

(No Model.)

G. H. WARING & O. B. WHITE.  
STEAM ENGINE.

No. 512,638.

Patented Jan. 9, 1894.

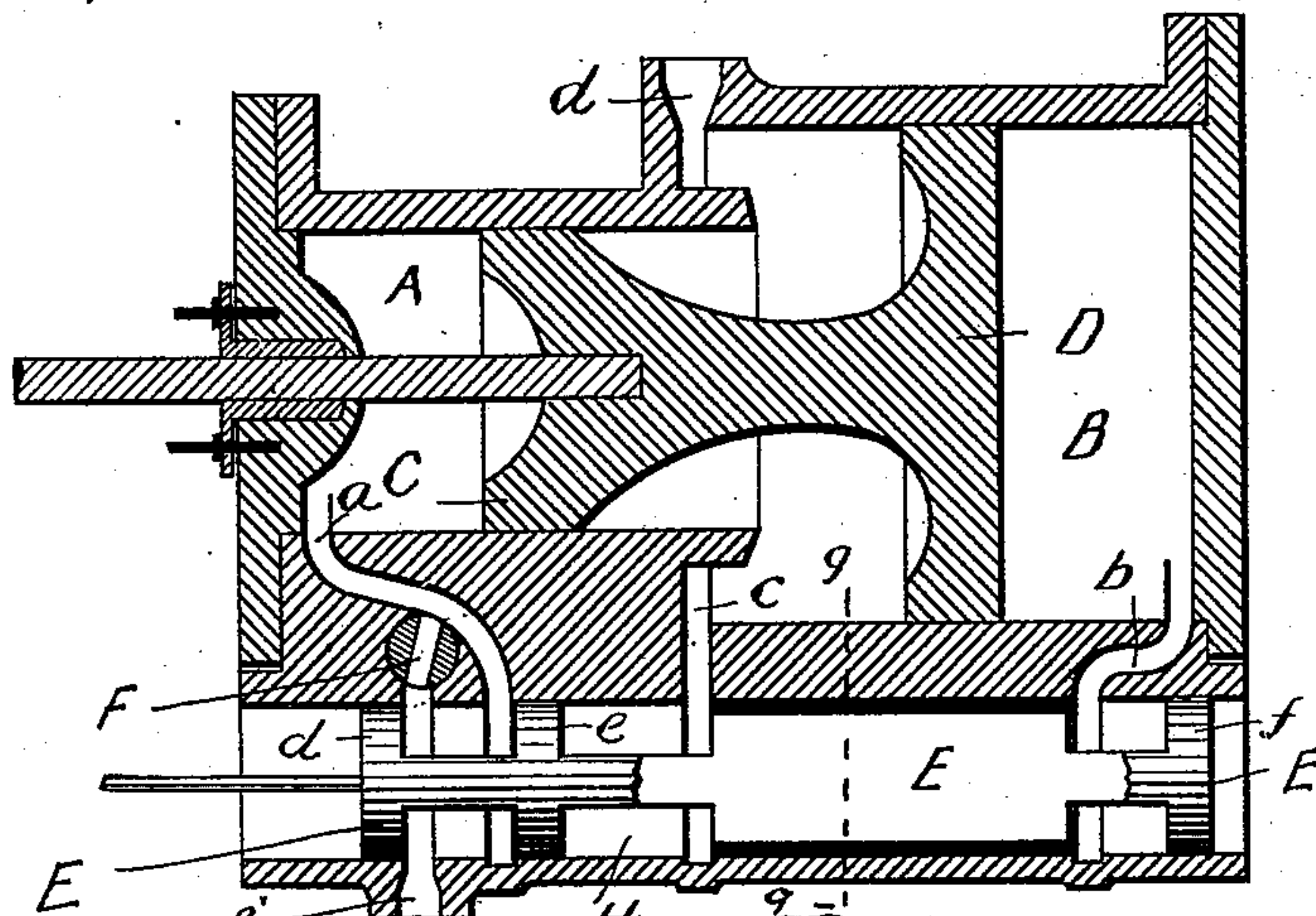


Fig. 1.

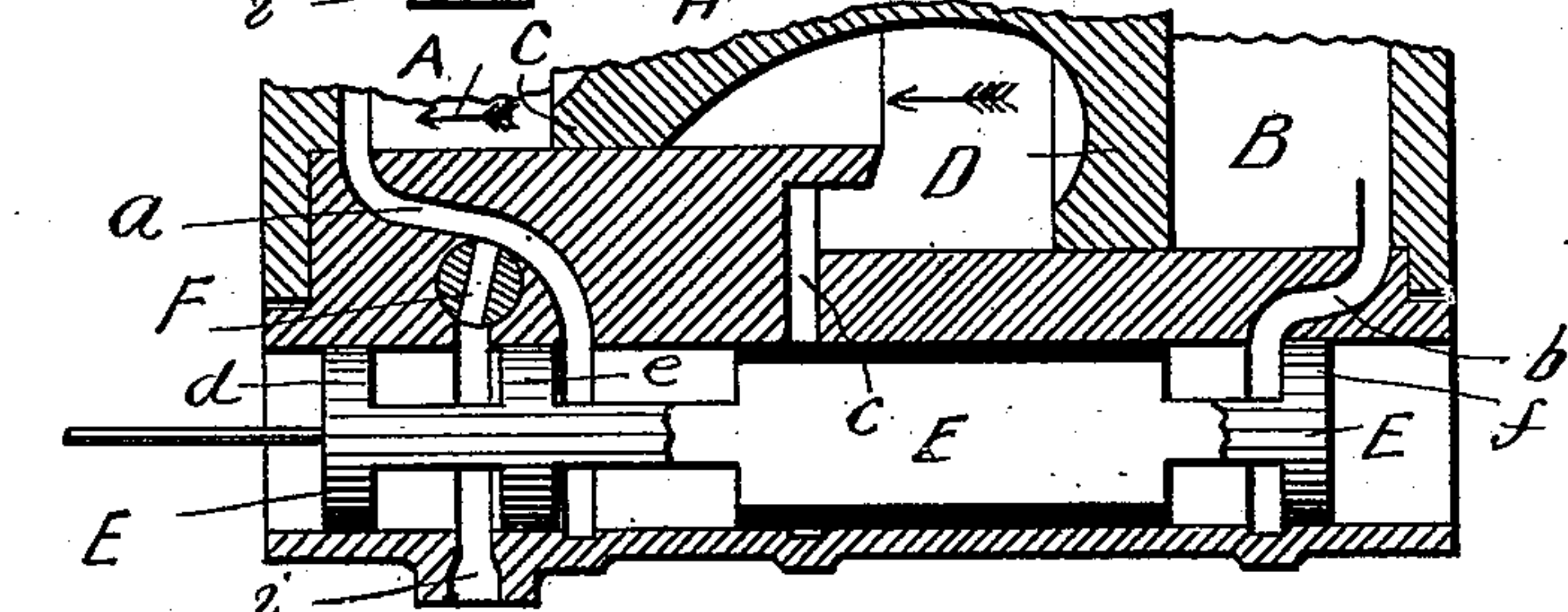


Fig. 2.

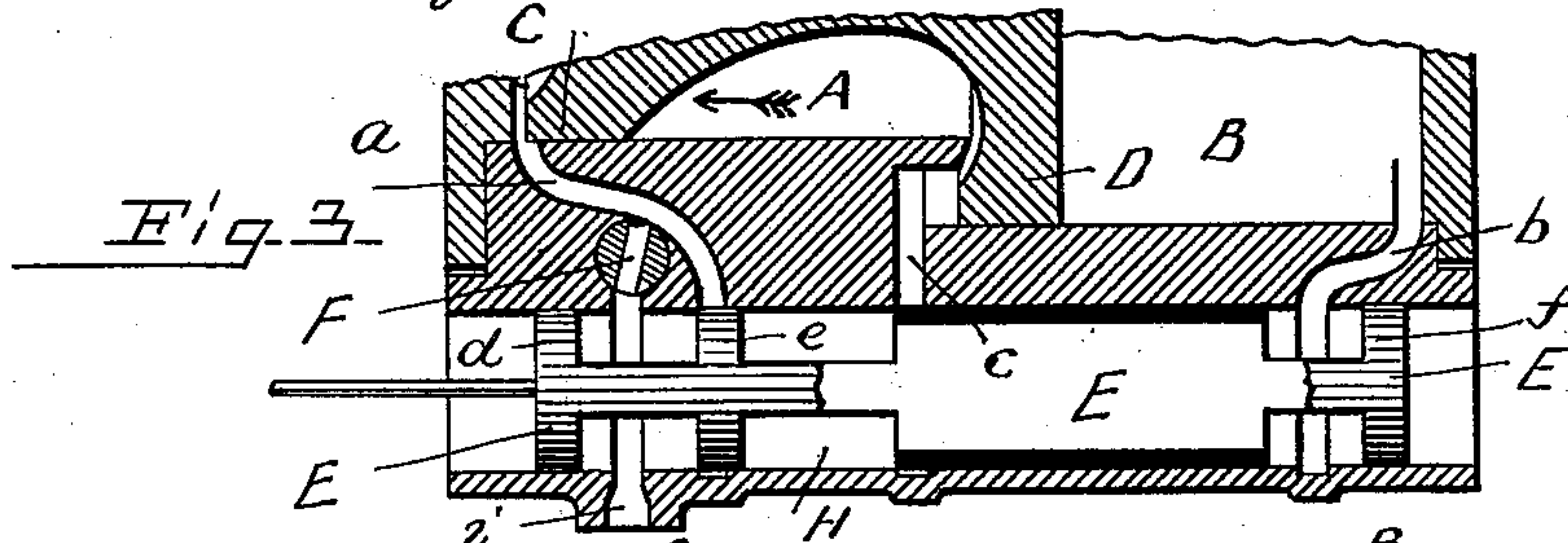


Fig. 3.

Fig. 7.

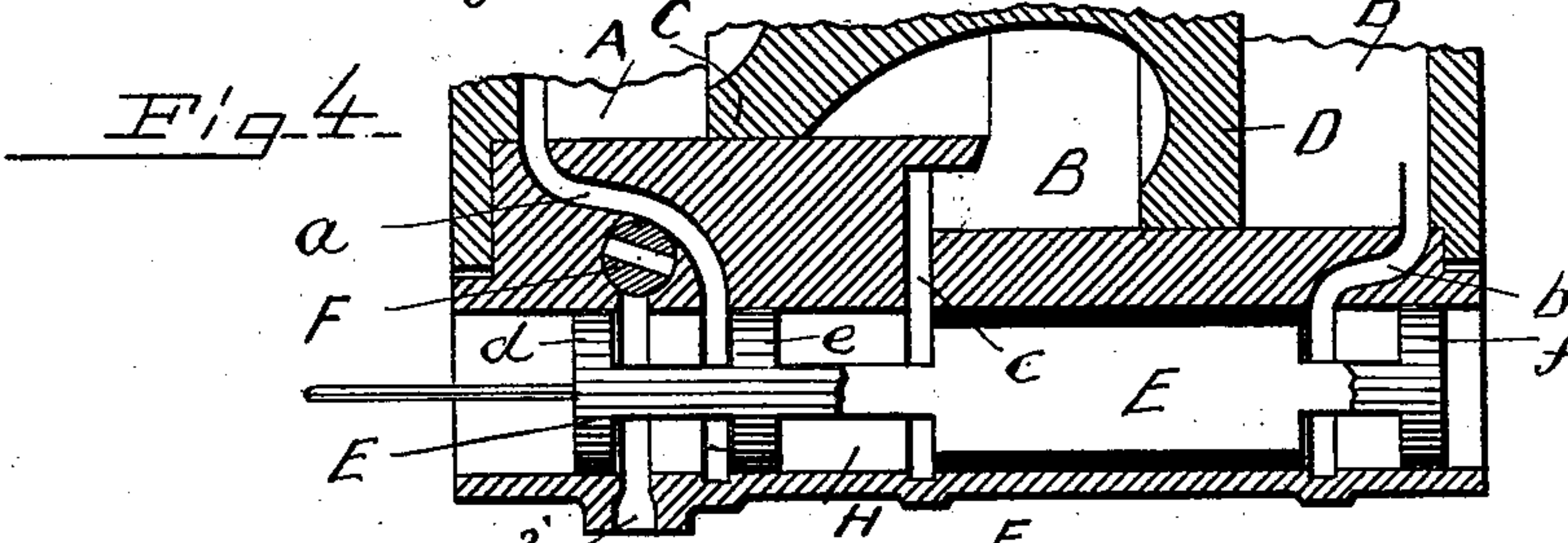


Fig. 4.

Fig. 8.

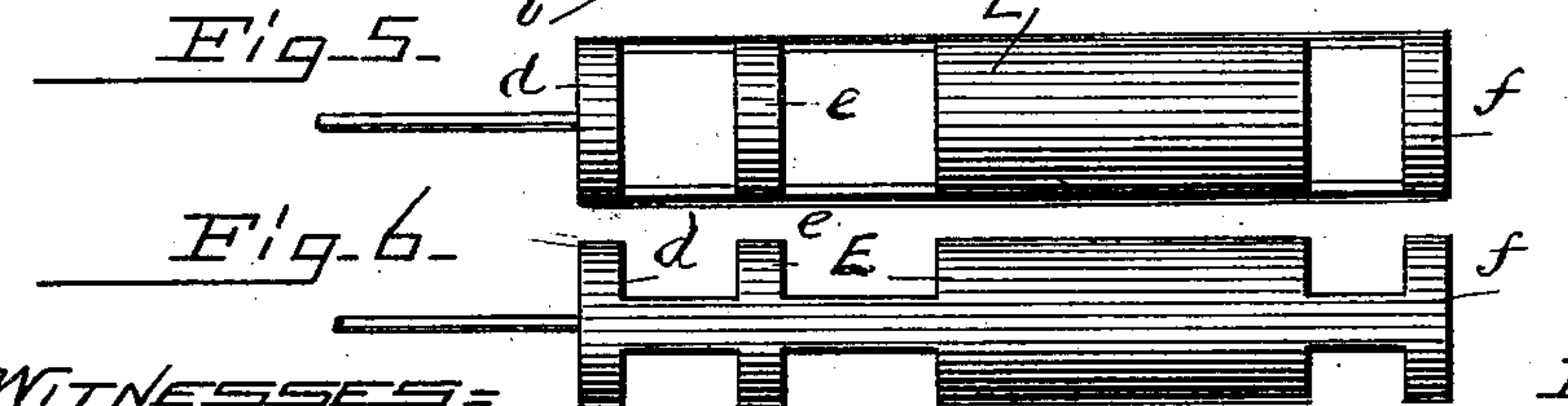
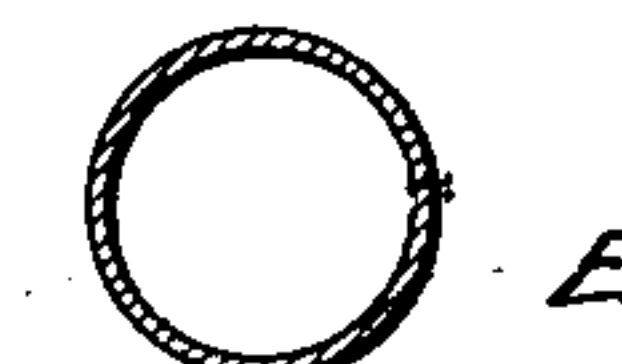


Fig. 5.

Fig. 9.



Fig. 6.



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# UNITED STATES PATENT OFFICE.

GEORGE H. WARING AND OSCAR B. WHITE, OF ST. JOHN, CANADA.

## STEAM-ENGINE.

SPECIFICATION forming part of Letters Patent No. 512,638, dated January 9, 1894.

Application filed May 15, 1893. Serial No. 474,349. (No model.)

*To all whom it may concern:*

Be it known that we, GEORGE H. WARING and OSCAR B. WHITE, of the city of St. John, in the county of St. John, in the Province of New Brunswick, in the Dominion of Canada, have invented certain new and useful Improvements in Steam-Engines, of which the following is a full, clear, and exact description.

Reference is made to the accompanying drawings in which—

Figure 1 is a horizontal section of the device. Figs. 2, 3 and 4 are horizontal part sections of the device in different positions.

Fig. 5 is a top view of the valve. Fig. 6 is a side view of the valve. Figs. 7 and 8 are end views of the valve. Fig. 9 is a cross sectional view of said valve.

The first part of our invention relates to the combination of two cylinders of different diameters having a common center and of equal length, connected to and opening freely into each other and two pistons of different diameters having a common center and solidly connected, adapted to fit and reciprocate in the cylinders.

The second part of our invention relates to a valve and steam chest having openings which are controlled by the valve so as to admit steam to the small cylinder and from it to the large one and from the large cylinder to both cylinders between the two pistons.

The third part of our invention relates to an auxiliary valve, or by-pass which is used in starting the engine and when open allows live steam to both the small and large pistons so as to cause them to reciprocate in the cylinders.

Similar letters refer to similar parts throughout the several views.

A and B are small and large cylinders opening freely into each other and having equal lengths and a common center.

C and D are small and large pistons solidly connected as shown and adapted to fit and reciprocate in the cylinders A and B respectively.

E is a hollow cylindrical valve adapted to reciprocate in its chamber and in conjunction with the passages, or ports *a*, *b*, *c* and *i* admit and control steam so that it will cause the pistons C and D to reciprocate. The stem of

said valve is provided with pistons *d*, *e*, and *f*, as shown in the drawings.

F is a rotary auxiliary valve by which live steam may be admitted to either piston to cause them to reciprocate when starting.

Our device works as follows: Steam from the boiler enters at *i*, Fig. 1, and passes through the steam chest between the pistons of the valve E and through the port *a* to the cylinder A which causes the piston C to move forward to the end of the stroke when the valve E moves back, Fig. 2, and allows the steam in A to pass through 1 and E's hollow center to the port *b* and into the cylinder B. As the steam passes into A and B the piston D being larger than the piston C the pistons are forced back toward the crank in the direction of the arrows. Steam is again admitted to the small cylinder A, Fig. 1, which causes it to again move forward and the exhaust or dead steam in the cylinder B is forced out through the port *b* and through the hollow part of the valve E and through the port *c* into the two cylinders A and B, but between the pistons and escapes from there through the exhaust port *d*. On the completion of this outward stroke, as in Fig. 1, exhaust steam is again admitted to the large cylinder B in the manner hereinbefore described and as illustrated in Fig. 2, which causes the inward stroke as before, in the direction of the arrows. The engine is allowed to run high pressure this way, until up to speed and thoroughly warmed up when the auxiliary or starting valve F is closed as in Fig. 4 and then the live steam is admitted to the small cylinder A as before; but on the completion of the outward stroke the steam in A is cut off from the boiler and by means of the valve E allowed to expand into the large cylinder B and the pressure being equal on the pistons C and D they move in toward the crank in the direction of the arrows as in Fig. 2. The engine now runs by high pressure or live steam acting on C and this steam expanding into B and acting on D, which being larger than C while the pressure is the same on each, causes the inward or return stroke and so on throughout the entire run, the dead steam in the cylinder B exhausting as before described.

What we claim as new, and desire to secure by Letters Patent, is—

1. In a steam engine, the combination with  
two cylinders of different diameters and of  
common center and length, of two pistons of  
different diameters, solidly connected and  
5 adapted to fit and reciprocate in said cylin-  
ders, a port communicating with the smaller  
of said cylinders, an auxiliary valve control-  
ling said port, a port communicating with the  
larger of said cylinders, a port located be-  
10 tween the two pistons and communicating  
with both said cylinders, and a main valve  
having a hollow cylindrical portion, said main  
valve controlling all of said ports, substan-  
tially as described.

15 2. In a steam engine, the combination with  
two cylinders of different diameters and of  
common center and length, of two pistons of  
different diameters, solidly connected and

adapted to fit and reciprocate in said cylin-  
ders, a port communicating with the smaller 20  
of said cylinders, a port communicating with  
the larger of said cylinders, a port located be-  
tween the two pistons and communicating  
with both said cylinders, and a valve having  
a hollow cylindrical portion and the stem of 25  
which is provided with pistons *d*, *e* and *f*, con-  
trolling said ports, substantially as described.

In testimony whereof we have hereunto set  
our hands in the presence of two subscribing  
witnesses.

GEORGE H. WARING.  
OSCAR B. WHITE.

Witnesses:

CHARLES F. SANFORD,  
ALEXANDER J. BARNHILL.