(No Model.) 2 Sheets—Sheet 1.

C. A. WILSON.

COMPOUND STEAM PUMPING ENGINE.

No. 313,793. Patented Mar. 10, 1885.

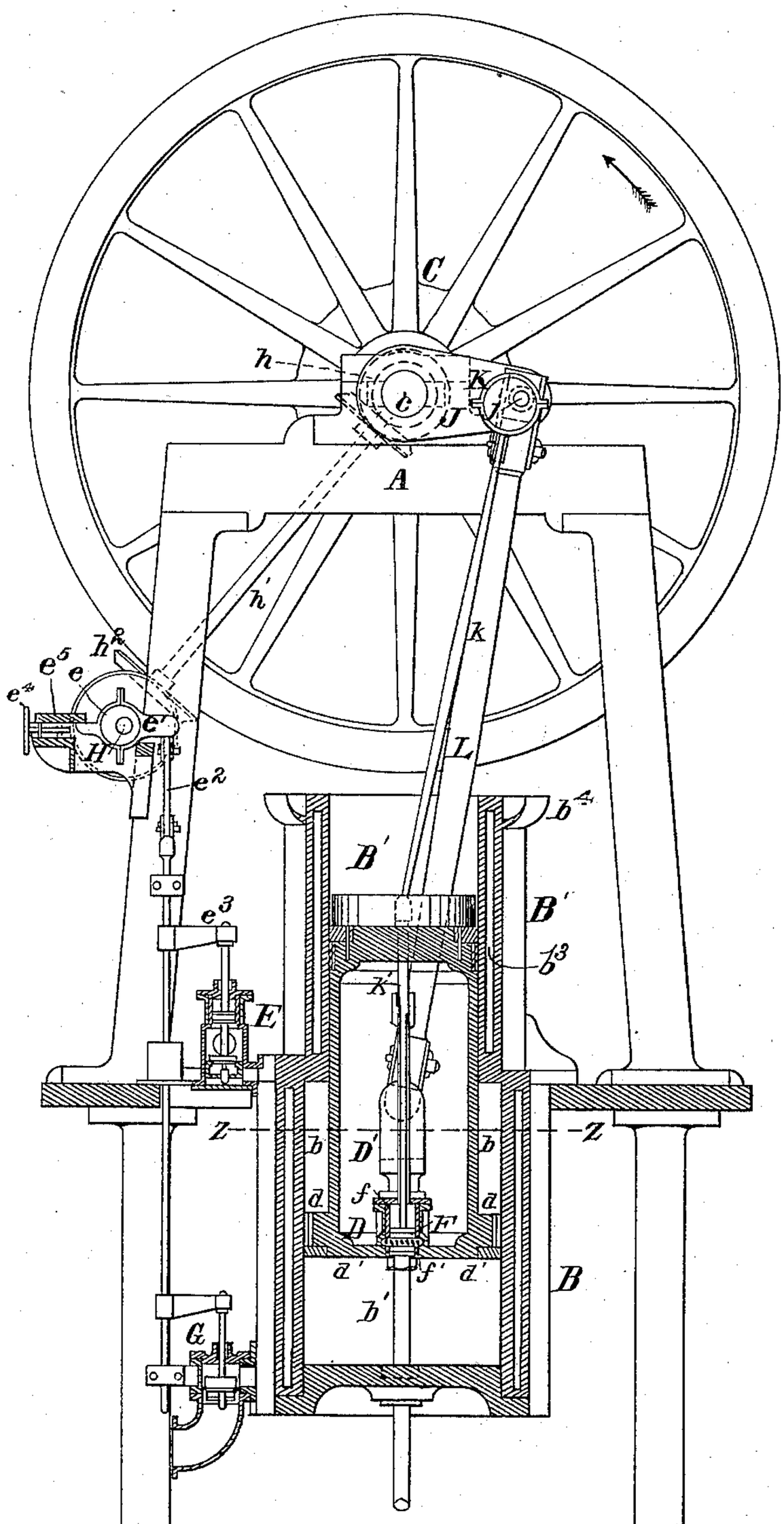

Fig. 1.

Attest.

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Attorney

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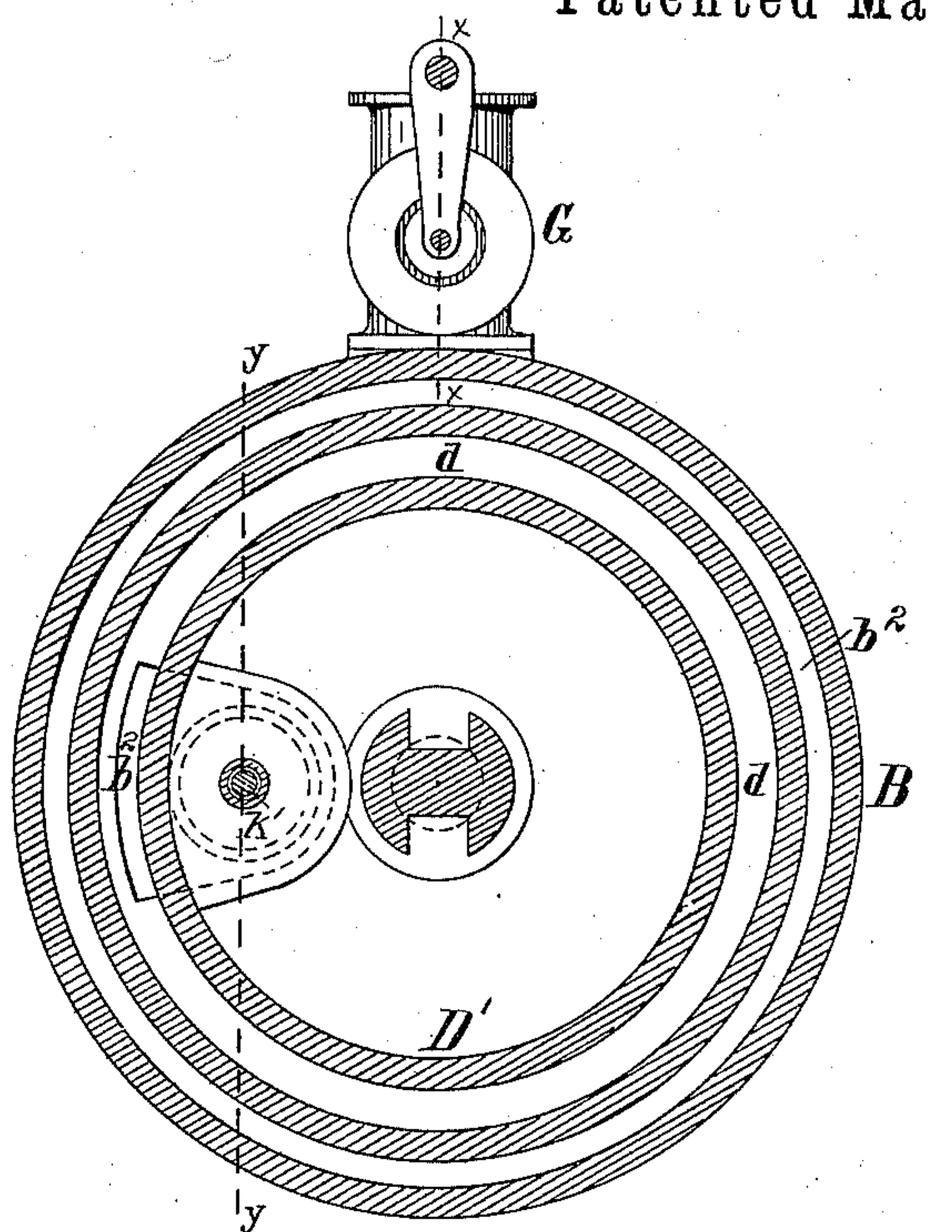

Fig. 2.

Fig. 3.

Attest

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UNITED STATES PATENT OFFICE.

CHARLES A. WILSON, OF CINCINNATI, OHIO.

COMPOUND STEAM PUMPING-ENGINE.

SPECIFICATION forming part of Letters Patent No. 313,793, dated March 10, 1885.

Application filed October 10, 1884. (No model.)

To all whom it may concern:

Be it known that I, CHARLES A. WILSON, of Cincinnati, in the county of Hamilton and State of Ohio, have invented certain new and useful Improvements in Compound Steam Pumping-Engines, of which the following is a specification.

My invention relates to that class of steam-engines, particularly pumping-engines, in which the steam is used upon two pistons of unequal area, known usually as "compound engines;" and it consists of a novel arrangement of steam-pistons and steam and exhaust valves and devices for operating the valve intermediate of the high and low pressure pistons, as will be fully explained hereinafter.

In the accompanying drawings, Figure 1 is a sectional elevation of my improvement, taken partly on line *x x* and partly on line *y y* of Fig. 2. Fig. 2 is a transverse section thereof on line *z z* of Fig. 1, and Fig. 3 is a detached sectional view of the piston-head and intermediate steam and exhaust or equalizing valve.

Similar letters of reference indicate similar parts.

A is the engine-frame, upon which are mounted the steam-cylinder B, fly-wheel C, and shaft *c*. The engine shown is of the "trunk-piston" variety, D being the piston proper, and D′ the trunk thereof. The cylinder B′ is the trunk-guide. The piston D has an annular surface, *d*, upon the upper side and a circular surface, *d′*, upon the under side. The annular surface forms the high-pressure piston and the circular surface the low-pressure piston.

By reference to Fig. 1 it will be seen that steam acting upon the high-pressure piston forces the piston D downward, and steam acting upon the low-pressure piston forces the piston D upward. The downstroke is therefore made with steam direct from the boiler and the upstroke with expanded steam.

E is the steam-admission valve, which, when opened, connects the annular space *b* of cylinder B with the boiler. (Not shown.)

F is the valve which, when opened, connects the annular space *b* with the circular space *b′* of cylinder B.

G is an exhaust-valve, which, when opened, connects the circular space *b′* with the condenser, (not shown,) if engine is made condensing, or with the atmosphere if engine is made non-condensing. The eccentric shaft H is driven by miter-wheels *h*, (shown by dotted lines, Fig. 1,) shaft *h′*, and miter-wheels h^2, in order that the revolutions of shaft H shall be the same as engine-shaft *c*.

Upon shaft H is mounted an eccentric, *e*, which operates the steam-valve E through the gear e' e^2 e^3, and a similar eccentric behind eccentric *e*, which, by means of the customary eccentric yoke and lifter-rod, operates the exhaust-valve G.

The action of the eccentric *e* on steam-valve E may be varied by the hand-gear e^4 e^5, to cause said valve to close earlier or later, according to requirements of the engine.

The gear for operating the valves E and G is that commonly employed on modern puppet-valve pumping-engines, and need not be further described herein.

Referring to the intermediate or equalizing valve F, (see Fig. 3,) this may be of the annular-piston variety, as shown, working in the cylindrical valve-case *f*, and provided with the ports *f′*, or it may be a double-beat puppet-valve of any of the well-known forms; or any suitable form of valve may be employed.

b^2, Figs. 2 and 3, is a port connecting the annular space *b* with the annular space f^2 of valve-case *f*, and through the ports *f′* of valve F with the space *b′* under piston D. The valve F is operated by the small eccentric K, keyed to the crank-pin *j* of engine-crank J, which, through the rod *k* and stem *k′*, gives said valve F a motion in its case *f* independent of the motion derived from the crank J, connecting-rod L, and piston D. Thus if it be assumed that in the position of moving parts shown the piston D is ascending and the fly-wheel moving in the direction of the arrow, Fig. 1, then the valve F, by action of eccentric K, would be open, and when the crank J was at the upper center the valve F will have just closed. Then during the downstroke the eccentric K would hold the valve F closed until the crank J was nearly on the lower center, when valve F would just begin to open. The steam-valve E

begins to open just before the completion of upstroke to give lead to the engine, and remains open during such portion of the downstroke of piston D as may be required in the operation of engine, but always closes before valve F begins to open, to prevent steam from the boiler passing through annular space *b* above piston D into circular space *b'* under the piston. The exhaust-valve G opens to the condenser or atmosphere simultaneous with or after the valve F closes during the upstroke of piston D, and closes slightly before the piston has completed the downstroke. The engine is double-acting—high pressure on the downstroke and low pressure on the upstroke—valves E and F constituting, respectively, the steam and exhaust valves for the high-pressure stroke, and valves F and G constituting, respectively, the steam and exhaust valves for the low-pressure stroke. Thus valve F performs a double function, being the exhaust-valve to the annular cylinder *b* and steam-valve to the circular cylinder *b'*, so much of cylinder B as lies above the piston D being considered the annular cylinder, and that portion below the piston D at any point in its stroke being considered the circular cylinder.

The action of the engine is as follows: Steam being admitted from the boiler to the annular space *b*, the piston D is driven downward to the end of its stroke, when (or before) steam-valve E is closed and intermediate valve, F, is opened, connecting space *b* with space *b'*. The pressure being equalized in the spaces above and below the piston D, the pressure on the larger surface *d'* of piston D forces the piston up against the counter-pressure on annular surface *d* when the piston completes its upstroke, or slightly before the valve F closes, and the exhaust-valve G opens, connecting the portion of cylinder B under the piston D with the condenser or with the atmosphere.

b^2 is a jacket to which steam may be admitted from the boiler, and b^3 an air-space to prevent radiation of heat from the surface of trunk D' through the walls of trunk-guide B'.

b^4 is an annular lip around the top of trunk-guide B', which receives the condensation from the surface of trunk D', from which it may be conveyed away by suitable drip-pipes.

I am aware that trunk-engines are not new, and that compound engines with one cylinder common to two pistons, one of which is annular, are not new, and these I do not claim.

Having described my invention, what I claim is—

1. The combination of the stationary cylinder B, the steam-inlet valve E, attached to the upper end thereof, the exhaust-valve G, attached to the lower end of the same and connected with the steam-inlet valve, and the piston D, arranged in the cylinder to form the annular space *b*, with the valve F working through the piston for connecting the annular space *b* with the space *b'* below the piston, the crank-shaft *c* of the engine connected with the piston, an eccentric, K, connected with the crank-shaft, and a connection between the eccentric and the valve F, substantially as described.

2. The combination of the stationary cylinder B and the piston D, arranged to form the annular space *b* between the cylinder and piston, the engine crank-shaft *c*, connected with the piston, the equalizing-valve F, seated in the piston, for connecting the annular space *b* with the space *b'* under the piston, an eccentric, K, connected with the engine crank-shaft, and a connection between the eccentric and the equalizing-valve, substantially as described.

3. The combination of the stationary cylinder B, having the trunk-guide B', the piston D, having the trunk D', and arranged in the cylinder to form the annular space *b*, the steam inlet and outlet valves E and G, connected together, and attached, respectively, to the upper and lower ends of the stationary cylinder, the engine crank-shaft *c*, connected with the piston and also with the steam-inlet valve, an eccentric, K, connected with the engine crank-shaft, an equalizing-valve, F, seated in the piston, for connecting the annular space *b* with the space beneath the piston, and a connection between the eccentric and the equalizing-valve, substantially as described.

4. The combination of the stationary cylinder B, the piston D, having the annular upper surface, *d*, the annular space *b* between the cylinder and piston, the valve F seating in the piston, the steam-inlet valve E, connecting with the annular space, the engine crank-shaft *c*, and a connection between the piston and the crank-shaft, and an independent connection between the valve F and the said crank-shaft, substantially as described.

5. The combination of the stationary cylinder B, the piston D, having the lower surface, *d'*, and arranged in the cylinder to form the circular space *b'* below the piston the valve F seating in the piston, the steam-outlet valve G, attached to the stationary cylinder and connecting with the space *b'*, the engine crank-shaft *c*, a connection between the piston and crank-shaft, and an independent connection between the valve F and the said crank-shaft, substantially as described.

In testimony whereof I have signed my name to the foregoing specification in the presence of two subscribing witnesses.

CHARLES A. WILSON.

Witnesses:

CHAS. ANDERSON,

JOHN W. HILL.