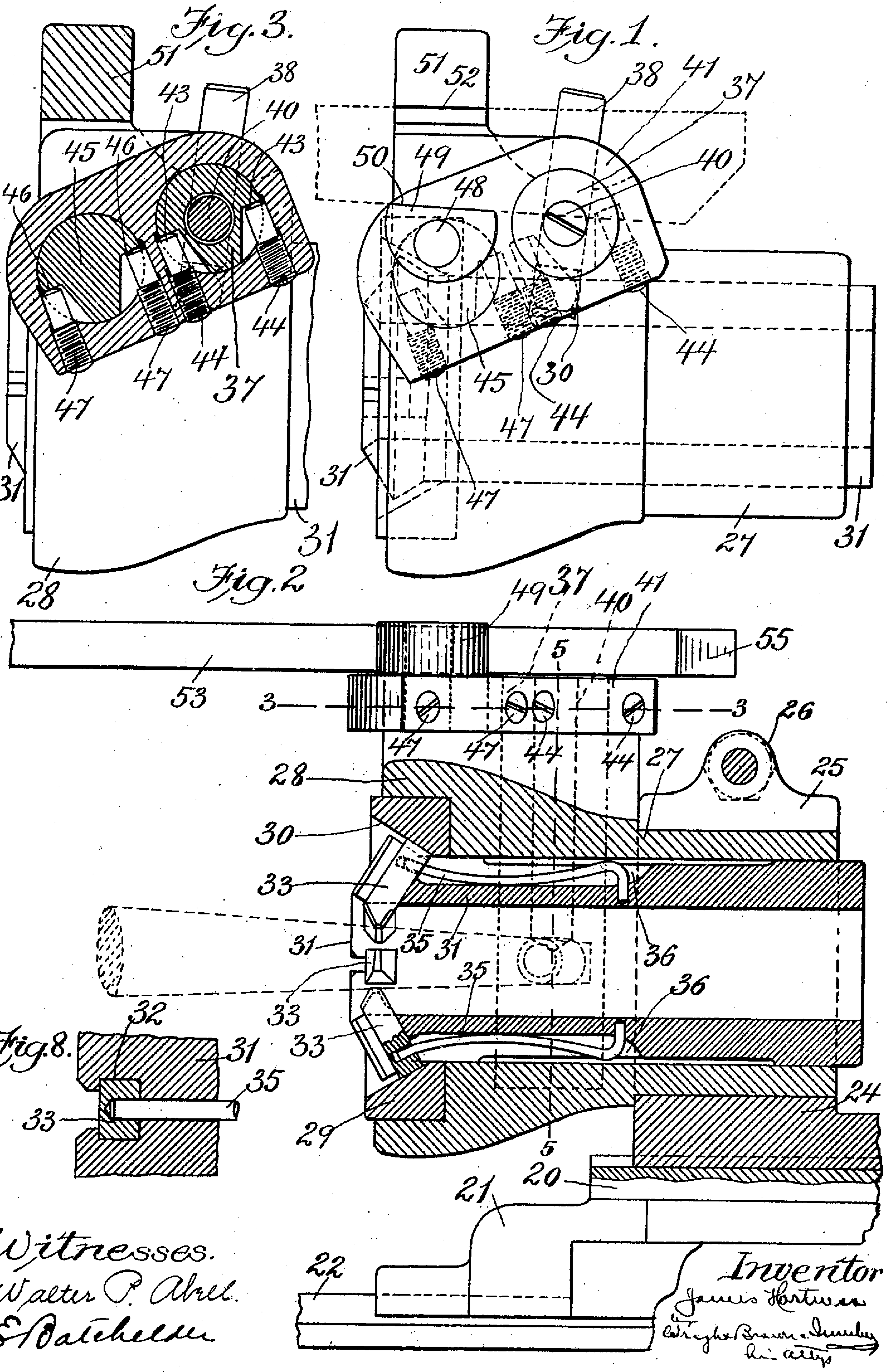
No. 877,925. PATENTED FEB. 4, 1908.

J. HARTNESS.
TAPER TURNING TOOL.

APPLICATION FILED MAR. 29, 1905.

3 SHEETS—SHEET 1.



Witnesses.
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3 SHEETS—SHEET 2.

Fig. 4.

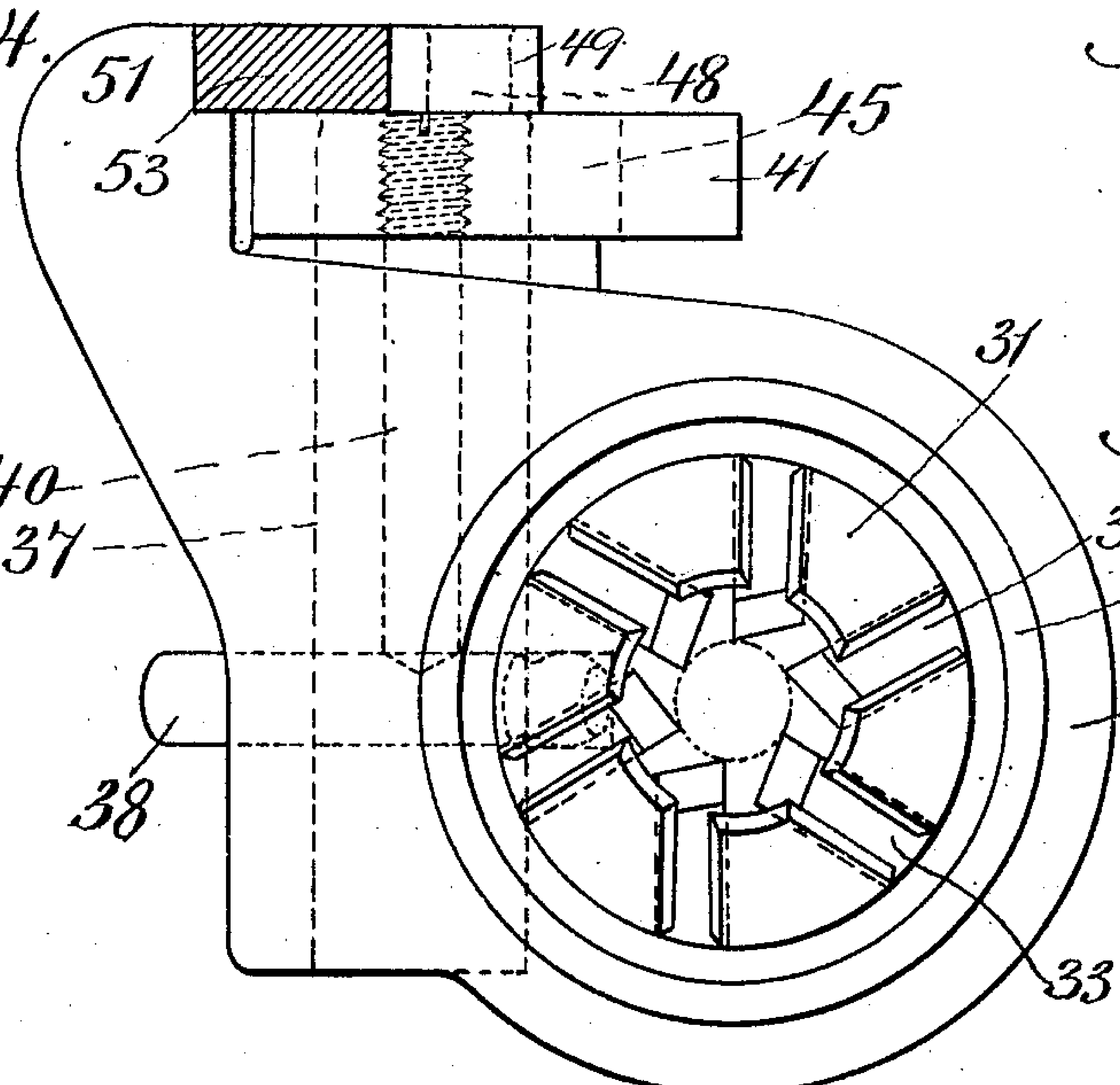


Fig. 7.

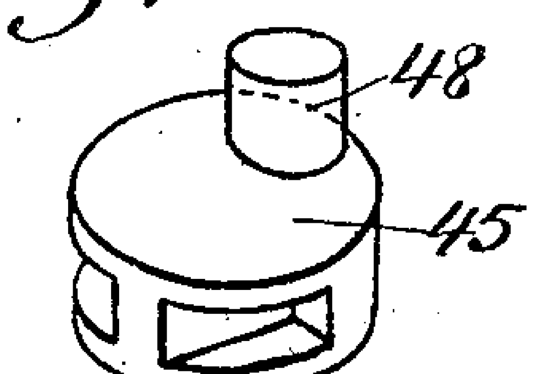


Fig. 6.

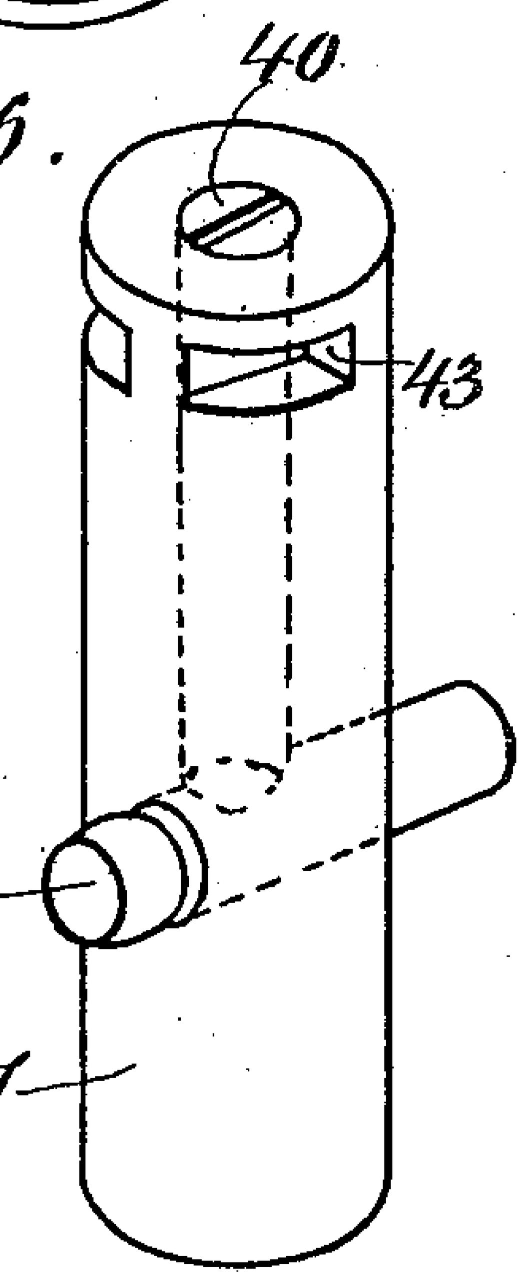


Fig. 5.

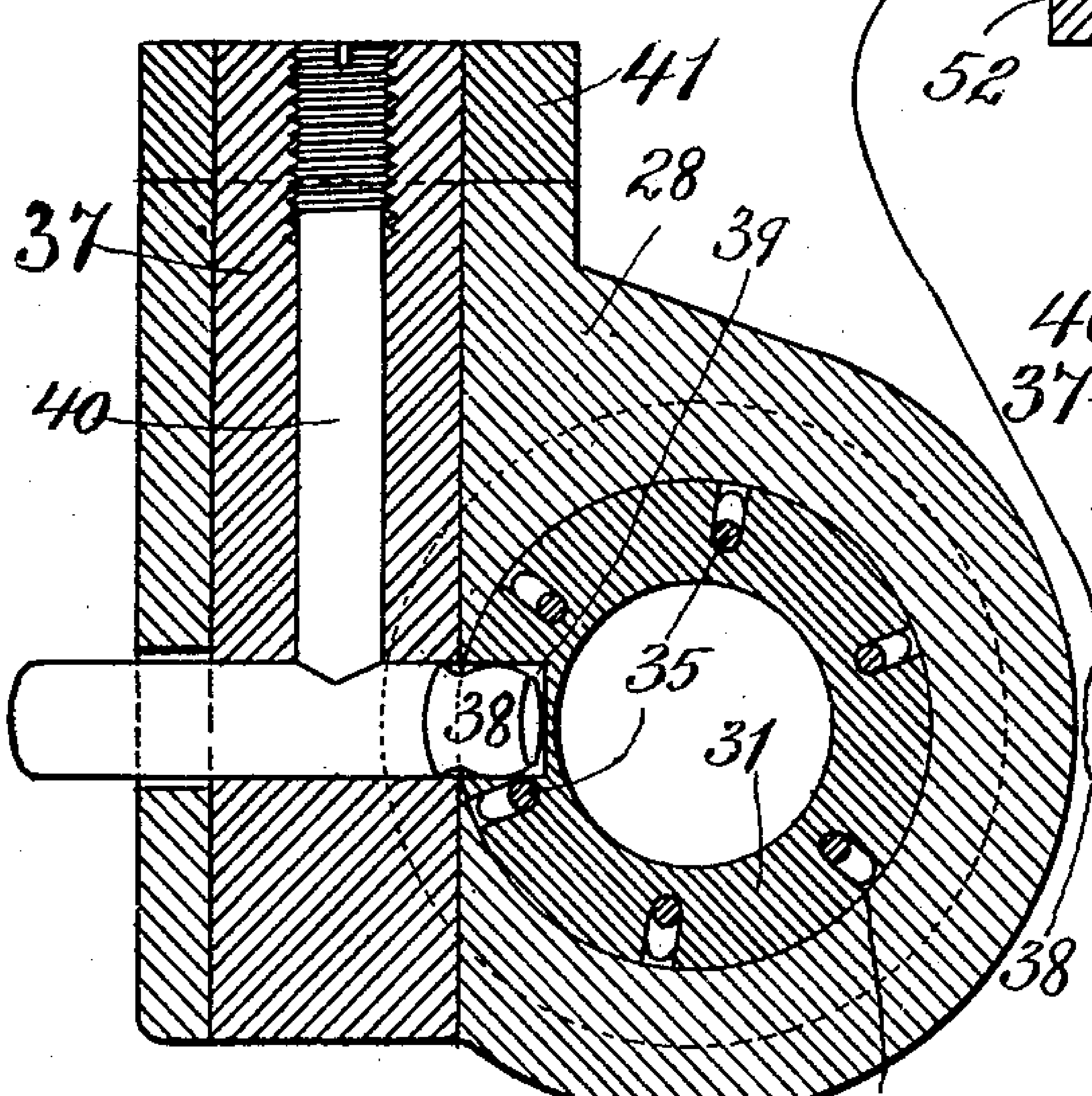


Fig. 9.

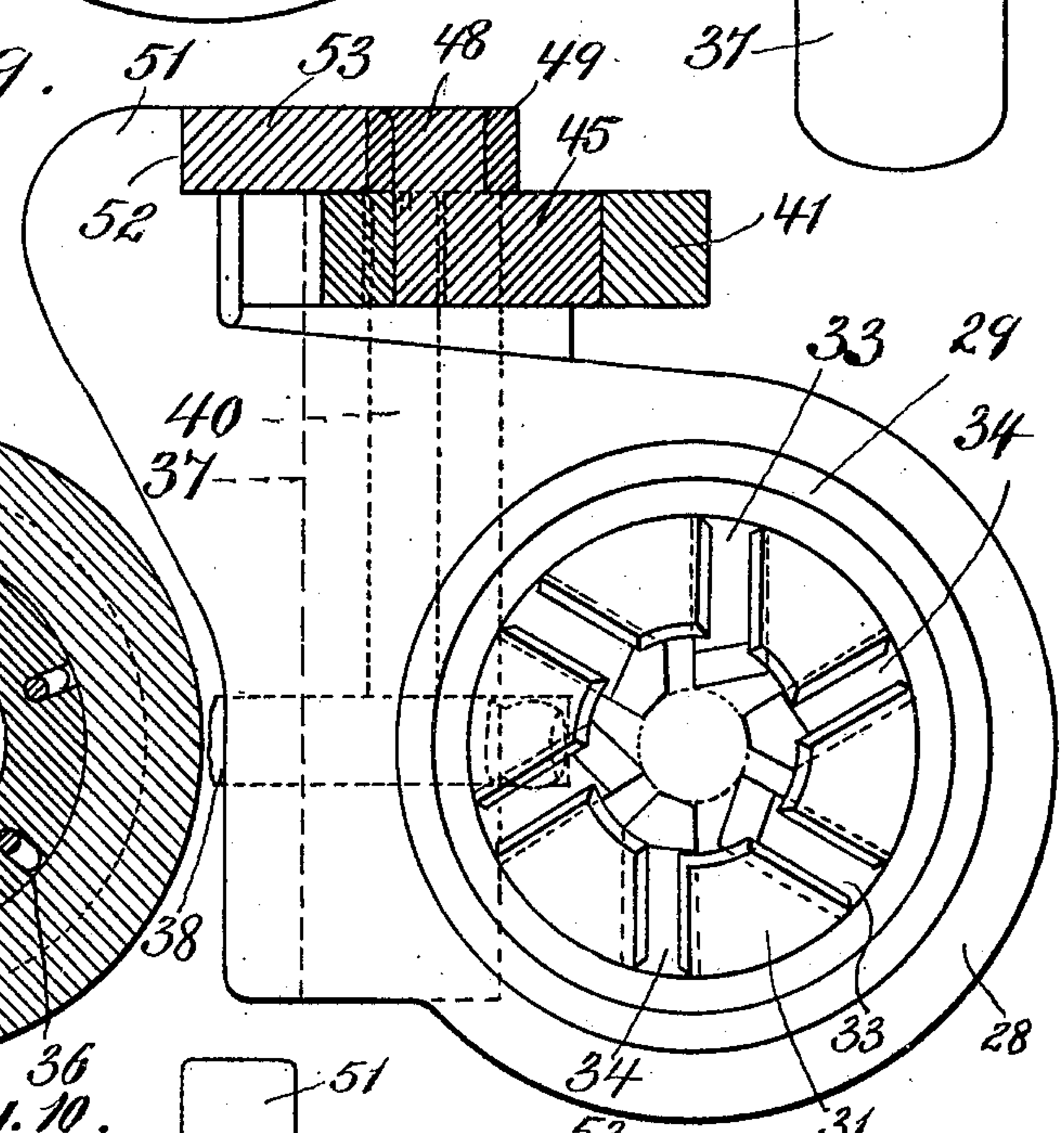
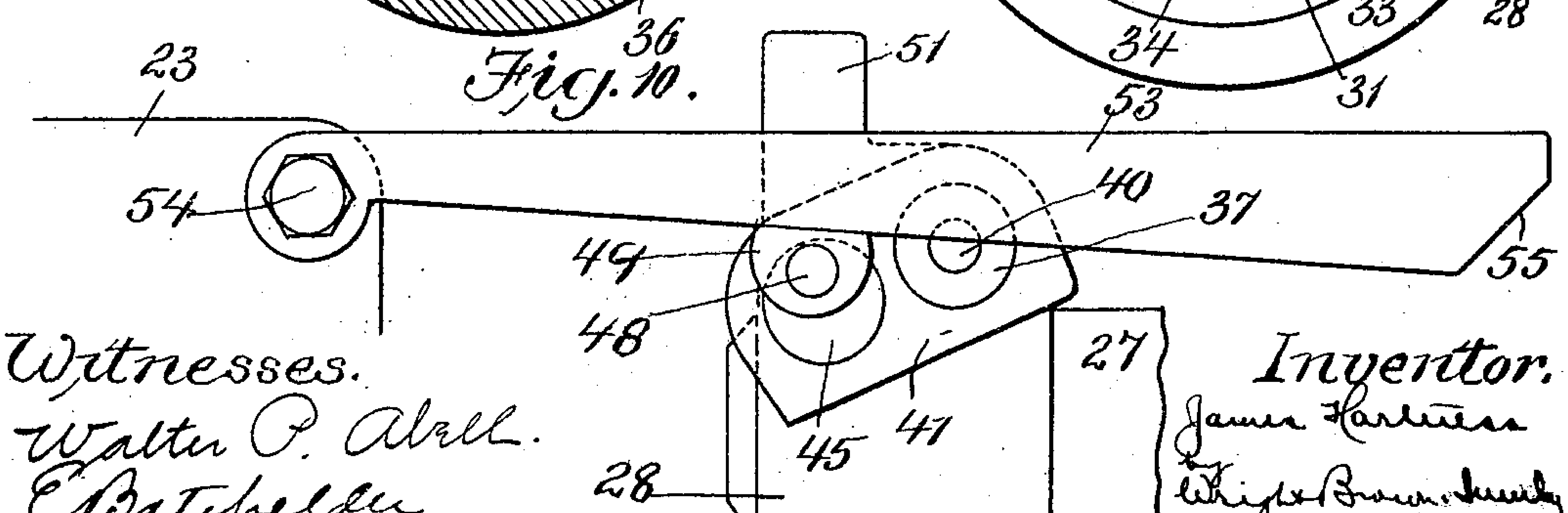


Fig. 10.



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3 SHEETS—SHEET 3.

Fig. 12.

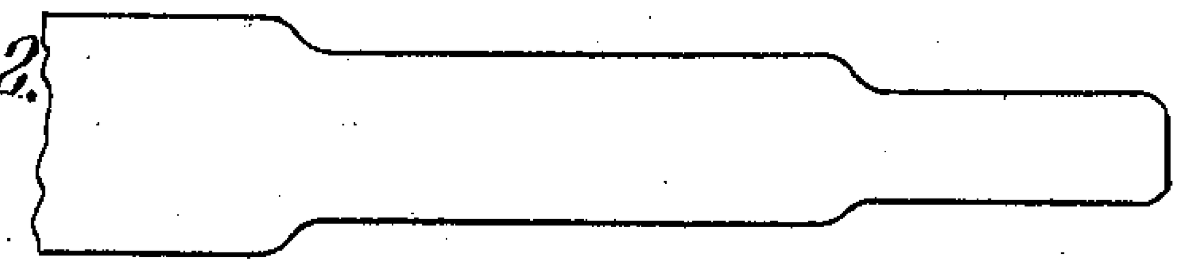


Fig. 11.

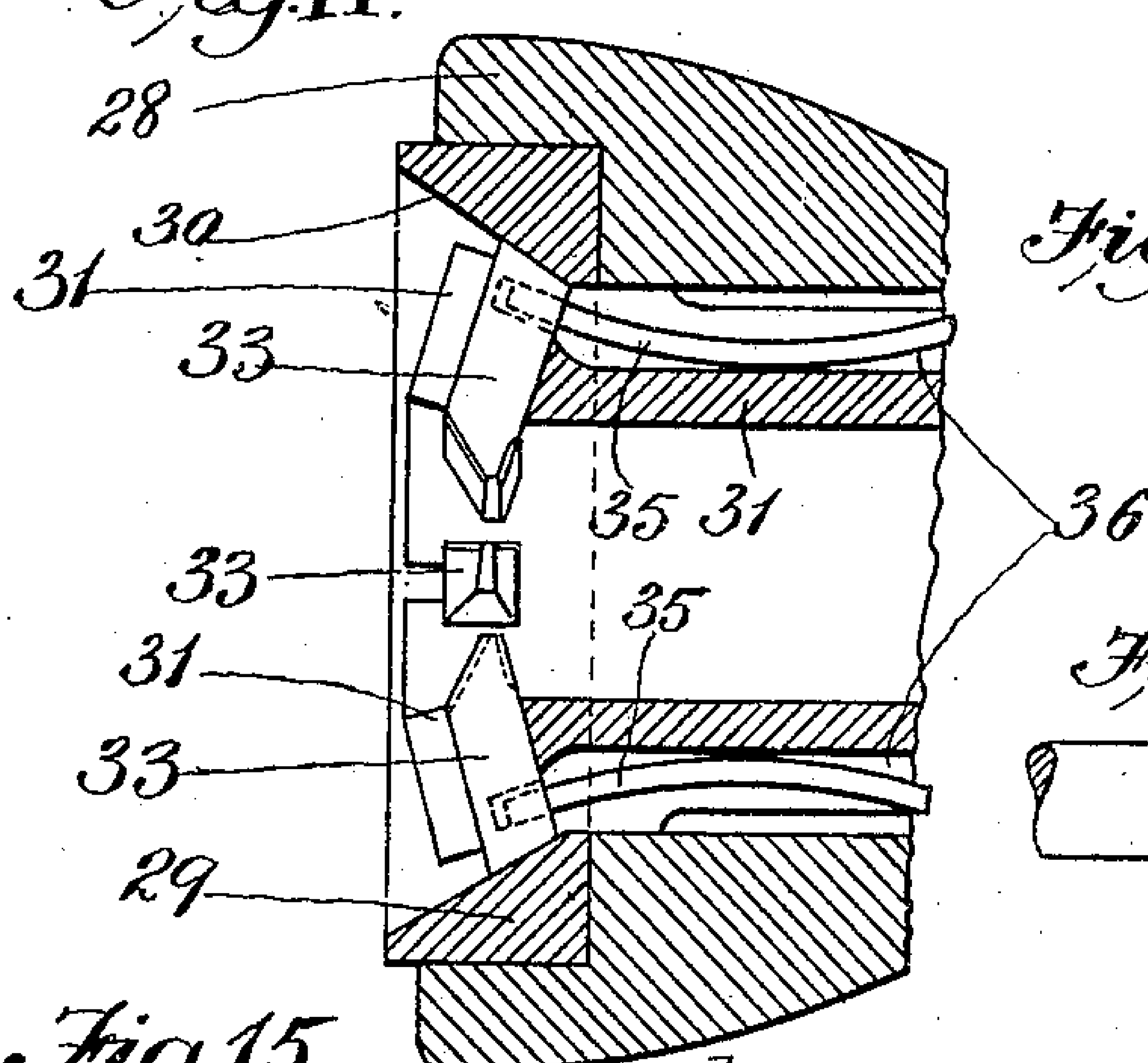


Fig. 13.

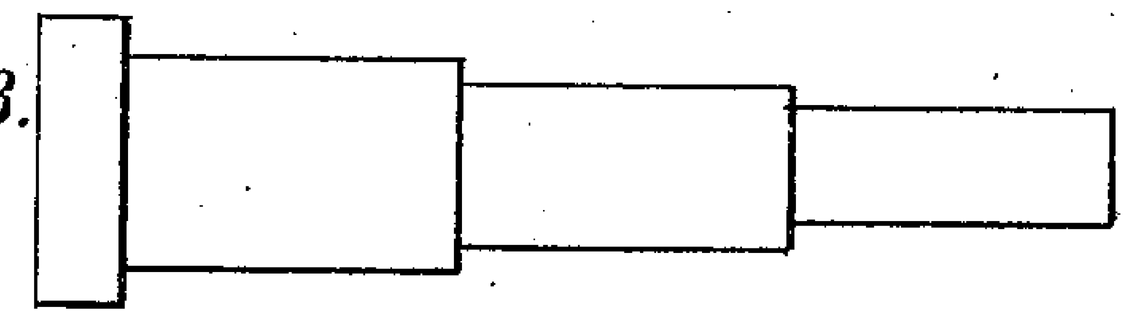


Fig. 14.

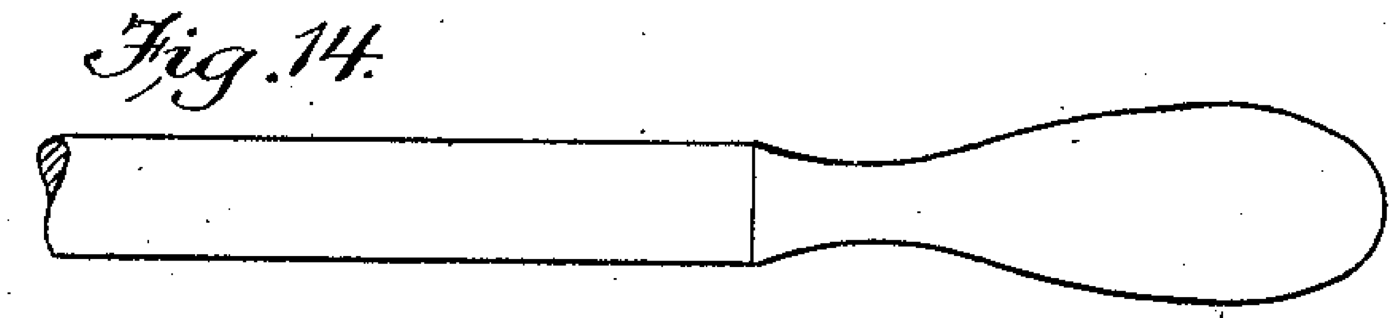


Fig. 15.

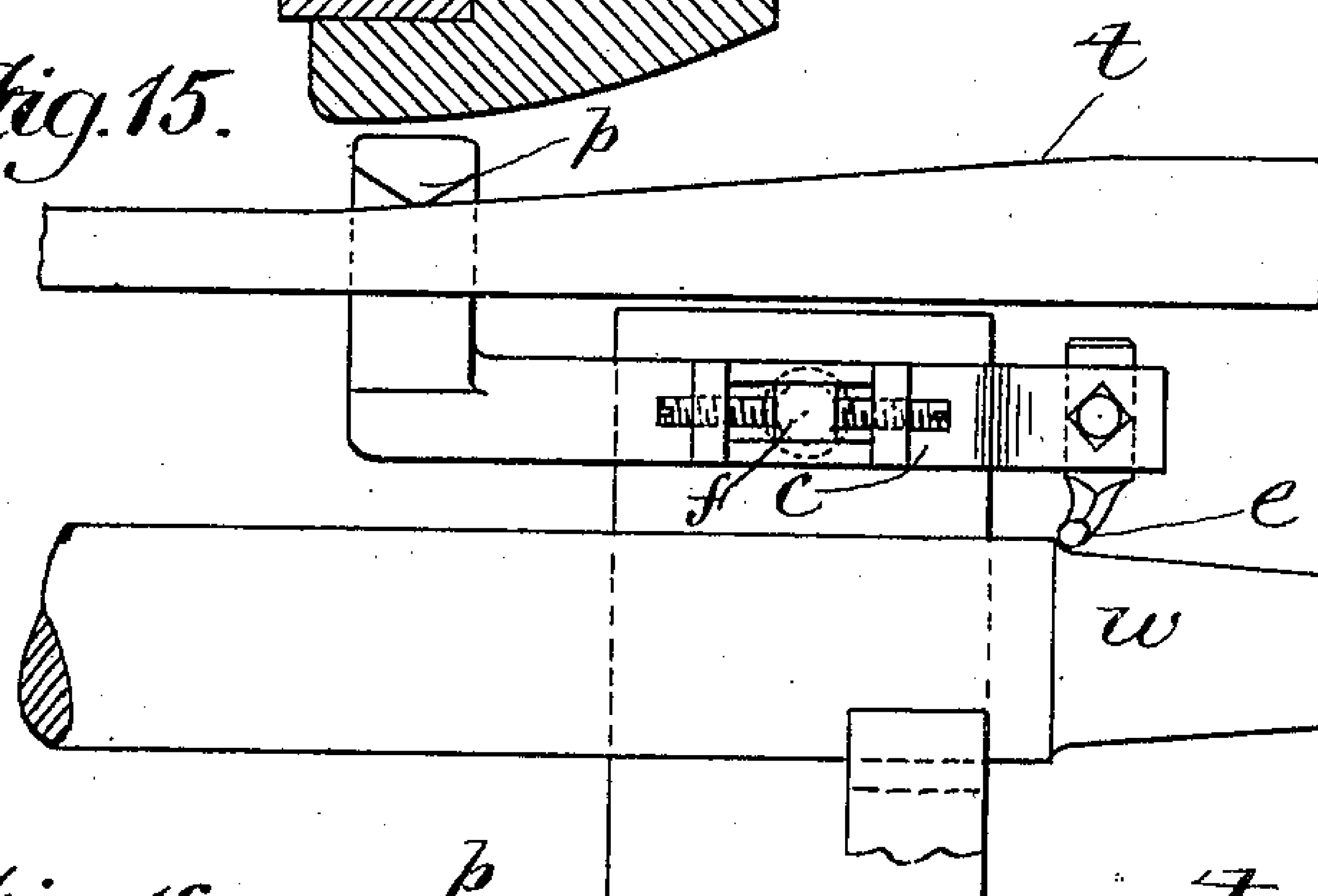


Fig. 16.

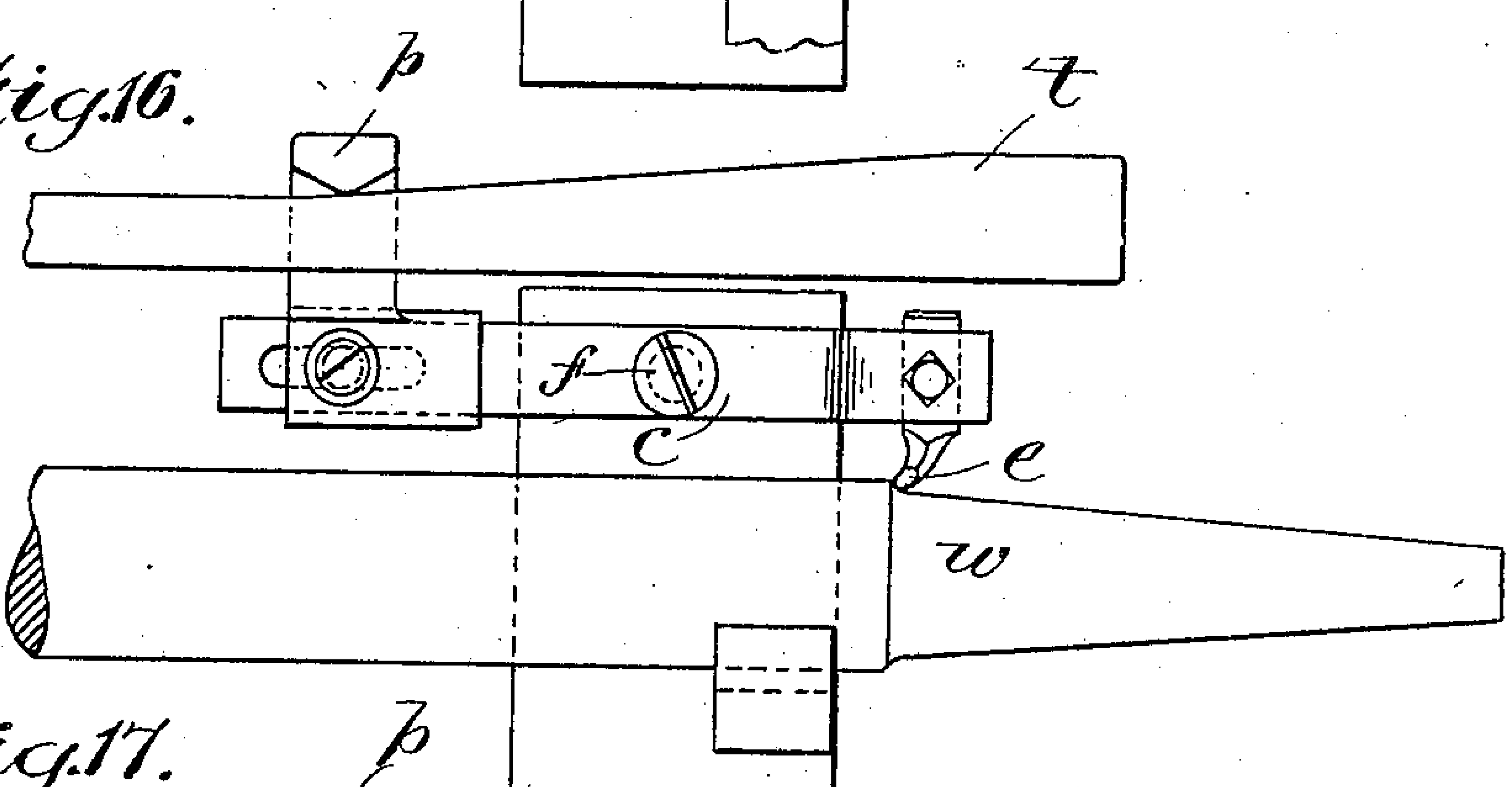
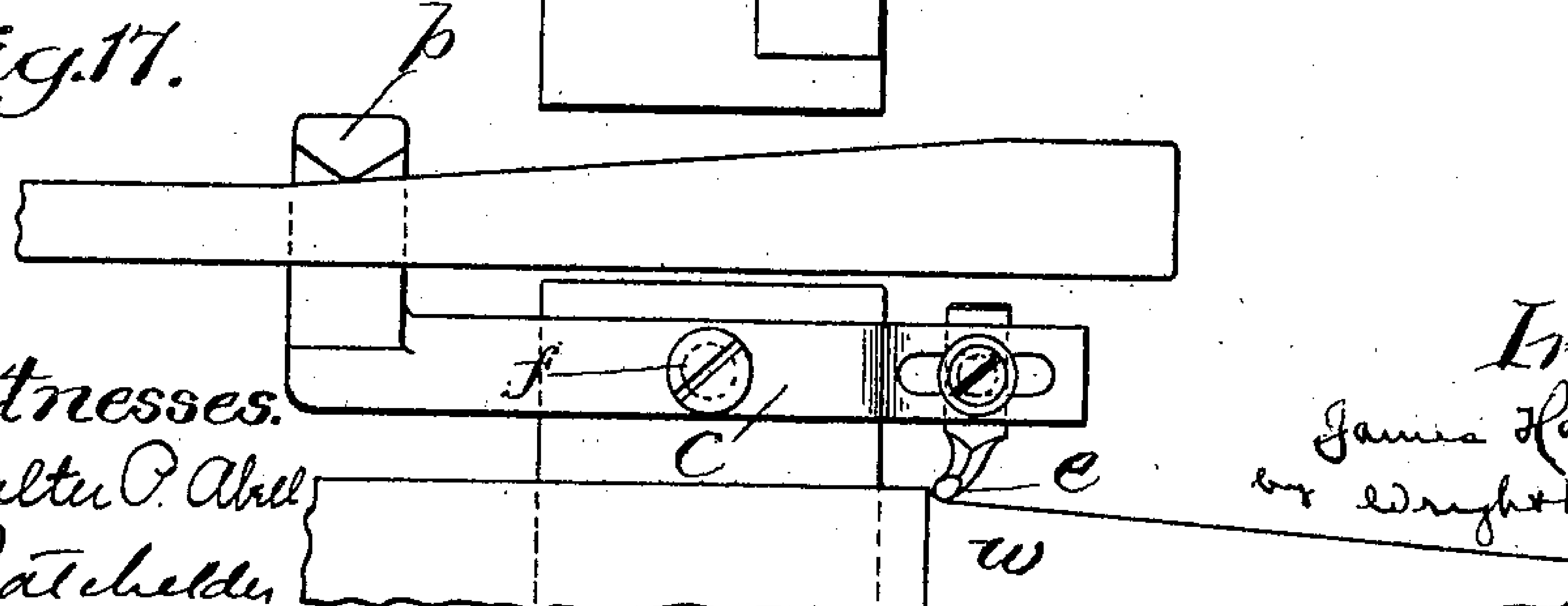


Fig. 17.



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THE NORRIS PETERS CO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

JAMES HARTNESS, OF SPRINGFIELD, VERMONT.

TAPER-TURNING TOOL.

No. 877,925. **Specification of Letters Patent.** **Patented Feb. 4, 1908.**

Application filed March 29, 1905. Serial No. 252,635.

To all whom it may concern:

Be it known that I, JAMES HARTNESS, of Springfield, in the county of Windsor and State of Vermont, have invented certain new and useful Improvements in Taper-Turning Tools, of which the following is a specification.

This invention has for its object to provide a simple, durable and efficient taper-turning tool, for employment in metal-working lathes.

Referring to the accompanying drawings: Figure 1 represents in side elevation a taper-turner embodying the invention. Fig. 2 represents a vertical longitudinal section therethrough. Fig. 3 represents a section therethrough on the line 3—3 of Fig. 2. Fig. 4 represents an end elevation of the tool. Fig. 5 represents a section on the line 5—5 of Fig. 2. Fig. 6 represents a rotary upright or member by which motion is transmitted to the cutter-holder. Fig. 7 represents the adjustable member for supporting the templet-engaging member. Fig. 8 shows in section and somewhat enlarged part of the cutter-holder, one of the cutters, and the tension spring which is attached to the cutter. Fig. 9 is an end elevation similar to Fig. 4, illustrating the use of work-rests or centering devices in connection with the cutters. Fig. 10 illustrates the tool in operative relation to a templat. Fig. 11 illustrates the cutters arranged more nearly at right angles to the axis of the work. Figs. 12, 13 and 14 illustrate forms of work that may be produced by the tool from a templet Figs. 15, 16 and 17 are conventional diagrammatic views of a simple form of one feature of the invention.

It will be understood at the outset that while I refer to the invention as a taper-turner, that I desire to include by that term forms of the invention for turning tapering and symmetrical forms, as well as performing what may be technically termed a "turning" operation for the production of shouldered cylindrical work. It will be further understood that the invention is not limited to the details of construction and arrangement which I have seen fit to illustrate, and likewise that the phraseology herein employed is for the purpose of description and not of limitation.

The tool, as a whole, is well adapted for use in connection with any form of lathe in which there is a relative movement of the tool and the work in lines parallel to the axis of the work. In the drawings, the tool is shown as being mounted upon a flat turret 20, placed upon a carriage 21 movable upon ways or shears 22 toward and from an abutment 23, such as the headstock.

The tool includes any suitable form of main supporting frame, such as, for instance, that illustrated at 24, in which there is a split annulus 25, the members of which are adapted to be drawn together by a bolt or screw 26, to securely clamp a stationary sleeve 27, as shown in Fig. 2. It is not essential, however, that this annulus should be split, because the aperture therethrough may be angular, the periphery of the sleeve in that case being complementally formed and the sleeve being held against movement by any suitable means such as a set-screw or the like. The sleeve or outer member is elongated to constitute a head or cutter-engaging device 28 which is counterbored to receive a hardened ring 29 which is internally and outwardly tapered or beveled to provide a bearing-surface 30 for the cutters. Within the sleeve or head is placed a second sleeve 31 which in the illustrated embodiment of the invention constitutes a cutter-carrier. There is a relative longitudinal movement between the sleeve and the cutter-head which results in an adjustment of the work-engaging members, which consist of cutters and work-rests or centering devices toward and from the axis of the work. According to the present embodiment of the invention, the cutter-carrier itself is longitudinally moved by templet-controlled means which will presently be described, but it is obvious that the cutter-head could be moved relatively to the carrier, or that the ring 29 could be moved, and the head the sleeve held stationary.

In its end, which is outwardly swelled or enlarged for the purpose, the carrier has substantially radial guideways or undercut grooves 32, in which are placed one or more cutters 33 and back-rests or centering devices 34, as shown in Fig. 9, if it be desired to employ the latter. The employment of back-rests, however, is in many cases unnecessary, since I may use cutters alone, as shown in Fig. 4. The cutters are substantially oblong both in plan view and in side elevation, and they are arranged at such an angle to the axis of the work that their outer ends, which are properly curved, bear against the beveled or bearing surface 30, as best shown in Fig. 2, taken in connection with Fig. 4. Each cutter is properly shaped to provide an acute point or edge for engaging the work and removing a chip therefrom. These cutters may be arranged at a different angle, as shown in Fig. 11, in which they are represented as being at nearly a right angle to the axis of the work.

I have stated that the cutters are substantially axially arranged, but it will be observed that the median longitudinal lines of the cutters are tangential to a circle circumscribed about the axis of the work, although the sides of the tool which terminate in the cutting point are radial to said axis. I desire to have it understood, therefore, that, while referring to the cutters as radially arranged or radially adjustable, I mean that the cutters are so arranged that their adjustment brings them nearer to or further from the work or the axis thereof. Each of the cutters is engaged by the free end of a spring 35 arranged in a longitudinal groove 36 in the cutter-carrier, the other end of each spring being bent and inserted in an aperture in the said carrier. The tension of the springs exerts a constant stress tending to move the cutters outward and to hold their outer ends firmly against the bearing-surface 30. This is assisted by the outward thrust of the work on the cutters.

From the foregoing description, it will be seen that a relative longitudinal movement of the two members 31 and 28 tends to move the cutters inward or outward, as the case may be.

I may utilize this construction and arrangement of parts as described for securing a mere adjustment of the cutters for turning non-tapering stock, as will be readily understood, but according to the present embodiment of the invention, I utilize said means for effecting a gradual relative adjustment of the two members 28 31 for the purpose of turning a taper on the work. To this end it will be observed that the head is laterally enlarged and is apertured to form a bearing for a rock-shaft 37 whose axis is at right angles to the axis of the work and of the cutter-carriage. This rock-shaft has two arms, levers or members angularly arranged, one engaged with the cutter-carrier, and the other adapted to be adjusted by its engagement with a templet during the movement of the tool-carriage.

The carrier-engaging member consists of a pin 38 which is passed transversely through the shaft 37 and has a rounded end which projects into an aperture 39 formed in the side of the cutter-carrier 31. This pin may be removed, and is longitudinally adjustable, being held in place by a screw-pin 40, the conical lower end of which engages a countersink in the said pin 38. The other member, which is moved by its engagement with the templet, consists of a bar or plate 41 which is apertured to receive the shaft and which is arranged longitudinally of the templet. The shaft is cut away to provide two bearing-surfaces 43 43 against which are screwed the ends of screw-pins 44 passed into the side of the member 41. By means of this construction, the bar or plate 41 which constitutes an arm or lever is easily adjusted rotatively with respect to the shaft and rigidly secured after adjustment, for a purpose to which reference is hereinafter made.

The arm 41, the shaft, and the arm 38, constitute, as it were an angle-lever or bell-crank, whereby force lateral to the axis of the work is transmitted to the cutter-carrier to move it longitudinally of the axis of the work. In the free end of the arm 41 and in an aperture formed therein, is placed a disk 45 which is cut away to form bearing-surfaces 46 46 similar to those at 43 against which bear the ends of the screw-pins 47 passed into the side of the said arm. This disk carries an eccentric stud or pin 48 which may be engaged with a templet, but in order to provide a flat face bearing against the templet, there is placed loosely upon the pin 48, a rider or member 49 with a flat surface or face 50.

The head is provided with a shoulder or abutment 51 rigid therewith, having a face or surface 52 in the same horizontal planes with and opposite the face 50 of the member 49 on the pin 48. Between the two opposing faces 50 and 52 may be inserted a templet such as indicated at 53 in Fig. 10. This templet is pivoted at one end by a bolt or stud 54 to the headstock or other stationary part of the lathe, and it is suitably beveled or otherwise formed on one side to provide a face for engaging said member 49, its free end being beveled as at 55 on said side for its easier insertion between the member 49 and the abutment 51. The opposite side of the templet forms a face for engaging the abutment 51, the top and bottom faces or sides of said templet being inactive and being formed in any way that may be desirable or convenient.

From the foregoing description, it will be seen that when the tool-carrier is moving lengthwise of the work, the work-engaging members will move simultaneously away from or toward the axis of the work, as the shaft 37 rocks, this rocking being due to the varying width of the templet.

After the work has once been turned, the cutters may be adjusted for a new diameter, by means of the screws 44 which adjust the arm 41 relatively to the shaft 37 and the pin 38.

In all taper-turners of which I have knowledge, it has been impossible to vary the taper of the work independent of the templet, but in accordance with my invention, this may be accomplished with a single templet, and it will be understood that this feature of my invention may be employed in other forms of turning tools.

I have heretofore in a general way referred to the disk 45 having the eccentric pin 48. This disk is shown as set in the rocker-arm 41 so that a line connecting the axis of the pin and the axis of the disk is substantially at right angles to a line connecting the axis of the disk to the axis of the shaft 37. Now it will be observed that by rotatively adjusting the disk, the pin 48 may be moved toward and from the axis of rotation of the shaft 37, to vary the leverage of the arm 41, so that the taper of the work may be varied as desired, without changing the templet or the position thereof, since although the actual movement of said member about the axis of the shaft 37 due to its sliding engagement with the templet is the same in length in each case, yet the length of movement of the active end of arm 38 is varied in accordance with said adjustment to effect a greater or less movement of the cutters, by effecting a correspondingly increased or decreased sliding movement of the cutter-carrier. This adjustment may be effected in various ways, being based upon the principle that, an adjustment of the fulcrum of a lever, or an adjustment of the points of power or load, effects a variation in the length of movement of the load. Hence in the present embodiment of the invention, it would be possible to secure a variation in the taper in the finished work by adjusting the point of the load, *i. e.*, by longitudinally adjusting the arm 38, as well as by adjusting the point of power, to wit,—by adjusting the stud 48. On the other hand, the same result could be achieved by effecting a relative adjustment of the fulcrum and the arm 38 or the arm 41. In either case, I vary the operative lengths of the two arms which, as previously stated, constitute a lever fulcrumed by the shaft 37 in its bearing. Reduced to its simplest form, this feature of the invention might consist of a bar, having at one end a cutter to engage the work and bearing at its other end against the templet with an adjustable fulcrum. Or, it might consist of such a bar with a fixed fulcrum and an adjustable point of power, or of a bar with a fixed fulcrum, a fixed point of power, and an adjustable cutter or point of load, all as indicated conventionally and diagrammatically in Figs. 15 to 17, in which t is the templet; c the lever; p the point of power or engagement of the lever with the templet; f, the fulcrum; e, the cutting edge or point of load; and w, the work.

The invention is capable of further refinement for transmitting movement from the lever to the cutters or rests, or from the templet to the lever, but in any case it may be stated that means are provided by which the point of load of the lever may be caused to move through a greater or less distance to effect a variation in the movement in the cutters or cutting edges to vary the angularity of the finished work.

For the purpose of illustrating forms of work that may be produced by the tool herein described, reference may be had to Figs. 12, 13 and 14. These samples of work may be reproduced with a smaller diameter but with the same contour or configuration by adjusting the arm 41 about the shaft 37, or may be reproduced with a different contour by adjusting the stud 48 towards or from the shaft 37, all without changing the form of the templet.

Where it is desired to produce work having square shoulders, the member 49 will have a square edge so as to move quickly from one plane to another when a shoulder is reached in the templet.

I desire to point out the fact that the cutters are illustrated as backed off in both directions axially of the work so that the turner may be used in traveling either to or from the chuck, according to the requirements of the work.

There are numerous other advantages incident to the construction which I have illustrated which it is unnecessary to refer to in detail, as they will be apparent to those skilled in the art to which the present invention relates.

Having thus explained the nature of the invention, and described a way of constructing and using the same, although without attempting to set forth all of the forms in which it may be made, or all of the modes of its use, I declare that what I claim is:

1. A turner comprising tubular telescoping members, movable longitudinally one with respect to the other, cutters engaging both of said members, means by which the relative longitudinal movement of said members effects a substantially radial movement of said cutters, a templet, and mechanism controlled by the templet for effecting the relative movement of said members.

2. A turner comprising concentric tubular members longitudinally movable one with respect to the other, cutters carried by one of said members and arranged substantially radially with relation thereto, means on the other member for effecting a movement of the cutters towards or from the work when said members are relatively moved, and mechanism for effecting said described movement of said members, in combination with a templet controlling said mechanism and relatively to which said turner is movable.

3. A turner comprising concentric members movable longitudinally one with respect to the other, cutters engaging both of said members, means by which said cutters are

moved towards or from the work by said relative movement of said members, and mechanism for effecting said relative movement of said members, in combination with a templet relatively to which said turner is movable for controlling said mechanism.

4. A taper-turner comprising concentric tubular members longitudinally movable, one longitudinally with respect to the other, cutters engaging both said members, means by which the cutters are moved substantially radially toward or from the work by said relative movement of said members, a rock-shaft arranged at an angle to the axis of said members, a bearing therefor stationary with respect to one of said members, and means on the rock-shaft for effecting said described relative movement of said members when said shaft is rocked.

5. A taper-turner comprising concentric members longitudinally movable, one with respect to the other, cutters engaging both said members, means by which said cutters are moved relatively to said members toward or from the work by said relative movement of said members, a rock-shaft, a bearing therefor stationary with respect to one of said members, means on the rock-shaft for effecting said described relative movement of said members when said shaft is rocked, a templet relatively to which said turner is movable, and a templet-controlled arm on said shaft for rocking said shaft.

6. A taper-turner comprising a head having a tapered surface, a cutter-carrier having a cutter bearing against said tapered surface, and templet-controlled means on said head for effecting a relative longitudinal movement of said carrier and said head in combination with a templet for controlling said means.

7. A taper-turner comprising a tubular head having a tapered internal surface, a cutter-carrier concentric with relation to the head and having one or more guideways, one or more cutters arranged to slide in said guideway or guide-ways and having its or their end or ends bearing against said surface, and templet-controlled levers for effecting a relative longitudinal movement of said head and carrier in combination with a templet for controlling said levers.

8. A taper-turning mechanism comprising a templet adapted to be attached to a stationary part of the lathe; and a turning tool adapted to be attached to a tool-slide and having a rigid abutment and a movable member with confronting surfaces to receive the templet between them, said turning tool also having a plurality of substantially radially-disposed sliding cutters, a carrier for said cutters, a head concentric with said carrier and having means for simultaneously adjusting said cutters by a relative longitudinal movement of said head and said carrier, and means actuated by said movable member for effecting said relative movement of said carrier and said head.

9. In a taper-turner, a cutter, a templet, and templet-controlled mechanism for adjusting the cutter to produce tapered work, said mechanism comprising an oscillatory cutter-controlling arm, cutter moving mechanism connected to said arm and a templet-engaging member on said arm adjustable toward and from the axis of oscillation of said arm.

10. In a taper-turner, a cutter, a templet, and templet-controlled mechanism for adjusting the cutter to produce tapered work, said mechanism comprising an oscillatory cutter-controlling arm adapted to be arranged substantially longitudinally of the templet, cutter moving mechanism connected to said arm a templet-engaging member on said arm, and means for adjusting and fixing said member to and at different distances from the center of oscillation of said arm.

11. In a taper-turning mechanism, a tapering templet in combination with an arm adapted to be rocked by said templet, a rock-shaft to which said arm is connected, a cutter, a cutter-carrier, a cutter-adjusting member, said cutter-carrier and said cutter-adjusting member being concentrically arranged and being relatively movable to adjust said cutter relatively to the carrier, and means operated by said rock-shaft for effecting said relative movement of said carrier and said member.

12. In a taper-turning mechanism, a tapering templet in combination with an arm adapted to be rocked by said templet, a rock-shaft to which said arm is connected, one or more cutters, a cutter-carrier, a cutter-adjusting member, said cutter-carrier and said cutter-adjusting member being relatively movable to adjust said cutters relatively to their carrier, means operated by said rock-shaft for effecting said relative movement of said carrier and said member, a templet engaging member on said arm, and means for moving said last-mentioned member relatively to said arm to increase or decrease the effective leverage of said arm.

13. In a taper-turning mechanism, a tapering templet in combination with an arm adapted to be rocked by said templet, a rock-shaft to which said arm is connected, one or more cutters, a cutter-carrier, a cutter-adjusting member, said cutter-carrier and said cutter-adjusting member being relatively movable to adjust said cutters relatively to the cutter-carrier, means operated by said rock-shaft for effecting said relative movement of said carrier and said member, and means for effecting a relative adjustment of said shaft and said arm about the axis of said shaft.

14. In a taper-turning mechanism, a tapering templet in combination with an arm adapted to be rocked by said templet, a rock-shaft to which said arm is connected, one or more cutters, a cutter-carrier, a cutter-adjusting member, said cutter-carrier and said cutter-adjusting member being relatively movable to adjust said cutters relatively to said carrier, means operated by said rock-shaft for effecting said relative movement of said carrier and said member, means by which said shaft and arm are rotatively and relatively adjustable, a templet-engaging member on said arm, and means for adjusting the last said member relatively to said arm to vary the effective leverage thereof.

15. In a taper-turning mechanism, a tool having a templet-engaging abutment, substantially radial work-engaging members, a carrier for said members, a beveled face for engaging said members, said carrier and said beveled face being concentrically arranged, and mechanism for effecting a relative movement of said face and said carrier to effect a simultaneous adjustment of said members relatively to the axis of the work, said mechanism comprising a movable templet-engaging member confronting said abutment, in combination with the templet having a face on one side for engagement with said abutment, and a face on the other side for engagement with said templet-engaging member.

16. The combination with a templet and a movable tool carriage, of a taper turner comprising a cutter, a lever for moving the cutter having a point at which it transmits movement to the cutter relatively to the axis of the work, a point at which it receives motion from the templet as the carriage move- relatively to the templet, and a fulcrum, and means in consequence of which said points and fulcrum may be relatively adjusted to effect a variation in the length of movement imparted to the cutter.

17. The combination with a templet and a movable tool-carriage, of a taper turner comprising a cutter, a lever for moving said cutter having two arms, one adapted to be actuat as the carriage moves relatively to said templet, and the other being adapted to transmit motion to the cutter, and means for varying the operative lengths of said arms to effect a variation in the length of movement imparted to the cutter.

18. The combination with a templet and a movable tool-carriage, of a taper turner comprising a cutter, a lever for moving said cutter having two arms angularly arranged one having a point to which motion is transmitted or permitted by the templet, and the other having a point at which motion is transmitted to the cutter, and means in consequence of which at least one of said points may be adjusted longitudinally of its arm.

In testimony whereof I have affixed my signature, in presence of two witnesses.

JAMES HARTNESS.

Witnesses:
M. B. May,
C. C. Stecher.