(No Model.) 4 Sheets—Sheet 1.

J. T. METCALFE.

STEAM ENGINE.

No. 343,542. Patented June 8, 1886.

Fig. 1.

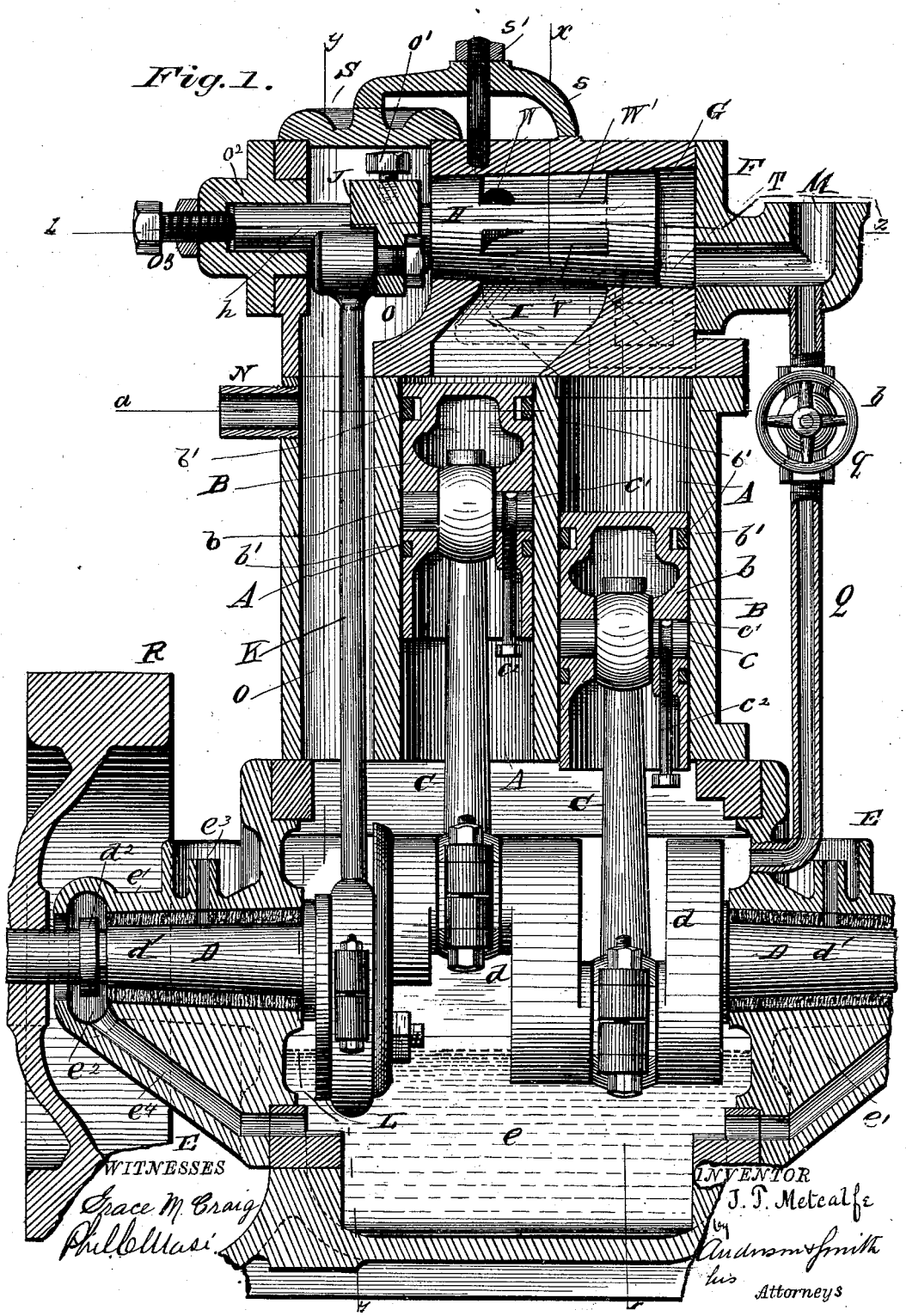

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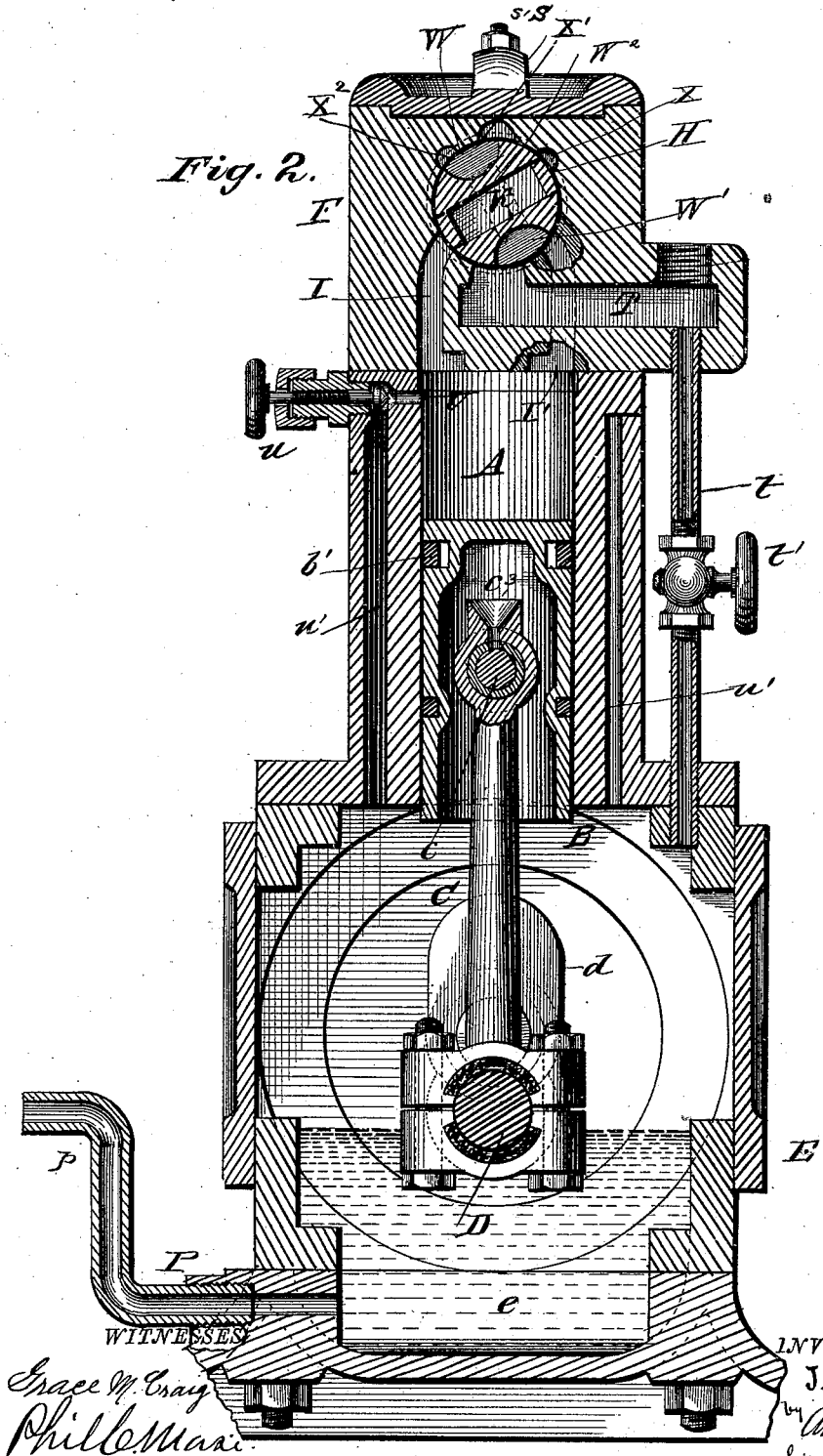
Fig. 2.



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(No Model.) 4 Sheets—Sheet 3.

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STEAM ENGINE.

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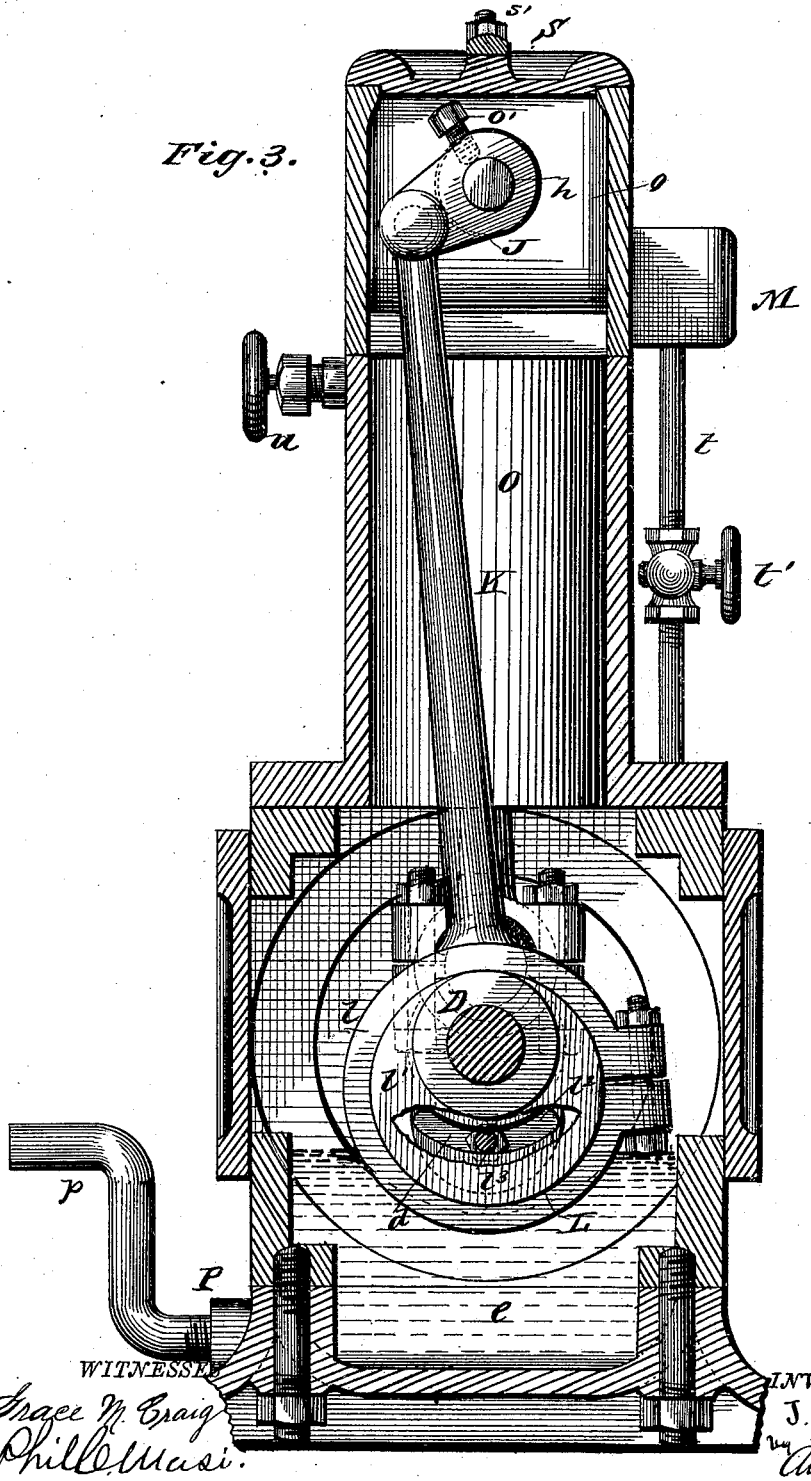
Fig. 3.



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(No Model.) 4 Sheets—Sheet 4.

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STEAM ENGINE.

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Fig. 4.

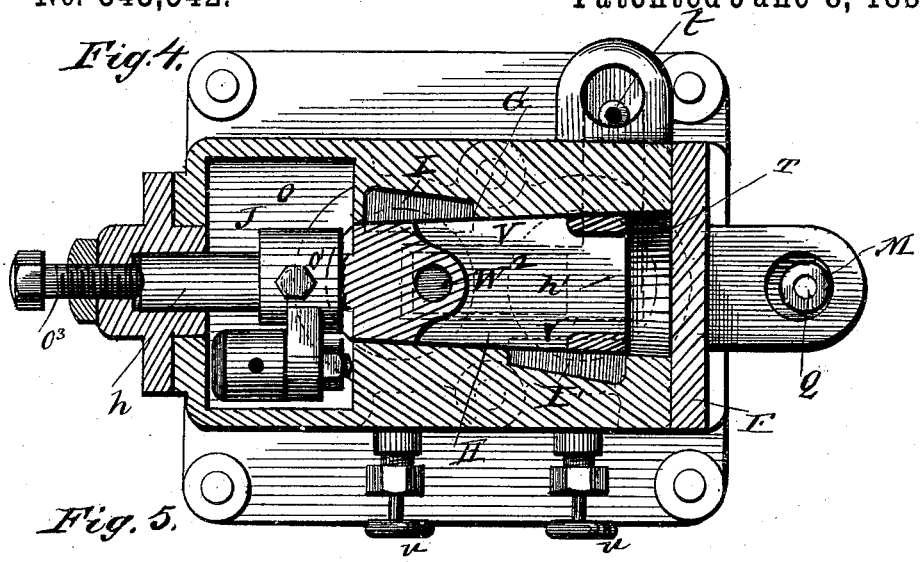


Fig. 5.

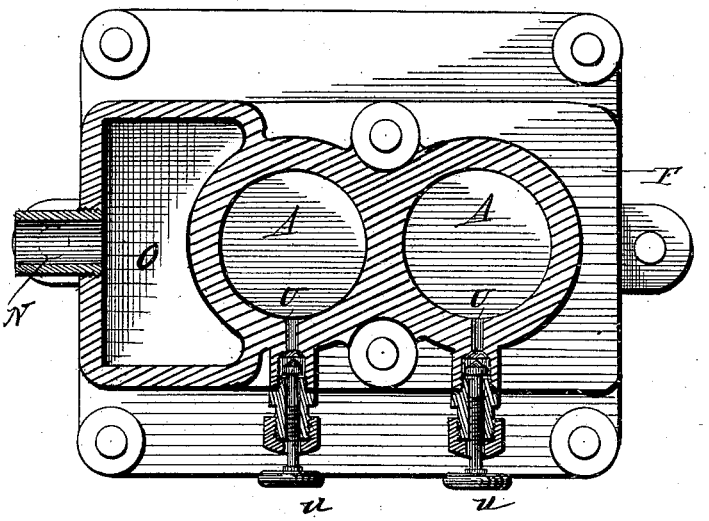
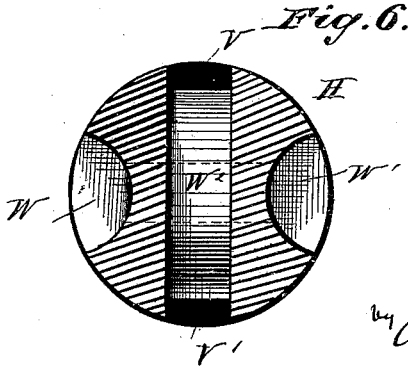


Fig. 6.



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UNITED STATES PATENT OFFICE.

JOHN T. METCALFE, OF QUINCY, PENNSYLVANIA.

STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 343,542, dated June 8, 1886.

Application filed May 9, 1885. Serial No. 164,918. (No model.)

To all whom it may concern:

Be it known that I, JOHN T. METCALFE, a citizen of the United States, residing at Quincy, in the county of Franklin and State of Pennsylvania, have invented certain new and useful Improvements in Steam-Engines; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

Figure 1 is a central vertical sectional view. Fig. 2 is a transverse sectional view taken on the lines *x x* of Fig. 1. Fig. 3 is a similar view taken on the lines *y y* of Fig. 1. Fig. 4 is a horizontal sectional view taken on the lines *z z* of Fig. 1. Fig. 5 is a similar view taken on the lines *a b* of Fig. 1; and Fig. 6 is an enlarged transverse sectional view of the valve.

This invention relates to steam-engines with two single-acting cylinders which work alternately to each other, and are usually set vertically, its object being to construct a compact, well-balanced, and durable high speed engine of the class referred to.

The invention consists in the construction and novel arrangement of parts hereinafter described, and pointed out in the appended claims.

Referring to the accompanying drawings by letter, A A designate the two vertical cylinders of the engine, in which move the pistons B B.

C C are the connecting-rods, attached in the usual manner to the diametrically-opposite cranks *d d* of the shaft D, which has end bearings in the heads of a casing, E, secured to the lower ends of the cylinder, and forming an oil-chamber, *e*, hereinafter explained.

F is a casing secured to the top of the cylinders and containing the valve-chamber G, the horizontal conical valve H, and ports I and I′, which act both as steam and exhaust ports.

J is a crank on the stem *h* of the valve H, by means of which crank the valve is oscillated, and K is the eccentric-rod connecting the crank to the eccentric L on the crank-shaft D.

M is the steam-pipe from the boiler to the valve-chamber G, and N is a pipe or nozzle secured to an opening in the vertical chamber O, in which the eccentric-rod moves to take pressure off the oil-chamber *e*, and allow the escape of any waste-steam from the cylinders. The oil in the oil-chamber *e* is floated by water to a height sufficient to allow the cranks *d d* and eccentric L to turn therein at the lowest point of their strokes. The journals *d′ d′* of the crank-shaft D are extended and conical, as shown, and turn in conical bearings lined with composition metals in the heads *e′ e′* of the casing E.

d^2 d^2 are collars on the ends of the crank-shafts outside of the bearings, which collars rotate in circular chambers e^2 e^2 in the heads *e′ e′*.

e^3 e^3 are nipples in the casing E, through which oil is poured upon the journals of the shaft D, and e^4 e^4 are canals in the heads *e′*, running from the lower parts of the chambers e^2 to the oil-chamber *e*, as shown. When that portion of the oil poured through a nipple, e^3, that passes outward on the journal reaches the collar d^2, it is thrown off the shaft by the centrifugal force of said collar, collected in the chamber e^2, and returned through the canal e^4, to aid in lubricating the cranks and eccentric. The water below the oil in the chamber *e* is being constantly added to by the condensed steam from the exhaust, as hereinafter explained. To prevent the water rising too high, the discharge-tube P from the bottom of the chamber *e* is provided with the siphon *p;* consequently the surface of the oil stands always about the height of the top of the siphon, as is readily perceived.

Q is a pipe passing down from the steam-pipe to the chamber *e*, and provided with valve *q*, on opening which the chamber may be either emptied by steam-pressure or enough steam may be admitted to heat up the chamber and adjacent parts when they are exposed to cold.

R is a fly-wheel on one end of the shaft D, and constructed to overhang the bearing, as shown, so as to put less strain on the shaft.

The bearings of the connecting-rods C, that surround the wrist-pins of the cranks *d*, are lined with composition metal, as shown. The upper bearings of the connecting-rods are

bushed with bronze or other metal, through which bushings pass the transverse shafts *c c*, which are journaled in the bearings *b b*, made through interior bosses on the pistons B, about midway of their length.

c' is a circumferential groove made on each wrist-pin *c*, within one of its bearings, and c^2 is a set-screw, the point of which enters the groove *c'* and keeps the shaft in place.

b' b' are packing-rings in circumferential grooves in the piston, and c^3 is a funnel-shaped opening descending from the upper end of the rod C down on the wrist-pins *c*, by which oil descends on the shaft.

The cylinders A open below into the chamber *e*, and above through the ports I and I', through the floor of the casing F into the steam-chamber G. The said ports open the valve H at opposite points below its center.

o is the enlarged upper end of the chamber O, containing the crank J, which is secured on the valve-stem *h* by a set-screw, *o'*.

The eccentric L is composed of the ring *l*, from which the rod K ascends, and the disk *l'*, provided with the slot l^2, concentric with the shaft D.

l^3 is a set-screw passing through the arm of the adjacent crank, *d*. By means of the said screw and slot the eccentric can be set to reverse the engine.

The valve-stem has a bearing, o^2, in the outer wall of the chamber O, through which bearing passes the horizontal adjusting-screw o^3, to regulate the position of the valve H, and upon which the end of the stem *h* turns. The taper of the valve is made such that it will wear in its bearing equally with the wear of the end of the stem in the screw o^3, so that the valve will always keep tight. The valve-chamber opens into the space *o*, and the valve will enter therein slightly as it wears, so that by this construction no stuffing-boxes are needed.

S is a removable cap, which fits above the open upper end of the space *o*, and *s* is a retaining-bar which, by means of the screw *s'*, holds the cap in place. By taking the screw out the cap may be removed to examine the parts within the space *o*.

T is an exhaust-chamber, descending from the bottom of the valve-chamber between the ports I I', and then running outward, as shown. From the outer end of the chamber T the pipe *t* descends to the chamber *e*, and conveys thither a portion of the condensed exhaust-steam to keep a supply of water in said chamber. The supply is regulated by means of the valve *t'* on the pipe *t*.

U U are openings in the upper ends of the cylinders, controlled by the screw stop-valves *u u*. By means of these openings any water of condensation in said cylinders escapes through the vertical canals *u' u'* to the chamber *e*.

The valve H has a central longitudinal recess, *h'*, running from its large end inward, and provided with the side openings, V V', so situated that the former communicates in succession with the port I, the mouth of the exhaust-chamber T, and the port I' as the valve oscillates in one direction, and communicates reversely with the same as the valve oscillates reversely.

W W' are opposite longitudinal recesses on the surface of the valve, midway between the openings V V', and communicating through the valve by the canal W^2.

X, X', and X^2 are longitudinal recesses in the roof of the valve-chamber, respectively opposite the port I, the mouth of the exhaust-chamber T, and the port I', and have the same length and breadth thereas. As the opening V moves over the port I, the mouth of the exhaust-chamber, and the port I', the opening V' moves over the recesses X, X', and X^2, so that exactly the same strain, pressure, or exhaust is created on each side of the valve, and they are therefore evenly balanced and will wear evenly. The recess W' is so situated that when the port I is taking steam from the opening V it will make communication between the port I' and the mouth of the exhaust-chamber, and the reverse; and when the port I' is exhausting, as the recesses W and W' communicate, the recesses X' X^2 will also exhaust, as is plain from the description and drawings. The steam-pressure from the pipe M, being always upon the large end of the valve, will keep it always tight, and will drive it farther inward as it wears.

It is evident from the foregoing description and from the drawings that the cylinders must be adjacent to each other, and that the eccentric and rod must be to one side of the cylinders, otherwise the construction of the valve would have to be different. There is also less strain on the crank-shaft when the cranks are adjacent to each other, as must be the case in the described construction.

Having thus described my invention, what I desire to secure by Letters Patent is—

1. The combination, with the chamber *e*, pipe or nozzle N from the chamber O, and outlet-pipe P, provided with the siphon *p*, of the pipe Q, connecting the steam-pipe M to the chamber *e*, and the pipe *t*, connecting the exhaust-chamber T to the chamber *e*, substantially as specified.

2. The combination, in a steam-engine, of one or more steam-cylinders having a channel formed therein leading from the steam-cylinder to the crank case chamber, and provided with a relief-cock, whereby the water of condensation may be carried from the said cylinder to the chamber, substantially as specified.

In testimony whereof I affix my signature in presence of two witnesses.

J. T. METCALFE.

Witnesses:
THEO. MUNGEN,
I. L. METCALFE.