J. O. BAIRD.

Balance Steam-Engine.

No. 216,818. Patented June 24, 1879.

Fig. 1

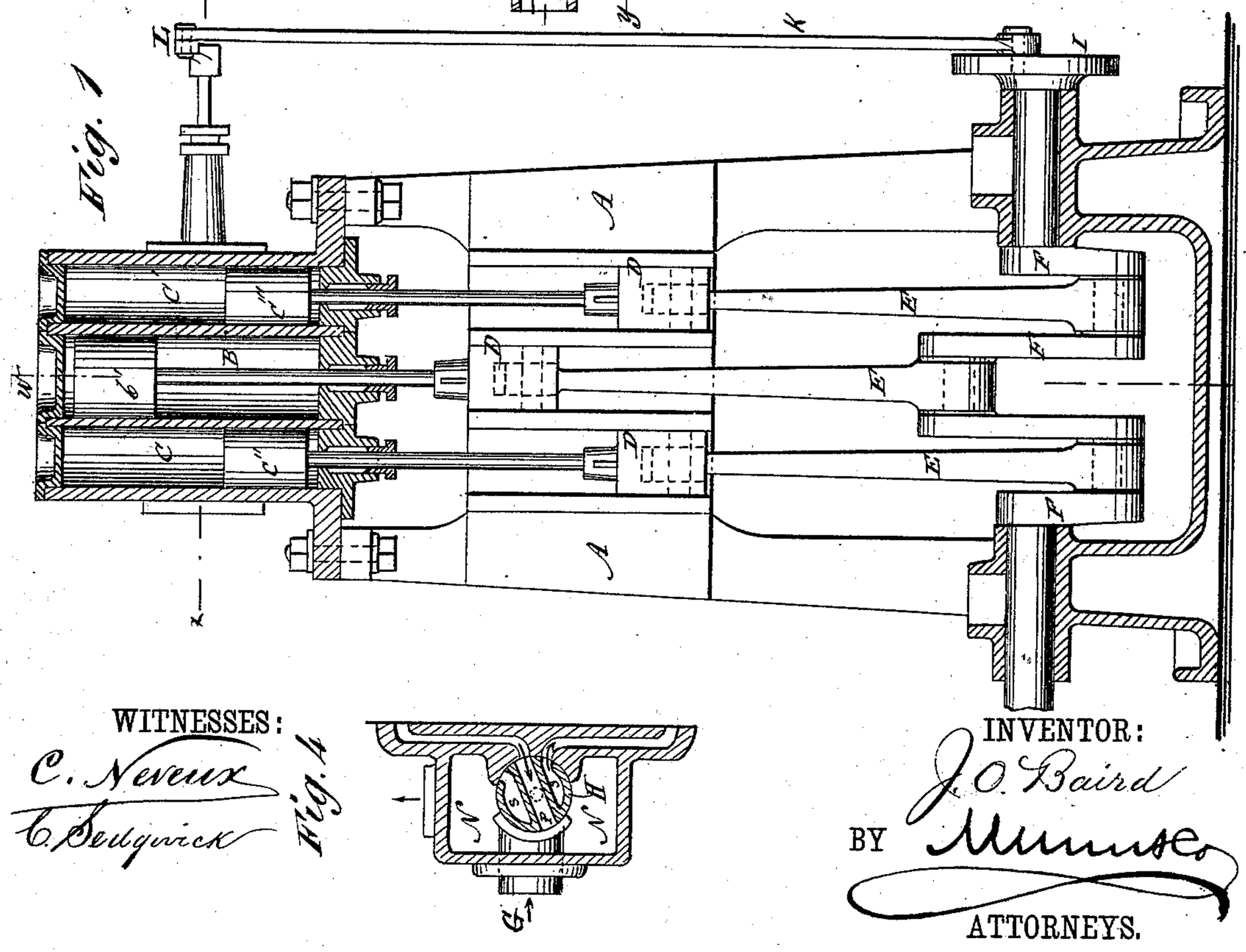

Fig. 2

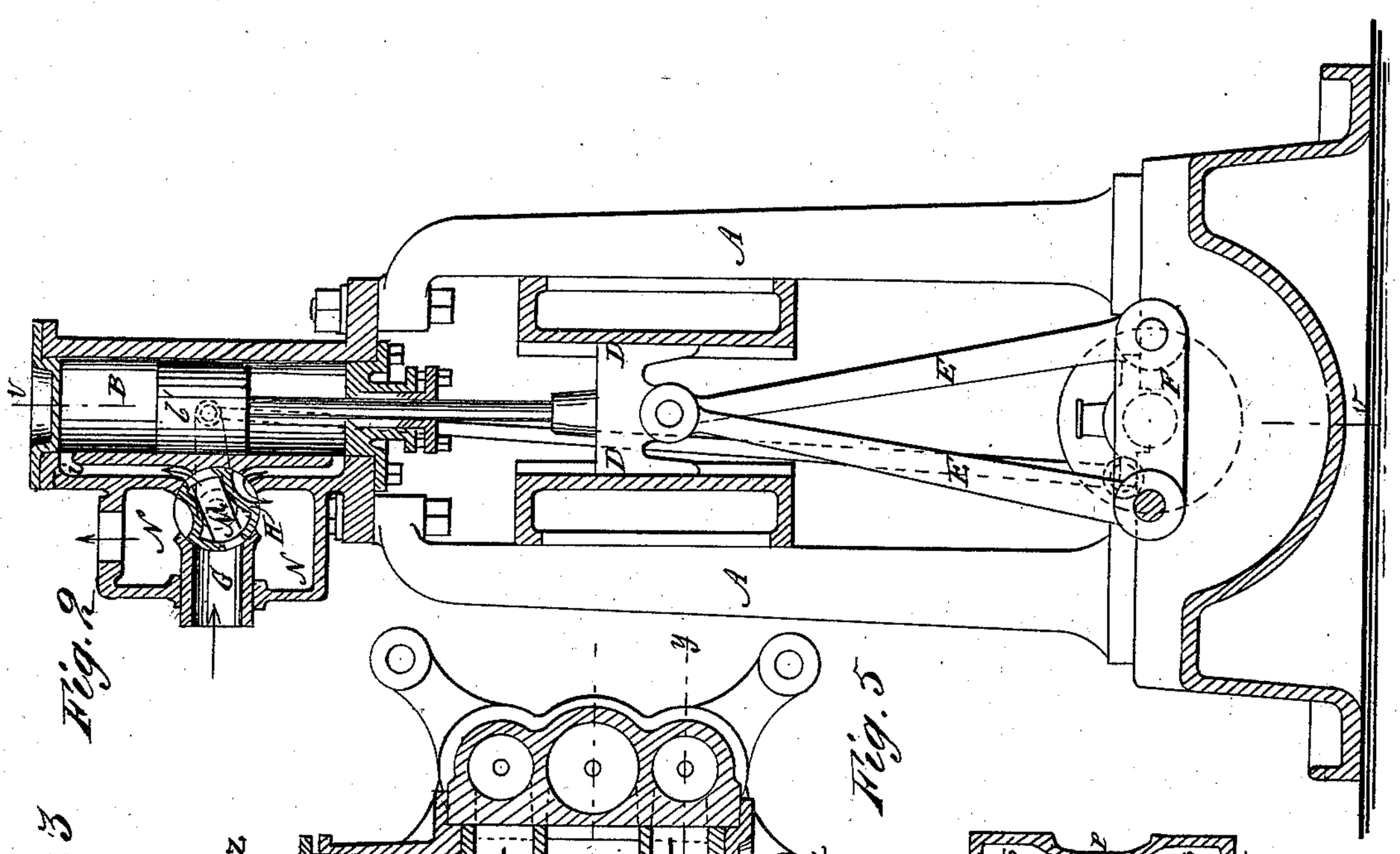

Fig. 3

Fig. 5

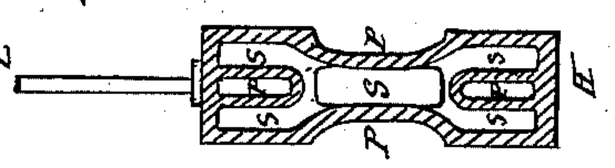

Fig. 4

WITNESSES:

C. Neveux

C. Sedgwick

INVENTOR:

J. O. Baird

BY Munn & Co

ATTORNEYS.

UNITED STATES PATENT OFFICE.

JAMES O. BAIRD, OF BROOKLYN, NEW YORK, ASSIGNOR TO HIMSELF AND JOSEPH BOYCE, OF SAME PLACE.

IMPROVEMENT IN BALANCE STEAM-ENGINES.

Specification forming part of Letters Patent No. **216,818**, dated June 24, 1879; application filed January 7, 1879.

To all whom it may concern:

Be it known that I, JAMES O. BAIRD, of Brooklyn, in the county of Kings and State of New York, have invented a new and Improved Balance Steam-Engine, of which the following is a specification.

Figure 1 is a vertical section of the engine through line *v v*, showing the three cylinders, pistons, piston-rods, and cranks. Fig. 2 is a vertical section on line *w w*, showing steam-entrance and cross-section of that part of steam-valve pertaining to the central and larger cylinder. Fig. 3 is a cross-section on line *x x* through cylinders, steam-chest, and steam-valves. Fig. 4 is a section on line *y y* through that part of steam-valve and steam-passages pertaining to small cylinder. Fig. 5 is a section on line *z z*, giving a longitudinal section of steam-valve.

Similar letters of reference indicate corresponding parts.

This invention has for its object the construction of an engine with two or more cylinders with pistons working alternately and having independent connections with the crank-shaft, so that a balance is produced in the strains transmitted to the crank at all points, and, in connection with the engine, a balance steam-valve of peculiar construction and efficiency.

In the drawings, A is the frame of the engine, supporting three cylinders—B, the larger one, and C and C′, the smaller ones—which are preferably made in one casting. The area of the larger piston, *b′*, is equal to the area of the smaller pistons, *c″* and *c‴*, combined, and consequently its force-transmitting power is equal.

The cross-heads run in grooved slides, which afford ample bearings, as shown at D D D, and are secured in the usual way to connecting-rods E E E, which connect with crank-shaft F, as shown, the central connecting-rod pertaining to the larger cylinder being set thereon in a direction opposite to that of the connecting-rods of the side cylinders.

The two pistons C″ and C‴ descend and rise simultaneously under the operation of the direct pressure of the admitted steam, alternating in their movement with the larger piston, *b′*. The result of this alternate action of the pistons is to produce a balance in the strains transmitted to the crank at all points, so, in fact, that the engine may be run with the caps removed from the crank-shaft bearings.

While in the ordinary balance-engine the adjustment of connecting-rod brasses is extremely difficult, on account of one piston being connected to two cranks, (thereby in effect forming a forked connecting-rod,) this difficulty is entirely overcome by the independent connecting-rods, and the adjustment rendered simple and easy.

The independent connection also permits each piston to be taken out for inspection or repair without interfering with the other or others. This cannot be done in the ordinary balance-engine without disconnecting the whole engine. It is designed by this arrangement to make the forces exerted on opposite cranks equal.

It will be observed that the arrangement of the cylinders secures bearings for the cranks and cross-heads, which are very much larger than those of any other balance-engine—an advantage of great importance in the matters of smooth running and durability.

The length of the crank-bearings, it is evident, depends upon the distance between the centers of the outside cranks. Let us take the case of the ordinary balance-engines having two pistons in one cylinder. The cylinder being five and one-half inches in diameter, the greatest distance between the centers of the outside cranks will be four and one-fourth inches, while in the case of the three-cylinder balance-engine the distance will be eleven inches, or more than two and one-half times as long; and in a two-cylinder engine of this design they would be seven inches, ample bearings for crank-bearings of engines designed for many purposes.

The matter of long bearings is very important when the high speed at which the balance-engine is designed to run is considered.

The flaring mouth of the induction-pipe G

fits closely over the valve H, and conveys the steam directly to its interior, so that all external pressure upon the valve is avoided, and consequently all friction between the valve and its seat arising from steam-pressure.

It will be seen that the valve is cylindrical and that a semi-rotary reciprocating motion is imparted to it by the combined action of the eccentric I, rod K, and crank L.

In Fig. 2 the valve is shown in the position of admitting steam through passage M and the steam-port *i* into the center cylinder above the piston, while the steam under the piston escapes through the lower port, as indicated by an arrow, into the exhaust-chamber N, whence it finally escapes, as indicated.

In Fig. 4 the valve is shown in position for steam to enter under one of the small pistons, while from above the exhaust escapes through the central passage, O, into and out of exhaust-chamber, as indicated.

In Fig. 5 the steam-passages of the valve are indicated by letters *s s s*, while the exhaust escapes into exhaust-chamber at P P P.

The peculiar form of the passages in the valve allows of simple and straight ports in the cylinders, making the casting of the cylinders an easy operation, while the casting of an ordinary balanced engine's cylinders is an extremely difficult matter, because of the intricate steam-passages.

It is obvious that this style of valve and steam-ports is also well adapted to a two-cylinder balanced engine with pistons working alternately, as described, and that a two-cylinder balanced engine of this general design and constructed on this principle would possess many advantages over all other balanced engines.

I am aware that others have designed engines of two or more cylinders, some of which have two pistons in one cylinder, and in some of which the steam is used directly in one or more of the cylinders and expansively in the other or others; and my attention has been directed to the inventions of Mr. George L. Washburn, of Worcester, Massachusetts, one of which relates to the arrangement of cylinders and steam-ports, so that the steam after being used on one side of a given piston is permitted to flow to the other side of the same piston and to another cylinder to be used expansively, and the other of which is a peculiar arrangement of two cylinders with single-acting pistons and a larger cylinder with a double-acting piston, upon whose sides the steam from the other cylinders is used expansively.

Not only is the arrangement of my cylinders and steam-ports radically different, as herein shown, from those of Washburn or any others, so that by it heretofore unknown advantages in construction and working have been secured, but the desirable effects obtained by other peculiarities of my construction do not result from any other construction with which I am acquainted.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

The combination of two cylinders, C C′, having pistons of equal diameter, with a cylinder, B, whose piston is double either of the others in cross-sectional area, operated alternately therewith and connected with the same crank-shaft, but to a crank diametrically opposite those of the smaller pistons, constructed and arranged as and for the purpose described.

JAMES O. BAIRD.

Witnesses:
C. SEDGWICK,
I. I. STORER.