(No Model.)

L. LAPYRE.

THREE CYLINDER ENGINE.

No. 253,299. Patented Feb. 7, 1882.

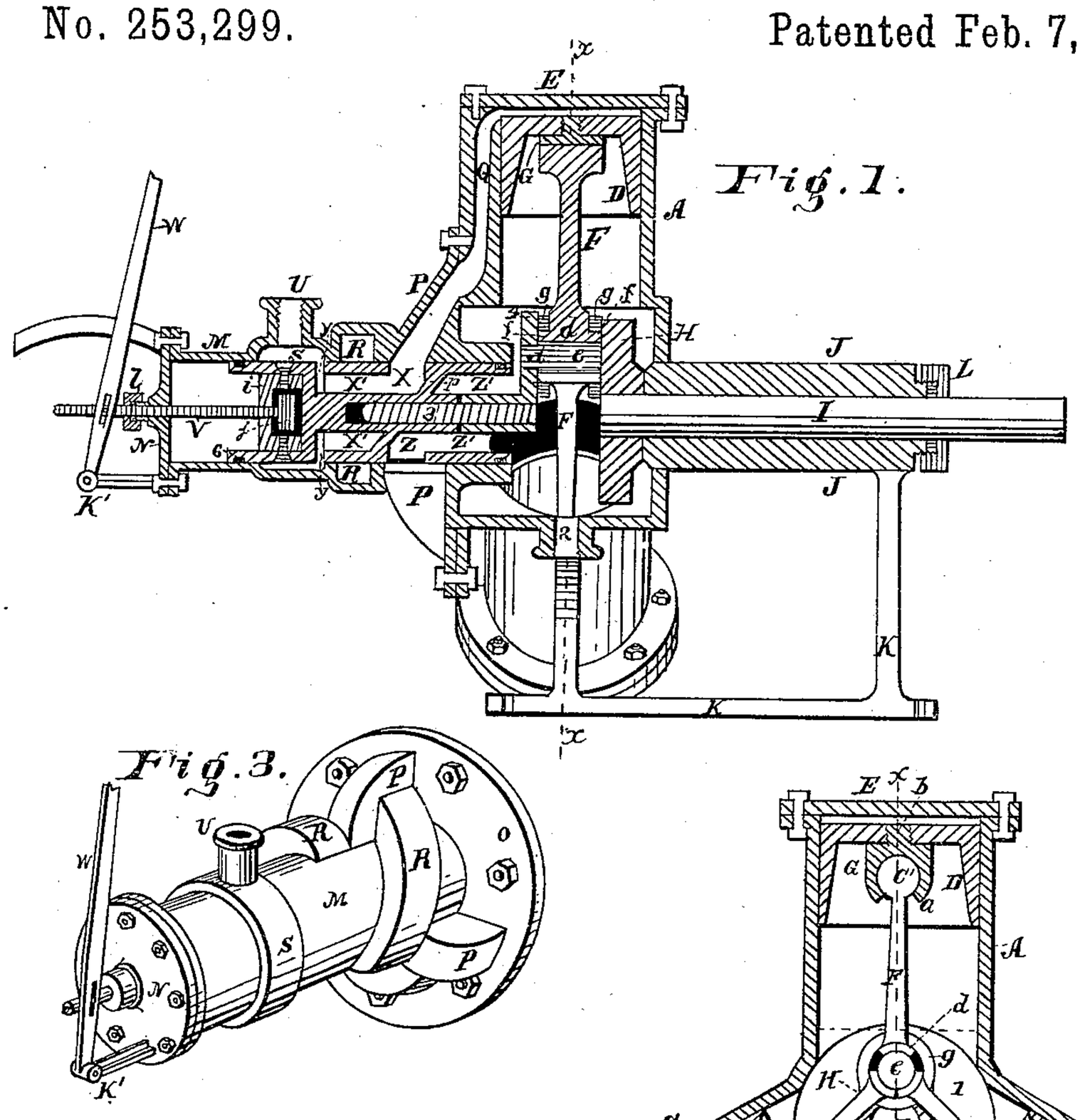

Fig. 1.

Fig. 3.

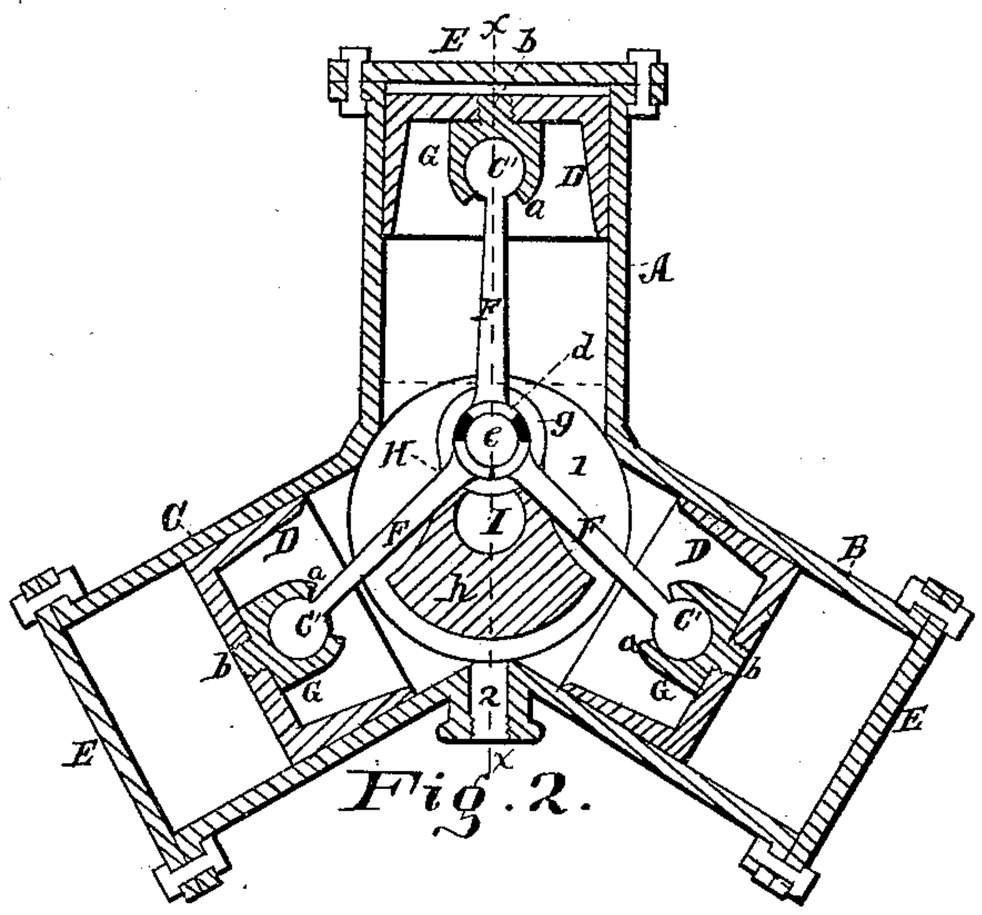

Fig. 2.

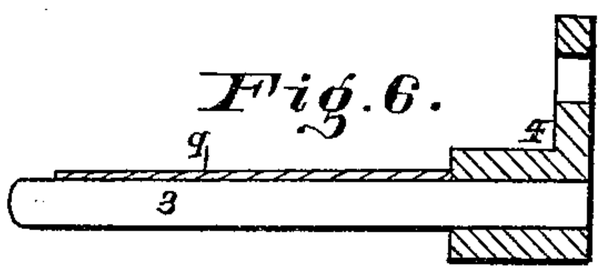

Fig. 6.

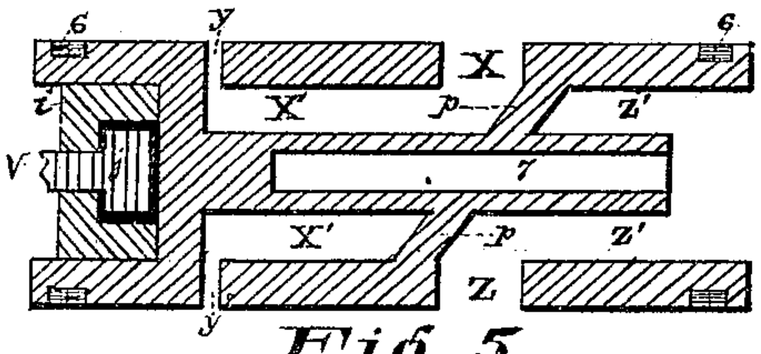

Fig. 5.

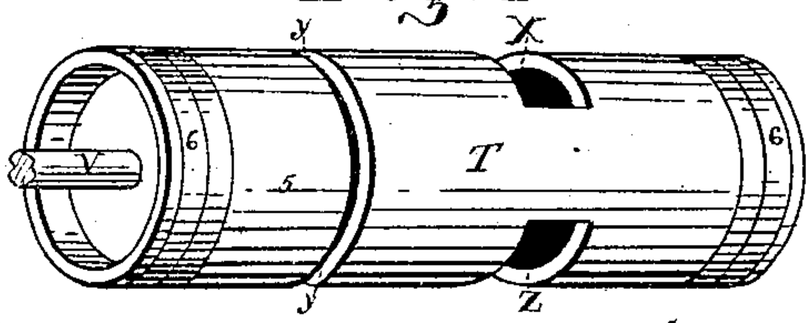

Fig. 4

Attest:
E. Hubbell,
J. Wm. Strahli.

Inventor.
Leopold Lapyre
per Wm. Hubbell Fisher
Atty.

UNITED STATES PATENT OFFICE.

LEOPOLD LAPYRE, OF CINCINNATI, OHIO.

THREE-CYLINDER ENGINE.

SPECIFICATION forming part of Letters Patent No. 253,299, dated February 7, 1882.

Application filed May 27, 1881. (No model.)

To all whom it may concern:

Be it known that I, LEOPOLD LAPYRE, of the city of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Three-Cylinder Steam-Engines, of which the following is a specification.

My improvements relate to that class of steam-engines known as "three-cylinder engines," and in which the pitman of each piston is connected to a common crank operated to turn a central shaft, and in which the crank is at no time on a dead-center.

An important feature of my invention consists in a novel and useful valve for controlling the admission of steam into the ports of the cylinder, and for enabling the direction in which the pitmen are turning the operating-shaft to be reversed at will.

Other subordinate features of my invention will be apparent from the following description.

Figure 1 represents a vertical longitudinal section of a steam-engine embodying my improvements, said section being a central one and taken at the dotted line *x x* of Fig. 2. Fig. 2 is a cross-section of Fig. 1, taken at the dotted line *x x* of Fig. 1. Fig. 3 is a view, in perspective, of the cap and of the exterior of the ports and the steam-supply inlet-port, the valve case and chamber, and a lever and its connections for operating the valve. Fig. 4 is a view, in perspective, of the valve, and Fig. 5 is a vertical longitudinal section taken through the center of the same. Fig. 6 is a central longitudinal section of the device for rotating the valve.

A indicates one of the cylinders, B another of same, and C another of same. These cylinders are located so that their longitudinal axes are in the same plane, and so that these axes, if projected, will meet in a common center. The longitudinal axis of each cylinder is located one hundred and twenty degrees distant from the longitudinal axis of each of the other cylinders, measured on a circle lying in a plane passing through these axes, and having for its center the central point in which said axes meet. Each cylinder has a piston, D, of any of the preferred forms, the form here shown being recessed on the inner side and flat on that side of it which is toward the outer end of the cylinder. Each of these pistons is single-acting—that is to say, takes steam at one end only, and in the present instance takes steam at the outer end. Each piston is preferably packed in any suitable manner, being preferably packed with the usual ring-packing. The packing is not shown in the drawings. The outer end of each cylinder is provided with a suitable head, as E, bolted to the cylinder, as shown in Figs. 1 and 2, or otherwise secured thereto. The cylinders are secured to each other at or near their inner ends by being cast together in one piece, as shown in the drawings, or by being bolted to a central drum.

Each piston D is provided with a pitman, F, suitably secured by a pivotal connection to its piston at the inner side of the latter, and connected to the crank H. In the present instance this pivotal connection is made by means of novel device G of my invention, to wit: The eye *a* of the aforesaid pivotal connection being cut away at its side next the pitman for a distance of ninety degrees to give free play to the aforesaid pitman, enough of the sides thereof being left to always retain and secure the outer bearing, C′, of the pitman in position within said pivotal device, thereby maintaining a flexible and reliable connection between the piston D and the pitman. A screw-threaded extension or nib, *b*, at the back of said pivotal connection engages a female screw in the piston, and thus secures the pivotal connection to the piston. The inner bearing of each pitman rests upon and is secured to the crank-pin *e* of the crank H in any suitable manner. In the present instance the pitmen are secured to the crank-pin by two rings, one on each side of the pitman, as follows: The inner bearing, *d*, of each pitman is provided at each side with an extension or flange, *f*, the bearing and the flange being made sufficiently narrow in the direction of the rotation of the crank to allow the free play of the pitman. One of said rings, *g*, fits over the flanges *f* on one side of the bearings, and is held in position by the face of the main-shaft crank H and the side of the pitmen, and another ring fits over the flanges *f* on the other side of the bearings *d*, and is held in position by the side or face of the bell-crank 4 and the side of the pitman. The crank H is fixed permanently on the shaft I, and preferably provided with sufficient counter-balance. The

shaft I is journaled in a bearing, as J, supported by the frame K of the engine, and is provided with a suitable packing-box, L, for preventing exhaust-steam from escaping around the shaft.

The valve-case M is formed of one piece and has a suitable head, N, secured thereto by bolts or other suitable means. The valve-case has a flange, O, whereby it (the case) is secured to the cylinders, the flange being connected to the cylinders preferably as shown. The valve-case is provided with three ports, P, located at equal distances from each other—viz., at a distance of one hundred and twenty degrees, each port connecting directly with a port, Q, leading to each cylinder, and entering the latter at or near its outer end. The valve-case has three reverse-ports, R. The inlet-entrance of each reverse-port begins in front of and on a line with one direct port, and passes over and around said valve-case and enters the next port P, as shown.

In front of the reverse-ports R is the annular steam-space S, to facilitate the admission of steam to the valve T. Steam is admitted to the steam-space S by means of the inlet-supply pipe U. The valve T is cylindrical in form and adapted to rotate on its axis, and also to move longitudinally within the valve-case. The means for causing it to slide are as follows: A rod, V, is provided with a head, *j*, located within a space formed by a cap, *i*, placed within a recess in the outer end of the valve T and secured to the latter by bolts. The rod V passes through a hole in the cap *i*, and also through the cap N of the case and beyond the head, where it is connected to a lever, W, fulcrumed at K′, whereby it imparts to the rod and the valve a longitudinal movement sufficient to throw the valve-port X from steam-port P and bring it opposite to the reverse-port R, thereby admitting the steam to the reverse-port R, which passes over to that port P which is one hundred and twenty degrees in advance of the crank, and thereby reversing the engine. The cap U at point where the rod V passes through the cap N is provided with a suitable steam-packing device, *l*.

The cylinder-valve T is provided with an annular steam-opening, *y*, which extends through the outer case of said valve for the purpose of admitting steam to the annular steam-port X′ and port X. It will be remarked that this annular steam-opening is at all times open to the annular steam-space *y*, aforementioned. The cylinder-valve has also an exhaust-port, Z, which is on the same circumferential line as port X, but is located on the opposite side of said cylinder from that on which port X is located. This port Z communicates with an annular chamber, Z′, in the valve, and this chamber Z′ opens directly into the exhaust drum or chamber 1, in which the crank operates, and escapes through exhaust-pipe 2.

The valve T is further provided with a longitudinal axial chamber, 7, supported by an oblique annular diaphragm, *p p*, which latter separates the live steam from the exhaust-steam. This axial chamber contains the valve-stem 3, which is rigidly attached to the valve or bell-crank 4, the latter being connected to the crank-pin *e* by the pin *t* or other suitable means. The valve-stem is thus actuated by the crank-pin *e* and rotates with shaft I. The valve is free to slide longitudinally upon said stem. The valve-stem is further provided with a feather, *q*, fitting in a feather keyway in the side of this axial chamber 7 of this valve. Thus the rotation of the valve-stem rotates the valve. This rotation of the valve admits the steam successively to each cylinder through its respective port Q and P, and the exhaust-port Z of the valve, on the rotation of the latter, exhausts the steam through the aforesaid ports Q and P after it (the steam) has done its work.

To reverse the engine the lever W is moved in that direction which is toward the right-hand side in Fig. 1 to such a distance that the valve will be moved longitudinally to such an extent that its port X shall come opposite to reversing-port R, allowing the steam to pass through reverse-port R to ports P Q one hundred and twenty degrees in advance of the crank, thereby necessarily reversing the engine, and on the rotation of the valve T the steam passes successively through each reverse-port R and the ports P Q, thereby continuing the working of the engine in said reverse direction. At the same time the exhaust-port Z successively on the rotation of valve T exhausts the steam from the ports R P Q after the steam has done its work as formerly through the direct ports P Q. While the engine is working in this reverse direction the reverse-ports R become a prolongation of the ports P and Q.

That portion 5 of the cylinder-valve—viz., the part lying to the left of the annular opening *y*—performs the office of a balancing-piston, and is a continuation of the shell of the axial chamber 7. The inside face or end of this portion 5 receives the pressure of steam, relieving the end-thrust of the valve from left to right, that would otherwise occur from the pressure of steam on the diaphragm *p*, and thus perfectly balancing the valve.

The packing-rings 6, located at either end of the valve, operate to render the valve more perfectly steam-tight.

What I claim as new and of my invention, and desire to secure by Letters Patent of the United States, is—

1. The cylinder-valve T, provided with annular steam-opening *y*, annular steam-port space X′, port X, counterbalancing piston or part 5, annular exhaust-port space Z′, exhaust-port Z, annular diaphragm *p*, and central axial chamber 7, in combination with valve-spindle 3 and bell-crank 4 and pin *t*, and a valve-case, substantially as and for the purposes specified.

2. The cylinder-valve T, provided with annular steam-opening *y*, annular steam-port space

X′, port X, counterbalancing piston or part 5, annular exhaust-space Z′, and exhaust-port Z, annular diaphragm *p p*, and devices enabling the valve to be rotated by the crank-pin *e*, substantially as and for the purposes specified.

3. The cylinder-valve T, provided with annular steam-opening *y*, annular port-space X′, port X, counterbalancing piston or part 5, annular exhaust-space Z′, exhaust-port Z, annular diaphragm *p p*, and devices for enabling the valve to be rotated and operated longitudinally, substantially as and for the purposes specified.

4. The cylinder-valve T, provided with annular steam-opening *y*, annular port-space X′, port X, counterbalancing piston or part 5, annular exhaust-port space Z′, exhaust-port Z, annular diaphragm *p p*, and devices for rotating the said valve, and cap *i*, in combination with rod V, provided with head *j*, lever W, and a valve-case, substantially as and for the purposes specified.

5. The reverse-steam ports R R R, in combination with the valve-case M, provided with cap N, annular steam-space S, having steam-inlet U, and provided with steam-ports P P P, and flange O, substantially as and for the purposes specified.

6. The valve-case M, provided with cap N, annular steam-space S, having steam-inlet U, steam-ports P P P, reverse-ports R R R, and flange O, in combination with the cylinder-valve T, provided with annular steam-opening *y*, annular steam-port space X′, steam-port X, counterbalancing piston or part 5, annular steam-exhaust space Z′, steam-exhaust port Z, annular diaphragm *p p*, and devices for enabling the valve to be rotated and operated longitudinally, substantially as and for the purposes specified.

LEOPOLD LAPYRE.

Witnesses:
WM. E. JONES,
E. R. HILL.