

No. 787,959.

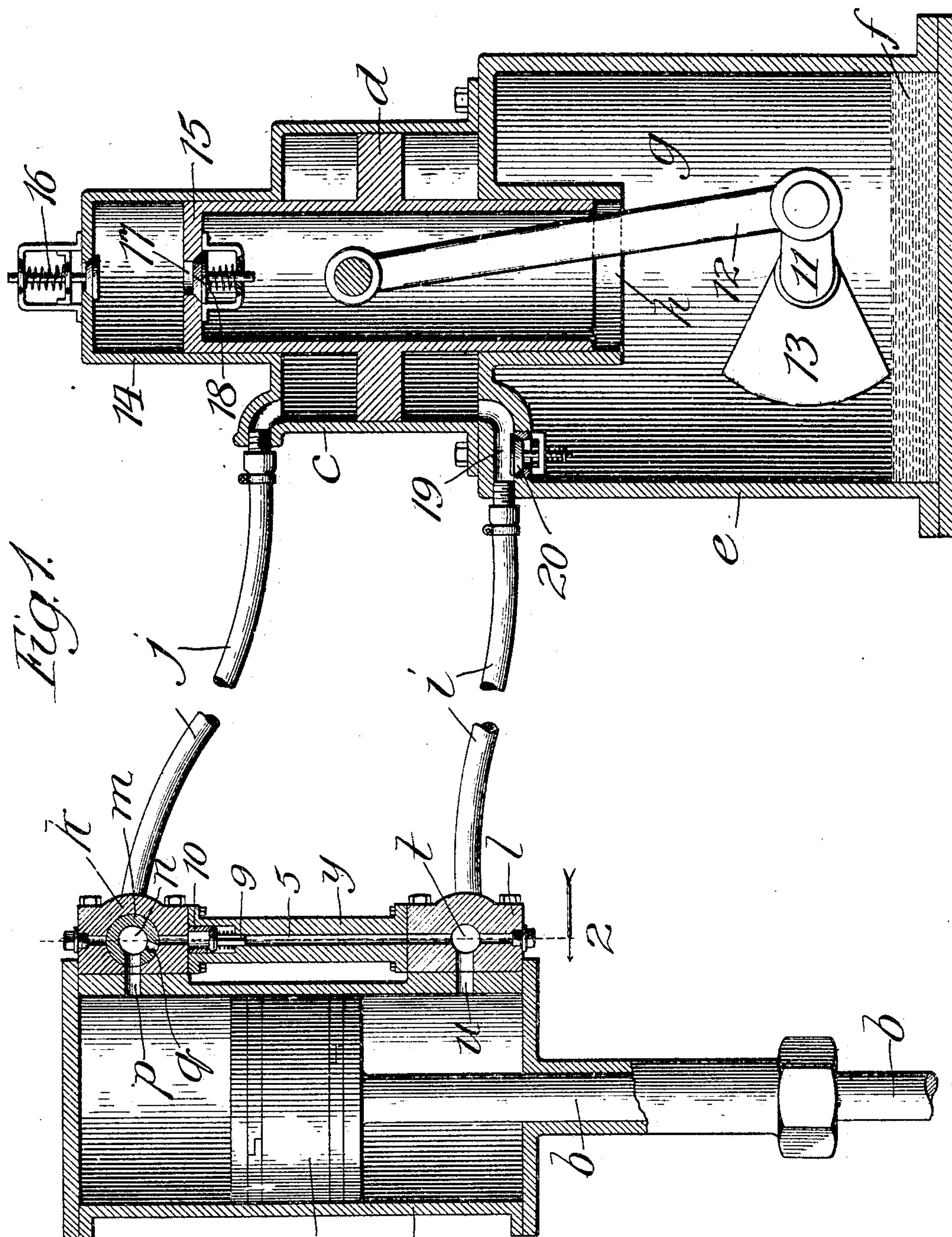
PATENTED APR. 25, 1905.

R. TEMPLE.

PNEUMATICALLY ACTUATED TOOL.

APPLICATION FILED JAN. 13, 1904. RENEWED FEB. 16, 1905.

2 SHEETS—SHEET 1.



Witnesses:  
*Ed. J. Gaylord,*  
*Geo. C. Raynor.*

Inventor:  
*Robert Temple,*  
 By *Thomas J. Sheridan,*  
*Att'y.*



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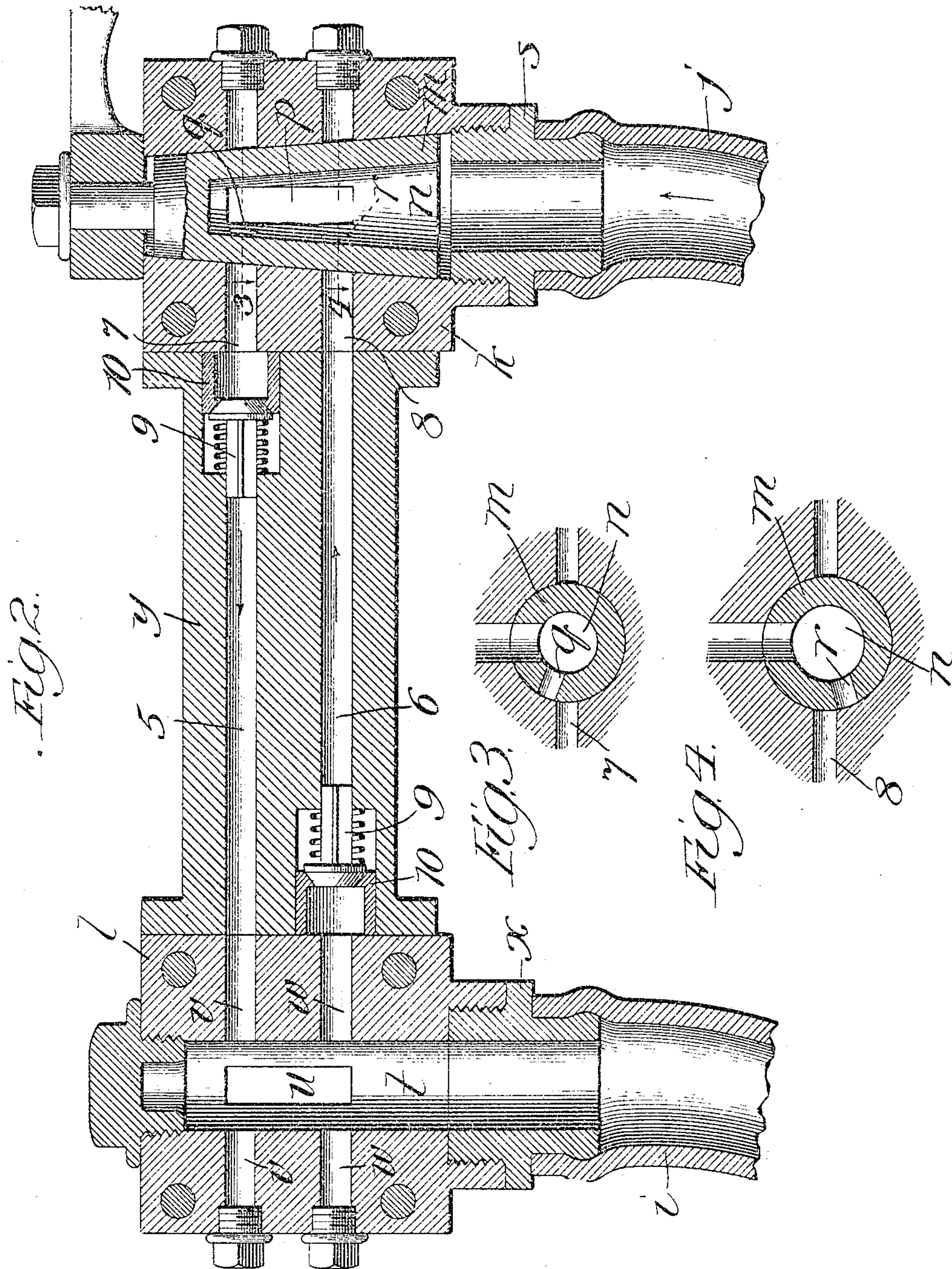
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Robert Temple,  
By Thomas F. Sheridan,  
Att'y



# UNITED STATES PATENT OFFICE.

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

## PNEUMATICALLY-ACTUATED TOOL.

SPECIFICATION forming part of Letters Patent No. 787,959, dated April 25, 1905.

Application filed January 13, 1904. Renewed February 16, 1905. Serial No. 245,877.

*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 the invention is to provide a simple, economical, and efficient pneumatically-actuated tool with means for pulsating the same.

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

The invention consists principally in a pneumatically-actuated tool in which there are combined a reciprocating tool-piston, a pulsating-engine connected therewith to furnish compressed air for reciprocating the same, an air-reservoir connected with said pulsating-engine, and a priming-piston for maintaining fluid under pressure in said reservoir.

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

In the accompanying drawings, Figure 1 is a sectional elevation of one type of a pneumatically-actuated tool as it appears when constructed in accordance with these improvements; Fig. 2, an enlarged sectional detail of the parts, taken on line 2 of Fig. 1 looking in the direction of the arrow; Fig. 3, a sectional detail taken on line 3 of Fig. 2 looking in the direction of the arrow and showing the controlling valve or cock mechanism in one position, and Fig. 4 a sectional view taken on line 4 of Fig. 2 looking in the direction of the arrow.

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 and parts thereof a tool-cylinder *a* is provided having a reciprocating tool-piston mounted therein, the piston-rod *b* of which extends out through one end thereof. To this piston-rod may be secured any desired tool, and such rod may be either integrally connected with the piston, as shown in the drawings, or separate therefrom, so that the piston alternately impinges and leaves said piston-rod. To furnish a closed circuit of air under pressure for this tool-cylinder, so as to reciprocate the piston, a pulsating-engine is provided, formed of an engine-cylinder *c*, in which a reciprocating or pulsating piston *d* is mounted. This cylinder is mounted upon a casing *e*, that forms a reservoir for holding oil, as at *f*, in the lower portion and air-pressure, as at *g*, in the upper portion. The engine-cylinder, as above suggested, is mounted upon this so that a portion of said casing would open directly into the engine-cylinder if it were not for the mounting of the reciprocating pulsating piston therein. This reciprocating pulsating piston is made trunk-shaped, with its open end *h* opening directly into the air-reservoir, where it is subjected to the pressure thereof and therein, all of which will be more fully hereinafter set forth.

The pulsating engine-cylinder is connected,



by means of the tubes *i* and *j*, with each end of the tool-cylinder, so that as the air under pressure in said pulsating piston is pressed at one end it is forced through one pipe into one end of the tool-cylinder and permitted to enter the other end of said pulsating engine-cylinder from the opposite end of the tool-cylinder.

It is very desirable that some means for equalizing the pressure in both ends of the tool and pulsating engine cylinders be provided. In order so to do, the tool-cylinder is provided with two detachable casings or castings *k* and *l*. The casting *k* is provided with a hollow plug-cock *m*, having a longitudinal passage *n* and transverse passages *p*, *q*, and *r*. The end of this casting which is opposite the open end of the hollow plug-cock is provided with a bushing *s*, to which is secured a pipe *j*, so that as air under pressure flows in the direction of the arrow it will pass first into the plug-cock and thence out through the passage *p* into the upper end of the tool-cylinder when the pulsating piston is moving upwardly. When the piston of the pulsating-engine is moving downwardly, the air under pressure will force the flow in a reverse direction. The casting *l* is provided with one longitudinal passage *t* and a radial passage *u*, leading therefrom into the lower end of the tool-piston, and radial passages *v* and *w*, extending clear through the casing. One end of the casing is provided with a bushing *x*, to which the pipe or flexible tube *i* is secured in any desired manner.

An intermediate casting *y* is provided, having two passages 5 and 6 therein and so connected with both of the castings *k* and *l* as to register with the passages *v* and *w* in one casting and 7 and 8 in the other. These latter passages 7 and 8 are adapted to register with the transverse passages *q* and *r*, respectively, in the plug-cock when such cock is brought to the desired position, as will more fully hereinafter appear. Each of the passages 5 and 6 is provided with check-valves 9 and 10, respectively, oppositely arranged, so that air under pressure can flow in but one direction through each of such passages and in an opposite manner to the direction in which it can flow in the other passage.

When the plug-cock is arranged in the manner shown in Figs. 1 and 2, the air under pressure can flow directly in and out of both ends of the tool-cylinder and will not flow through either passage; but when such plug-cock is turned, as it can be, so that its passage *q* registers with the passage 7, and if the pressure in the upper side of the tool-piston exceeds that below, air may flow out through the passages *p*, *q*, and 7, depress the check-valve 9, and thence flow through the passages 5, *v*, *t*, and *u* into the lower end of the tool-cylinder. When the plug-cock is moved in an opposite direction, so as to bring the pas-

sages *r* and 8 into register, and the pressure below the tool-piston is greater than that above, the air will flow in an opposite direction through such passage—that is, will flow out from the lower part of the piston-cylinder through passages *u*, *t*, *w*, 6, 8, *r*, *n*, and *p* into the upper part of the tool-piston. When desired, the plug-valve may be turned so as to entirely cut off connection with the upper and lower ends of the tool-cylinders, as shown in Figs. 2, 3, and 4.

To reciprocate the piston in the pulsating-engine a main driving crank-shaft 11 is provided and is connected to said piston by means of the connecting-rod 12, as shown particularly in Fig. 1. This crank-shaft is provided with a counterbalance 13, that alternately dips into and out of the oil, so as to spray the same and partially saturate the compressed air above such oil, so that as such compressed air is fed into any of the movable parts of the tool it will carry some of the finely-divided oil with it to lubricate the same, all of which will be understood and appreciated by those skilled in the art. The trunk-piston, opening downwardly toward the air-reservoir, is also lubricated by the oil in suspension in such compressed air. It will therefore be seen that the mechanism not only provides for the pulsating of a closed circuit of air, but also for the automatic lubrication of the parts.

To provide the tool with a priming-engine, so as to furnish air under pressure to the reservoir and maintain it at desired pressures, a priming engine-cylinder 14 is provided, formed integral and in line with the pulsating-engine, as shown particularly in Fig. 2. This cylinder is provided with a priming-piston 15, that forms an integral part of the pulsating trunk-piston. The priming engine-cylinder is provided with a passage connecting it with the outside air, in which is arranged a spring-pressed check-valve 16. The trunk-piston is provided with a passage 17, connecting the priming engine-cylinder with a passage formed through said trunk-piston leading to the compound air and oil reservoir. A spring-pressed check-valve 18 is arranged in this last-named passage, so that as air under pressure is formed in the priming-cylinder and reaches a point in excess of the pressure in the reservoir it will open this last-named check-valve and flow through the passages named into said reservoir above the oil therein.

A passage 19 is provided in the reservoir-casing and leading therethrough connects with the pulsating engine-cylinders below the piston thereof. This passage is provided with a spring check-valve 20, so constructed and arranged that when the pressure in the pulsating engine-cylinder falls below that in the reservoir the check-valve is opened and permits a portion of the pressure to flow from said reservoir into the pulsating-engine or into the closed circuit to equalize the same.



From the foregoing description of construction and arrangement of parts and from an examination of the drawings it will be seen that the circuit is a closed one and that if  
 5 any leakage occurs at either or both of said pistons—the tool or pulsating piston—it will simply lead past the same, but will stay at all times in the circuit, all of which will be thoroughly understood and appreciated by those  
 10 skilled in the art.

I claim—

1. In a tool of the class described, the combination of a reciprocating tool-piston, a pulsating-engine connected therewith to furnish  
 15 motive fluid for reciprocating the same, a reservoir connected with said engine, and a priming-piston for maintaining fluid under pressure in said reservoir, substantially as described.

2. In a tool of the class described, the combination of a tool-cylinder, a reciprocating piston mounted therein, a pulsating-engine provided with a pulsating piston connected with the cylinder of the reciprocating tool, a  
 25 reservoir for said pulsating-engine containing a quantity of oil and air under pressure to lubricate the parts by the movement of air under pressure through the same, and means for maintaining air under pressure in  
 30 said reservoir, 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, a hollow trunk pulsating piston therein, a reservoir containing oil and air under pressure connected with the cylinder of  
 35 said pulsating-engine, a priming-engine connected with said pulsating-engine and provided with a reciprocating piston connected with the pulsating piston, and means whereby  
 40 air as it is formed under pressure is passed into the air-reservoir, substantially as described.

4. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston in said cylinder, a pulsating engine-cylinder, a reciprocating pulsating hollow trunk-piston mounted therein, a reservoir upon which the engine-cylinder is mounted  
 45 adapted to contain oil and air under pressure, a valved connection between the reservoir and engine-cylinder, a priming-engine connected to the pulsating-engine, a piston reciprocatingly mounted therein and connected with the  
 50 pulsating piston, a passage between the priming-engine and the outer air provided with a check-valve connection, a passage through the trunk-piston connecting the priming-piston with the air-reservoir, and a check-valve in  
 55 said passage, substantially as described.

5. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, an air and oil reservoir, a pulsating-engine mounted upon said  
 60 air-reservoir, a valved connection between the

air-reservoir and the pulsating engine-cylinder, a trunk pulsating piston in said pulsating-engine with its open end in communication with the air-reservoir, pipe connections between the pulsating engine-cylinder and both  
 70 sides of the tool-piston, a main shaft rotatably mounted in the air and oil reservoir, and connections between said main shaft and the pulsating piston, substantially as described.

6. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, an air and oil reservoir, a pulsating-engine mounted upon said  
 75 air-reservoir, a valved connection between the air-reservoir and the pulsating engine-cylinder, a trunk pulsating piston in said pulsating-engine with its open end in communication with the air-reservoir, pipe connections between the pulsating engine-cylinder and both  
 80 sides of the tool-piston, a main shaft rotatably mounted in the air and oil reservoir, connections between said main shaft and the pulsating piston, a priming-cylinder attached to the pulsating engine-cylinder, a reciprocating  
 85 piston therein connected with the pulsating piston, and valved inlet and outlet passages connecting said priming engine-cylinder with the atmosphere and air-reservoir, substantially as described.

7. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating-engine connected with both ends of the tool-cylinder, passages connecting each end of the  
 90 tool-cylinder with the other, check-valve mechanisms, one in each of said passages and oppositely arranged, and valve mechanism at one end of the tool-cylinder for connecting either of said passages with that end of the cylinder  
 95 and the opposite end to guide the motive fluid in either direction and cut off the connections therebetween, substantially as described.

8. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating-engine connected with both ends of the tool-cylinder, passages connecting each end of the  
 100 tool-cylinder with the other, check-valve mechanisms, one in each of said passages and oppositely arranged, and a hollow plug-cock at one end of the tool-cylinder provided with longitudinal and transverse openings for controlling the direction of air or flow of motive  
 105 fluid from one end of the cylinder to the other and for cutting off or opening the same, substantially as described.

9. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating-engine connected with both ends of the tool-cylinder, passages connecting each end of the  
 110 tool-cylinder with the other, check-valve mechanisms, one in each of said passages and oppositely arranged, a hollow plug-cock at one end of the tool-cylinder provided with longitudinal  
 115 and transverse openings for controlling the direction of air or flow of motive fluid from one end of the cylinder to the other and for cutting off or opening the same, substantially as described.

10. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein, a pulsating-engine connected with both ends of the tool-cylinder, passages connecting each end of the  
 120 tool-cylinder with the other, check-valve mechanisms, one in each of said passages and oppositely arranged, a hollow plug-cock at one end of the tool-cylinder provided with longitudinal  
 125 and transverse openings for controlling the direction of air or flow of motive fluid from one end of the cylinder to the other and for cutting off or opening the same, substantially as described.



nal and transverse openings for controlling the direction of air or flow of motive fluid from one end of the cylinder to the other and for cutting off or opening the same, and a casting for said plug-cock provided with transverse passages extending entirely there-through and detachably secured to said tool-cylinder at one end so as to permit the reversible arrangement of said casting thereon, substantially as described.

10. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, a valved casing detachably and reversibly secured to one end of said tool-cylinder, a plug-cock therein provided with a longitudinal passage forming the main passage thereof and three radial passages for shutting off the motive fluid and controlling the direction or flow of the same to and from that end of the tool-cylinder, a second casting detachably and reversibly secured to

the other end of the tool-cylinder and provided with a longitudinal and three radial passages—one connecting with that end of the tool-cylinder and the other leading to and adapted to be connected with the other end of the tool-cylinder, an intermediate casting provided with two passages leading therethrough and adapted to be brought into connection with the detachable castings at each end of the tool-cylinder and register with two of the radial passages therein, oppositely-arranged check-valve mechanism for each of such passages of the intermediate casting, and a pulsating-engine connected with the passages in the castings at each end of the tool-cylinder, substantially as described.

ROBERT TEMPLE.

Witnesses:

S. G. GILL,

JOS. S. DAVIS.