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R. TEMPLE.

PNEUMATICALLY ACTUATED TOOL.

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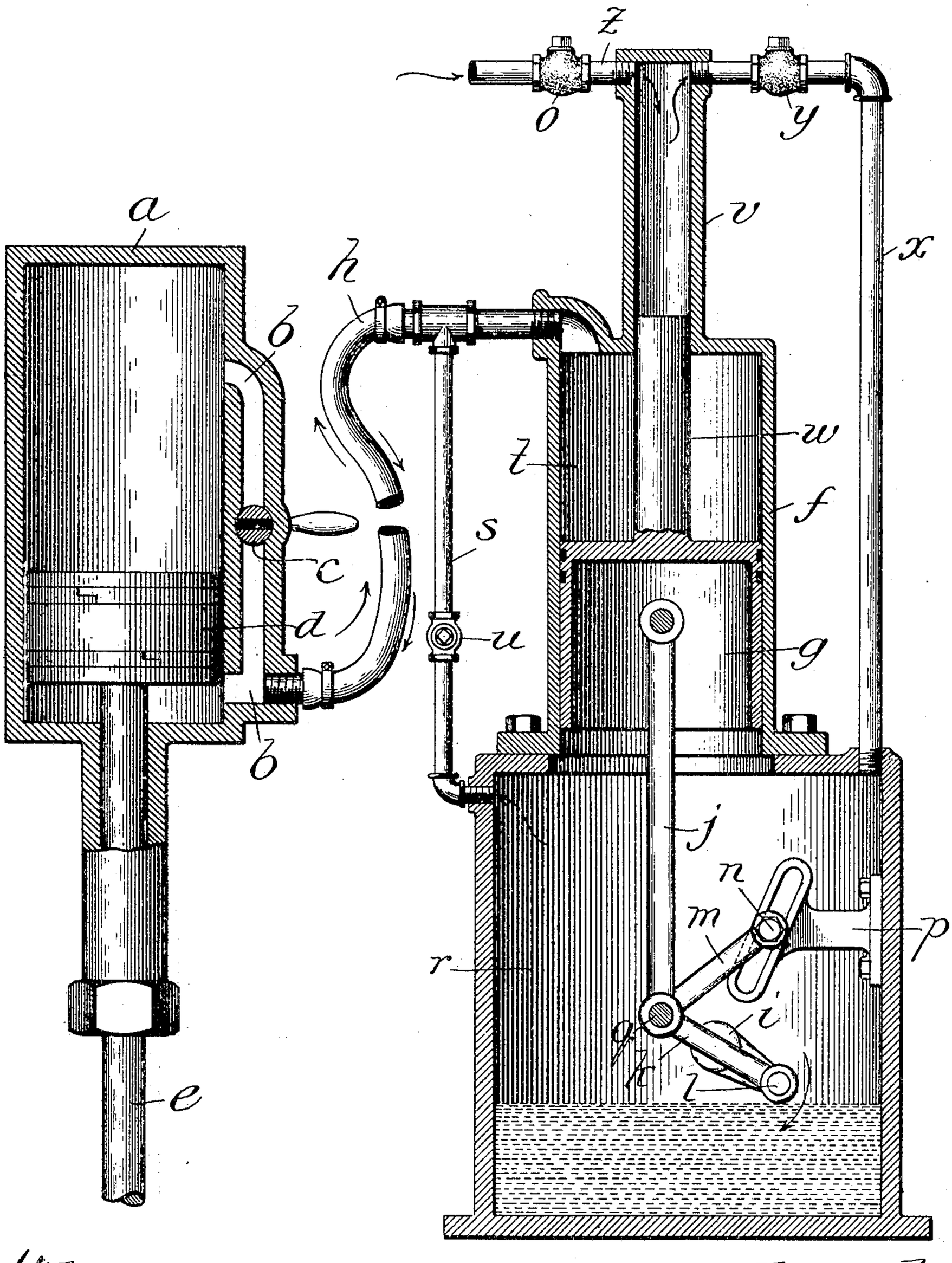

Witnesses:
Chas. E. Gaylord.
Geo. C. Davison.

Inventor:
Robert Temple,
By Thomas F. Sheridan
Atty.

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UNITED STATES PATENT OFFICE.

ROBERT TEMPLE, OF DENVER, COLORADO, ASSIGNOR TO THE TEMPLE GAS ENGINE & MACHINE COMPANY, OF DENVER, COLORADO, A CORPORATION OF COLORADO.

PNEUMATICALLY-ACTUATED TOOL.

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To all whom it may concern:

Be it known that I, ROBERT TEMPLE, a citizen of the United States, residing at Denver, in the county of Denver and State of Colorado, have invented certain new and useful Improvements in Pneumatically-Actuated Tools, of which the following is a specification.

The invention relates to that class of tools capable of being actuated by means of fluid under pressure—compressed air—and particularly to the means by which a circuit of compressed air is formed and maintained for the purpose of pulsating any desired tool, all of which will more fully hereinafter appear.

The principal object of this invention is to provide a simple, economical, and efficient pneumatically-actuated tool with means for reciprocating or pulsating the same.

Other objects of the invention will appear from an examination of the drawing and the following description and claims.

The invention consists principally in a pneumatically-actuated tool in which there are combined a tool-cylinder, a reciprocating tool-piston mounted therein, a pulsating engine-cylinder, a pulsating piston therein, and a single pipe or passage connecting the pulsating engine-cylinder with the reciprocating tool-cylinder to furnish a column or circuit of compressed air to reciprocate said tool-piston.

The invention consists, further and finally, in the features, combinations, and details of construction hereinafter described and claimed.

In the accompanying drawing the figure is a vertical sectional elevation of one type of pneumatically-actuated tool as it appears when constructed in accordance with these improvements.

In the art to which this invention relates it is well known that in the use of a rock-drill, for instance, the drill is shoved forward under tremendous pressure and has to go forward a certain predetermined amount before it can be retracted, so that when operating in certain kinds of rock the engine will sometimes give but a short blow and refuse to move backwardly. This invention, therefore, is intended primarily to be an improvement on such type of engines, in that instead of using compressed air and exhausting it a closed circuit of air under pressure is maintained, which pulsates the reciprocating tool and can be used to move the same backward and forward at any position of its stroke, all of which will more fully hereinafter appear.

In constructing a tool in accordance with these improvements, and describing, first, the reciprocating tool parts, the tool-cylinder *a* is provided, having a passage *b* leading from one end of the cylinder to the other. This passage is provided with a plug-valve *c*, adapted to be opened or closed, as will more fully hereinafter appear. A tool-piston *d* is provided and reciprocatingly mounted within the tool-cylinder, having a piston-rod *e*, which is preferably formed integral with the tool-piston. This piston-rod is adapted to hold or operate any desired operating-tool, such as a hammer, chisel, riveting, or cutting tool. To reciprocate the tool-piston, a single-acting pulsating-engine is provided, formed of an engine-cylinder *f* and a trunk-piston *g*, reciprocatingly mounted therein. This single-acting pulsating engine-cylinder is connected by means of a single pipe *h* with a passage *b* in the tool-cylinder.

When the parts are constructed and arranged as shown in the drawings, the pulsations of the piston *g* will force air into both ends of the tool-cylinder when the plug-valve *c* is open. In operation, however, the plug-valve is closed after both ends of the cylinder have become charged, so that the pulsations of air pass into the tool-cylinder below the tool-piston only, moving it upwardly and further compressing the air above the same. During the backward or downward movement of the pulsating piston a reduction in pressure is formed in the pulsating engine-cylinder, so that the air below the tool-piston rushes back therein to equalize the pressure between the two cylinders. At the same time the superior pressure which has been

confined above the tool-piston acts to drive the tool-piston forward at a rapid pace to act upon the desired tool.

In order to pulsate the piston *g* in the desired manner—that is, to move it upwardly slowly, so as to give time for the pulsations of the air and permit it to enter below the tool-piston, as above described, and to reciprocate said pulsating piston in a rapid manner—a main driving crank-shaft *i* is provided and connected with the trunk-piston by means of a compound connecting-rod formed in two parts *j* and *k*, one part of which is pivotally secured to the wrist-pin *l* of the crank-shaft and the other to the trunk-piston, as shown in the drawings.

Ordinarily if but a single-acting rod were employed both movements of the trunk-piston would occupy equal periods of time. As above suggested, however, it is desirable that the trunk-piston should be retracted in a shorter period of time than is occupied by raising or pushing it forward. In order to accomplish this, a controlling-link *m* is provided and pivotally and adjustably secured to the frame of the machine at *n* by means of the slotted bracket *p*. This controlling-link is also pivotally secured at *q* to the common fulcrum-point of the compound connecting-levers. The crank-shaft rotates in the direction indicated by the arrow, and it will be seen as the common fulcrum-point passes the line of centers between the wrist-pin, crank shaft, and pivotal connection of the trunk-piston it is depressed quite rapidly; but as it starts to raise the trunk-piston such raising movement is accomplished slowly, or, in other words, occupies a longer period of time than the depressing of said trunk-piston. To furnish a supply of compressed air, this frame portion is provided with a reservoir *r* and connected by means of a pipe *s* with the chamber *t* of the single-acting engine-cylinder. This pipe is further provided with a check-valve *u* of the usual construction to prevent the return of compressed air to the reservoir. A priming-cylinder *v* is provided, having a priming-piston *w* reciprocatingly mounted therein. This priming-cylinder is arranged in line with the axis of the pulsating engine-cylinder, and its piston is formed integral with the single-acting piston in said latter cylinder. A pipe *x* leads from said priming-cylinder to the reservoir and is provided with a check-valve *y*, that permits air to pass in one direction only—viz., into the reservoir, as indicated. A priming-cylinder is further provided with an inlet-pipe *z*, having a check-valve *o*, that permits air to enter such cylinder through said inlet-pipe, but does not permit it to exhaust therethrough.

I claim—

1. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston therein dividing said cylinder into two closed chambers, a pulsating engine-cylinder, a pulsating piston therein, and a single pipe or passage connecting the pulsating engine-cylinder with one chamber of the tool-cylinder to furnish a column of compressed air to said chamber which operates the tool-piston, thereby alternately compressing and permitting the air to expand in the other chamber of said tool-cylinder and thus reciprocating the tool-piston, substantially as described.

2. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston therein dividing said cylinder into two closed chambers, a pulsating engine-cylinder, a pulsating piston therein, a single pipe or passage connecting the pulsating engine-cylinder with the chamber of the tool-cylinder to furnish a column of compressed air to said chamber which operates the tool-piston, thereby alternately compressing and permitting the air to expand in the other chamber of said tool-cylinder and thus reciprocating the tool-piston, a passage *b* connecting both chambers of the tool-cylinder together, and a valve in said passage to open and close the same so as to permit of the building up of pressure in the second chamber of the tool-cylinder, substantially as described.

3. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a pulsating engine-cylinder provided with a pulsating piston, a single pipe or passage connecting one end of the pulsating engine-cylinder with passages leading to both ends of the tool-piston, and a valve for cutting off and opening passages in the tool-cylinder so as to control the admission and exhaust of the pulsations of compressed air to one or both ends of the tool-cylinder, substantially as described.

4. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston therein, an inlet and exhaust passage in said tool-cylinder leading from one end to the other, means for connecting one end of such passages with a source of air pulsations, and a valve in said passages to normally close the same against the passage of air from one end of the cylinder to the other and adapted to be opened so as to admit air from below the tool-piston to above the same, whereby the tool-piston is normally retracted by the pulsations of the air and forced forward by the air compressed above said tool-piston as the air below the same is exhausted, substantially as described.

5. In a tool-cylinder of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating engine-cylinder connected with the tool-cylinder to reciprocate the tool-piston therein, a pulsating piston in said pulsating-engine, a main driving crank-shaft, a com-

pound connecting-rod connecting the wrist-pin of the crank-shaft with the pulsating piston, and a controlling-link pivotally connected to the frame of the machine and to the compound connecting-rods, substantially as described.

6. In a tool-cylinder of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating engine-cylinder connected with the tool-cylinder to reciprocate the tool-piston therein, a pulsating piston in said pulsating-engine, a main driving crank-shaft, a compound connecting-rod connecting the wrist-pin of the crank-shaft with the pulsating piston, and a controlling-link pivotally connected to the frame of the machine and to the compound connecting-rods at their common fulcrum-point, substantially as described.

7. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a pulsating engine-cylinder connected with said tool-cylinder to furnish a circuit of compressed air to reciprocate the tool-piston, a pulsating piston mounted therein, a main crank-shaft, a compound connecting-rod pivotally connected with the wrist-pin of the crank-shaft and with the pulsating piston, and a controlling-link pivotally and adjustably secured to the frame of the machine and pivotally secured to the compound connecting-rods at their common fulcrum-point, substantially as described.

8. In a machine of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a pulsating engine-cylinder provided with a single pipe or passage connecting it with both ends of the tool-cylinder, valve mechanism on the tool-cylinder to regulate or control the pulsations of compressed air to one or both ends of the tool-cylinder, a pulsating piston in said pulsating engine-cylinder, a reservoir for holding compressed air connected with the pulsating engine-cylinder so as to maintain a desired pressure therein, a priming-cylinder and a priming-piston therein, and a pipe or passage leading from said cylinder to the air-reservoir, substantially as described.

9. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a single-acting pulsating-engine provided with a trunk-piston connected by a single pipe or passage with both ends of the tool-cylinder, valve mechanism for regulating and controlling the pulsations of air to one or both ends of the tool-cylinder, a frame or base portion providing an air-reservoir and with the open end of the single-acting engine-cylinder opening into the same, a pipe or passage leading from said air-reservoir to the single-acting engine-cylinder and provided with a check-valve, a priming engine-cylinder provided with a valve-passage connecting it with the air-reservoir, and a priming-piston reciprocatingly mounted in said priming engine-cylinder, substantially as described.

10. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a single-acting pulsating-engine provided with a trunk-piston connected by a single pipe or passage with both ends of the tool-cylinder, valve mechanism for regulating and controlling the pulsations of air to one or both ends of the tool-cylinder, a frame or base portion providing an air-reservoir and with the open end of the single-acting engine-cylinder opening into the same, a pipe or passage leading from said air-reservoir to the single-acting engine-cylinder and provided with a check-valve, a priming engine-cylinder provided with a valve-passage connecting it with the air-reservoir, a priming-piston reciprocatingly mounted in said priming engine-cylinder, a main driving crank-shaft, a compound connecting-rod pivotally secured to the wrist-pin of the crank-shaft and the trunk-piston of the pulsating-engine, and a controlling-link pivotally and adjustably secured to the frame of the machine and pivotally secured to the common fulcrum-point of the compound connecting-rod, substantially as described.

ROBERT TEMPLE.

Witnesses:
S. G. GILL,
JOS. S. DAVIS.