No. 647,455. Patented Apr. 10, 1900.

E. C. MEISSNER.

PNEUMATIC DRILL.

(Application filed May 15, 1899.)

(No Model.)

Fig. 4.

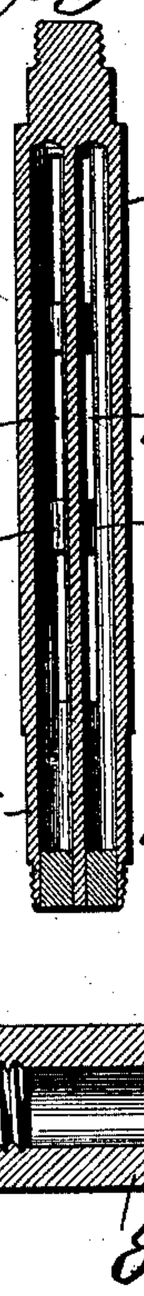


Fig. 5.

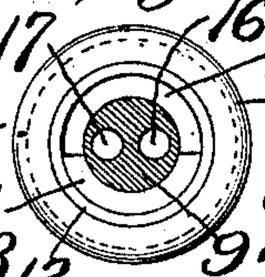


Fig. 6.

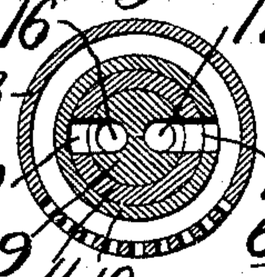


Fig. 1.

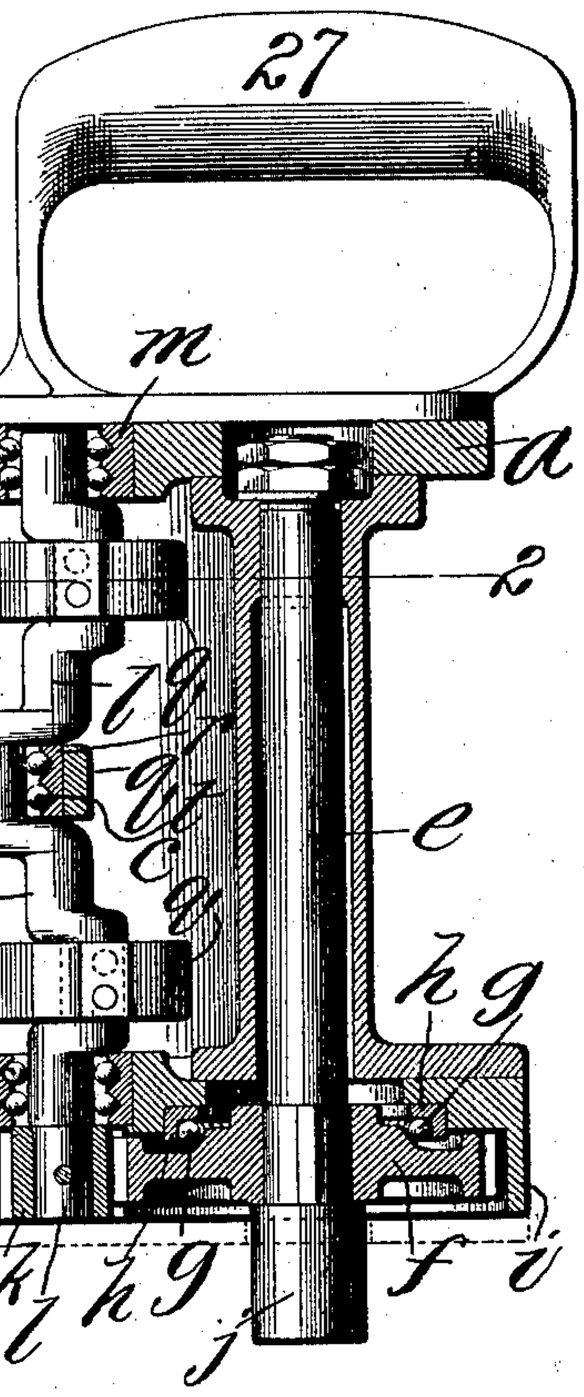


Fig. 2.

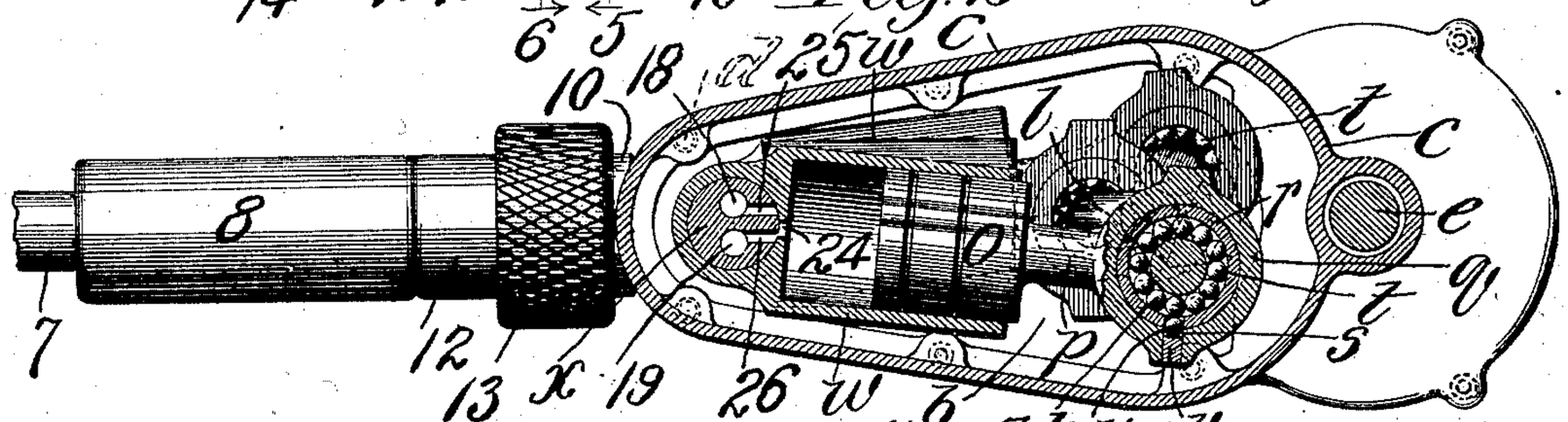
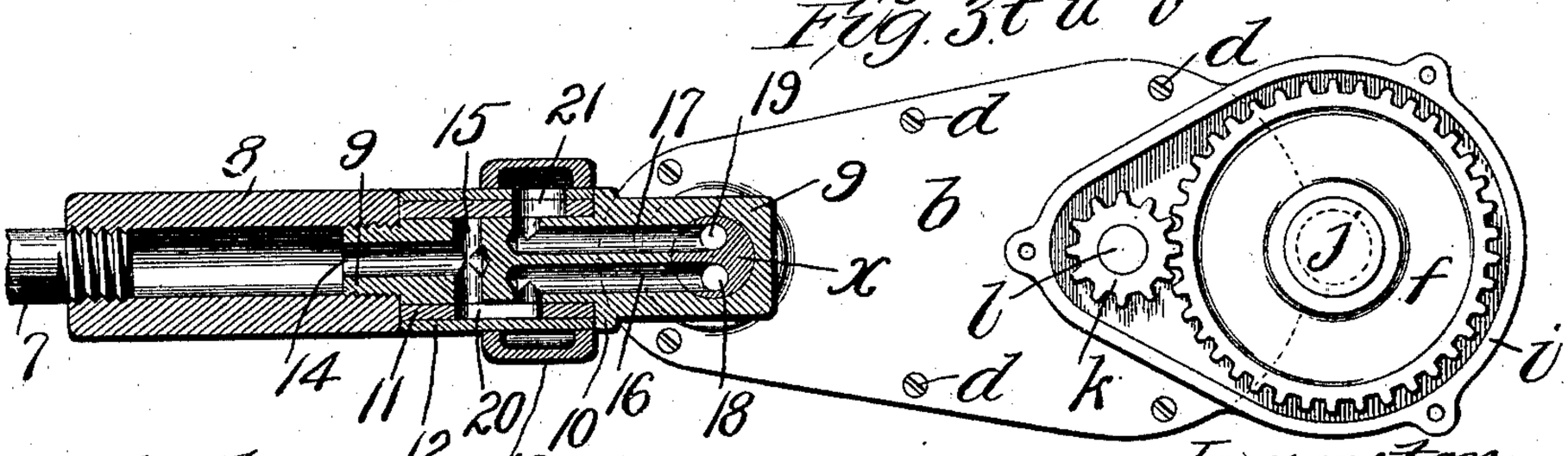


Fig. 3.



Attest:
Wm. F. Coe Jr.
A. S. Gray.

Inventor:
Edward C. Meissner.
by Baldwin & Cornwall
Attys.

UNITED STATES PATENT OFFICE.

EDWARD C. MEISSNER, OF ST. LOUIS, MISSOURI, ASSIGNOR TO THE STANDARD RAILWAY EQUIPMENT COMPANY, OF EAST ST. LOUIS, ILLINOIS.

PNEUMATIC DRILL.

SPECIFICATION forming part of Letters Patent No. 647,455, dated April 10, 1900.

Application filed May 15, 1899. Serial No. 716,925. (No model.)

To all whom it may concern:

Be it known that I, EDWARD C. MEISSNER, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a certain new and useful Improvement in Pneumatic Drills, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a longitudinal sectional view through my improved drill. Fig. 2 is a sectional view on line 2 2, Fig. 1. Fig. 3 is a bottom plan view showing the throttle-valve in longitudinal section. Fig. 4 is a detail longitudinal sectional view through the spindle on which the cylinders are mounted. Fig. 5 is a sectional view on line 5 5, Fig. 1. Fig. 6 is a sectional view on line 6 6, Fig. 1.

This invention relates to a new and useful improvement in pneumatic drills, the object being to construct a device of the character described which will be strong, simple in its construction, and cheap to manufacture. The drill is designed to be run, preferably, by compressed air as its motive fluid, which air is supplied to the drill through a flexible hose leading from some suitable source of supply.

With these objects in view the invention consists in the construction, arrangement, and combination of the several parts, all as will hereinafter be described, and afterward pointed out in the claims.

In the drawings, *a* indicates the top plate, and *b* the bottom plate, of a suitable casing or housing, between which is arranged the body portion *c* of said housing, to which body portion the top and bottom plates are secured by means of screws or other fastening devices *d*. The forward end of casing *c* is provided with a cored opening, in which is rotatably mounted a shaft *e*, which I will term the "driven" shaft. On the lower end of this shaft is arranged a gear-wheel *f*, said wheel being provided with a conical inner face against which rest balls *g*, seated in a race *h*. The ball-race *h* is preferably arranged in the bottom plate of the casing, which is suitably formed to receive the same, said bottom plate also having a projecting flange *i*, surrounding the gear-wheel *f* and its meshing pinion. The lower end of shaft *e* has a clutch, socket, or other suitable device *j* mounted upon it for receiving a bit or drill. (Not shown.) The object and purpose of the ball-bearing for the gear *f* is to provide antifriction devices to take up the end thrust of the shaft *e*, which, as shown, is shouldered against said gear and prevented from independent rotary motion thereon by means of a key, as is usual. The upper end of shaft *e* is threaded and provided with a washer and jam-nuts for the purpose of preventing forward displacement of said shaft.

k indicates a pinion in mesh with the gear *f*, said pinion being pinned to the lower end of a crank-shaft *l*.

m indicates ball-races introduced into the top and bottom plates *a* and *b*, respectively, said races providing suitable tracks for balls *n*, thus forming ball-bearings for the crank-shaft.

Crank-shaft *l* is shown in the drawings as what is known as a "three-throw" crank-shaft; but it is obvious that the number of throws thereof will be determined by the number of pistons coöperating therewith. In the construction shown the cranks in shaft *l*, being three in number, are arranged at one hundred and twenty degrees relative to each other, and on these cranks are mounted the outer ends of the pistons, which, as shown in Figs. 1 and 2, consist of a head *o*, a shank *p*, and an eye *q*, arranged on the outer end of the shank. This eye *q* receives the ball-race *r*, which in assembling the parts is slipped over the crank-shaft in the proper position and the eye of the piston introduced thereon, after which said eye and ball-race are drilled, as at *s*, for the introduction of the balls *t*. After the ball-race is full one extra ball *u* is introduced to fill the opening *s* and a plug *v* is inserted in the eye to close the same and hold said extra ball in position. As there are two sets of balls in each ball-race, I prefer to form the openings *s*, leading thereinto, in opposite sides of the eye; but they can be arranged on the same side, if desired.

The purpose of introducing the extra ball *u* in the opening *s* after the ball-race is filled is to close said opening to the balls in the

race and insure the presence of the proper number of balls in said race. The extra ball *u* also acts as a key to lock the ball-race against rotary and lateral movement in its eye or the eye on said ball-race, thus dispensing with any other means of fastening between these parts.

w indicates the oscillating cylinders, which are formed with eyes or bearings in their rear ends, which bearings are in alinement and strung on a hollow spindle *x*, suitably secured between the top and bottom plates *a* and *b* of the casing.

I will now describe the manner in which motive fluid is admitted to the drill and how said drill may be reversed by the proper manipulation of its throttle-valve.

7 indicates a nipple arranged on the end of a flexible supply-pipe, which nipple is screwed into a sleeve 8, said sleeve being mounted on the rear ends of a plug 9, through whose forward end the stem *x* passes. Plug 9 is provided with a flange 10, between which and the sleeve 8 is arranged a rotary element, which for the sake of simplicity in its manufacture consists of three pieces, one a sleeve 11, fitting over the plug 9 and provided with a suitable opening, over which is arranged an inclosing sleeve 12, said sleeve 12 carrying in its forward ends a hollow muffle-ring 13, formed with suitable openings leading to the exterior. These sleeves 11 and 12 and the muffle-ring are preferably pinned together, so that they will rotate in unison. Sleeve 8 serves to hold the rotary valve in position on the plug and also acts as a handle, which is designed to be grasped by the operator, the rotary valve being within convenient reach of said handle. The air coming from pipe 7 passes through sleeve 8 and enters an axial bore 14 in the plug 9, which axial bore connects with the cross-bore 15, opening at both sides of the plug. 16 and 17 are parallel bores in the forward end of the plug, whose rear ends open laterally, as shown in Fig. 3, and whose forward ends terminate at the eye of the plug, through which the spindle *x* passes. The spindle *x* is formed with parallel bores 18 and 19, which, through suitable lateral openings, register with the bores 16 and 17 of the plug.

One side of sleeve 11 is formed with a slot 20, of which the sleeve 12 is the outer wall, said slot being of such length as to establish communication between the cross-bore 15 and the rear terminus of either of the bores 16 or 17, depending upon the position of the rotary element. The opposite side of sleeve 11 and also the sleeve 12 are bored, as at 21, so as to register with either terminus at the rear ends of the bores 16 and 17 and establish communication between either of said bores and the muffle 13. When slot 20 establishes communication between the inlet-port and the bore 16, the opening 21 is in communication with the bore 17, which latter bore in such position of the parts will be the exhaust-port of the engine. When the rotary element is turned one-half of a revolution, the opening 21 may be made to register with the port 16, which will then be the exhaust-port, and the slot 20 would establish communication between the inlet-port and the bore 17. By adjusting the rotary element on the plug the available area of the inlet and exhaust ports of the engine may be controlled at the will of the operator for the purpose of varying the speed of the engine. By turning the rotary element, say, one-quarter of a revolution both the inlet and exhaust ports are closed. In order to arrest the movement of the rotary element in either extreme position, I introduce a pin 22 in the flange 10 of the plug, which fits in a semicircular recess 23. (See Fig. 5.) The head of each cylinder is provided with a slot 24, which is designed to cooperate with slots 25 and 26, leading from the bores 18 and 19, respectively.

The operation of the engine is as follows: Assuming the throttle-valve to be in the position shown in Fig. 3, the motive fluid will pass through the throttle-valve and enter the bore 18. As the position of the cylinders on the spindle is determined by the angle of the crank to which its piston is connected it follows that at least one of said cylinders will have its slot or port in registration with one of the slots or ports leading from the bore 18, and pressure will thereby be admitted behind the piston to throw said crank above or below the line of axis, so as to rotate the crank-shaft in one direction or the other. The crank-shaft causes the other pistons to return, in which movement the pressure behind the same is exhausted through the slots 24 and 25, the bore 19, and through the muffle to the exterior. Each piston of course has a dead central position in which the spindle and cylinder-ports are lapped or blinded; but as the crank-shaft moves beyond said central position at either end of the stroke the cylinder-port registers with the inlet or exhaust port of the spindle, depending upon whether said piston is in or out. At no time, however, are all three cylinders in such position that all of their ports are blinded, at least one of said openings opening to the inlet-bore and another opening to the exhaust-bore. By reversing the position of the throttle-valve the direction of rotation of the engine is likewise reversed.

Handle 27 is preferably arranged on the top plate *a* in line with the driven spindle *e*, and a drill or bit being introduced into the chuck on the lower end of said spindle is held to its work by the operator grasping said handle. When the drill or bit is properly centered, the throttle-valve is rotated so as to drive the drill in the proper direction, and should it be desired to reverse the engine to withdraw the bit, as when boring wood, after the bit is sunk sufficiently deep the throttle-valve is turned in an opposite direction, as is well understood. When through using the drill, all that is necessary is to turn the throt-

tle-valve about one-quarter of a revolution, so as to close both the inlet and exhaust ports and prevent the operation of the engine and the consequent loss of motive power.

While I have shown the speed of the drill reduced to a ratio of about one to four, yet it is obvious that a greater or less reduction can be had by changing the gearing.

I am aware that many minor changes in the constructions, arrangement, and combination of several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

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

1. The combination with a casing, of a spindle fixed therein and provided with inlet and exhaust ports, cylinders mounted on said spindle, pistons in said cylinders, a crank-shaft with which said pistons engage, a plug mounted on the end of the spindle and provided with ports in registration with the inlet and exhaust ports of said spindle, and a rotary valve coöperating with said plug to control the admission of pressure to, and exhaust from the spindle-ports; substantially as described.

2. The combination with a casing, of a spindle fixed therein and provided with inlet and exhaust ports, cylinders mounted on said spindle, pistons in said cylinders, a crank-shaft with which said pistons engage, a plug mounted on the end of the spindle and provided with ports in registration with the inlet and exhaust ports of said spindle, and a rotary valve mounted on said plug and provided with coöperating ports to admit and exhaust pressure to or from either of said spindle-ports, and means for limiting the movement of said valve; substantially as described.

3. The combination with a casing, of a spindle fixed therein and provided with inlet and exhaust ports, cylinders mounted on said spindle, pistons in said cylinders, a crank-shaft with which said pistons engage, a plug mounted on the end of the spindle and provided with ports in registration with the inlet and exhaust ports of said spindle, and a rotary valve mounted on said plug for admitting or exhausting pressure to or from either of said spindle-ports, and a muffle coöperating with the exhaust-passage of said valve; substantially as described.

4. The combination with a casing of a spindle fixed therein and provided with inlet and exhaust ports, cylinders mounted on said spindle, pistons in said cylinders, a crank-shaft with which said pistons engage, a plug mounted on the end of the spindle and provided with ports in registration with the inlet and exhaust ports of said spindle, and a rotary valve comprising sleeves 11 and 12, and a muffle 13, which are secured together and adapted to rotate on said plug for admitting or exhausting pressure to or from either of said spindle-ports; substantially as described.

5. The combination with a casing, of a spindle fixed therein and provided with inlet and exhaust ports, cylinders mounted on said spindle, pistons in said cylinders, a crank-shaft with which said pistons engage, a plug mounted on the end of the spindle and provided with ports in registration with the inlet and exhaust ports of said spindle, a rotary valve coöperating with said plug to control the admission of pressure to, and exhaust from the spindle-ports, and a sleeve 8 secured to the rear end of said plug for holding said valve in position, and also acting as a handle; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 10th day of May, 1899.

EDWARD C. MEISSNER.

Witnesses:
F. R. CORNWALL,
A. S. GRAY.