(No Model.)

H. E. DEPP.

COMBINED STEAM AND COMPRESSED AIR ENGINE.

No. 256,826. Patented Apr. 25, 1882.

Fig 1.

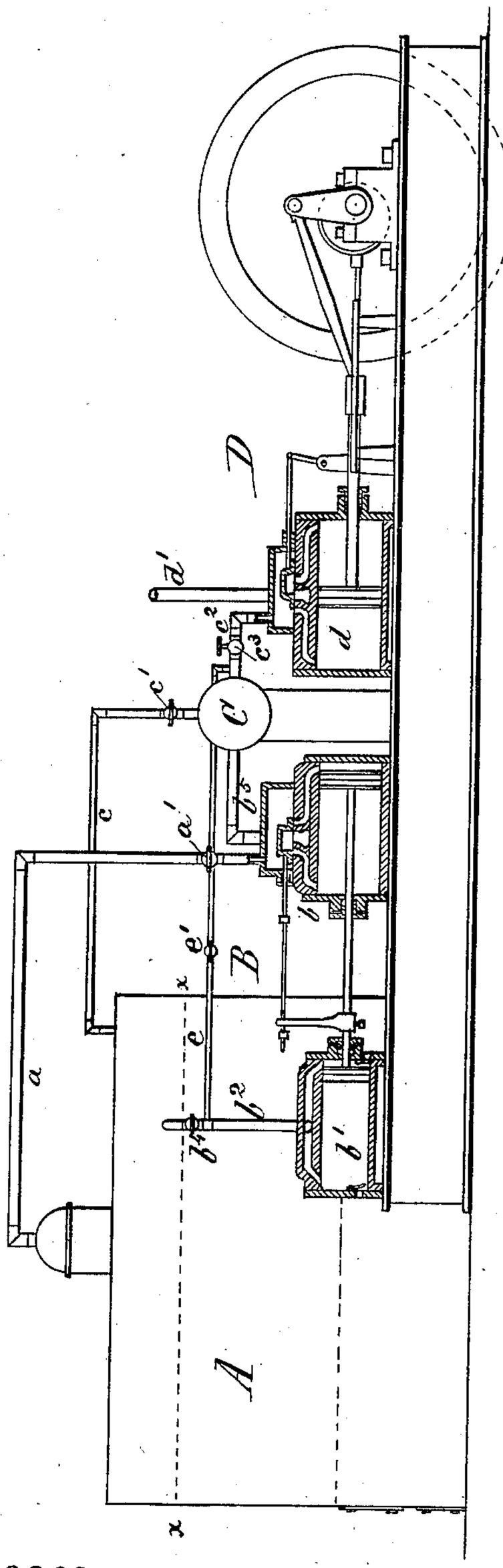
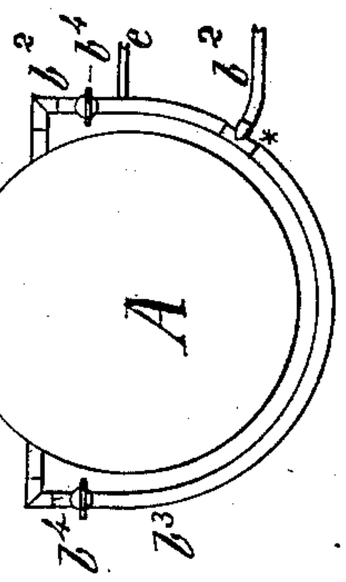


Fig 2.



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HEZEKIAH E. DEPP, OF SEDALIA, MISSOURI.

COMBINED STEAM AND COMPRESSED-AIR ENGINE.

SPECIFICATION forming part of Letters Patent No. 256,826, dated April 25, 1882.

Application filed January 24, 1882. (No model.)

To all whom it may concern:

Be it known that I, HEZEKIAH E. DEPP, a citizen of the United States, residing at Sedalia, in the county of Pettis and State of Missouri, have invented a new and useful Improvement in Combined Steam and Compressed-Air Engines, of which the following is a specification.

My invention relates to improvements in steam-engines driven by means of steam and compressed air combined; and to devices for compressing air and conducting it to a steam-boiler; and to devices for utilizing the exhaust steam of the air-compressor engine; and also to devices for regulating the flow of compressed air to the steam-boiler and to the steam-engine; and also to devices for regulating the flow of compressed air and steam combined to a reservoir interposed between the boiler and steam-engine.

The object of my invention is to economize fuel and steam and to secure an increase of power. I attain these objects by the devices illustrated in the accompanying drawings, in which—

Figure 1 is a view, partly in elevation and partly in section, of my apparatus for carrying out my invention, the cylinders of the steam-engine and air-compressor being in section and the other parts being in elevation. Fig. 2 is an end view of the boiler and compressed-air feed-pipe.

Similar letters refer to similar parts in the figures.

A represents a steam-boiler suitably walled up; B, an air-compressor; C, a reservoir, and D a steam-engine.

A steam-pipe, *a*, conducts the steam from the boiler A to the steam-cylinder *b* of the air-compressor B, which operates the air compressing-cylinder *b'*, from which the compressed air is conducted to the boiler A above the water-line *x x* by means of a pipe, b^2. This pipe b^2 may either extend from the point marked with a star or be provided with an extension-pipe, b^3, (see Fig. 2,) for conducting the compressed air to the boiler on the opposite side; and both the pipe b^2 and extension-pipe b^3 may be provided with a cock or valve, b^4, in order to regulate the flow of air. By introducing the compressed air into the boiler at opposite sides a very perfect admixture or union of steam and compressed air may be effected and the effective action of the steam-engine enhanced.

A cut-off valve, *a'*, is provided on the pipe *a* near the cylinder *b*, for the purpose of starting, stopping, or regulating the flow of steam from the boiler for working the compressed-air cylinder *b'*, and by this means a greater or less quantity of compressed air may be introduced into the boiler A, as may be desired. The exhaust-steam of the cylinder *b* is conducted by a pipe, b^5, to a reservoir, C, of suitable shape and construction, and into this reservoir live steam from the boiler A is also conducted by means of a pipe, *c*, provided with a regulating cock or valve, *c'*. The mixed steam and compressed air from the boiler are conducted by means of a pipe, c^2, provided with regulating cock or valve, c^3, to the cylinder *d* of the steam-engine D, the exhaust of which is, as usual, conducted away by a pipe, *d'*.

A pipe, *e*, may conduct compressed air to the main supply-pipe c^2 of the main steam-engine D, which supply of compressed air will be regulated or cut off by means of a cock or valve, *e'*, provided on said pipe *e* between the compressor and the main cock or valve c^3 of the engine D.

Operation: When steam is raised to a proper pressure in the steam-boiler A (all the cocks being closed at this time) the air-compressor B is started by opening the valve *a'*, and thereby admitting live steam from the boiler, and shortly after this the steam-engine D is set to work by opening the exhaust-cock c^3 of cylinder *b*. If the motive power (which now mainly consists of the exhaust of cylinder *b*) for the steam-engine D is not quite sufficient, the cock *c'* is opened and a supply of live steam from the boiler A is admitted through the reservoir C and pipe c^2 into the steam-engine D. In practice the cock *c'* will be connected with and operated by the governor of the steam-engine D. If it should be found that too much steam leaves the exhaust-pipe *d'* of engine D, an extra supply of compressed air will be furnished to the pipe c^2 by opening the cock *e'*, and thereby checking or diminishing the flow of exhaust-steam from cylinder *b* to cylinder *d*. By this construction, as described, I may have about a

steam-pressure of one hundred pounds to the square inch in the boiler A, which would be reduced by the consumption in operating the air-compressor to seventy pounds; but at the same time this consumption would be compensated for in volume by means of the compressed air introduced into the boiler—that is, an amount equal to about sixty-six per cent. in volume would be added; and it is evident that this percentage can be vastly increased by careful arrangement and construction of the various parts of the apparatus in accordance with the special service required of the same.

Thus it will be seen that I economize fuel and steam while reducing a higher power to a lower power by use and consumption in the manner herein set forth.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In combination with a steam-boiler, A, and steam-engine D, an air-compressor, B, and reservoir C, said parts being provided with pipes a b^5 c c^2, and said pipes having suitable regulating-cock, substantially as and for the purpose described.

2. In combination with a steam-boiler, A, and steam-engine D, an air-compressor, B, reservoir C, pipes a, b^2, b^3, b^5, c, c^2, and e, and with cocks or valves a' b^4 c' c^3 e', substantially as and for the purpose described.

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