No. 672.263.

Patented Apr. 16, 1901.

W. E. DEAN.

PORTABLE PNEUMATIC DRILL.

(Application filed Oct. 8, 1900.)

(No Model.)

3 Sheets—Sheet 1.

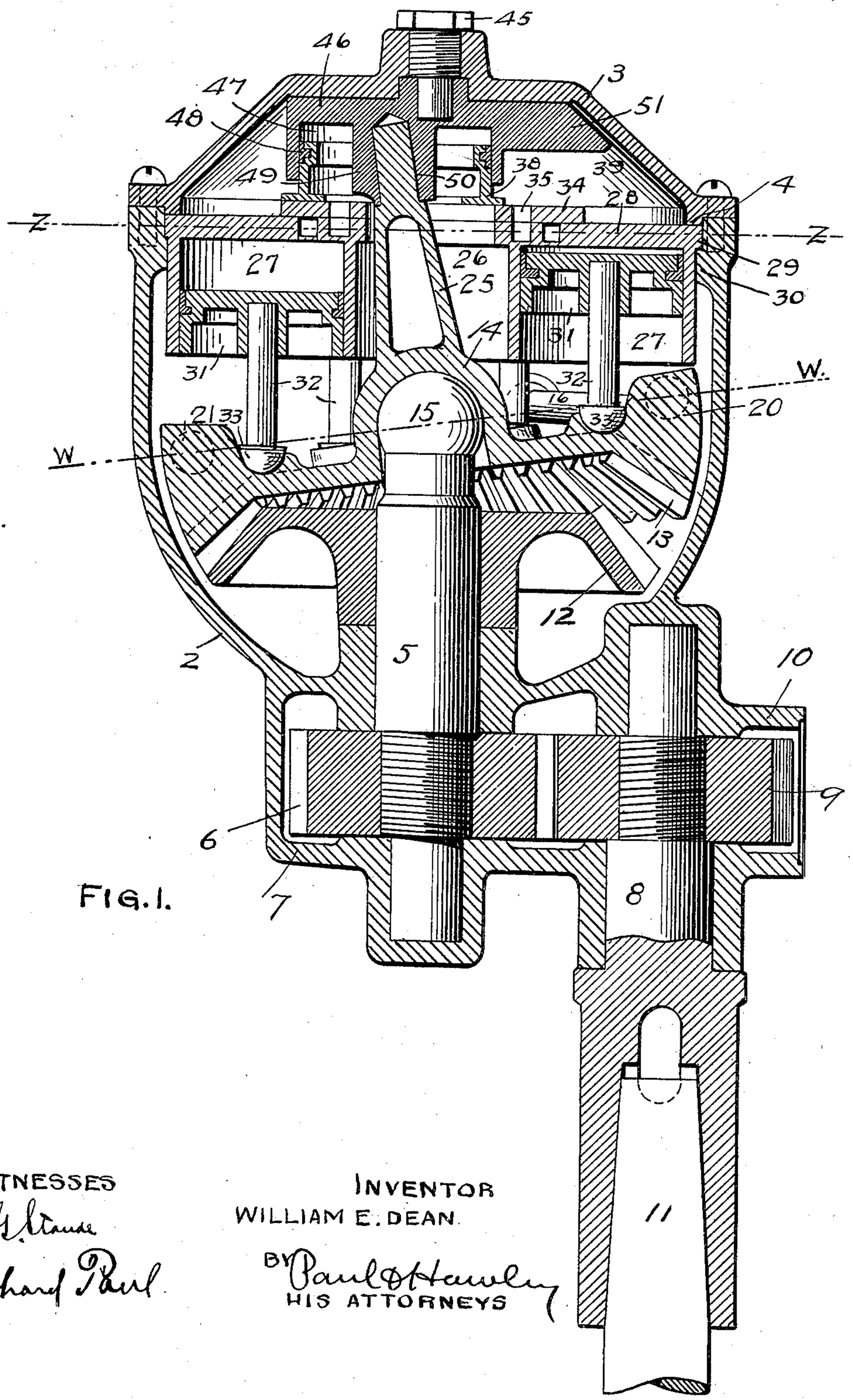

FIG. 1.

WITNESSES
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3 Sheets—Sheet 2.

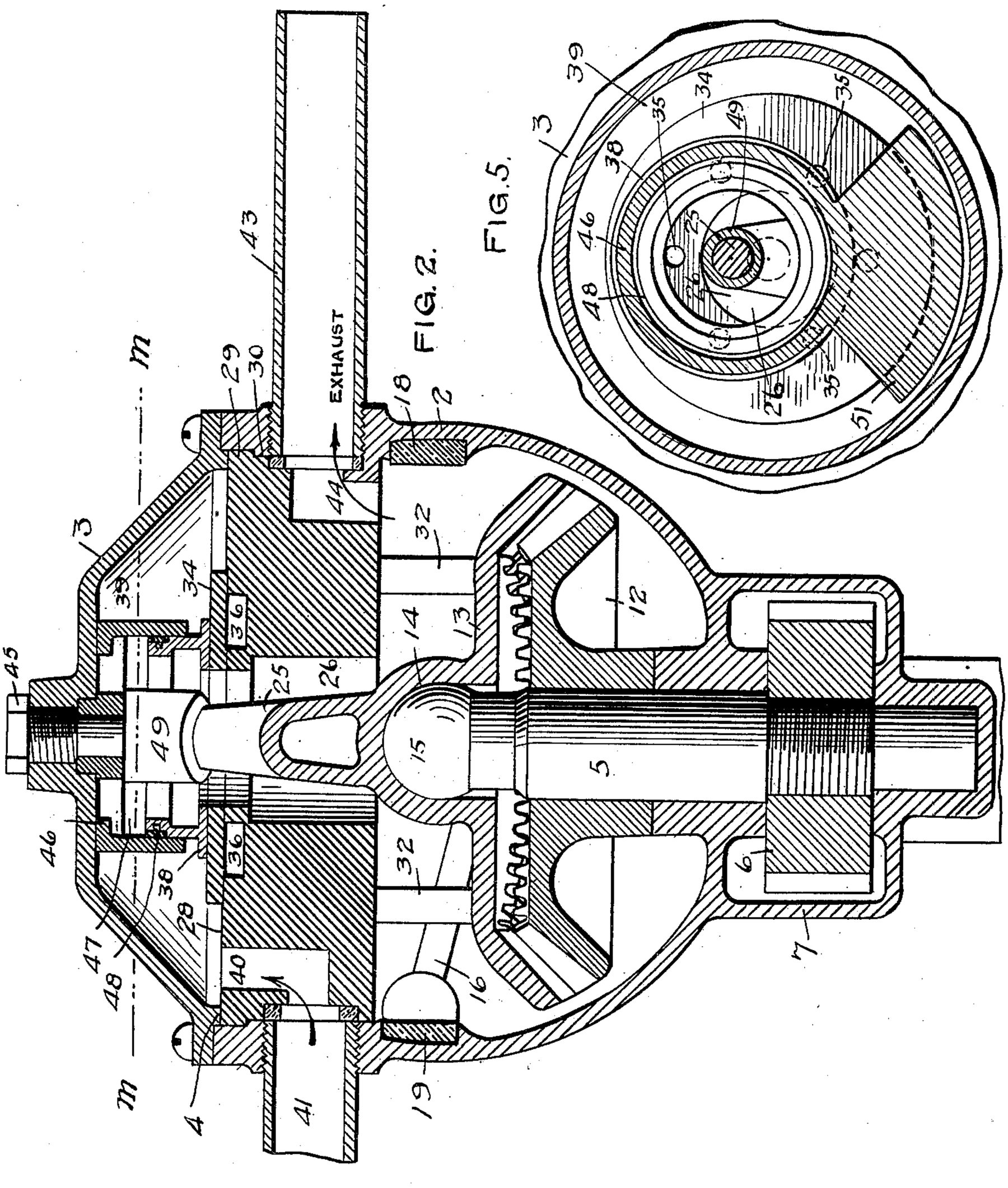

FIG. 2.

FIG. 5.

WITNESSES.

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(No Model.) 3 Sheets—Sheet 3.

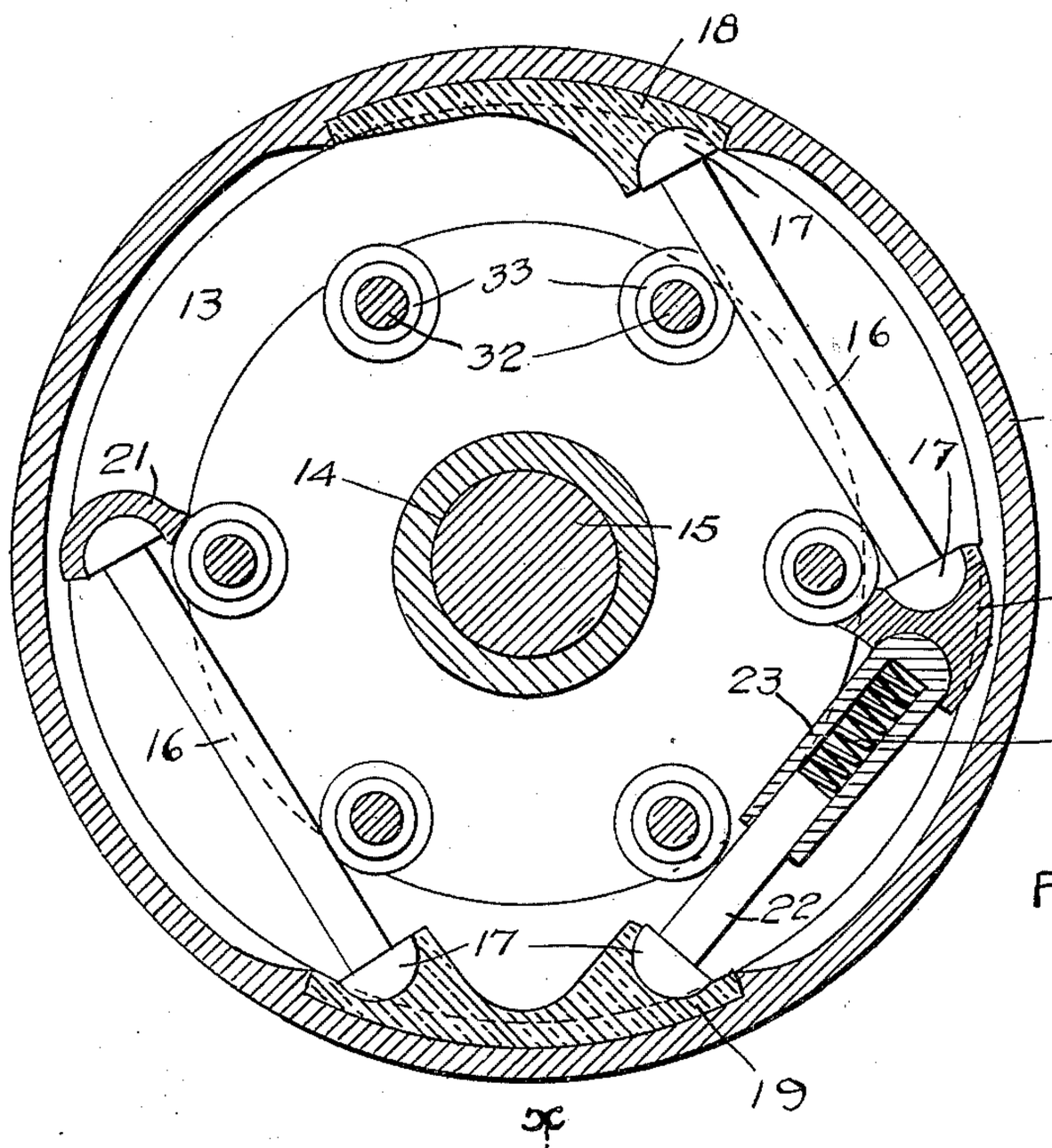

FIG. 3

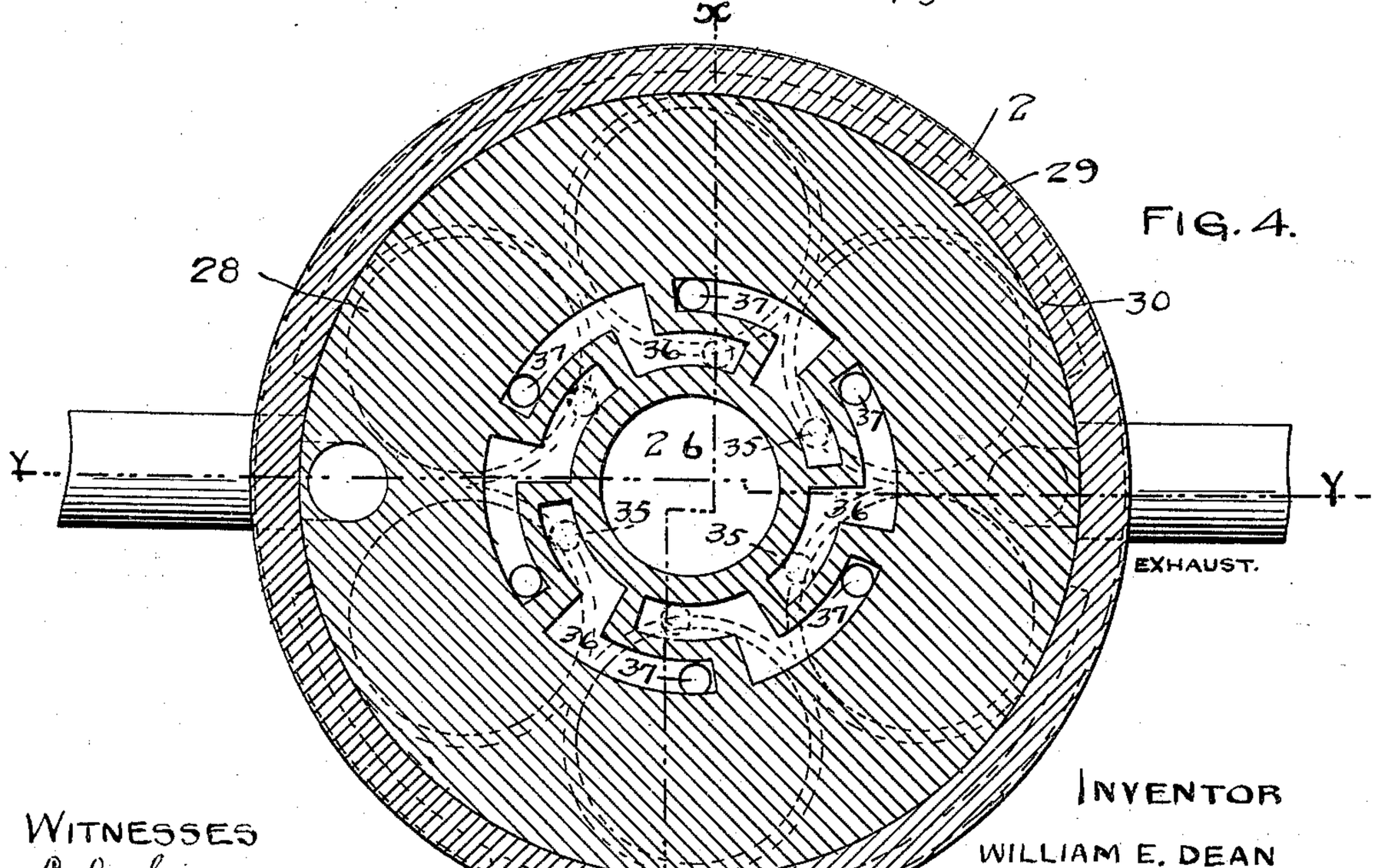

FIG. 4.

WITNESSES
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UNITED STATES PATENT OFFICE.

WILLIAM E. DEAN, OF WEST SUPERIOR, WISCONSIN, ASSIGNOR OF ONE-FOURTH TO ROBERT KELLY, OF SAME PLACE.

PORTABLE PNEUMATIC DRILL.

SPECIFICATION forming part of Letters Patent No. 672,263, dated April 16, 1901.

Application filed October 8, 1900. Serial No. 32,364. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM E. DEAN, of West Superior, Douglas county, Wisconsin, have invented certain new and useful Improvements in Portable Pneumatic Drills, of which the following is a specification.

My invention relates to pneumatic drills and reamers; and one object of the invention is to provide a device which without the employment of extra attachments can be conveniently used for drilling and reaming in metal plates where, particularly in ship construction, the holes frequently must be made in the plates close to a bulkhead or in a corner or beside another plate that is at an angle to the one wherein the holes are being made.

A further object is to provide a pneumatic drill wherein the expansive power or force of the air to operate the piston is fully utilized.

A further object is to provide a drill that will be composed of fewer parts and much lighter, though fully as strong and durable as the devices of this kind now in general use.

Further objects of the invention will appear from the following detailed description.

The invention consists generally in various constructions and combinations, all as hereinafter described, and particularly pointed out in the claims.

In the accompanying drawings, forming part of this specification, Figure 1 is a vertical section of a pneumatic drill embodying my invention, taken on the line *x x* of Fig. 4. Fig. 2 is a similar view on the line *y y* of Fig. 4. Fig. 3 is a transverse section on the line *w w* of Fig. 1. Fig. 4 is a similar view on the line *z z* of Fig. 1. Fig. 5 is a transverse section on the line *m m* of Fig. 2.

In the drawings, 2 represents a suitable casing wherein the mechanism of the drill is arranged. The casing is preferably cup-shaped and provided with a conical cap 3, secured thereon by machine-screws or in any other suitable way. A depending flange 4 is preferably provided on said cap and is adapted to fit snugly within the top of the casing and form an air-tight joint therewith. Mounted in bearings in the lower part of said casing is a shaft or spindle 5, whereon a gear 6 is secured within a housing 7.

In order that a drill may be used close to a bulkhead or in a corner or beside another plate secured at an angle to the plate wherein the holes are being made, I prefer to arrange the drill-spindle 8 at one side of the shaft 5 and provide thereon a gear 9 within a housing 10 and meshing with the teeth of the gear 6. The spindle 8 is provided with a suitable socket for the shank of the drilling or reaming tool 11.

The size of the gears 6 and 9 may be varied according to the speed desired, and additional gears may be employed if it is found necessary or desirable to place the drill-spindle at a greater distance from the central shaft. A beveled driven gear 12 is secured on the shaft 5, and a driving-gear 13 is arranged above said driven gear and provided with a socket 14 to receive a ball 15 on the end of the shaft 5, and whereon said driving-gear is supported and adapted to rock or oscillate. The driven gear has preferably forty-five teeth and the driving-gear forty-eight, or three more, and as the gears mesh when the driving-gear is operated it follows that its teeth must find or engage as many teeth on the driven gear, and consequently the latter will be advanced three teeth with every complete circuit of oscillations of the driving-gear, and it will require fifteen complete oscillations of the driving-gear to produce one revolution of the driven gear. As before stated, the driving-gear rocks or oscillates on its support, and to prevent it from revolving I prefer to provide two struts 16, connecting said gear and the wall of the casing. These struts have rounded ends 17 and are arranged, respectively, between steps 18 and 19 on the walls of the casing and wings 20 and 21 on said driving-gear. A third strut 22 is arranged between the steps 18 and wing 20 and telescopes at one end with a hollow pin 23, wherein is arranged a coil-spring 24. The strut 22 holds the driving-gear in its place with a yielding pressure and prevents it from running backward and allowing the struts 16 to drop out of their proper position.

The driving-gear is provided with an axis or stem 25, that projects up through an opening 26 between a series of vertical cylinders 27, which are arranged in a circle and are preferably formed integrally with a cylinder-head 28. This head is provided with a flange

29, adapted to fit snugly within said casing between a shoulder 30 thereon and the flange 4. I prefer to provide six of these cylinders having as many pistons 31, provided with stems 32, that have rounded ends 33 to bear upon correspondingly-shaped sockets in the top of the driving-gear. Upon the top of the cylinder-head 28 I provide a flat valve-seat 34. This valve-seat is provided with ports 35, that communicate with the space above the cylinder-head, and with irregular ducts 36, leading to ports 37 in said head over the respective cylinders and communicating therewith. The ports 35 and 37 are preferably arranged in concentric circles, the ports 35 being included within the inner circle and each in advance of the cylinder with which it communicates and adapted to admit air to the cylinder in rotation. This construction permits air to be admitted to each cylinder before the valve passes over it, and there is consequently ample time to utilize the expansive force of the air between the point where it is cut off and where it begins to exhaust from the cylinder.

Upon the valve-seat 34 I arrange a slide-valve 38, preferably in the form of a ring, with an open center into which the cylinders exhaust and adapted to slide over the seat 34, while forming a close air-tight joint therewith. During its movement the valve alternately opens and closes the inlet-ports leading to the cylinders. The arrangement of this valve with respect to the inlet-ports is such that when one port begins to receive air the first preceding port will be wide open and the cylinder with which it is connected under full pressure, while the second preceding port will be closed and the air cut off from its cylinders before the piston has completed its downstroke. The piston, however, will be carried the remainder of its stroke by the expansive force of the air already received, and as soon as it begins its upstroke the port will be opened into the open center or exhaust-passage of the valve and the air discharged from the cylinder.

Above the cylinder-head, within the cap 3, is an air chamber or reservoir 39, that communicates through a port or passage 40 in said head with an air-inlet pipe 41 in the wall of the casing. This air-inlet pipe is adapted for use as a handle for the operator while using the drill and is connected at its outer end to a suitable air-supply tube 42. Upon the opposite side of the drill I provide an exhaust-pipe 43, forming another handle and connected with the opening 26 and with the sliding valve by an exhaust-passage 44. Mounted on the bearing-screw 45 in the top of the air-chamber 39 is a block 46, having in its under side a recess or chamber 47 to receive the valve 38 and a suitable packing-ring 48 provided thereon. This chamber through the open center of said valve communicates with the exhaust and is separated from the air-chamber 39 by air-tight joints and is provided with a depending stud 49, having an inclined socket 50 to receive the end of the driving-gear axis 25.

The block 46 is eccentrically mounted on the bearing-screw 45, and when the driving-gear is rocked by the operation of the cylinder-piston said block and the valve carried thereby will describe a gyrating movement over the valve-seat and the ports therein. The block 46 being centrally mounted on the driving-gear axis, I prefer to provide a counterbalance 51, overhanging one side of the block and balancing the same to prevent any undue jar or vibration arising from the oscillation of the driving-gear. The socket in the depending stud or wrist 49 is bored at such an angle that a line through its center would intersect the axis of the shaft 5 in the center of the head or ball whereon the driving-gear is supported. The movement of the gyrating block will control the oscillation of the driving-gear and hold its teeth in proper mesh with the teeth of the driven gear.

In operation the air is admitted to the air-chamber, and entering the port 35, that may be exposed, passes down through the duct leading to the cylinder. As the piston is forced down by the air-pressure the rolling or rocking gear is tilted and the valve moved over its seat, exposing another inlet-port and admitting the air to the next succeeding cylinder. The port of the preceding cylinder is then closed and the full expansive force of the air utilized on the downstroke of the piston. The port is then opened as soon as the piston has reached the limit of its downstroke, so that when it begins its upstroke the exhaust will be open and the air will pass out into the chamber wherein the valve is arranged and from thence to the exhaust-pipe. The operation of the valve will be continued in the same manner, each inlet-port being alternately open and cut off as the valve revolves.

The air-pressure in the cylinders may be regulated according to the speed at which it is desired to operate the driven gear and the size of the hole to be drilled. It will be understood that the number of teeth in the driving and driven gear may be varied, and instead of placing the drill-spindle at one side of the driven shaft it may be arranged concentric therewith, and in various other ways the details of the mechanism herein set forth may be modified without departing from my invention.

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

1. In a pneumatic drill, the combination, with a casing, of a driven gear mounted therein, a rocking non-revolving gear mounted above said driven gear and adapted to mesh therewith, said driving-gear having a greater number of teeth than said driven gear, a cylinder-head provided in said casing, a series of cylinders thereon, pistons therefor having

stems connected with said driving-gear, a series of air-inlet ports provided in said head and communicating respectively with said cylinders and with an air chamber or reservoir each port preceding in position the cylinder with which it is connected, whereby each piston is operated before the valve passes over the same, a ring valve arranged to gyrate over said head and said ports and adapted to open a port while the first succeeding port is beginning to receive air and the first preceding port is closed and the cylinder-piston operated by the expansive force of the air, operative connections provided between said valve and said driving-gear, and inlet and exhaust ports provided in said casing, substantially as described.

2. In a pneumatic drill, the combination, with a casing having air inlet and exhaust ports, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a beveled driven gear mounted on said shaft, an oscillating driving-gear also beveled supported above said driven gear and adapted to mesh therewith when operated, said driving-gear having a greater number of teeth than said driven gear, a cylinder-head, a series of cylinders depending from said head, pistons therefor having their stems connected with said driving-gear, air-inlet ports provided in said cylinder-head leading respectively to said cylinders, each port being in advance of the cylinder with which it is connected, a gyrating valve adapted to slide over said head and alternately close and open said ports, and means connecting said valve with said driving-gear, substantially as described.

3. In a pneumatic drill, the combination, with a casing having suitable handles, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear mounted on said shaft, a driving-gear having a socket to receive the rounded upper end of said shaft and whereon said driving-gear is adapted to rock or oscillate, said driving and driven gears having beveled teeth adapted to mesh when said driving-gear is operated, there being a greater number of teeth on said driving-gear than on said driven gear, an axis or stud provided on said driving-gear, a cylinder-head having a central opening to receive said axis, a series of cylinders arranged in a circle on said cylinder-head, pistons therefor, stems connecting said pistons with said driving-gear, a series of air-inlet ports provided in said cylinder-head communicating respectively with said cylinders, a sliding valve mounted on said cylinder-head and adapted to alternately open and close said ports, and means connecting said driving-gear axis and said valve, substantially as described.

4. The combination, with a casing having suitable handles and air inlet and exhaust ports, passing through the same, of a shaft mounted in said casing, a drill-spindle operatively connected with said shaft, a beveled driven gear mounted on said shaft, a non-revolving driving-gear having beveled teeth mounted above said driven gear and adapted to engage and operate said driving-gear when rocked or oscillated, said driving-gear having a greater number of teeth than said driven gear, means for preventing the revolution of said driving-gear, a cylinder-head provided in said casing, cylinders depending therefrom, pistons therefor having stems connected with said driving-gear, air-inlet ports provided in said cylinder-head and communicating respectively with said cylinders, a gyrating valve provided on said cylinder-head and adapted to alternately close and open said ports, and means connecting said valve with said driving-gear.

5. In a pneumatic drill, the combination, with a casing having suitable handles, of a shaft mounted therein, a drill-spindle operatively connected with said shaft to be driven thereby, a beveled driven gear secured on said shaft, a driving-gear mounted above said driven gear and adapted to rock or oscillate on its support and mesh with said driven gear when so operated, said driving-gear having a greater number of teeth than said driven gear, a cylinder-head mounted in said casing above said driving-gear, a series of cylinders depending therefrom, pistons therefor having stems connected with said driving-gear, a series of air-inlet ports provided in said cylinder-head and communicating respectively with said cylinders, a sliding gyrating valve provided within an air-chamber above said cylinder-head and adapted to alternately close and open said ports, a suitable counterbalance for said valve, means connecting said valve with said driving-gear, and air inlet and exhaust ports communicating with the interior of said casing, substantially as described.

6. The combination, in a pneumatic drill, with a casing, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear mounted on said shaft, a rocking driving-gear supported above said driven gear and adapted to mesh therewith and having a greater number of teeth than said driven gear, a stud or axis provided on said driving-gear, a cylinder-head having an opening to receive said axis, a series of cylinders depending from said cylinder-head, pistons therefor having their stems connected to said driving-gear, a series of air-inlet ports provided in said cylinder-head and communicating respectively with said cylinders and with the space above said cylinder-head, a ring-valve adapted to slide over said head and alternately open and close said ports, a pivoted block having a chamber or recess to receive said valve and connected with said axis, whereby said valve will be operated by the rocking of said driving-gear, and air inlet and exhaust ports communicating respectively with the space above said cylinder-head and with said recess or chamber, substantially as described.

7. In a pneumatic drill, the combination, with a casing having suitable inlet and outlet ports, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear mounted on said shaft, a rocking driving-gear supported above said driven gear and adapted to mesh therewith when oscillated or rocked, said driving-gear having a greater number of teeth than said driven gear, a cylinder-head, cylinders depending therefrom, pistons therefor having stems connected with said driving-gear, a series of air-inlet ports provided in said cylinder-head, each port preceding in position the cylinder with which it is connected, ducts or passages connecting said ports with their respective cylinders, a gyrating slide-valve provided on said cylinder-head and adapted to close each port for a sufficient period to allow the expansive force of the air to operate the piston before the port is opened to the exhaust, and means connecting said valve with said driving-gear, substantially as described.

8. The combination, with a casing, of a shaft mounted therein, a drill-spindle operatively connected to said shaft, a driven gear mounted on said shaft, a rocking or oscillating driving-gear supported above said driven gear and adapted to mesh therewith when rocked or oscillated, said driving-gear having a greater number of teeth than said driven gear, a stem or axis provided on said driving-gear, a cylinder-head having a central opening through which said axis extends, a series of cylinders arranged in a circle around said opening, pistons therefor having stems connected with said driving-gear, air-inlet ports provided in said head and communicating respectively with said cylinders, a block pivoted above said cylinder-head and having a suitable chamber or recess and connected with said driving-gear axis, a sliding ring-valve provided within said chamber and adapted to move over said head and alternately close and open said air-ports and inlet and exhaust ports provided in said casing and communicating respectively with the space above said cylinder and with said chamber through said cylinder-opening, substantially as described.

9. The combination, with a casing having suitable inlet and exhaust openings, of a shaft mounted therein, a housing provided on said casing at one side of said shaft, a drill-spindle mounted therein, suitable gears connecting said drill-spindle and said shaft, a driven gear secured on said shaft, an oscillating or rocking driving-gear supported above said driven gear and adapted to mesh therewith when operated, said driving-gear having a greater number of teeth than said driven gear, a cylinder-head, cylinders thereon, pistons for said cylinders, stems connecting said pistons with said driving-gear, a series of air-inlet ports provided in said cylinder-head and communicating respectively with said cylinders, a sliding valve provided on said head and adapted to alternately close and open said inlet-ports, and means connecting said valve with said driving-gear whereby when said gear is rocked or oscillated by the movement of said pistons said valve will be moved also to close or open said ports.

10. The combination, with a casing having air inlet and exhaust ports, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear mounted on said shaft, a rocking or oscillating driving-gear supported above said shaft and adapted to mesh therewith when operated and having a greater number of teeth than said driven gear, struts 16 connecting said driving-gear and the wall of said casing, a strut 22 adapted to yield longitudinally also connecting said driving-gear and said casing, whereby said driving-gear is prevented from revolving and from running backward, a cylinder-head, cylinders thereon, pistons therefor connected with said driving-gear, a series of air-inlet ports provided in said cylinder-head and communicating respectively with said cylinders, a gyrating slide-valve provided on said head and adapted to alternately close and open said ports and means connecting said valve with said driving-gear, substantially as described.

11. The combination, with a casing and a suitable cap or cover therefor, of a driven gear mounted in said casing, a driving-gear supported above the same and adapted to rock or oscillate on its support said driving-gear meshing with said driven gear when operated and having a greater number of teeth than said driven gear, a stem or axis provided on said driving-gear, means for locking said driving-gear against revolution, a cylinder-head, cylinders thereon, pistons therefor connected with said driving-gear, a series of air-inlet ports provided in said cylinder-head communicating respectively with said cylinders, a block pivoted within an air-chamber provided above said cylinder-head, said block having a chamber or recess and a suitable counterbalance and provided with a socket to receive said driving-gear axis, a sliding ring-valve provided within said chamber or recess and adapted to move over said air-ports and alternately close and open the same, and inlet and exhaust ports communicating respectively with the space above said cylinder and with said chamber or recess, substantially as described.

12. In a pneumatic drill, the combination, with a casing, of a driven gear mounted therein, a rocking driving-gear having a greater number of teeth than said driven gear and adapted to mesh therewith, a series of cylinders in said casing, pistons therefor connected with said driving-gear, a series of air-inlet ports communicating, respectively, with said cylinder, the inlet to each port preceding in position the cylinder with which the port is connected, whereby each piston is operated before the valve passes over the same, a valve adapted to gyrate over said ports and

open a port while the first succeeding port is beginning to receive air and the first preceding port is closed and the cylinder-piston operated by the expansive force of the air, and operative connections provided between said valve and said driving-gear, substantially as described.

13. In a pneumatic drill, the combination, with a casing, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear mounted on said shaft, an oscillating driving-gear having a greater number of teeth than said driven gear and adapted to mesh therewith, a series of cylinders provided with ports having their intake ends in advance of the cylinders with which they are respectively connected, pistons therefor having their stems connected with said driving-gear, a gyrating valve adapted to alternately close and open said ports, and means connecting said valve with said driving-gear.

14. In a pneumatic drill, the combination, with a casing having suitable handles, of a shaft mounted therein, a drill-spindle operatively connected with said shaft, a driven gear on said shaft, a driving-gear having a socket to receive the rounded upper end of said shaft and whereon said gear is adapted to rock or oscillate, said driving-gear having a greater number of teeth than said driven gear, an axis or stud provided on said driving-gear, a series of cylinders provided with air-inlet ports, pistons for said cylinders connected with said driving-gear, a valve adapted to alternately open and close said ports, and means connecting said driving-gear axis and said valve, substantially as described.

15. The combination, with a casing, of a driven gear therein, an oscillating driving-gear above the same and having a greater number of teeth than said driven gear and meshing therewith, and suitable struts provided between said casing and said driving-gear and preventing the revolution of the latter while permitting its oscillation substantially as described.

16. The combination, with a casing, of a driven gear therein, an oscillating driving-gear above the same having a greater number of teeth than said driven gear and meshing therewith, struts 16 and 22 provided between said casing and said driving-gear and said strut 22 having a yielding connection with said gear, for the purpose specified.

17. The combination, with a casing, of a shaft mounted therein, a driven gear, an oscillating driving-gear having a greater number of teeth than said driven gear and adapted to mesh therewith, struts 16 provided between said casing and said driving-gear and preventing the revolution of the latter, a strut 22 and a hollow pin 23 having a spring 24 interposed between said strut 22 and said driving-gear, for the purpose specified.

18. The combination, with a suitable casing having an air-chamber, of a series of cylinders having ports opening into said chamber, pistons for said cylinders, the inlets of said ports being in advance of the cylinders with which they are connected, whereby each piston is operated before the valve passes over the same, and a valve adapted to gyrate over said ports and open one port while the first succeeding port is beginning to receive air and the first preceding port is closed and the cylinder-piston operated by the expansive force of the air, substantially as described.

19. The combination, with a casing, of a shaft and driven gear, a rocking driving-gear having a greater number of teeth than said driven gear and adapted to mesh therewith, a series of cylinders, pistons therefor connected with said driving-gear, ports for said cylinders, a valve adapted to alternately open and close said ports, a pivoted guiding member for said valve and operative connections provided between said member and said driving-gear, whereby the movement of said gear will operate said valve, for the purpose specified.

20. The combination, with a casing, of a shaft and driven gear, a rocking driving-gear having a greater number of teeth than said driven gear and adapted to mesh therewith, a series of cylinders, pistons therefor connected with said driving-gear, ports for said cylinders, the inlet-openings to said ports being in advance or preceding the cylinders with which they are respectively connected, a valve adapted to alternately open and close said ports, a pivoted guiding member for said valve and operative connections provided between said member and said driving-gear, whereby the movement of said gear will operate said valve, for the purpose specified.

In witness whereof I have hereunto set my hand this 29th day of August, 1900.

WILLIAM E. DEAN.

In presence of—
A. S. EATON,
MARTIN O. HAUGNER.