

J. E. HANGER.

LATHE FOR THE MANUFACTURE OF ARTIFICIAL LIMBS.

No. 339,879.

Patented Apr. 13, 1886.

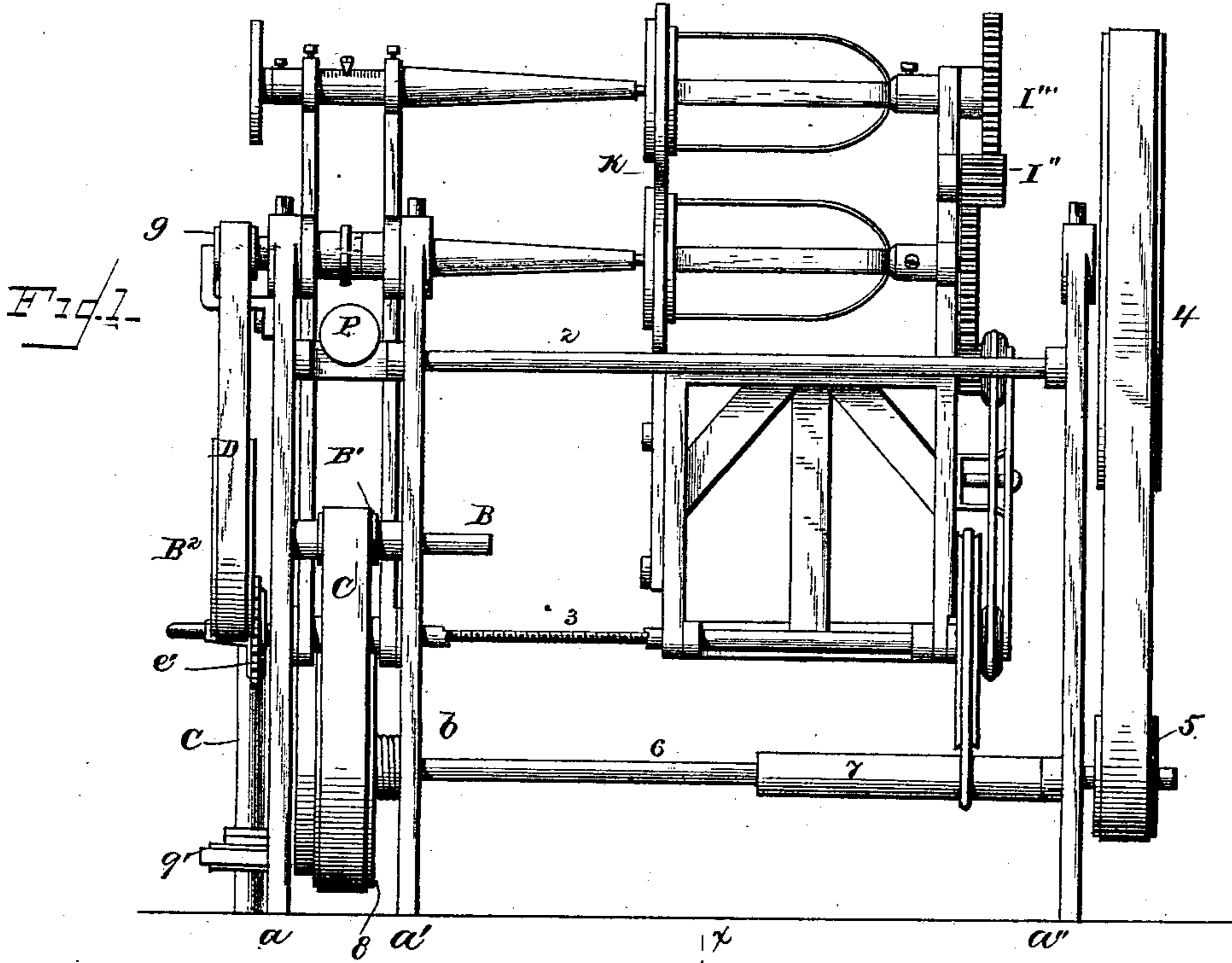
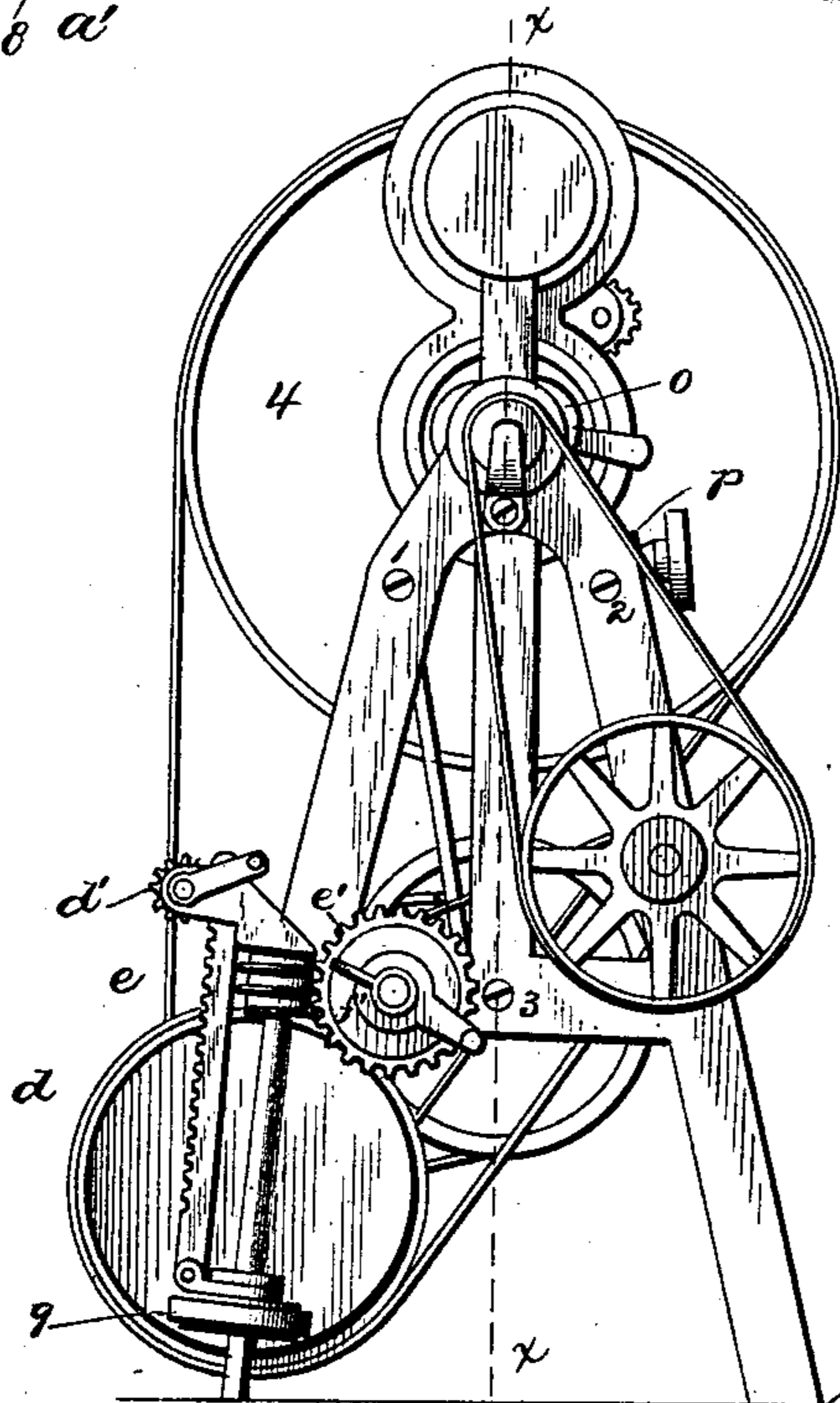


Fig. 2.



WITNESSES  
*F. L. Quard*  
*E. W. Johnson*

*James E. Hanger*  
 INVENTOR  
*George E. Lemow*  
 His Attorney

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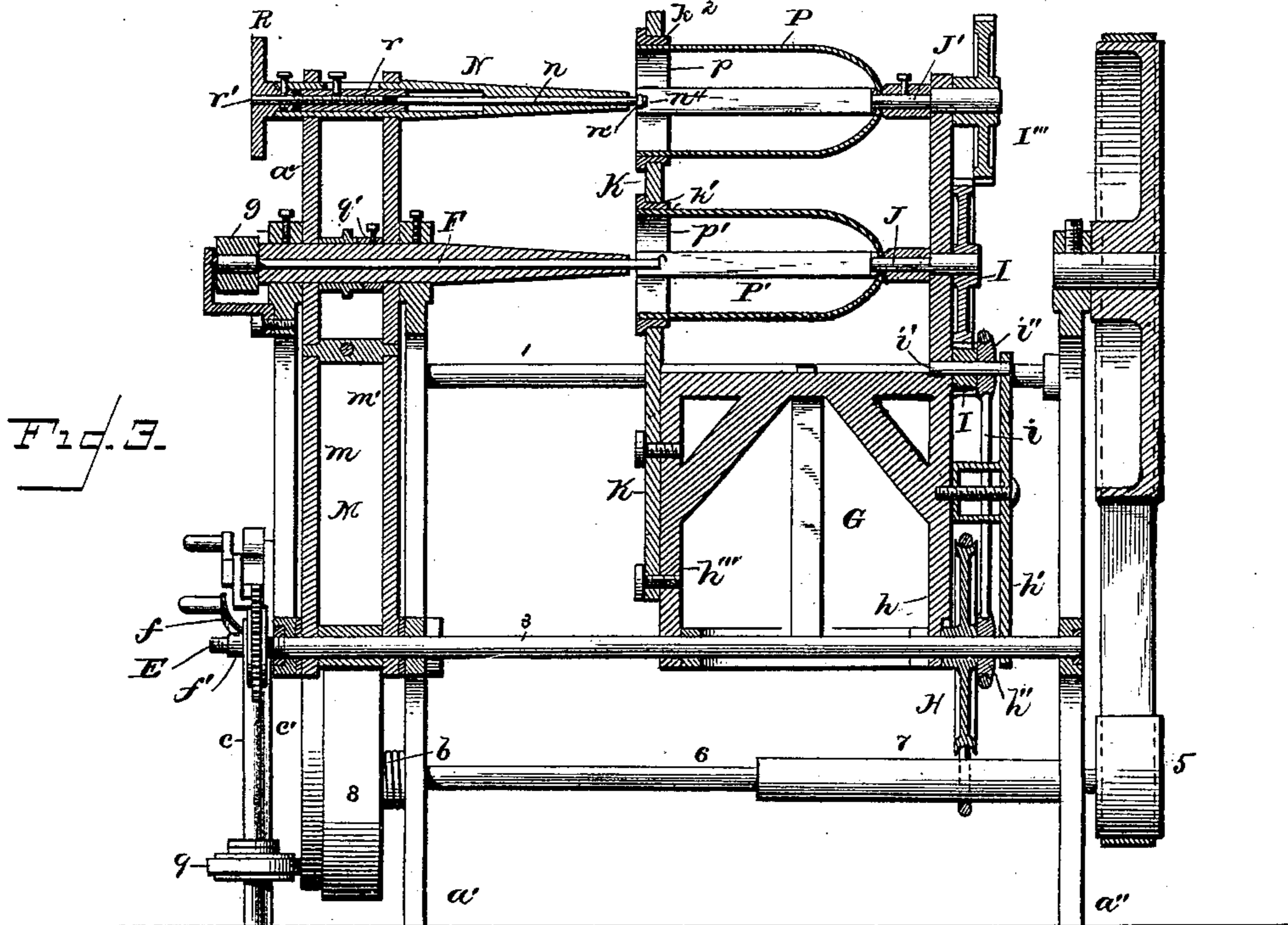


Fig. 3.

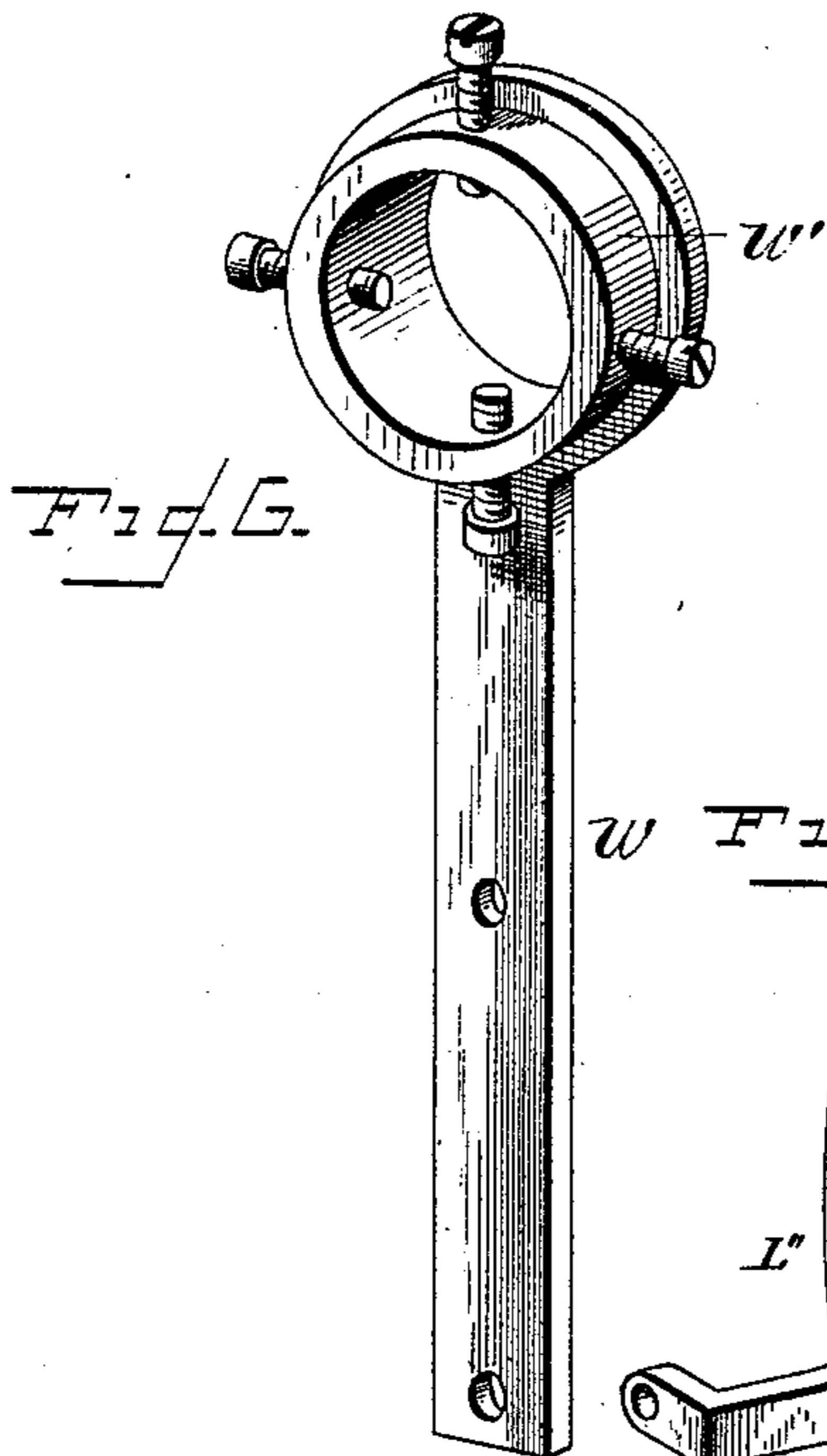


Fig. 6.

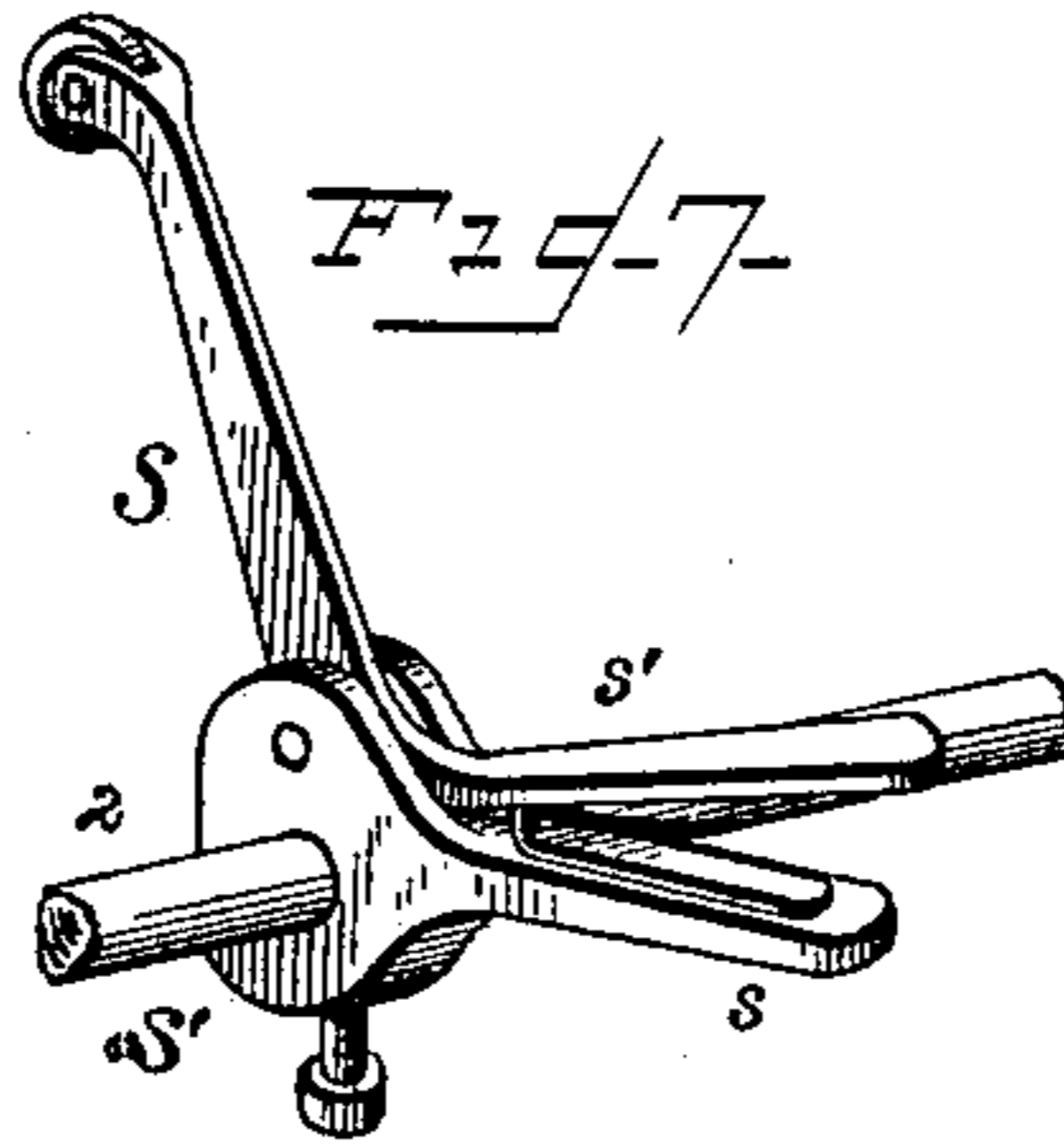


Fig. 7.

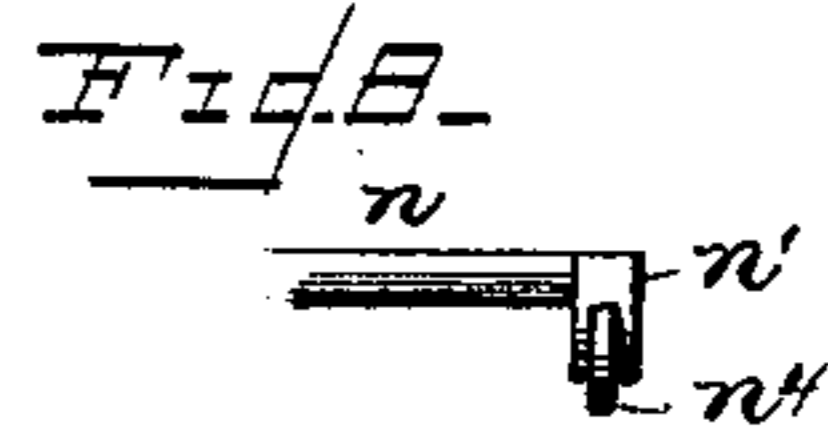


Fig. 8.

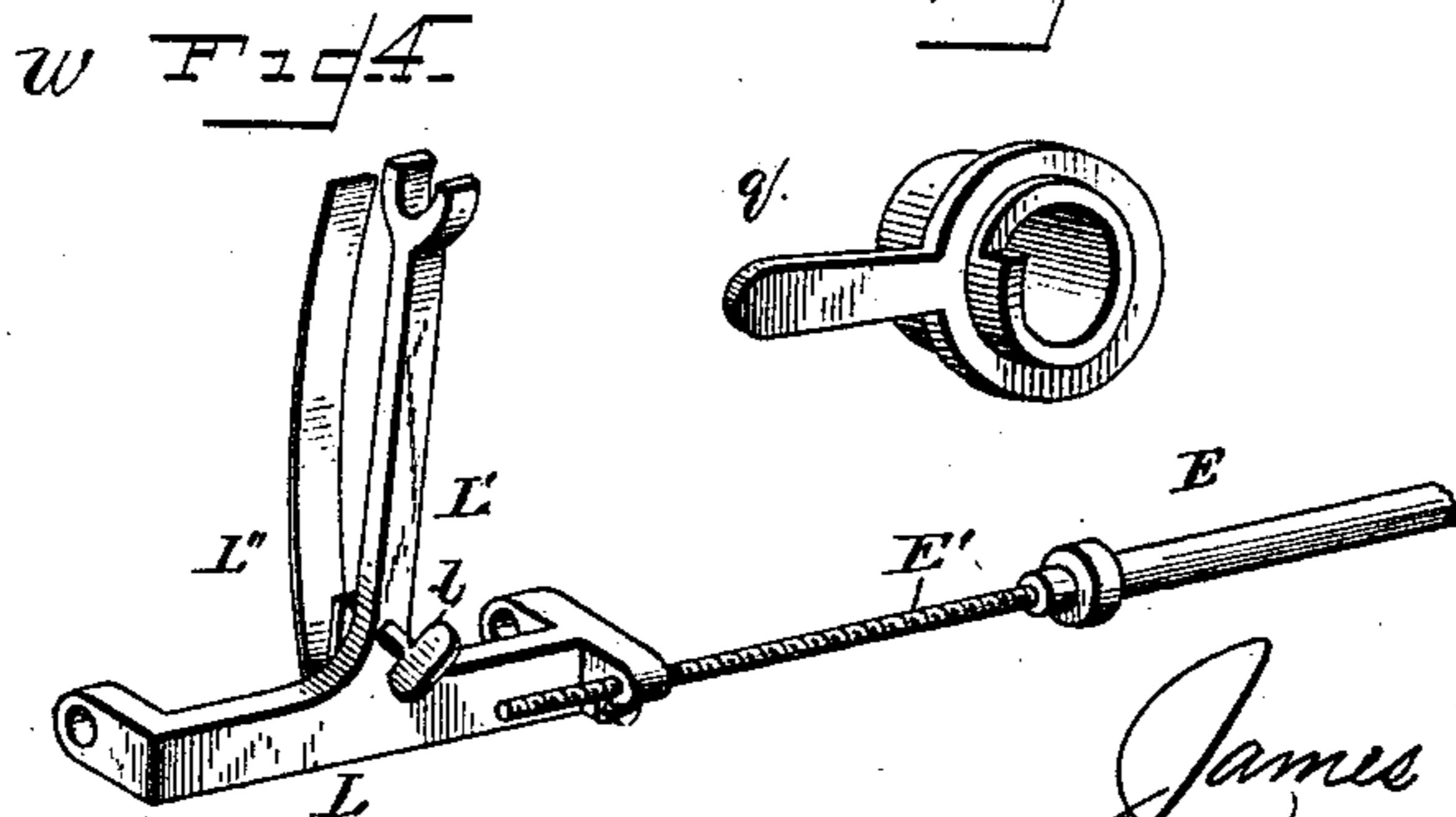
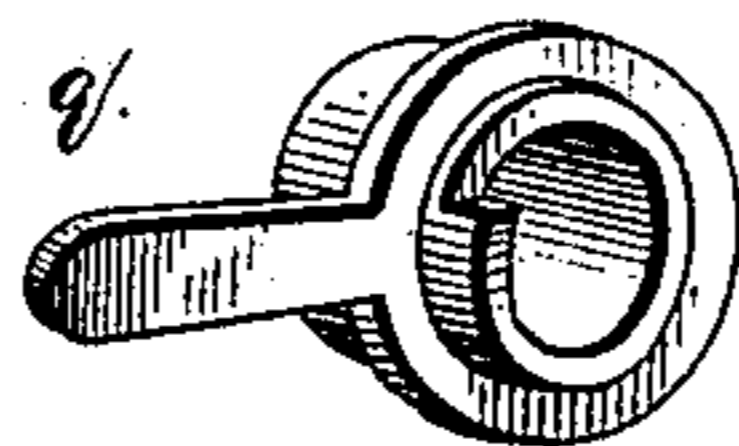


Fig. 4.

Fig. 5.



WITNESSES  
*F. L. Ourand*  
*E. M. Johnson*

*James E. Hanger*  
 INVENTOR  
*George E. Lemons*  
 his Attorney

# UNITED STATES PATENT OFFICE.

JAMES E. HANGER, OF RICHMOND, VIRGINIA.

## LATHE FOR THE MANUFACTURE OF ARTIFICIAL LIMBS.

SPECIFICATION forming part of Letters Patent No. 339,879, dated April 13, 1886.

Application filed October 1, 1885. Serial No. 178,737. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES E. HANGER, a citizen of the United States of America, residing at Richmond, in the county of Henrico and State of Virginia, have invented certain new and useful Improvements in Lathes for the Manufacture of Artificial Limbs; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

My invention relates to certain new and useful improvements in lathes which are designed especially for the manufacture of artificial limbs, the leading objects of my invention being to provide a lathe or machine which can be utilized in making a socket for an artificial limb from a plaster or other mold of the stump; also providing such a machine with means whereby the socket or interior cut-away portions of the artificial limb may be made either larger, smaller, or of the same size as the pattern or mold.

Another object of my invention is to provide a mechanical means whereby the interior of the artificial limb can be made or patterned from the exterior; and, further, in providing the lathe with means for making the limb longer or shorter, larger or smaller, in diameter.

My invention also consists in the method or process of manufacturing artificial limbs, and in the construction of a lathe with its attachments, as will be hereinafter set forth.

In the accompanying drawings, Figure 1 is a side view of a lathe constructed in accordance with my invention, and especially adapted for the manufacture of the sockets of artificial limbs from a pattern. Fig. 2 is an end view of Fig. 1. Fig. 3 is a sectional view taken through the line *x x* of Fig. 2. Figs. 4 and 5 are detail perspective views. Fig. 6 is a detail perspective view of a holder, which is used in shaping the interior of an artificial limb after the same has been shaped; and Fig. 7 is a perspective view of the guide which bears upon the exterior or shaped pattern of

the limb in cutting away the interior, so as to make a shell.

A represents the main frame, which preferably consists of the A-shaped uprights *a a'*, which are rigidly attached to each other by longitudinal rods 1, 2, and 3. The driving-wheel 4 has a bearing upon a stub-shaft, which is attached to the upper portion of the upright *a'*, and said driving-wheel is connected by a belt to a pulley, 5, which is rigidly attached to the shaft 6, said shaft being provided between the uprights *a'* and *a''* with a wide pulley, 7, which is rigidly attached thereto. The shaft 6 carries at its opposite end a pulley, 8, which has a flat outer surface, against which the friction-wheel 9 will contact, and in order to secure a firm contact between this pulley and the friction-wheel the shaft 6, adjacent to the hub of the pulley and between the upright *a'*, is encircled by a spiral spring, *b*.

The friction-wheel 9 hereinbefore referred to is mounted upon a vertical rotating shaft, *c*, which is provided with a feather, *c'*, and upon this vertical shaft slides the friction-wheel 9, which is adjustable thereon, the upper portion of said friction-wheel having a sleeve which is embraced by the clutch, said clutch having pivotally attached thereto a rack-bar, *d*, which meshes with the pinion *d'*, which can be turned by means of a crank-arm so as to adjust the rack-bar and friction-wheel. It will readily be seen that by moving the friction-wheel 9 to different sides of the center of the flat face of the pulley 8, the direction of the rotation of the shaft *c* will be changed, and by adjusting the friction-wheel to and from the center of the pulley 8 the speed of the same with relation to the driving-wheel will be changed. The upper end of the shaft *c* is provided with a worm-screw, *e*, which is rigidly attached to the same, and engages with a gear-wheel, *e'*, which gear-wheel is moved by the same, so as to turn the shaft E, which carries the screw-threaded bar E', as shown in Fig. 4. The outer end of the shaft E, adjacent to the upright *a* of the frame, has rigidly attached thereto a disk with an inner flange, a ring having gear-teeth being placed upon said disk so that it can rotate thereon when the outer disk is loosened. A crank-arm, *f*, is attached to the outer disk, which fits over the end of

the shaft and the toothed ring. This outer disk is provided with inwardly-projecting pins, which enter perforations in the disk attached to the shaft. The disk  $e''$  is clamped up-  
5 on the gear-wheel  $e$  by a thumb-screw,  $f'$ , which passes over to the threaded portion of the outer end of the shaft E.

Between the uprights  $a a'$  of the frame is journaled a shaft, B, having pulleys B' and  
10 B'', the belt C passing over the pulleys 8 and B', while the belt D connects the pulley B'' with a drive pulley,  $g$ , which is attached to the spindle F, which carries the cutting-tool.

By means of the gearing hereinbefore de-  
15 scribed, it will be noted that when the main driving-pulley 4 is rotated motion therefrom at an increased ratio will be communicated to the spindle of the cutting-tool in one direc-  
20 tion while the shaft E may be rotated in either direction, so as to carry the movable carriage, which is mounted on the rod 3 in either direction and at any desired rate of speed. A carriage, G, is pivotally attached to the rod  
25 3, so that it can rock and be moved longitudinally thereon. Between the members  $h$  and  $h'$  of this carriage is located a grooved driving-wheel, H, which has a bearing on the rod 3, the hub of said wheel having a grooved pulley,  $h''$ , rigidly connected there-  
30 to. The belt which passes over the driving-wheel H also passes over the pulley 7. The pulley  $h''$  drives the pulley  $i''$  and the shaft  $i'$  upon which the pulley  $i''$  is located also carries a pinion, I, which meshes with a  
35 cog-wheel, I', which is secured to the shaft J. The cog-wheel I meshes with a pinion, I'', which moves upon a stationary shaft attached to a projecting portion of the member  $h$  of the movable carriage G, and a cog-wheel, I''', also  
40 meshes with said pinion, so that the cog-wheels and their shafts will both rotate in the same direction. When it is desired that these cog-wheels and their shafts will rotate in op-  
45 posite directions, the pinion I'' is removed and the upper cog-wheel placed so as to mesh with the lower cog-wheel, I', thus changing the direction of the motion of the shafts.

To the inner ends of the shafts J and J' are attached baskets or clamping devices for hold-  
50 ing the pattern or mold and the blank to be shaped, said baskets being held at their opposite ends by a frame, K, which is attached at its lower end by means of set-screws to the member  $h'''$  of the carriage G.

55 Upon the shaft 3, between the members  $h$  and  $h'''$  of the carriage G, is attached a casting, L, as shown fully in Fig. 4, said casting having an outwardly-projecting portion with a screw-threaded socket, through which passes  
60 the screw-threaded rod E'. Said casting is also provided with an upwardly-projecting arm, L', the upper end of which is bifurcated, so as to partially embrace the rod 1, and thus holding said casting upon the frame while admit-  
65 ting its longitudinal movement upon the rod 3. The casting L is centrally provided with a spring, L'', which is connected to the same

by having its lower portion formed into an eye which passes around a bail, and the upper  
70 end of said spring bears against the central portion of the cross-bar of the carriage so as to hold the carriage against the end of the spindle which contacts with the pattern and  
75 the cutting-tool. The opposite end of the spring bears against a thumb-screw,  $l$ , which can be adjusted to regulate the pressure of the spring.

To the rod 3, between the uprights  $a$  and  $a'$  of the main frame, is pivotally attached a mov-  
80 able frame, M, which carries near its upper end a socket, N, through which the bar of the guide-mandrel passes. The members  $m$  and  $m'$  of the frame M, opposite the upper portions of the upright  $a a'$  of the frame, are enlarged  
85 laterally and provided with transverse openings  $o$ , through which the socket of the cutting-tool passes, said socket also passing through openings at the upper ends of the uprights  $a a'$ . The openings  $o$  are for the  
90 purpose of allowing the movable frame M to be adjusted, so that the upper socket can be moved laterally or the frame M oscillated. This adjustment is made by means of a thumb-  
95 screw, P, which is attached so as to turn in a bearing,  $p$ , which is secured to the rod 2 between the uprights  $a a'$ , the opposite end passing through the nut  $o'$ , which is pivotally  
100 attached between the side bars of the frame M. After the movable frame M has been adjusted it can be secured rigidly in the desired position by turning lever  $q$ , which is  
105 attached to a sleeve with a cam-shaped face, as shown in Fig. 5, which will force said sleeve against the sleeve  $q'$ , which has a similarly-shaped inner face, thus spreading  
110 said sleeves so that their outer edges will contact with the inner sides of the members  $m$  and  $m'$ , adjacent to the openings  $o o$ , and force them against the upper ends of the up-  
115 rights, thus rigidly holding them in position by frictional contact. The socket F, through which the shaft of the cutting-tool passes, is firmly secured in openings in the upper part of the uprights  $a$  and  $a'$ , and upon said socket  
120 the sleeve having the lever  $q$  turns. The shaft of the cutting-tool is rotated by the belt D, which passes over the pulley  $g$ , hereinbefore referred to. The socket N, which is attached  
125 to the upper end of the oscillating frame M, carries the shaft having the guide-roller which contacts with the pattern or mold, and the inner end of said shaft is attached to a sliding  
130 block,  $r$ , having a hollow and partially-screw-threaded interior, into which passes the screw-threaded rod  $r'$ , the outer end of said rod being provided with a hand-wheel, R, whereby  
the block  $r$  can be adjusted so as to carry with it the shaft and the guide-roller. The sliding  
or adjustable block  $r$  is provided with a pointer which passes through a slot in the  
upper part of the socket, so as to point to  
gage-marks thereon, by providing the shaft of the guide-roller with means whereby it can be  
adjusted longitudinally, and from a pattern I

am enabled to make a correspondingly-shaped article, the length of which will be greater or less, according to the adjustment of the shaft. The end of the shaft  $n$  has attached thereto an

5 arm,  $n'$ , which carries a wheel,  $n''$ , which rotates upon the arm, said wheel being located to one side of the center of the shaft  $n$ , so that the wheel will enter and ride upon cavities and elevations in the pattern or mold.

10 The cutting-tool, which is rotated by the pulley  $g$ , may be of any ordinary construction.

The baskets or frames  $P$  and  $P'$  are removably attached to the shafts  $J$  and  $J'$ , and they are provided with flanged rings  $p$  and  $p'$ , which have bearings in the circular openings  $k$  and  $k'$  of the frame  $K$ , and the mold or pattern, which is secured to the upper frame or basket, can be attached thereto by any suitable means, as set-screws, clamps, or equivalent devices. The upper basket,  $P$ , is intended to hold the mold or pattern having an interior cavity which it is designed to copy, while in the lower basket is secured a blank in which it is

25 desired to make a corresponding shaped cavity.

In making artificial limbs a plaster of paris casting or mold is first taken of the stump of the limb, and said mold, when sufficiently hardened, is placed in the upper basket and secured thereto, the carriage being at one end of the machine. The mold or matrix is fastened in the upper basket, having its upper or larger end about flush with the ring of said basket, and as near the center as possible. The blank, having been cut off to proper length, is then fastened in the lower basket opposite to mold, or as nearly opposite thereto as practicable, also as near its center as possible. The guiding-roller is adjusted longitudinally, so that it and the cutter will enter their respective pieces at the same time, or as may be desired, the lateral adjustments being made by means of movable frame  $M$  and thumb screw  $P$ , so that the

45 cutter will not have too deep a cut. The machine is put into motion and a cut is taken through. The basket is then set for another cut by means of movable frame  $M$  and thumb-screw  $P$ . This operation is repeated till the

50 socket is of desired size. It will be noticed that the oscillating movement of the carriage and basket is governed entirely by the guide-wheel  $n''$ , against which the surface of the mold is held by the adjustable spring attached to the carriage. This spring yields to the irregularities of the surface of the mold as the guide traverses the entire surface of the mold by the rotation of baskets and longitudinal movement of carriage, and produces an oscillation that

60 must correspond exactly with the irregularities of the mold, and these oscillations move the blank to and from the cutter correspondingly. When the parts are thus adjusted, an exact copy, both as to configuration and size, will be produced.

When it is desired to copy the pattern, so as to produce a limb having a greater or less

length than the mold or pattern, the shaft  $n$  is adjusted longitudinally, and when a larger or less diameter is wanted the adjustment is

70 made by moving the oscillating frame  $M$  to either one or the other side of the center.

When it is desired to cut the reverse of the pattern or make the exterior of a right or left limb from a single pattern, it can be done by

75 simply removing the pinion  $I''$  and reversing the roller  $L'''$ , thus causing the pattern to revolve in one direction, while the blank to be cut after the same is revolved in the opposite

80 direction.

It will be noticed that the oscillating movement of the carriage and baskets in making a pattern from a mold or matrix is governed entirely by the guide-wheel  $n''$  of the pattern-shaft, said mold being held against the wheel

85 by the spring  $L''$ .

When it is desired to hollow out a limb or make a shell having an equal thickness, the exterior having been shaped, the baskets  $P$   $P'$  and the frame  $K$  are removed and a frame,

90  $W$ , as shown in Fig. 6, is attached to the carriage. The limb is then secured to the frame  $W$  by means of the set-screws which pass through the rotary sleeve  $W'$ , the opposite end of the limb being attached by means of a

95 suitable clamp to the shaft  $J$ .

A longitudinally-adjustable dog provided with handle  $s$ , and ears, between which is pivoted a lever, as shown in Fig. 7, is attached to the shaft 2 by a set-screw, and when it is

100 desired to use the same it is rigidly attached to the shaft, so that the roller which is mounted at the end of the lever  $S$  will be directly opposite the cutting-tool, and so as to leave a space equal to the required thickness of the shell.

The dog is provided with a spring, which is located between the handle  $s$  and the handle  $s'$  of the lever  $S$ , and the lever is firmly pressed against a stop in the dog. The spring is of

110 sufficient strength to overcome the strength of the spring  $L''$ , which bears against the carriage. The object of the spring and pivoted lever is to leave a greater thickness at points desired in the shell by pressing the handles

115  $s$  and  $s'$  together.

When it is desired to turn the exterior of a right or left limb from an opposite pattern, a straight bar is attached to the carriage in place of the frame  $W$ , said bar having perforations for the reception of clamping-screws, which are located on a line with the shafts

120  $J$   $J'$ . The pattern is then screwed to the upper shaft, and the blank from which it is desired to cut the reverse is attached to the lower shaft,  $J$ , the pinion  $I''$  being removed

125 and the gear-wheels  $I'$  and  $I'''$  being placed so as to mesh with each other, so as to cause the pattern and the blank to rotate in opposite directions.

In making a limb as above described, the carriage is tilted, so that it will be out of

130 line or to one side of the roller on the end of the shaft  $n$  and the cutting-tool.

To make a limb similar to a given exterior

pattern the pinion is not removed, and both pattern and blank revolve in the same direction.

In performing any of the operations herein-  
5 before described, it should be remembered  
that, if desired, I can make the limb or other  
object either larger or smaller by moving the  
frame M, and longer or shorter by moving lon-  
gitudinally the guiding-roller.

10 The lathe herein described may be used for  
other purposes than in the manufacture of ar-  
tificial limbs.

I claim—

15 1. The method herein described of making  
artificial limbs, the same consisting in forming  
from plastic material a pattern or former,  
then securing said pattern or former in posi-  
tion to be contacted with by a mandrel guid-  
ing and controlling the material presented to  
20 the cutter, and then manipulating the parts  
to cause the cutter to operate upon the mate-  
rial to form the limb-section, substantially as  
set forth.

25 2. The method herein described of making  
artificial limbs, the same consisting in secur-  
ing a pattern or former in position to contact  
with a mandrel, guiding and controlling the  
material presented to the cutter, then adjust-  
ing the mandrel out of line with the cutter  
30 and manipulating the parts to cause the cutter  
to have a greater or less travel on said limb-  
section than that of the mandrel, substantially  
as set forth.

35 3. The method herein described of making  
artificial limbs, the same consisting in causing  
a pattern or former to approach a mandrel  
and the limb material to approach the cutter  
at the same relative speed, and then longi-  
tudinally adjusting the mandrel to secure an  
40 extended or decreased operation of the man-  
drel and former compared with that of the  
material and cutter, substantially as set forth.

45 4. In a machine for making artificial limbs,  
the rotating baskets, arranged and operating  
substantially as set forth.

50 5. The combination, in a machine for mak-  
ing artificial limbs, of the baskets P and P', a  
cutter and mandrel, and devices for holding  
said baskets, substantially as set forth.

55 6. The combination, in a machine for mak-  
ing artificial limbs, of pattern and blank hold-  
ers, a cutter and mandrel, devices for longi-  
tudinally adjusting said mandrel, and means  
for rotating said holders, substantially as set  
forth.

60 7. The combination, with the pattern and  
blank holders, of a cutter, devices for trans-  
versely adjusting said cutter, a mandrel, and  
means for rotating said baskets, substantially  
as set forth.

65 8. The combination, with the pattern and  
blank holders, of a frame carrying the same  
pivotally connected, as described, a spring,  
L', and means for regulating the tension of  
the spring, and devices for rotating said hold-

ers, and a mandrel and cutter, substantially  
as set forth.

9. The combination, with a pattern and blank  
holders, of a frame carrying the same, a thread-  
ed shaft which moves said frame, and devices 70  
for rotating said shaft, and means for revers-  
ing the rotation of the same, substantially as  
set forth.

10. The combination, with a pattern and  
blank holders, of a frame carrying the same, 75  
a shaft upon which said frame travels, devices  
for rotating a threaded shaft, and hand ap-  
pliances for rotating the same, substantially  
as set forth.

11. The combination, with a pattern and 80  
blank holders, of two vertical standards piv-  
otally secured, a mandrel carried thereby, and  
devices, as described, for forcing said stand-  
ards against the fixed portions of the machine-  
frame, and a cutter, substantially as and for 85  
the purpose set forth.

12. The combination, with a pattern and  
blank holders, of vertical standards pivotally  
secured, a mandrel carried thereby, and a  
thumb-screw for transversely adjusting said 90  
standards, and a cutter, substantially as de-  
scribed.

13. The combination, with a blank holder,  
of a cutter and a spring-yielding lever for va-  
rying the position of the blank relative to the 95  
cutter, as set forth.

14. The combination, with the pivoted frame  
K. of a removable blank-holder, spring L', a  
lever secured adjacent to said holder and pro-  
vided with a spring-seated guide-arm, substan- 100  
tially as set forth.

15. The combination, with a pivoted frame,  
of blank and pattern holders, gearing for ro-  
tating said holders, and means for changing  
the direction of the rotation of the pattern- 105  
holder, substantially as set forth.

16. The combination, with a threaded shaft,  
of a shaft, 2, a carriage moved by said threaded  
shaft, and having an arm, L', bearing against  
said shaft, and devices for rotating said thread- 110  
ed shaft, substantially as set forth.

17. The combination, with a mandrel, of  
means for longitudinally adjusting said man-  
drel, an index carried by said mandrel, and a  
scale for indicating the degree of adjustment 115  
of said mandrel, substantially as set forth.

18. The combination, with a mandrel hav-  
ing its end portion bent to present an angular  
arm, of a roller mounted on said angular arm,  
substantially as set forth. 120

19. The combination of a sleeve having a  
longitudinal slot, of a mandrel bearing in said  
sleeve and provided with a pin engaging said  
slot, substantially as set forth.

In testimony whereof I affix my signature in 125  
presence of two witnesses.

JAMES E. HANGER.

Witnesses:

E. W. JOHNSON,  
HONORA TAYLOR.