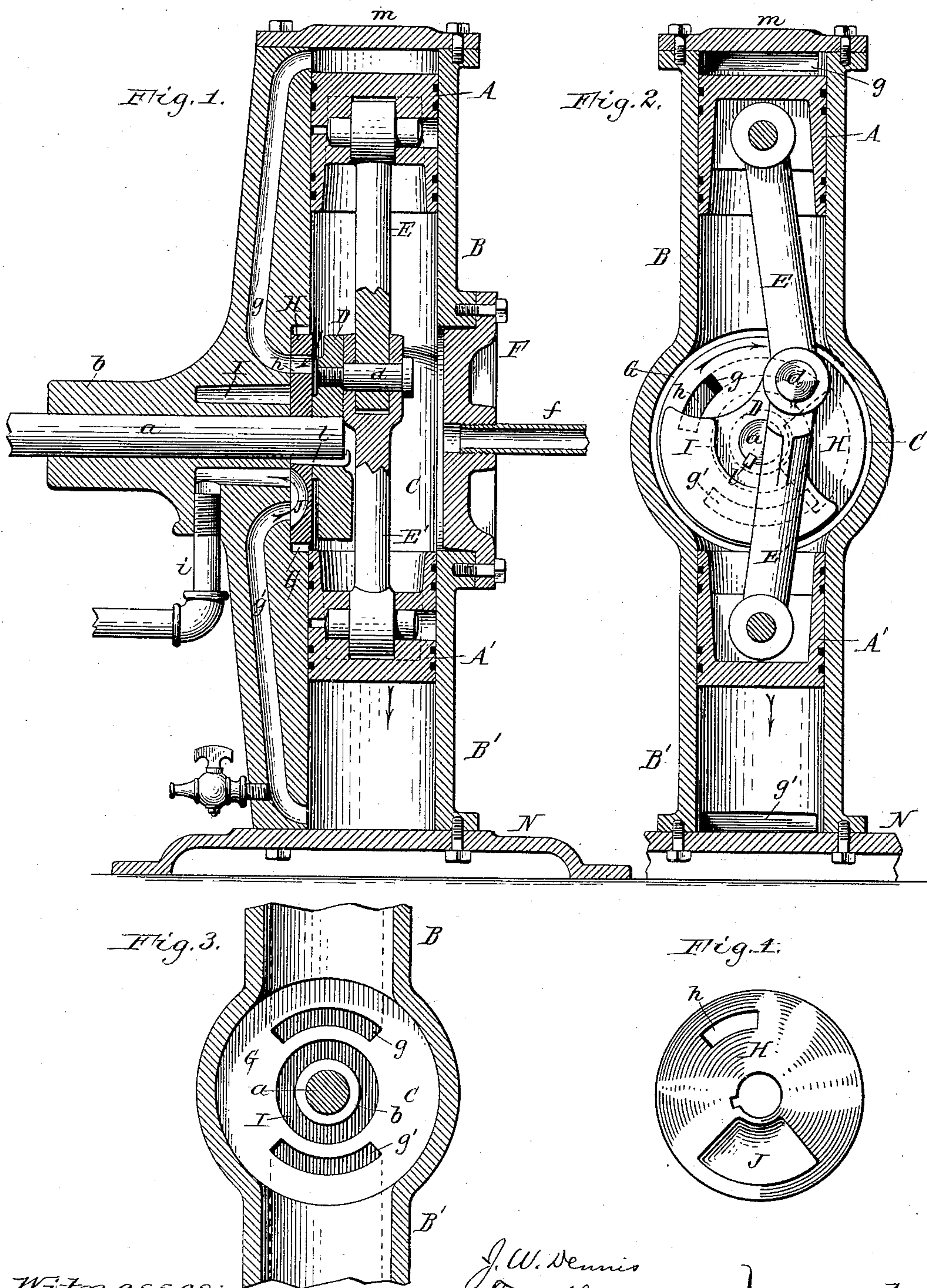


(No Model.)

J. W. DENNIS & F. A. SHOEMAKER.  
STEAM ENGINE.

No. 409,457.

Patented Aug. 20, 1889.



Witnesses:  
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# UNITED STATES PATENT OFFICE.

JOSEPH W. DENNIS AND FRANK A. SHOEMAKER, OF BUFFALO, NEW YORK.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 409,457, dated August 20, 1889.

Application filed May 13, 1889. Serial No. 310,569. (No model.)

*To all whom it may concern:*

Be it known that we, JOSEPH W. DENNIS and FRANK A. SHOEMAKER, citizens of the United States, residing in the city of Buffalo, in the county of Erie and State of New York, have invented new and useful Improvements in Steam-Engines, of which the following is a specification.

This invention relates to that class of steam-engines which contain two or more cylinders and connected pistons moving therein, and in which the steam is admitted to a chamber formed at the junction of the cylinders and admitted from said intermediate chamber to the outer ends of the cylinders and exhausted therefrom by a rotary valve.

The object of our invention is to produce a simple engine of this kind which is composed of comparatively few parts, which can be constructed at small expense, and which is easily kept in order.

In the accompanying drawings, Figure 1 is a sectional elevation of our improved steam-engine. Fig. 2 is a vertical section at right angles to Fig. 1. Fig. 3 is a cross-section of the central portion of the engine, showing the valve-seat. Fig. 4 is a rear elevation of the valve.

Like letters of reference refer to like parts in the several figures.

A A' represent two single-acting pistons arranged in two cylinders B B', which communicate at their inner ends with an intermediate steam-chamber C.

a represents the engine-shaft journaled in an elongated bearing b, which is formed on the rear side of the chamber C. The shaft a projects into the chamber C and carries within the latter a counterbalanced crank D, having a wrist-pin d, which is connected with both pistons A A' by rods E E'.

f is the steam-supply pipe opening into the intermediate chamber C and attached to a removable head or cover F, which closes an opening in the front wall of said chamber.

G represents a circular valve-seat formed in the rear portion of the chamber C behind the crank-wheel D and concentric with the engine-shaft.

g g' represents the steam-ports extending from the valve-seat G to the outer or upper and lower ends of the cylinders B B'.

H is a circular or disk valve mounted on the engine-shaft behind the crank-wheel and rotating on the valve-seat G. This valve is provided with an arc-shaped steam-port h, which is adapted to open a communication between the intermediate steam-chamber C and either of the steam-ports g g'.

I represents the annular exhaust-port which surrounds the inner portion of the bearing of the engine-shaft and communicates with an exhaust-pipe i.

J represents an exhaust-cavity formed in the rear side of the valve-disk H nearly opposite the steam-port h thereof. The valve and the crank-wheel may be secured to the engine-shaft by the same key l, as shown in Fig. 1; but the valve is preferably loosely fitted on the key, so that the steam-pressure against its front side will hold it tightly against its seat and prevent leakage, while in small engines it will render the employment of a stuffing-box around the shaft unnecessary. The upper end of the upper cylinder is closed by a cover m, and the lower end of the lower cylinder by the base-plate N. The steam enters the intermediate chamber C through the supply-pipe f, and, filling the chamber, presses against the inner faces of both pistons alike, whereby the outward pressure upon the pistons is balanced.

In the position of the parts represented in Figs. 1 and 2, the upper steam-port g has just begun to be uncovered by the port h of the valve, so that steam is admitted through the port g above the upper piston A. The exhaust-cavity J of the valve has just begun to uncover the lower port g', so that the steam contained below the lower piston A' is being exhausted. The pressure against the inner faces of the pistons being balanced, both pistons are forced downwardly by the pressure applied above the upper piston, and this continues until the pistons reach the end of the downward stroke, when the valve causes steam to be admitted below the lower piston and the steam to be exhausted from above the upper piston.

Our improved engine is easily constructed at small expense, as cross-heads, guides, and piston-rods are dispensed with. Both cylinders being in line with each other, they are readily bored out at one operation, while the

journal for the shaft and the valve-seat and other surfaces concentric therewith are readily bored out by another operation, so that the entire inner finishing of the engine is readily effected by two simple operations upon the lathe. The moving parts all work in steam, so that they are easily lubricated, while they are protected against external influences.

We have described our engine as being actuated by steam; but it is obvious that it may be actuated by compressed air, water, or any other suitable vapor, gas, or liquid under pressure.

We claim as our invention—

The combination, with the cylinders, of an intermediate chamber which communicates with the inner ends of the cylinders, and which is at one side provided with an opening closed

by a removable cover, and at the opposite side closed and provided with a central shaft-bearing, and an annular valve-seat containing an annular exhaust-port surrounding said bearing, and ports leading to the ends of the cylinders; a shaft arranged in said bearing, a crank secured to said shaft, a valve mounted on said shaft between the crank and the valve-seat, and pistons connected with said crank, substantially as set forth.

Witness our hands this 25th day of April, 1889.

JOSEPH W. DENNIS.  
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Witnesses:

JNO. J. BONNER,  
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