

No. 626,368.

Patented June 6, 1899.

W. E. CRANE.  
VERTICAL ENGINE.

(Application filed Sept. 18, 1897.)

(No Model.)

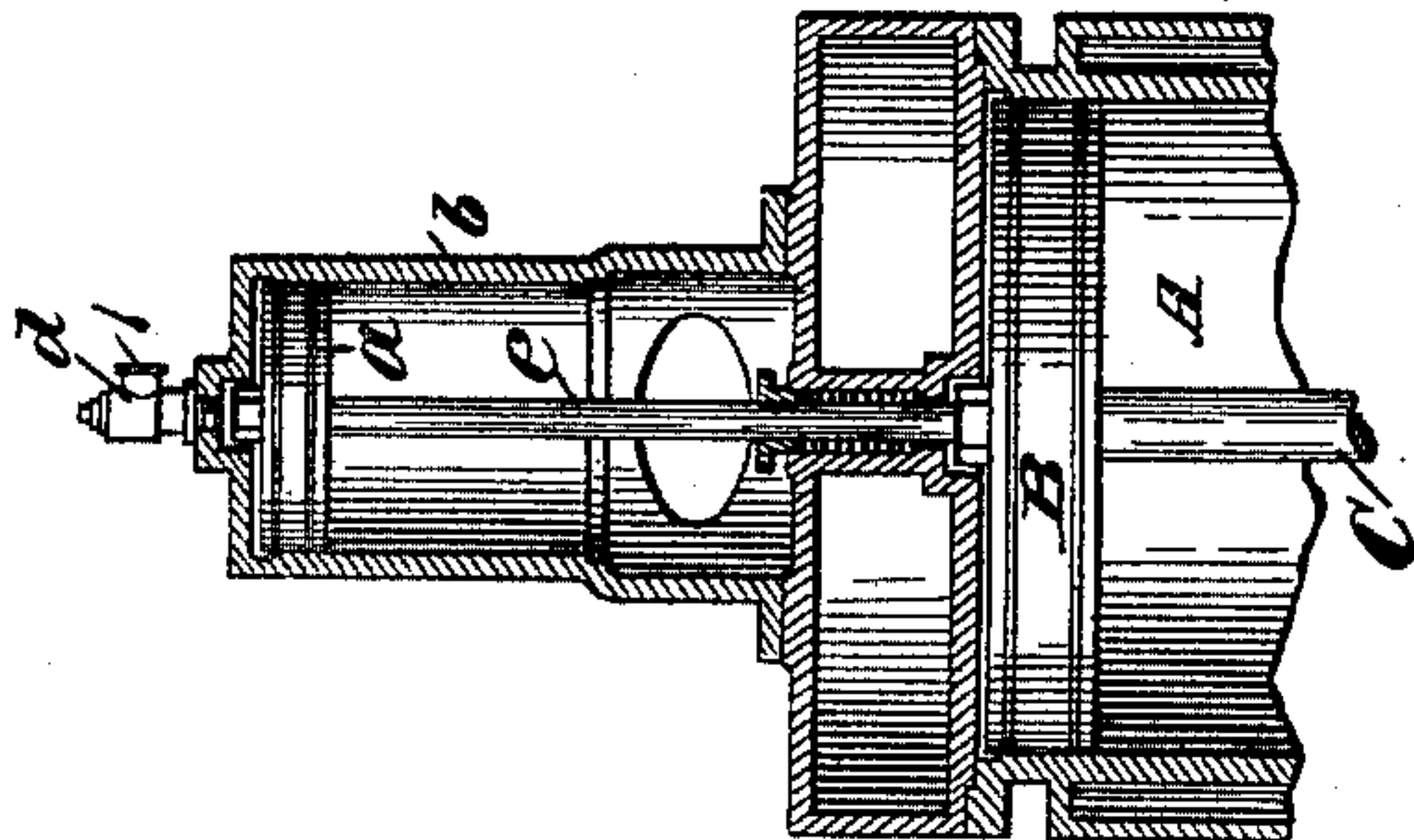


Fig. 2.

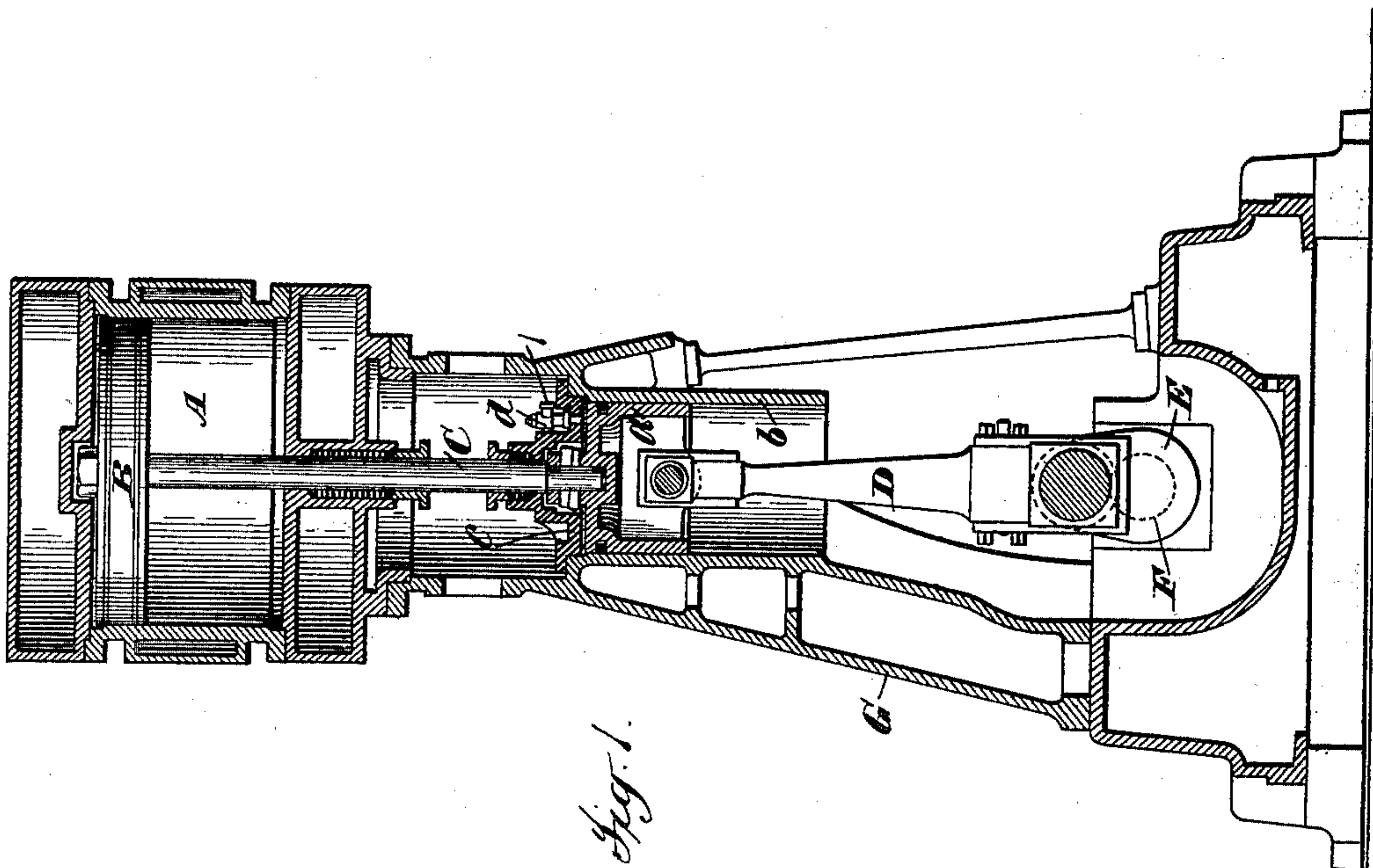


Fig. 1.

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# UNITED STATES PATENT OFFICE.

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## VERTICAL ENGINE.

SPECIFICATION forming part of Letters Patent No. 626,368, dated June 6, 1899.

Application filed September 18, 1897. Serial No. 652,122. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM E. CRANE, a citizen of the United States, residing at Waterbury, county of New Haven, and State

5 of Connecticut, have invented certain new and useful Improvements in Vertical Engines, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

10 The object of the present invention is to provide an improved means for balancing the weight of the moving parts of vertical double-acting steam and similar motor engines, so as to secure a uniform action on the down-

15 stroke, in which the weight of the moving parts assists the steam-pressure, and on the upstroke, in which this weight opposes the steam-pressure, the especial object of the invention being to provide a simpler, cheaper, and more reliable means for this purpose

20 than those heretofore employed. I secure this result by the use of a balancing-piston moving against atmospheric pressure on the downstroke of the engine and assisted thereby on the upstroke, the opposite side of the

25 piston being subjected to a pressure less than that of the atmosphere. The pressure upon the piston opposing the atmospheric pressure may be substantially a vacuum or of

30 any desired amount, the balancing-piston being made of the proper size, according to such pressure and the weight of the moving parts; but I preferably employ an adjustable relief-valve, by which the amount of such pressure

35 opposing the atmospheric pressure can be controlled and regulated, as desired, to secure the desired action.

For a full understanding of the invention a detailed description of the same will now

40 be given in connection with the accompanying drawings, showing constructions embodying the invention in preferred forms as applied to a single-cylinder vertical-crank engine of common form, and the features forming the invention will then be specifically

45 pointed out in the claims.

In the drawings, Figure 1 is a vertical diagrammatic section of the engine, showing the balancing-piston between the engine-piston

50 and crank-shaft. Fig. 2 is a similar partial section showing the balancing-piston above the engine-piston.

Referring to said drawings, A is the engine-cylinder, B the piston, C the piston-rod, and D the crank-rod connecting the

55 piston to the crank E on crank-shaft F, all of which parts, with the engine-frame G, may be of any suitable construction of a double-acting engine.

As shown in Fig. 1, the piston-rod C and

60 crank-rod D are connected through a piston a, which forms the balancing-piston of my construction and works in the balancing-cylinder b, formed or supported in the frame G in any suitable manner. This cylinder b is

65 open at its lower end, so that the lower side of the piston a is subjected to atmospheric pressure, and is closed at its upper end by the head c, through which the piston-rod C works. This head c is provided with an air-relief

70 valve d, opening upward, so as to permit the escape of air from the cylinder b on the upper side of the balancing-piston a and prevent the return of air thereto. This air-relief valve may be of any common or suitable

75 construction, but preferably is adjustable, as common in air-relief valves, the common screw-plug l being shown for this purpose, so that the air-relief valve may be set to preserve substantially a vacuum in the cylinder

80 b above the piston a or to carry some pressure in this portion of the cylinder, and thus secure exactly the balancing action desired. In some constructions it may be found desirable to thus carry a few pounds pressure, so

85 as to secure some compression and cushion on the upstroke instead of cushioning in the cylinder A on piston B or in addition to such cushioning.

The construction shown in Fig. 2 is substantially the same as that shown in Fig. 1,

90 except that the balancing-cylinder b is mounted upon the head of the engine-cylinder A and the balancing-piston a formed by a smaller extension e of the engine piston-rod

95 C or by a separate rod connected thereto. This construction is desirable in that it involves no special construction of the engine-frame.

The operation of the construction will be

100 understood without extended description, it being obvious that the balancing-piston a in both constructions shown will work against atmospheric pressure on the downstroke, thus



opposing the steam-pressure, so as to offset or balance the weight of the moving parts of the engine, and that upon the return or up stroke the atmospheric pressure below the piston *a* will exert the same pressure upon the piston, tending to lift the moving parts of the engine, so that the work of the piston *B* is substantially the same on the down and up strokes and the desired uniform action of the engine thus secured. As the piston *a* moves upward any air in the cylinder *b* above piston *a* on starting or resulting from leakage in excess of the pressure for which the relief-valve *d* is set will be forced out through the relief-valve, so as to secure the desired pressure upon the top of the piston *a* in opposition to the atmospheric pressure on its under side.

It will be seen that my invention provides a very simple, cheap, and durable balancing construction, assuring a uniform balancing pressure, as this depends upon the atmospheric pressure, and avoiding entirely the serious objections existing to the balancing constructions heretofore employed using balancing-pistons working against the pressure of steam, compressed air, or liquid under varying pressure, which are expensive in construction and maintenance and require automatic regulating-valves to secure a uniform balancing pressure, with the resulting liability to disarrangement and lack of durability in the apparatus.

It will be understood that the invention is

not to be limited to the form or arrangement of the engine shown, as the invention may be applied to engines of many different classes and in any manner suitable to secure the desired result.

What I claim is—

1. The combination with a vertical double-acting engine, of a balancing-piston subjected to atmospheric pressure and to a pressure less than atmospheric upon its opposite sides and arranged to be acted upon by the atmospheric pressure to oppose the main piston during the downstroke of the engine and to assist the main piston during the upstroke, substantially as described.

2. The combination with a vertical double-acting engine, of a balancing-piston subjected to atmospheric pressure and to a pressure less than atmospheric upon its opposite sides and arranged to be acted upon by the atmospheric pressure to oppose the main piston during the downstroke of the engine and to assist the main piston during the upstroke, and an adjustable relief-valve for controlling the pressure on the balancing-piston opposing the atmospheric pressure, substantially as described.

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

WILLIAM E. CRANE.

Witnesses:

C. J. SAWYER,  
T. F. KEHOE.