(No Model.)

8 Sheets—Sheet 1.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

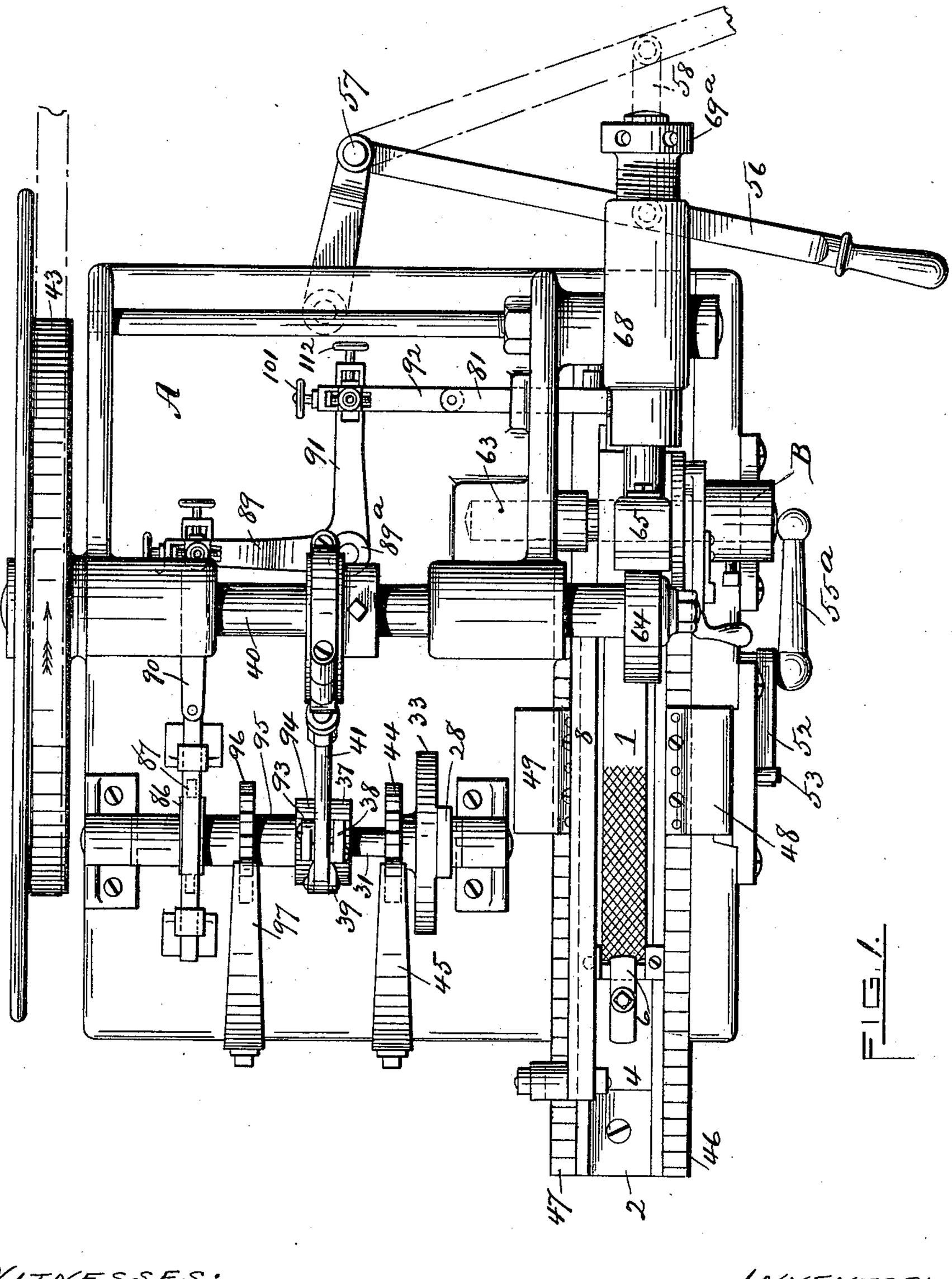


FIG. 1.

WITNESSES:

Charles T. Ramniger.

Ira L. Fish

INVENTOR:

James A. McHardy

By Wilmarth H. Thurston

Atty.

(No Model.)

8 Sheets—Sheet 2.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

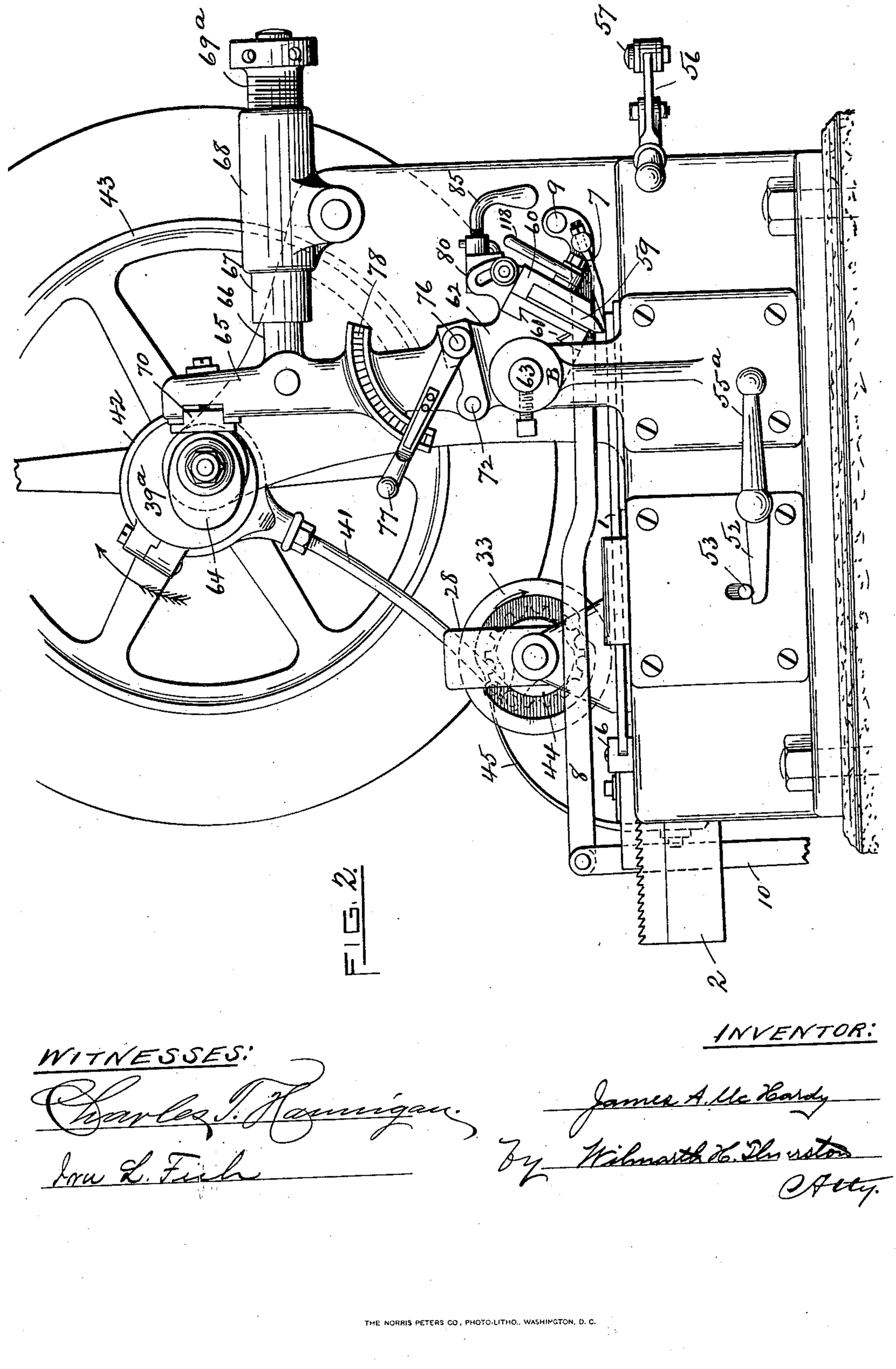


FIG. 2.

WITNESSES:

Charles T. Hannigan.

Ira L. Fish

INVENTOR:

James A. McHardy

By Wilmarth H. Thurston

Atty.

(No Model.) 8 Sheets—Sheet 3.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

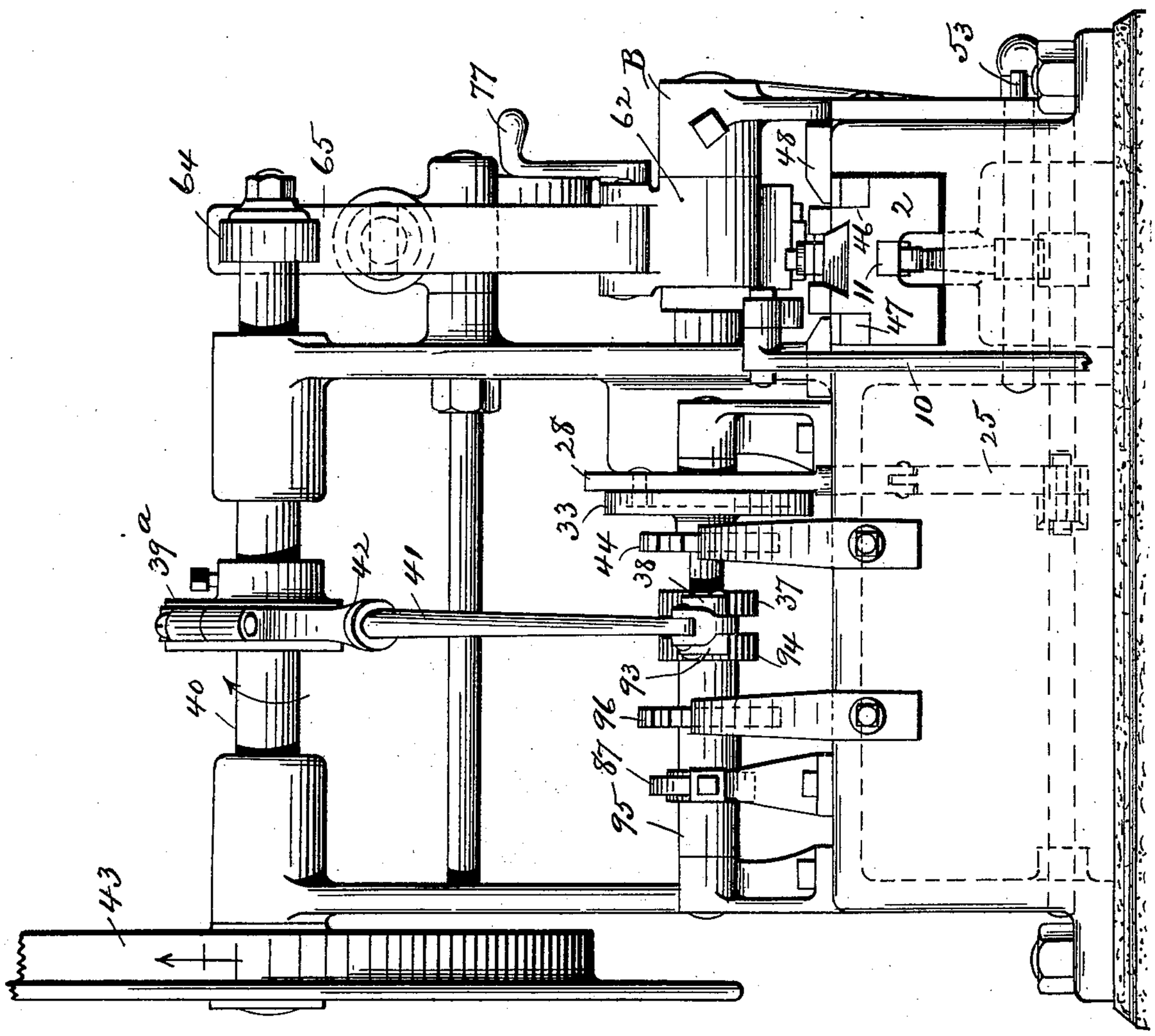


FIG. 3.

WITNESSES:

Charles T. Hazenjaeger.

Ina L. Fish

INVENTOR:

Jas A. McHardy

By Wilmarth H. Thurston

Atty.

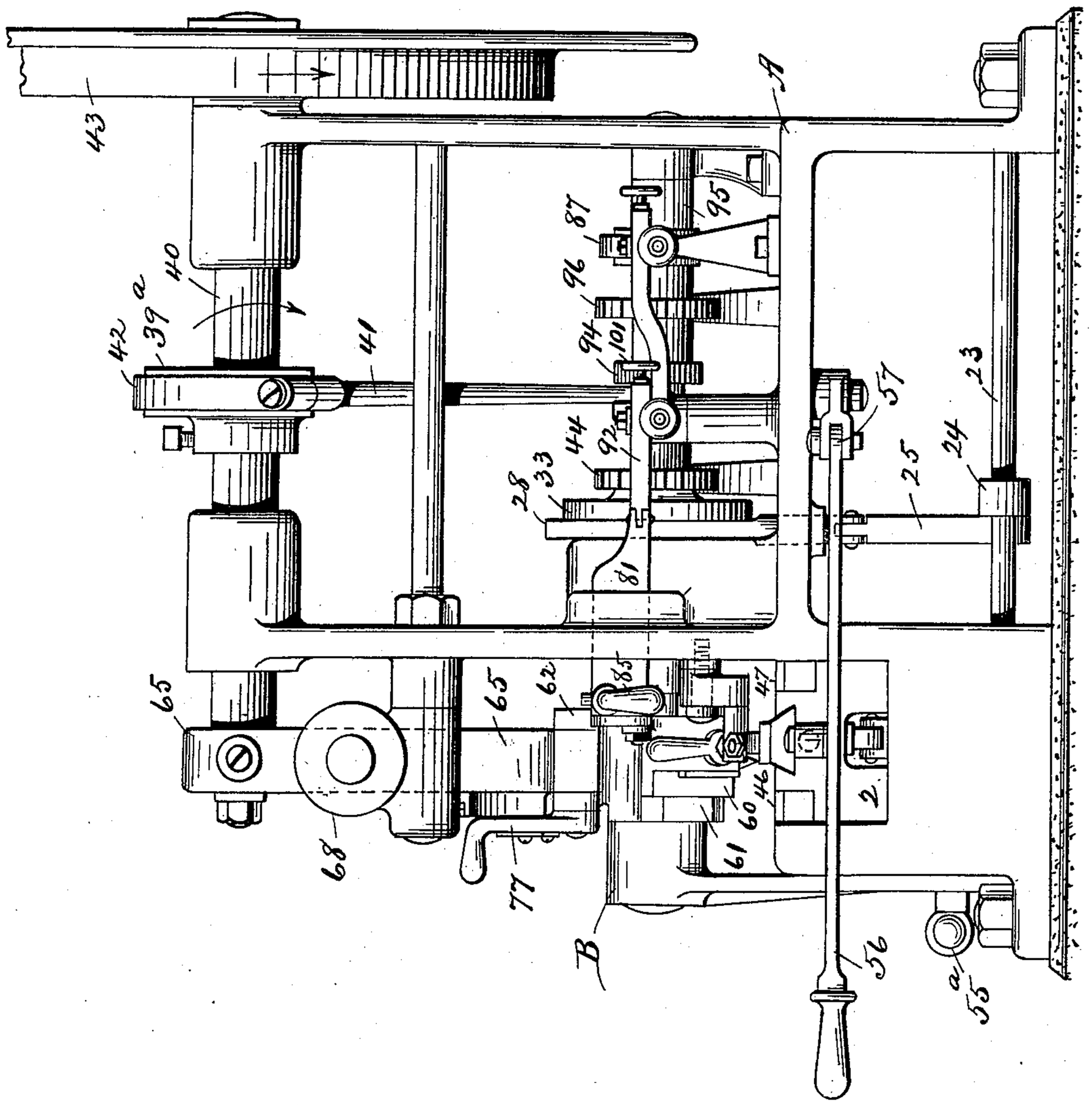
(No Model.) 8 Sheets—Sheet 4.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

FIG. 4.



WITNESSES:

Charles T. Hannigan.

Ira L. Fish

INVENTOR:

James A. McHardy

by Wilmarth K. Thurston

Atty.

(No Model.) 8 Sheets—Sheet 5.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

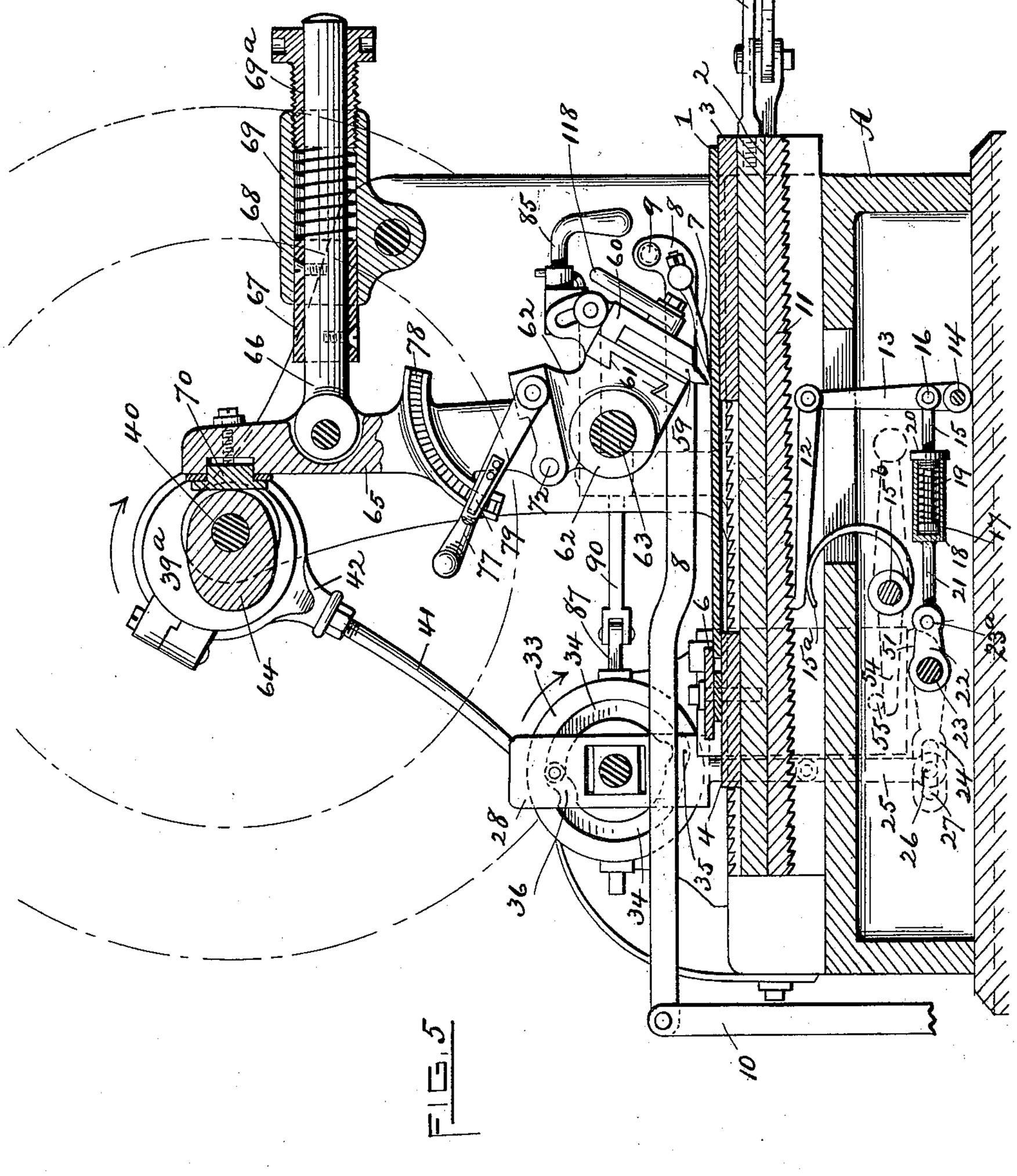


FIG. 5

WITNESSES:

Charles T. Hemmingway

Ira L. Fish

INVENTOR:

James A. McHardy

By Wilmarth H. Thurston

Atty.

(No Model.) 8 Sheets—Sheet 6.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

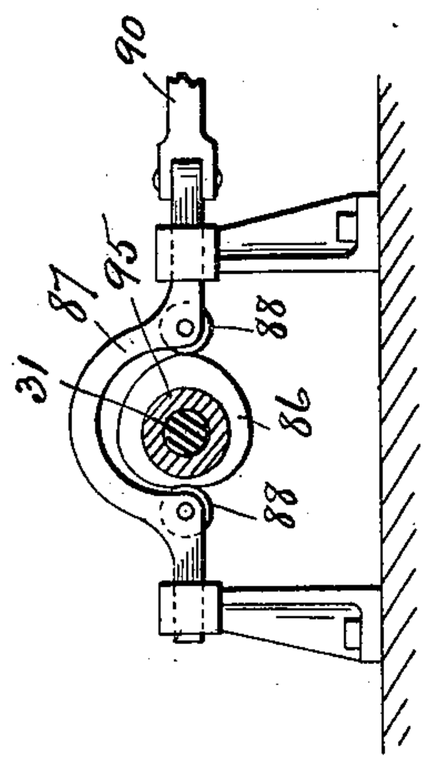
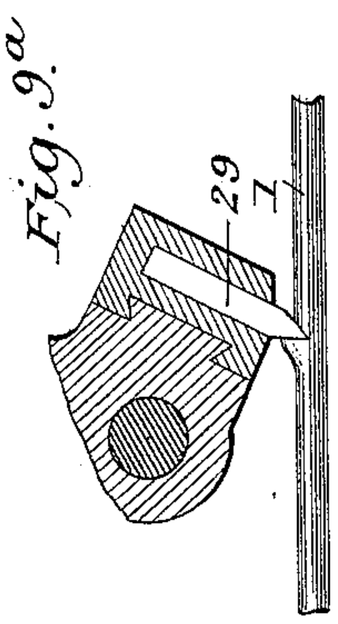


FIG. 7.



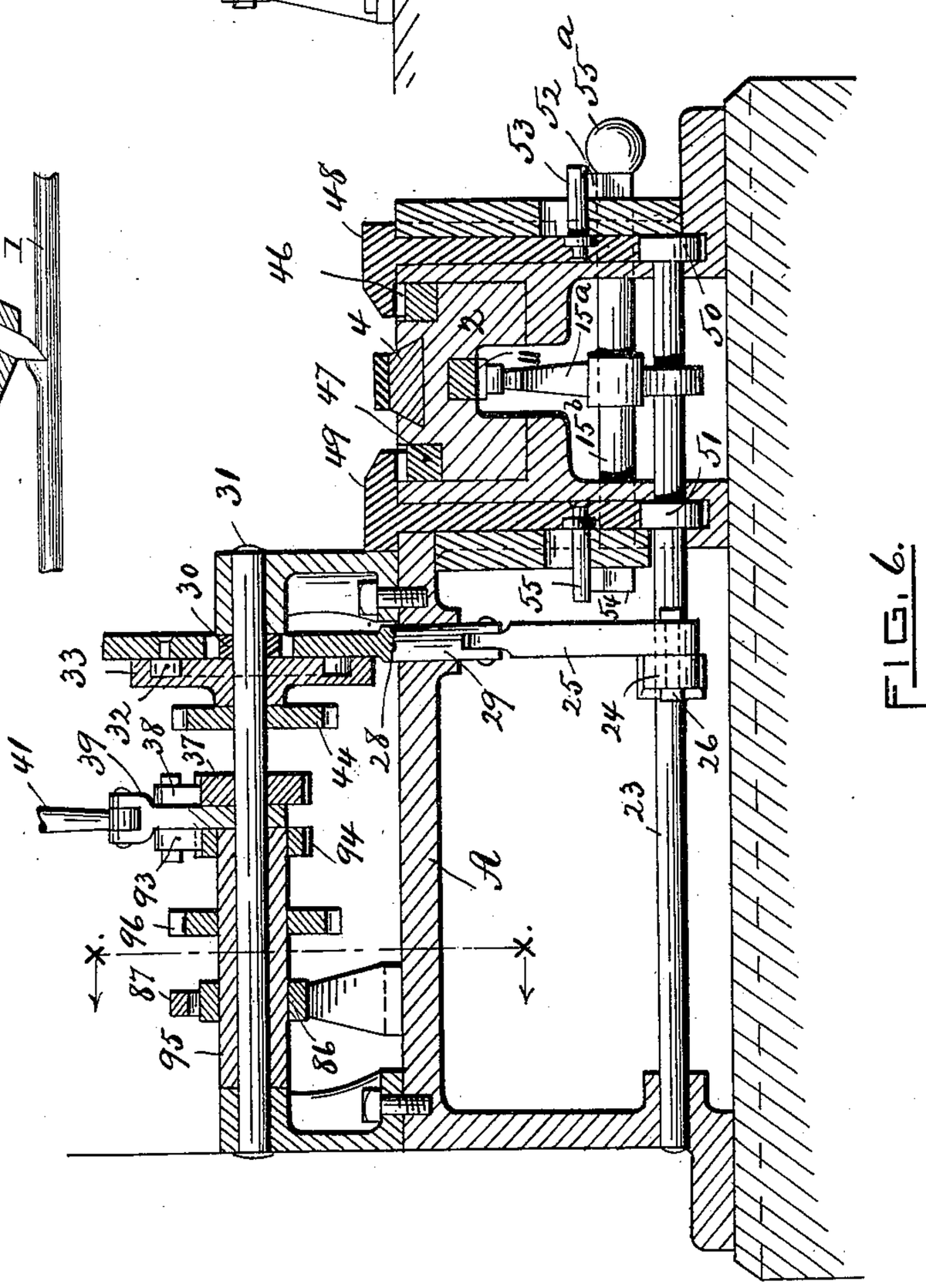


FIG. 6.

WITNESSES:

Charles T. Hannigan.

Ira L. Fish

INVENTOR:

James A. McHardy

By Wilmarth H. Thurston

Atty.

(No Model.) 8 Sheets—Sheet 7.

J. A. McHARDY.

RASP MACHINE.

No. 606,020. Patented June 21, 1898.

FIG. 9.

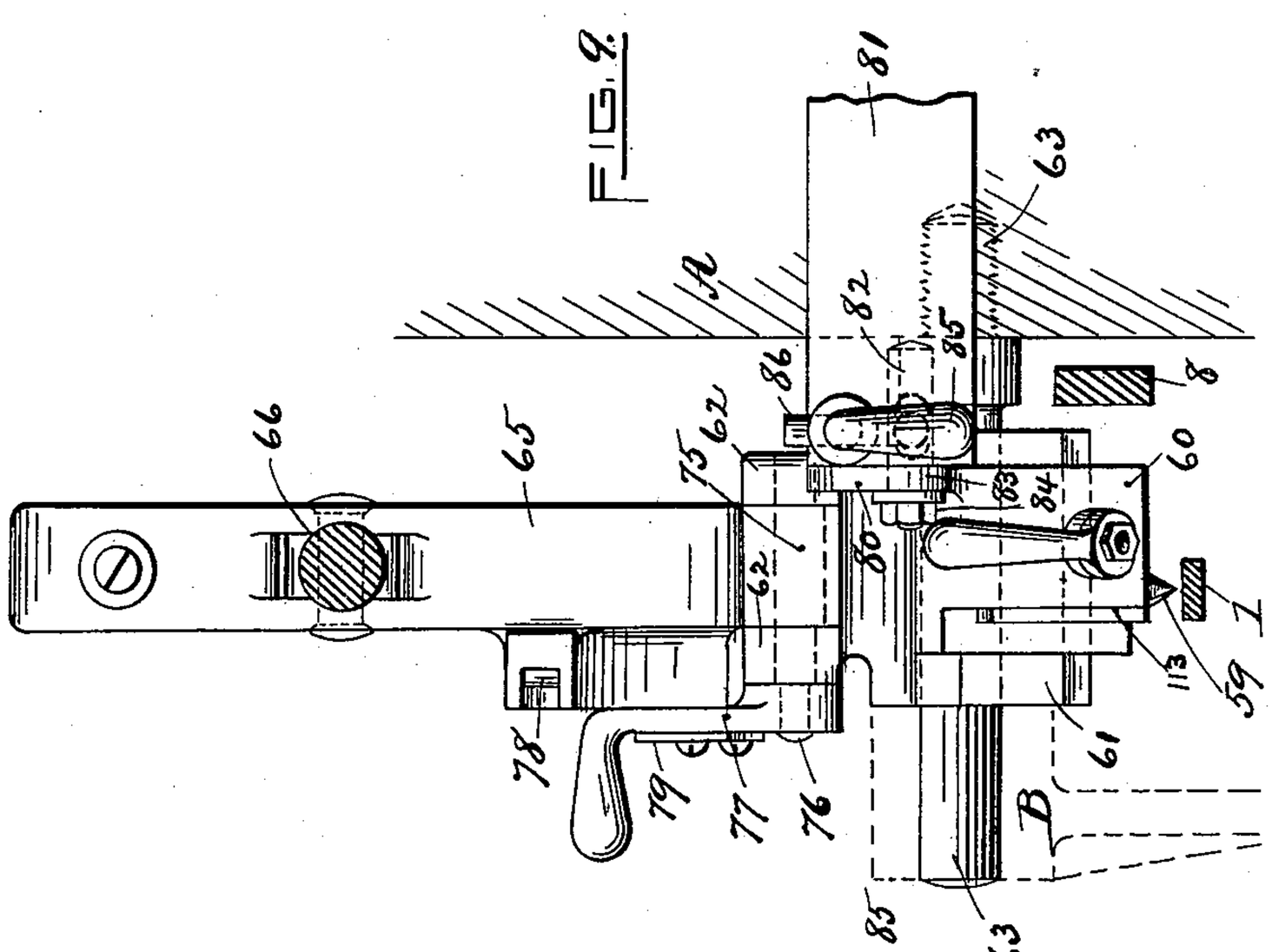
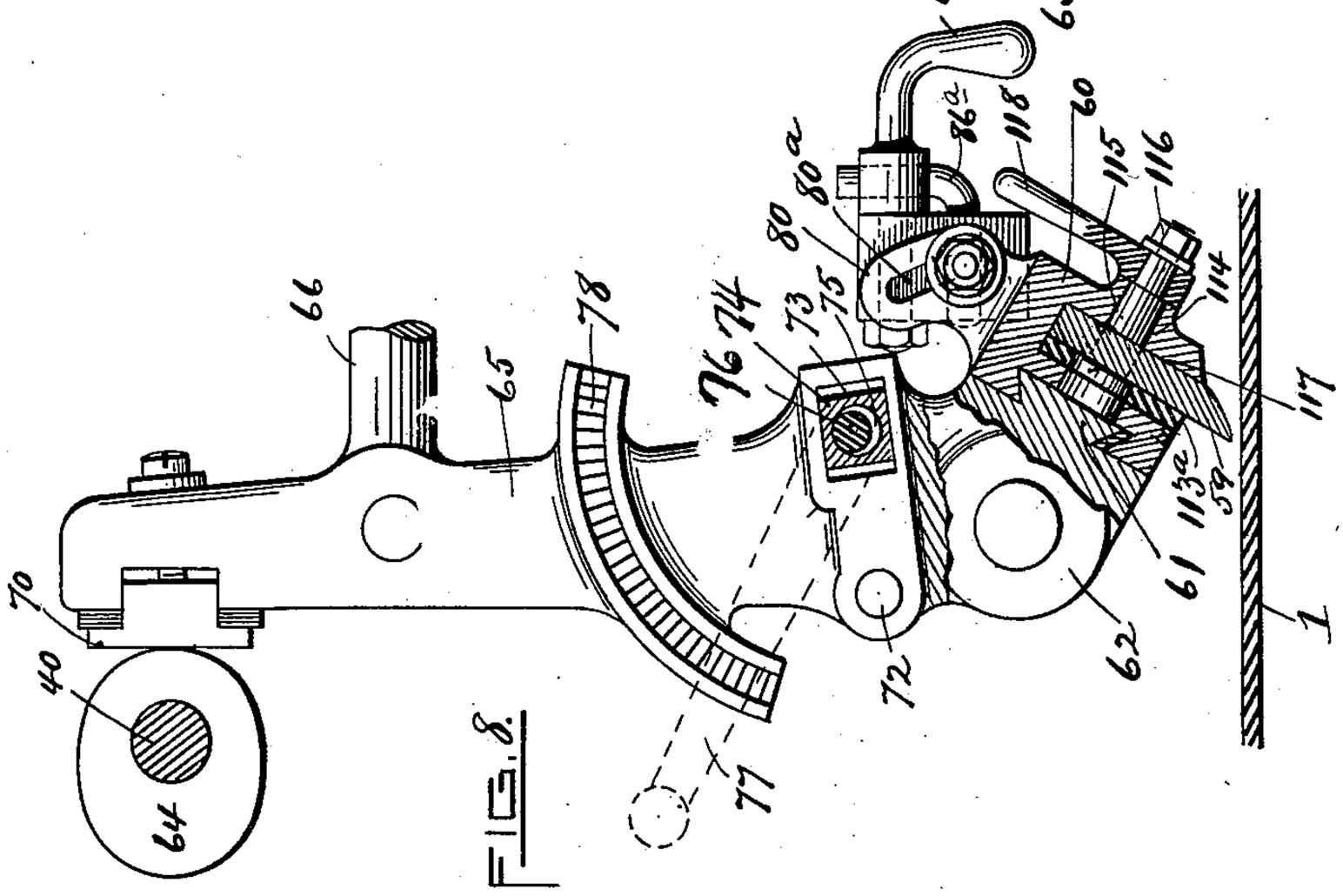


FIG. 8.



WITNESSES:

Charles T. Hannigan.

Ira L. Fish

INVENTOR:

James A. McHardy

By Wilmarth H. Thurston

Atty.

(No Model.)

8 Sheets—Sheet 8.

J. A. McHARDY.

RASP MACHINE.

No. 606,020.

Patented June 21, 1898.

FIG. 11.

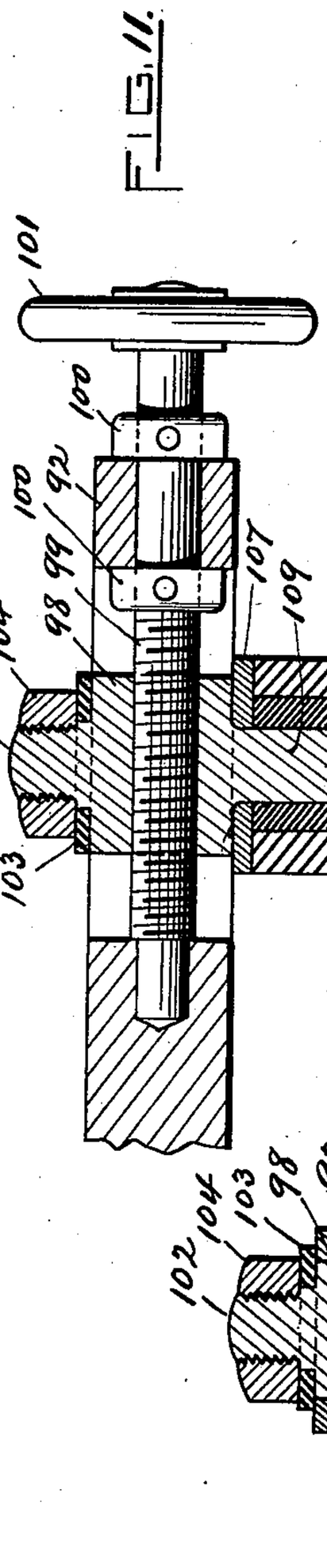


FIG. 10.

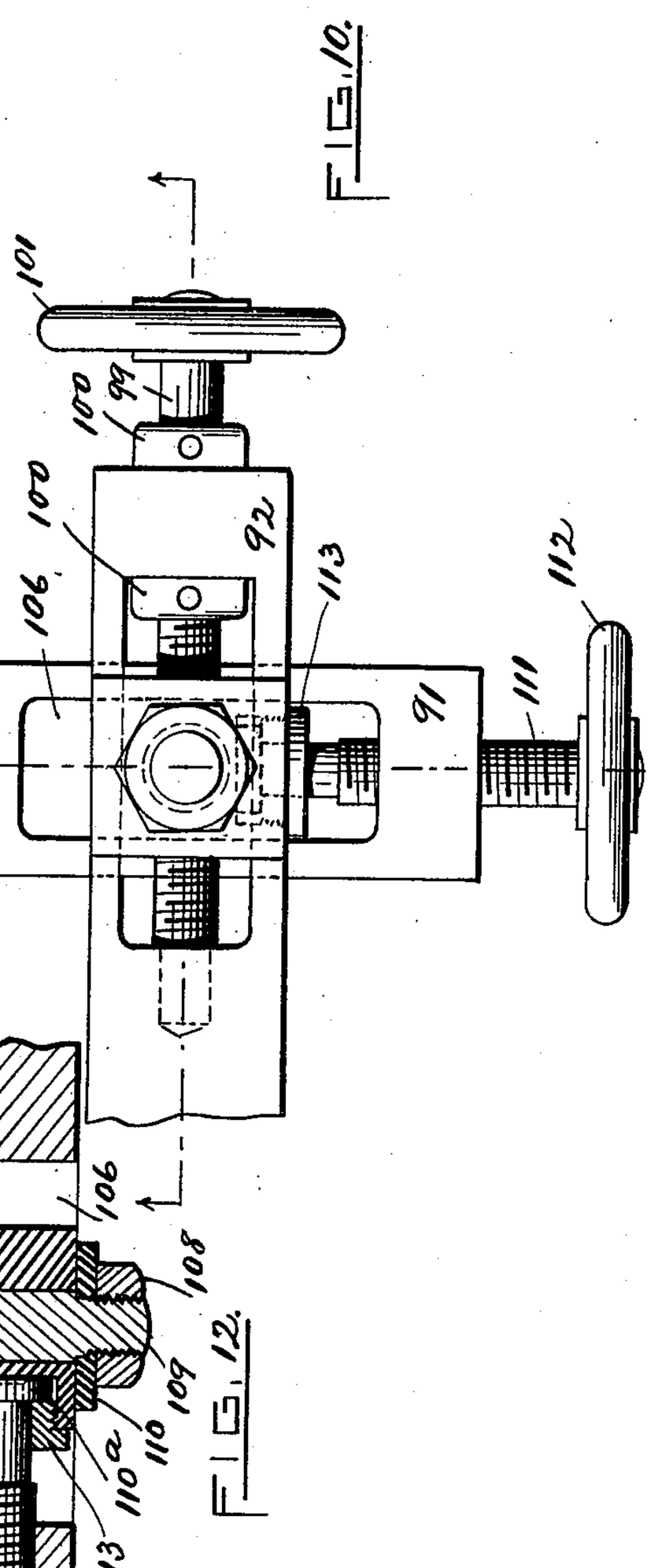
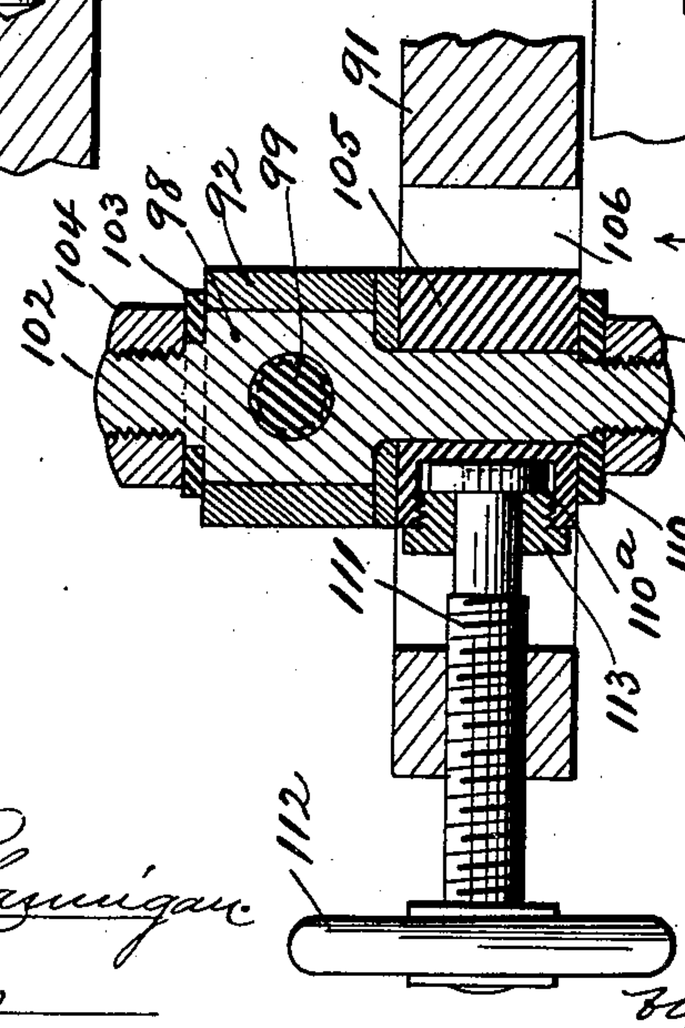


FIG. 12.



WITNESSES.

Charles T. Hazenigan.

Ira L. Fish

INVENTOR.

James A. McHardy

by Wilmarth & Thurston

Atty.

UNITED STATES PATENT OFFICE.

JAMES A. McHARDY, OF PROVIDENCE, RHODE ISLAND, ASSIGNOR, BY MESNE ASSIGNMENTS, TO THE NICHOLSON FILE COMPANY, OF SAME PLACE.

RASP-MACHINE.

SPECIFICATION forming part of Letters Patent No. 606,020, dated June 21, 1898.

Application filed May 25, 1896. Serial No. 593,053. (No model.)

To all whom it may concern:

Be it known that I, JAMES A. McHARDY, a subject of the Queen of Great Britain, residing in the city and county of Providence, in the State of Rhode Island, have invented certain new and useful Improvements in Rasp-Machines; and I do hereby declare the following specification, taken in connection with the accompanying drawings, forming part of the same, to be a full, clear, and exact description thereof.

The present invention relates to rasp-cutting machines, and has for its object the production of a machine of the above class which shall be simple in construction and which will run at a higher rate of speed than has hitherto been practicable; and to this end the invention consists of the features and combinations hereinafter described and claimed.

The machine illustrated in the drawings, which embodies the present improvements in their preferred form, comprises generally a blank-supporting carriage which is intermittently fed forward after the completion of each row of rasp-teeth and a head which is oscillated about a fixed axis and carries a cutter rigidly secured thereon. The rear face of the cutter is so formed that it lies in or within the arc described by the point of the cutter, and the cutter is forced into the blank in an arc, the rear face sliding along the bottom of the recess formed by its point or just clearing said recess, so that there is no pressure on the rear face of the cutter. It is preferred to force the tool into the stock by means of a cam or eccentric rather than by a blow, as in the former case the cutting-tool enters the blank gradually and at a slower speed, so that the machine can be run at a higher speed without heating the tool and blank. The cutting-tool is mounted in a carriage which slides on the oscillating head and is moved transversely of the blank after the cutting of each tooth by suitable means.

The machine is also provided with means for regulating the transverse movement of the carriage while the machine is in motion, thereby adapting the machine for cutting tapered rasp-blanks.

The detail construction of the machine will be understood by reference to the following description, taken in connection with the accompanying drawings, in which—

Figure 1 is a plan view of the machine. Fig. 2 is a front elevation. Fig. 3 is an elevation of the left end of the machine. Fig. 4 is an elevation of the right end of the machine. Fig. 5 is a vertical section through the blank-supporting carriage, partly in elevation. Fig. 6 is a vertical section through the shaft 31. Fig. 7 is a detail view of the cam for feeding the tool-carriage. Figs. 8 and 9 are details of the cutter-head and operating and adjusting means. Fig. 9^a is a detail of the cutter and blank. Figs. 10, 11, and 12 are details of parts to be described.

The rasp-blank 1 is supported on blocks 3 4, secured in a groove 5, formed in a carriage 2, which is mounted in suitable ways formed in the frame A, said blank being held in place by the clamp or holder 6 and the presser-finger 7. The finger 7 is secured to a presser arm or lever 8, pivoted to the frame A at 9 and having its free end connected to a weight (not shown) by a link 10. The carriage 2 may be fed forward after the completion of each row of teeth by any suitable means, and in the drawings is shown the preferred form of such means. Secured to the under side of the carriage 2 is a rack 11, which is engaged by the pawl 12, pivoted to the end of an arm or lever 13, pivoted to the frame at 14, and operated through a rod 15, pivoted thereto at 16. A spring 15^a is secured to a shaft 15^b and serves to hold the pawl 12 in engagement with rack 11. The rod 15 is provided with a head or flange 17, which fits within a cylinder 18 and is held against the end of said cylinder by means of a spring 19, interposed between the head 17 and a plug 20, screwed into the end of said cylinder. The cylinder 18 is carried on the end of a rod 21, which is pivoted at 23^a to the rock-arm 22, secured to the rock-shaft 23. An arm 24 is also secured to the shaft 23 and is adjustably connected to a link 25 by means of a bolt 26 and slot 27, said link being also connected to a reciprocating rod or yoke 28. The yoke 28 is guided in a bearing 29 in the frame and on a block 30, which fits within a slot in said yoke and surrounds a shaft 31, mounted in suitable bearings secured to the frame A. A bowl 32 on the yoke 28 runs in

a cam-groove formed in a disk 33, secured to the shaft 31, said cam-groove being formed with the dwells 34, the swell 35, and the depression 36. The shaft 31 is revolved intermittently through a ratchet-wheel 37, secured thereto, which is engaged by a pawl 38, pivoted to a pawl-carrying arm 39, loosely mounted on shaft 31. Said arm 39 is reciprocated from an eccentric 39ª, mounted on the main driving-shaft 40, by means of the rod 41, pivoted to the end of said arm and connected to the eccentric-strap 42. The driving-shaft 40 is driven continuously by a band-pulley 43, secured thereto and connected to any suitable source of power. A notched locking-disk 44 is secured to the shaft 31 and is engaged by a roll on a spring-arm 45 to lock said shaft in position after each forward movement, said arm yielding and allowing the forward movement of said shaft under the action of the pawl 38.

Any suitable means may be employed for limiting the feeding movement of the blank-carriage and releasing said carriage to allow the forward movement of the same; but it is preferred to use the form of means shown, which is as follows:

The carriage 2 is provided with the racks 46 47, preferably secured on opposite sides of the carriage and the teeth of which are staggered—that is, the teeth on one rack are substantially the distance of half a tooth length in advance of the teeth of the other rack. The racks 46 and 47 are engaged by teeth formed on the dogs or slides 48 and 49, the teeth on said racks being in line, or, if desired, the rack-teeth may be in line and the teeth on the slides staggered. In either case, however, when one dog or slide is in engagement with the teeth of its rack the other dog or slide will rest on its rack half-way between the teeth. The slides 48 49 are arranged in suitable ways on opposite sides of the carriage 2 and are operated at the proper times by arms or tappets 50 51, secured to the rock-shaft 23 and engaging the ends of said slides. The arms 50 and 51 extend from shaft 23, upon opposite sides thereof, so that when the shaft 23 is rocked in one direction one of said slides will be operated and when said shaft is rocked in the opposite direction the other of said slides will be operated. The shaft 15ᵇ extends outside the frame and carries at its outer end an arm 52, which engages a pin 53, extending from the slide 48, and the other end of said shaft carries an arm 54, which engages a similar pin 55, extending from slide 49. The outer end of shaft 15ᵇ also carries a handle 55ª, by which said shaft may be turned to lift the slides 48 49 out of engagement with the racks 46 47, the same movement of the shaft also throwing the spring 15ª into such a position that the pawl 12 will drop out of engagement with the rack 11, so that the carriage may be returned to its initial position. A lever 56 is pivoted at 57 to an arm pivoted to the frame and is connected to the carriage by means of the rod 58 and serves as a means for returning the carriage to its initial position after the completion of a rasp.

The tool or cutter 59 is rigidly clamped in the tool-carriage 60 by any suitable means, but preferably by the means hereinafter described, and the tool-carriage is rigidly supported on ways 61, formed on the head 62. Said head is loosely mounted on a stud 63, secured in the frame A and an outer bearing B, and may be oscillated to force the cutter 59 into the blank to lift up the metal and form a tooth by any suitable means. In order that the cutter 59 may enter the blank smoothly and without any undue strain upon the cutter and may bend or lift up the stock to form a proper tooth, the rear face of said cutter is so formed that it lies in or within an arc described about the axis of stud 63 as a center—that is to say, in the arc described by the point of the cutter. In practice the rear face of the cutter will usually be ground so that there is a clearance between said face and the recess formed in the rasp-blank as the cutter enters the blank, and said face will lie within the arc described by the point of the cutter. The shape of the cutter-point will depend upon the shape of the tooth to be cut; but it is preferred to form said point substantially V-shaped and to so form the front face that it will be substantially at right angles to the surface of the blank when the cutter is in its forward position.

The means shown, and which it is preferred to use for oscillating the head 62 to force the cutter into the blank, consists of a cam 64, secured to the driving-shaft 40 and engaging a hardened-steel plate 70 on an arm 65, secured to said head. A rubber washer 71 may be interposed between the plate 70 and arm 65, if desired. A rod 66, pivoted to arm 65, has secured thereto a sleeve 67, which fits within a cylinder 68, pivoted to the frame. A spring 69 surrounds said rod and bears against the sleeve 67 and a plug 69ª, screwed into the cylinder 68, and holds the arm 65 against the cam 64.

In order to adjust the depth to which the cutter shall enter the blank and also to lift the cutter, if desired, so that it will not act on the blank, the arm 65 is adjustably secured to the head 62 and preferably by the means shown. As shown, the arm 65 is pivoted at 72 in a recess formed in the head 62 and is provided with a slot 73, in which a sliding block 74 is fitted. The block 74 is mounted on an eccentric 75, formed on a stud 76, pivoted in the head 62 and having an arm 77 secured to its outer end. The arm 65 is provided with a rack 78, which is engaged by a spring-catch 79 on arm 77. By shifting the arm 77 the eccentric 75 will act to lift the cutting-tool away from the blank and thus decrease the depth of the cut, and by shifting the arm far enough the cutter will be lifted, so that it will not act on the blank.

After the cutting of each tooth it is necessary that the relative position of the cutter and blank should be changed in order that the cutter may enter the blank at a different point on the next reciprocation of said cutter, and this is preferably accomplished by moving the carriage on the head 62, although it is obvious that the same result could be accomplished by moving the blank-carriage laterally. The preferred means for moving the tool-carriage is as follows:

The carriage is provided with a lug or projecting plate 80, in which is formed a curved slot 80ª. A sliding bar 81 is connected to the carriage 60 by means of a stud 82, which is turned down and passes loosely through the slot 80 and is provided with the washer 83 and nut 84 on its outer end. It is advisable that the rasp-teeth be so formed that they shall not be in line with each other longitudinally of the blank, and the stud 82 is therefore preferably adjustably secured to the bar 81, so that the relative positions of the cutter and blank may be changed at will. In the form shown the stud 82 slides in the bar 81 and is adjusted and held in its adjusted position by the handle 85, pivoted in said bar and connected to said stud by the curved arm 86ª, which passes through a slot in the bar 81 and engages said stud. The bar 81 is moved backward and forward step by step by the heart-shaped cam 86, acting through the following connections: A slide or yoke 87 carries two bowls 88, which engage cam 86 on opposite sides, and said slide is connected to one arm, 89, of a bell-crank lever 89ª by means of the link 90. The other arm, 91, of the bell-crank lever is connected with the bar 81 by a link 92. The cam 86 is moved a step forward at each revolution of the driving-shaft 40 by means of a pawl 93, pivoted on the arm 39 and engaging a ratchet-wheel 94, secured to the sleeve 95, on which the cam 86 is also secured, said sleeve being loosely mounted on the shaft 31. A locking-wheel 96 is also secured to sleeve 95 and is engaged by a roll on a spring-arm 97 to lock the cam 86, and therefore the tool-carriage, in position after each feeding movement.

In order that the cutting-tool may be accurately adjusted transversely with relation to the blank, means are provided for adjusting the length of the connections between the cam 86 and the carriage 60, and to adapt the machine for cutting different-width rasps means are provided for regulating the transverse feed of the carriage 60. In cutting tapered rasp-blanks it is necessary that the distance the carriage 60 is moved after the cutting of each tooth should be varied as the width of the blank varies, and it is therefore preferred to so construct the means for regulating the transverse feed of the carriage that said means may be operated without stopping the machine. The preferred form of the adjusting and regulating means above referred to is illustrated in the drawings and is as follows:

The link 92 is provided with a slot at its rear end, in which slides a block 98, which is adjusted by means of the screw-rod 99, loosely pivoted in the link 92 and held in position by the collars 100 and provided with a hand-wheel 101 at its outer end. A stud 102 projects from the upper side of the block 98 and carries a washer 103, which is held in place against the upper surface of link 92 by a nut 104. A second stud 109 projects from the under side of block 98 and passes loosely through a block 105, mounted to slide in a slot 106, formed in the arm 91. A washer 107 is interposed between the under face of link 92 and the upper face of arm 91, and the parts are held in position by a nut 108 and washer 110 on the end of stud 109. The block 105 is recessed on one end and receives the flanged end 110ª of a rod 111, screw-threaded in the end of arm 91 and provided with a hand-wheel 112. A screw-plug 113 surrounds the rod 111 and serves to hold the flanged end 110 in the recess in block 105. By turning the wheel 112 the pivoted connection between the link 92 and arm 91 is adjusted to or from the axis of the bell-crank lever 89ª, and the feed of the carriage 60 thus regulated. By turning the wheel 101 the position of the carriage and the tool carried thereby may be accurately adjusted transversely of the blank. If desired, the adjusting devices above described may be placed at the pivotal connections between the arm 89 and link 90 instead of at the connection between the arm 91 and link 92, or they may be placed at both points, as shown, and the range of adjustment thereby increased.

The cutter may be clamped rigidly to the carriage 60 in any desired manner; but it is preferred to use the means shown for clamping said cutter, which consists of the wedge-shaped slide 113ª, which is operated by a cam or eccentric 114, formed on the stud 115, pivoted in the carriage 60. The stud 115 is rotated to move the slide 113ª by a handle 118, keyed thereto and held in place by a washer and nut 116. The cutting-tool is placed in the recess 117 in the carriage, the front wall of which is formed by the slide 113ª and is clamped firmly between the rear wall of said recess and said slide by turning the handle 118 to draw said slide toward the right in Fig. 9.

The operation of the machine is as follows: The blank 1 is placed upon the carriage 2 in the proper position and the carriage moved into proper relation to the cutter 59, the cutter being raised out of operation by throwing handle 77 to the left. The machine is now started and the handle 77 thrown to the right to bring the cutter into position to make the depth of cut desired. The head 62 is reciprocated by the cam 64 at each revolution of the shaft 40, and the cutter 59, being rigidly secured to said head, is forced gradually into and under the metal of the blank 1, thus bending or lifting the metal to form a rasp-tooth, the peculiar formation of the rear face of the tool allowing said action without any

tendency to bend the cutter forward, and the pressure on the front of the cutter being in lines substantially parallel to the rear face. Each revolution of the shaft 40 also moves the cam 86 one step forward, and thus feeds the carriage 60 laterally one step, the parts being so timed that the forward movement of the cam takes place when the cutter 59 is clear of the blank 1. The cam-disk 33 is also moved one step forward at each revolution of the shaft 40, the bowl 32 riding in the dwells 34 and not affecting the yoke 28 while the carriage 60 is being fed across the blank. Just after the carriage has been reversed, however, and while the cutter is still free from the blank the disk 33 is moved forward to carry the depression 36 past the bowl 32, thus forcing the yoke 28 downward and quickly returning it to its normal position. This movement of the yoke 28 rocks the shaft 23 and through the arm 22 compresses or energizes the spring 19, which tends to force the carriage 2 forward through the pawl 12 and rack 11, said carriage being held from movement by the teeth on slide 49, which engage rack 47. As the shaft 23 reaches the limit of its movement the arm 51 has lifted the slide 49 clear of the rack 47 and the carriage 2 is quickly fed forward under the action of spring 19, said carriage being stopped by the engagement of the slide 48 with rack 46. The bowl 32 now rides in the dwell 34 until the carriage 60 reaches the opposite side of the blank, when the swell 35 is fed past the bowl, thus rocking shaft 23 in the opposite direction and energizing the spring 19, as before. This movement of the shaft 23 lifts slide 48, thus releasing the carriage 2, so that the spring 19 may act to feed said carriage forward until the slide 49 engages the teeth of rack 47 and stops said carriage. Thus the cutter is fed backward and forward across the blank and the blank fed forward after the completion of each row of teeth. In order that the teeth may not be in line with each other longitudinally of the blank, the operator rocks the handle 85 to the right or left after the cutting of every two or three rows of teeth, thus varying the relation of the blank and cutter in the formation of different rows of teeth.

In cutting tapered blanks the operator gradually decreases the transverse feed of the carriage 60 as the width of the blank decreases by turning the wheel 112, and thus moving the block 105 nearer the axis of the bell-crank lever 89a.

What I claim as my invention, and desire to obtain by Letters Patent, is—

1. In a rasp-machine the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its rear face in or within the arc described by its point, and means for oscillating said head to force said cutter into said blank to lift the metal and form a tooth, substantially as described.

2. In a rasp-machine, the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its rear face in or within the arc described by its point, means for oscillating said head to force said cutter into said blank to lift the metal and form a tooth, and means for regulating the depth to which the cutter shall enter the blank, substantially as described.

3. In a rasp-machine, the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its rear face in or within the arc described by its point, means for forcing said cutter into the blank, and a spring for returning said cutter, substantially as described.

4. In a rasp-machine the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its rear face in or within the arc described by its point, means for oscillating said head to force said cutter into said blank to lift up the metal and form a tooth, and means for intermittently changing the relative positions of the cutter and blank, substantially as described.

5. In a rasp-machine the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its rear face in or within the arc described by its point, an arm secured to said head, a cam for rocking said arm, whereby said cutter is forced into said blank and the metal lifted to form a tooth, substantially as described.

6. In a rasp-machine the combination with a support for the blank, of an oscillating head mounted to oscillate about a fixed axis, a tool-carriage mounted on said head, a cutter rigidly secured in said carriage and having its rear face in or within the arc described by its point, means for oscillating said head to force said cutter into the blank to lift the metal and form a tooth, and means for intermittently moving said carriage on said head, substantially as described.

7. In a rasp-machine, the combination of an oscillating head, means for securing a cutter to said head, an arm adjustably secured to said head, means for adjusting said arm without stopping the machine, substantially as described.

8. In a rasp-machine the combination of an oscillating head, means for securing a cutter to said head, an arm pivoted to said head, and an adjustable connection between said arm and head, substantially as described.

9. In a rasp-machine the combination of an oscillating head, an arm pivoted to said head, a stud pivoted in said head, a cam on said stud engaging said arm, and means for adjusting said stud, substantially as described.

10. In a rasp-machine the combination of a reciprocating head a tool-carriage mounted

on said head, means for feeding said carriage on said head, and means for regulating the action of said feeding means without stopping the machine, substantially as described.

11. In a rasp-machine the combination of a reciprocating head, a tool-carriage on said head, a sliding bar, an adjustable connection between said bar and head, and means for intermittently moving said bar, substantially as described.

12. In a rasp-machine the combination of a reciprocating head, a tool-carriage on said head, a slot in said carriage, a sliding bar, a stud projecting through said slot and adjustably connected to said bar, substantially as described.

13. In a rasp-machine the combination of a reciprocating head, a tool-carriage on said head, a sliding bar, a stud connected to said carriage and mounted in said bar and a handle for regulating the position of said stud, substantially as described.

14. In a rasp-machine the combination of a reciprocating head, a tool-carriage mounted thereon, a cam for moving said carriage on said head, connections between said cam and carriage, means for regulating the action of said cam, and means for adjusting the length of said connections, substantially as described.

15. In a rasp-machine the combination with a reciprocating head, a tool-carriage mounted on said head, a lever, connections between said lever and said carriage, means for adjusting said connections radially and transversely of said lever, and means for oscillating said lever, substantially as described.

16. The combination of an arm, a block adjustably mounted on said arm, and provided with a stud, a second block pivoted on said stud, and a movable part on which said second block is adjustably mounted, substantially as described.

17. The combination with a carriage, of means for feeding said carriage comprising a spring, means independent of the carriage for energizing said spring, and means for restraining and releasing said spring, substantially as described.

18. The combination with a carriage, of means for feeding said carriage comprising a spring, means independent of the carriage for energizing said spring, a dog for restraining said spring, and means for releasing the dog, substantially as described.

19. The combination with a carriage, of means for feeding said carriage forward comprising a spring, means independent of the carriage for energizing said spring, and means for holding said carriage against the action of said spring and releasing said carriage, substantially as described.

20. The combination with a carriage, of a rack secured to said carriage, a pawl engaging said rack, means for reciprocating said pawl comprising a spring, means for energizing said spring, and means for holding and releasing said carriage, substantially as described.

21. The combination with a carriage, of a rack secured thereto, a pawl engaging said rack, a rock-shaft, a spring connection between said shaft and pawl, means for holding said carriage against the action of said pawl and spring, and means for releasing said carriage by the rocking of said shaft, substantially as described.

22. The combination with a carriage, of a spring for feeding said carriage forward, means independent of the carriage for energizing said spring, a dog for holding said carriage against the action of the spring, and means for releasing said dog, substantially as described.

23. The combination with a carriage, racks secured to said carriage, dogs arranged to engage said racks and tappets directly engaging said dogs for alternately moving the dogs out of engagement with the racks, and means for feeding the carriage forward, substantially as described.

24. The combination with a carriage, of means for feeding said carriage forward, means for stopping and releasing said carriage, and mechanism for throwing said feeding and stopping and releasing means out of operation, substantially as described.

25. In a rasp-machine the combination with a support for the blank, of a head mounted to oscillate about a fixed axis, a cutter rigidly mounted on said head and having its point adjacent a vertical line passing through the axis of the head, and means for oscillating said head whereby the cutter is carried both downward and with an inward sweep.

JAMES A. McHARDY.

Witnesses:
IRA L. FISH,
W. H. THURSTON.