

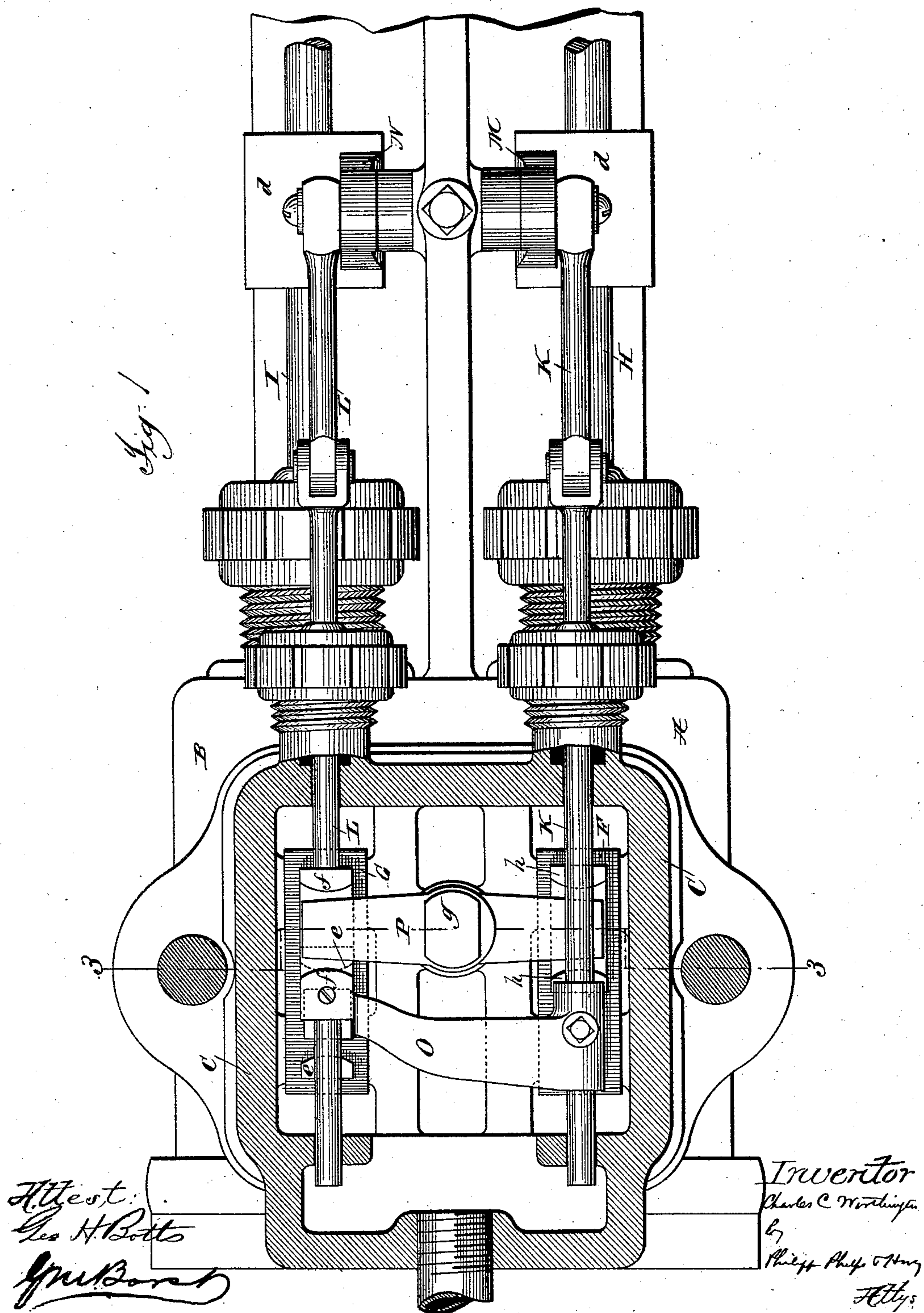
(No Model.)

5 Sheets—Sheet 1.

C. C. WORTHINGTON.
VALVE MOTION FOR DUPLEX ENGINES.

No. 455,555.

Patented July 7, 1891.



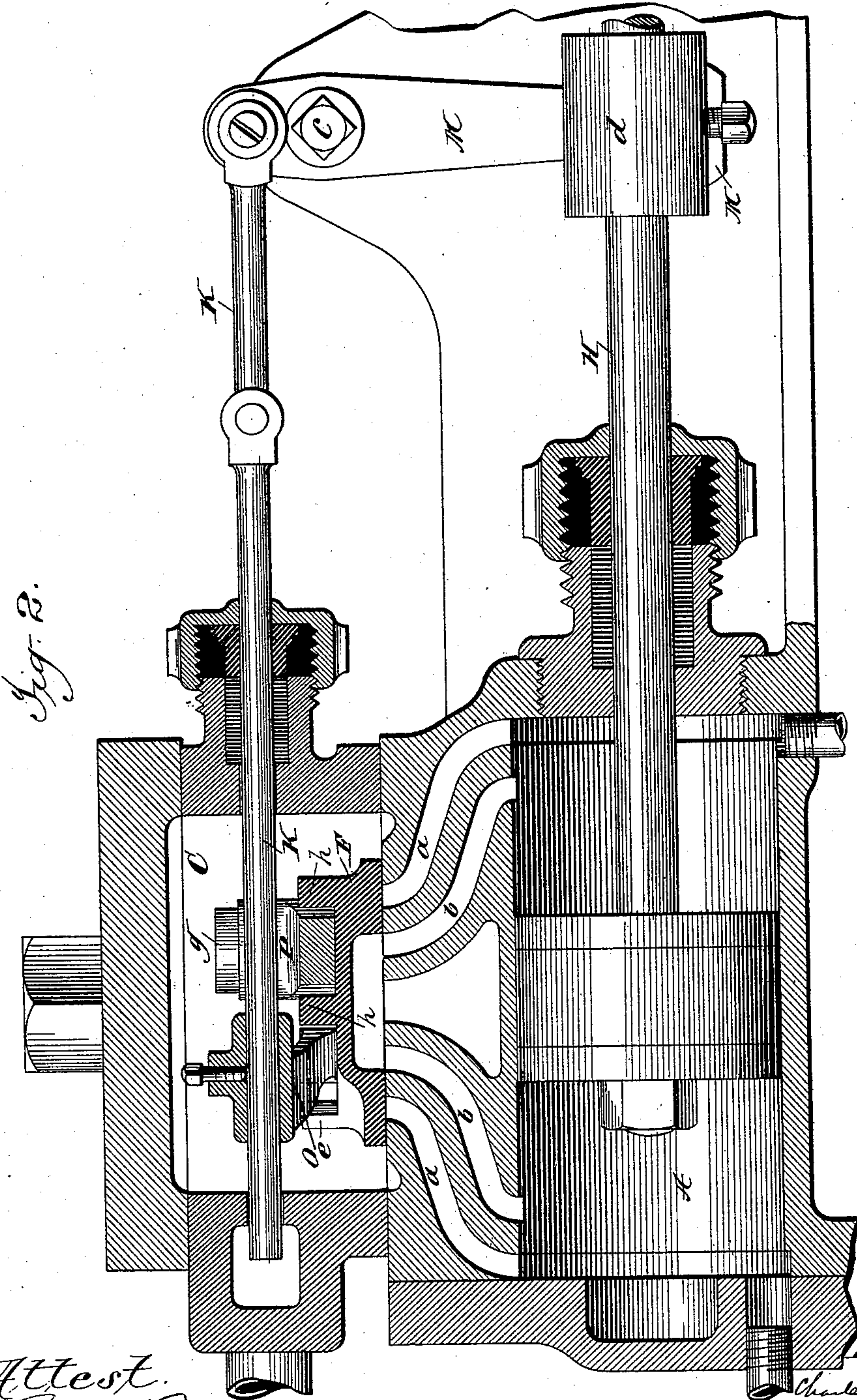
(No Model.)

5 Sheets—Sheet 2.

C. C. WORTHINGTON.
VALVE MOTION FOR DUPLEX ENGINES.

No. 455,555.

Patented July 7, 1891.



Attest.
Geo. H. Bots.
Wm. Bots.

Inventor
Charles C. Worthington
by Philip Phelps Hney
Atty.

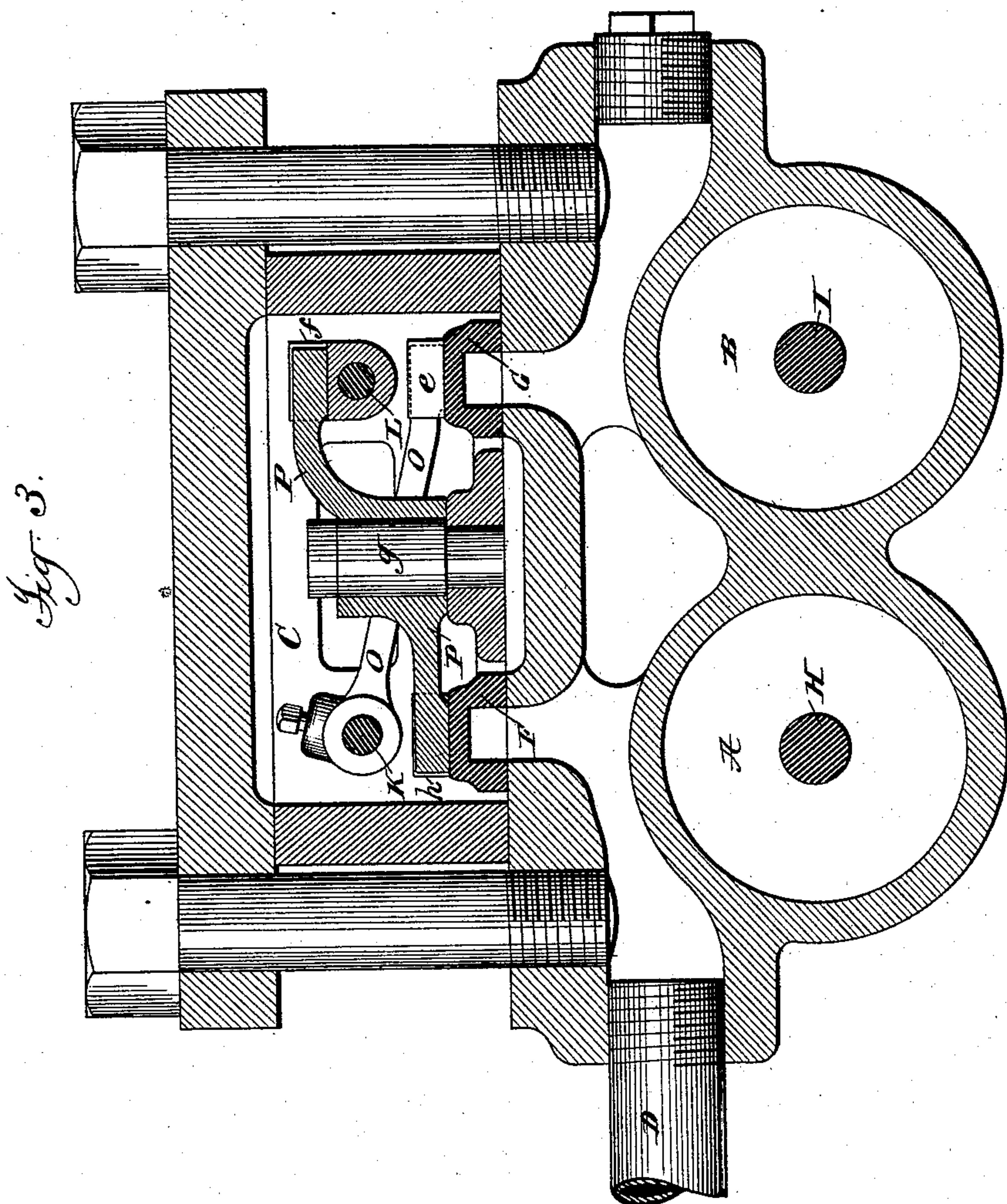
(No Model.)

5 Sheets—Sheet 3.

C. C. WORTHINGTON.
VALVE MOTION FOR DUPLEX ENGINES.

No. 455,555.

Patented July 7, 1891.



Attest:
Geo. H. Potts
J. M. Borer

Inventor:
Charles C. Worthington
by Philip Phelps Honey
Attys

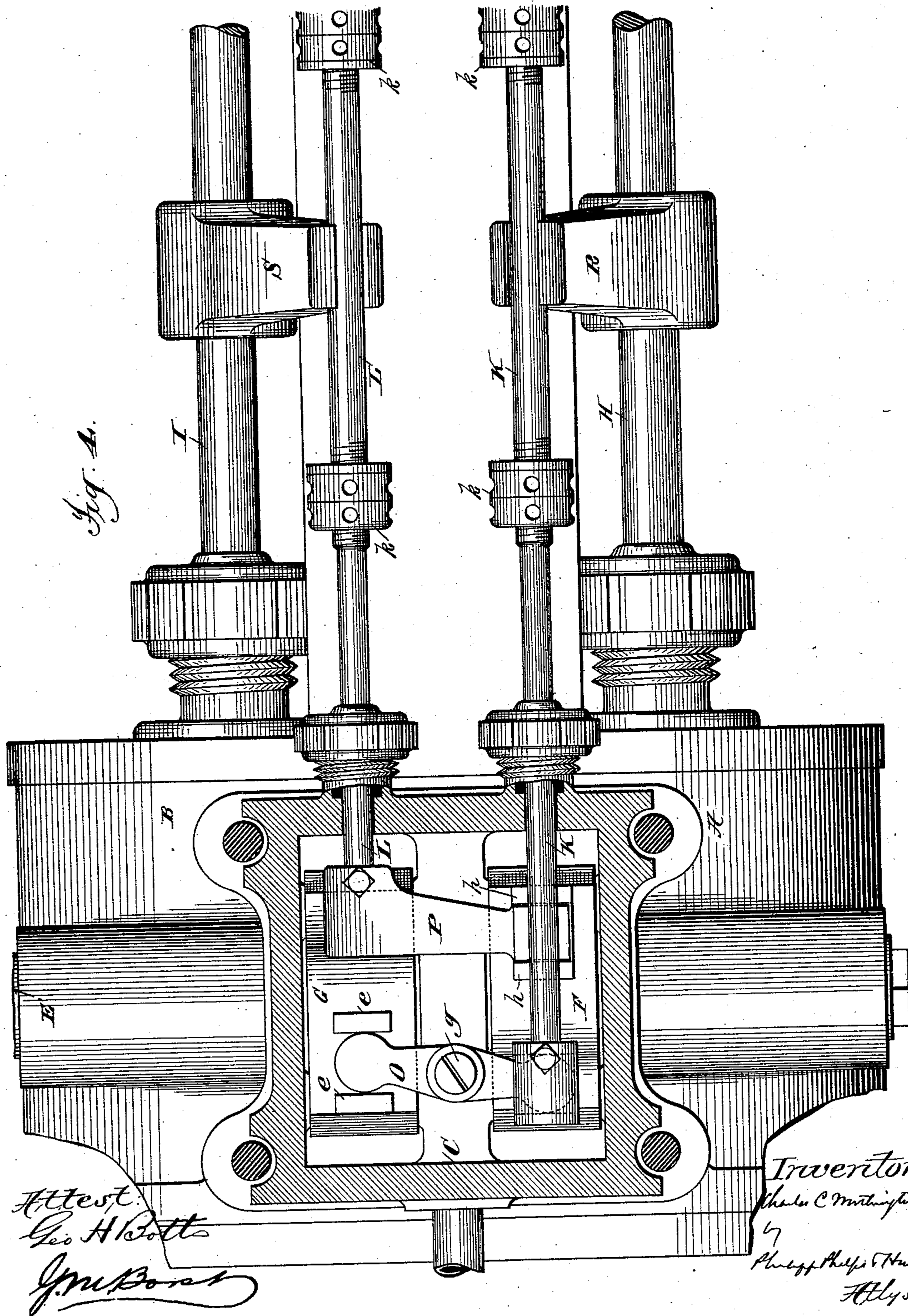
(No Model.)

5 Sheets—Sheet 4.

C. C. WORTHINGTON.
VALVE MOTION FOR DUPLEX ENGINES.

No. 455,555.

Patented July 7, 1891.



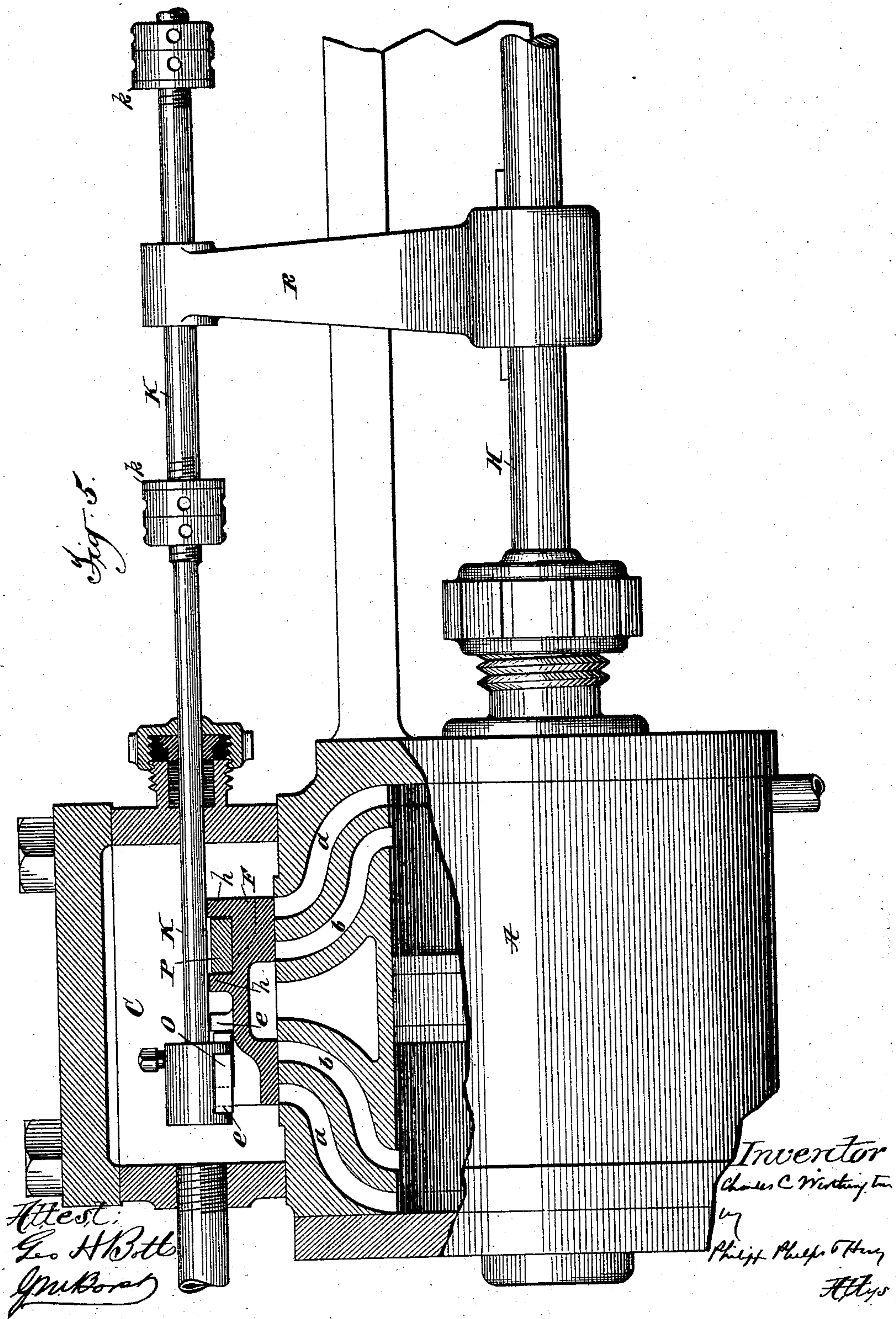
(No Model.)

5 Sheets—Sheet 5.

C. C. WORTHINGTON.
VALVE MOTION FOR DUPLEX ENGINES.

No. 455,555.

Patented July 7, 1891.



UNITED STATES PATENT OFFICE,

CHARLES C. WORTHINGTON, OF IRVINGTON, NEW YORK.

VALVE-MOTION FOR DUPLEX ENGINES.

SPECIFICATION forming part of Letters Patent No. 455,555, dated July 7, 1891.

Application filed September 22, 1890. Serial No. 365,715. (No model.)

To all whom it may concern:

Be it known that I, CHARLES C. WORTHINGTON, a citizen of the United States, residing at Irvington, county of Westchester and State of New York, have invented certain new and useful Improvements in Valve-Motions for Duplex Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to duplex engines, its object being to provide an improved valve movement in which fewer parts are exposed, and which shall be simpler, cheaper, and require less oiling than valve-movements heretofore in use.

In duplex engines as commonly constructed the cross-motion for operating the valve of one side of the engine from the other side has been placed outside the steam-chest between the piston-rods and valve-rods, and on account of the necessity of reversing the movement of one of the valves from that of its actuating piston-rod operating-levers of different form have been required, involving the construction of several parts of different dimensions. The mechanism of the cross-motion also being outside the steam-chest, is exposed to accident, and each moving part requires to be oiled separately. In those constructions in which the cross-motion has not been placed between the piston-rods and valve-rods the operation of the valve on one side of the engine from the other side has been attained either by cross-ports in the valve-chest or, where attained by means of mechanical cross-motion devices between the valve-rods and valves, the valves or ports on one side of the engine have been arranged to secure the reversal of the movement of one of the valves relatively to its actuating piston-rod, necessitating the use of different forms of valves or different arrangements of steam-ports on the opposite sides of the engine. I avoid these objections and provide a construction in which each valve-rod is operated by its own piston, employing fewer parts and these of simpler construction, and in which the cross-motion is placed inside the steam-chest, the moving parts of the cross-motion thus being constantly lubricated by steam and oil from the ordinary steam-pipe

lubricator, avoiding all other oiling. In that form of the duplex engine in which the tappet-movement is not employed the lost motion is inside the steam-chest; but in that form which employs the tappet-movement I place the lost motion outside of the steam-chest, and thus oblige the engine to make a full stroke by moving the opposite valve only at the time when the operating-piston has nearly accomplished its stroke.

For a full understanding of my invention a detailed description of an engine embodying the same will now be given, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a sectional plan of a duplex engine containing my invention. Fig. 2 is a longitudinal section taken through one of the steam-cylinders. Fig. 3 is a cross-section on the line 3 3 of Fig. 1. Fig. 4 is a sectional plan of a duplex engine employing a tappet movement; and Fig. 5 is a longitudinal sectional elevation of the same, the section being taken through one of the steam-cylinders.

Referring now to said drawings, A B are a pair of steam-cylinders provided with the usual induction and exhaust ports *a b*, the induction-ports communicating with the steam-chest C and the exhaust-ports with the exhaust-pipes D E, controlled by the sliding D-valves F G, as is usual in this class of construction.

H I are the piston-rods of the respective cylinders and K L the corresponding valve-rods, these valve-rods being operated from the piston-rods on their own side of the engine by means of levers M N of the first class pivoted at *c* and engaging the respective piston-rods by means of the usual adjustable spools *d*, the levers and connections on opposite sides of the engine being identical in construction.

Inside the steam-chest C is adjustably secured to the valve-rod K, an arm O extending across the steam-chamber and engaging the slide-valve G by means of lugs *e* thereon, a certain amount of lost motion being allowed the arm O between the lugs. The valve-rod L carries lugs *f*, engaging one end of a lever P, mounted on a pivot *g*, central to the valve-chest, this lever P extending across the chest and engaging the slide-valve F by means of

lugs *h*, carried thereby, lost motion being provided between the lugs and lever, preferably at both ends of the latter, the lugs *f* being preferably made adjustable, as shown.

5 It will readily be understood that the movement of the piston-rods on each side of the engine operates the valve-rods on the same side and that valve-rod *K* near the end of one stroke moves the slide-valve *G* in the
10 same direction as the valve-rod and opposite to that of the piston-rod *H* on the same side of the engine, and the valve-rod *L* near the end of its stroke moves the slide-valve *F* in a direction opposite to that of the valve-rod
15 and the same as that of the piston-rod *I*, the direction of movement of the valve-rod and valve being reversed by means of the lever *P*.

The construction shown in Figs. 4 and 5 is the same, except that the valve-rods are op-
20 erated by means of tappets *R S*, carried by the piston-rods and engaging adjustable lugs *k* on the corresponding valve-rods, lost motion being provided between the tappets and lugs. In this construction no lost motion need
25 be provided inside the valve-chest, the arm *O* and lever *P* being in constant or nearly constant engagement with their respective lugs.

The arrangement of the cross-motion with
30 its plane of movement parallel or substantially parallel with the plane of movement of the valve reduces the vertical measurement of the engine, permitting the cross-motion to be placed within the steam-chest without ma-
35 terially increasing the size of the latter.

While the construction shown and described forms a simple and convenient arrangement of parts embodying my invention it will be understood that my invention is not to be
40 limited to the specific construction shown, as various other devices for carrying out my invention may readily be provided by one skilled in the art.

While I have shown and described my in-
45 vention as applied to a simple duplex engine it will be understood that it is equally applicable to compound-engines of this type.

What I claim is—

1. In a duplex engine, the combination,
50 with the steam-cylinders on opposite sides of the engine, and their valves, of valve-rods operating the valves on the opposite side of the engine from the valve-rods, the movement of one of the valves being reversed relatively to
55 the piston on the opposite side of the engine, substantially as described.

2. In a duplex engine, the combination,
60 with the steam-cylinders on opposite sides of the engine, and their valves, of valve-rods operating the valves on the opposite side of the engine from the valve-rods and actuated from their own side of the engine, the movement of one of the valves being reversed relatively to
65 the piston on the opposite side of the engine, substantially as described.

3. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of

the engine, and their pistons and valves, of valve-rods operating the valves on the oppo-
70 site side of the engine from the valve-rods and actuated by the piston-rods on their own side of the engine, the movement of one of the valves being reversed relatively to its actuating piston-rod, substantially as de-
75 scribed.

4. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of the engine, and their pistons and valves, of valve-rods operated by the piston-rods on
80 their own sides of the engine, and cross-motion devices between the valve-rods and valves on opposite sides of the engine, reversing the movement of one of the valves relatively to its actuating piston-rod, substantially as de-
85 scribed.

5. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of the engine, and their valves, of cross-motion devices inside the steam-chest operating the
90 valves from the opposite side of the engine and reversing the movement of one of the valves, substantially as described.

6. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of the engine, and their valves, of cross-motion
95 devices inside the steam-chest operating the valves from the opposite side of the engine and reversing the movement of one of the valves, said cross-motion devices being constructed with lost motion, substantially as de-
100 scribed.

7. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of the engine, and their pistons and valves, of
105 valve-rods operated by the pistons on their own sides and cross-motion devices inside the steam-chest operating the valves from the valve-rods on the opposite side of the engine and reversing the movement of one of the valves, substantially as described.
110

8. In a duplex engine, the combination,
with the steam-cylinders on opposite sides of the engine, and their pistons and valves, of
115 valve-rods operated reversely by the pistons on their own sides of the engine and cross-motion devices inside the steam-chest operating the valves from the valve-rods on the opposite side of the engine, the relative movement of one of the valve-rods and its valves being reversed, substantially as described.
120

9. The combination, with the steam-cylinders on opposite sides of the engine, and their
125 pistons and valves, of the valve-rods *K L*, operated by the piston-rods on their own side of the engine, and arm *O* and lever *P*, operated by the respective valve-rods and operating the valves on the opposite side of the engine, substantially as described.

10. The combination, with the steam-cylinders on opposite sides of the engine, and their
130 pistons and valves, of piston-rods *H I*, valve-rods *K L*, levers of the first class connecting the piston-rods and valve-rods on the same side of the engine, arm *O*, operated by one of

the valve-rods and operating the valve on the opposite side of the engine, and lever P, operated by the other valve-rod and operating the opposite valve, lost motion being provided between the piston-rods and valves, substantially as described.

11. The combination, with the two valve-rods of a duplex engine, of the rigid arm O, moved by one valve-rod, and the pivoted lever P, moved by the other valve-rod, and valves

operated by said arm and lever, substantially as described.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

CHARLES O. WORTHINGTON.

Witnesses:

B. W. PIERSON,
LOUIS R. ALBERGER.