H. E. DEPP.

Air and Steam Engine.

No. 201,874. Patented April 2, 1878.

Fig 1.

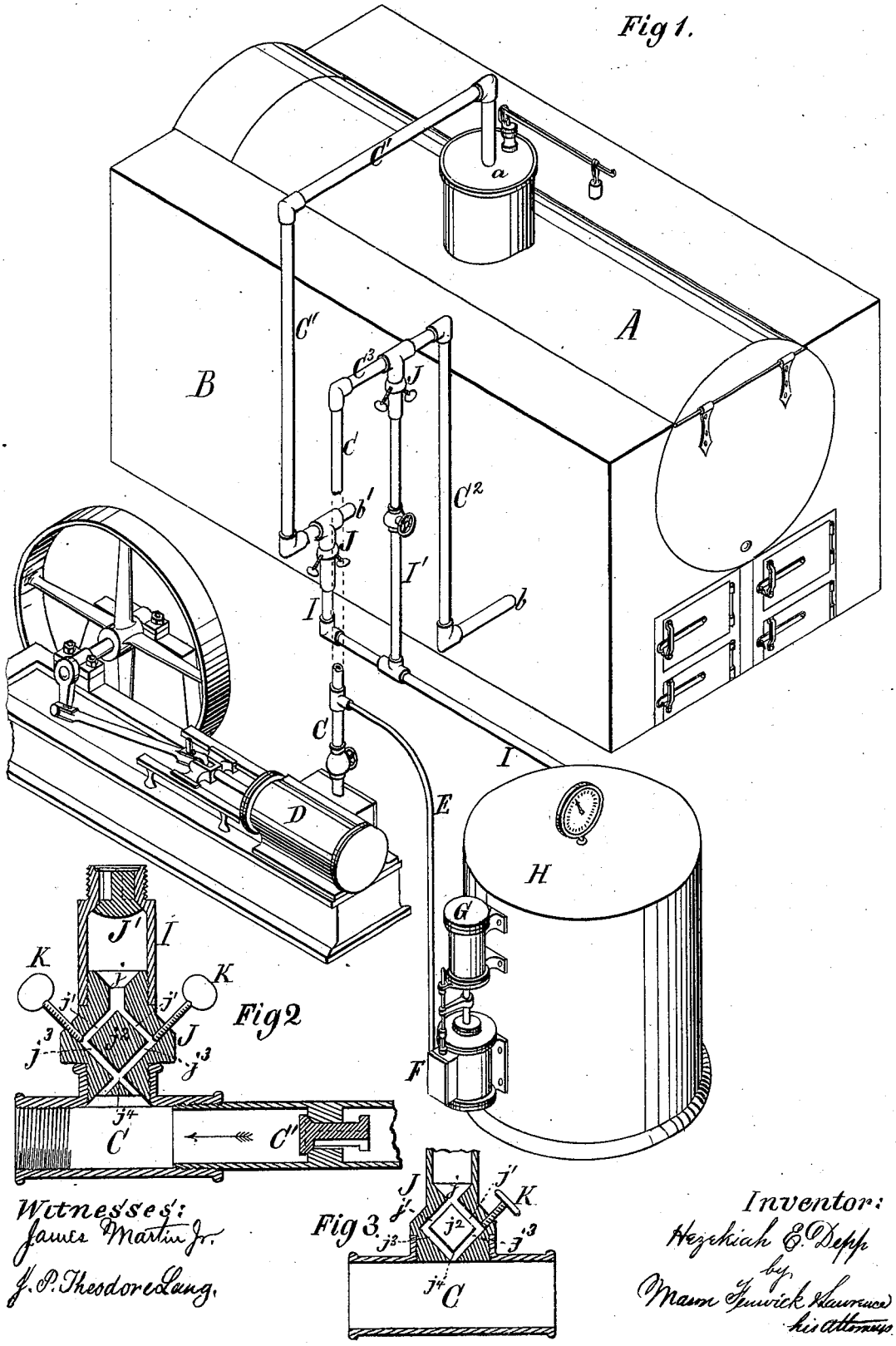

Fig 2

Fig 3.

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HEZEKIAH E. DEPP, OF SEDALIA, MISSOURI.

IMPROVEMENT IN AIR AND STEAM ENGINES.

Specification forming part of Letters Patent No. **201,874**, dated April 2, 1878; application filed January 30, 1878.

To all whom it may concern:

Be it known that I, HEZEKIAH E. DEPP, of Sedalia, in the county of Pettis and State of Missouri, have invented a new and useful Improvement in Air and Steam Engines; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a central longitudinal section of the device which is employed for applying the currents of compressed air to the current of steam, and of the steam-pipe and its check-valve. Fig. 2 is a similar section of the same device, slightly modified. Fig. 3 is a perspective view of an ordinary steam-engine and air compressing and supplying apparatus, to which my invention is shown applied in two different ways, with a view of illustrating the principle of operation of my invention.

The nature of my invention consists, first, in a joint-connection between the compressed-air apparatus and the steam pipe, chest, or cylinder of a steam-engine and the boiler, whereby the compressed air is introduced amid the steam after it has been heated by friction induced by violent contact of the air with interrupting surfaces, and with intersecting currents of its own or of the steam at the point where the air and steam are first brought together, and thus the quantity of heat present, due to the steam at a certain pressure, is momentarily enhanced by the heat produced from friction on the air, and, consequently, a sudden and more effective expansion of and commingling of the compressed air with the steam is accomplished at the point where the power of the same can be utilized to the greatest advantage.

My invention further consists in certain combinations of parts, as hereinafter described and specifically claimed, for controlling and regulating the operation of the invention.

In the drawings, Figs. 1 and 2, C is the steam-pipe between the boiler and steam-chest of a steam-engine, and I is the air-pipe between the air-compression cylinder or reservoir and steam-pipe C. The pipes C and I are connected to one another by a joint-piece, J, which has one or more small or contracted passages, j j^1, of zigzag shape, extending through it from end to end, as shown. The entrance to this joint-piece is a single passage, j, and the extension of the passages is in an outward oblique direction on either side of the solid center j^2 of the piece J for a certain distance, and then in an inward oblique direction, as at j^3 j^3, across one another to the discharging end of the piece, as at j^4, and thus the passages communicate at two separate points with the chamber in which the steam from the boiler is conducted to the steam chest or cylinder of the engine.

K K represent cut-off or regulating screw-plugs applied to the connecting-joint J, so as to be in line with the portions j^3 j^3 of the passages, and, when screwed in partly or wholly, will regulate the quantity of air allowed to pass into the steam-pipe, or cut it off entirely on one or both sides of the center j^2 of the piece J.

In Fig. 3 the passages in the piece J are changed slightly in form, and unite in one at the discharge end of the piece J, and a single regulating and shut-off screw-plug is employed.

In both constructions of the joint-piece J, the steam passage or passages through it are in the shape of an angle, and the current of air flowing through the pipe I is divided at the top of the solid center j^2, and forced around on each side of the said center in separate jets, and then reversed in their course and made to come together again at j^4, and then either cross each other in the joint-piece or in the steam-pipe, as illustrated in Figs. 1 and 2. The compressed air, being thus forced through the connection-joint in two currents and caused to come together again at an angle, is subjected to friction, and produces friction, which causes heat, and by this means the temperature of the compressed air is increased, and the air consequently is more readily expanded when it commingles with the steam in the pipe C, and without reducing the quantity of heat present in the steam at the point where the union of air and steam takes place; in fact, the amount of heat present in the two agents is greater than would be in the steam alone, or in steam and air, the latter not heated by friction. The result of the commingling of steam

and compressed air in the manner described is the production of a motive power far superior to steam or air when used separately at as high a degree as these agents combined are used.

In Fig. 1 of the drawings, a boiler, A B, steam-engine D, and compressed-air reservoir, with steam-engine and force-pump F G, are shown connected for operation. These contrivances are to be of any known and suitable construction, and will be provided with the necessary steam-pipes, stop-cocks, throttle-valves, gages, and usual adjuncts.

The air-compressor may be run by the same engine that operates the machinery, or independently by a small engine.

In practice, in order to prevent back action from sudden increase of pressure at the joint J, it is preferable to have a check-valve in each of the pipes C and I; but with a well-regulated blast the valves may not be necessary in these pipes.

It is thought that the most advantageous mode of using the two currents—viz., compressed air and steam—will be to have the pressure of the air a little greater than that of the steam, as thereby the certainty of the mingling will be increased.

In the illustration (Fig. 1 of the drawing) of the application of my invention, A B represent a steam-boiler with a steam-dome, *a;* D, an engine, and H a compressed-air cylinder or reservoir, with a steam-engine, F, and force-pump G, for pumping in and compressing the air which is to be mingled with the steam. C^1 is a portion of the steam-pipe C, leading from the dome *a* of the boiler into the fire-box or superheater of the boiler A B, as at *b'*, and coming out of the superheater at *b*, and extending upward, as at C^2, and horizontally, as at C^3, and uniting with the steam-pipe C, which leads into the steam-chest of the engine.

To the portion C^3 of the steam-pipe a portion, I', of the compressed-air pipe I is connected, and in this portion I' the improved joint-connection J may be attached, as shown; or, instead of applying this joint at this point, it may be applied on the horizontal portion of the pipe C^1, which enters at *b'* into the superheater. Whichever of the plans of applying the joint is adopted, the operation of heating the air by friction will be carried on; but if the air is passed from the reservoir through the pipe I and its portion I', it will not pass into the superheater with the steam, but will pass along with the superheated steam down the pipe C (shown broken and then connected by dotted lines in the drawing) into the steam-chest; and if the air is passed directly along the pipe I to the portion which enters the superheater at *b'*, it will be mixed with the steam before it enters the superheater, and enter at *b'* and come out at *b*, and pass along pipe C^2 C^3, and along pipe C into the steam-chest.

E indicates a steam-pipe, by which the engine F of the force-pump is driven by steam taken from pipe C.

The great object sought to be attained is to effect the mixing or mingling of air heated by friction with the steam at the point where the instantaneous action due to expansion of the compressed air can be brought to bear most effectively upon the piston or object to be moved.

A good effect, however, may be produced by injecting a straight current of air with a force-pump into a steam chest or boiler, such air being supplied directly from the force-pump instead of from the reservoir; but the plan I have described I regard as the most effective and preferable.

Having described my invention, what I claim is—

1. The method herein described of using compressed air heated by friction at the point where the air commingles with the steam, and introduced on an angle into the steam-pipe or steam-chamber, substantially as described.

2. The connecting-joint J between air-pipe, steam-pipe, or steam chest or cylinder and boiler, or directly into the boiler, constructed substantially as described.

3. The combination of the steam-pipe C, air-pipe I, and a suitable check valve or valves, substantially as described.

Witness my hand, in the matter of my application for a patent for an improved air and steam engine, this 26th day of January, A. D. 1878.

HEZEKIAH E. DEPP.

Witnesses:

O. A. CRANDALL,

R. A. BLAIR.