

(No Model.)

3 Sheets—Sheet 1.

F. MOORFIELD.

APPARATUS FOR FORMING AND SHAPING HOLLOW ARTICLES.

No. 476,058.

Patented May 31, 1892.

Fig. 1.

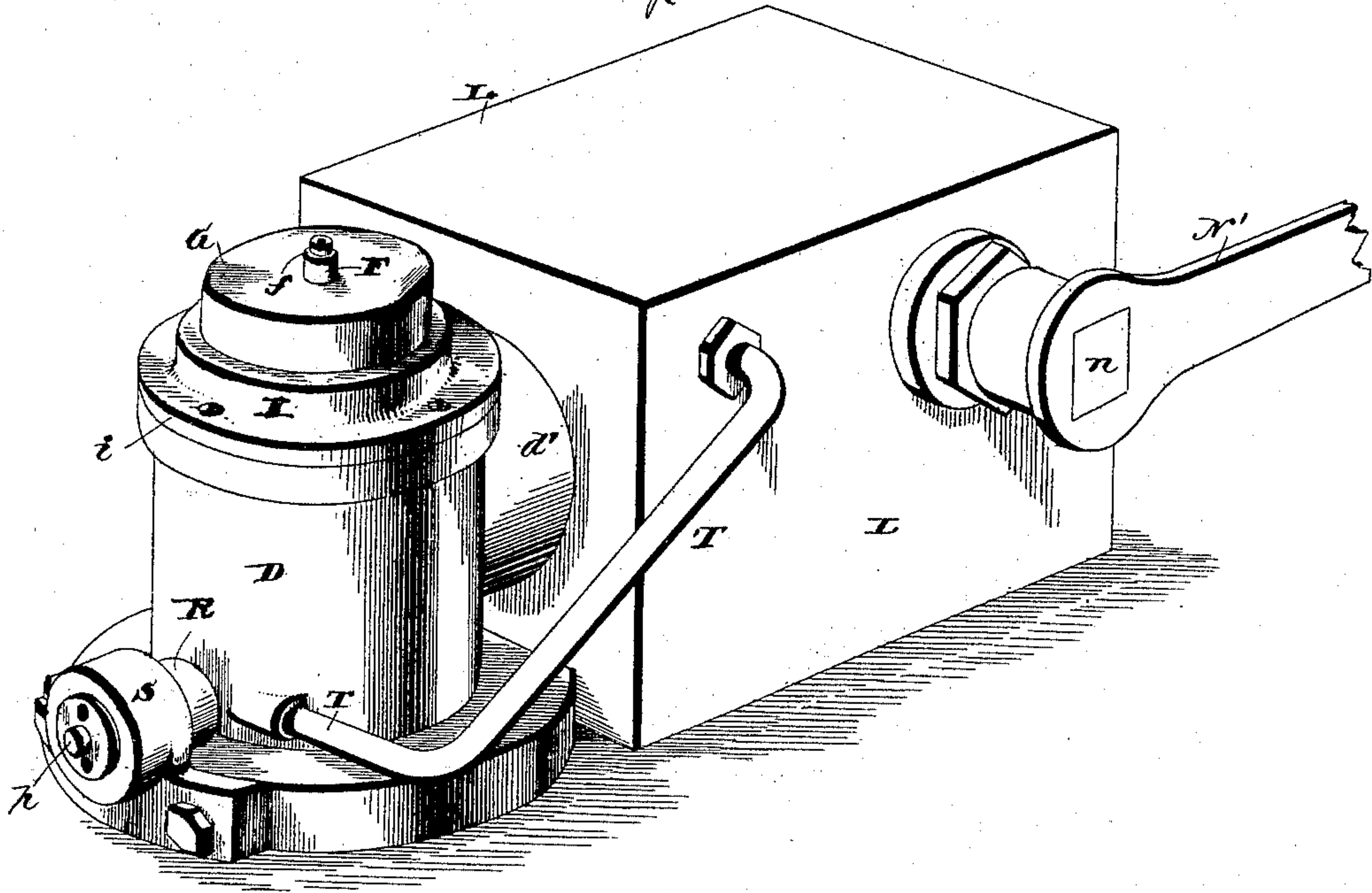
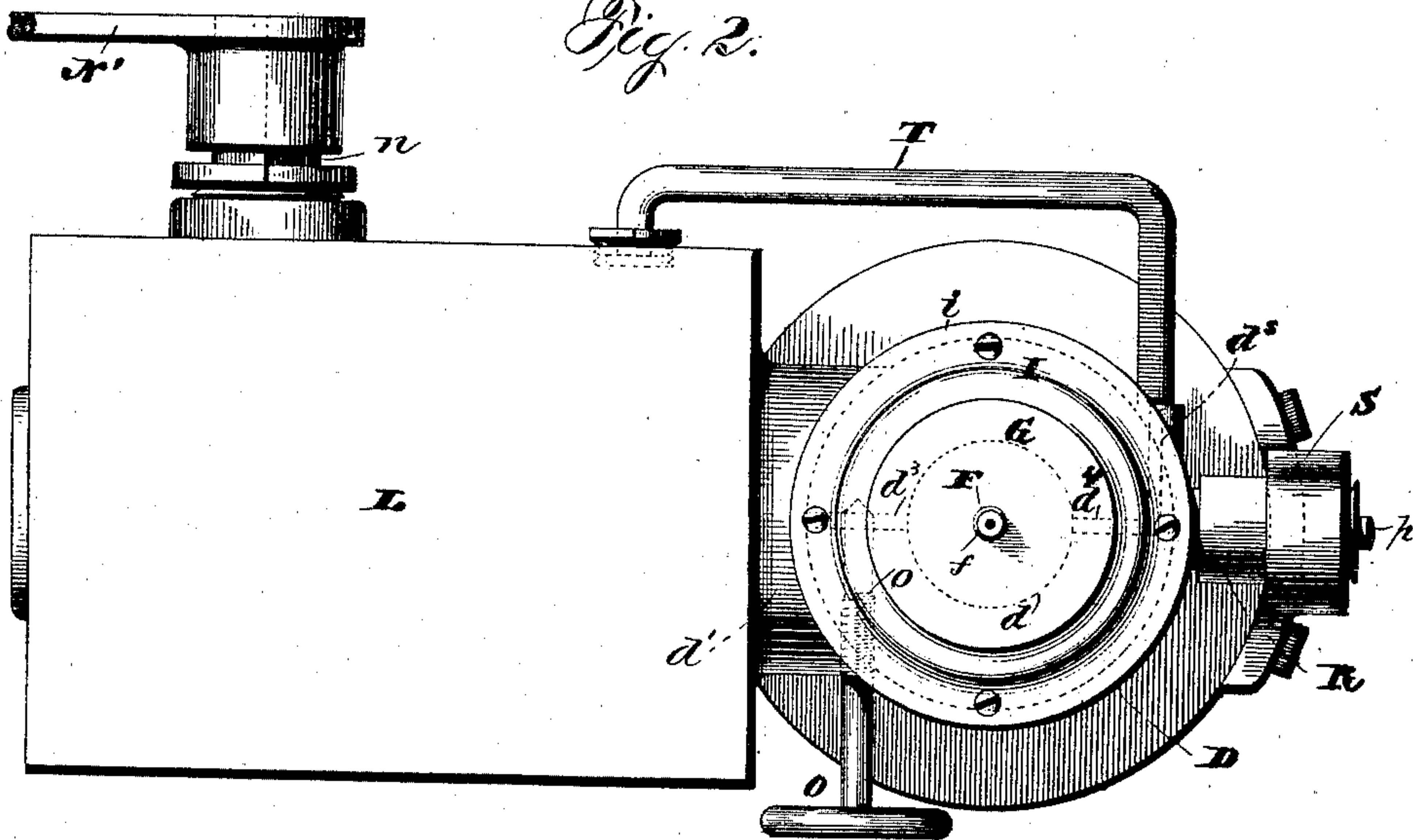


Fig. 2.



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(No Model.)

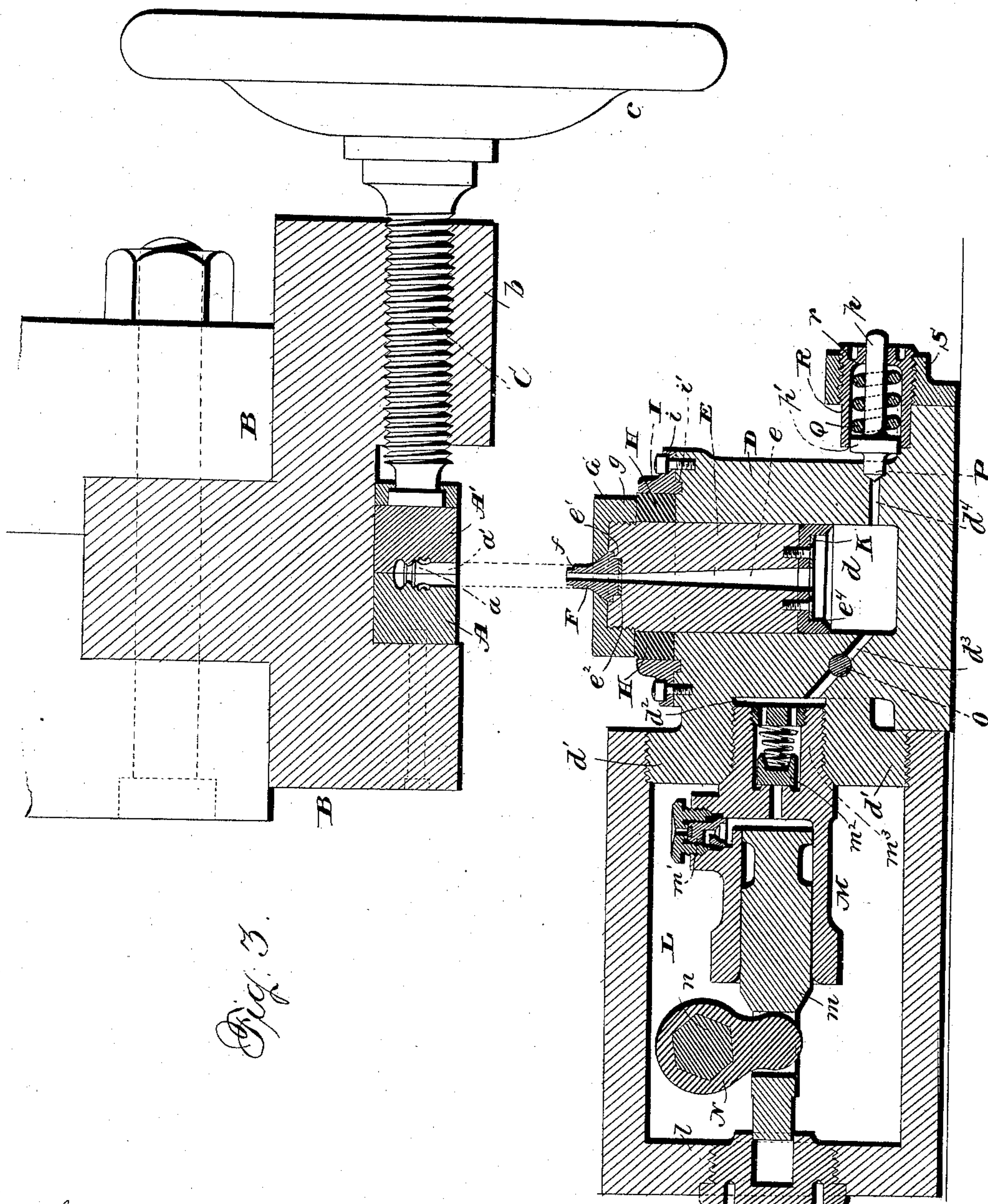
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3 Sheets—Sheet 3.

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Fig. 4.

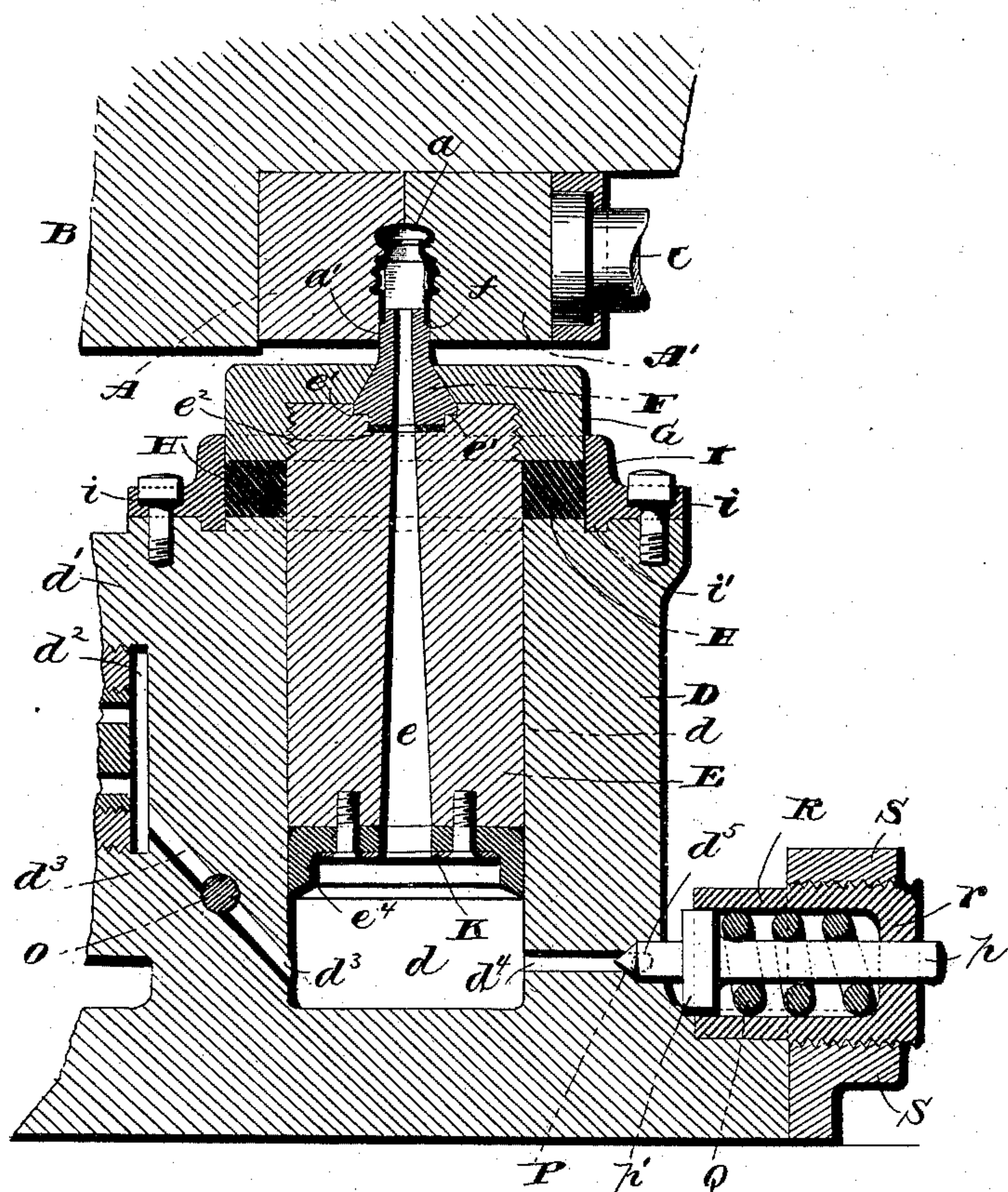
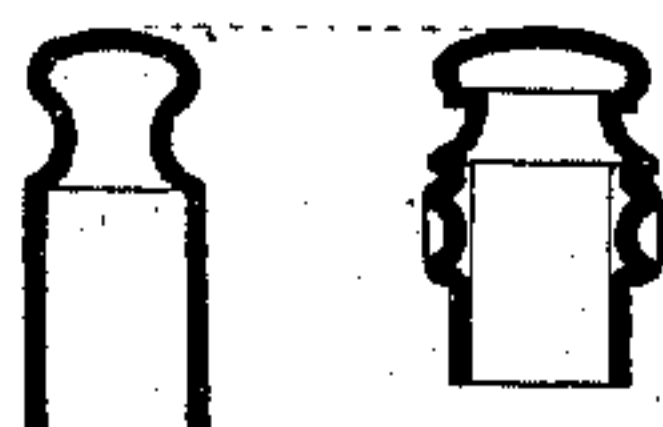


Fig. 5. Fig. 6.



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UNITED STATES PATENT OFFICE.

FRANK MOORFIELD, OF BROOKLYN, NEW YORK.

APPARATUS FOR FORMING OR SHAPING HOLLOW ARTICLES.

SPECIFICATION forming part of Letters Patent No. 476,058, dated May 31, 1892.

Application filed March 7, 1891. Serial No. 384,178. (No model.)

To all whom it may concern:

Be it known that I, FRANK MOORFIELD, of Brooklyn, in the county of Kings, and in the State of New York, have invented certain new and useful Improvements in Apparatus for Forming or Shaping Hollow Articles; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, in which—

Figure 1 is a perspective view of my apparatus, no die being shown; Fig. 2, a plan view thereof; Fig. 3, a longitudinal section of the same and a die to be used therewith with the parts in position before an operation; Fig. 4, a similar view of a portion only of what is shown in the preceding figure, drawn to a larger scale, showing the position of parts during a forming operation. Figs. 5 and 6 are views, respectively, in section, of a blank from which a watch-stem or pendant is to be made and a formed or completed stem.

Letters of like name and kind refer to like parts in all of the figures.

The object I have had in view in inventing my apparatus has been to simplify and lessen the number of operations necessary to form hollow articles of various kinds ordinarily made from sheet metal, and thereby to considerably cheapen and expedite their production; and to this end my invention consists in the apparatus and the parts thereof adapted to accomplish the formation of hollow bodies or articles by means of some suitable fluid under pressure, as hereinafter specified.

My apparatus as used consists, essentially, of two parts—a die of appropriate shape or configuration adapted to receive and contain a roughed-out blank approximating in general shape the form the completed article is to have and mechanism operating to produce and transmit to the blank when within the die the pressure to cause it to conform thereto.

The former may be, as shown, a sectional die composed of two parts, one A, secured immovably to a suitable head or support B, and one A', made movable with reference to the other to permit the insertion of a blank and the removal of the completed article. A convenient mode of imparting the required movement to the movable part A' is to use a screw C, passing through a screw-threaded opening in

a downwardly-extended portion *b* of the head B and having a swiveled connection at its inner end with said part A'. At its outer end said screw is furnished with a suitable hand-wheel *c*, by means of which it may be rotated. The head B and the die with it are adapted to be moved vertically, for a reason hereinafter given. Below the die is a vertically-arranged cylinder D, whose lower end is closed, but whose upper end is open, and said cylinder is so disposed that the vertical axis of its chamber *d* is in line with the transverse center of the formative opening or matrix *a* of the die. Closely fitting the chamber *d*, but capable of longitudinal movement therein, is a piston E, through which extends, from top to bottom, an opening or passage *e*, preferably increasing in diameter from top to bottom. In the upper face of the piston, concentric with the opening *e*, is provided a comparatively shallow recess *e'*, whose lower portion is made of less diameter than the upper, so as to form an annular shoulder or offset. This shouldered recess *e'* constitutes a seat for a nipple F, whose opening is of the same diameter as the upper end of the opening *e* in the piston and in line with said opening. The portion of the nipple which is contained within the recess *e'* conforms in shape thereto, and between its lower face and the bottom of said recess is placed a gasket or washer *e''*, of leather or other suitable material, which, together with the form of the abutting surfaces of the nipple and the piston, makes a fluid-tight joint between the parts. The gasket or washer has an opening through it of the same diameter as and registering with that of the nipple. Exteriorly the nipple for about one-half its length tapers inward and upward and is then cylindrical, and it is confined in place by means of a collar G, having a centrally-located opening conforming in shape and size to the taper portion of the nipple with which it engages. Said collar has a downwardly-extending peripheral flange *g*, which interiorly is screw-threaded to engage external threads on the periphery of the upper portion of the piston E. When the collar G is screwed down to secure the nipple upon its seat in the piston, the cylindrical portion of the nipple will extend above the upper face of said collar. The diameter of the cylindrical portion

of the nipple is precisely the same as that of the outer portion a' of the cavity or matrix of the die when the parts A and A' are placed together, except at its upper extremity, where the diameter is reduced sufficiently to enable it to enter a short distance into the body or article being operated on, and to provide a shoulder f to engage the lower end of such body, for a purpose hereinafter to appear.

In a space left between the lower face of the flange g of the collar G and the upper face of the cylinder D is placed an annulus H, of rubber or some other elastic body, or a coiled spring whose normal tendency, when expanding, is to raise the piston E in the cylinder-chamber d , but which is capable of yielding to permit said piston to be depressed or lowered when sufficient force is applied thereto. Surrounding the rubber annulus to protect and confine it against lateral expansion when subjected to pressure is a ring I, having a height substantially equal to that of the elastic body or annulus when fully expanded and held in place by screws passing through a horizontal flange i into the cylinder D, and by an annular flange i' on its under side engaging an annular recess in the contiguous face of the cylinder.

At its lower end, which when the piston is raised is some distance from the bottom of the chamber d , the piston has secured to it a washer e^4 of some flexible material, as leather, to form a tight joint with the sides of said chamber. Said washer has a downwardly-extending portion to engage the sides of the chamber and a horizontal portion which is clamped or held between the under surface of the piston and a disk K of metal by means of headed screws passing into the piston. At its center the washer has a perforation registering with the opening e in the piston.

The fluid I prefer to use in my apparatus is water, and for its use I make the following provision: At one side of the cylinder D is a vessel or reservoir L, preferably square or rectangular in cross-section and somewhat longer than wide, closed at one end by a wall l and having at its other end an internal screw-thread to engage the external thread on a boss or projection d' , formed on the side of the cylinder D. In this vessel or reservoir, which is designed to hold the water to be used, is a pump M, whose piston or plunger m is adapted to be reciprocated by a crank-arm N, which engages a slot in the piston-rod, said arm being fixed to a rock-shaft n , that projects for a portion of its length through a suitable stuffing-box in the side wall of the vessel outside of the latter, and there has secured to it a lever N', by which it may be oscillated or rocked. In the pump are an inlet port or passage controlled by a suitable valve m' and an outlet or discharge port controlled by a back-pressure valve m^2 , and the pump is held in place by having a cylindrical threaded portion m^3 screwed into a threaded recess or cavity d^2 , provided in the projection or boss

d' of the cylinder D. A space is left between the end of the portion m^3 and the contiguous wall of the cavity d^2 , into which the pump discharges, and from this space extends a conduit or passage d^3 downward at an inclination through the wall of the cylinder into the chamber d , opening therein below the lowest point reached by the piston E in its downward movement. This passage constitutes the means of communication between the pump and the chamber d . For the performance of a function hereinafter set forth I provide a hand-valve O, by which said passage may be closed.

Near the lower end of the chamber d and extending outwardly therefrom through the cylinder-wall at a point diametrically opposite the passage d^3 is an opening or passage d^4 , whose outer portion is enlarged and contains a valve-seat for a conically-faced valve P, which is adapted to close the passage d^4 , being caused so to do by a coiled spring Q, surrounding the stem p of said valve and bearing at one end against an annular enlargement or collar p' thereon, while at its other end bearing against the head r of a cylindrical shell R, which incloses said parts. As a means to assist in guiding the valve P, its stem p is passed through an opening formed for it in the head r of the shell R. The latter has its periphery for a portion of its length threaded to engage a threaded opening in a bracket S, that is secured to and projects above a flange on the bottom edge of the cylinder D, so that by rotating the shell and so moving it back and forth the tension of the spring Q may be varied and the valve, which is designed to operate as a relief-valve, set to act at various pressures. Intersecting the passage d^4 , so as to be placed in communication therewith only when the valve P is open, is a passage d^5 in the wall of the cylinder D, and extending from the outer end of such passage to an opening which passes into the interior of the vessel or reservoir L, preferably near its top, is a pipe T to convey back to the reservoir such water as may escape when the relief-valve is caused to open.

I will now proceed to describe the operation of the apparatus constructed as above set forth.

As will be readily understood, an apparatus constructed in accordance with my invention can be used in shaping and ornamenting articles of endless variety as to configuration and use; but for the purpose of illustration I show and in describing its operation shall specifically refer to it only as constructed for and applied to the manufacture of the stems or pendants for watches. To make a stem or pendant, a blank (see Fig. 5) approximating in general shape the completed article is placed within the die-matrix a , the die part A' being given its proper position relative to the part A. In its vertical extent the matrix a should be such that the lower edge of the blank when therein shall

be a short distance above the lower edge of the die. The head or support B, with the die, is next lowered, so that the cylindrical part of the nipple passes into the die-opening or matrix with its shoulder abutting against the lower edge of the blank and its reduced portion entering the blank's lower end, which it should snugly fit, and the piston E is depressed, causing a compression of the rubber annulus or spring H. By this time a watertight joint will be formed between the nipple, the side and end of the blank, and the wall of the die-opening, because of the peculiar structure of the nipple. The pump should now be operated and water forced from the reservoir L through the passage d^3 in the cylinder-wall to the chamber d below the piston E, thence through the opening in the latter, and in the nipple into the blank. The pressure of the water on the blank will compel it to conform to and take the configuration of the die, and simultaneously with the action of the water itself directly upon the blank the pressure applied to the lower end of the piston in consequence of the possibility of upward movement of the latter will move said piston, and so cause a longitudinal compression of the blank, because of the contact with its lower edge of the shoulder f on the nipple. The pressure to which the forming article shall be subjected by the piston relative to that given by the water acting directly upon the article (which should be, as I consider desirable, the same as the latter) is determined by and depends simply on the area the lower surface of the piston shall have. If it should be desired to maintain the pressure for any length of time without subjecting the pump to undue strain, thereby permitting the employment of a light pump, or, if the back-pressure valve m^2 should be inoperative, the hand-valve O can be used to close the passage d^3 from the pump to the cylinder-chamber. When the stem has been completed, the head B is moved upward to permit it to be removed from the die, which may be done upon separating the parts of the latter, and owing to the presence of the spring or elastic body H in a compressed state the piston E will move upward at the same time to the limit of its upward movement. In consequence of this upward movement of the piston the cubic contents of the chamber d below it will be increased and the level of the upper end of the nipple F elevated, so that as the die, with the stem, moves away therefrom there will be no overflow of such water as the stem contains; but it will be passed into the piston-opening e . By this means convenient and complete provision is made for disposing of such water as goes into the article and in a way which permits of its most economical use, as the water can be used again and again without undue waste. Inasmuch as there may be variation in the degree of movement of the piston—as, for instance, where it is pressed down farther on lowering the die-car-

rying head B at one time than at another—so that at different times a greater or less volume of water may be required to obtain the pressure necessary to cause the metal of a blank to conform to the die configuration, the relief-valve P is set to operate when the pressure necessary has been attained, and a quantity of water is thrown by the pump always in excess of the amount needed for such pressure, thereby insuring that the proper degree of pressure shall always be applied to the article being made. It will be seen, therefore, that this valve is particularly useful and important in conjunction with the piston, in view of possible variation, on account of the latter, in the volume of water needful at different times; as without it should the pump be designed to throw invariably a certain quantity of water there might be at one time greater pressure than actually needed, while at another time less. The valve P, of course, will act each time the apparatus is operated, and such water as passes from the cylinder-chamber d through the passage d^4 is conveyed back to the reservoir through the means before set forth, so that it is disposed of conveniently and in a manner to permit of its repeated use without waste.

The importance and value of my perforated piston must be obvious. It provides means for subjecting the blank of the article being formed to pressure externally, while the water is operating directly on it internally, and also for preserving the tightness of the joint between the nipple it carries and the article being formed. It forms an expedient to prevent overflow and waste of water, which the formed article in the die may contain, and in conjunction with the elastic body between it and the cylinder end it acts as a cushion when the die-carrying head is moved downward into position for a forming operation. Although I have not shown it in the drawings, I contemplate placing on the upper face of the reduced portion of the nipple a centrally-perforated washer, preferably like that on the lower face of the piston E, as an additional precaution to form a tight joint with the article to be formed. This expedient may be necessary in making bodies larger than watch-stems—such, for instance, as watch centers and backs—and it may be well to here remark that in forming bodies like these latter it is necessary to provide the blank with a short neck to be engaged by the nipple. Bodies such as stems or pendants have a shape which renders them capable of use with the latter without special adaptation. I also contemplate having the die arranged to be fixedly held, and instead of moving it to position for an operation mount the fluid forcing and conveying or pressure apparatus so as to have it movable toward and from the die. Then, too, the reservoir or vessel L may be placed beneath instead of at the side of the cylinder D and other pressure-creating

apparatus used in place of the pump. Such changes as these are not substantive ones, but are within the scope of my invention.

By using apparatus constructed in accordance with my invention the manufacture of articles which heretofore have been made by using punches, rolls, sectional, expansible tools, and the like is greatly simplified and cheapened. The parts of the apparatus itself are such as to enable it to be gotten up in a form quite convenient for use and not necessitating much room.

Having thus described my invention, what I claim is—

1. In combination with a cylinder or other suitable appliance, a piston having a passage or conduit, and suitable means to transmit a fluid to the cylinder-chamber to move said piston and to be passed in part through its conduit, which communicates with said chamber in the direction in which the piston is moved by the fluid, substantially as and for the purpose specified.

2. In combination with a cylinder or other suitable appliance, a piston having a central unobstructed passage from end to end, and suitable means to transmit a fluid to the cylinder-chamber to move said piston and to be passed in part through the passage therein, said passage communicating with said chamber and the movement of the fluid through the piston-passage being in the direction in which the piston is moved by the same, substantially as and for the purpose shown.

3. In combination with an open-ended cylinder, a piston having a passage or conduit and suitable means to transmit a fluid to the cylinder-chamber to move said piston and to be passed in part through the conduit therein, said conduit being in communication with said chamber and allowing movement of fluid through it in the direction of the movement of the piston, substantially as and for the purpose set forth.

4. In combination with a cylinder, a piston having a passage or conduit, and an elastic body compressed or placed under tension by said piston when it is moved in one direction and operating by its expansion to move said piston in an opposite direction, substantially as and for the purpose described.

5. In combination with a cylinder, a piston having a passage or conduit, a flange on the piston overlapping a portion of the cylinder, and an elastic body between such flange and said portion of the cylinder, which is compressed by said piston when moved in one direction and operates in expanding to move the same in the reverse direction, substantially as and for the purpose shown and described.

6. In combination with a cylinder, a piston having a passage or conduit, a flange on the piston, an elastic body between the flange and a contiguous portion of the cylinder, and a ring inclosing said body, substantially as and for the purpose shown.

7. In combination with a cylinder, a vertically-movable piston having a vertical passage or conduit adapted at its upper end to discharge into an article to be shaped, a vessel or reservoir communicating with the cylinder-chamber, and a pump in such reservoir to force a fluid to the cylinder-chamber and through the piston, substantially as and for the purpose set forth.

8. In combination, a vertically-arranged cylinder, a vertically-movable piston therein having from top to bottom a passage or conduit adapted to communicate with a die containing an article to be shaped, a vessel or reservoir communicating with the cylinder-chamber below the piston, and suitable means to force fluid thereto from the reservoir to move said piston and to be in part passed through its conduit, substantially as and for the purpose described.

9. The method of making hollow articles, which consists in causing a blank in a die to conform thereto by means of a fluid under pressure, and while being subjected to such pressure preventing stretching thereof by subjecting it to endwise pressure, which compresses the metal of said blank during its tendency to stretch while being conformed to said die, substantially as and for the purpose set forth.

10. In combination with a cylinder, a piston having an opening or passage and a nipple or part to abut against and convey fluid to a body to be formed or shaped, substantially as and for the purpose specified.

11. In combination with a cylinder, a piston having a nipple provided with a shoulder to abut against the body to be formed or shaped and a portion to enter into said body, substantially as and for the purpose shown.

12. In combination with a cylinder, a piston having a nipple adapted to form a tight joint with the wall of the matrix, a die for holding the body to be shaped, and a shoulder to abut against the latter, substantially as and for the purpose set forth.

13. In combination with a die for holding the body to be shaped, a suitably-mounted nipple adapted to enter such die and form therewith a tight joint and having a reduced portion to enter into and form a joint with the body to be formed, substantially as and for the purpose described.

14. In combination, a cylinder, a perforated piston, a nipple having its perforation registering with that of the piston, and the collar for securing the nipple to the piston, substantially as and for the purpose specified.

15. In combination, a cylinder, a perforated piston having in its upper face a shouldered recess to form a seat, a nipple seated therein, and a screw-threaded collar engaging thread on the piston to secure said nipple in place, substantially as and for the purpose set forth.

16. In combination, a cylinder, a perforated piston, a nipple having its perforation registering with that of the piston, the flanged col-

lar for securing the nipple to the piston, and the elastic body between the flange of the collar and an adjacent portion of the cylinder, substantially as and for the purpose shown.

5 17. In combination, a cylinder, a piston having a passage or conduit, suitable means to transmit a fluid under pressure to and through said piston, and a relief-valve, substantially as and for the purpose set forth.

10 18. In combination, a cylinder, a piston having a passage or conduit, suitable means to transmit a fluid under pressure to and through said piston, a passage opening outward from the cylinder-chamber, and a relief-valve to
15 control said passage, substantially as and for the purpose specified.

19. In combination, a cylinder, a piston having a passage or conduit, a fluid-reservoir, suitable means to force fluid therefrom to and
20 through said piston, a relief-valve controlling a passage from the cylinder, and the conduit to convey escaping fluid back to the reservoir, substantially as and for the purpose shown.

20. In combination, a cylinder, the boss projecting therefrom, a reservoir connected to
25 said boss, the pump within the reservoir also attached to the latter, communicating with the cylinder-chamber, and means for conveying fluid from the latter to a body to be shaped,
30 substantially as and for the purpose shown.

21. In combination, a cylinder, a piston therein having a passage or conduit and adapted to be moved against the body to be formed, and suitable means to transmit a fluid to said piston and through the passage therein into
35 the body to be formed, substantially as and for the purpose described.

22. In combination, a movable die and a movable body or piston having a passage or conduit to convey fluid to the interior of said
40 die, substantially as and for the purpose shown.

23. In combination with a perforated or hollow piston and the wall or part with which it should form a tight joint, the washer on the
45 piston perforated in alignment with its opening, and a pump or other means for forcing fluid under pressure to said piston to move and be in part moved through the same in the
50 direction of its movement, substantially as specified.

In testimony that I claim the foregoing I have hereunto set my hand this 2d day of March, 1891.

FRANK MOORFIELD.

Witnesses:

H. G. TAYLOR,

W. C. CARRICK.