W. Whitham,

Compound Steam Engine.

No. 2,242. Patented Sep. 4, 1841

Fig. 2.

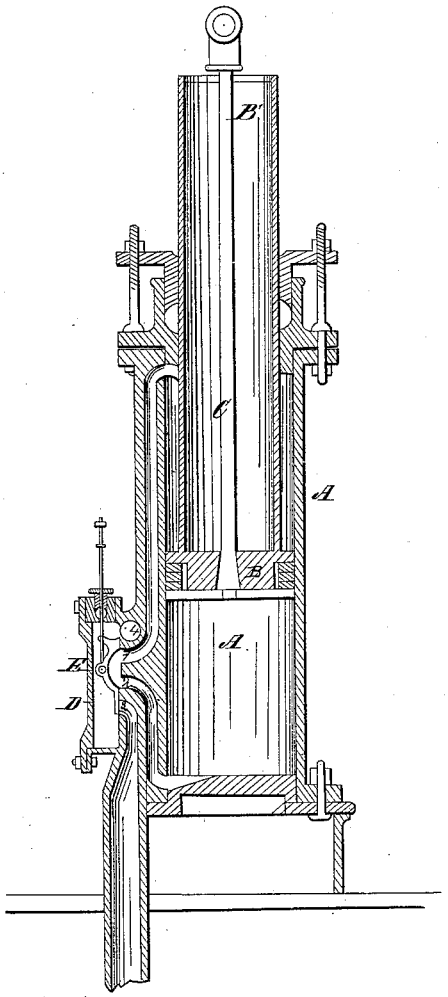
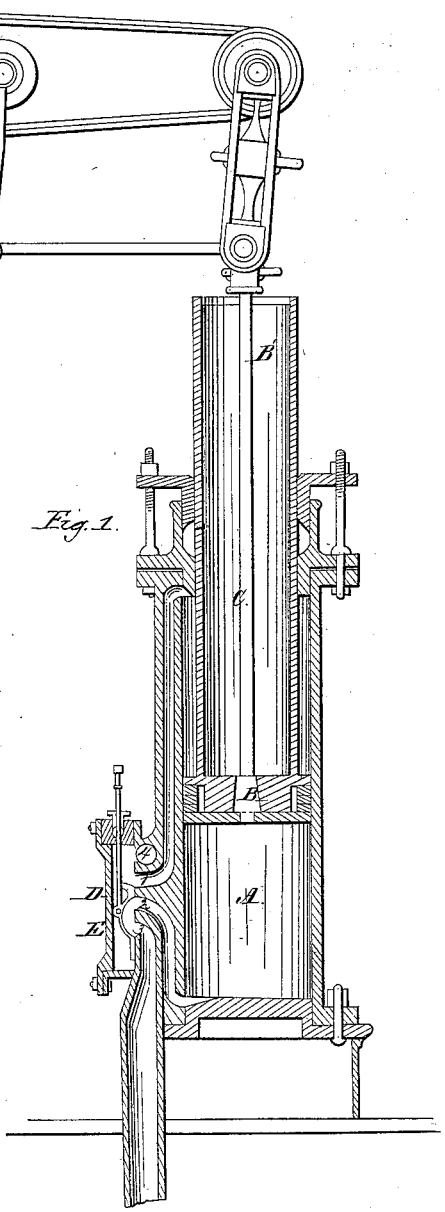


Fig. 1.



Witnesses:
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UNITED STATES PATENT OFFICE.

WILLIAM WHITHAM, OF HUDDERSFIELD, ENGLAND.

STEAM-ENGINE.

Specification of Letters Patent No. 2,242, dated September 4, 1841.

To all whom it may concern:

Be it known that I, WILLIAM WHITHAM, a subject of the Queen of Great Britain, and now residing at Huddersfield, in the county of York, England, have invented or discovered new and useful Improvements in Engines to be Worked by Steam; and I, the said WILLIAM WHITHAM, do hereby declare the nature of my said invention and the manner in which the same is to be performed are particularly described and ascertained in and by the following description thereof, reference being had to the drawings hereunto annexed and to the figures and letters marked thereon—that is to say:

My invention of improvements in engines to be worked by steam consists in such a modification and arrangement of and addition to some of the ordinary and well known parts of such engines as enable me to perform within one and the same cylinder all the separate functions of the three distinct varieties of reciprocating steam engines, distinguished by the several names of high pressure, expansive pressure, and atmospheric pressure engines and to derive three descriptions of pressure resulting from one and the same steam admitted into the interior of one and the same cylinder to operate in impelling one and the same piston, first, by high pressure; second, by expansive pressure; and thirdly, by condensation with direct atmospheric pressure.

Description of the drawing marked A.—Figure 1 represents a vertical section of that part of a steam engine to which my improvements are applied having the slide valve in the proper position for the descending stroke. Fig. 2 shows the same vertical section with the valve in the proper position for the ascending stroke.

In each of the figures the same letters of reference indicate similar parts.

A is the steam cylinder of the usual form B the piston which I call a compound piston because it partakes of the qualities both of the piston and plunger combined. The lower parts of the piston (B) fits the interior circumference of the cylinder (A) and is made to work steam tight therein by metallic or other packings in the usual manner. The upper part (B^1) which I call the plunger part rises from the piston (B) in the form of a hollow cylinder having its exterior surface turned perfectly cylindrical and smooth. This part which is made longer than the interior cavity of the cylinder (A) passes through the cylinder cover and the stuffing box within the last of which it is made to work steam tight by any of the well known modes of packing usually resorted to for a similar purpose. (C) is the piston rod having its lower end fixed in the center of the piston (B) and its upper connected to the beam cross gudgeon and the links of the parallel motion in the usual manner; and I would have it understood that though I have here represented the piston rod (C) as being attached to a beam such beam is not absolutely necessary as motive power may be transmitted from the piston to machinery by any of the well known means employed for that end. (D) is a valve box through which open three steam passages (1, 2, 3) the upper passage (1) leads to the upper part of the cylinder the middle passage (2) leads to the lower part of the cylinder while the lower passage (3) leads to the condenser. (E) is a slide valve of the usual form; with the exception of the lower part which part is so extended lengthwise in a flat surface as to cover the eduction passage (3) when the valve is in the position shown in section Fig. (2) as will be hereinafter explained. (4) is the steam passage leading to the boiler in which must be fixed the throttle valve for regulating the speed of the engine which valve may be controlled by a governor or by any other means calculated to insure the steady performance of the engine.

The slide valve (E) may be worked by an eccentric or by any of the well known contrivances for that purpose. All the other parts of my engine are similar to the corresponding parts of other reciprocating steam engines which being well known need no further description. The difference between the area of the internal cavity of the cylinder (A) and the area of a section of the plunger part of the piston B determines to what number of times a given volume of steam shall expand as for instance if the area of the plunger part be three and the area of the cylinder be four the steam will expand from one volume to four volumes and it is evident that by increasing the circumference of the plunger part of the piston (B) and diminishing the annular space between the internal circumference of the cylinder (A) and the external circumference of the plunger part of the piston (B) the principle of expansion may be carried to the

utmost beneficial extent. When the engine is to be set to work the slide valve (E) must be detached from the eccentric and raised above its working range in order to open a communication between the boiler and the condenser for the purpose of what is technically called blowing through that is allowing the steam to expel the air out of the condenser. When that is done and the infection cock opened if an ascending stroke be required the slide valve must be moved below its working range in order to open both the passages (1) and (2) that is the upper and lower passages of the cylinder to the pressure of the steam from the boiler. In this state the pressure in the upper and lower part of the cylinder is equal and the piston (B) with its plunger part is forced upward with a power proportionate to the sum of the plunger's area multiplied by the pressure of the steam in the cylinder over and above the pressure of the atmosphere. When the piston has ascended to the top of the cylinder the valve (E) must be raised and connected to the eccentric which necessarily places the valve in the proper position for the descending stroke. But if after expelling the air out of the condenser a descending stroke is required the valve must be connected to the eccentric at once.

Figure 1 shows the position of valve (E) when the piston is making a descending stroke. The upper passage (1) is admitting steam from the boiler to the annular space between the plunger (B′) part of the piston (B) and the cylinder (A) which steam is acting upon the annular surface of the piston B at the same time the two passages (2) and (3) are connected by the hollow cavity within the valve and form a communication between the bottom of the cylinder and the condenser. A vacuum below the piston consequently exists while the direct pressure of the atmosphere upon the whole area of the plunger (B′) together with the pressure of the steam on the annular surface of the piston B combine their united forces to depress the piston.

Note.—In calculating the effective pressure of the steam acting upon the annular surface of the piston part (B) an additional pressure equal to that of the atmosphere over and above the direct high pressure must be added.

Fig. (2) shows the position of the valve (E) when the piston is making an ascending stroke. The eduction passage (3) is shut by the flat-extended surface on the bottom of the valve (E) while the two passages (1) and (2) are connected by the hollow cavity within the valve and form a communication between the upper and lower ends of the cylinder (A) thus shutting off all communication between the boiler and the cylinder and also between the cylinder and the condenser. The high pressure steam which during the preceding descending stroke had accumulated in the annular space between the interior surface of the cylinder (A) and the exterior surface of the plunger part of the piston (B) is now acting against the plunger with its whole force of expansion for the descending stroke while the annular surface of the piston (B) is rendered inert or passive in consequence of the pressure above and below being equal. By the time the piston has ascended to the top of the cylinder the high pressure steam is again admitted to act upon the annular surface of the piston. At the same time the bottom of the cylinder is opened to the condenser whereby the steam beneath the piston (reduced by previous expansion to the state of low pressure steam) is condensed as before and the alternate motion of the piston is continued. On comparing the amount of power produced by each stroke of the piston respectively it is found that the descending impulse exceeds the ascending impulse. Now in order to equalize the two I weight the rim of the fly wheel at about one eighth of its circumference back from the perpendicular supposing the crank to stand vertical and I attach the air pump to the outer arm of the beam so that the power required to work this pump is taken from the greater impulse and the pump is exhausting when the cylinder is open to the condenser.

What I claim as the invention is—

The combination of the peculiar piston and BBB′ C within a steam cylinder A having suitable steam ways and slides or valves by which the steam having acted by high pressure on one side of the piston may pass into the cylinder on the other side of the piston and act by expansion pressure on the larger area of the piston and thus produce the return stroke of the piston as described.

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Witnesses:
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