J. M. WHITING.

Combined Air and Steam Engines,

No. 217,758. Patented July 22, 1879.

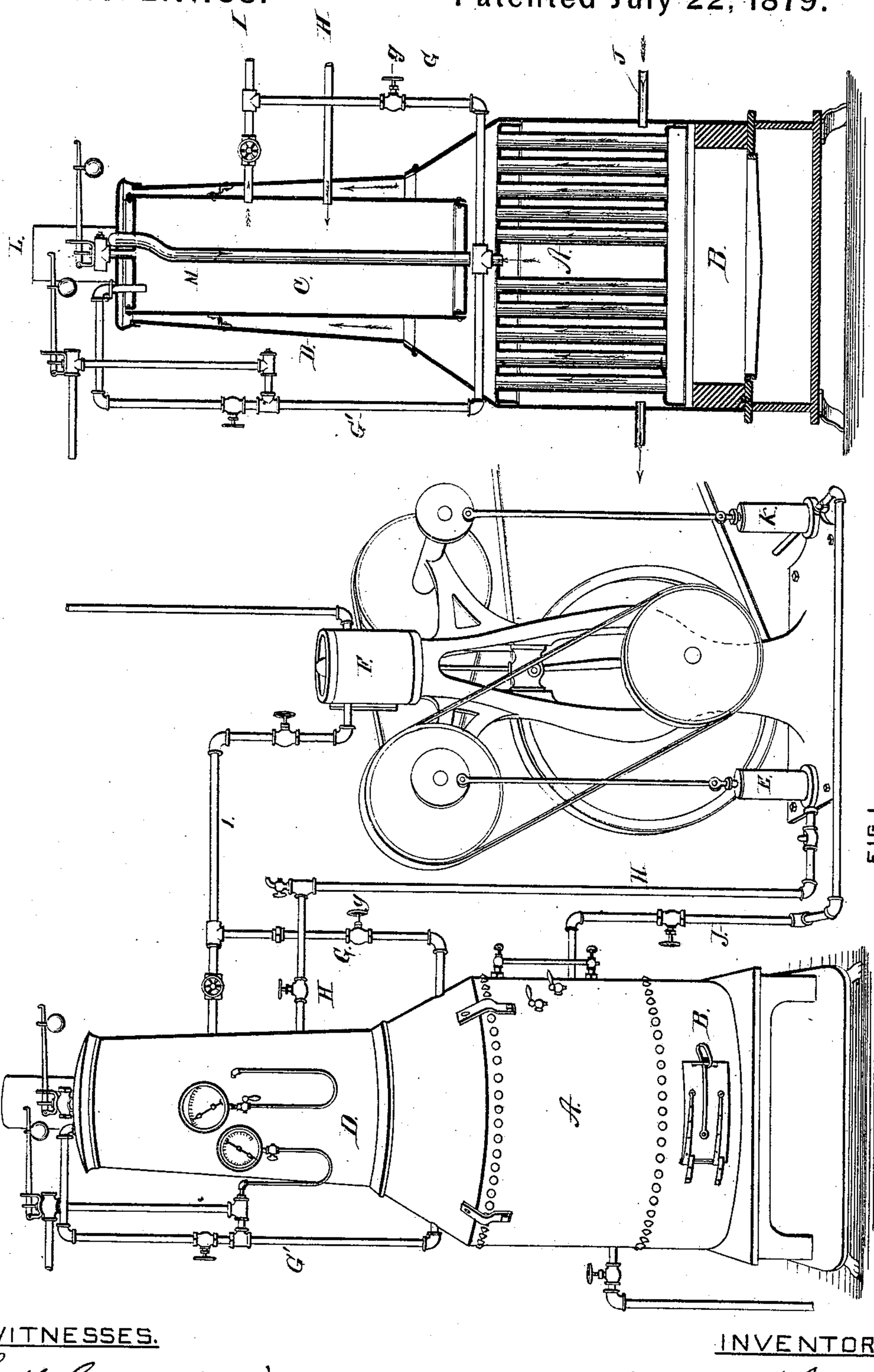

FIG. 2.

FIG. 1.

WITNESSES.

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JAMES M. WHITING, OF PROVIDENCE, RHODE ISLAND.

IMPROVEMENT IN COMBINED AIR AND STEAM ENGINES.

Specification forming part of Letters Patent No. **217,758**, dated July 22, 1879; application filed March 3, 1879.

To all whom it may concern:

Be it known that I, JAMES M. WHITING, of Providence, in the State of Rhode Island, have invented a new and Improved Combined Air and Steam Engine; and I do hereby declare that the following specification, taken in connection with the drawings making a part of the same, is a full, clear, and exact description thereof.

Figure 1 is a view of my invention. Fig. 2 is a section of same.

My invention relates to improvements in engines deriving their propelling power from a combination or mixture of steam and heated air, and to the means and manner of combining and mixing the same, and has for its object economy in fuel.

A, Figs. 1 and 2, is a tubular steam-boiler of ordinary construction, having underneath a fire-pot, B, and above a cylinder, C, surrounded by a jacket, D. The cylinder C is connected with the boiler A by the pipes G and G′, and with the air-pump E by the pipe H, and with the cylinder F by the pipe I.

The cylinder, as described, is constructed, located, and connected with the boiler in such a manner, and so incased in the jacket D, as that the escaping heat may be utilized in keeping the cylinder C hot. The steam and air are not superheated after being mixed; but the air is heated, expanded, and mixed with the steam at one and the same time within the heated cylinder C, and acts directly upon the piston of the engine. By heating and expanding the air and mixing it with the steam all at the same time within the heated cylinder, I am not only enabled to use a large amount of air without condensing the steam, but also to get the benefit upon the piston of the engine of the entire power resulting from the sudden expansion of the air, and at the same time save the fuel required to superheat in case the mixture and expansion should occur elsewhere.

The boiler A is supplied with water forced through the pipe J by the pump K in the usual way.

The engine proper is the same in its construction and operation as the steam-engines now in use, and it is therefore unnecessary to specify its parts or describe its operation.

Having designated the several parts of my invention, I will proceed to describe its operation. A fire having been kindled under the boiler A, steam is generated therein, and the heat passing through the tubes is carried around the cylinder C, and finally escapes into the smoke-pipe L. The cylinder C may also be provided with one or more tubes, M, if desired, for the passage of the heat in its way to the smoke-pipe. As soon as sufficient steam is generated the engine is started for the purpose of operating the air-pump E and forcing air into the cylinder C.

In generating the steam for the purpose of starting the engine and operating the air-pump, as before mentioned, the steam is allowed to pass through the pipes G and I on its way to the cylinder F; but when it is desired to introduce the air and drive the engine by a mixture of steam and air, the cock *g* is closed. The cylinder C, upon starting the air-pump, receives both steam and air, the former passing through the pipe G′, while the air is forced through the pipe H, both combining within the cylinder C, and passing out through the pipe I to the cylinder F of the engine.

The relative proportions of steam and air may be accurately regulated by means of suitable cocks upon the respective pipes.

It will now be readily seen that an amount of fuel is thus saved equal to the difference between the amount of heat required to expand six parts of air or generate six parts of steam.

What I claim as my invention, and desire to secure by Letters Patent, is—

The cylinder C, directly connected with the steam-boiler A by means of the steam-pipe G′, entering the cylinder at the top, with the air-pump E by the air-pipe H, entering below the middle of the cylinder, and with the cylinder F by the pipe I, in combination with the boiler A, air-pump E, and cylinder F, the parts all arranged as shown, and for the purpose set forth.

JAMES M. WHITING.

Witnesses:
WALTER B. VINCENT,
G. M. CARPENTER, Jr.