

F. M. PRESCOTT & E. P. WORDEN.
STEAM ENGINE.

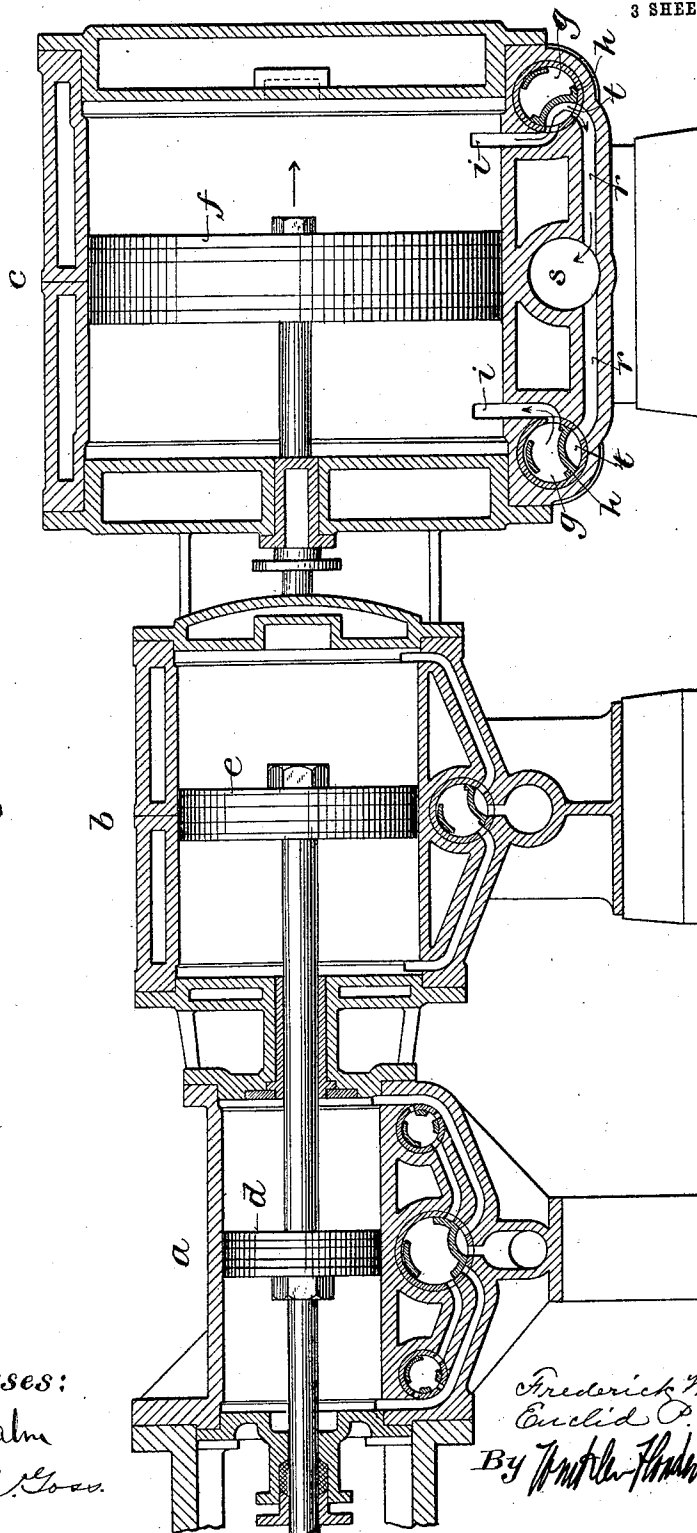
APPLICATION FILED JULY 10, 1907.

1,033,930.

Patented July 30, 1912.

3 SHEETS—SHEET 1.

Fig. 1.



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3 SHEETS—SHEET 2.

Fig. 2.

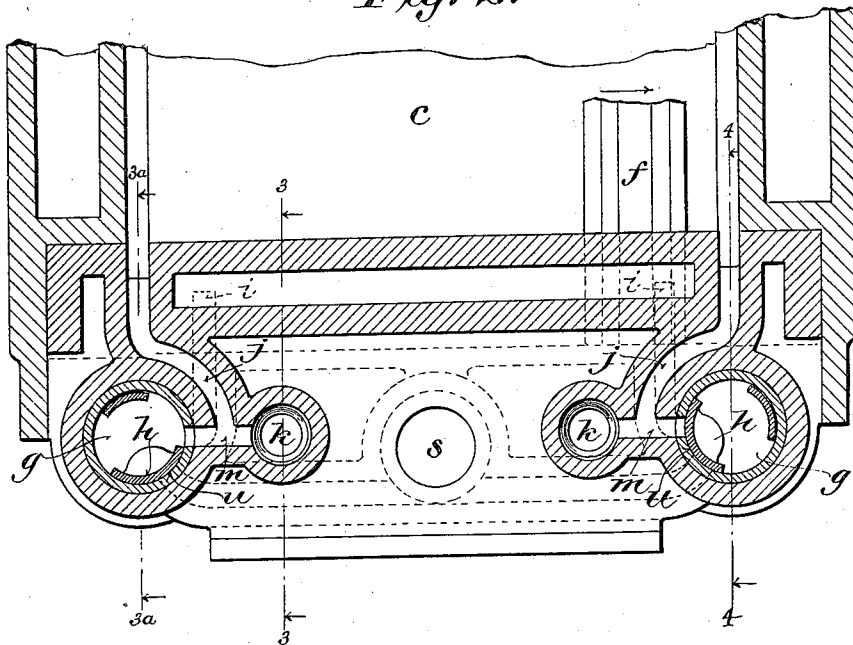
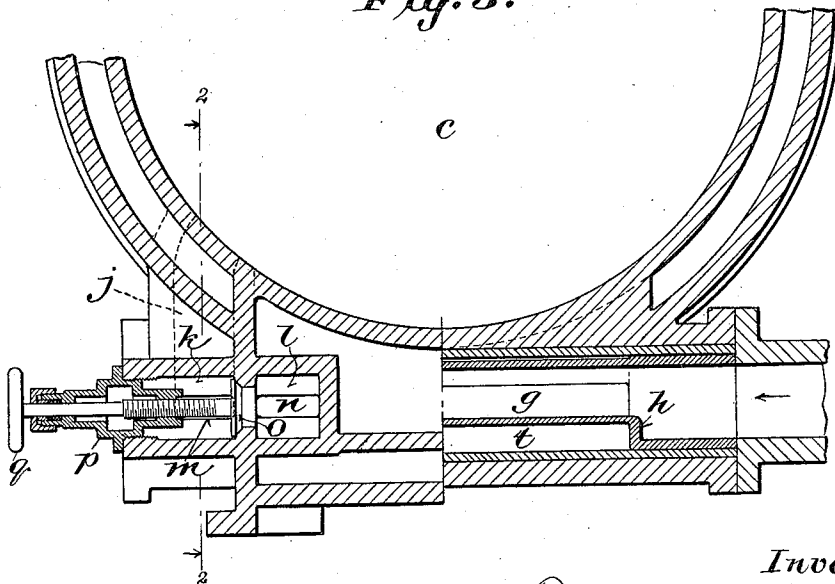


Fig. 3.



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3 SHEETS—SHEET 3.

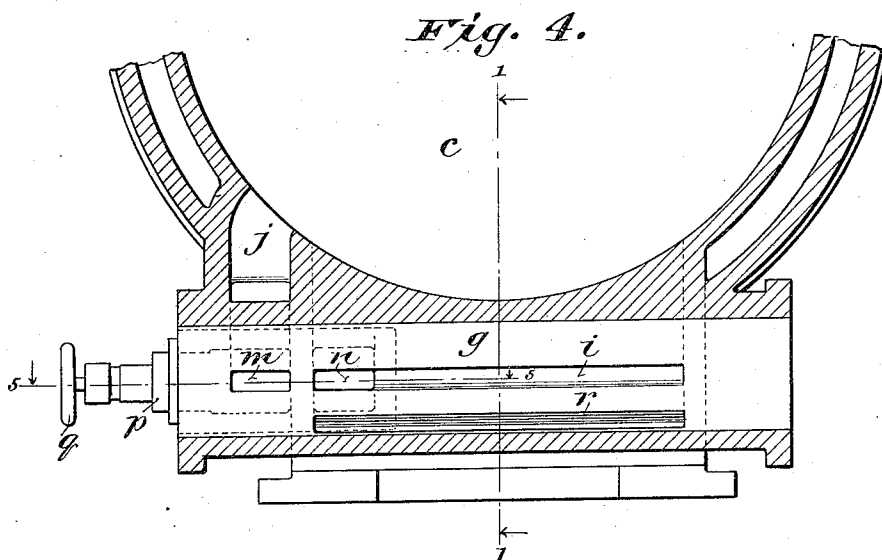


Fig. 5.

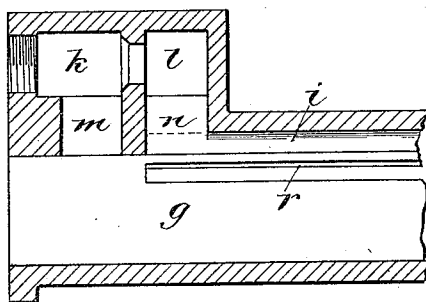
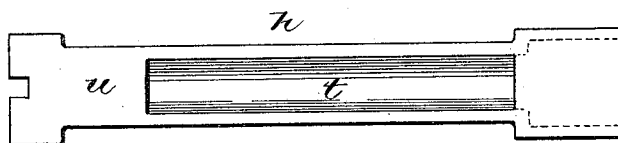


Fig. 6.



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UNITED STATES PATENT OFFICE.

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STEAM-ENGINE.

1,033,930.

Specification of Letters Patent.

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To all whom it may concern:

Be it known that we, FREDERICK M. PRESCOTT and EUCLID P. WORDEN, citizens of the United States, residing at Milwaukee, in the county of Milwaukee and State of Wisconsin, have invented certain new and useful Improvements in Steam-Engines, of which the following is a specification, reference being had to the accompanying drawing, forming a part thereof.

This invention relates more particularly to direct acting simple or multiple expansion pumping engines.

Its main objects are to reduce clearance space and at the same time provide for varying the steam cushion of the piston in the ends of the cylinder, without reducing or affecting the admission and main exhaust of steam, and generally to improve the construction and operation of engines of this class.

It consists in certain novel features of construction and in the peculiar arrangement and combinations of parts as hereinafter particularly described and pointed out in the claims.

In the accompanying drawing like characters designate the same parts in the several figures.

Figure 1 is an axial section on the line 1 1, Fig. 4, of a triple expansion engine embodying the present invention; Fig. 2 is a vertical section of the low pressure cylinder and valves on the line 2 2, Fig. 3; Fig. 3 is a vertical cross section, the left hand half on the line 3 3, and the right hand half on the line 3^a 3^a, Fig. 2; Fig. 4 is a vertical cross section on the line 4 4, Fig. 2; Fig. 5 is a horizontal section on the line 5 5, Fig. 4; and Fig. 6 is a face view of one of the distributing valves.

For the purpose of illustration and explanation, the improvements constituting the invention are shown and will be described in connection with a low pressure cylinder of a triple expansion engine, although they may be embodied in a simple engine or in connection with any or all of the cylinders of multiple expansion engines.

Referring to Fig. 1 of the drawing, *a* des-

ignates the high pressure cylinder, *b* the intermediate cylinder and *c* the low pressure cylinder, and *d*, *e* and *f*, the pistons of the respective cylinders.

The low pressure cylinder is formed or provided on one side at the ends with transverse cylindrical distributing valve chambers *g* in which are fitted the oscillatory distributing valves *h*. Each chamber *g* is connected with the interior of the cylinder *c* by a main port *i*, as shown in Fig. 1, and by an auxiliary port *j*, as shown in Figs. 2, 3 and 4. The auxiliary ports *j*, which are of smaller area than the main ports *i*, as shown in Fig. 4, open into the cylinder *f* at or close to its ends, while the main ports *i* open into the same at a distance from its ends, as shown in Figs. 1 and 2. Adjacent to and parallel with the valve chambers *g*, the cylinder *c* is formed or provided with regulating valve chambers, each comprising two compartments, an outer compartment *k* and inner compartment *l*, as shown in Figs. 3 and 5. The compartment *k* is connected with the associated valve chamber *g* and auxiliary port *j* by a branch port *m*, separate and distinct from the opening of the main port *i* into said chamber, and the compartment *l* is connected by a branch port *n* with said chamber and main port, as shown in Figs. 4 and 5. As shown in Fig. 4, the branch ports *m* and *n* are of the same area or as large as the auxiliary ports *j*, those portions of the branch ports *m* which connect the valve chambers *g* with the ports *j* serving solely as admission ports and the branch ports *n* serving solely as exhaust ports.

A regulating or throttling valve *o*, which has a seat in an opening between the compartments *k* and *l*, as shown in Fig. 3, controls communication between said compartments and between the auxiliary port *j* and the branch port *n* at each end of the cylinder. This valve is provided with a stem which is threaded in a cap and stuffing box closing the outer end of the compartment *k*, and is provided at its outer end with a hand wheel *q* or other means for turning it by hand. Exhaust ports *r* opening from the valve chambers *g* adjacent to the openings of

the main ports *i*, connect said chambers with an exhaust way or passage *s*, as shown in Fig. 1.

The distributing valves *h*, which are operated by the usual or any suitable form of valve gear (not shown) are formed in their working faces, as shown in Fig. 6, with cavities *t* adapted to bridge and connect the main ports *i* with the exhaust ports *r*, as shown at the right in Fig. 1. At one end of these cavities the valves are formed with extended cylindrical faces *u*, which are adapted to close the branch ports *m* when the associated main and exhaust ports *r* are connected and communicate with each other through the cavities *t*, as shown at the right in Figs. 1 and 2. Live steam is supplied to the valve chambers *g* at one end thereof, as shown in Fig. 3.

The engine so far as the improvements constituting the present invention are concerned, operates as follows: Assuming that the piston *f* is moving as indicated by the arrow on Fig. 1, toward its back head, the valve *h* at the left occupying the position in which it is shown in Figs. 1 and 2, uncovers both the main and branch ports *i* and *m*, admitting steam through them and the auxiliary port *j* into the cylinder, while the valve *h* at the right, connects the main port *i* with the exhaust port *r* through the cavity *t*, as shown in Fig. 1, allowing the steam to escape from the cylinder ahead of the piston. In this position of the valve *h* at the right, its face *u* covers the branch port *m*, as shown in Fig. 2, and prevents the escape of steam through the auxiliary port *j* and valve chamber *g* directly into the exhaust port *r*, and if the associated regulating valve *o* is closed, as shown in Fig. 3, no steam can pass from said auxiliary port *j* and the compartment *k* into the compartment *l* and thence through the branch port *n* into the main port *i*, which now communicates through the cavity *t* in the valve *h* with the exhaust port *r*. When the piston *f* passes over and closes the main port *i* as shown in Fig. 2, all escape of steam from the space between it and the back head is cut off, and the steam contained in said space will be compressed, and cushion to the fullest degree the piston at that end of its stroke. As the piston completes its back stroke, the distributing valves are reversed, the valve at the right opening both the main port *i* and the branch port *m* and admitting steam first through said branch port and the auxiliary port *j* behind the piston, which now covers the main port *i*. As soon as the piston on its return stroke passes and uncovers the main port *i*, steam will be admitted through said main port as well as the branch and auxiliary ports *m* and *j* into the cylinder.

By opening the regulating valves *o* more

or less, the escape of steam from the cylinder through the auxiliary and branch ports *j* and *m*, valve chambers *k* *l* and branch ports *n* can be varied, and the amount of cushion at the ends of the piston stroke adjusted as desired when the associated main ports *i* are covered by the piston and the branch ports *m* are covered by the faces *u* of the distributing valves *h*. It will thus be seen that with the construction and arrangement of valves and ports as herein shown and described, while steam is freely admitted through both the main ports *i* and the auxiliary ports *j* into the cylinder behind the piston, it can escape from the cylinder behind the piston only through the main ports *i*, unless the regulating valves *o* are open, and then only to the extent of the opening of said valves, by way of the auxiliary and branch ports *j* and *m*, the compartments *k* and *l* of the regulating valve chambers, and the branch ports *n* which open into the valve chambers *g* in communication with the main ports *i*. It will also be observed that both the distributing and the regulating valves being located close to the ends of the cylinder, the ports connecting them with the interior of the cylinder are short, and the clearance space is thus reduced to a minimum.

Various changes in the details of construction and arrangement of parts may be made without departing from the principle and intended scope of the invention.

The term "steam" as herein employed is intended to include any other elastic fluid medium, such as air, by which engines of this class are or may be operated.

We claim:

1. In a steam engine the combination of a cylinder having main and auxiliary ports, the auxiliary ports opening into the cylinder nearer its ends than the main ports and each having branches opening separately into the associated distributing valve chamber, distributing valves controlling the admission and exhaust of steam to and from said cylinder through said ports and adapted to admit steam simultaneously into both ports at each end of the cylinder, and to close one branch of each auxiliary port when the associated main port is open to exhaust, and regulating valves each controlling the exhaust through the other branch of the associated auxiliary port.

2. In a steam engine the combination of a cylinder having valve chambers at the ends and main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports opening into the cylinder nearer its ends than the main ports and each having two branches opening into the associated valve chamber, a regulating valve controlling one of the branches of each auxiliary port, and distributing valves fitted in said chambers,

adapted to admit steam directly and simultaneously into both main and auxiliary ports at each end of the cylinder and having faces at one end which close the other branches of the auxiliary ports when the main ports are open to exhaust.

3. In a steam engine the combination of a cylinder having cylindrical valve chambers at the ends, exhaust ports leading from the valve chambers, main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports opening into the cylinder nearer its ends than the main ports and each having two branches opening into the associated valve chamber approximately in line with the main port, a regulating valve controlling communication between the two branches of each auxiliary port, and oscillatory distributing valves fitted in said chambers and each adapted to admit steam directly and simultaneously into both the main and auxiliary ports and having a cavity adapted to connect the main port and one branch of the auxiliary port with the exhaust port and a face adjacent to one end of said cavity adapted to close the other branch of the auxiliary port when the main port and the exhaust branch of the auxiliary port are connected by said cavity with the exhaust port.

4. In a steam engine the combination of a cylinder having distributing valve chambers at the ends, regulating valve chambers comprising two compartments adjacent to and parallel with the distributing valve chambers, exhaust ports leading from the distributing valve chambers, main ports connecting the distributing valve chambers with the interior of the cylinder at a distance from the ends thereof, auxiliary ports communicating with the interior of the cylinder adjacent to its ends, a branch port connecting one compartment of each regulating valve chamber and the associated distributing valve chamber with the auxiliary port at that end of the cylinder, branch ports connecting the other compartments with the distributing valve chambers, regulating valves controlling communication between said compartments, and distributing valves each adapted in one position to directly and simultaneously admit steam into both main and auxiliary ports and in another position to simultaneously connect the main port and the exhaust branch of the auxiliary port with the exhaust port and close the other branch of the auxiliary port.

5. In a steam engine the combination of a cylinder having valve chambers adjacent to the ends, exhaust ports leading out of said chambers, and main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports, opening into the cylinder nearer its ends

than the main ports and each having two branches opening into the adjacent valve chamber and each of as great area as the auxiliary port, and distributing valves each adapted in one position to connect the main port and one branch of the auxiliary port with the exhaust port and close the other branch of the auxiliary port, and in another position to admit steam directly and simultaneously into both the main and auxiliary ports.

6. In a steam engine the combination of a cylinder having transverse cylindrical valve chambers adjacent to the ends, exhaust ports leading from said chambers, and main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports opening into the cylinder nearer its ends than the main ports and each having branches, one of which opens into the adjacent main port and the other into the associated valve chamber independently of said main port and each of as great area as the auxiliary port, and distributing valves fitted in said chambers, and each adapted in one position to admit steam directly and simultaneously to both main and auxiliary ports and having a cavity adapted in another position of the valve to connect the main port and one branch of the auxiliary port with the exhaust port and a face adapted to close the other branch of the auxiliary port when the main port is connected with the exhaust port.

7. In a steam engine the combination of a cylinder having valve chambers adjacent to its ends, main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports opening into the cylinder nearer its ends than the main ports, branch ports connecting each auxiliary port with the associated valve chamber and being of as great area as said auxiliary port, one of said branch ports serving solely for admission of steam into and the other solely for exhaust of steam from the cylinder, regulating valves controlling the exhaust branches of the auxiliary ports, and distributing valves controlling the admission of steam to the cylinder through the main ports and admission branches of the auxiliary ports and the exhaust from the cylinder through the main ports and exhaust branches of the auxiliary ports and having faces adapted to close the admission branches of the auxiliary ports when said exhaust branches are open to exhaust.

8. In a steam engine the combination of a cylinder having transverse valve chambers adjacent to its ends, main and auxiliary ports connecting each valve chamber with the interior of the cylinder, the auxiliary ports opening into the cylinder nearer its ends than the main ports, exhaust ports

opening from the valve chambers adjacent to the main ports, branch ports separately connecting each auxiliary port with the associated valve chamber, one of said
5 branches serving solely as an exhaust and the other as an admission port, regulating valves controlling the exhaust branches of the auxiliary ports, and distributing valves adapted to simultaneously connect the main
10 ports and exhaust branches of the auxiliary ports with the exhaust ports and having

faces adapted to close the admission branches of the auxiliary ports when the exhaust branches thereof are open to exhaust.

In witness whereof we hereto affix our 15 signatures in presence of two witnesses.

FREDERICK M. PRESCOTT.
EUCLID P. WORDEN.

Witnesses:

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F. J. TILLMAN.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."