J. A. WOODBURY, J. MERRILL & G. PALLEN.

AIR ENGINE.

No. 10,081. Patented Oct. 4, 1853.

Fig 1.

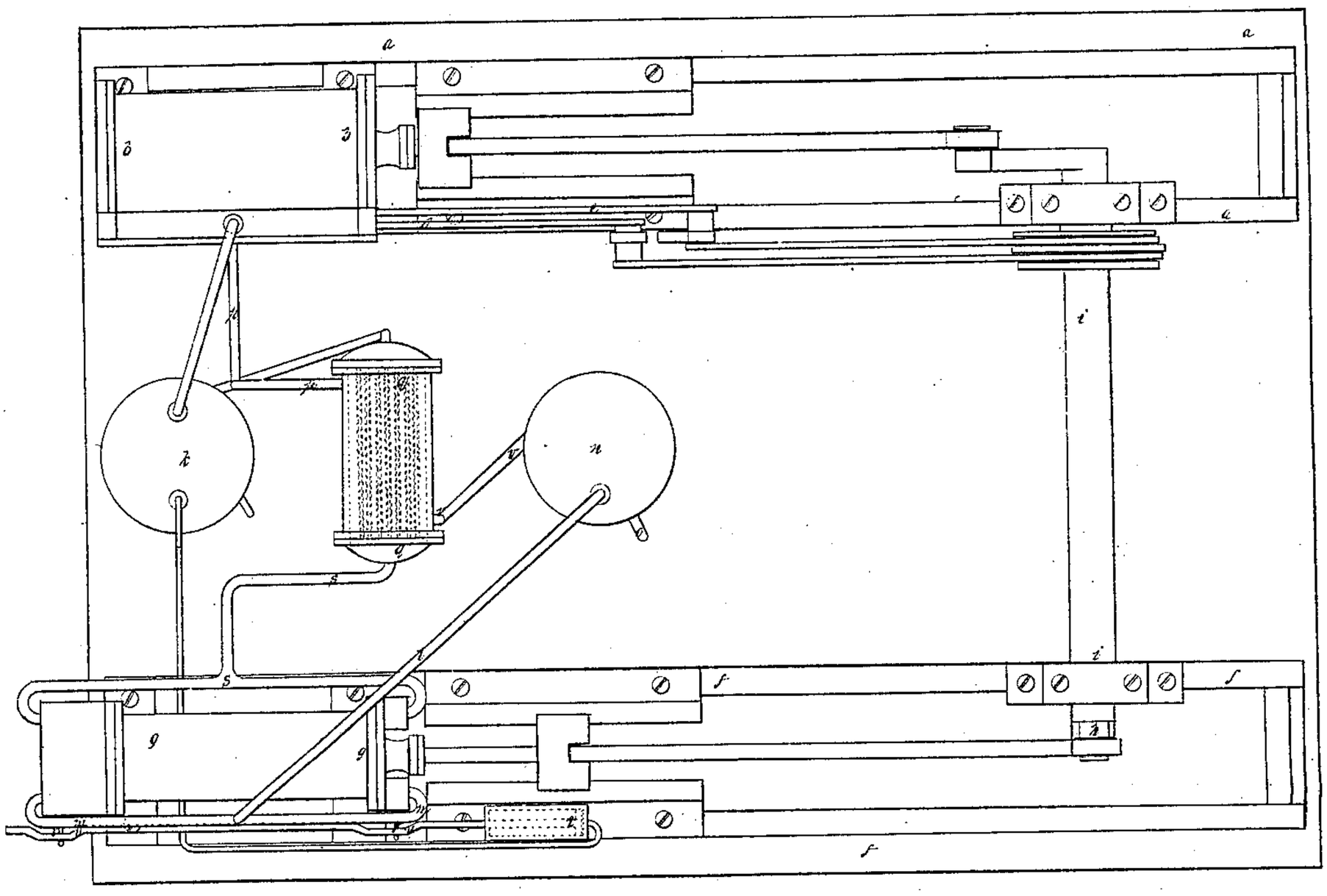


Fig 2.

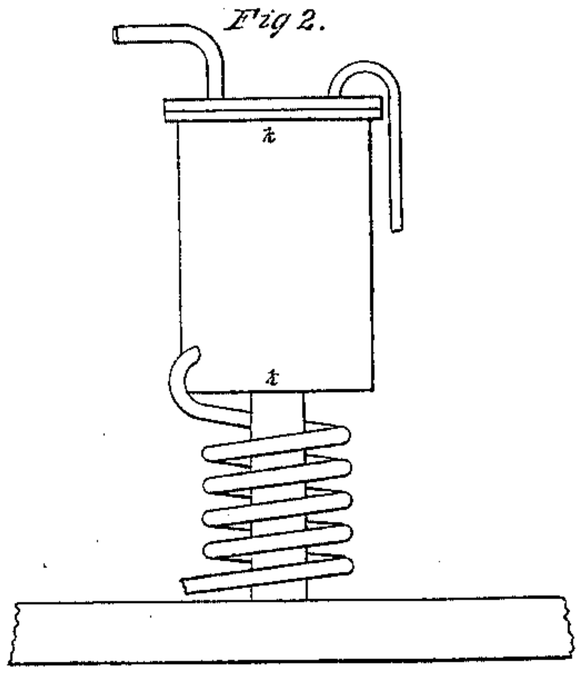
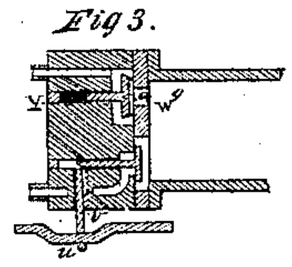


Fig 3.



UNITED STATES PATENT OFFICE.

JAMES A. WOODBURY, OF WINCHESTER, AND JOSHUA MERRILL AND GEORGE PATTEN, OF BOSTON, MASSACHUSETTS.

AIR-ENGINE.

Specification of Letters Patent No. 10,081, dated October 4, 1853.

To all whom it may concern:

Be it known that we, JAMES A. WOODBURY, of Winchester, in the county of Middlesex and State of Massachusetts, JOSHUA MERRILL and GEORGE PATTEN, both of Boston, in the county of Suffolk and State aforesaid, have invented certain new and useful Improvements on our Air-Engine, patented January 5, 1853, and that the following description, taken in connection with the accompanying drawings, hereinafter referred to, forms a full and exact specification of the same, wherein we have set forth the nature and principles of our said improvements by which our invention may be distinguished from others of a similar class, together with such parts as we claim and desire to have secured to us by Letters Patent.

The figures of the accompanying plate of drawings represent our improvements.

Fig. 1 is a plan or top view of our engine. Fig. 2 is an elevation of the receiver. Fig. 3 is a detail view which will be hereinafter referred to.

Our improvements are made upon an air engine for which Letters Patent of the United States were granted to us, bearing date the fifth day of January, 1853, and described in the schedule annexed to the same.

In our mode of using the air as a motive power, as fully described in the schedule above referred to, the natural atmosphere, which exerts a force of fifteen pounds to the square inch, is started with as a base, and is compressed to the required extent in a receiver and then expanded to double its volume, by the application of a certain degree of heat, the amount of pressure thus obtained, depending upon the density of the compressed air. It will be evident that if instead of starting with air which exerts a pressure of fifteen pounds per square inch, or that of the natural atmosphere, we commence with or take into the air pump, more dense or compressed air, which exerts a much greater pressure than the atmosphere, the extra pressure consequent upon the greater density of the air first employed, will be increased in the same ratio as in the first instance, by still further compressing this dense air in the air pump, and then doubling its volume in the hot receiver.

As it is often desirable to work an engine at a very high pressure, especially in locomotives, we have effected this desideratum of using a denser medium to commence with, and the consequent high pressure exerted on the piston or the cylinder, which is the result of still further compressing the already compressed air and then expanding it in the receiver by supplying the air pump from a reservoir or receiver of compressed air, instead of from the natural atmosphere.

a, *a*, *a*, in the drawings represent the bed piece of the engine.

b, *b*, is the cylinder with the supply and cut off valves worked respectively by the valve rods *d*, *e*.

On the frame *f*, *f* parallel to the frame *a*, *a* is placed the air pump *g*, *g*, the piston and connecting rod of which are operated by a crank *h* on the main shaft *i*, *i*.

k, *k* is the air receiver to which the heat is applied.

The operation of the engine is as follows: the air pump *g*, *g*, instead of drawing its supply from the atmosphere, receives it through the pipe *v* and its branches, *m*, *m* which communicate with the supply valves of the air pump, from a reservoir or receiver *n* into which air is first forced through the aperture at *o*, by a small hand pump which may be operated by a band running from the main shaft *i*, *i* of the engine. The piston of the cylinder *b*, *b* is started by air delivered from the receiver *k*, *k* as described in the schedule herein before referred to, and the exhaust air, instead of passing out into the atmosphere, is conducted through the pipe *p*, *p* around the flues of the exhaust cylinder *q*, *q* and through the pipe *r*, *r* to the reservoir or receiver *n*, from which it is delivered to the air pump to be again compressed. The compressed air in passing from the air pump to the heated receiver *k*, *k*, is conducted through the pipe *s*, *s* to the exhaust cylinder *q*, *q*, through the flues of which (heated by the exhaust air passing around them) it passes already partially heated, to the hot receiver *k*, *k*. The pipe *r*, *r*, which leads from the exhaust cylinder to the receiver *n*, may be passed through a water tank, so that the air shall be cold when it enters the said receiver *n*, *n*.

From the above it will be seen, that as the exhaust air, instead of passing out into the atmosphere, is conveyed to the receiver *n* this receiver becomes filled with dense or

compressed air, which is delivered to the air pump, and still further compressed before passing to the heated receiver *k k*,—the additional hand pump which communicates with the receiver *n n*, serving to supply the small quantity of air which may be lost or wasted in passing through the engine.

A uniform pressure may be kept up in the receiver *n* insubstantially the same manner as described in the schedule hereinbefore referred to, for regulating the pressure in the heated receiver *k k*, the air in which, when exerting more pressure than the engine requires, acting upon a piston *t* which slides an arm *u u* which operates the stems, *v*, *v* of the supply valves of the air pump and opens them.

The apertures in each end of the air pump, which communicate with the pipe *s s*, are opened and closed at the proper time, to allow the compressed air to pass into the receiver *k k* and prevent its return into the air pump, by a peculiar arrangement of valves, as shown in Fig. 3. This valve *w* is so constructed, that the back pressure from the receiver *k k* will not prevent it from opening, which result would otherwise happen with an ordinary eduction valve. It will be seen by inspection of Fig. 3, that the valve is dish shaped or concave on the surface nearest the air pump, and that the two edges of said surface are brought to a point, or a very thin edge *x*, so that the valve will present a very small seat or bearing, and from its peculiar shape, will expose the same or about the same surface to the pressure of air in the air pump as is exposed to the back pressure in the receiver *k k*,—forming a balance valve, thus the pressure of air in the pump, will readily open the valve, which will be aided in closing at the proper time by the spring *y*.

What we claim as our invention and improvement in atmospheric air engines, is—

Supplying the air pump from a receiver into which air has been condensed by a hand pump, auxiliary engine or otherwise, (the hand pump or auxiliary engine being used for the purpose of charging and sustaining a uniform pressure in the receiver from which the air pump is supplied) when the same is done in combination with a second receiver into which the air is to be still more compressed and maintained at a uniform pressure or nearly so, by the application of heat to the air on its passage to the working cylinder, all in the manner and for the purposes herein above set forth.

JAMES A. WOODBURY.
JOSHUA MERRILL.
GEORGE PATTEN.

Witnesses:
EZRA LINCOLN,
JOSEPH GAVETT.