(No Model.)

J. H. FOGARTY.

STEAM ENGINE.

No. 369,511. Patented Sept. 6, 1887.

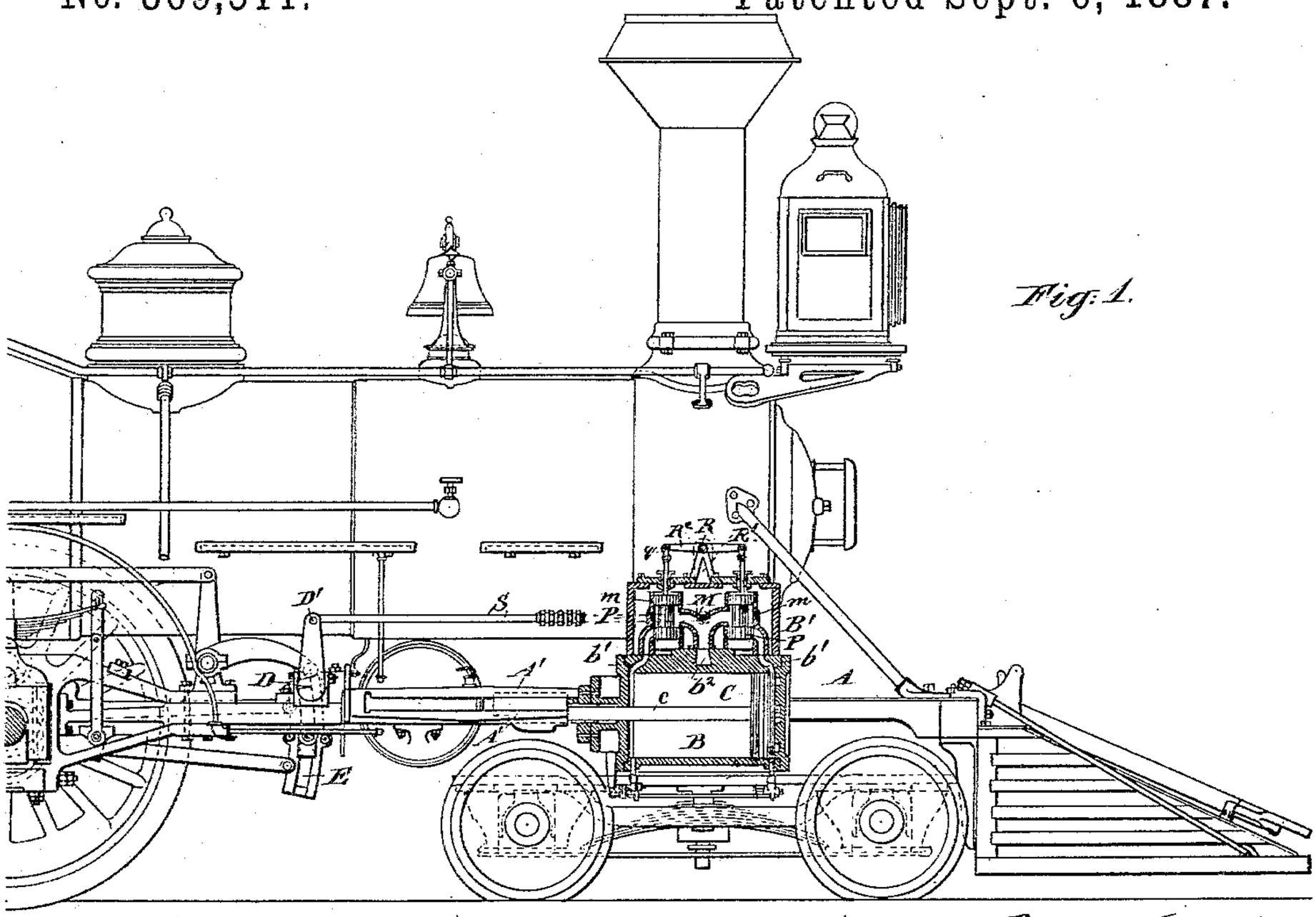

Fig: 1.

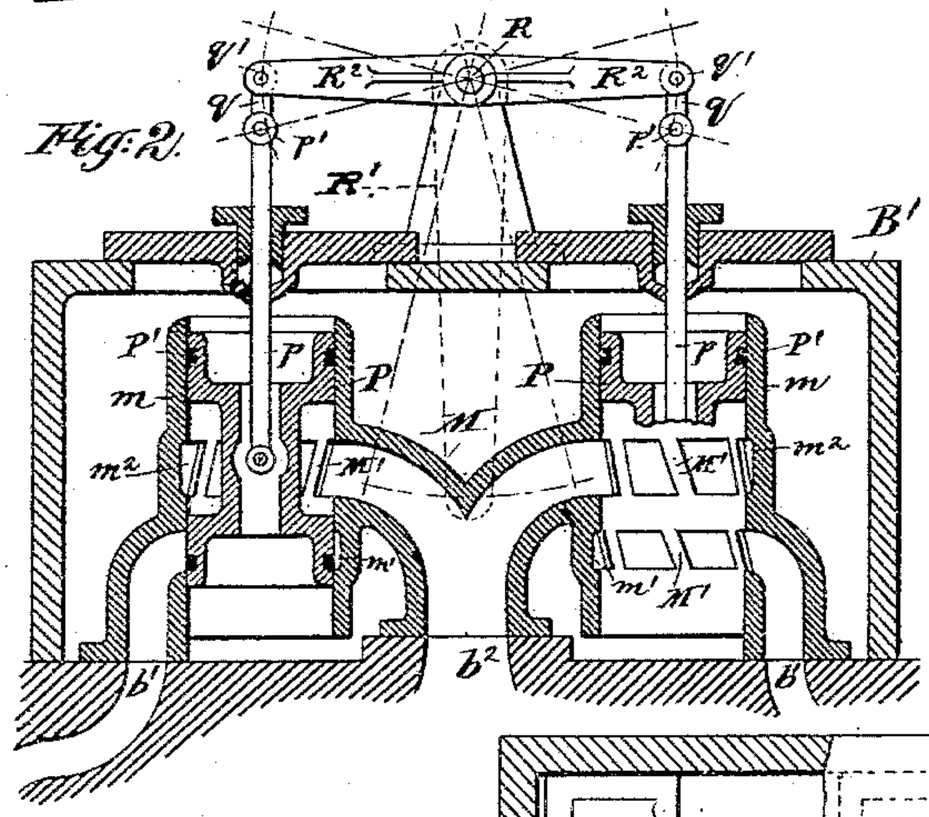

Fig: 2.

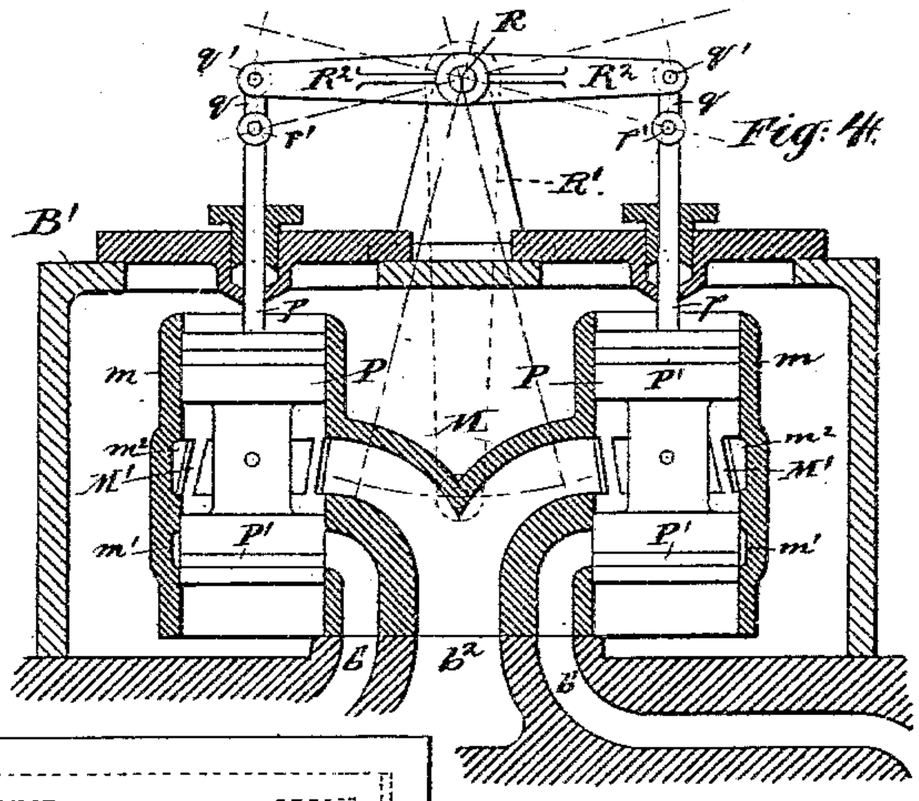

Fig: 4.

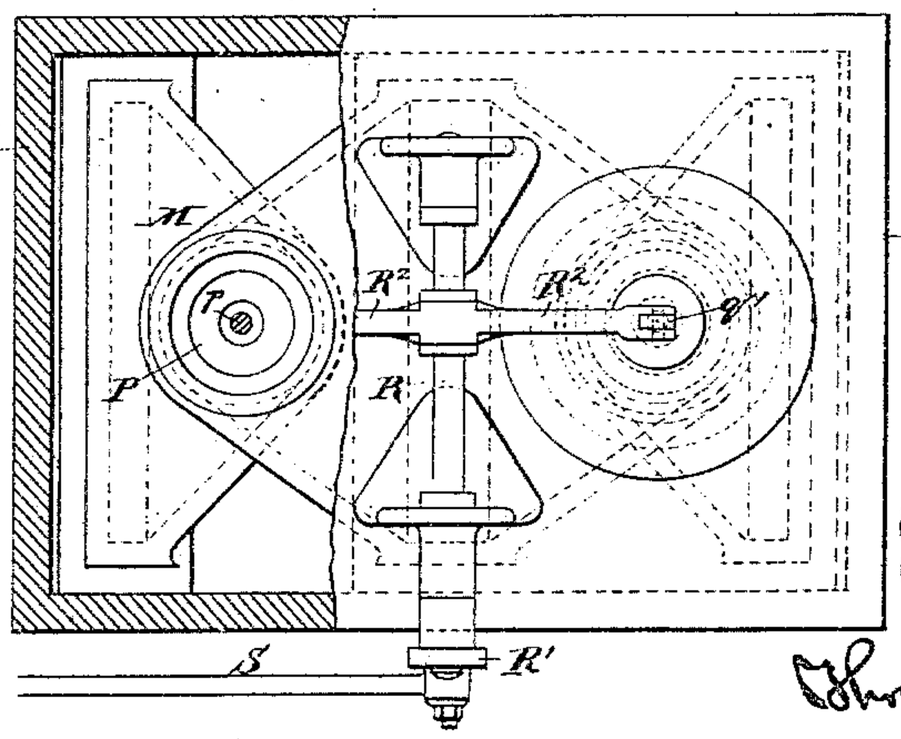

Fig: 3.

Witnesses:
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Thomas Drew Seton

UNITED STATES PATENT OFFICE.

JAMES H. FOGARTY, OF NEW YORK, N. Y.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 369,511, dated September 6, 1887.

Application filed December 6, 1886. Serial No. 220,815. (No model.)

To all whom it may concern:

Be it known that I, JAMES H. FOGARTY, of New York city, in the State of New York, have invented a certain new and useful Improvement in Steam and Gas Engines, of which the following is a specification.

The improvement relates to the valves and the parts immediately adjacent thereto which control the induction and eduction of the steam to and from the cylinder. I employ two valves, one for each end of the cylinder. Each valve serves both to admit and discharge. I have devised a construction which makes each perfectly balanced both as to the pressure of the steam and the gravity, and which causes all parts to be uniformly treated.

The invention may apply to cylinders already in use, or to new ones made in the same manner as heretofore; but I can carry out the invention in a different and on some accounts superior manner by constructing the cylinder with special reference thereto.

The accompanying drawings form a part of this specification, and represent the invention as applied to a locomotive.

Figure 1 is a side elevation, partly in section, showing the front end of a locomotive. The cylinder has been specially constructed with reference to the application of my invention. Fig. 2 is a corresponding vertical section, showing a portion on a larger scale. Fig. 3 is a corresponding plan view, partly in horizontal section. Fig. 4 is a vertical section corresponding to Fig. 2, but representing a modification.

Similar letters of reference indicate corresponding parts in all the figures where they occur.

A is the framing of the locomotive, and A' A' are the slides, which perform their usual functions of guiding the cross-head. The locomotive may have the ordinary boiler, smoke-pipe, driving-wheels, truck, &c.

B is one of the cylinders, containing a reciprocating piston, C, connected by the piston-rod *c* to the cross-head, and through the latter to the cranks on the driving-wheels, all in the ordinary manner. B' is the steam-chest fixed firmly but removably to the cylinder. It is longer and higher than the ordinary steam-chest, for reasons which will presently appear.

D is the ordinary rock-shaft, receiving motion through a Stevenson link, E, from eccentrics arranged as usual.

In the interior of the steam-chest is inclosed a casting, M, which performs important functions. It is bolted tightly upon the cylinder B, and has two upright cylinders, *m m*, each having two internal horizontal grooves or ports, m' m^2, extending quite around and communicating, respectively, with ports b' b^2, cored in the cylinder B. A piston-valve, P, contracted at its mid-length, but fitting steam-tight at its upper and lower ends, plays tight and easy up and down in each cylinder *m*. Each piston-valve P connects by a rod, *p*, knuckle p', link *q*, and knuckle q' with an arm, R^2, of a balance-shaft, R, which is mounted in fixed bearings, and receives a rocking motion through an arm, R', and link S, which latter is connected with an arm, D', on the rock-shaft D. The port b' communicates with the interior of the main cylinder B. The port b^2 is the exhaust-port, and communicates with the atmosphere.

In each piston-valve P are metallic packings P', which may be held outward either by springs or by the pressure of steam. These packings are well known and require no specific description. The ports b' b^2, which encircle each piston, are bridged across at short intervals by oblique bridges M', which serve an important function in keeping the packings in place as they slide alternately in one direction and the other across the ports.

Both the upper and lower ends of each cylinder *m* are open to the pressure of the steam in the interior of the steam-chest. The live steam therefore acts with its full force equally against the top and bottom faces of each piston-valve P. The pressure of the steam is thus perfectly balanced on each piston itself. The gravity of each piston-valve is exactly balanced by that of the other, each being connected to an equal arm, R^2, on opposite sides of the balance-shaft R. There is a passage longitudinally through the interior of each valve only partially obstructed by the valve-stem and the transverse pin which engages it. This passage allows the access of live steam to the interior of the valve, and insures that all parts are heated up to the temperature of the live steam.

The proportions are such that when the link E is by the proper shifting mechanism (not represented) raised to its highest or depressed to its lowest position, so as to give the greatest rocking motion to the rock-shaft R, and consequently the greatest vertical movement to the pistons P′, the steam is admitted below one of the piston-valves P through the port *m′ b′* to fill one end of the main cylinder, while the corresponding passage at the opposite end is in free communication through the hollow central portion of the opposite piston-valve P and the exhaust-port b^2 with the external atmosphere. As the piston C reciprocates, the balance piston-valves P P alternately rise and sink and distribute the steam to the proper end of the cylinder and discharge it from the other end. The same effect follows the shifting of the link E with this arrangement as with the ordinary slide-valves. The shifting it from one extreme to the other reverses the engine. The shifting it from either extreme position to one of the intermediate positions reduces the motion of the piston-valves P, so as to cut off the admission of live steam and cushion the exhaust-steam. The effect is the same as with the hollow-throated slide-valve ordinarily employed on locomotives, but with all sides of the cylinder *m* completely immersed in the live steam, and also the valve traversed by and thoroughly heated by the same, so that all parts are fully up to the temperature of the live steam, the pressure of the steam and also the gravity of the valves balanced.

Little inconvenience or loss of effect is found to result under favorable conditions from the space involved in the valve-passages; but under other conditions such space is objectionable. The construction shown in these figures involves somewhat less space in the valve-passages than that in the ordinary locomotive.

Fig. 4 shows a construction in which there is more space in the valve-passages. The construction shown in this figure, which represents a modification of my invention, may be employed on engines already made and in use by simply making the required changes in the steam-chest and its inclosed and connected parts. In this figure the ports *b′*, communicating with the ends of the cylinder, are more tortuous than in the other form. With short cut-off and high compression—such as is common for full speed with fast trains—the increased space is no disadvantage. For slower trains the construction shown in Figs. 1 to 3 is preferable.

I attach importance to the fact that the cylinders *m m* are upright and open at both ends, and that the piston-valves P P, carried therein, being of equal weight connected to equal arms on opposite sides of the balance-shaft R, are exactly balanced, not only as to the pressure of the steam, but also as to the gravity of the parts. I also attach importance to the fact that the cylinders *m m* are mounted within the steam-chest and so conditioned that live steam has access to their exteriors. This insures that under all conditions, not only after the parts have become properly warmed up by long use, but also on first admitting steam to the steam-chest, the cylinders will be heated always to as high a temperature as the piston-valves, and that the temperature on all sides will be equal. In consequence of this the piston-valves may be fitted to work in their respective cylinders with any required degree of tightness. They may be made to fit so closely that they may be used successfully without packing and without any risk of ever being expanded by heat to a greater extent than the cylinders so as to stick fast and endanger the breaking of the machinery.

Modifications may be made in the forms and proportions of the parts without departing from the principle or sacrificing the advantages of the invention. I have shown what I consider the best for general locomotive use.

Parts of the invention may be used without the whole. I can dispense with the packing P′ and with the bridges M′.

I can shorten the arms D′ R′ and carry the rod S in an inclined position instead of the horizontal one.

I claim as my invention—

1. In a steam or gas engine, vertically-arranged piston-valves having passages therethrough and cylinders therefor inclosed within the steam-chest, with the exterior of said cylinders and the interior of the valves bathed in live steam, and means, substantially as described, for operating the said valves, as herein specified.

2. In a steam or gas engine, two piston-valves, P P, connected to opposite arms, R^2, on a balance-shaft, R, with means for rocking the latter, in combination with the two cylinders *m m* and the steam-chest A′, inclosing the latter, as herein specified.

In testimony whereof I have hereunto set my hand, at New York city, New York, this 1st day of December, 1886, in the presence of two subscribing witnesses.

JAMES H. FOGARTY.

Witnesses:
CHARLES R. SEARLE,
M. FREEMAN BOYLE.