

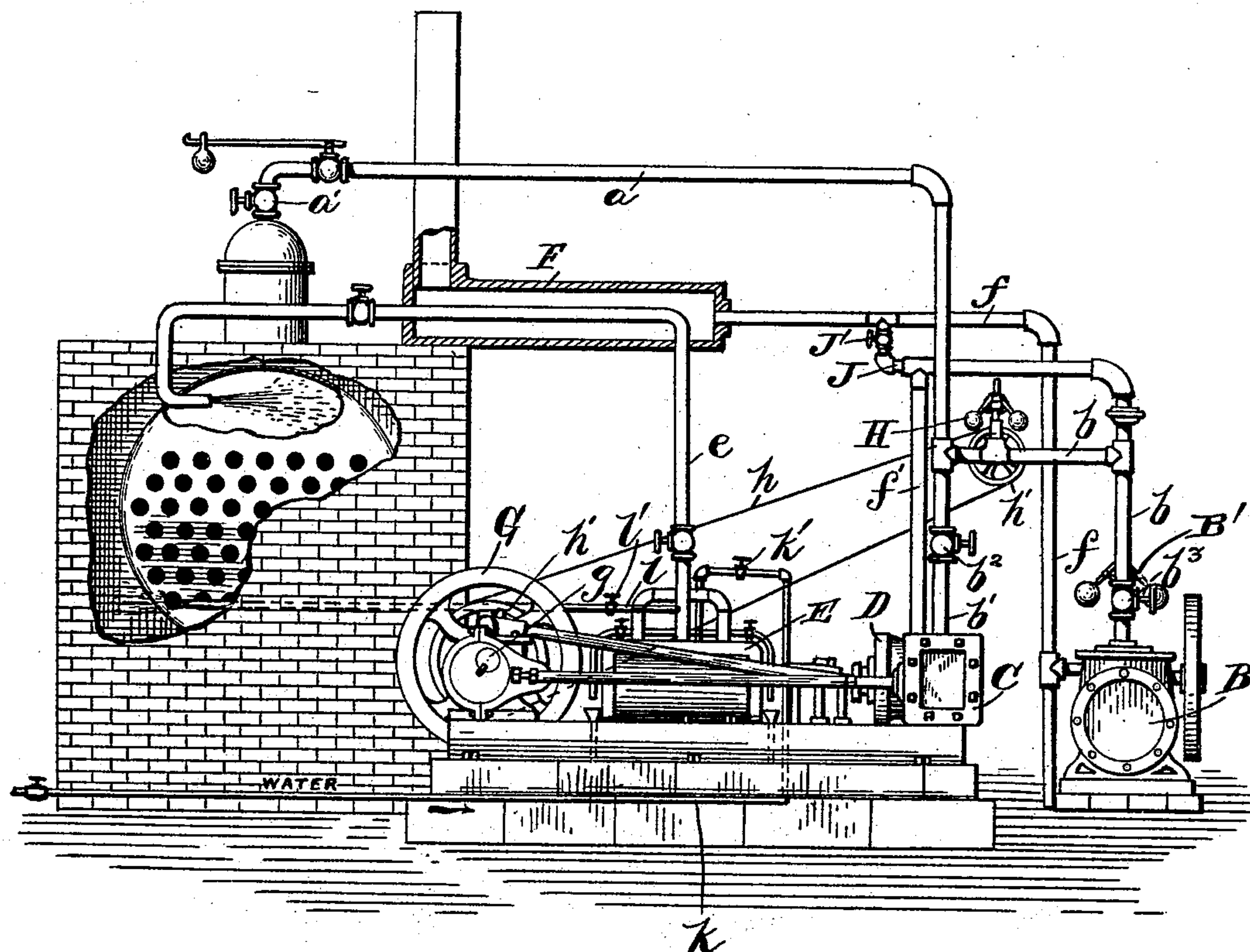
(No Model.)

H. E. DEPP.

MIXED AIR AND STEAM ENGINE AND GENERATOR.

No. 521,762.

Patented June 19, 1894.



Witnesses

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UNITED STATES PATENT OFFICE.

HEZEKIAH E. DEPP, OF SEDALIA, MISSOURI, ASSIGNOR TO OLIVIA M. RITCHEY, OF SAME PLACE.

MIXED AIR AND STEAM ENGINE AND GENERATOR.

SPECIFICATION forming part of Letters Patent No. 521,762, dated June 19, 1894.

Application filed October 28, 1893. Serial No. 489,425. (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 certain new and useful Improvements in Mixed Air and Steam Engines and Generators; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

My invention relates to improvements in devices for feeding air and water to steam boilers, and its objects are, first, to supply compressed air and water, having first heated them to the temperature of the exhaust from the main engine, to the boiler; second, to utilize the exhaust steam for such heating, and third, to use the live steam on its way to the engine to operate the air compressor or pump. I accomplish these objects by the peculiar construction and combinations of devices hereinafter more particularly described and claimed.

In the accompanying drawing forming part of this specification, the figure represents a side elevation of the devices embodied in my invention.

The live steam pipe *a*, leading from the steam dome of an ordinary horizontal, tubular boiler, has connection with the engine B by a branch pipe *b* and with the steam chest C of the cylinder D, by pipe *b'*. The pump E is operated by the cylinder D and is provided with air and water inlets. The pipe *e* leading from said pump E receives and compresses air and water and conveys them to the boiler into which they are discharged. An exhaust pipe *f* connected to the engine discharges into a steam box F which is provided with an ordinary exhaust pipe. The pipe *e* from the air compressor enters this box at one end and passes therethrough on its way to the boiler, thus the contents of said pipe are heated to the temperature of the exhaust steam from the main engine and when discharged into the boiler will not cause the condensation of the steam as they otherwise would. The steam that exhausts from the engine will not be equal in temperature to the steam in the boiler but the heat

caused by the compression of the air in the air compressor and absorbed by the water therein will be sufficient in addition, to raise the temperature of the air and water to the required degree. The piston rod of the cylinder D is connected by a pitman and crank to a fly wheel G which in turn actuates an eccentric *g* operating the valve in the chest C. An exhaust pipe *f'* from said cylinder communicates with the supply pipe *b* of the engine, thus conducting the exhaust of said cylinder to the engine. A branch pipe J connects this exhaust pipe *f'* with the exhaust pipe *f* so that, if desirable, the exhaust from cylinder D can be turned into the steam box F by opening cock J', and thus the compressor could be operated without the main engine when so desired. A governor H is mounted in the branch pipe *b* and is connected with the shaft of the fly wheel by a belt *h* and belt wheels *h'*. A cock *b²* is placed in the supply pipe of the cylinder D and a cock *b³* in the supply pipe of the engine to regulate the flow of steam to each respectively. A cock *a'* is also provided to regulate the flow of steam from the steam dome into pipe *a*. The air compressor cylinder as before mentioned has a suitable water supply pipe *k* so that the water may act as a lubricant to the air cylinder while under high pressure. This pipe has a cock *k'* which controls the supply. A pipe *l* provided with a regulating cock *l'* is connected to the pipe *e* and discharges into the heating space surrounding the boiler, thus allowing compressed air to be supplied to aid combustion if desired.

For low pressure the air can be compressed without water and lubricated with oil, but for high pressure water must be used. I prefer water as it helps to supply the boiler with water.

The operation of the devices is as follows: Live steam passes from the steam dome through pipe *a* and branch pipes *b* and *b'* and simultaneously starts the air pump and the engine. The compression of the air in the air pump or compressor causes considerable heat which is taken up or absorbed by the water admitted to said pump. This heated water and air pass through pipe *e* which is heated by the exhaust steam in the steam

box F as before described. The exhaust steam from cylinder D passes by pipe *f'* to pipe *b* and thus to the engine B. By this arrangement the steam that is used to operate the pump is not wasted, but used again in the engine B. The engine though, is not altogether dependent on the cylinder exhaust for its supply of steam as branch pipe *b* supplies it with steam directly from the boiler, but this only when the pump is at rest or moving slowly. By placing the governor in the pipe *b* I regulate the supply of steam so that when the pump is working its full capacity the governor will close pipe *b* and cause all the supply for the engine to first pass through the cylinder D. It will thus be seen that the engine always has the same pressure of steam, said steam sometimes passing through both the pipe *b* and the cylinder D, and sometimes through the pipe alone or the cylinder alone according to whether the cylinder is in operation or not.

By my invention a great saving of fuel is accomplished as the force used in running the air compressor or pump is not lost but is returned to the boiler in the shape of highly heated and compressed air. It will be seen from the foregoing description that the chief element used to accomplish the desired saving of fuel is heated and compressed air. It has been proven in practice that air supplied in such a way has a very decided advantage in preventing condensation of steam. It has been also successfully demonstrated that aereated steam is much more effective than

steam alone as it has a much more lively action.

The supply pipe *b*, which receives the supply of live steam directly from the boiler and also the exhaust from the pump engine, has the usual governor *B'* placed therein to govern the supply of steam and consequently the speed of the engine.

What I claim as my invention is—

1. The combination with a steam boiler, of an engine, steam connection from said engine to said boiler, an air compressor introduced in said connection and discharging into the boiler, a steam discharge from said compressor to said engine, and a governor operated by said compressor and placed in the supply pipe of said engine, substantially as described.

2. The combination with a steam boiler, of an air compressor actuated by and discharging into the same, an engine, steam connection between said engine and said compressor and between said boiler and engine, a governor regulating the supply of steam from the boiler to the engine and operated by the compressor, and a steam exhaust heating the air supplied to the boiler from the compressor, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

HEZEKIAH E. DEPP.

Witnesses:

J. E. RITCHEY,
E. C. MASON.