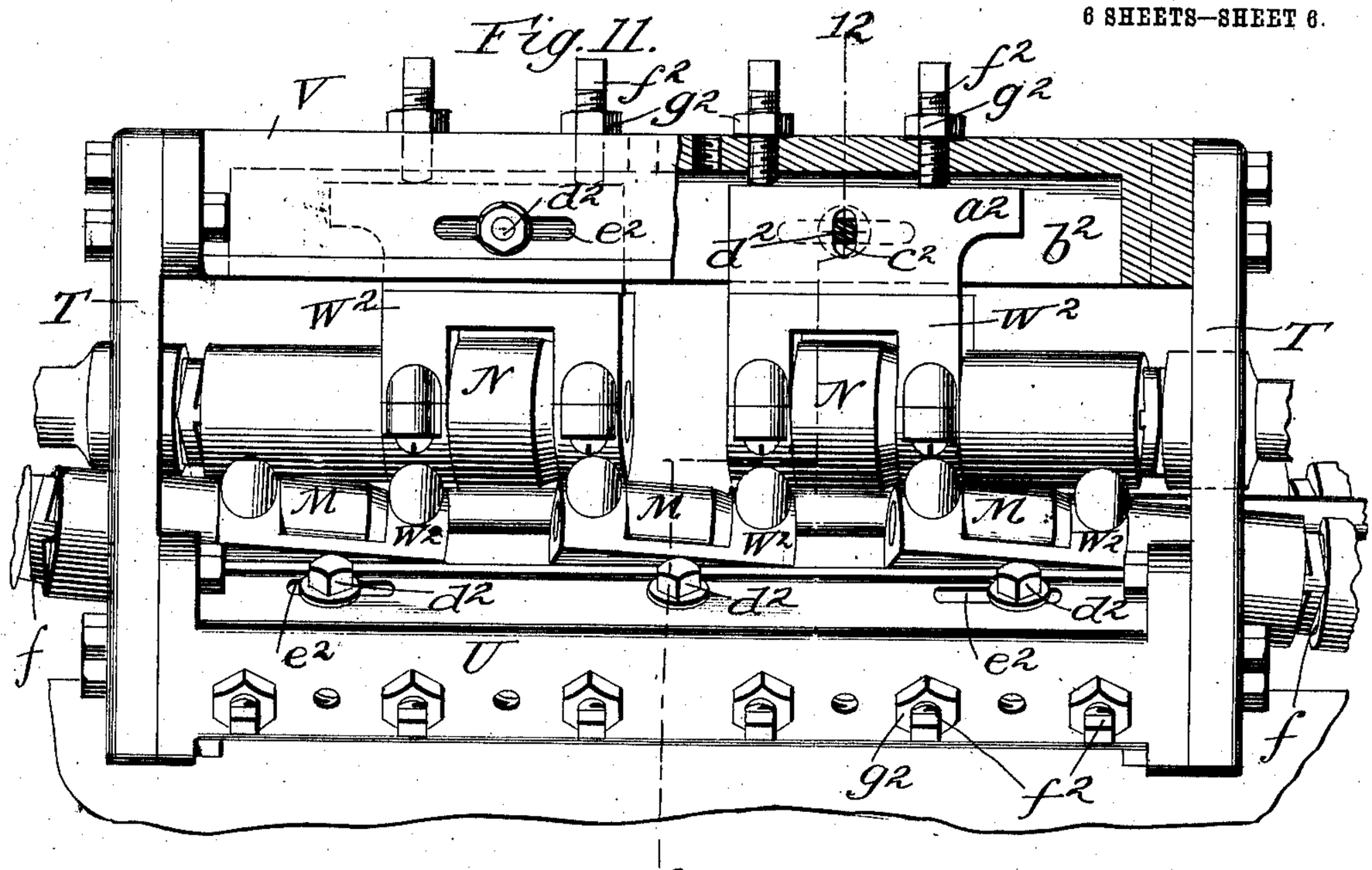


Fig. 12.

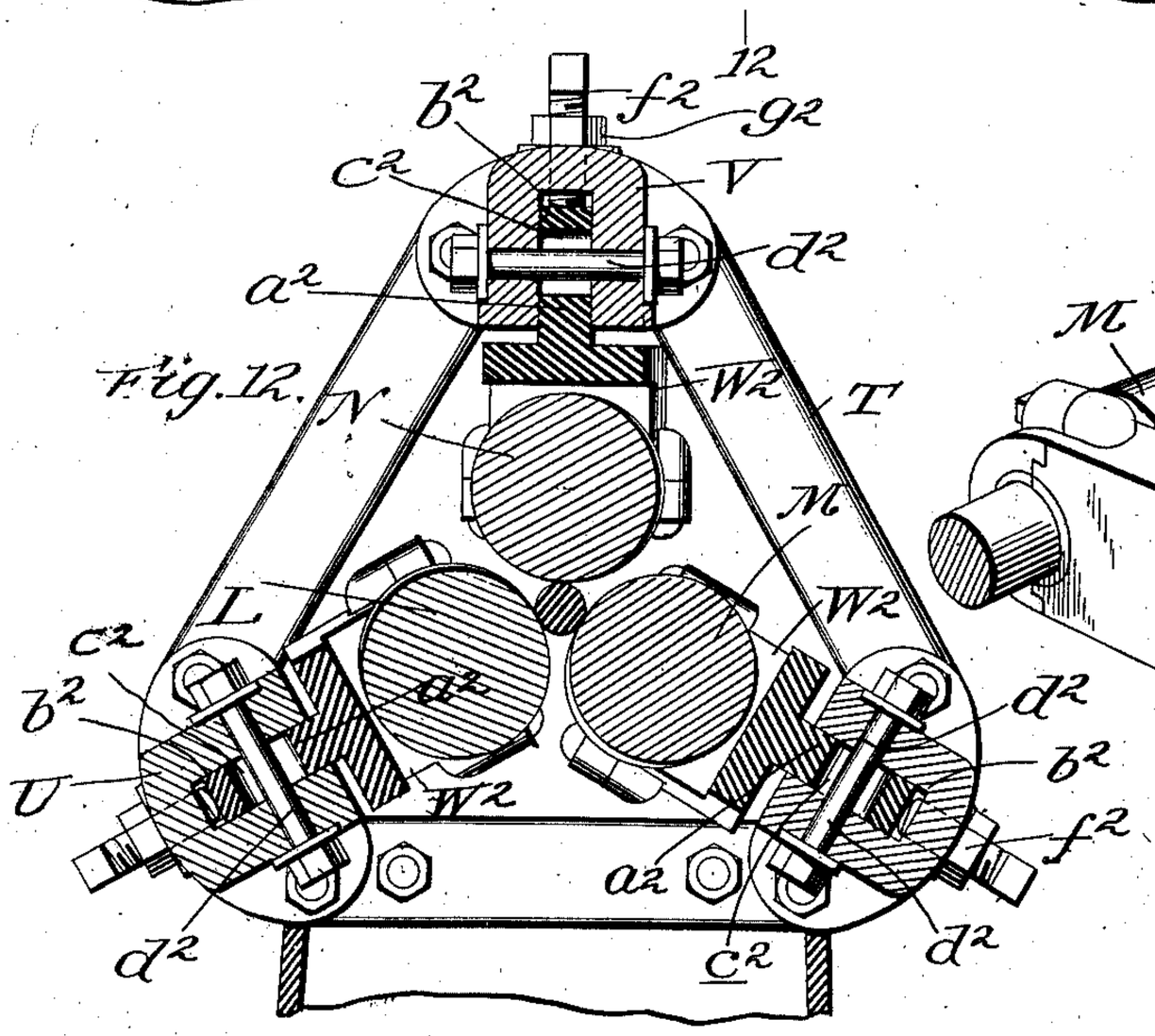
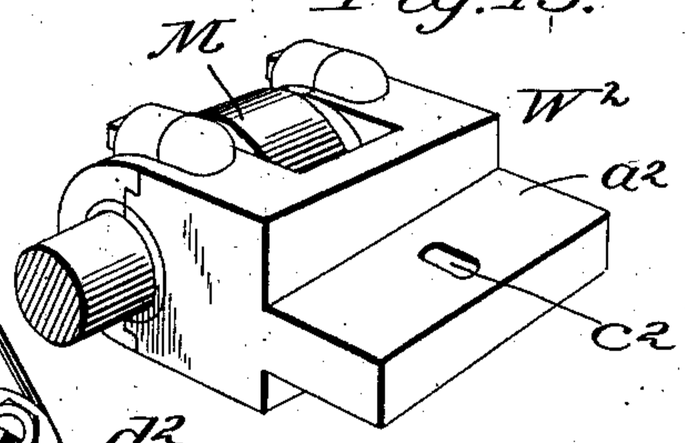


Fig. 13.



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UNITED STATES PATENT OFFICE.

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MACHINE FOR STRAIGHTENING SHAFTING AND THE LIKE.

No. 846,497. Specification of Letters Patent. Patented March 12, 1907.

Application filed January 4, 1906. Serial No. 294,632.

To all whom it may concern:

Be it known that I, WALTER J. MUNCASTER, a citizen of the United States, residing at Cumberland, in the county of Allegany and State of Maryland, have invented certain new and useful Improvements in Machines for Straightening Shafting and the Like, of which the following is a specification.

My invention has reference to a machine for straightening shafting, rods, bars, tubing, and the like, and consists in various novel features, details, and combinations, hereinafter set forth with the aid of the accompanying drawings, wherein—

Figure 1 is a front elevation of the machine with portions broken away or in section; Fig. 2, a vertical cross-section on the line 2 2 of Fig. 1 looking toward the left; Fig. 3, a similar section on the line 3 3 of Fig. 1 looking toward the right; Fig. 4, a partly-sectional elevation of the middle portion of the machine; Fig. 5, a perspective view designed to illustrate the relative positions of the sliding journal boxes or bearings of the adjustable lower rolls and their connections; Fig. 6, a partially-sectional elevation of one set of the lower rolls, showing the wedge by which the intermediate roll is adjusted; Fig. 7, a perspective view of one of the roll-supports and its base or turn-table; Fig. 8, a perspective view of the base of one of the intermediate roll-carriages; Fig. 9, a perspective view of one of the wedges used to raise the intermediate lower roll-bearings; Fig. 10, a perspective view of a portion of the framework on which the roll-supports are mounted and guided; Fig. 11, a partially-sectional elevation of the working portion of a machine embodying my invention in simpler but less perfect form; Fig. 12, a cross-section on the line 12 12 of Fig. 11; Fig. 13, a perspective view of one of the rollers of said simpler machine and its support or carrier; Fig. 14, a diagrammatic elevation of the rolls, showing the oblique arrangement of their axes with reference to one another and to the common axis about which all are grouped.

My primary purpose is to true and straighten highly-finished shafting, tubing, and the like, and to do this it is essential that the mechanism act with precision and that it exert no abrading, rubbing, or tearing effect upon the body treated, but that it act only by rolling and exert its force in lines truly radial to the axis of such body. Incidental to the attainment of this result is the prompt, convenient, and accurate adjustment of the rolls to suit bodies of different diameters.

The objects stated are efficiently attained by the machine illustrated in Figs. 1 to 10, inclusive, and may be quite well accomplished by the simpler embodiment of my invention illustrated in Figs. 11 to 13, inclusive.

Referring first to the more complete form of the machine, its construction will now be described.

Fig. 1 gives a good idea of the general appearance of the machine, which consists of a substantial bed or frame A, carried on stools or pedestals B and having mounted in or upon it the several sets of rollers by which the straightening is performed, together with the gearing for rotating and the devices for adjusting the said rollers. The driving-gear comprises a main shaft C, carried in boxes or bearings in frame A and bearing at one end a belt-wheel D, through which to receive motion from any convenient prime motor, and at or near each end a pinion E, which meshes with and gives rotation to a large gear-wheel F. Each gear F is keyed or otherwise made fast upon a tubular shaft G, and each shaft G is journaled or carried in bearings *a a* of vertical housings H H, bolted or otherwise secured upon frame A. Each shaft G is furnished with a pinion *b*, which meshes with three similar pinions *c*, *d*, and *e*, carried by three shafts I, J, and K, journaled in bearings in the housings H H, as shown in Figs. 1 and 2. The tubular shafts G serve to give motion, through the pinions named, to the three shafts, yet being tubular in form permit the shafting or other body operated upon to be passed longitudinally through them and through the space between the three shafts I J K. Each of the three shafts just mentioned gives rotary motion to one or another of three rollers L M N, which are grouped about the projected axis of tubular shaft G in what may be termed "spiral" order or arrangement—that is to say, their axes are oblique to each other and to the common axis

about which they are grouped, as best illustrated in Fig. 14. To effect this rotation of the rollers L M N, I provide between them and shafts I J K connecting rods or shafts O P Q, the ends of which connect with shafts I J K and with rolls L M N by means of universal joints *f* of suitable construction. As the rolls L M N are made longitudinally adjustable, the connecting rods or shafts O P Q are made telescopic, as seen in Fig. 1, a cross-pin, spline, feather, or other means being provided to prevent rotation of either section of the telescopic shaft independently of the other.

In the foregoing description I have indicated that both sets of rolls L M N are positively driven, and in practice such is the preferred arrangement, though I may in some cases drive one set only. It will be seen by referring to Figs. 1 and 4 that the two lower rolls L and M of each group occupy like positions in the length of the machine, while the third roll N of each group is not directly over the rolls L M, but is set nearer the mid-length of the machine. At a point between the proximate ends of the upper rolls N, but at the same level as and in like position with rolls L M, is another pair of rolls R S. The various rolls are so spaced that the lower rolls L and M, R and S, L and M alternate in longitudinal order or arrangement with the upper rolls N N, or, in other words, rolls N N lie over the gaps or spaces between the lower roll pairs L M, R S, and L M. The lower rolls form a bed or support for the rod, shaft, or other body, and the rolls L M, together with the upper rolls N, serve to rotate and to advance such rod or shaft. If the shaft or rod be bent so that portions are eccentric to the longitudinal axis, such portions in passing beneath the rolls N will be pressed by said rolls downward or inward at a point immediately beneath rolls N, and consequently between the supporting-roll pairs L M and R S. Since the shaft travels from end to end between the rolls, every portion of its length is acted upon and straightened.

An important feature of the work of this machine is that the pressure is radial to the axis of the shafting or body treated and without any dragging or rubbing action or tangential strain, such as is produced by flier-rolls, with which are used special devices for pushing or pulling the work longitudinally through or between the rolls.

It is necessary that provision be made for adjustment of the rolls toward and from the common axis about which they are grouped in order to adapt them accurately to the object operated upon, and it is desirable that this adjustment be of such range as to permit the same machine to operate on bodies of quite widely-varying diameter. Such adjustment may be effected by setting up or receding each roll separately, as hereinafter more fully explained; but I prefer to employ adjusting devices by which the rolls may be quickly and accurately adjusted in proper relation to one another. Such mechanism is illustrated in Figs. 1, 3, 4, 5, and 6, in connection with which it will be explained, together with the construction of the framing which carries it and which is shown in Figs. 1, 3, 4, 6, and 10.

At suitable points in the length of bed or frame A are placed two vertical frames T T, each in the form of an open equilateral triangle, one side of which rests upon and is bolted or otherwise rigidly secured to the bed or base A. The angles of each frame T are connected by metal beams or girders U, U, and V with the corresponding angles of the companion frame, said beams or girders consequently being parallel with the bed or base A. Each beam or girder is formed with lugs or bosses *g*, bored or perforated to receive heavy tie-bolts *h*, which extend from girder to girder and being furnished with nuts *i* on both sides of the lugs or bosses *g* serve both to tie together and to rigidly brace the triangular framework consisting of the two vertical frames T T, girders U U V, and bolts *h*. The girders U U are designed to carry and guide the carriages W, in which are journaled the paired lower rolls L and M, L M, and R S, and the girder V supports and guides the carriages X, in which are journaled the upper rolls N. The distance between the points of support and of pressure is in general terms proportionate to the diameter of the shaft or body operated upon. Hence the rolls should approach each other longitudinally as they are moved inward toward the common axis and should longitudinally recede from each other as they move outward from the common axis. To attain this result, the supporting and guiding faces of the beams or girders U U V, which all face inward toward the axis of the work, are inclined toward such axis as they approach the mid-length of the girders, as is indicated in Figs. 1, 4, 6, and 10. The rolls R and S being midway between the two pairs of rolls L M, L M, which are moved toward each other, require no longitudinal adjustment, and as the rolls N N are required to maintain a position midway between the roll pairs L M, L M, and R S they require to be moved only one-half as far longitudinally as do the rolls L M, L M. Rolls N N, however, require the same extent of radial movement toward or from the common work-axis as do rolls L M, L M, and R S. Hence the inclination of the guiding-faces of girder V must be twice as great as that of the guiding-faces of girders U U, so that with half as much endwise movement of their carriages they shall give a radial movement equal to that of the roll-carriages of girders U U.

The roll-carriages are of the form and con-

struction shown in Figs. 5, 6, 7, and 8, comprising a recessed base Y, the side walls or flanges of which fit the edges of the girders, a roll-carrying section Z, swiveled upon the base Y, and retaining-plates *j*, bolted to the flanges or walls of the base-section and serving to retain the base upon the girder. The base is formed with an annular groove *k* to receive an annular neck or collar *l*, formed on the under face of the top section Z, to center the top section and prevent lateral displacement, retaining-bolts *m* being carried through elongated openings *n* in the base of the upper section and screwed into the base Y. This construction permits the upper section to be turned to any desired angle to the base and to be there clamped against accidental swiveling or turning. The upper carriages are of course reversed. Each roll-carrying section Z is formed with two divided journal boxes or bearings *o* to receive the journals of one or another of the rolls L M, L M, N N. The rolls R S requiring no longitudinal movement, but only radial adjustment, are mounted in carriages A′, differing from the carriages W in having longer flanges or side walls to the base-section and employing no retaining-plates *j*. In lieu of these, elongated bolt-holes or slots *k*′ are formed in the walls or flanges of the base, through which pass bolts *l*′, which screw into the girders U U. To prevent movement of the roll-carriages A′ in any except a radial direction with reference to the work-axis, flanges or ribs *m*′ are formed upon the girders U U, between which the base of the carriage or the flanges thereof are seated. The radial movement of the roll-carriages A′ must be precisely the same as that of the carriages of rolls L M, L M, and to effect such movement I provide a wedge-bar B′, which lies in a groove or channel *n*′ in the upper or inner face of girder U, one in each, said wedge-bar being bolted to or otherwise connected with the base Y of one of the roll-carriages, as seen in Fig. 6, so as to move longitudinally in unison therewith. The channel *n*′ is of uniform depth, or, in other words, its bottom is parallel with the guiding-face of the girder U, and the upper face of the wedge-bar lies horizontal or is parallel with the under face of the base of roll-carriage A′. It will thus be evident that as carriage W moves longitudinally and carries with it the wedge-bar said bar will elevate or move inward the roll-carriage A′ at precisely the same rate or to the same extent as the carriage W is elevated or moved inward by riding up the inclined face of the girder U. In this way the radial adjustment of rolls R S is made precisely the same as that of rolls L M, L M.

To move the rolls L M L M simultaneously and equally, I provide, preferably, the mechanism shown in Figs. 1, 3, 4, and 5. This comprises two Y-shaped yokes C′ D′, fulcrumed at their lower ends in the frame or bed A and having the upper ends of their arms connected by rods *p* with the bases Y of the carriages or rolls L M L M, as best seen in Figs. 1 and 5. Swiveled in the bed or base A at or about its mid-length is a long right-and-left nut or sleeve E′, the end portions only of which need be tapped or threaded. This nut or sleeve carries a worm-wheel F′ and is connected by jointed rods G′ screwing into its opposite ends with the yokes C′ D′, so that by rotating said sleeve or nut the yokes can be caused to swing toward or from each other, and thus to approach or recede the roll-carriages W W. A worm or screw H′, carried by a shaft I′, suitably swiveled in base or bed A, meshes with and serves to rotate worm-wheel F′ and nut or sleeve E′ to cause the stated movement of the yokes and roll-carriages. Shaft I′ carries a hand-wheel J′, by which to rotate it, and it will be understood from the foregoing description that by turning said wheel the roll pairs L M L M will be caused to approach the roll pair R S equally, and the three roll pairs will be moved radially inward toward the work-axis, each to precisely the same extent. To enable the attendant to determine readily the extent of longitudinal and radial adjustment, a scale *q* may be marked upon one of the girders U, to be read in connection with the forward end of one of the roll-carriage bases Y, the scale indicating the radial movement or affording a ready basis for estimating the same. The upper roll-carriages can be similarly operated, if desired, but I prefer to provide for each of these a screw K′, screwing into the base-block of the carriage swiveled in the girder V and furnished with a hand-wheel L′, as seen in Fig. 4. Under this arrangement the upper carriages may be run to the proper point, as ascertained by reading a scale on the girder, or, as is preferred, a piece of shafting of the diameter for which the lower roll pairs are set or adjusted may be laid upon said lower rolls and the screws K′ then turned until the upper rolls N take their proper bearing upon the shaft, which will occur when the rolls reach a position midway between the lower roll pairs.

I have above suggested that the roll-carriages may be adjusted separately and without the special appliances described. A construction suitable to this mode of adjustment and proportionately simple is illustrated in Figs. 11, 12, and 13. In these figures I have shown the same general arrangement of triangular frames T T and girders U U V, the girders being in this case longitudinally channeled. The roll-carriages W^2 are each formed with a longitudinal guiding web or rib a^2 to enter and fit neatly in the channel b^2 of the girder on which it is mounted, and this rib is provided with a slot c^2 at right angles to its length or radial to the common axis about which the rolls are grouped. The slot c^2 is to

receive a bolt d^2, which passes through slots e^2 in the side walls of the channeled girder, as seen in Figs. 11 and 12, the slots c^2 and e^2 permitting both radial and longitudinal adjustment of the roll-carriages. When the desired adjustment is attained, the nut of bolt d^2 is tightened, thereby causing the walls of the channel b^2 to bind or clasp firmly the rib or web a^2 of the carriage and to hold the carriage against displacement. To give the proper radial adjustment to the roll-carriages W^2 and insure proper relation of the roller-faces to the shafting or other work, I provide heavy tap bolts f^2, which screw through tapped openings in the outer wall of the girder and bear against the rear or outer edge of web or rib a^2, as seen in Fig. 11. Each tap bolt is provided with a jam-nut g^2 to prevent its working loose. As seen in Fig. 11, the web or rib a^2 of each carriage W^2 is made of length sufficient to permit adequate longitudinal adjustment of the carriage without passing out of the range of the bolts f^2. While this construction is cheaper and simpler than that first described, it is less convenient to set or adjust and does not permit of equally-fine adjustment. It will of course be understood that the carriages W^2 may be made in two parts, one swiveled on the other after the manner of the carriages W, in which case practically the same adjustments would be possible, though requiring greater care and more time to make.

I have shown and described one complete set of rolls capable of performing the straightening operation. If it be desired to repeat this operation one or more times, the roll sets may be duplicated or multiplied to any extent desired. As the mode of construction, arrangement, and operation would in such case remain unchanged, it is deemed unnecessary to further illustrate such increase in the number of rolls.

Having thus described my invention, what I claim is—

1. In a machine for straightening cylindrical bodies, the combination of two pairs of rolls and an intermediate roll, the paired rolls and single roll being arranged with their axes oblique to each other and to the common axis about which they are grouped, and at varying points in the length of said axis; and means for imparting rotation to at least two of said rolls.

2. In a machine for straightening cylindrical bodies, the combination of two pairs of supporting-rolls, an intermediate roll, and means for imparting rotation to at least two of said rolls, the several rolls being arranged about a common axis and having their axes oblique to said common axis and to each other.

3. In a machine for straightening cylindrical bodies, the combination of two pairs of rolls and a roll intermediate the proximate ends of the two roll pairs, the several rolls being grouped about a common axis and having their axes oblique thereto and to each other, and the paired rolls being movable longitudinally toward and from the intermediate roll.

4. In a machine for straightening cylindrical bodies the combination of two pairs of rolls, and a roll intermediate the proximate ends of the two roll pairs, the several rolls being grouped about and movable toward and from a common axis, and having their axes oblique to said common axis and to each other.

5. In a machine for straightening cylindrical bodies, the combination of two pairs of rolls, and a roll interposed between the proximate ends of the two roll pairs, the several rolls being grouped about and movable toward and from a common axis, and having their axis oblique to said axis and to each other, and the paired rolls being longitudinally movable toward and from the intermediate roll.

6. In a machine for straightening cylindrical bodies, the combination of a suitable framework having guideways converging toward a common axis; roll-carrying carriages mounted and longitudinally movable upon said guideways; an intermediate roll-carrying carriage movable radially or in a right line perpendicular to said axis; and connections between one of the longitudinally-movable roll-carriages and the radially-movable carriage, for imparting to it such radial movement.

7. In a machine for straightening cylindrical bodies, the combination of a suitable frame having three or more sets of guideways converging toward a common axis; three roll pairs mounted in carriages arranged end to end upon the lower sets of guideways, the intermediate pair being fixed against longitudinal movement, and the outer pairs being longitudinally movable toward and from the intermediate pair; and independent roll-carrying carriages mounted upon the upper guideways, in alternation with the lower carriages and rolls, said independent carriages and rolls being longitudinally movable toward and from each other.

8. In combination with girders U, U, converging toward a common axis, and with roll-carrying carriages mounted and longitudinally adjustable thereon; roll-carrying carriages mounted upon the guideways intermediate of said longitudinally-movable carriages and movable toward and from said common axis; girder V having guideways likewise converging toward the common axis and having twice the degree of inclination of the girders U, U; and roll-carrying carriages mounted and movable on the guideways of girder V.

9. In combination with paired rolls L, M

and R, S, intermediate roll N; gearing for imparting rotation to said rolls L, M and N; and telescopic shaft connections between the rolls and gearing, whereby said rolls are adapted to be longitudinally adjusted without becoming disconnected from the gearing.

10. In combination with a frame comprising girders U, U and V, having guideways converging toward a common axis; carriages mounted and longitudinally movable on said guideways and provided with rolls; other roll-carriages mounted at the mid-length of the girders U, U, provided with rolls, and movable radially to said common axis; yokes C′, D′, connected with the longitudinally-movable carriages; means for causing said yokes to approach and recede from each other; and wedges carried by two of the longitudinally-movable carriages and passing between the radially-movable carriages and the girders on which they are supported, whereby the radially-movable carriages are caused to move simultaneously with the longitudinally-moving carriages.

11. In combination with girders or supports having converging guideways; roll-carriages mounted and longitudinally movable upon said guideways; roll-carriages mounted upon the guideways intermediate of the longitudinally-movable carriages and movable radially toward and from the common axis toward which the guideways converge; and means for simultaneously moving the several carriages toward and from said common axis.

12. In a machine for straightening cylindrical bodies, the combination of a frame provided with guideways convergent toward a common axis; roll-carrying carriages mounted on said guideways and movable longitudinally thereon to cause their endwise and axial approach; interposed roll-carrying carriages movable radially toward and from said common axis; and means for thus adjusting the roll-carriages, said carriages having their roll-receiving bearings swiveled upon their bases, substantially as described, whereby the angle of roll-axes may be varied to accord with the approach or separation of the rolls.

13. In combination with a suitable frame, comprising girders U, U, and V, having convergent guideways; roll-carrying carriages mounted and longitudinally movable on said guideways; yokes C′, D′, connected with some of said carriages; a two-part rod G′, having its proximate ends reversely threaded; a nut E′ connecting the rod-sections; and means, substantially such as described, for rotating said nut.

14. In combination with a main frame, and roll-carrying carriages mounted and longitudinally movable thereon toward and from each other; yokes C′, D′, connected with said carriages; a divided rod G′, having its sections connected with the respective yokes; a nut E′ connecting the rod-sections; a worm-wheel F′ carried by said nut; a worm H′ meshing with said worm-wheel; a shaft I′ carrying said worm; and means for turning said shaft.

15. In combination with girders U, U, having guideways convergent toward a common axis; a girder V having guideways also convergent toward said axis, but at twice the angle of those of the girders U, U; roll-carrying carriages mounted on the several guideways and longitudinally adjustable thereon; and screws swiveled in the girder V and threaded in the carriages thereon, for moving said carriages longitudinally upon their guideways.

16. In a machine for straightening cylindrical bodies, a main frame comprising a base; two triangular frames mounted thereon; girders extending from one to the other of said frames, connecting the same, and provided with convergent guideways; and tie-rods connecting the girders at points intermediate of the triangular frames, substantially as shown and described.

17. In a machine for straightening cylindrical bodies, the combination of three pairs of rolls; an intermediate opposing roll or rolls between the first and second pairs of rolls; an intermediate opposing roll or rolls between the second and third pairs of rolls, all of said rolls being grouped about and movable toward and from a common axis, and having their axes oblique to one another and to the common axis, the rolls being longitudinally adjustable; and means for imparting rotary motion to at least two of the rolls.

18. In a machine for straightening cylindrical bodies, a series of rolls grouped about and radially adjustable toward and from a common axis and also longitudinally adjustable, said rolls being beveled at their forward or receiving ends to facilitate entrance of a cylindrical body between them and having their axes oblique to one another and to the common axis; and means for rotating at least two of said rolls.

19. In a machine for straightening cylindrical bodies, a series of rolls grouped about a common axis and having their axes oblique to one another and to said common axis; and means for imparting rotation to at least two of said rolls, the rolls being set at varying points in the length of said common axis and being adjustable toward and from said axis and also longitudinally thereof.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WALTER J. MUNCASTER.

Witnesses:
A. F. GETTY,
ROBT. SHRIVER.