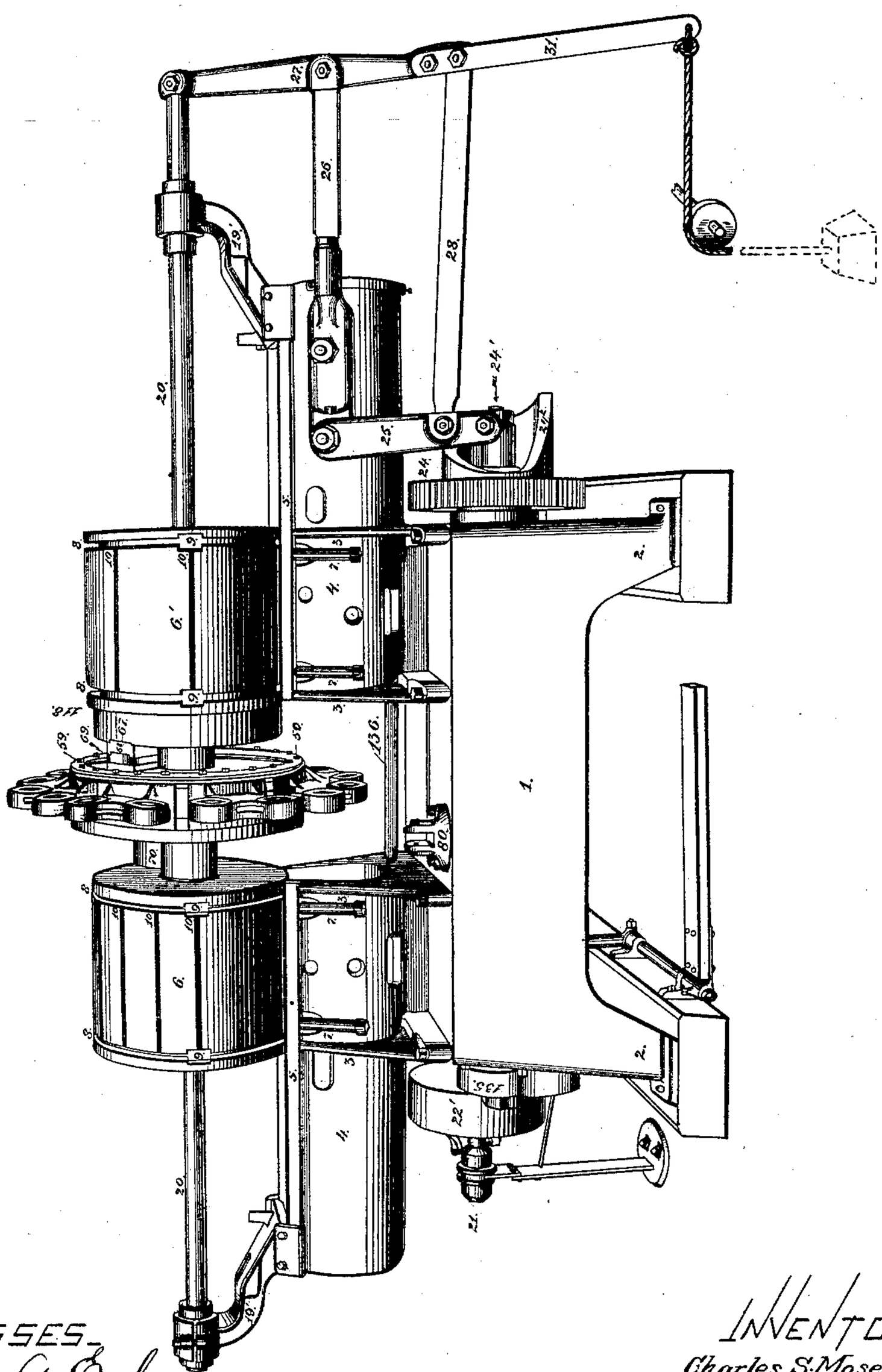
(No Model.) 21 Sheets—Sheet 1.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig. 1.



WITNESSES—
Arthur A. Orb
Wellington Kugler

INVENTOR—
Charles S. Moseley

By his Attorney
Frank L. Dyer

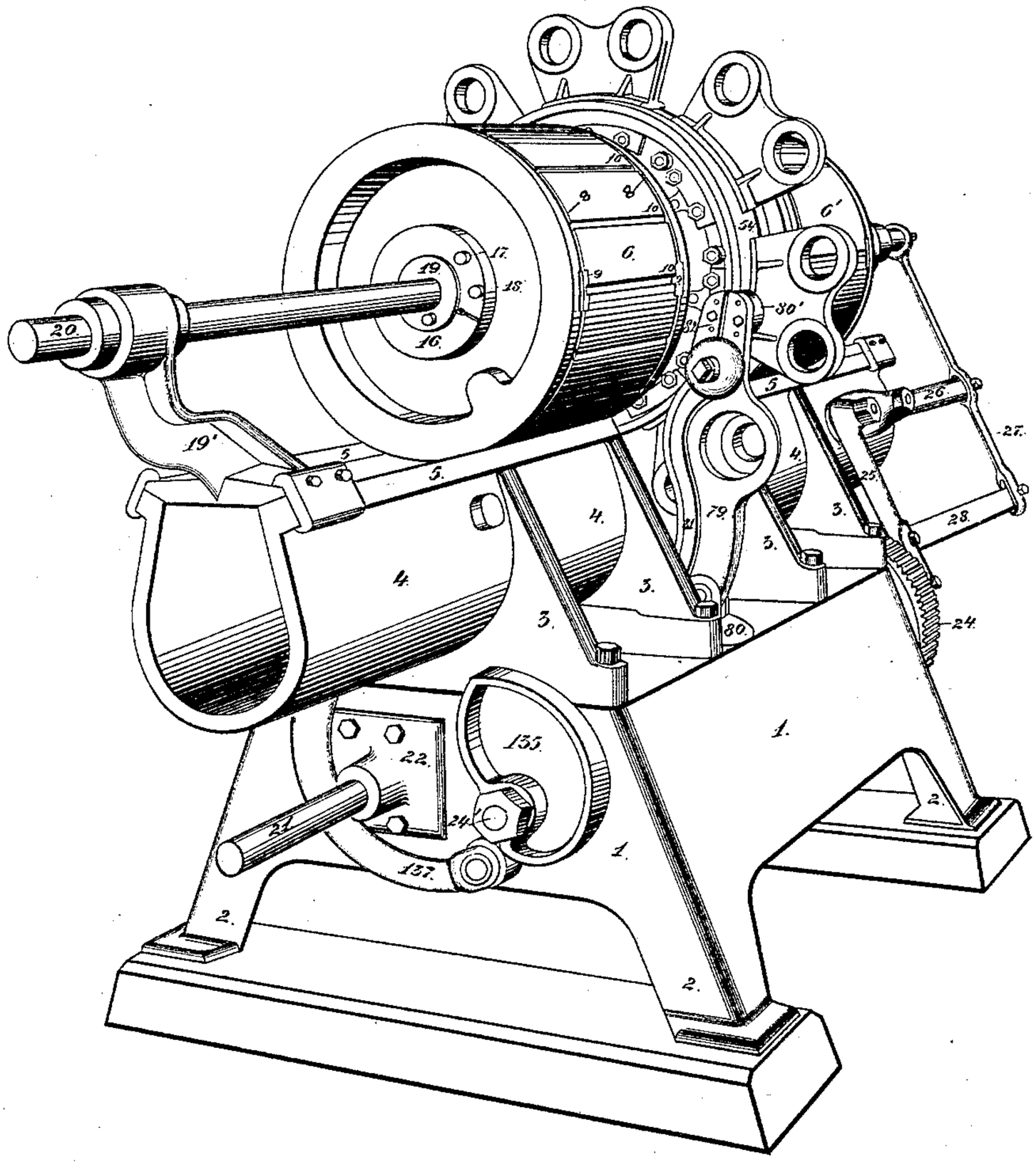
(No Model.) 21 Sheets—Sheet 2.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 2.



Witnesses
Leonard H. Dyer
Arthur C. Eck

Inventor
Charles S. Moseley,
By his Attorney
Frank L. Dyer

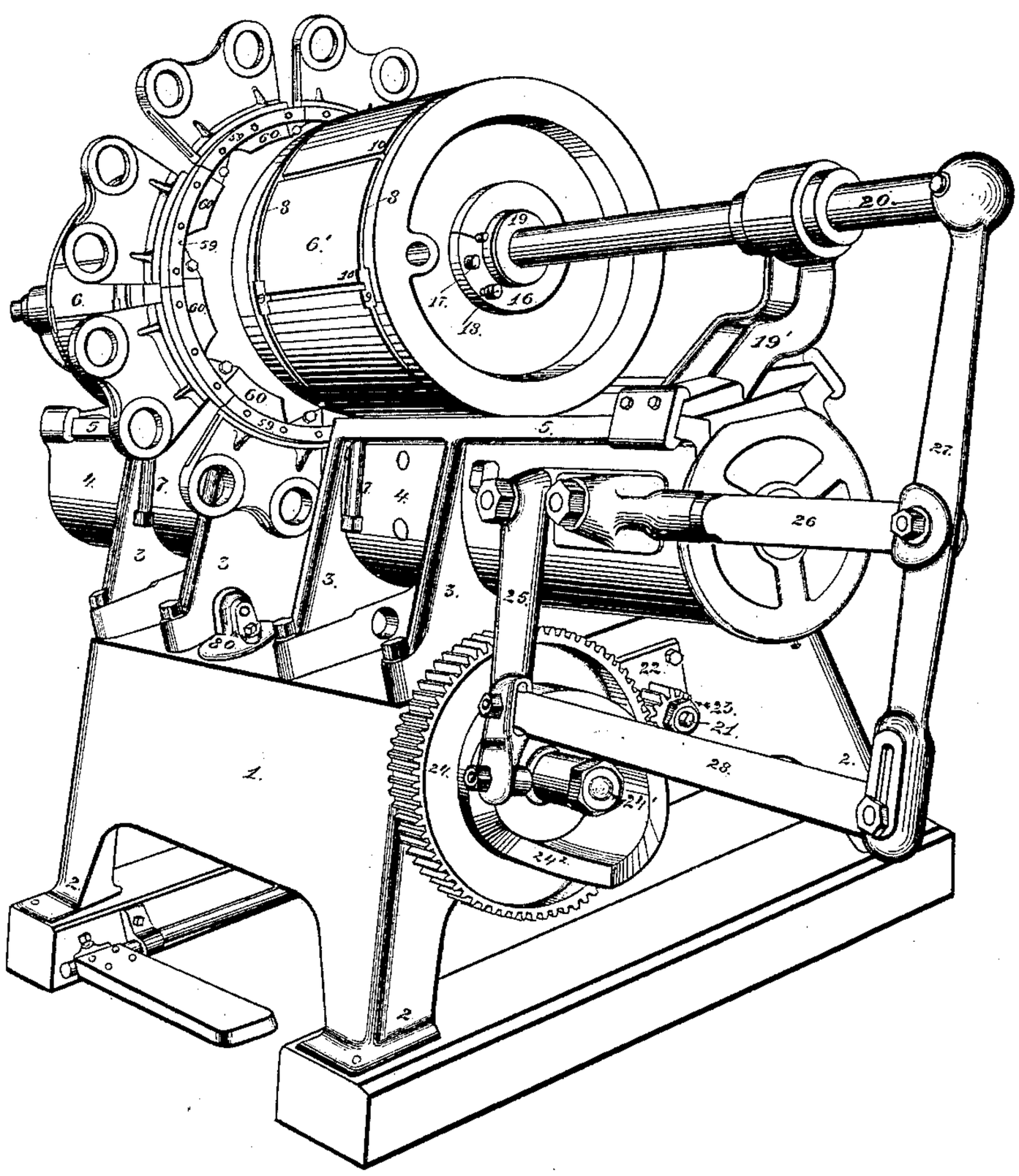
(No Model.) 21 Sheets—Sheet 3.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 3.



Witnesses
Arthur W. Cobb.
Wellington Hugler.

Inventor
Charles S. Moseley.

By his Attorney
Frank L. Dyer.

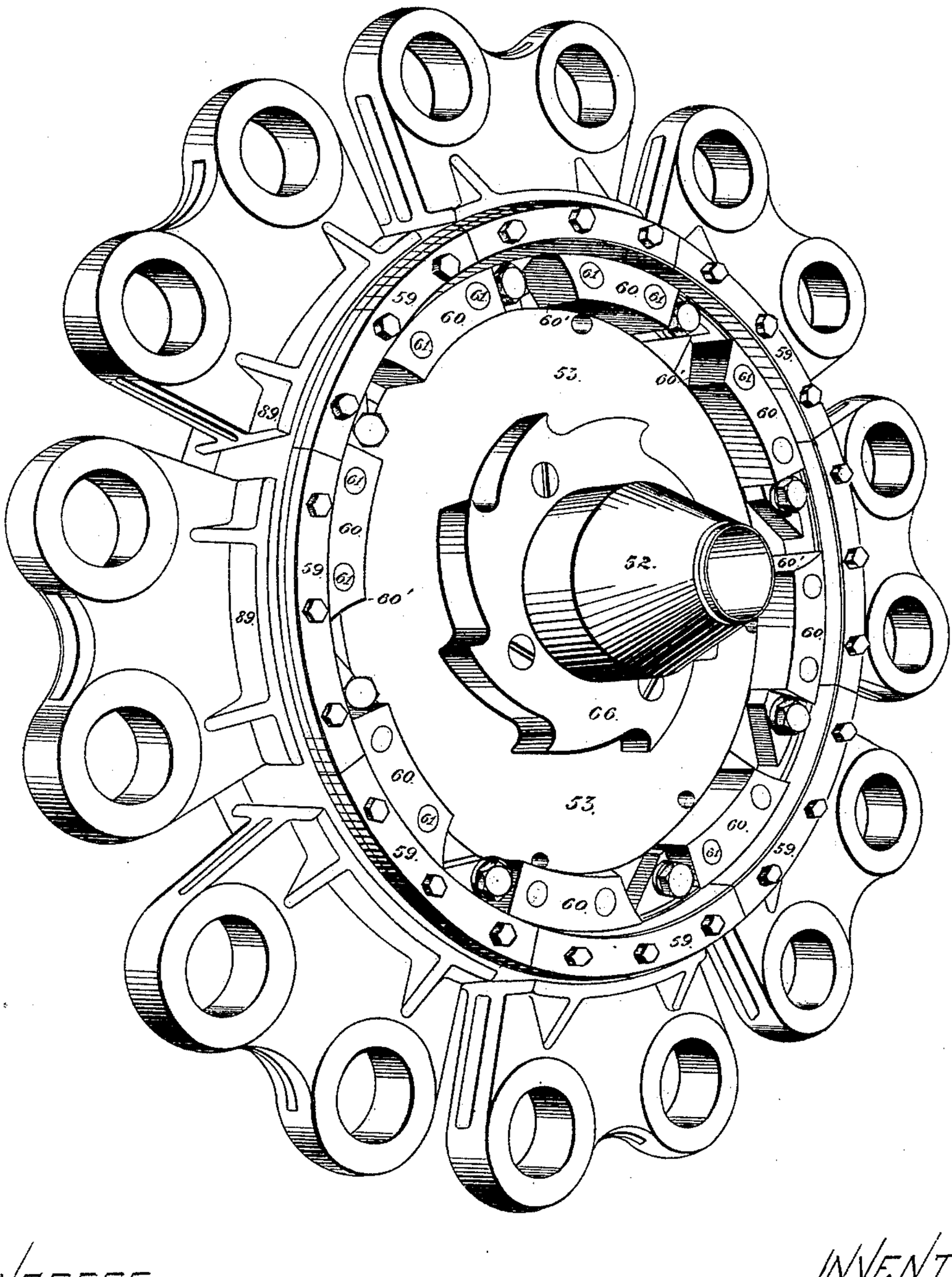
(No Model.) 21 Sheets—Sheet 4.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 4.



WITNESSES -

Wellington Snyder

INVENTOR -

Charles S. Moseley

By his Attorney

Frank L. Dyer

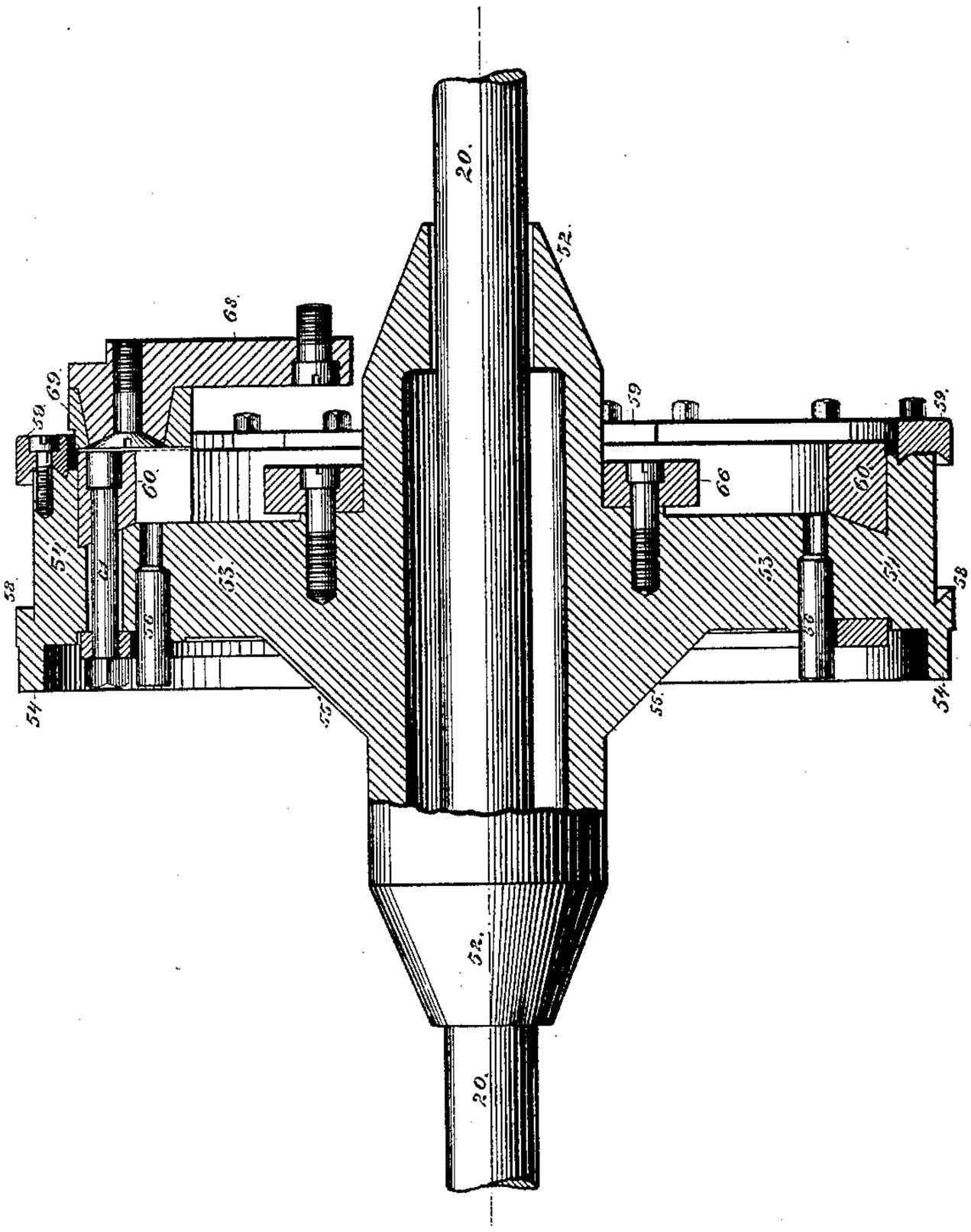
(No Model.) 21 Sheets—Sheet 5.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 5.



WITNESSES.
Arthur A. Orb.
Wellington Kugler

INVENTOR.
Charles S. Moseley.

By his Attorney
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 6.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

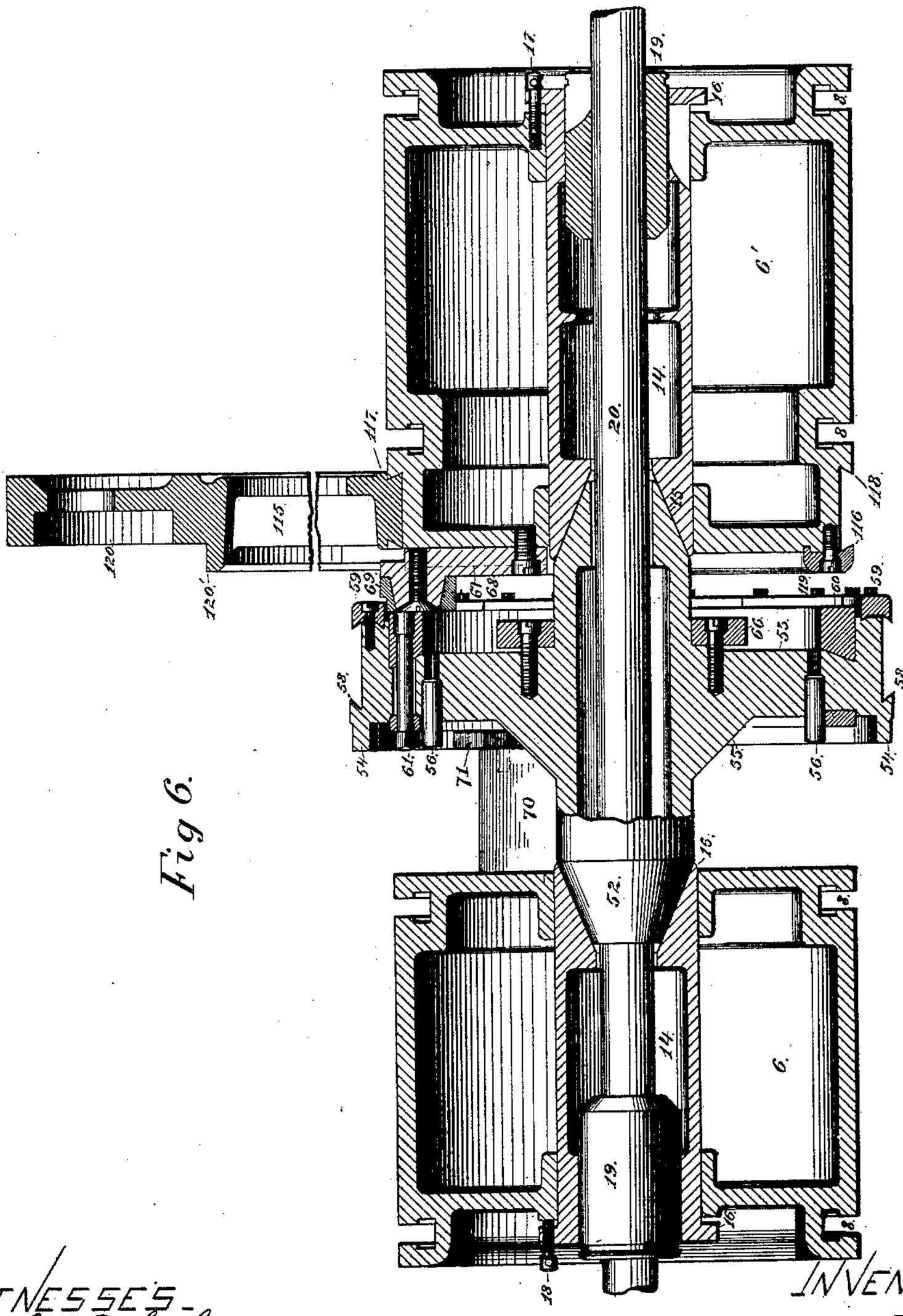


Fig 6.

WITNESSES -
Arthur A. Erb.
Willington Snyder

INVENTOR -
Charles S. Moseley
By his Attorney
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 7.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 7.

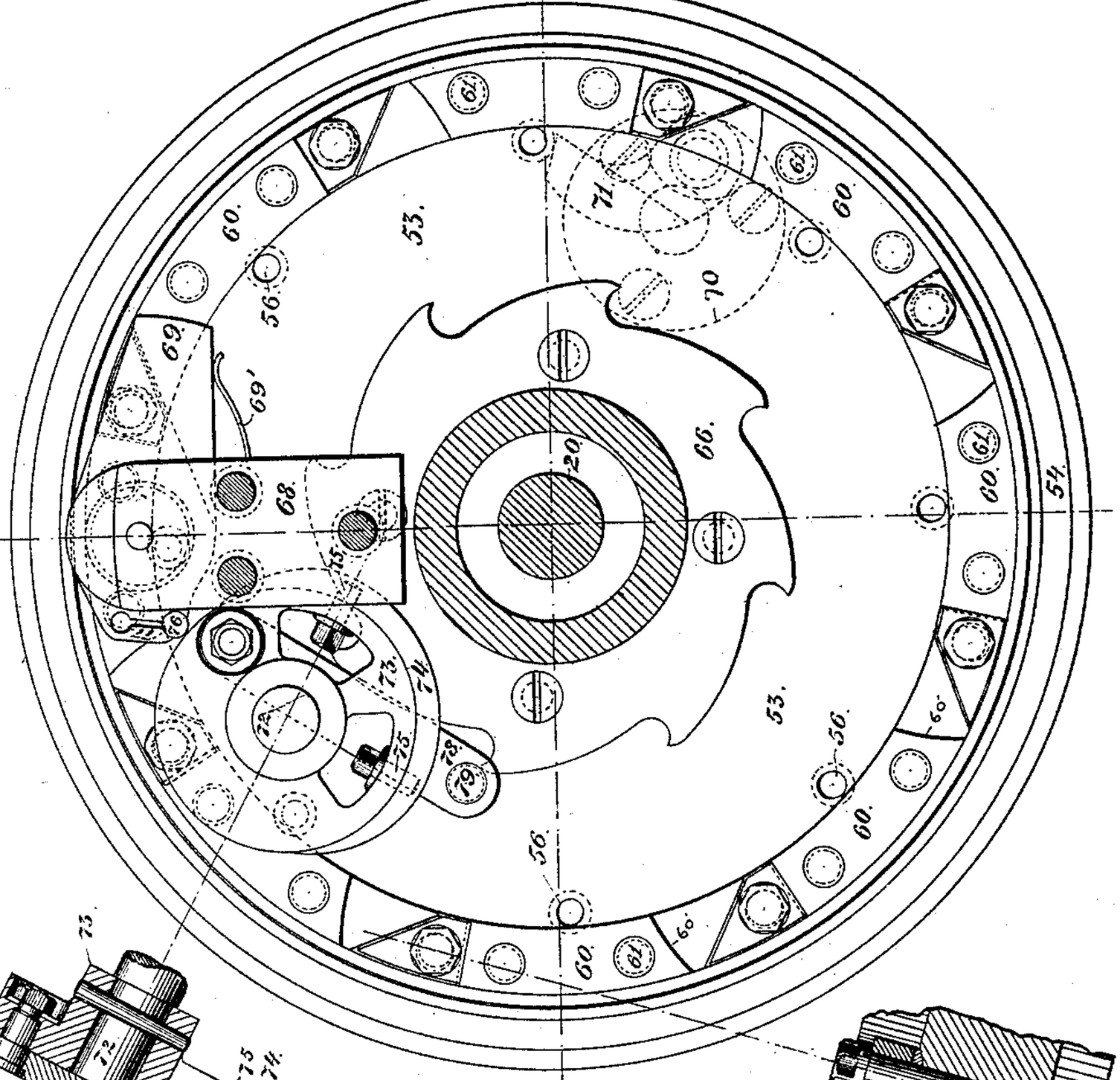
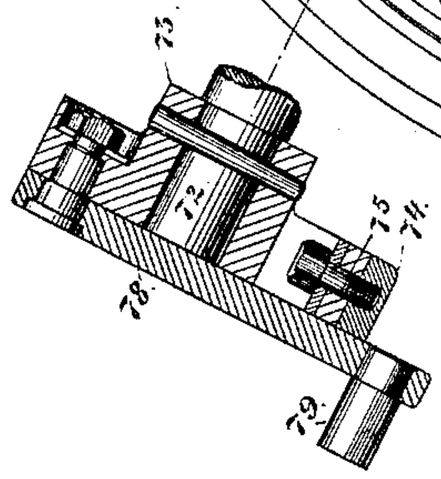


Fig 8.



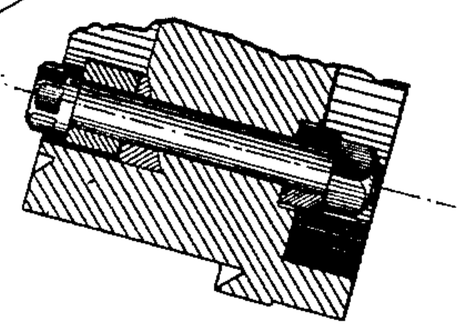
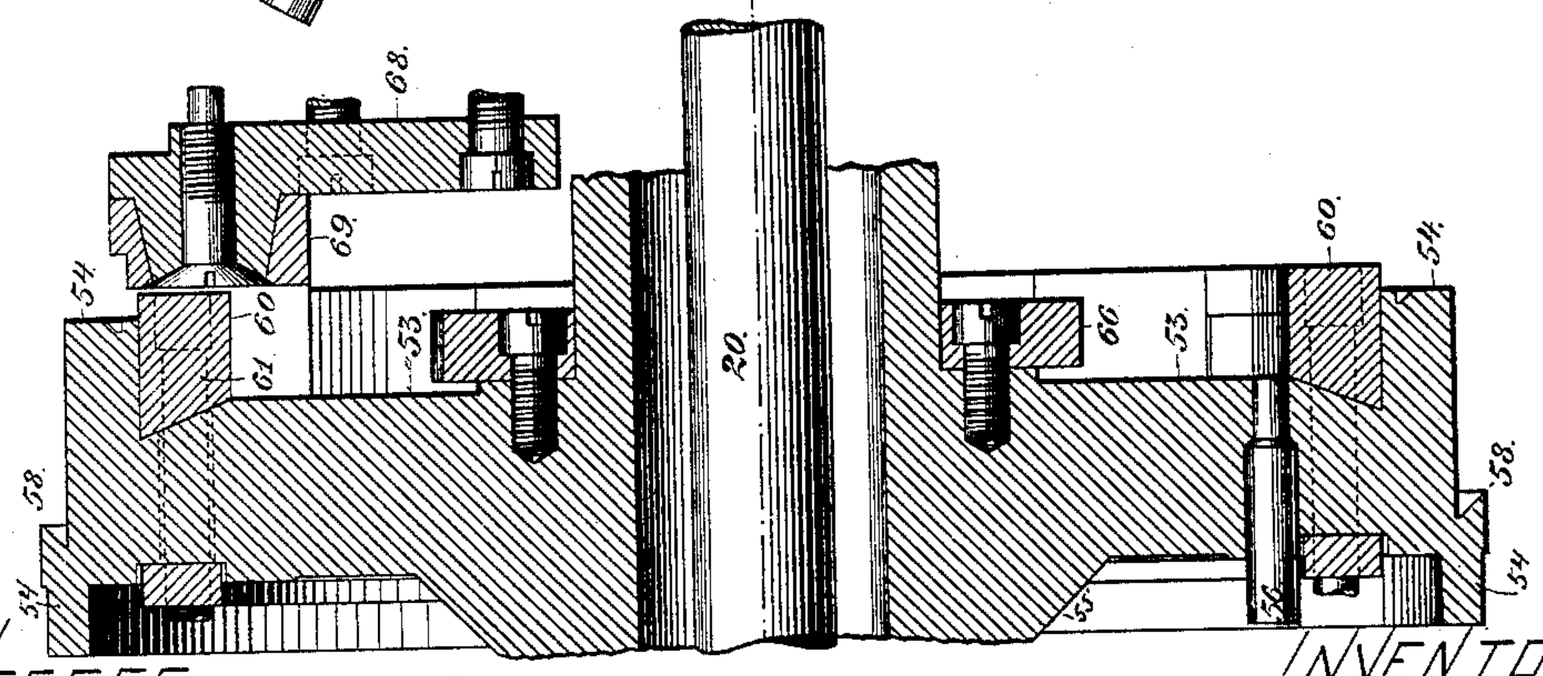


Fig 9.



WITNESSES -
Arthur A. Orb.
Wellington Kugler

INVENTOR -
Charles S. Moseley
By his Attorney. Frank L. Dyer

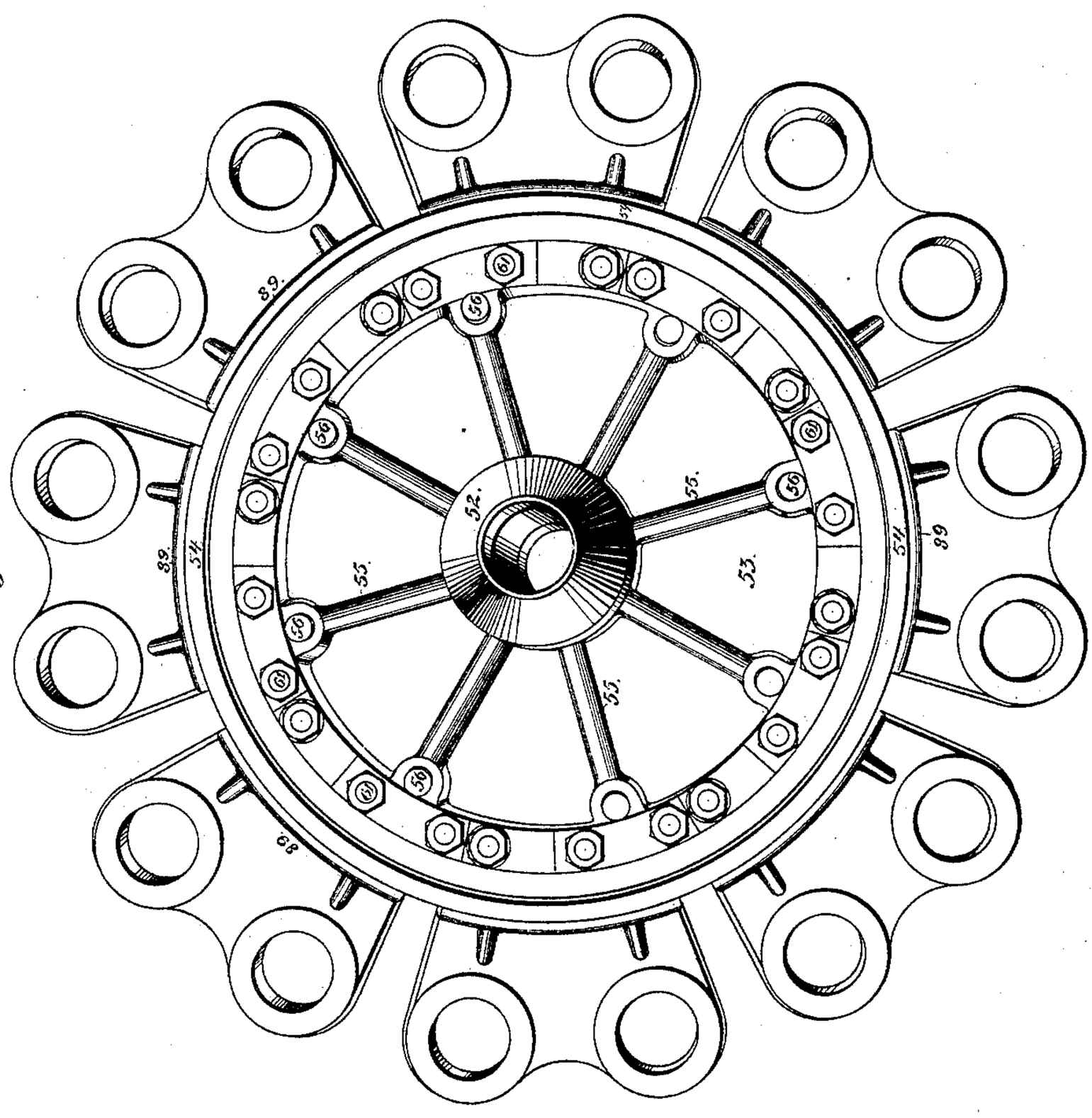
(No Model.) 21 Sheets—Sheet 8.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig. 10.



WITNESSES—
Arthur A. Orb.
Wellington Kingler

INVENTOR—
Charles S Moseley.

By his Attorney.
Frank L. Dyer

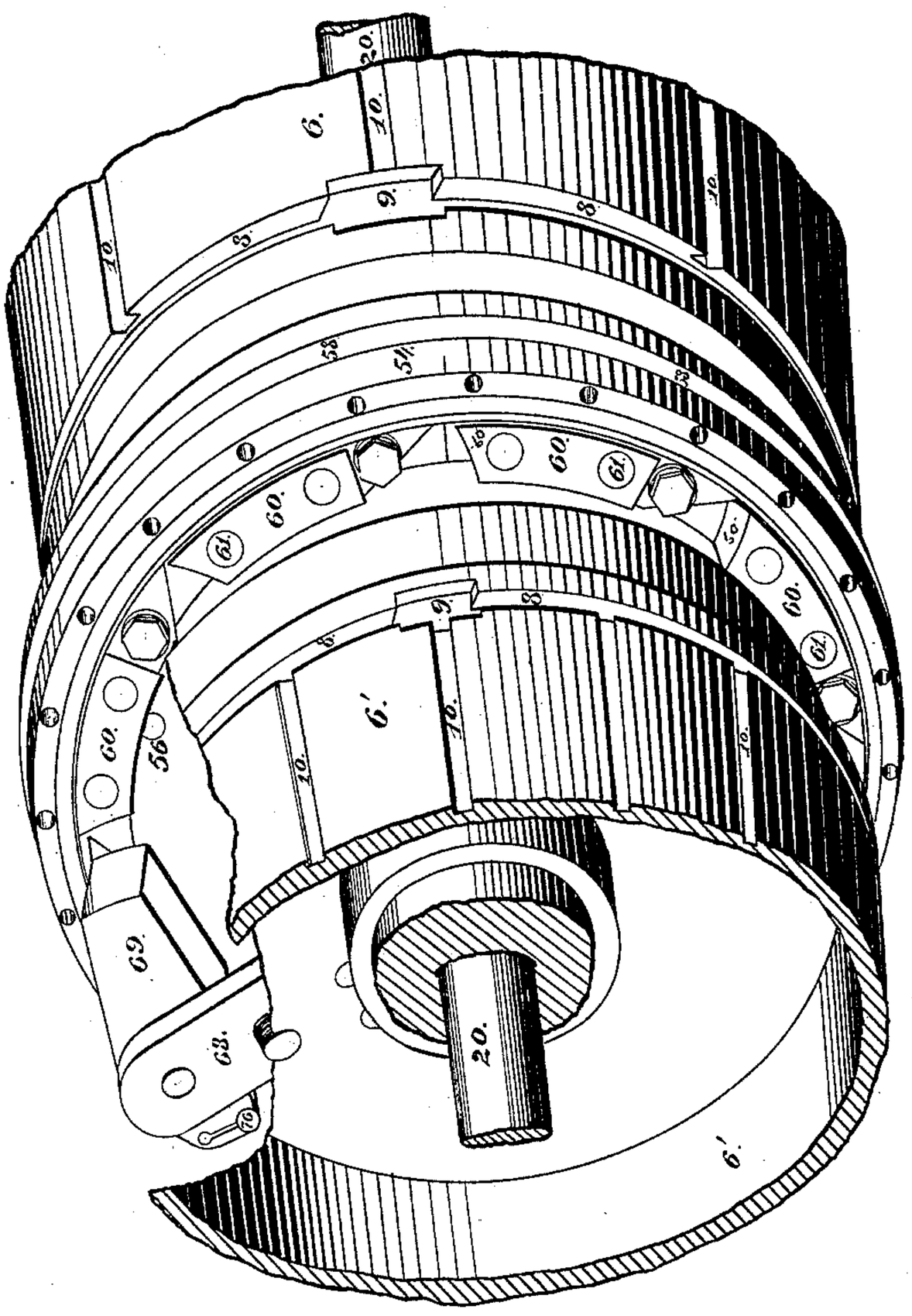
(No Model.) 21 Sheets—Sheet 9.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 11.



WITNESSES

Arthur A Erb.

Leonard H. Dyer.

INVENTOR.

Chas. S. Moseley.

by Frank L. Dyer

his Attorney

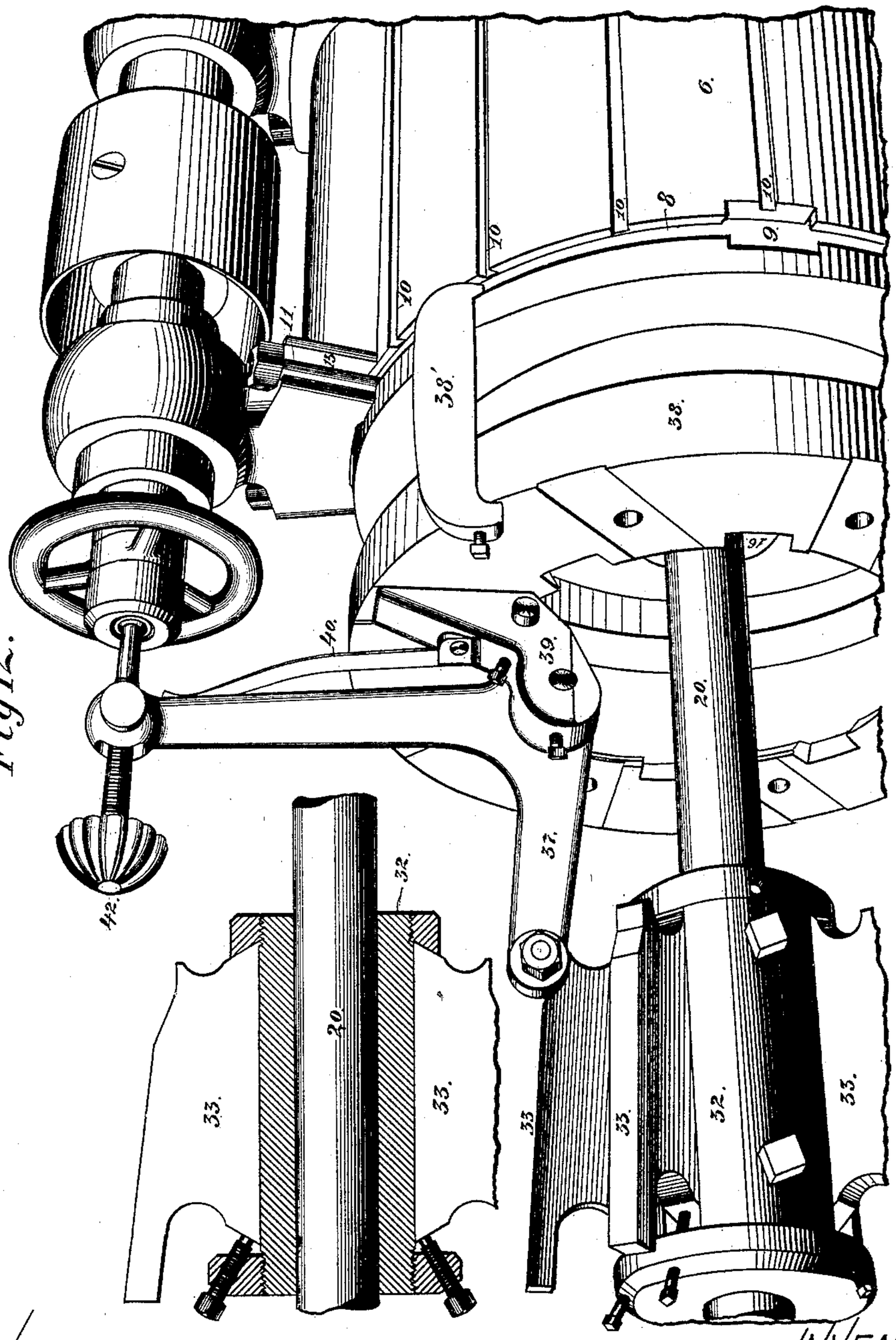
(No Model.) 21 Sheets—Sheet 10.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 12.



WITNESSES -

Wellington Snyder

INVENTOR -

Charles S. Moseley

By his Attorney

Frank L. Dyer

(No Model.) 21 Sheets—Sheet 11.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

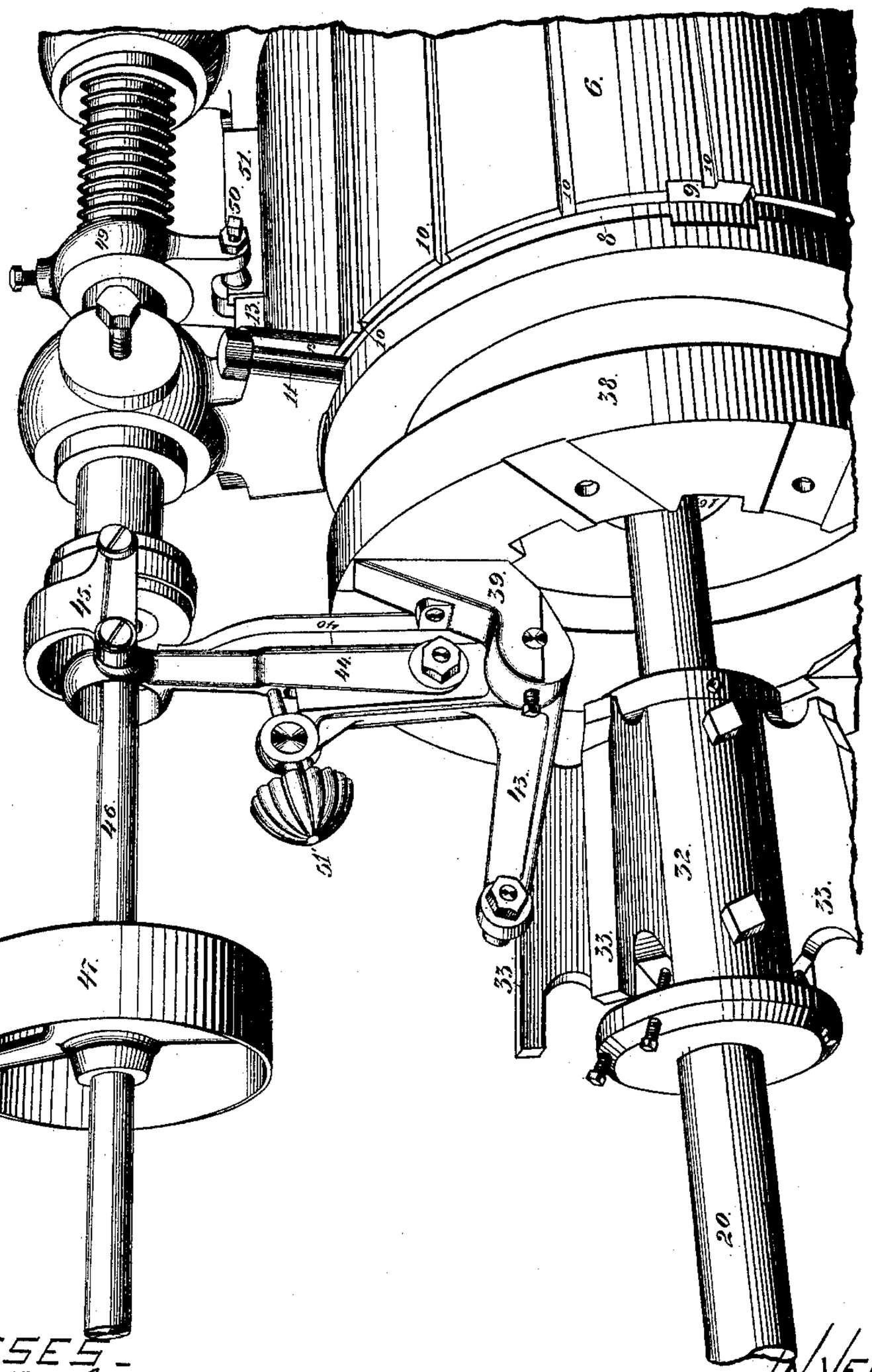


Fig 13.

WITNESSES-
Arthur C. Eddy
Wellington Snyder

INVENTOR-
Charles S. Moseley.
By his Attorney
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 12.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 14.

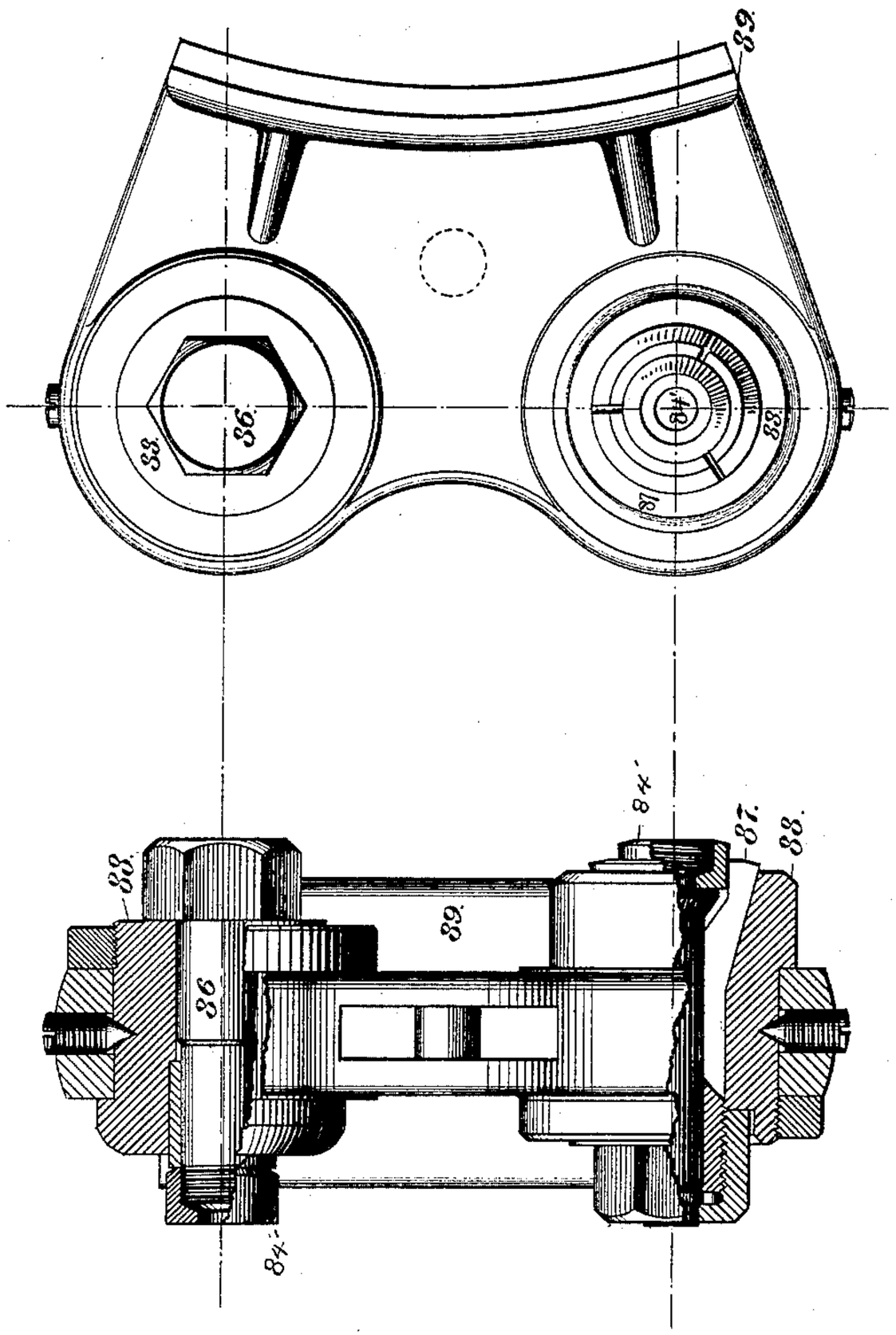
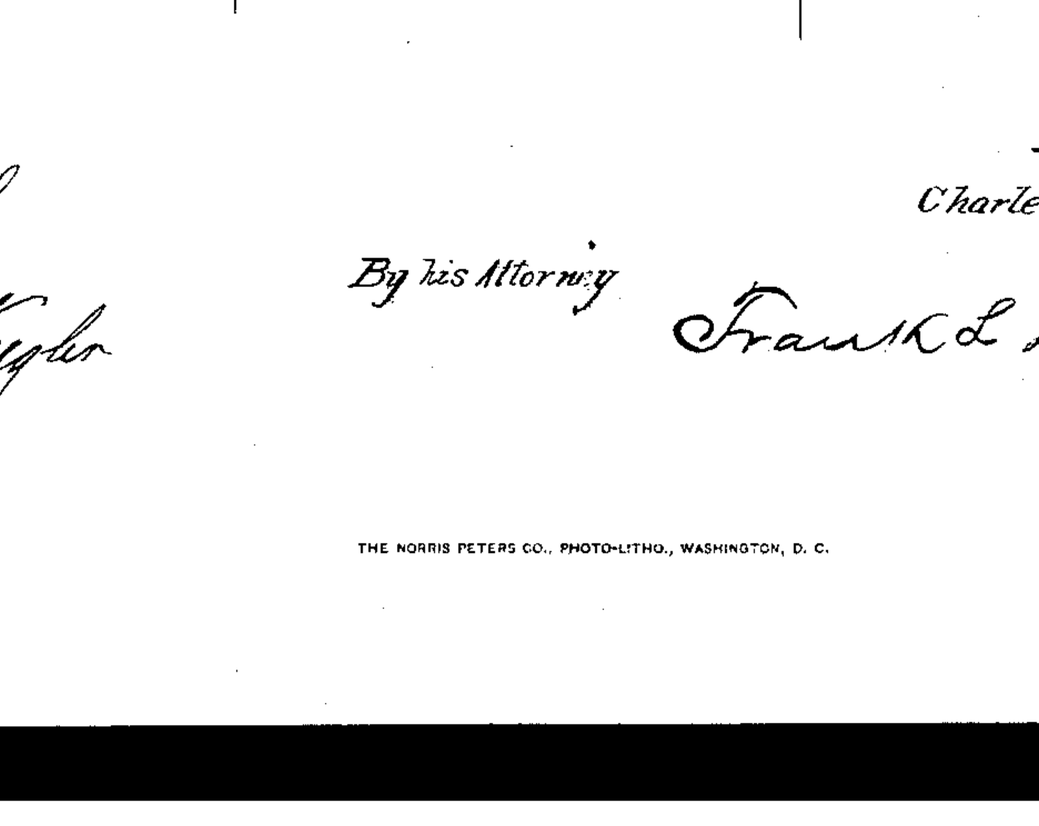


Fig 15.



WITNESSES-
Arthur A. Erb.
Willington Snyder

INVENTOR-
Charles S. Moseley
By his Attorney
Frank L Dyer

(No Model.) 21 Sheets—Sheet 13.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 16.

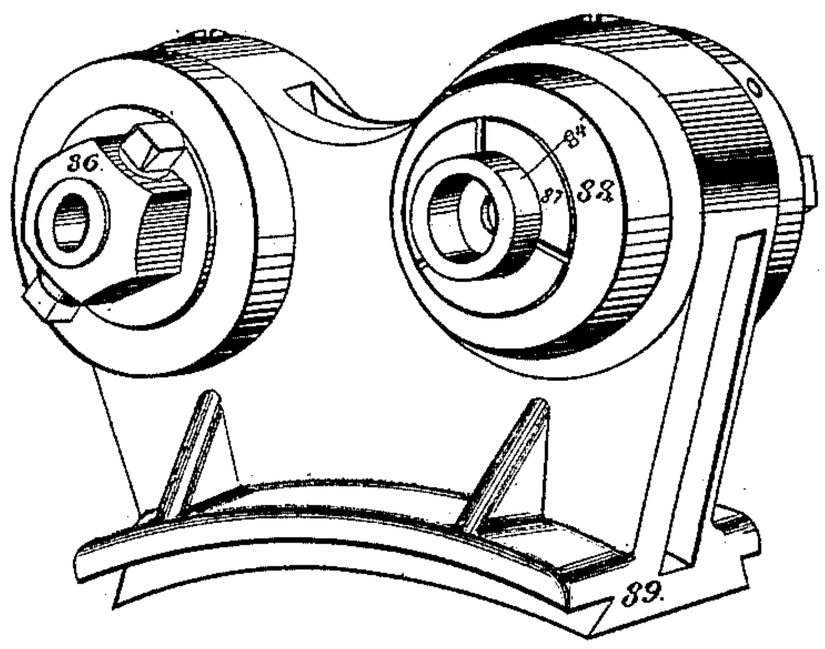
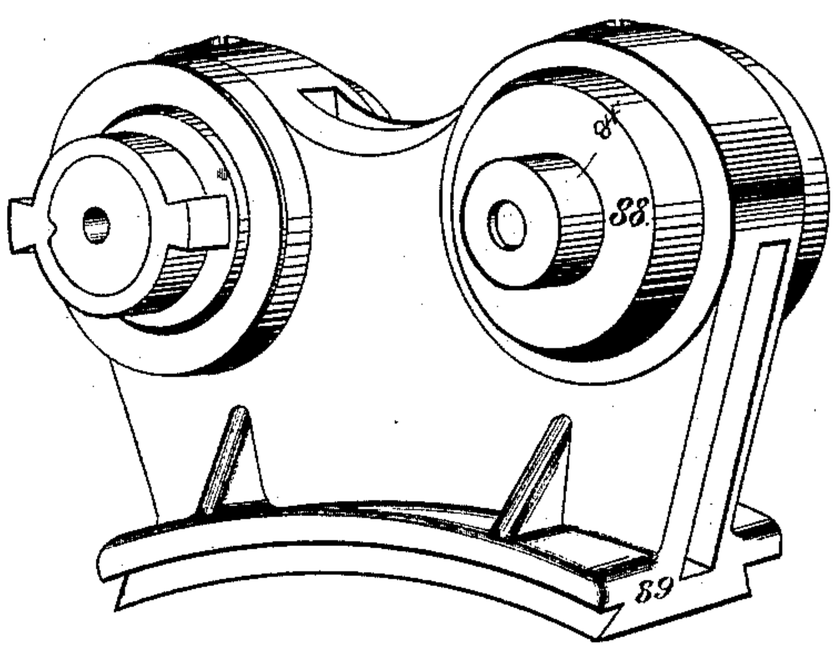


Fig 17.



Witnesses
Arthur W. Erb.
Wellington Kuyler

Inventor
Charles S. Moseley

By his Attorney
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 14.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 19.

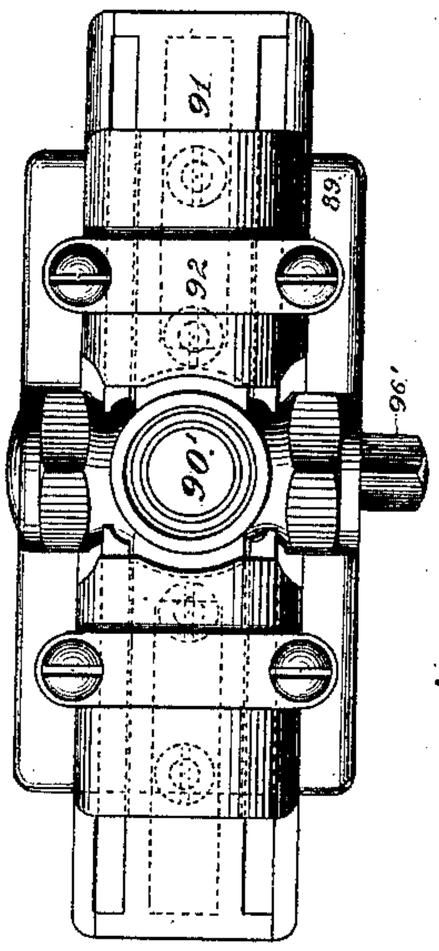


Fig 18.

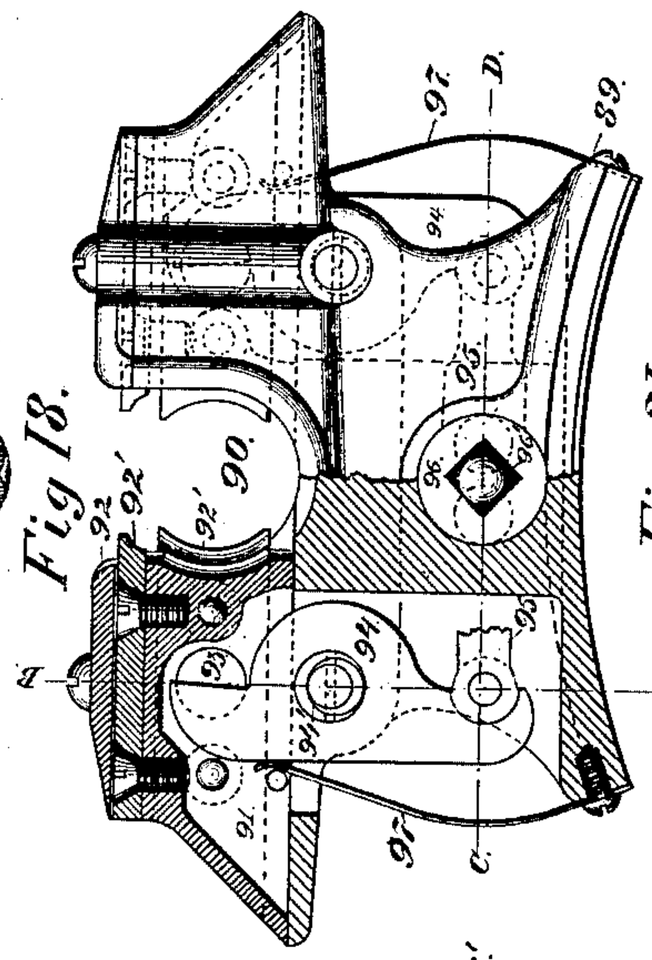


Fig 21.

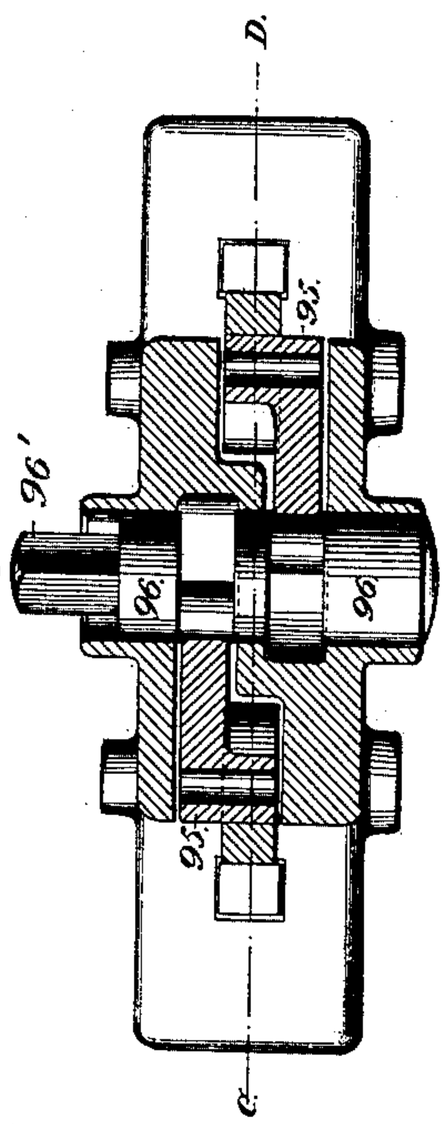
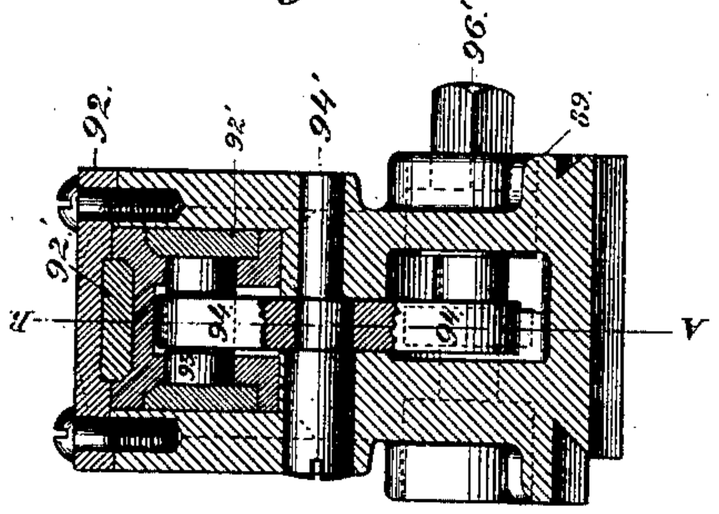


Fig 20.



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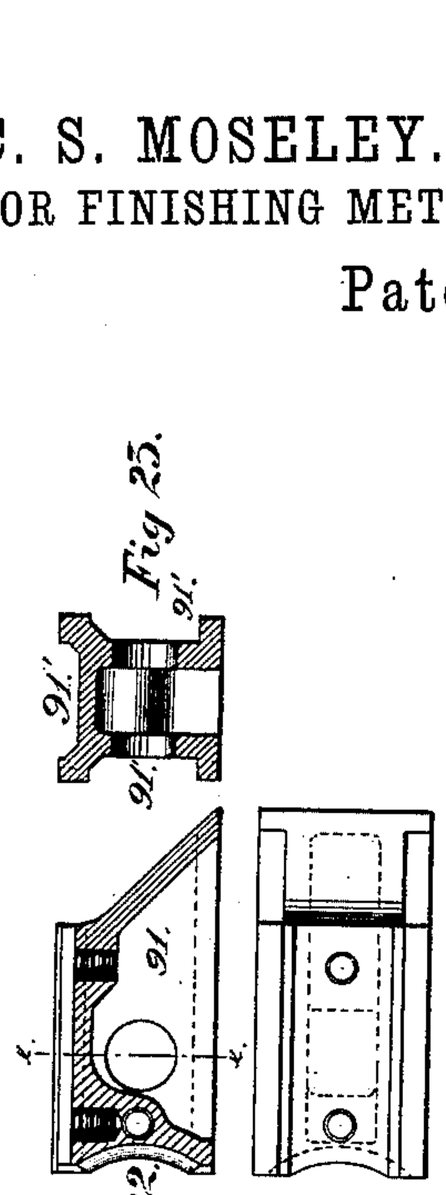

WITNESSES.
Arthur A. Erb.
Wellington Snyder

INVENTOR.
Charles S. Moseley.
By his Attorney. Frank L. Dyer

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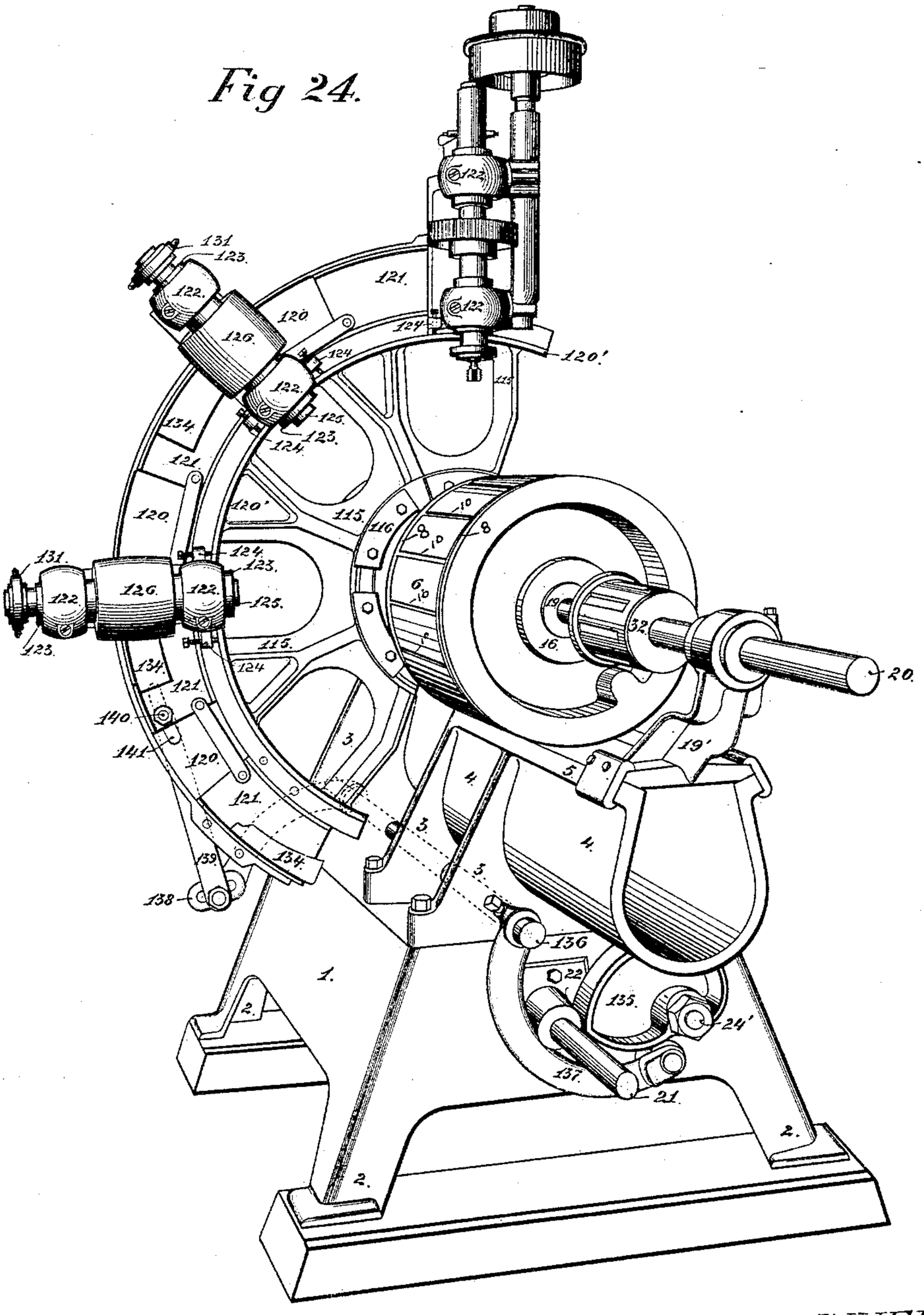
C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 24.



WITNESSES.

Arthur A. Erb.

Leon and H. Lyon.

INVENTOR.

Chas. S. Moseley

by Frank L. Dyer

his Attorney

(No Model.) 21 Sheets—Sheet 16.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 25.

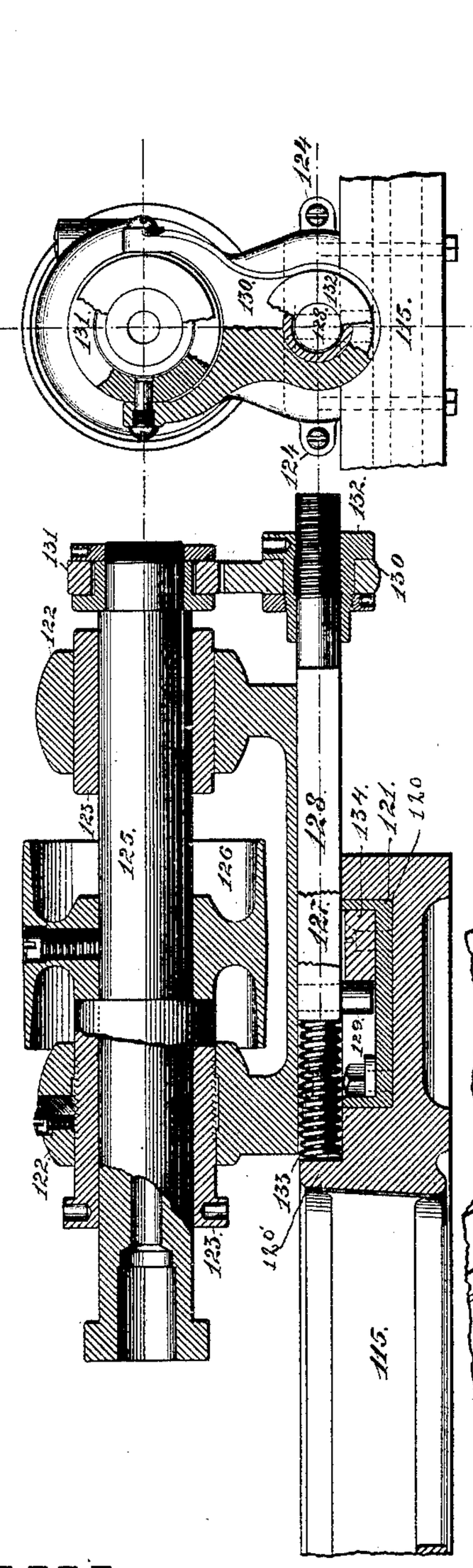


Fig 25.a.

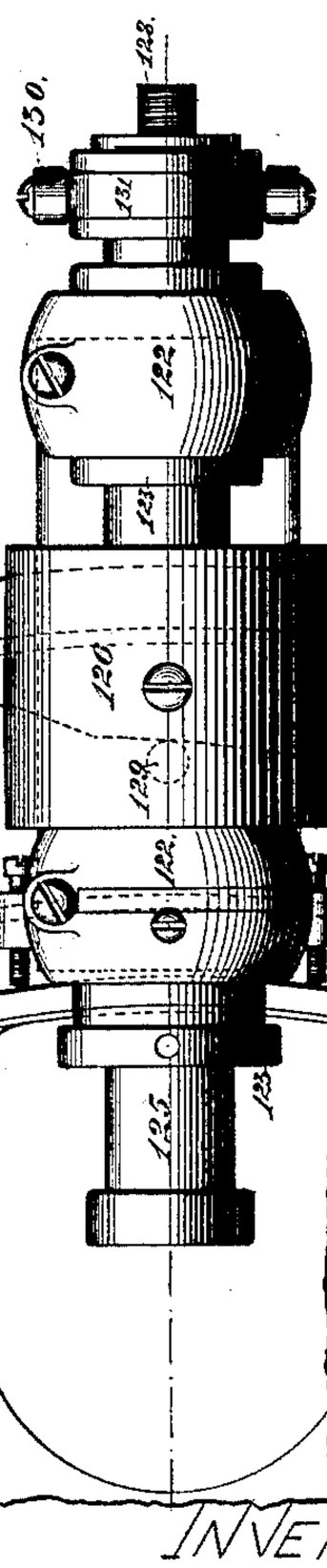


Fig 25.b.

WITNESSES-
Arthur A. Erb.
Willington Snyder

INVENTOR-
Charles S. Moseley
By his Attorney
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 17.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

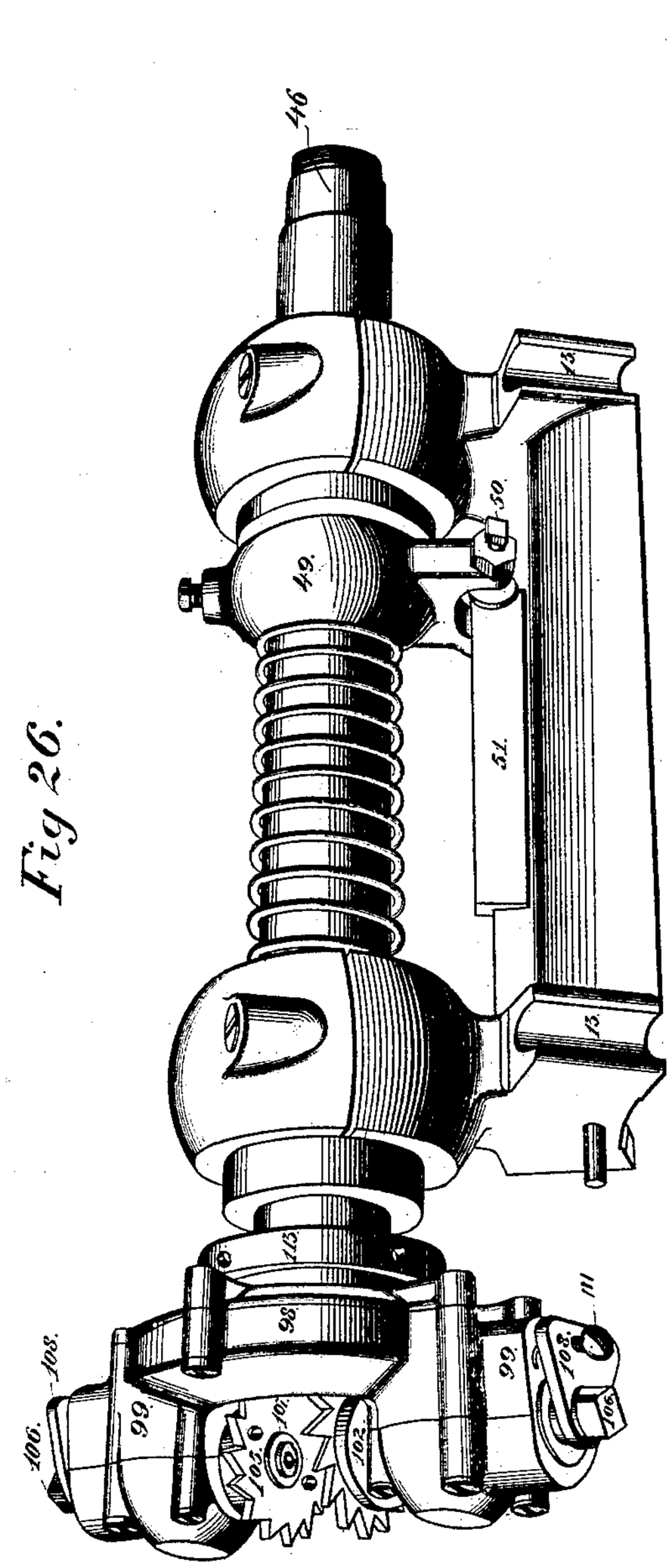


Fig 26.

WITNESSES.
Arthur A. Eob.

Wellington Kugler

INVENTOR.
Charles S. Moseley.

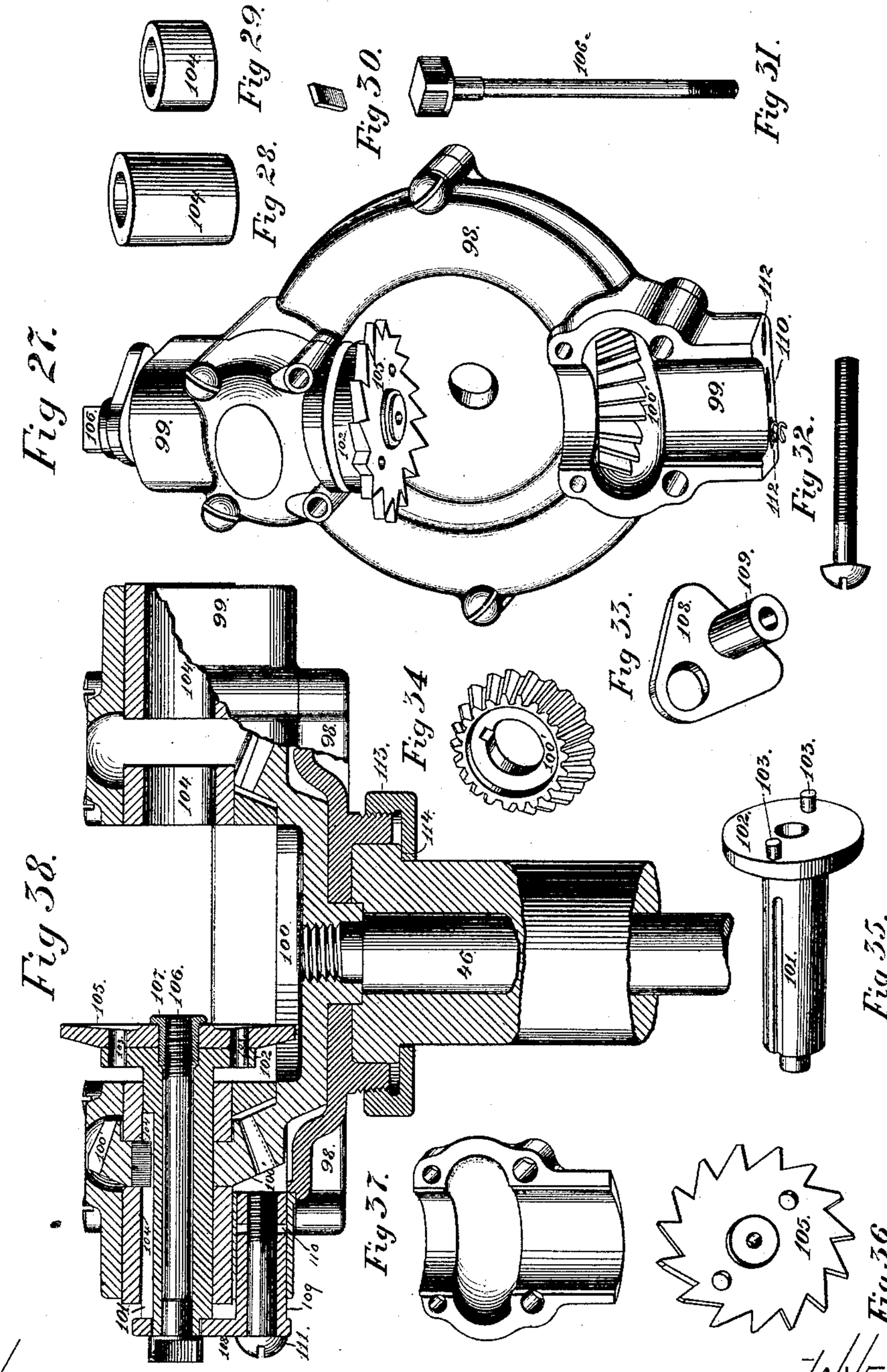
By his Attorney.
Frank L. Dyer

(No Model.) 21 Sheets—Sheet 18.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.



WITNESSES
Arthur A. Erb.
Wellington Kuglir

INVENTOR -
Charles S. Moseley.

By his Attorney Frank L. Dyer.

(No Model.) 21 Sheets—Sheet 19.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 39.

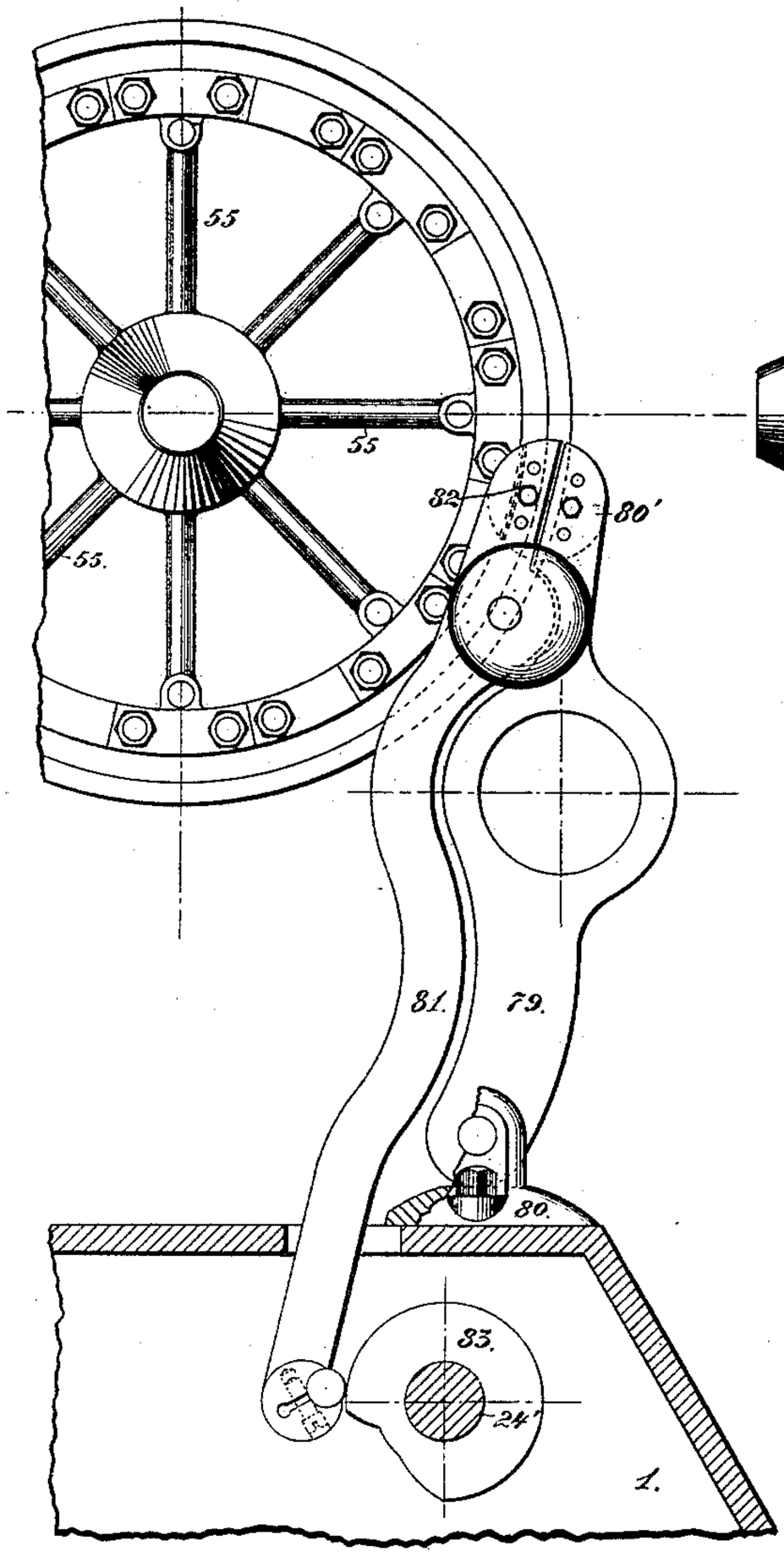
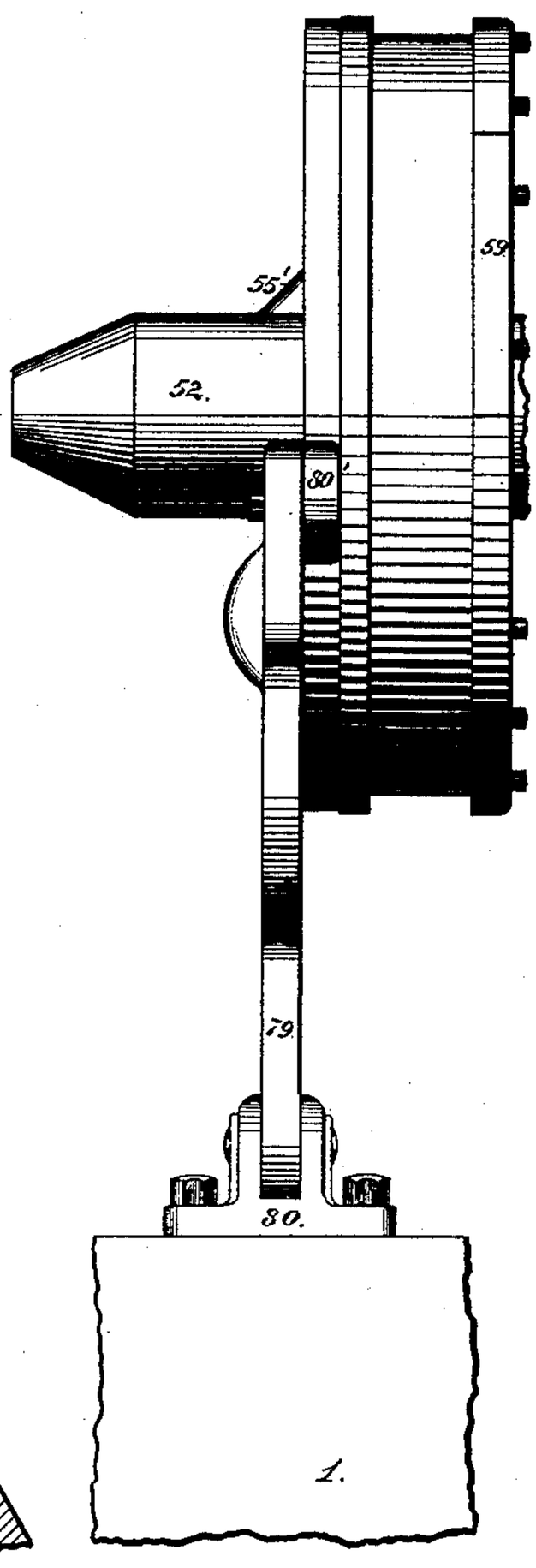


Fig 40.



WITNESSES
Arthur A. Erb.
Wellington Snyder

INVENTOR -
Charles S. Moseley.
By his Attorney Frank L. Dyer

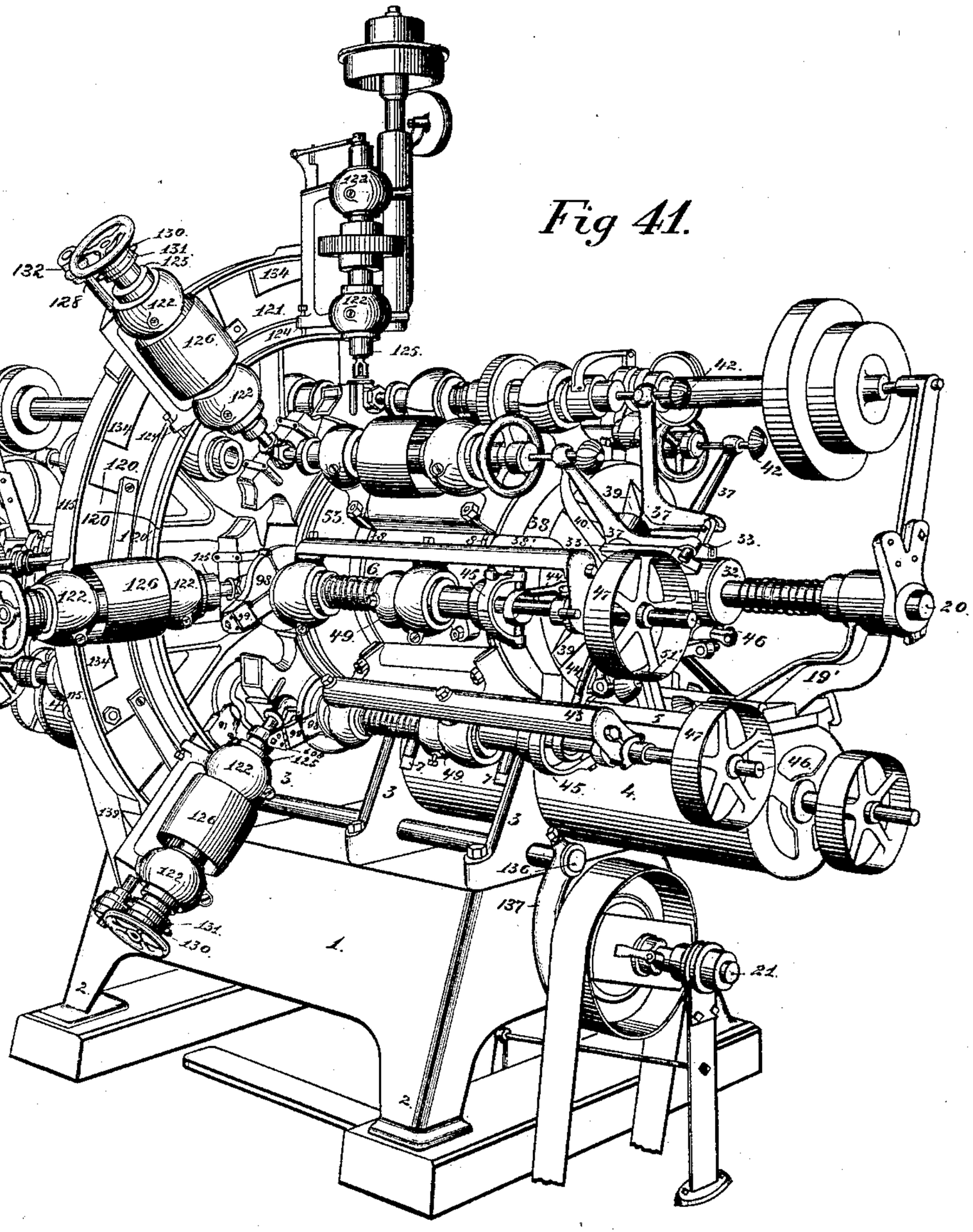
(No Model.) 21 Sheets—Sheet 20.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

Fig 41.



Witnesses
Arthur A Eck
Leonard Hayes

Inventor
Charles S. Moseley.
By his Attorney
Francis L. Dyer

(No Model.) 21 Sheets—Sheet 21.

C. S. MOSELEY.

MACHINE FOR FINISHING METAL GOODS.

No. 462,671. Patented Nov. 3, 1891.

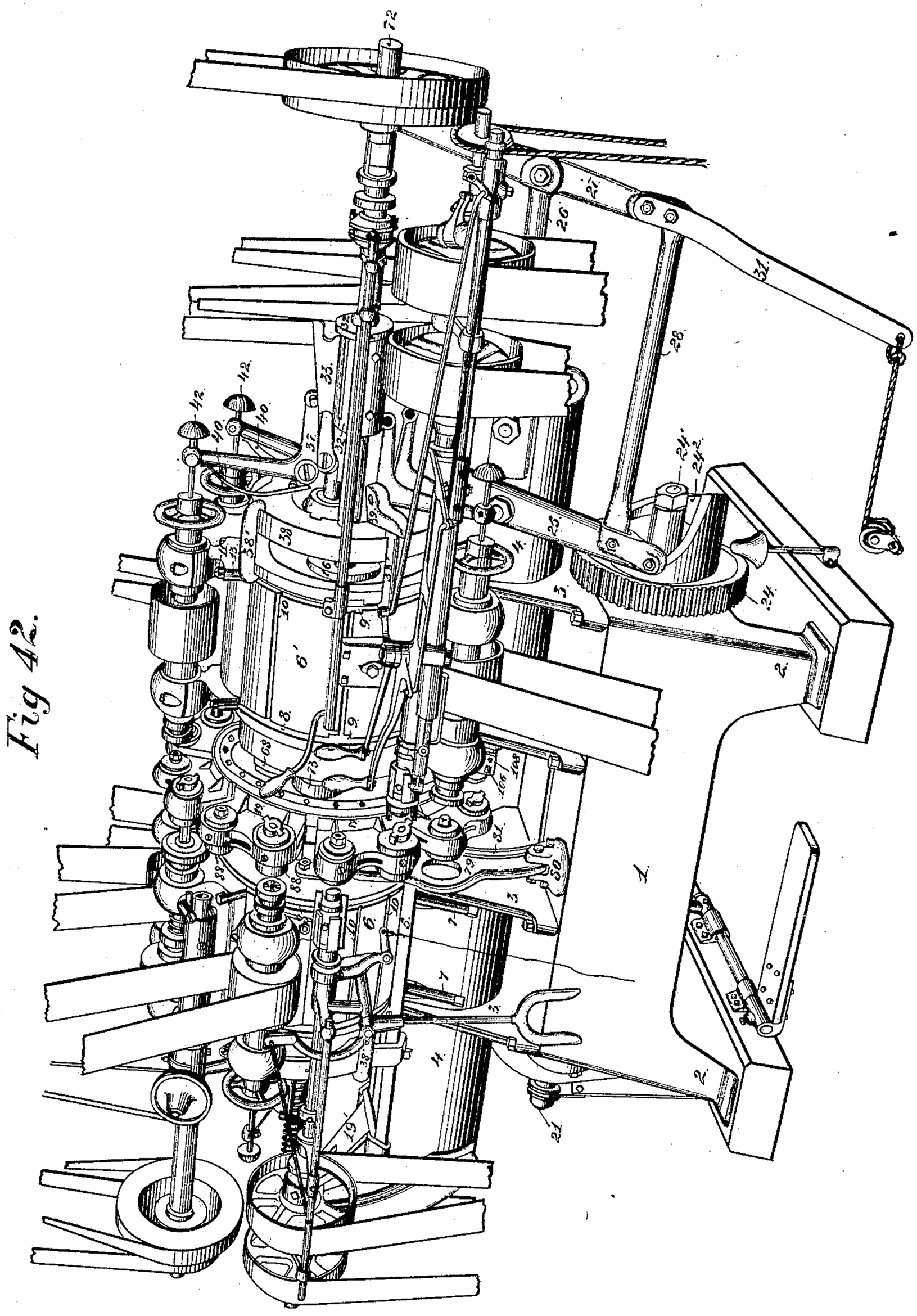


Fig 42.

WITNESSES.

Arthur A. Erb.

Leon and L. Dyer.

INVENTOR.

Chas. S. Moseley

by Frank L. Dyer

his Attorney

UNITED STATES PATENT OFFICE.

CHARLES S. MOSELEY, OF DUBUQUE, IOWA.

MACHINE FOR FINISHING METAL GOODS.

SPECIFICATION forming part of Letters Patent No. 462,671, dated November 3, 1891.

Application filed June 23, 1890. Serial No. 356,314. (No model.)

To all whom it may concern:

Be it known that I, CHARLES S. MOSELEY, a citizen of the United States, residing at Dubuque, in the county of Dubuque and State of Iowa, have invented certain new and useful Improvements in Machines for Finishing Metal Goods; and I do hereby declare the following to be a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

It was generally the custom in the finishing of metal goods to first place the rough casting to be operated upon in a machine and subject it to a set of cutters, whereby one portion only of the same was finished. It was then placed in another machine and subjected to another cutter for finishing another part of the same, and this operation repeated again and again until the article was entirely completed. It will therefore be seen that many handlings of a single piece were required to complete a single article of manufacture. In some cases, as in steam-valves, there are many portions to be operated upon requiring a corresponding number of machines and cutters to do the work, so that the finishing of metal goods as formerly practiced was very expensive. In later years, however, the production of such goods has been somewhat improved and numerous suggestions have been made for reducing their cost by quickening the required operations. One method consisted in placing the casting in a chuck and subjecting it to a cutter for the first operation, after which another cutter was brought in line and the second operation performed, and so on with the different cutters, the article remaining in the same machine during the different operations. Another consists in placing the casting in a chuck and subjecting it on both ends at the same time when practicable to a double set of cutters, so that two portions of the work are done at once. The cutters are then changed or the semi-finished article removed to another machine. Notwithstanding these various improvements, it is obvious that the art of finishing metal goods is still very imperfect, for the reason that more time is required to transfer them from one machine to another than to perform the operations required. Following this line of invention it is evident that three or more sets of cutters can be used where a greater number of distinct parts are to be operated upon—such, for example, as in ordinary steam-valves, where there are three openings, each requiring separate cutters for screw-threading, squaring, truing the valve-seat, &c. Consequently the perfect metal-finishing machine would be one which would require no change of cutters or transfer of the article from one machine to another. Such is the machine I have invented and which is illustrated in the accompanying drawings, forming a part of this application, and which will be fully described and claimed hereinafter.

The object of my invention is to provide an automatic machine capable of manufacturing with rapidity and precision articles of the above-named general character without the necessity of removal from the machine until completed.

Another object of this invention is to provide certain new and improved cutters especially adapted for use with my improved machine and by which the squaring operations on certain classes of goods are greatly facilitated, and the operation of squaring may be completed in the same machine and at the same time with other operations for finishing metal goods, which has never been accomplished before. By use of this invention I am enabled to operate upon a number of articles at the same time.

Another advantage is that the machine is applicable for use with work upon which two or more sets of cutters can be used during the time of one operation or with work upon which only one set of cutters may be used upon a single piece at the same time.

Another advantage is that each simultaneous operation of all the cutters on the various parts of the several castings, if transferred to one casting, would be equivalent to its full completion, and that a casting finished in all its parts is taken out of the machine every time a new operation is performed on the castings in the machine, as will be fully explained hereinafter; and a still further advantage is the loss of no time while placing the article in the machine, which has not hitherto been attained. In my machine this work is done while the cutters are in operation doing their work.

The chief novelties or improvements in my

machine are, first, a disk for carrying the holders of the work to be finished, which is mounted between two drums or their equivalents; second, a number of rotating and sliding cutter-spindles mounted circularly upon said drums and capable of motion toward and from said disk; third, a number of rotating and sliding cutter-spindles mounted on an auxiliary radial frame and capable of motion toward and from the periphery of the disk; fourth, various new and improved cutters mounted upon such spindles; fifth, mechanism for moving the spindles toward and from said disk; sixth, mechanism for rotating the disk, and, seventh, certain new and improved holders for chucking the articles to be finished, and also other and less important details of improved construction, as will be more fully hereinafter described and claimed.

For the better comprehension of my invention attention is called to the accompanying drawings, forming a part of the specification, and wherein—

Figure 1 is an elevation of the machine with the cutters and cutter-spindles, radial cutter-holders, radial cutters and spindles, and cutter-actuating mechanism removed; Fig. 2, a perspective view of the same, showing the machine at one end and the clamp grasping the disk; Fig. 3, a perspective view from the other end; Fig. 4, a perspective view of the disk from one side, showing one set of holders thereon and the indices in position; Fig. 5, a longitudinal view, partly in section, of the disk, partly in elevation; Fig. 6, a sectional view through the drums and disk; Fig. 7, a side elevation of the disk, with the actuating mechanism attached thereto; Fig. 8, a separate sectional view of the cam pawl-wheel for actuating the disk; Fig. 9, a sectional view of the disk in detail; Fig. 10, a view of the disk, showing the opposite side of that shown in Fig. 4; Fig. 11, a separate perspective view of a portion of the drum, showing the manner of attaching the pawl thereto; Fig. 12, an enlarged perspective view of one end of one of the drums, showing the mechanism for advancing the horizontal cutters toward and retracting them from the work; Fig. 13, a modification thereof; Fig. 14, an enlarged elevation of one form of holder for certain kinds of work; Fig. 15, a plan of the same, partly in section; Figs. 16 and 17, perspective views of both sides of said holder; Fig. 18, an elevation of another form of holder for holding work, whereby two or more cutters may operate upon the work at the same time; Fig. 19, a plan of the same, showing the body of a valve in position; Fig. 20, a sectional view taken on the line A B of Fig. 18; Fig. 21, a sectional view taken on the line C D of Fig. 18; Fig. 22, a detached sectional view of a separate slide for the holder; Fig. 23, a section taken on the line X X of Fig. 22; Fig. 24, a perspective view illustrating the auxiliary radial cutter holders and showing particularly the mechanism for controlling the radial spindles and cutters. Figs. 25, 25^a, and 25^b are sectional elevation and plan views of one of the radial spindles and its carrier. Fig. 26 is a perspective view of a detached carrier, with its spindle and squaring-head ready to be mounted on the drum; Fig. 27, a perspective view of one squaring-head having one cutter and means for operating said cutter removed. Figs. 28, 29, 30, 31, 32, 33, 34, 35, 36, and 37 are views of details of the squaring-head. Fig. 38 is a view, partly in section, of a squaring-head, showing one cutter and operating mechanism removed; Fig. 39, an elevation, partly in section, of the auxiliary clamping-jaws for holding the disk in position; Fig. 40, a side elevation of the same; Fig. 41, a perspective view of the machine complete; and Fig. 42, a front perspective view of the complete machine.

In all the above views corresponding parts are designated by identical figures of reference.

The base 1 of the machine is made of cast-iron of a general rectangular form, with preferably four corner supports 2 2 2 2, and is made of such weight and strength as to set firmly and rigidly in position. Upon the top of this base are bolted the braces 3 3 3 of the auxiliary supports 4 4. These latter supports are made in a general horseshoe form and provided on their upper edges with rectangular tracks 5 5, and project some distance beyond the base 1, and are made preferably of cast metal. It is not necessary to make these supports in horseshoe shape, because angular forms may answer as well; but by making them as I have a rigid support is obtained with a minimum amount of material, and also for convenience in operating the machine, as will more fully appear hereinafter.

The tracks 5 5 are parallel, accurately aligned, and in the same plane with each other. Mounted upon these tracks are metallic drums 6 6′, held in position by means of bolts 7 7, passing through the tracks 5 5 and entering the periphery of said drums. These drums are also in the same plane with each other and are rigidly fastened on the auxiliary supports. In a machine such as I am now describing these drums are cylindrical, about two feet in length, and one and a half feet in diameter. Around the periphery of each drum and near their respective ends are cut T-shaped grooves 8 8, having enlarged openings 9 9 for the entrance of the retaining-bolt heads, as will be more fully described hereinafter. Lengthwise upon the periphery of each drum are cut a series of rectangular grooves 10 10, parallel with each other. These grooves act as guides for the spindle-carriers, to be more fully described hereinafter. I designedly cut upon drum 6 double the number of grooves that are cut upon drum 6′, in order that the cutter-spindles may be placed directly opposite each other on each drum, or alternately, for the purpose described hereinafter. The

carriers for holding the cutter spindles or shafts are placed upon each drum, and are each provided with a tenon which is adapted to engage with one of the grooves in the drums and held rigidly in position by means of bolts 11 11, having heads sliding in said grooves 8 8 and entering slot 13 in each carrier. These bolts are placed in the T-shaped grooves through the enlarged openings 9 9, before referred to. By thus holding the spindle-carriers in position on the drums it will be evident that they can be quickly removed and their positions changed at will. Within the drums are metallic sleeves 14, each provided at one end with taper bearings 15, between which is mounted the disk, to be more fully described hereinafter. I have thus provided taper bearings for the disk, and in order that any wear may be taken up each of the sleeves 14 is provided with a flange 16, projecting out over the rear end of each drum, and within this flange is an adjusting-screw 17, engaging with a screw-threaded chamber in the rear end of each drum. By turning this screw it will be evident that the sleeve 14 may be made to advance inwardly and close upon the hub of the disk to take up any wear. I also provide screws 18, threaded through the flange of each sleeve and bearing against the rear head of each drum, so that these latter screws may be turned inwardly and thereby cause the sleeve to retract. The reciprocating shaft 20 of the machine passes entirely through the drum and the hub of the disk and bears only in the bearing-pieces 19. For the further support of the reciprocating shaft I provide bearing-pieces 19′, adjustably secured to the auxiliary support 4.

The shaft 21 of the machine is mounted in suitable bearings 22, through the base 1, and passes from one end of the machine to the other. It is provided on one end with a pulley, to which power is applied, and on the other with a pinion 23, engaging with a gear-wheel 24, which revolves with the shaft 24′, running through the base 1 parallel with the shaft 21. On the face of this gear-wheel 24 and turning with the shaft 24′ is placed a cam 24^2. Bearing against this cam is the lower end of lever 25, pivoted to the side of the auxiliary support 4. Mounted on the pivoted rod 26 projecting from the auxiliary support 4 is a lever 27, connecting with the cam-lever 25 by means of a connecting-rod 28. This lever 27 connects at its upper end with the reciprocating shaft 20.

From the mechanism just described it will be evident that the following operation will take place: Power is applied to the pulley on the shaft, which drives the pinion and gear-wheel and which rotates the cam on the face of the gear-wheel. This causes the lower end of the cam-lever 25 to be moved back and forth by the cam, and the reciprocating shaft follows this movement through the intermediate lever 27 and connecting-rod 28. The shaft is returned to its original position by means of a weight attached to the extension-piece 31, or by means of a spring arranged in any suitable position. These movements of the reciprocating shaft operate the cutters, as will now be described in connection with Fig. 12. I place upon the reciprocating shaft, near the outer end of each drum, sleeves 32, having parallel grooves corresponding with certain of the grooves on the drums. Securely fastened within these grooves are placed inclined pieces 33. Engaging with the operating-face of each inclined piece is the horizontal arm of a pivoted angle-lever 37. These levers are mounted on a circular support 38, held in place by means of suitable clamps 38′, engaging with T-shaped grooves, heretofore described, in each drum and also secured to each auxiliary support. This circular support is provided with radial recesses corresponding to certain of the grooves on each drum and on sleeves 32. Secured within the recesses on each circular support is a bearing-piece 39 for the angle-lever 37, and which is rigidly held in position. The horizontal arm of each angle-lever is held normally against the outer face of each inclined piece by means of the leaf-spring 40 bearing against the vertical arm thereof. The upper end of the vertical arm connects with an adjusting-screw 42, which bears against or connects with the outer end of the cutter-spindles. These cutter-spindles are mounted, as before mentioned, in suitable carriers attached to the face of each drum, and are rotated by means of a belt passing around a pulley or by other suitable mechanism. At the inner end of each cutter-spindle is to be placed a cutter or a set of cutters for performing the necessary work, and, if required, one of the spindle-carriers can be placed within each auxiliary support 4 4. By means of the mechanism I have just described the cutters are advanced and withdrawn when the reciprocating shaft is moved backward and forward, as above described. The horizontal arm of each angle-lever while ascending the incline forces the vertical arm against and compresses spring 40, and also moves the cutter-spindles toward the disk, to be hereinafter described. While descending the said incline spring 40, by the release of its tension, withdraws the cutter-spindle from the disk. The movement of the cutter-spindles can be conveniently adjusted by means of the adjusting-screw 42. In order that the cutters may be advanced rapidly to a position adjacent to the work and then advanced slowly into the work, I make the inclined pieces of the form shown in the drawings, Figs. 12 and 13—viz., with short steep inclines at their forward ends and with slight inclines for the remaining distance—causing the horizontal arms of the angle-levers to be elevated rapidly at first and slowly afterward.

In Fig. 13 I have shown a modification of that just described and which is constructed as follows: I provide the shaft in this case with the inclined pieces and mount the lever

on the circular support, as I have just described. The lever in this case, however, is made in two parts 43 and 44. The part 43 resembles the angle-lever I have just described, and is provided at its outer end with an adjusting-screw 51′. The part 44 is provided with a yoke-piece fitting over the upper end of the part 43 and is pivoted as I have shown. The upper end of the part 44 is pivoted or is connected to the outer end of the cutter-spindles by means of a connecting-link 45. The particular connection with the cutter-spindle is by means of a ring-piece bearing between the two sleeves, so that the cutter-spindle is at liberty to turn, if need be. In this case the cutters are operated by means of a small shaft 46, passing through the cutter-spindle, and which is operated preferably by means of a belt passing over a pulley 47. The cutters and cutter-spindles are withdrawn from their work in this case by means of a coiled spring passing around the spindle and bearing between the guide-piece 49 and one of the bearings for the spindle. The guide-piece 49 is held in position on the cutter-spindle by means of a set-screw and is provided at its inner end with two screws 50 and 50, which may be set upon opposite sides of track 51, thereby securing the movement of the cutter-spindles in a straight line. By means of the adjusting-screw 51′ the two parts 43 and 44 may be separated more or less and the path of the movement of the cutter-spindles adjusted.

The disk-wheel shown in Figs. 4 to 11, inclusive, for holding the work, and of which a general mention has been made, will now be described. It consists of a hollow hub having cone-shaped ends, as before mentioned, and through which the reciprocating shaft 20 passes without contact. This hub is made integral with the body 53 of the disk, which is surrounded by a rim 54, which projects on both sides of the body. The rim is also provided with an inclined lip 58 on its outer face, around and against which the holders are held. In order that the body of the disk may be strengthened, I provide the same with integral radiating braces 55 55, resembling spokes, as shown in Fig. 10; or, if need be, the radial braces may be dispensed with entirely and the hub may be enlarged, as at 55′, Figs. 5, 6, and 9, so as to strengthen the disk. At the outer end of each radiating brace, of which there are several corresponding to the grooves on the drum 6′, is secured a pin 56, passing some distance in the interior of the body. The holders are provided with a flange at their inner faces corresponding to the shape of the outer face of the disk and are held in position on said disk and against the rim 54 by means of clamp 59. These clamps 59 project from the rim of the disk and correspond to the rim 58. Directly beneath these clamping-pieces are placed and securely fastened indices 60 60. These indices are held in position against the face of the disk by means of bolts 61, passing entirely through the body of the disk. The operative faces 60′ of each of the indices are made concentric to correspond with the operative face of the pawl 69, which is also concentric, to be more fully described hereinafter, so that the position of the disk when one of the indices is against the pawl will be the same whether the pawl is partially or wholly in place. It is of the utmost importance that the indices shall be equidistant around the disk, in order that the disk will present the work at the exact position of the cutters. Any index that is accurately adjusted will answer my purpose; but I prefer the index and the adjusting mechanism described in my application filed in the United States Patent Office on the 15th day of January, A. D. 1890, Serial No. 337,018. Surrounding the hub of the disk on the same side as the indices is firmly secured wheel 66, suitably provided with ratchet-teeth corresponding in number to the indices. I provide the inner head of one drum with a recess 67, within which a suitable piece 68 is rigidly fastened. Upon this piece is pivoted the pawl 69, provided with a concentric face, as before described, and adapted to engage with the concentric face of the indices of the disk. On the other drum is a cylindrical extension or stud 70, to which is pivoted another pawl 71. This pawl, as before mentioned, engages with pins 56 on adjacent side of the disk. As the disk rotates the pawl 71 will successively engage with the different pins, and thereby prevent the disk from being reversed. As one of the indices passes over pawl 69 the said pawl is caused to be elevated, as will appear hereinafter, and engage with the concentric face of the next, thus preventing the disk from being moved forward. The mechanism for controlling this pawl 69 and also for advancing the disk step by step in its rotation will now be described.

An auxiliary shaft 72, by passing through the drum 6′ parallel with the reciprocating shaft 20, is provided on its inner end with a ribbed wheel 73, which is in a plane parallel with the disk and adjacent thereto. This shaft is rotated by a belt or other suitable means, and is provided at its outer end with a clutch.

I do not limit myself to any particular kind of clutch, but reserve the privilege of adopting that which will be most applicable to my purpose. This clutch is locked and unlocked at each revolution of the shaft, causing the intermittent movements of the disk.

I have devised a clutch which has proven successful in this operation, but need not describe it, since any other kind may be used.

The ribbed wheel 73 above mentioned is provided with a removable cam portion 74, held in place by means of screws 75, inserted in slotted openings, that the position of the cam on said wheel may be adjusted. Engaging with the periphery of this wheel and with its cam portion is a bearing-piece 76 on the

rear of the pawl 69, and this bearing-piece is held in place by means of the clamping-jaw 77. Beneath the pawl 69 I place the spring 69′ for the purpose of forcing up said pawl to engage with the face of the indices. It will now be seen that as the cam-wheel 73 is revolved the bearing-piece 76 of the pawl will be elevated by the contour of the cam and the pawl will be disengaged from the indices of the disk, and as the bearing-piece rides down the cam the pawl 69 will be forced up to engage with the indices by the spring 69′. Pivoted on the outer face of the ribbed wheel is an actuating-pawl 78, provided at its outer end with a short cylindrical pin 79, which engages with the teeth on the ratchet-wheel 66.

From the mechanism just described it will be seen that the operation of advancing the disk is as follows: The shaft 72 is caused to make a whole revolution and is then stopped automatically by means of the clutch before mentioned. As the ribbed wheel 73 revolves the pawl 78 is caused to advance during the first part of the revolution of the wheel 73 and causes the ratchet-wheel to be moved forward one tooth and the disk advanced the space of one of the indices. During the remainder of the revolution the pawl 78 is retracted and ready to engage with the next tooth above. As the disk advances the pawl 71 drops behind one of the pins 56, preventing the disk from reversing. As the ribbed wheel 73 is revolved its cam portion 74 will engage with the rear end 76 of the pawl 69 and cause said pawl to be disengaged from the index, allowing the disk to be advanced, and as the bearing portion 76 rides down the cam 74 the spring 69′ will cause the pawl 69 to engage with one of the next succeeding indices and prevent the disk from being farther advanced, and as the ribbed wheel continues to revolve the actuating-pawl 78 will be retracted. Thus it will be seen that the disk is securely held from moving by the two pawls 69 and 71, and that by reason of the concentric face of the pawl 69 and the corresponding shape of each of the indices 60 the disk will be held securely from moving forward, whether the pawl is raised entirely in front of each of the indices or only engages the same but slightly. However, as a further security against any possible rotation of the disk when it is required to be kept stationary I use a peculiarly-constructed intermittent clamp adapted to grasp the rim 54 of the disk, Figs. 2, 39, and 40. This consists of a clamping-piece 79, pivotally mounted in a suitable bearing 80, which is bolted to the top of the base of the machine at one side of the disk. The upper end of this clamping-piece is provided with a removable jaw 80′, which engages with the rim of the disk on its outside. Pivoted to this piece 79 is another clamping-piece 81, which is also provided with a jaw 82, which engages with the other side of the rim of the disk, and when the jaws are brought together the rim of the disk will be held very rigidly between them. This movement of the clamping-jaws is brought about by means of a cam 83, mounted upon the shaft 24′ within the base of the machine, and which preferably rotates with the shaft 24′. It will thus be seen that I make use of three distinct devices for preventing any movement of the disk when it is required to keep it stationary—viz., pawls 69 and 71 and the clamping-jaws just described—so that there may be no possible disarrangement of the disk.

In some kinds of work it is only possible to operate on one face of a casting at the same time—such, for instance, as the small flanged nut 84′. (Shown in Figs. 14, 15, 16, and 17.) In this case I make use of the holders shown generally in the views illustrating the disk, which are also shown enlarged in Figs. 14, 15, 16, and 17. These holders consist each of a base turned to correspond with and to fit the periphery of the disk and adapted to be secured against the inclined rim of the disk by means of the removable clamping-pieces 59, already pointed out. I provide each of these holders with two cylindrical portions 88. Within one of these portions is placed a split chuck 87, which may be of any well-known and suitable construction. The action of split chucks being of common knowledge, it is unnecessary to describe the same here. This chuck is adapted to hold securely one of the flanged nuts 84′, and to present the same to the cutters on one side of the machine, whereby it may be partially finished and entirely screw-threaded. Within the other cylindrical portion 88 is placed an ordinary bolt 86, and its screw-threaded end is adapted to engage with the screw-threaded part of the nut 84′, which is placed on the bolt 86 after it has been presented to the cutters on one side and has been screw-threaded and partially finished. After being placed on the bolt 86 the nut 84′ is presented to the cutters on the other side of the machine and is further and completely finished.

For many kinds of work it is possible with this machine to operate on two or more faces at the same time, and for this I have devised a convenient holder, which is shown in Figs. 18, 19, 20, 21, 22, and 23 in detail. This holder is provided with a flange 89, as are the holders just described, and which is adapted to be clamped against the rim of the disk by means of the clamping-pieces 59 in like manner. This holder is provided with a recess 90 in its outer edge for the reception of the articles to be finished, so that they will be held with their faces to be operated upon extending on each side of the holder and out from the center of the same. The upper part of the holder is recessed in a rectangular form for the reception of the slides 91 91, which may be moved backward and forward in said recess. The slides are held within the holder by means of suitable cap-pieces 92, placed

over the same and fastened to the body of the holder. Each slide is provided with a recess 91′ in each side and also in its top. Within these three recesses are secured pieces of corresponding shape 92′, which are securely fastened to their respective slides. These pieces are of such shape as to firmly grasp the necks of the articles to be finished, as shown in Fig. 19. Engaging loosely with pin 93 in the body of each slide is the upper end of lever 94, which is mounted within the holder, as will be presently described. Pivoted at the lower end of each lever is a short connecting-arm 95, which projects inwardly and engages with the double crank-shaft 96, which is horizontally mounted within the holder. These connecting-arms are held always against said crank-shaft to form a toggle-joint by means of a leaf-spring 97, attached on each side of the holder and engaging with the slides and tending to separate the same, so that the upper ends of the levers are held away from each other. In order that a very delicate adjustment of these slides may be effected, I mount each lever 94 on an eccentric-pivot 94′, which can be turned to change the fulcrum of the levers and in this way increase or decrease the extent of the movements of the upper ends of each. The shaft 96 is provided with a squared portion 96′, by which it may be turned by means of a key or crank or by any other suitable device.

The manner of operating is as follows: The body of the valve 90′ is laid in crosswise of the holder at the half-circular space or recess 90. Then the double crank is turned partly around, forcing out the connecting-arm 95 against the lower end of the levers 94. This movement causes the slides to approach the body of the valve and the pieces 92′ to clasp the neck of the valve and firmly hold said valve while it is being operated upon by the cutters. By turning the double crank-shaft 96 in the opposite direction their lower ends are released, and the springs 97 draw the slides 91 back and with them the upper ends of the levers 94, and the valve is released.

One of the squaring-heads, with the cutters for squaring two opposite sides of a valve end, will now be described. Mounted rigidly on the inner end of a cutter-spindle is a metallic casing 98, provided with two extensions 99 99 on each side thereof. Mounted within this casing on the shaft 46, before described, is a beveled cog-wheel 100. The cog-wheel engages with beveled pinions 100′, which are placed within the extensions before described. Each of these beveled pinions is splined to a hollow shaft 101, in order that the shaft may be moved lengthwise with relation to each pinion. The inner end of each shaft is provided with an integral face-wheel 102, having two studs or pins 103 on its face. Each hollow shaft turns in suitable cylindrical bushings 104, placed within each extension of the main casing and on each side of the bevel-pinions, as shown in Fig. 38. Secured to the face-wheel on each hollow shaft and prevented from turning thereon by means of the pins or studs 103, before mentioned, are the cutter-wheels 105, which are held rigidly in position against said face-wheel by means of a screw-bolt 106, passing through said hollow shaft and engaging with a nut 107. The rear end of each hollow shaft passes through the angular pieces 108 and are held in position therein by means of the screw-bolts just described, as shown in Figs. 27 and 38. These angular pieces are provided on one side with cylindrical extensions 109, which engage with openings 110 in the ends of the casing and through which extend adjusting-screws 111, engaging with the casing. The angular pieces 108 are normally kept out against the heads of the adjusting-screws 111 by means of coiled springs located in suitable recesses 112 in each end of the casing. By means of these screws 111 I am enabled to adjust the cutters to the different kinds of work. The operation of these cutters is as follows: Power is applied to shaft 46, which rotates the cog-wheel 100, which meshes with and turns in opposite directions the beveled pinions 100′. These pinions by being splined to the hollow shafts turn the same, and the cutters are thereby rotated. Now as the cutter-spindles and the casing and cutters are advanced by means of the reciprocating shaft 20 and the inclines 33 the cutters are caused to approach the work placed on the disk and engaging with the faces of the same perform the work of squaring in a very efficient manner. By incasing the cog-wheel, pinions, &c., I exclude all chips or cuttings, and in this way prevent any obstruction or unnecessary wear of parts. The casing is held, preferably, in place on the cutter-spindles by means of the screw-threaded sleeve 113, engaging with the rear portion thereof and bearing against a shoulder 114 on the spindle.

It will of course be understood that I do not limit myself to the use of the particular kind of cutters I have described in operating my machine, as any other cutters can be used.

In some kinds of work three faces can be operated upon at the same time—such, for example, as the bodies of steam-valves, such as I have shown in the drawings, Fig. 19. In this variety of work I make use of an auxiliary attachment, which is clearly shown in the drawings and more particularly in Figs. 24 and 41. This attachment I will now describe. It consists of a circular piece 115, fastened to an extension upon the drum 6′ by means of clamping-pieces 116, by which the base 117 is forced against an integral rim 118 on the drum 6′. These clamping-pieces 116 are prevented from moving laterally by projections fitting in the grooves 119, cut in the head of the drum 6′. Upon one side of this circular piece 115 is formed a recessed track 120,

within which are placed sliding pieces 121, connected together, the use of which will be mentioned hereainfter. Near the inner margin of track 120 is an extension 120′, which forms a shoulder. The spindle-carriers for the radial cutters consist of a body portion 122 and two bearing-boxes 123, resembling the spindle-carriers for the horizontal cutters. Each of these radial spindle-carriers is bolted against the face of circular piece 115 and rests against the shoulder 120, as shown in Fig. 25ª. By means of suitable adjusting-screws passing through the ears 124 the radial spindle-carriers are radially adjusted so as to point directly toward the center of the disk. Mounted within each carrier is a cutter-spindle 125, adapted to receive suitable cutters at their inner ends and which are rotated by means of belts passing over band-wheels 126. These spindles are arranged radially around the periphery of the disk to point directly toward its center. At the back of the base of each radial spindle-carrier is a suitable groove or recess 127, and in the groove is placed a reciprocating shaft or rod 128, provided with a short pin 129, extending rearwardly. At the outer end of this shaft is attached a connecting-piece 130, having a semicircular end which is loosely connected with the collar 131, mounted at the outer end of each radial spindle, whereby the spindle can rotate freely therein. The connecting-piece 130 is adjustably attached to the outer portion of the reciprocating shaft or rod 128 by means of a threaded sleeve 132, engaging with the screw-threads on said shaft. By screwing the sleeve in or out on the reciprocating rod the relative position between the radial spindles and reciprocating rods can be varied at pleasure, and in this way the extent of movement of the radial cutters can be adjusted. The reciprocating rod 128 is kept normally in an outward position by means of a coiled spring 133, placed within the recess 127 in the base of each radial spindle-carrier. The sliding pieces 121, before mentioned, are each provided with curved inclines 134 on their face corresponding in number to the radial spindle-holders, and which engage with the pins 129 on the reciprocating rods and answer the same purpose as the inclines upon the reciprocating shaft 20. As the sliding pieces are advanced along the track 120 the inclines 134 force the pins 129 and reciprocating rods 128 inwardly, and the spindle is thereby moved forward to engage with the work. As the sliding pieces are reversed the coiled springs 133 in each spindle-carrier, forcing outwardly the reciprocating rods and spindles to their normal position, withdraw the cutters from the work.

The movement of the sliding pieces is brought about as follows: On the same shaft with the gear-wheel 24, but at the other end of the machine, I mount a cam 135, shaped substantially as shown in Figs. 1 and 2. At the rear side of the machine and running parallel with the shaft 24′ is an oscillating shaft 136, mounted in suitable bearings through the braces 3 3 3 3 and extending beyond the radial cutter-holders. Mounted on one end of this shaft is an arm 137, having a friction-roller at its outer end which engages with the cam 135, and as the cam is revolved the arm 137 will be moved downward and outward. At the opposite end is another arm 138, projecting outward and connecting directly through a rod 139 to a stud 140, which is attached to one of the sliding pieces 121, before mentioned, and which passes through a slot 141 in the back of the radial cutter-holders.

I have described all the parts of the machine, and its operation will be now detailed as in the case of finishing a steam-valve such as I have shown in position in the second form of the holders. Power is applied to the driving-shaft and to the various spindles for the horizontal and radial cutters. A casting is supposed to be placed in the front holder upon the disk, and by means of the operating mechanism therefor the disk is advanced, so that the casting is brought in line with the first sets of cutters, which are advanced by means of the reciprocating shaft 20, as before described, and which, I will say, furnish the front faces of the article. While this piece is being operated upon by the first set of cutters a second one is placed in the succeeding holder, and when the disk is advanced another step the first casting is brought to the second set of cutters, which, for instance, finish a portion of the ends, and the second piece is brought to the first set. While the cutters are working simultaneously upon these two a third casting is placed in the presenting-holder, when the disk revolves another step, so that the first piece reaches to the third set of cutters, the second to the second set, and the third to the first set. Let it be supposed that the third set of cutters screw-thread the article. The work thus progresses step by step until the casting first placed in the machine has made one entire revolution with the disk and been operated upon by all the required cutters — horizontal and radial — when it is removed from the machine with its several parts entirely finished, it being of course understood that the radial cutters operate on the upper portion of the article precisely in the same way that the horizontal cutters operate on the ends of the article. In this way it will be clearly seen that during each pause of the disk in its revolution and while the various cutters are in operation one casting is turned out therefrom entirely finished, quite irrespective of the number of operations required to be performed on each and at a uniform rate of speed of the machine. It will also be seen that no time is lost in the working of the machine by feeding it with the castings, as this is done while

the various cutters are performing their work. Upon some of the various pieces of steam-valves, while the operations required are substantially the same, it becomes necessary to pass them twice around the disk before they can be wholly finished, since they cannot be held in such manner as will allow the cutters to work on each end of the same at the same time—such, for instance, as the flanged nut 84. This is accomplished by using the first set of holders described and by placing the cutter-carriers in positions alternate to each other on the two drums. The work is now placed within the split chuck on one side of the holder and the disk advanced one step, bringing the work in line with the first set of cutters, when the first operation is performed. While this is being done another piece is placed in the corresponding chuck of the succeeding holder and the disk advanced another step in the manner described, and so on until the casting first placed in the machine has made one entire revolution with the disk, being operated on at one end only and by the cutters of one drum. It is now removed and placed upon the other side of the holder with its unfinished end pointing in the opposite direction, when it is brought in contact with the cutters on the other drum, rough castings only being fed at the same time to the first side. Now as the disk advances it will be seen that each cylindrical portion of the holders contains an article and that one end of the same will be presented to one set of cutters on one drum and the other end in the same holder in its other cylindrical portion, but at the other side will be presented to the alternate cutters on the other drum. Thus after the articles are passed around a second time and been subjected to the action of the alternate cutters they leave the machine entirely finished. It may now be observed that after the machine is put in motion and this work is being turned out therefrom I am enabled to produce from the machine a finished casting in the same space of time that is required to complete a single operation upon any one of its parts as in the first case.

In work of the variety just named wherein but one end at a time can be operated upon an arrangement such as I have adopted upon one drum is necessary, which has upon its surface double the number of grooves that are made upon the other, so that the cutters can be brought to face opposite to each other in finishing articles of the first class and in alternation in finishing those of the second class.

It will be evident that my machine admits of numerous modifications without departing from the leading idea in its invention.

As an outgrowth of my invention a new and improved method of manufacturing metallic goods is proposed which consists, broadly, in operating successively upon a number of like articles of manufacture in one machine at the same time, by means of which one completely-finished article or piece is taken from the machine after each successive operation is performed, and this will be embraced in my claims.

Having now described my invention and its mode of operation, what I desire to secure by Letters Patent is—

1. In a metal-finishing machine, the combination, with a revolving article-holder, of a series of reciprocating cutters on each side thereof, said cutters being set in alternation with each other, whereby the cutters on one side are adapted to perform a series of operations on one side of the articles and the cutters on the other side are adapted to simultaneously perform a series of operations on the other side of the articles.

2. In a metal-finishing machine, the combination of a pair of drums, a holder carrying the articles to be finished and rotatively mounted between the drums, a series of cutters mounted on the periphery of each drum, and a series of radial cutters mounted on a frame attached to one drum, substantially as set forth.

3. In a metal-finishing machine, the combination of a pair of drums, a holder for carrying the articles of manufacture rotatively mounted between said drums, with adjustable bearings in each, and a series of cutters mounted around the periphery of each drum, substantially as set forth.

4. In a metal-finishing machine, the combination of a pair of drums grooved on their peripheries, a series of cutters removably mounted in said grooves, and a rotating holder for carrying the articles of manufacture mounted between the drums, substantially as set forth.

5. In a metal-finishing machine, the combination of a pair of drums grooved on their peripheries, one being provided with double the number of grooves of the other for the purpose mentioned, a series of cutters adapted to be removably mounted in said grooves, and a rotating holder for carrying the articles of manufacture mounted between the drums, substantially as set forth.

6. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles of manufacture mounted between said drums, a series of cutters mounted upon the peripheries of said drums, and a shaft passing through the drums and the hub of the holder, and mechanism connected with the shaft for advancing cutters toward the holder, for the purposes set forth.

7. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles to be finished and mounted between the drums, a series of cutters mounted around the periphery of each drum, and a shaft passing through both of the drums and the hub of the holder and provided with inclined pieces thereon for operating the cutters, and mechanism operated in

conjunction with said inclined pieces, substantially as set forth.

8. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles to be finished mounted between the drums, a series of cutters mounted on the periphery of each drum, a reciprocating shaft passing through the drum and the hub of the holder and provided with inclined pieces thereon, angle-levers engaging with said inclined pieces connected to the cutter-shafts for advancing the cutters toward the holder, and a spring for each cutter for retracting the same, substantially as set forth.

9. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles to be finished mounted between the drums, a series of cutters mounted on each drum, a reciprocating shaft passing through the drums and the hub of the holder and carrying inclined pieces, angle-levers connecting the cutter-shafts with their respective inclined pieces for operating the cutters, and adjusting mechanism on each lever for adjusting the path of movement of each cutter, substantially as set forth.

10. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles to be finished mounted between the drums, a reciprocating shaft passing through the drums and the hub of the holder carrying inclined pieces, a separate ring mounted in the rear of each drum, and a number of angle-levers on said ring and engaging with the reciprocating inclines and connecting with the cutter-shafts, substantially as set forth.

11. In a metal-finishing machine, the combination of a pair of drums, a rotating holder for carrying the articles to be finished mounted between the drums, a series of cutters mounted on the peripheries of the drums, a reciprocating shaft passing through the drums and the hub of the holder, a number of variable inclined pieces removably secured to said shaft for the purpose mentioned, and a number of angle-levers connecting the cutter-shaft with said inclines, all adapted to operate as set forth.

12. In a metal-finishing machine, the combination of a base, a pair of drums mounted thereon, a rotating holder for carrying the articles to be finished mounted between said drums, a series of cutters removably mounted on the periphery of each drum, a reciprocating shaft passing through the drums and the hub of the holder for actuating said cutters, inclined pieces secured to said shaft, levers engaging with said inclined pieces, and a lever pivoted upon the end of said reciprocating shaft and engaging with a cam, whereby said shaft is reciprocated, substantially as set forth.

13. In a metal-finishing machine, the combination of a base, a pair of drums mounted on said base, a rotating holder rotating between said drums, a series of cutters secured to the peripheries of said drums, a reciprocating shaft passing through each drum and the hub of the holder and having inclined pieces, and the angle-levers engaging with said pieces and connected with the cutters, a radial support secured to one drum and carrying reciprocating cutters, and mechanism for actuating said radial cutters, substantially as set forth.

14. In a metal-finishing machine, the combination of a base, a pair of drums mounted on the base, a rotating holder for carrying the articles to be finished rotating between the drums, a series of cutters secured to the periphery of each drum and mechanism for actuating the cutters, a series of radial spindles mounted on a frame attached to the supporting-edge of one drum, sliding pieces in said support carrying curved inclined pieces which work indirectly against the spindle, and connecting mechanism for actuating said sliding piece and the radial cutters, substantially as set forth.

15. In a metal-finishing machine, the combination of a pair of drums, a sliding sleeve in each drum, a rotating holder carrying the articles to be finished between said sleeves, and a series of cutters secured to each drum, substantially as set forth.

16. In a metal-finishing machine, the combination of a pair of drums, each provided with circumferential T-shaped grooves therein, a number of retaining-bolts engaging with said grooves and holding the carriers for the cutter-spindles in place on said drums, and a rotating holder for carrying the articles to be finished mounted between said drums, substantially as set forth.

17. In a metal-finishing machine, the combination of a pair of drums having cutters mounted on their peripheries, a rotating holder for carrying the articles to be finished mounted between said drums, a pawl for preventing the movement of said disk in one direction, another pawl for preventing the reverse movement of the disk, and mechanism for rotating the disk, substantially as set forth.

18. In a metal-finishing machine, the combination of a pair of drums, each having a series of cutters mounted on their peripheries, a rotating holder for carrying the articles to be finished rotating between said drums, a series of pins on one side of said holder with which a pawl engages, and a number of indices on the other side of said holder with which another pawl engages, for the purposes all set forth.

19. In a metal-finishing machine, the combination of a pair of drums, each having a series of cutters mounted on its periphery, a rotating holder for carrying the articles to be finished rotating between said drums, a number of pins on one side of said holder with which a pawl engages, a number of indices on the other side of said holder with which an-

other pawl engages, a ratchet-wheel attached to said holder, and the pawl engaging with said ratchet-wheel for revolving the holder, substantially as set forth.

20. In a machine of the character described, the combination of a rotating holder adapted to carry the articles to be finished and having a ratchet-wheel secured thereto, and a face-wheel adjacent to said ratchet-wheel and carrying a pawl engaging with said ratchet-wheel, whereby said holder is rotated, as and for the purposes set forth.

21. In a machine of the character described, a rotating holder carrying the articles to be finished, having indices with which a pawl engages, a ratchet-wheel secured to said holder, a face-wheel rotating adjacent to said ratchet-wheel and carrying a pawl engaging with said ratchet-wheel, and a cam portion secured to said face-wheel for actuating the pawl which engages with the indices, substantially as set forth.

22. In a machine for finishing metal goods, a rotating article-holder, with a clamp for grasping said holder and firmly retaining the same while the articles are being operated upon in said holder, for the purposes set forth.

23. In a machine of the character described, a rotating article-holder carrying the articles to be finished, having indices set in one face of said holder, and a pawl engaging with said indices, for the purposes set forth, in combination with a clamp for grasping said holder and preventing it from moving while the articles in the same are being operated upon, for the purposes set forth.

24. In a machine of the character described, two drums, each having a series of cutters removably mounted upon its periphery, a central rotating article-holder rotating between said drums, a clamp for grasping said holder and retaining the same while the cutters are operating upon the articles in said holder, and mechanism for operating said clamp, for the purposes set forth.

25. In a metal-finishing machine, the combination of a pair of drums, each having a number of cutters mounted on its periphery, a holder for carrying the articles to be finished rotating between said drums, a number of pins on one side of said disk with which a pawl engages, a number of indices on the other side of said disk with which another pawl engages, mechanism for rotating the disk, and a clamp for clamping the rim of the disk, substantially as set forth.

26. In a metal-finishing machine, the combination of a pair of drums, each having a number of cutters mounted on its periphery, a disk for carrying the articles to be finished rotating between said drums, a number of pins on one side of said disk with which a pawl engages, a number of indices on the other side of said disk with which another pawl engages, a clamp for clamping the rim of the disk, and a cam working in the base of the machine for actuating said clamp, substantially as set forth.

27. In a metal-finishing machine, the combination of a rotating disk for carrying the articles to be finished, a series of radial spindles mounted around the periphery of said disk, a collar at the outer end of each spindle in which a connecting-piece engages, a reciprocating rod attached to said connecting-piece, and sliding inclines for actuating said reciprocating rod, substantially as set forth.

28. In a metal-finishing machine, the combination, with a rotating disk and a number of cutters working adjacent thereto, of a removable holder secured to the periphery of said disk and provided with slides carrying removable pieces for grasping the articles to be finished, substantially as set forth.

29. In a metal-finishing machine, the combination, with a rotating disk and a set of cutters working adjacent thereto, of a removable article-holder secured to the periphery of the disk and provided with slides to which removable pieces are attached for grasping the article, and means, substantially as described, whereby the slides are operated, substantially as set forth.

30. A removable holder provided with slides to which a number of pieces are attached, a lever mounted on an eccentric-bolt and connecting each slide with a crank-surface of the shaft within the holder, and means for revolving said shaft, substantially as set forth.

31. In a metal-finishing machine, a squaring-head removably attached to a spindle, said squaring-head consisting of cutters mounted on individual shafts set in the same straight line, means for adjusting the cutters endwise, and a shaft passing through the spindle and coacting with the cutter-shafts to actuate said shafts, substantially as set forth.

32. In a metal-finishing machine, the combination, with a rotating disk for carrying the article to be finished, of a number of squaring cutter-heads adjacent thereto, each supplied with two rotary cutters mounted parallel to each other, with the axes of said cutters parallel to the face of the holder, for the purpose of squaring the opposite sides of the articles to be finished.

33. In a metal-finishing machine, the combination, with a rotating disk for carrying the articles to be finished, of a number of squaring-heads, each secured to a slide and supplied with two removable cutters revolved by a shaft within the slide, for the purposes set forth.

34. In a metal-finishing machine, the combination, with a rotating disk for carrying the articles to be finished, of a number of squaring cutter-heads adjacent thereto and each head carrying adjustable rotary cutters, and means, substantially as described, for adjusting the cutters.

35. In a metal-finishing machine, the com-

bination, with a rotating disk for carrying the articles to be finished, of a number of squaring cutter-heads adjacent thereto and each head removably secured to a spindle, a rotating shaft within the spindle carrying a bevel gear-wheel, smaller gear-wheels engaging with said bevel gear-wheel and rotating the cutters, substantially as described.

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

CHARLES S. MOSELEY.

Witnesses:
MONROE M. CADY,
GEORGE CRANE.