No. 820,345. PATENTED MAY 8, 1906.

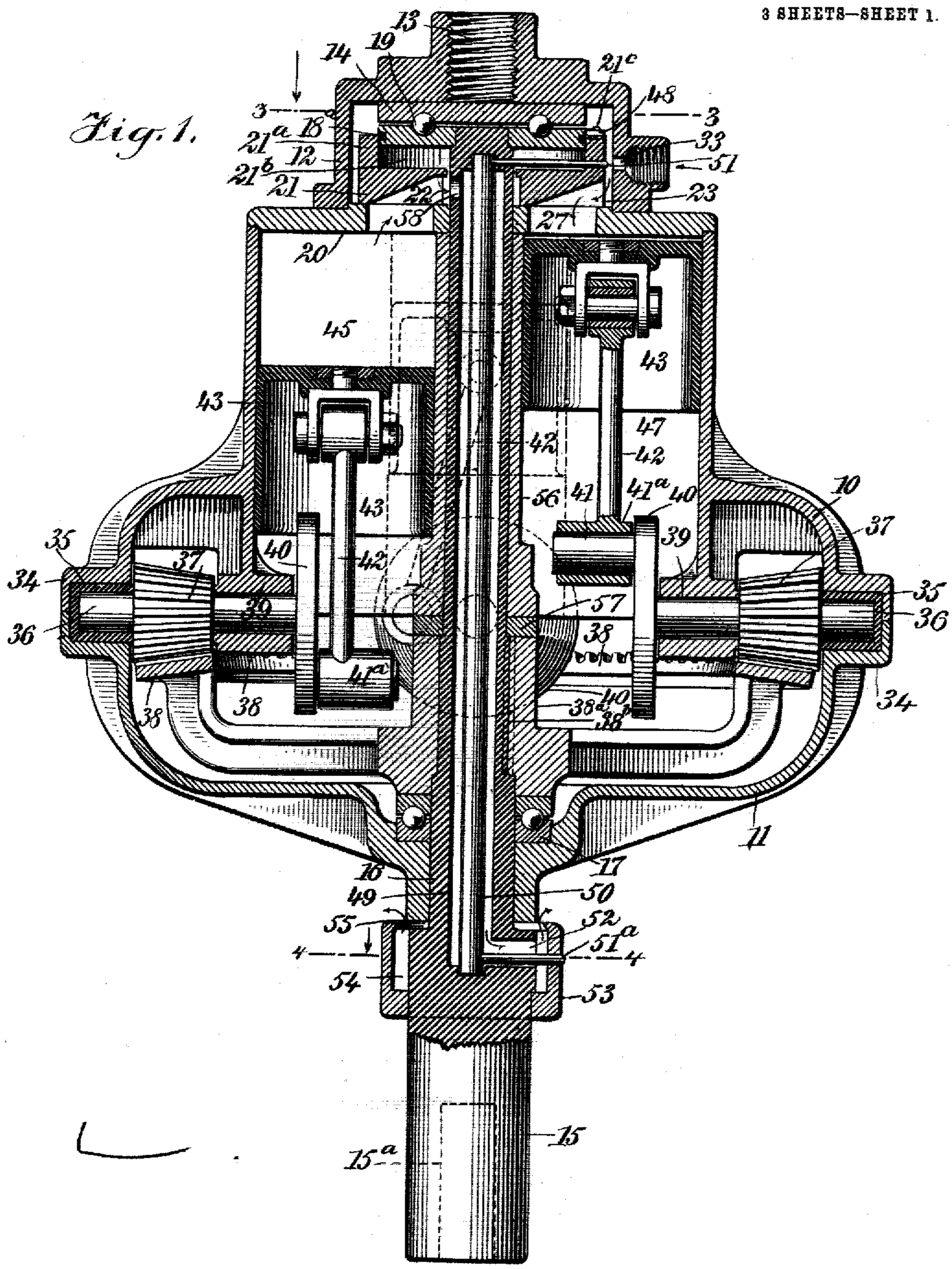
H. BROUSSEAU.

PNEUMATIC DRILL.

APPLICATION FILED OCT. 8, 1904.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

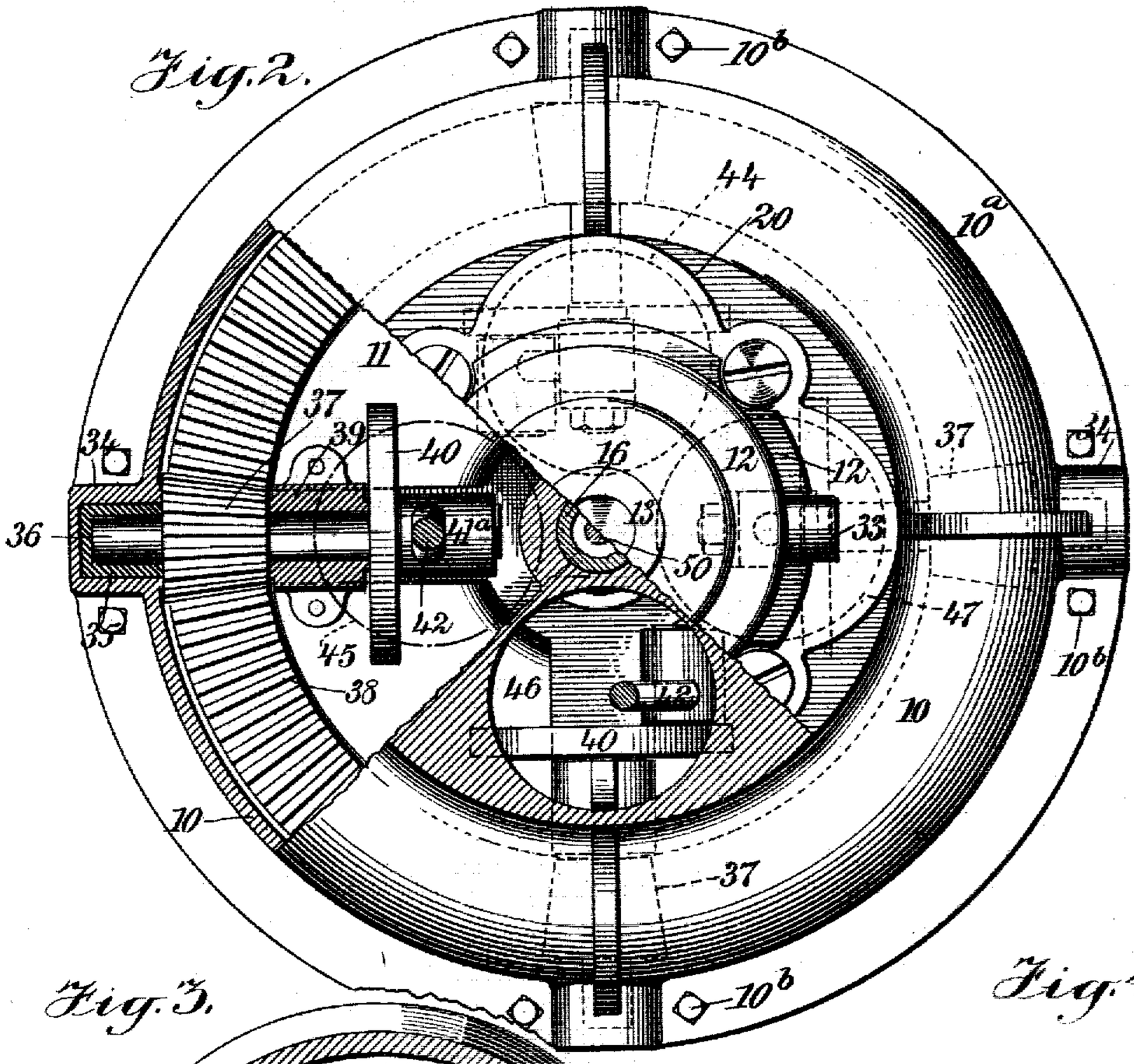


Fig. 3.

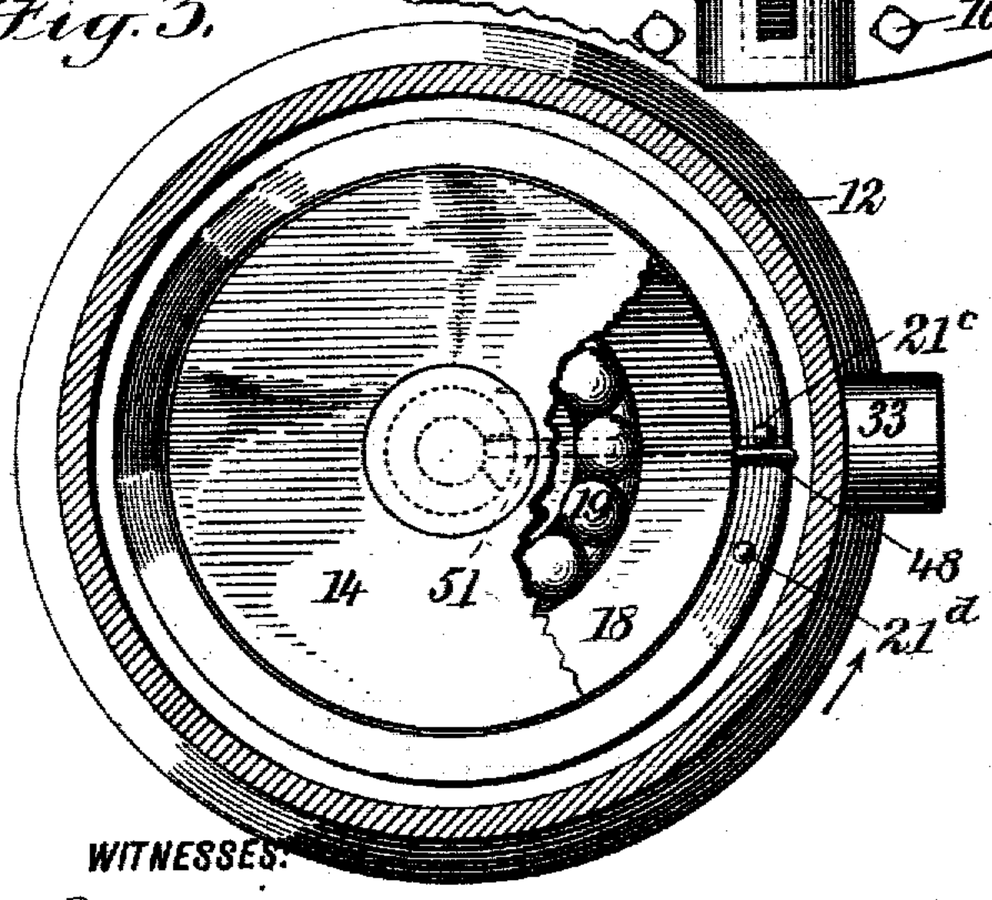
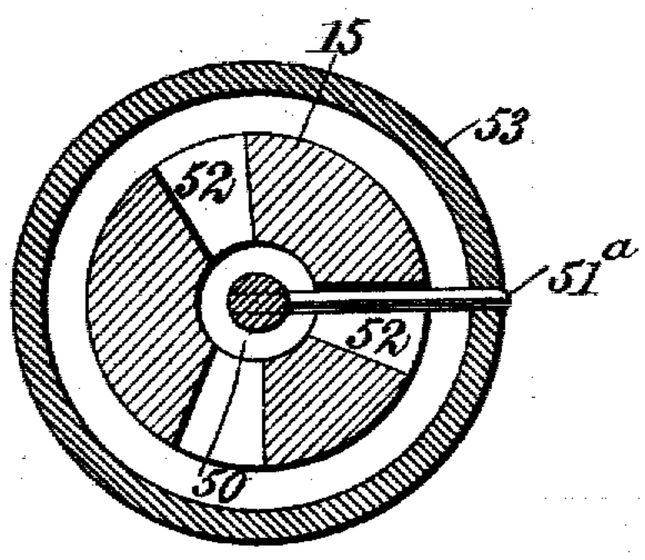


Fig. 4.



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3 SHEETS—SHEET 3.

Fig. 5.

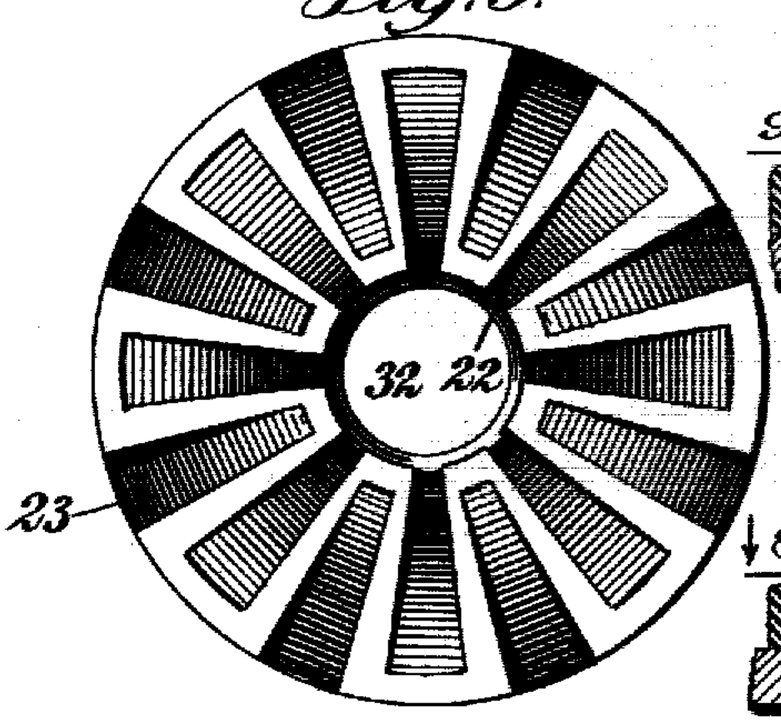


Fig. 6.

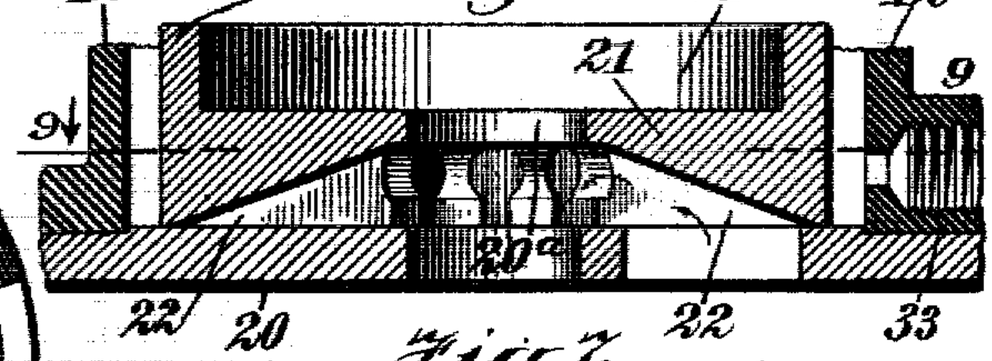


Fig. 7.

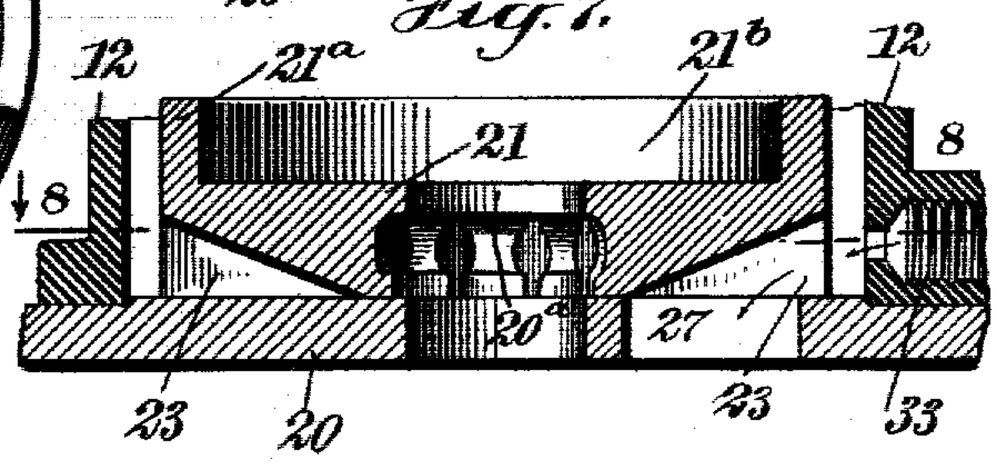


Fig. 8.

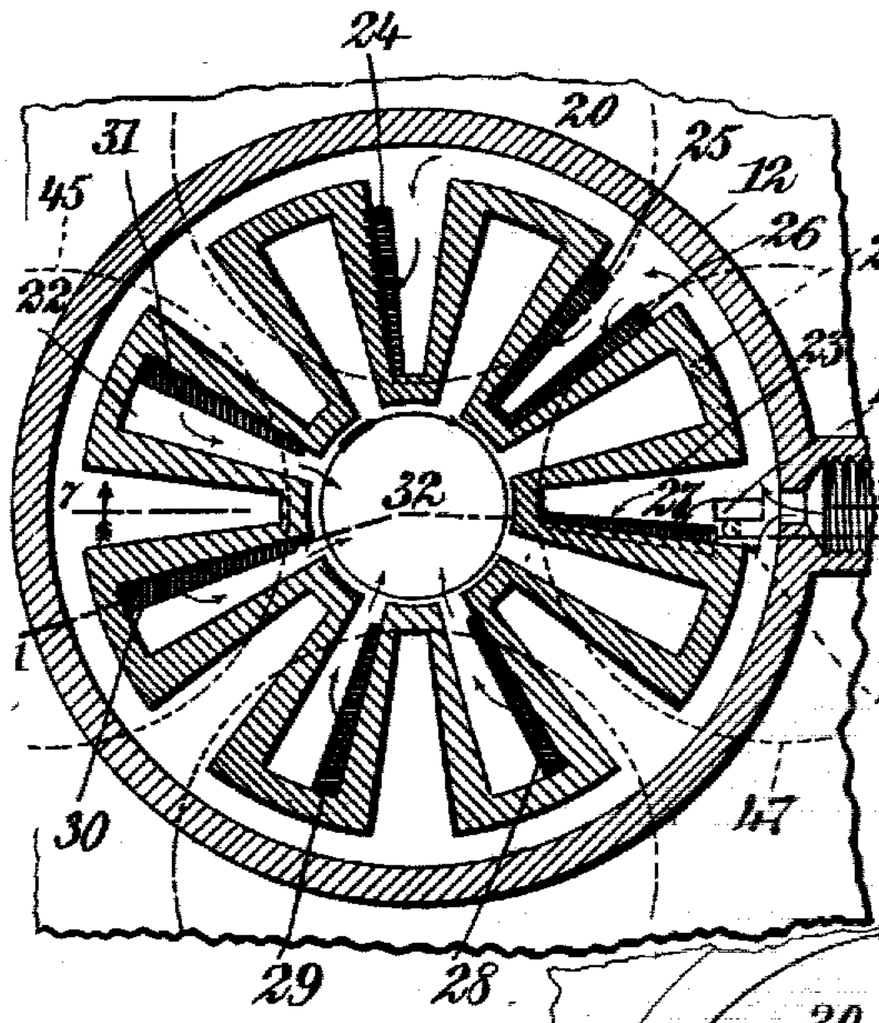


Fig. 9.

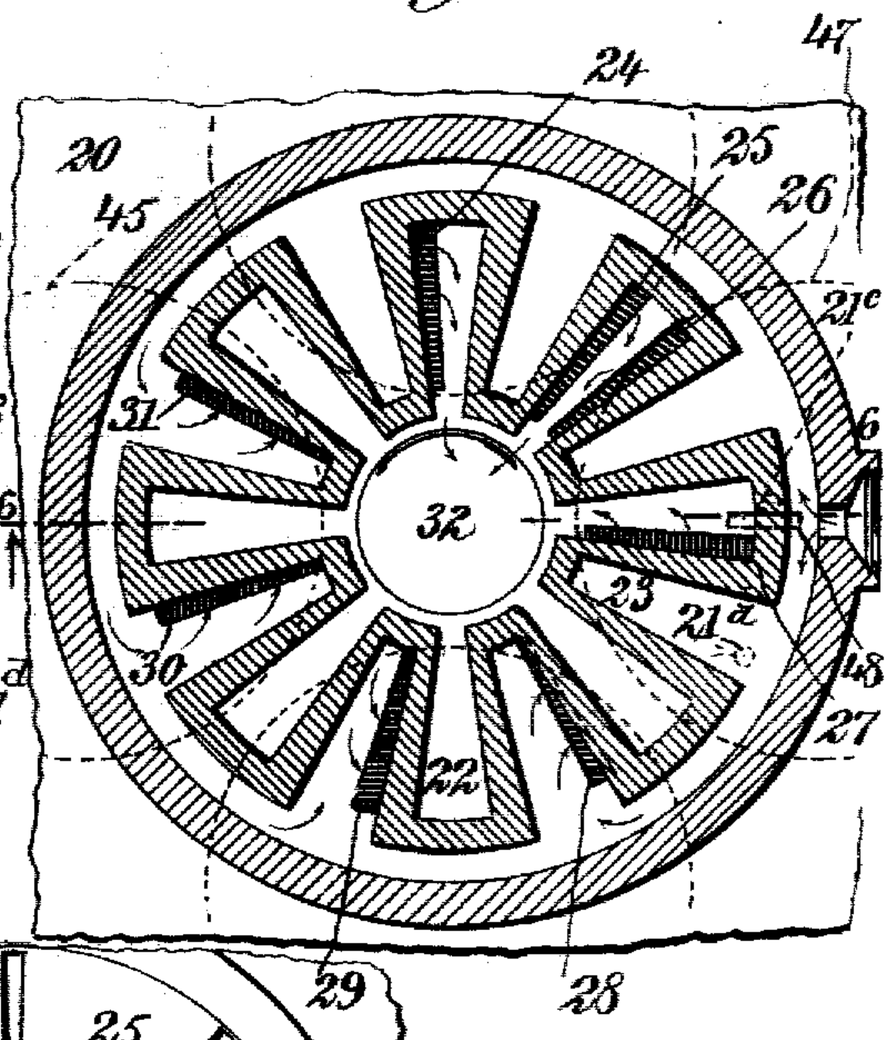
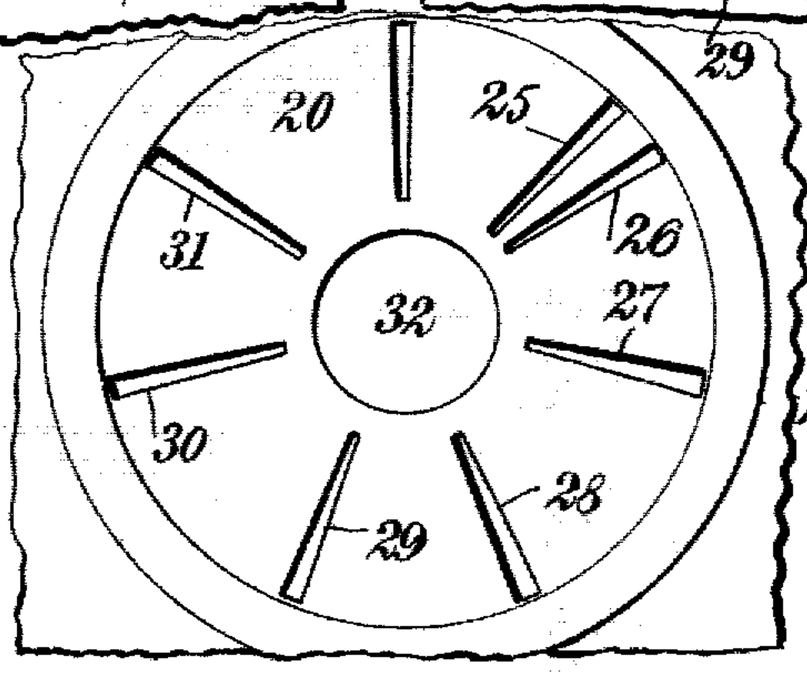


Fig. 10.



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UNITED STATES PATENT OFFICE.

HARRY BROUSSEAU, OF NEW YORK, N. Y.

PNEUMATIC DRILL.

No. 820,345. Specification of Letters Patent. Patented May 8, 1906.

Application filed October 8, 1904. Serial No. 227,675.

To all whom it may concern:

Be it known that I, HARRY BROUSSEAU, a citizen of the United States, and a resident of the city of New York, Flushing, borough of Queens, in the county of Queens and State of New York, have invented a new and Improved Pneumatic Drill, of which the following is a full, clear, and exact description.

My invention relates to pneumatic drills and analogous mechanism, my more particular object being to produce certain advantages of construction and operation hereinafter described, and pointed out in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a vertical cross-section on the line 1 1 of Fig. 8 through a pneumatic drill embodying my invention and showing the mechanism for turning the drill-spindle. Fig. 2 is a plan view of the same, partly broken away. Fig. 3 is an enlarged section upon the line 3 3 of Fig. 1 looking in the direction of the arrow and showing the limiting-stops for adjusting the revoluble valve and also one of the ball-bearings of the drill. Fig. 4 is an enlarged section upon the line 4 4 of Fig. 1 looking in the direction of the arrow and showing a part of the means for reversing the drill. Fig. 5 is an inverted plan view of the main revoluble valve. Fig. 6 is an enlarged cross-section of the valve resting upon its seat and is taken upon the line 6 6 of Fig. 9 looking in the direction of the arrow. Fig. 7 is a somewhat similar view, but showing the valve in its first position, and is taken upon the line 7 7 of Fig. 8 looking in the direction of the arrow. Fig. 8 is a horizontal section through the valve and is taken upon the line 8 8 of Fig. 7 looking in the direction of the arrow. Fig. 9 is a somewhat similar view of the valve, but showing the same in a different position, and is taken upon the line 9 9 of Fig. 6 looking in the direction of the arrow; and Fig. 10 is a fragmentary plan view of the valve-seat.

The upper half 10 and the lower half 11 of the drill are respectively provided with flanges 10^a, integral therewith, and are secured together by bolts 10^b. Mounted over the member 10 is a dome 12, provided with a threaded neck 13, into which may be inserted a rod for manipulating the drill. A bearing-plate 14 is rigidly mounted within the dome 12. The drill-shank is shown at 15 and is provided with an aperture 15^a for holding the drill-bits, this aperture being of the usual conformity. The upper end of the shank 15 is provided with a sleeve 16, and encircling this sleeve is a ball-bearing 17. A bearing-plate 18 is disposed adjacent to the bearing-plate 14 and separated therefrom by revoluble balls 19, the plates and balls thus constituting a very effective type of ball-bearing. The valve-seat is shown at 20 and the revoluble valve at 21, the valve having a central opening 20^a. This valve is provided with a flange 21^a, integral therewith. The plate 18 is provided with a packing 18^a and is thereby rendered air-tight relatively to the flange 21^a. The valve is provided with exhaust-passages 22 and with inlet-passages 23. These exhaust-passages and inlet-passages are cuneiform and are disposed alternately and so arranged that all of the inlet-passages are in communication with each other and all of the exhaust-passages are likewise in communication with each other, as will be understood from Figs. 5, 6, 7, and 9. The inlet-passages 23 as a whole and the exhaust-passages 22 as a whole are separated by a single endless wall of zigzag conformity, as will be understood from Fig. 5. This zigzag wall rests directly upon the valve-seat, as indicated in Figs. 6 and 9. The chamber 21^b in the valve is in open communication with the exhaust-passages, and the total upward air-pressures upon the valve are approximately equal to the total downward air-pressures thereupon. This is easily done by properly apportioning the several areas respectively acted upon by the air-pressures. The valve is therefore balanced. Mounted upon the upper surface of the flange 21^a are stop-pins 21^c 21^d, disposed a slight distance apart, as indicated. The valve-seat 20 is provided with ports 24, 25, 26, 27, 28, 29, 30, and 31, preferably eight in number and disposed as indicated in Fig. 10, the ports 25 and 26 being comparatively near together and the remaining ports being spaced equidistant from each other. The valve-seat 20 is also provided with a central aperture 32, and the general air-inlet passage is shown at 33 and is contracted, as indicated in Fig. 1.

The casing is provided with pockets 34, within which are bearings 35, and revolubly engaging these bearings are stub-shafts 36, carrying bevel-gears 37. These stub-shafts also rest in bearings 39 and are provided at their respective inner ends with crank-disks 40. These crank-disks are provided with

crank-pins 41, engaged by bearings 41ª, and connected with these bearings are pitmen 42, connected with pistons 43, whereby the crank-disks 40 are driven. Four cylinders 44, 45, 46, and 47 are provided and are disposed equidistant around the sleeve 16, as indicated more particularly in Fig. 2. The sleeve 16 is provided with a central passage 49, in which is journaled a shaft 50, provided with a pin 51, extending radially therefrom through an opening in the valve 21, and also provided with a pin 51ª, extending radially through a slot 52 in the shank 15. A handle 53, having substantially the general form of a cup, is neatly fitted upon the shank 15, and passing through the wall of this cup 53 and snugly engaging the same is the pin 51ª, adapted to move angularly with reference to the slots 52, through one of which it passes. This cup is provided with a chamber 54 and with a contracted outlet 55, as shown more particularly in Fig. 1. The cylinders 44, 45, 46, and 47 are provided with walls 56, whereby they are separated from each other, these walls being connected together and preferably integral, so as to form a hollow member encircling the hollow spindle 16. A washer 57 bears against this member 56 and is engaged by the hub 38ª of the large gear 38, which meshes with the gear 37. By means of a key 38ᵇ the hub is prevented from moving relatively to the sleeve 16.

The ports 24 25 communicate with the cylinder 44, 26, 27 with the cylinder 47, 28, 29 with the cylinder 46, and 30 31 with the cylinder 45.

The operation of my device is as follows: The several parts being assembled, air-pressure being applied to the general air-inlet 33 and the handle 53 being adjusted as indicated in Fig. 4, the valve-seat 20 and the valve 21 occupy the position indicated in Fig. 8. The ports 24, 25, 26, and 27 are now opened and admit air to the cylinders 45 and 47. The air exhausting from the other two cylinders finds its way through the ports 28, 29, 30, and 31 and exhaust-passages 22 into the central exhaust-passage 49, whence it passes radially outward through the slots 52 into the chamber 54 in the handle 53 and thence upwardly, making its escape from the outlet 55. Any oil or grease with which the several movable parts may be saturated creeps downwardly and enters the chamber 54, but is not allowed to enter the radial slots or passages 52 or the central exhaust-passage 49 for the reason that the air is all the while escaping through these passages, as indicated by the arrow. The reciprocating of the several pistons under air-pressure causes the revolution of the valve 21, so that the several ports of the valve-seat 20 are alternately opened and closed, the rotation of the crank-disks thus being continuous. The crank-disks thereupon confer rotary motion upon the several bevel-gears 37, and these in turn transmit a constant rotary motion to the large bevel-gear 38, which being keyed upon the hollow spindle 16 causes the same to revolve continuously. If now it be desired to reverse the direction of rotation of the shank 15 and hollow sleeve 16, the handle 53 is grasped by the fingers and is turned so that the pin 51ª is moved angularly a slight distance within the slot 52, as will be understood from Fig. 4, the shank 15 being practically immovable by the hand. The pin 51ª being thus moved slightly in a clockwise direction causes the shaft 50 to turn slightly, and this moves the pin 51 angularly. As the pin 51 is connected with the rotary valve 21 the latter is moved a distance representing about one-eighth of its circumference, as will be understood from Figs. 8 and 9. The bearing-plate 18 being connected rigidly with the upper end of the sleeve 16 and revoluble therewith is turned to the same extent as the hollow spindle 16. The valve 21 is thus turned to such an extent that the pin 21ᶜ lodges against a lug 48, as indicated in Fig. 9, which marks the limit that the rotary valve 21 can move relatively to the sleeve 16. The air-pressure being again turned on, the air enters the cylinder 45 through the ports 30 and 31 and also enters the cylinder 36 through the ports 28 and 29, the exhaust-air meanwhile making its escape from the other two cylinders through the ports 24, 25, 26, and 27. The result is that the several crank-disks rotate in a direction opposite to that in which they first rotated and of course cause the main gear 38 to travel likewise in a contrary direction, carrying with it the sleeve 16 and the shank 15. The rotation of the shank 15 in either direction can never cause the handle 53 to turn so as to reverse the rotation of this shank, for the reason that any lag which may exist in the handle 53, due to the movement of the shank, tends to so turn the handle 53 as to keep the rotation always in the same direction. In other words, if the handle 53 should become caught in some other mechanism, and thereby have a backward twist, the direction of this twist is such as not to reverse the direction of rotation.

An important feature of my invention is the shape of the valve 21. The exhaust-passages 22 and the inlet-passages 23 are disposed radially with reference to the center of the valve and so arranged that the lower face of the valve presents a zigzag line, as will be understood from Fig. 5, no one of the inlet-passages being at any time in communication with any one of the exhaust-passages. The air escaping through the central exhaust-passage 49 tends to keep the working parts comparatively cool.

It will be noted that no matter what may be the direction of rotation of the shank 15 the bevel-gears 37 all coact to produce a uniform

rotation of the large gear member 38. The relation of the bevel-gears 37 and 38 is preferably eight revolutions of each gear 37 to one revolution of the large bevel-gear 38. The valve 21 while being rotated under air-pressure makes the same number of revolutions as the bevel-gear 38, but while being adjusted by hand for the purpose of reversing the drill moves a distance approximating one revolution of one of the gears 37.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. The combination of a revoluble sleeve provided with a shank for connecting the same with a member to be driven, and also provided with a sleeve having an exhaust-passage, a shaft journaled within said exhaust-passage and free to rock relatively to said sleeve, manually-operated mechanism for causing said shaft to rock, a valve-seat disposed adjacent to said sleeve and provided with ports, a revoluble valve mounted upon said valve-seat and provided with passages for registering with said ports, mechanism connecting said shaft with said valve for the purpose of adjusting the same relatively to said ports, and means for admitting an expansible medium to said valve and through the same to said ports.

2. The combination of a revoluble member provided with a shank and with an exhaust-passage, a shaft journaled within said exhaust-passage and free to rock within certain limits relatively to said revoluble member, a handle for turning said shaft within said limits, a valve-seat, a valve fitted thereupon and movable relatively thereto, and a pin connected with said shaft and with said valve for the purpose of adjusting the same relatively to said seat.

3. The combination of a revoluble spindle, a disk rigidly mounted thereupon and provided with a packing, a rotary balanced valve loosely encircling said spindle and engaging said packing so as to form an air-tight connection, and pneumatic mechanism provided with ports coacting with said revoluble valve.

4. The combination of a revoluble spindle, a disk mounted rigidly thereupon and provided with a ball-bearing, a revoluble valve partially encircling said disk, means for forming an air-tight connection between said disk and said valve, a valve-seat adjacent to said valve and provided with ports, and means for supplying an aeriform body through said valve and into said ports.

5. The combination of a valve-seat provided with ports, a revoluble valve mounted upon said seat, mechanism connected with said valve-seat and adapted to be driven by pressure of an aeriform body flowing through said valve, a revolubly-driven member connected with said mechanism thus driven, and a manually-operated member encircling said revolubly-driven member and provided with connections extending to said revoluble valve for reversing the direction of rotation thereof.

6. The combination of pneumatically-driven mechanism provided with a revoluble member having an exhaust-passage, and an oil-receptacle encircling said exhaust-passage.

7. The combination of rotary motor mechanism provided with a reversible valve and with a revoluble driven member, a manually-operated member of substantially cylindrical form encircling said revoluble driven member and concentric thereto, and connections from said manually-operated member to said revoluble valve for reversing the latter.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

HARRY BROUSSEAU.

Witnesses:
MAX STEINER,
MARTIN KRAUS.