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R. TEMPLE.

PNEUMATICALLY ACTUATED TOOL.

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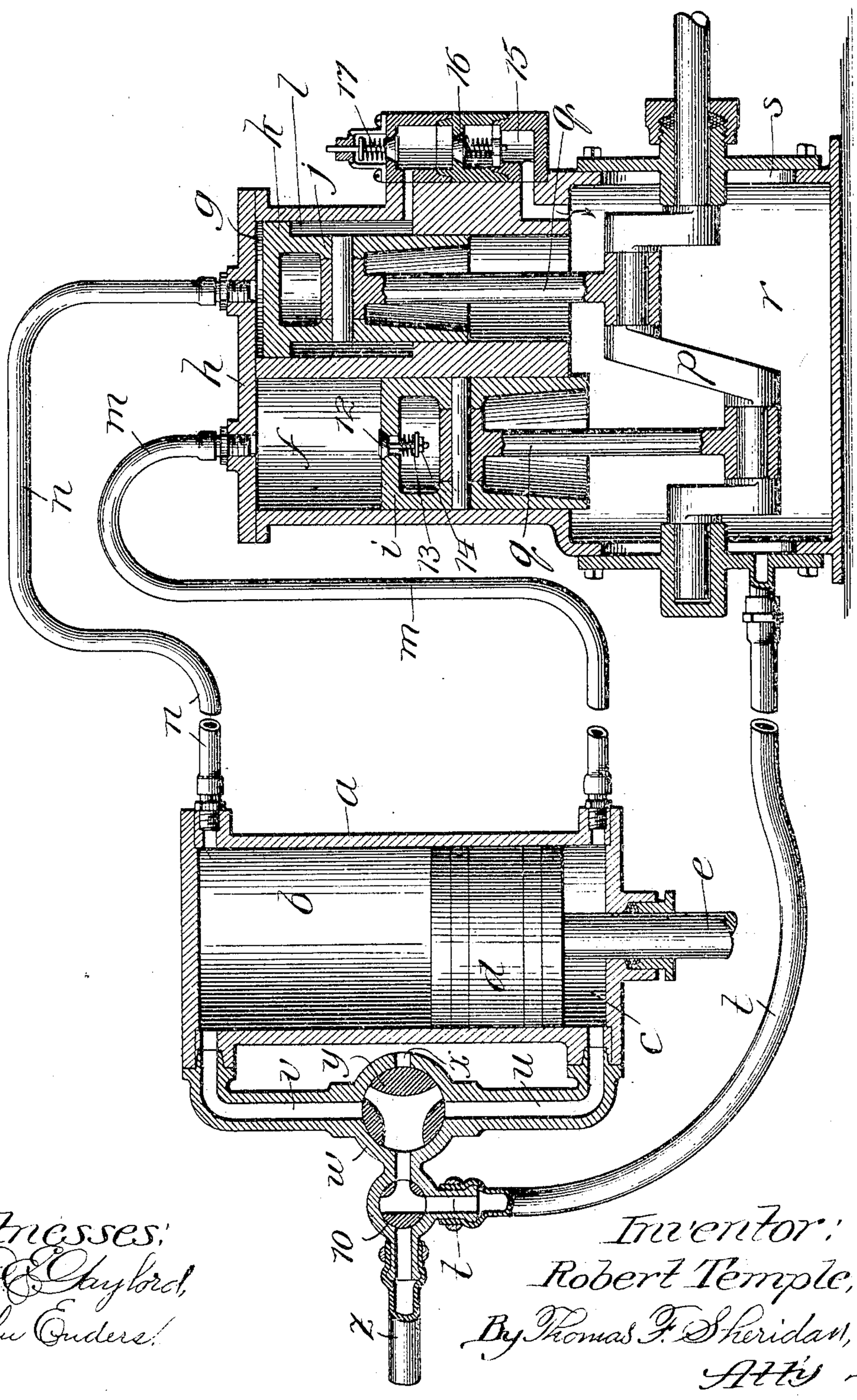

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UNITED STATES PATENT OFFICE.

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PNEUMATICALLY-ACTUATED TOOL.

SPECIFICATION forming part of Letters Patent No. 787,962, dated April 25, 1905.

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To all whom it may concern:

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

This invention relates to that class of tools which are capable of being actuated by means of fluid under pressure—compressed air—and particularly to the construction and arrangement of the parts by which the air is compressed and distributed throughout the system, 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.

The invention consists principally in a pneumatically-actuated tool in which there are combined a tool-cylinder, a reciprocating tool-piston mounted therein, two pulsating engine-cylinders closed at one end and open at the other end, a single-acting pulsating piston in each of the said pulsating engine-cylinders, a pipe or passage leading from one of said pulsating-cylinders to one end of the tool-cylinder, a pipe or passage leading from the other pulsating engine-cylinder to the other end of the tool-cylinder, a casing forming a chamber connecting the open ends of each of the pulsating engine-cylinders together, and means for operating the pulsating pistons.

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

In the accompanying drawing the figure shows a sectional elevation of one type of a 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 predetermined distance before it can be retracted, so that when operating on certain kinds of rock the engine will sometimes give out a short blow and refuse to move backward. This invention therefore is intended, primarily, to be an improvement on that type of engine in that instead of using the compressed air and exhausting it by the usual method air under pressure is maintained in the system and pulsated, so as to reciprocate the tool-piston, with its tool, in any desired manner, such piston, with its tool, being adapted to be moved backward and forward at any position of its stroke.

In constructing a tool in accordance with these improvements I provide a tool-cylinder *a*, having a cylindrical chamber therein divided into two parts *b* and *c* by means of a tool-piston *d*. The tool-piston has a projecting piston-rod *e*, extending, preferably, out through one cylinder-head and to which any tool may be attached to suit different circumstances and conditions. To reciprocate this tool-piston, two parallel-arranged pulsating engine-cylinders are arranged in one casting—that is, one casting is preferably provided with two parallel-arranged pulsating-engine-cylinder chambers *f* and *g*. The outer ends of these chambers are closed by means of a cap *h*, while the inner ends are open. Each of these cylinders is provided with a pulsating piston *i* and *j*. The piston *j*, however, is shouldered, as at *k*, which divides its chamber into two parts or chambers, one forming a pulsating-chamber *g* and the other an annular compressing-chamber *l* on opposite sides of the shoulder. It will be noticed that the annular compressing-chamber *l* is on the withdrawing side of the piston-shoulder—that is, the side opposite the pulsating side—so that during the retractable movement of the piston—the time when it is performing its least work—the additional function of compressing the air is performed. The pulsating engine-chamber *f* is connected with the chamber *c* at one end of the tool-cylinder by means of a pipe or passage *m*, and the other pulsating engine-chamber, *g*, is connected with the chamber *b* at the other end of the tool-cylinder by means of a pipe or passage *n*.

To reciprocate the pulsating piston mech-

anism, a double crank-shaft *p* is provided and connected with the piston by means of connecting-rods *q*. This crank-shaft may be driven in any suitable way, either directly connected with an armature-shaft of an electric motor or the crank-shaft of a turbine-engine or in any desired way with any desired prime mover.

In the drawing it will be seen that the combined cubical volume of both of the pulsating engine-cylinders when the pistons are in position is less than that of the cubical volume of the tool-cylinder. This arrangement and proportioning of the parts is such that it aids in securing as elastic and springy a blow as it is possible to secure.

To furnish the system with its supply of compressed air, an air-reservoir *r* is provided, formed by means of a casing *s*, which is attached to the pulsating engine-frame and may be used, when desired, as a base therefor. This air-reservoir connects the open ends of both of the pulsating engine-cylinders together, so that any leakage that occurs from one side of the pulsating pistons to the other will either enter the system from the reservoir or the reservoir from the system and not be lost. This compressed-air reservoir is also connected with the system by means of a pipe or passage *t*, which is connected with both ends of the tool-cylinder by means of branched passages *u* and *v*. The connections are interrupted by means of a valve-casing *w*, which is provided with passages connecting the pipes or passages *t*, *u*, and *v*, and with a fourth passage *x*, which connects the valve-chamber with the atmosphere. In this valve-casing is arranged a three-way-valve cock *y*, which is adapted to connect the passage *t* with either passage *u* or *v* of the branched passages or connect either of the branched passages *u* and *v* with the atmospheric passage *x*.

When it is desirable to use some other source of compressed-air supply in the reservoir, a pipe or passage *z* is provided and connected with the branched passages at the point where the pipe or passage *t* connects therewith, and such connecting-point should in such instances be provided with a second three-way valve 10, so as to close the system to the pipe *z*, as shown in the drawing, whenever necessary. At other times the second three-way valve may be turned to cut off the pipe or passage *t* from the system and connect the pipe or passage *z* therewith, all of which will be understood and appreciated by those skilled in the art. Again, when desirable, automatic mechanism may be used for charging the system from the reservoir, and in such instances one or both of the pulsating engine-pistons may be provided with spring-pressed check-valve mechanism 12, the tension of the spring 13 being regulated by means of nut mechanism 14. From an inspection of the drawing it will be seen that the arrangement of the check-valve is such that it opens toward the pulsating side and closes toward the reservoir side, so that when the pressure on the pulsating side exceeds that on the reservoir side the valve is kept closed; but when the pressure system falls below that contained in the reservoir such check-valve mechanism will open until the pressures are equal on both sides of the piston.

To furnish the reservoir with its supply of air under pressure, a valved pipe or passage 15 is provided, which connects the annular compressing-chamber *l* with the reservoir-chamber *r*. This valved passage is provided with a spring-pressed check-valve 16, as shown, that permits air under pressure to pass through such passage in one direction only. This passage is also provided with a spring-pressed inlet-valve 17, that permits air to enter the annular compressing-chamber during one stroke of the piston *k*, all of which will be understood and appreciated by those skilled in the art.

I claim—

1. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, two pulsating engine-cylinders closed at one end and open at the other, a single-acting pulsating piston in each of the said pulsating engine-cylinders, a pipe or passage leading from one of said pulsating-cylinders to one end of the tool-cylinder, a pipe or passage leading from the other pulsating-cylinder to the other end of the tool-cylinder, a casing forming a chamber connecting the open ends of each of the pulsating engine-cylinders together, and means for operating the pulsating pistons, substantially as described.

2. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, two pulsating engine-cylinders closed at one end and open at the other, a single-acting pulsating piston mounted in each of the pulsating engine-cylinders, a pipe or passage leading from one pulsating engine-cylinder to one end of the tool-cylinder, a pipe or passage leading from the other pulsating engine-cylinder to the other end of the tool-cylinder, branched passages connecting both ends of the tool-cylinder with a source of fluid-pressure supply to furnish the system with the proper fluid under pressure, and a valve in said branch passage to connect and disconnect the branched passages with the source of fluid under pressure, substantially as described.

3. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, two pulsating engine-cylinders closed at one end and open at the other, a pipe or passage connecting one of said pulsating-cylinders with one end of the tool-cylinder, a second pipe or passage connecting the other pulsating engine-cylinder

with the other end of the tool-cylinder, a casing forming a reservoir-chamber which connects both the open ends of the pulsating engine-cylinders together, a pulsating piston in each of said pulsating-cylinders, crank-shaft mechanism for reciprocating the pulsating piston mechanism, means for furnishing said reservoir with a supply of fluid under pressure, and a pipe or passage connecting both ends of the tool-cylinder with said reservoir to supply the system with the desired fluid under pressure, substantially as described.

4. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, pulsating-engine-cylinder mechanism connected with both ends of the tool-cylinder, pulsating piston mechanism dividing one of said pulsating-cylinders into two chambers—one a pulsating and the other a compressing side, and a reservoir connected with the system and with the compressing-chamber to receive its initial supply of fluid under pressure, substantially as described.

5. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, pulsating-engine-cylinder mechanism connected with both ends of the tool-cylinder, a casing providing an air-reservoir, a shouldered pulsating piston in one of the pulsating engine-cylinders dividing such cylinder into two chambers—a pulsating and a compressing chamber, a pipe or passage connecting the reservoir with both sides of the tool-piston to furnish the system with a supply of compressed air, a valved passage connecting the compressing side of the pulsating engine-cylinder with the reservoir, and means for operating the pulsating piston mechanism, substantially as described.

6. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, pulsating-engine-cylinder mechanism connected with both ends of the tool-piston, a compressed-air reservoir connected with the system to furnish it with a supply of compressed air, a shouldered pulsating piston reciprocatingly mounted in the pulsating-engine-cylinder mechanism and dividing one of the cylinders into two chambers—a pulsating and an annular compressing chamber, means for reciprocating the pulsating piston mechanism, and a valved passage connecting the compressing-chamber of the pulsating engine mechanism with the air-reservoir, substantially as described.

7. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, pulsating-engine-cylinder mechanism connected with both ends of the tool-cylinder, a compressed-air reservoir connected with the system to furnish it its supply of compressed air, a shouldered pulsating piston reciprocatingly mounted in one of the pulsating engine-cylinders and dividing it into two chambers—a pulsating-chamber on one side of the shouldered piston and an annular air-compressing chamber on the opposite side thereof, a valved passage connecting the annular compressing-chamber with the air-reservoir, and means for reciprocating the pulsating piston mechanism, substantially as described.

8. In a tool of the class described, the combination of a tool-cylinder, a tool-piston reciprocatingly mounted therein two pulsating engine-cylinders arranged parallel to each other closed at one end and open at the other—one connected with one end of the tool-cylinder and the other with the other end thereof, a casing providing a compressed-air reservoir connecting the open end of the pulsating engine-cylinders together, a pulsating piston in each of said pulsating engine-cylinders one of said pistons having a shoulder which divides its cylinder into two chambers—a pulsating and an annular compressing chamber, a valved passage connecting the annular compressing-chamber with the air-reservoir, and a passage or pipe connecting the air-reservoir with the system to furnish it a supply of air under pressure, substantially as described.

9. In a tool of the class described, the combination of a tool-cylinder, a reciprocating tool-piston mounted therein, two parallel-arranged pulsating engine-cylinders of less combined volume than the tool-cylinder and closed at their outer and open at their inner ends, one of said cylinders being connected with one end of the tool-cylinder and the other with the other end, a casing providing a compressed-air reservoir connecting the open ends of the pulsating engine-cylinders together, a pulsating piston in each of said pulsating engine-cylinders, means for furnishing the air-reservoir a supply of compressed air, and a passage connecting the air-reservoir with a system of compressed air, substantially as described.

10. In a tool of the class described, the combination of a tool-cylinder provided with a reciprocating tool-piston, two parallel-arranged pulsating engine-cylinders of less combined volume than the tool-cylinder and closed at their outer and open at their inner ends, a pipe or passage connecting one of said pulsating engine-cylinders with one end of the tool-cylinder, a pipe or passage connecting the other end of said pulsating engine-cylinder with the other end of the tool-cylinder, branched pipes or passages connected with both ends of the tool-cylinder, a casing providing a reservoir connecting the open ends of the pulsating engine-cylinders together, pulsating piston mechanism in each of the pulsating engine-cylinders, a shoulder on one of said pulsating pistons which divides its cylindrical chamber into two parts—a pulsating-chamber and an annular compressing-chamber, a valved passage connecting the

annular compressing-chamber with the air-reservoir, an air-inlet valve for said annular compressing-chamber, a pipe or passage connecting the air-reservoir with the branched passages of the tool-cylinder, a valve-casing connected with the branched passages of the tool-cylinder, air-reservoir pipe and atmosphere, a valve in said valve-casing to connect and disconnect the passages therein named, and means for reciprocating the pulsating piston mechanism, substantially as described.

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