P. F. ODDIE.

DIRECT ACTING PUMP.

APPLICATION FILED APR. 20, 1908.

974,698. Patented Nov. 1, 1910.

2 SHEETS—SHEET 1.

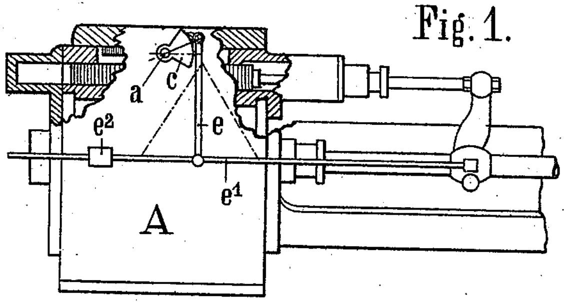

Fig. 1.

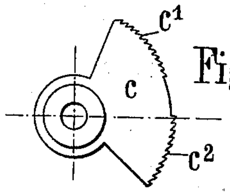

Fig. 4.

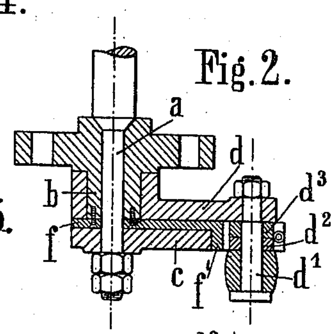

Fig. 2.

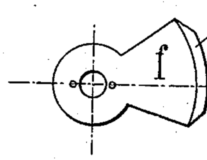

Fig. 5.

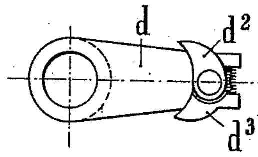

Fig. 6.

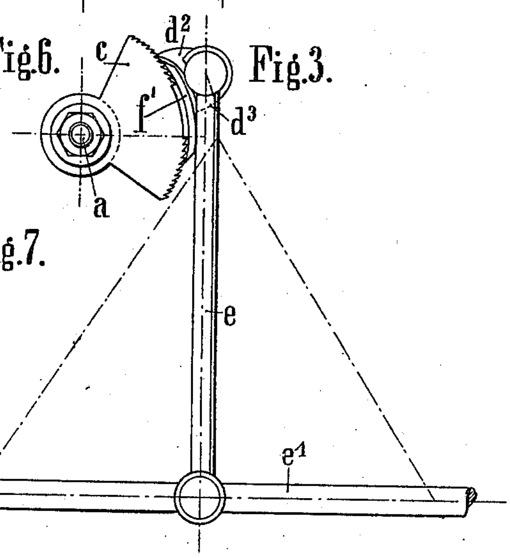

Fig. 3.

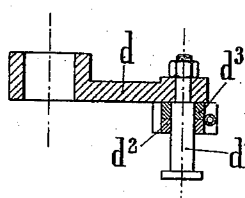

Fig. 7.

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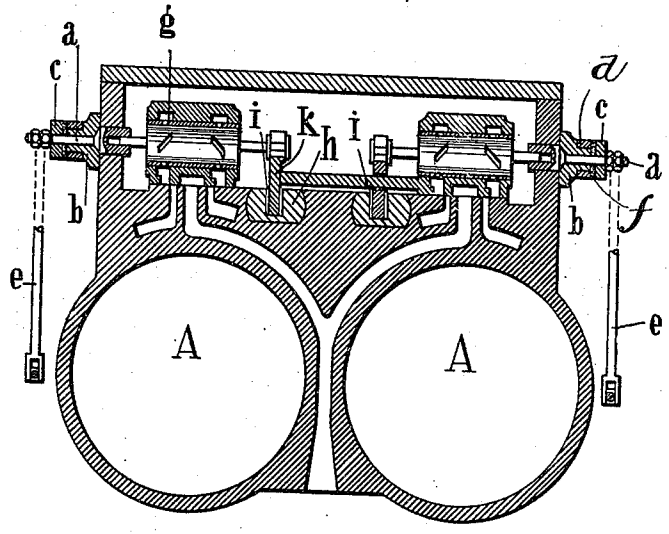
2 SHEETS—SHEET 2.

Fig. 8.



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UNITED STATES PATENT OFFICE.

PHILIP FRANCIS ODDIE, OF WIMBLEDON, NEAR LONDON, ENGLAND.

DIRECT-ACTING PUMP.

974,698. Specification of Letters Patent. **Patented Nov. 1, 1910.**

Application filed April 20, 1908. Serial No. 428,274.

To all whom it may concern:

Be it known that I, PHILIP FRANCIS ODDIE, engineer, a subject of the King of Great Britain and Ireland, and resident of Wimbledon, near London, England, have invented new and useful Improvements in Direct-Acting Pumps, of which the following is a specification.

This invention relates to direct-acting pumps where the stroke is not determined by the action of a crank or similar mechanism but is more or less indeterminate. Now in such pumps, the point at which the supply of steam or motive fluid must be cut off to bring the reciprocating parts to rest at the end of the correct stroke, must be varied for each alteration of the speed, as the period of expansion, or that portion of the stroke in which the piston will travel after the fluid has been cut off in the cylinder is proportional to the momentum of the parts, or in other words, the speed at which the pump is run. Now the constant necessity for this hand regulation forms a great drawback to such a pump, and often results in a large waste of working fluid, especially where the delivery of the pump is constantly varying, such as with boiler feed pumps working on a large number of boilers in electric power station and the like; since, as it is impossible to alter the expansion by hand for every change of speed, the pumps are worked with short strokes at slow speeds, in order to provide against the pistons striking the cylinder heads at higher speeds.

The object of the present invention is the removal of this defect, by supplying an automatic regulation of the expansion valves instead of hand regulation.

The principle on which my invention works is to actuate the cut-off or expansion valves in such a way that at every stroke a slightly increased period of admission is given to the fluid entering the cylinder, which tends to cause each stroke to be slightly longer than the preceding stroke, and this length of stroke continues until the normal or full stroke is reached or slightly exceeded. The expansion valves are then actuated to lessen the period of admission, thus counteracting the small increased admission given at each stroke.

Various ways can be devised for carrying out this invention, the principle however remaining the same, namely that the admission is constantly increasing so long as the pump is working with a length of stroke below the normal, but as soon as the pump has reached full strokes or slightly over full strokes, the action is checked, and if necessary, reversed. I have found however that in practice the directly mechanical operation has advantages as regards simplicity and certainty of action, and the accompanying sheet of drawings shows one form of carrying out my invention as applied to a direct-acting pump fitted with expansion or cut-off valves.

Figure 1 is an outside view of the steam end of such a pump fitted with my invention. Figs. 2 and 3 show to an enlarged scale the various operating parts together, while Figs. 4, 5, 6 and 7 show details of certain of the same parts. Fig. 8 is a central cross section of a pump involving my invention.

a is a spindle which engages in the expansion valves in such a way that any turning movement given to this spindle imparts a corresponding turning movement to the expansion valves, so as to alter the period of admission of steam to the cylinder A.

Attached to the spindle is a bearing b, through which the spindle a passes. To the outer end of the spindle is attached a quadrant c having on its peripherey teeth c', c^2. A rock shaft d is mounted freely on the bearings b, and carries at its outer edge a pin d', on which are freely mounted pawls d^2, d^3.

A quadrant f corresponding with the quadrant c, but attached to the bearing b is provided, and is formed with an outwardly disposed flange f' projecting across the central outer edge of the quadrant c so as to hold the pawls d^2 and d^3 away from engaging in the teeth of the quadrant c for a certain portion of the circumference of the quadrant c.

An oscillating motion is given to the rock shaft d by means of the rod e, engaging at one end with the pin d', being hinged at the other end to the rod e', this rod partaking of the motion of the piston. This rod is guided in the bearing e^2, so that its motion is parallel with the motion of the piston or piston rod.

In operation, the motion of the piston rod being transferred to the rod e by means of the rod e' will cause the rock shaft d to oscillate, carrying the pawls d^2 and d^3 with it, the outer ends of which will bear on the

flange f' of the fixed quadrant f. The spindle a engages in the distributing valves g (Fig. 8) so that any turning movement of the spindle is imparted to the valves. The valves are moved by guide-blocks h, which have slots i, by means of guides k. The guide-blocks h are connected to rods which are driven through the piston-rod, being secured to the same piston-rod to which is attached the rod e'. If the guide-blocks are driven in a longitudinal direction with respect to the piston-rod the valves move in direction transversal thereto, opening and closing thereby the steam-ports corresponding to the position imparted through the spindle a.

Just about the middle of the stroke, when the rock shaft d is at its highest point, the pawl d^2 will pass over the flange of the fixed quadrant f, and engage in the teeth c' of the quadrant c, and will move the quadrant slightly higher, which being attached to the spindle a will operate the expansion valves, so as to give a slightly increased admission. As the stroke proceeds, the rock shaft d will descend, and should the stroke be slightly exceeded, the pawl d^3 will pass over the lower end of the flange of the fixed quadrant f, and engage in the lower set of teeth c^2 of the quadrant c, moving the quadrant c slightly back, and through the spindle a will cause the expansion valves to give slightly less admission. It is arranged that so long as the pump is making short strokes or strokes below the normal, the pawl d^3 will not come in contact with the lower set of teeth c^2 of the quadrant c at the ends of the stroke. Hence no motion to give less admission will be given to the expansion valves, whereas at every stroke the pawl d^2 will come in contact with the upper set of teeth c' at about the middle of the stroke, and a slightly increased admission will be given. In this way I am able in a pump without flywheel or rotating parts to provide a simple and efficient means of regulating automatically the expansion required to insure full strokes at greatly varying speeds and pressures, the regulation being controlled by the length of stroke made by the the pump itself.

I claim:—

In a direct acting pumping engine having an indeterminate length of stroke, the combination of a plurality of cylinders, a piston in each cylinder, a main valve and a distributing valve for each cylinder and means for automatically varying the periods of fluid pressure through said valves controlled by the length of stroke of said pistons, said means including a toothed quadrant and ratchet adapted at times to engage the teeth on said quadrant and at other times to engage a smooth part of said quadrant and connections between said ratchet and said pistons; substantially as described.

In testimony, that I claim the foregoing as my invention, I have signed my name in presence of two witnesses, this 6th day of April 1908.

PHILIP FRANCIS ODDIE.

Witnesses:

F. L. RANDS,

R. F. WILLIAMS.