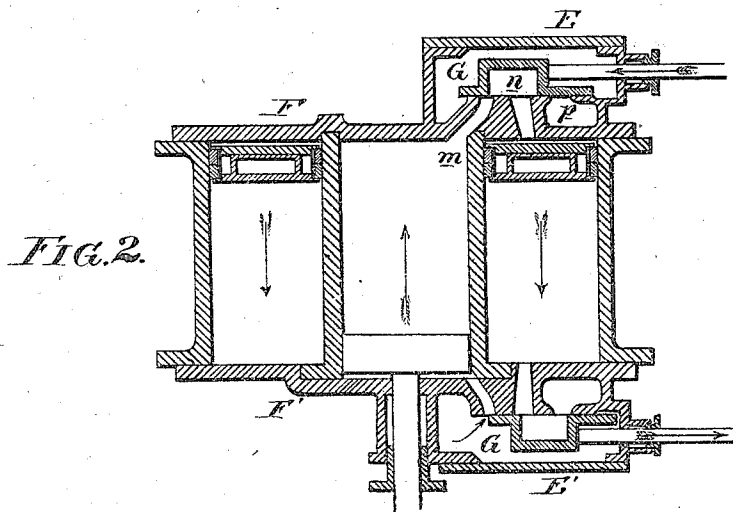
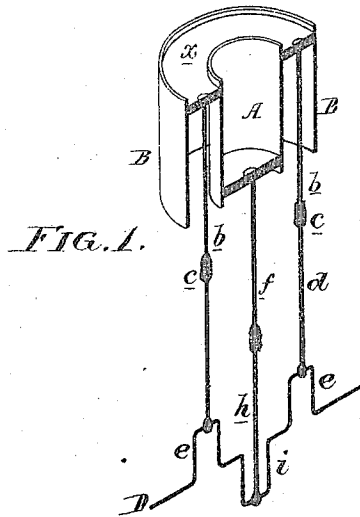


S. ARCHBOLD.

Compound Steam-Engines.

No. 134,344.

Patented Dec. 31, 1872.



Witnesses, Thomas M. Morgan  
Harry Smith

S. Archbold  
By his attys.  
Houson & Son.

# UNITED STATES PATENT OFFICE.

SAMUEL ARCHBOLD, OF CHESTER, PENNSYLVANIA.

## IMPROVEMENT IN COMPOUND STEAM-ENGINES.

Specification forming part of Letters Patent No. 134,344, dated December 31, 1872.

*To all whom it may concern:*

Be it known that I, SAMUEL ARCHBOLD, of Chester, Delaware county, Pennsylvania, have invented an Improvement in Compound Steam-Engines, of which the following is a specification:

My invention relates to that class of steam-engines in which a central steam-cylinder of small area for receiving high-pressure steam is surrounded by an annular cylinder of larger area for receiving the exhaust steam from the smaller cylinder; and the object of my invention is, first, to so balance or approximately balance the operating parts of an engine of this class as to insure regularity and uniformity of action; and, secondly, a simple and efficient system of valves and ports.

I attain the first object by connecting the piston of the small central cylinder A and that of the larger annular cylinder B to the cranks *ee* and *i* of the shaft D, in the manner illustrated in the perspective skeleton diagram, Figure 1 of the accompanying drawing, so that the two pistons and their connections must invariably move in contrary directions. The second object I attain in the manner illustrated in the vertical section, Fig. 2.

Compound steam-engines have heretofore been made in which a large annular cylinder contained a smaller central cylinder, this plan having been resorted to in the construction of large pumping-engines. The pistons and their connections of both cylinders, however, invariably moved in the same direction—a defect which my invention is designed to obviate.

The annular piston *x* of the large, annular cylinder B has two piston-rods, *b b*, which are connected to guided slides *cc*, the latter being connected by rods *dd* to cranks *ee* on the shaft D, the piston-rod *f* of the central cylinder A being similarly connected by a rod, *h*, to a central crank, *i*.

It will be seen that the cranks *ee* project from the shaft D in a direction the reverse of that of the crank *i*, the centers of the pins of all the cranks and the center of the shaft D being in or very nearly in the same line.

As by this plan of arranging the cranks the pistons of the two cylinders must necessarily move in contrary directions, the weight of one piston and its connections during the downward stroke must, in a measure, be counteracted by the upward stroke of the other piston and its connections. In other words, the

pistons and their connections of the two cylinders are approximately balanced, and a more uniform and steady action of the engine is insured than by any other relative arrangement of the cranks.

It will be observed in reference to Fig. 2, that there are two valve-chests, E and E', one forming part of or being connected to the upper cover F of the two cylinders, and the other forming part of or being connected to the lower cover F'. The steam-chests communicate with each other and with the steam-boiler, and each chest contains an ordinary slide-valve, G, adapted to ports *m*, *n*, and *p*, the first for admitting live steam to the small cylinder, the second for admitting the exhaust steam of the small cylinder to the large annular cylinder, and the third for the discharge of the exhaust steam of the large cylinder. As seen in Fig. 2, the piston of the small cylinder has reached the limit of its downward movement, and that of the larger cylinder the limit of its upward movement, both pistons being about to return, as shown by the arrows, and the two valves being in the relative position shown, and moving in the direction pointed out, the upper valve being in such a position that the steam can be exhausted through the ports *m* and *n* from the smaller into the larger cylinder, while the lower valve permits the steam in the large cylinder to exhaust through the ports *n* and *p* into a passage communicating with the air or with a condenser.

The valves move in opposite directions, and may be operated by one eccentric, with a result which will be readily understood by engineers without explanation.

I claim as my invention—

1. In a compound steam-engine having a small cylinder contained within a larger annular cylinder, the pistons connected to a single shaft, and cranks arranged in the manner described, for the purpose specified.

2. The combination, with the covers of the said two cylinders, of slide-valves and ports, arranged substantially as described.

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

SAML. ARCHBOLD.

Witnesses:

WM. A. STEEL,  
HUBERT HOWSON.