No. 757,970. PATENTED APR. 19, 1904.

W. T. SEARS.

PNEUMATIC TOOL.

APPLICATION FILED SEPT. 4, 1903.

NO MODEL.

Fig. 1.

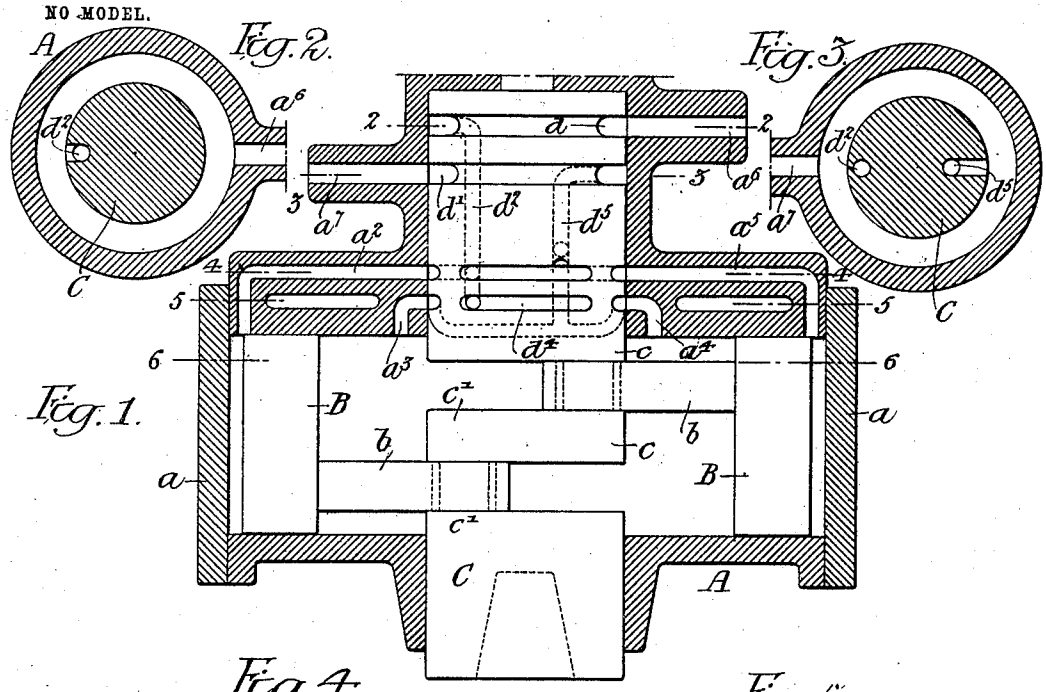


Fig. 2.

Fig. 3.

Fig. 4.

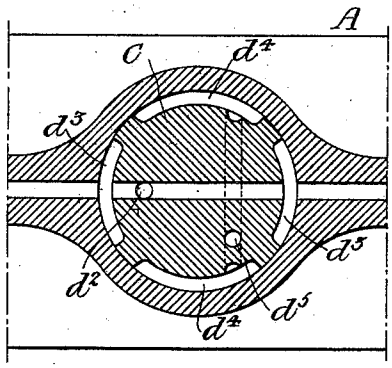


Fig. 5.

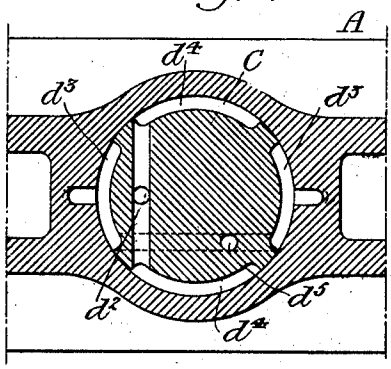
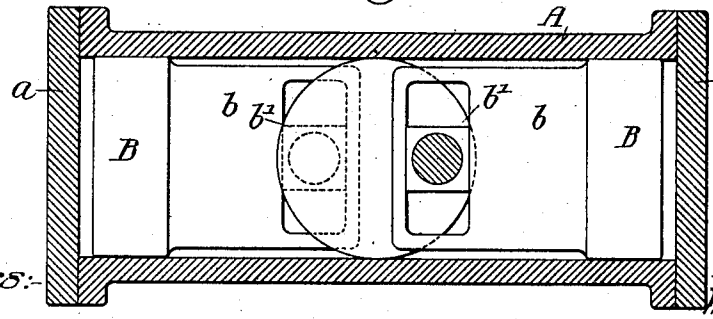


Fig. 6.



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No. 757,970. Patented April 19, 1904.

UNITED STATES PATENT OFFICE.

WILLARD T. SEARS, OF HARRISBURG, PENNSYLVANIA.

PNEUMATIC TOOL.

SPECIFICATION forming part of Letters Patent No. 757,970, dated April 19, 1904.

Application filed September 4, 1903. Serial No. 172,014. (No model.)

To all whom it may concern:

Be it known that I, WILLARD T. SEARS, a citizen of the United States, residing at Harrisburg, Pennsylvania, have invented certain Improvements in Pneumatic Tools, of which the following is a specification.

My invention relates to certain improvements in that class of pneumatic tools in which one or more reciprocating pistons rotate a shaft or spindle having attached to it the tool proper.

The object of the invention is to construct a tool of the above character which shall be of simple design and shall possess but few working parts. This construction is such that a long life with a minimum of repairs is secured, while at the same time the arrangements of the parts are such that the tool is exceedingly light relatively to its power.

A further object of the invention is to provide a tool in which the strains shall to a great extent be balanced, and thus do away with the vibration during operation.

These objects I attain as hereinafter set forth, reference being had to the accompanying drawings, in which—

Figure 1 is a sectional elevation through the center line of my improved tool, showing the relative arrangement of the parts; and Figs. 2, 3, 4, 5, and 6 are sectional plan views taken on the lines 2 2, 3 3, 4 4, 5 5, and 6 6, respectively.

In the above drawings, A is the cylinder casting or casing, having within it a cavity in which there are two pistons B, while at right angles to this is a second cavity having in it the crank-shaft C, this latter being provided with passages by which it is made to serve as the valve for controlling the flow of fluid to and from the cylinder. There is a head a at each end of the cylinder, and in the form of my invention shown in the drawings the cavity for the crank-shaft passes through said cylinder in the line of its axis, while one of the pistons is on each side of the shaft. From each piston there projects a slotted plate b, rigidly attached thereto and having in its slotted portion a sliding block b'. The crank-shaft has two cranks c and c', each of which is engaged by one of the blocks b', so as to be connected to one of the pistons.

There are formed in the cylinder-casting four passages a^2, a^3, a^4, and a^5, the first two of which communicate with the piston-cavity on one side of the crank-shaft, while the others connect with said cavity on the opposite side. The pistons and the connecting-plates are so designed relatively to the cranks that the above-mentioned passages are made to enter the piston-cavity just beyond the end points of the strokes of their respective pistons, while the cranks are placed relatively to the crank-shaft so as to be one hundred and eighty degrees apart. It is, however, to be noted that three pistons operating in the cavities one hundred and twenty degrees apart would perform identically the same function. The four passages have port-openings into the cavity for the crank-shaft, as has also a passage a^6, connected to a source of supply for motive fluid, and a passage a^7, connected to the exhaust. The crank-shaft itself has a number of passages formed circumferentially, one set of these being in the plane of the supply-passage and the other in the plane of the exhaust-passage, while the other two are respectively in the planes of the passages a^2 a^5 and of the passages a^3 a^4 at the points where these open into the crank-shaft cavity, (in the present instance one above the other.) By properly spacing and locating circumferentially the passages a double tier of the same is unnecessary, since openings for the supply and exhaust could be in a single line or tier around the shaft and in practice are so made. As shown, however, the explanation is simplified. It is also to be understood that the same result would be obtained if the annular spaces were made in the outer frame or body of the casing and holes or relatively narrow ports made in the shaft. The first and second of these circumferential passages d and d' are simply annular cavities opening onto the cylindrical surface of the crank-shaft, while the two latter are each divided into four independent chambers. A connecting-passage d^2 extends between the annular cavity d and a pair of opposite cavities d^3, being also con-

nected to a pair of cavities d^4, situated in the plane of the passages a^3 a^4 and ninety degrees distant from the cavities d^3, which, it will be noted, lie in the plane of the passages a^2 a^5.

As indicated in the dotted lines, the lower portion of the crank-shaft is provided with a tapered cavity for the reception of a tool, such as a drill or reamer. Similarly a second connecting-passage d^5 extends between the annular passage d' and a pair of the passages d^3, as well as to a pair of passages d^4 ninety degrees distant therefrom.

In operation fluid under pressure enters through the channel a^6 and flowing into the annular cavity d passes down through the passage d^2 to a pair of cavities d^3 and also to a pair of the cavities d^4 ninety degrees from the same upon the surface of the crank-shaft. As will be seen from an inspection of Fig. 1, said motive fluid is now free to enter the passages a^2 and a^5, while it will also be noted that the passages a^3 and a^4 are in connection with the exhaust through a pair of the cavities d^4 and the connecting-passage d^5. The result of this is that the two pistons are impelled toward each other and turn the crank-shaft so as to bring the pair of passages d^4 which are in connection with the passage d^2 opposite the passages a^3 and a^4, while the passages a^2 and a^5 are placed in connection with the exhaust through the passages d^5 and the annular passage d'. The pistons are now simultaneously moved away from each other, it being understood that the blocks b' slide in the slotted plates b, so as to permit of such motion. As long, therefore, as the motive fluid is admitted through the passage a^6 the said pistons will continue to be reciprocated toward and from each other and will consequently continuously turn the crank-shaft, with its tool.

As will be understood by those skilled in the art, an additional pair of pistons may be coupled to the crank-shaft, the cylinder-casting being formed for their accommodation with a second cylinder at right angles or at any other suitable angle to the one illustrated and the crank-shaft being provided with the necessary cavities for fluid supply and exhaust, the whole being a duplicate of the construction shown in the drawings.

It is to be noted that when during the operation the pistons are nearest one another the slotted plates projecting therefrom so fit into the cut-away portions of the crank-shaft by which the cranks are formed that there is practically very little clearance, and yet this advantage is secured by an exceedingly simple construction which does not involve internal heads or projections into the cylindrical cavity for the pistons.

I claim as my invention—

1. The combination in a pneumatic tool of a cylinder, a crank-shaft, a piston in the cylinder connected to the shaft, said cylinder having ports for the admission and exhaust of motive fluid, said ports being placed to permit the said fluid to act on both faces of the piston, the crank-shaft also having in it passages for controlling said fluid, said passages being formed to coact with the ports of the cylinder, substantially as described.

2. The combination in a pneumatic tool of a casing having in it two cavities and having passages connecting one cavity with the other cavity, a piston in one cavity and a shaft in the other, said shaft being connected to the piston and having in it passages connected to a source of supply for motive fluid, said passages being placed to coact with the passages of the casing and said latter passages opening into the cylinder so as to cause motive fluid to act positively on both faces of the piston, substantially as described.

3. The combination in a pneumatic tool of a casing having within it two cavities provided with passages connecting one cavity with the other, two pistons in one cavity and a shaft in the second cavity connected to said pistons, said shaft having in it passages connected respectively to the exhaust and to the source of supply for motive fluid, said shaft-passages coacting with the passages of the casing and said latter passages entering the piston-cavity in such positions as to permit of motive fluid being supplied to and exhausted from both faces of each piston, substantially as described.

4. The combination of a casing having in it two cavities intersecting one another, a shaft in one cavity extending into the other, pistons in the second cavity on opposite sides of the shaft and operatively connected thereto, the said casing having for each piston a plurality of passages whereby it is connected to the cavity for the shaft, said shaft having in it passages opening on its cylindrical surface and placed to coact with said first-mentioned passages, substantially as described.

5. The combination of a casing having two cylindrical cavities of which one is provided with a head or heads, two pistons in said cavity, a shaft in the second cavity elongated to extend between the pistons, said casing having a plurality of passages on each side of the shaft, said passages connecting respectively the ends of the piston-cavity and portions thereof adjacent to the shaft, to the shaft-cavity, said casing-passages opening into the piston-cavity at points beyond the ends of the strokes of the respective pistons and said shaft having in it passages placed to coact with the passages of the casing, substantially as described.

6. The combination of a casing having a cylinder with pistons therein, a crank-shaft in the casing having cranks and pins, a slotted plate rigidly attached to each piston, said plates being connected respectively to the pins

independently of each other, there being exhaust and supply passages in the shaft opening on the cylindrical surface thereof and other passages in the casing coacting with the same and entering the piston-cavity, substantially as described.

7. The combination of a casing having in it two cavities, a pair of pistons in one cavity, a shaft in the other cavity connected to said pistons, said casing having in it two passages for each piston opening into the piston-cavity at points adjacent to the ends of the path traveled by said pistons, said passages also opening into the cavity for the crank-shaft, said shaft having a series of annular passages in its surface coacting with the other passages, certain of the annular passages being connected to a source of supply for motive fluid and others being connected to the exhaust, substantially as described.

8. The combination of a casing having in it two cavities, a shaft in one of said cavities having cranks and means for the attachment of a tool to be operated, said shaft having passages through it and two sets of passages opening on its cylindrical surface, pistons in the second cavity of the casing connected to the cranks, there being passages from the portions of the second cavity adjacent to the shaft, opening into the shaft-cavity and coacting with one set of passages in the shaft, and other passages from the ends of the second cavity also opening into the shaft-cavity and coacting with the second set of shaft-passages, substantially as described.

9. An engine having a cylinder, a piston and a crank-shaft connected thereto, said shaft having in it passages, there being other passages coacting with said shaft-passages and opening into the cylinder at points beyond the piston when it is at the two ends respectively of its stroke, so as to admit and exhaust motive fluid from both faces of the piston, substantially as described.

10. An engine having a cylinder, a crank-shaft extending into the same, pistons connected to the shaft and operating in the cylinder, said cylinder having opening into it a plurality of passages for each piston and said shaft being constructed with openings coacting with said passages for controlling the flow of motive fluid to and from the cylinder, substantially as described.

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

WILLARD T. SEARS.

Witnesses:
W. O. SMITH,
IOLA E. OYSTER.