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

ATMOSPHERIC ENGINE.

No. 9,739. Patented May 17, 1853.

Fig. 1

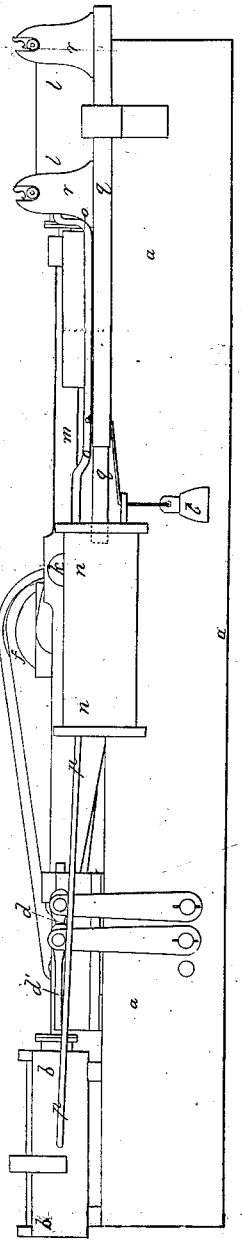
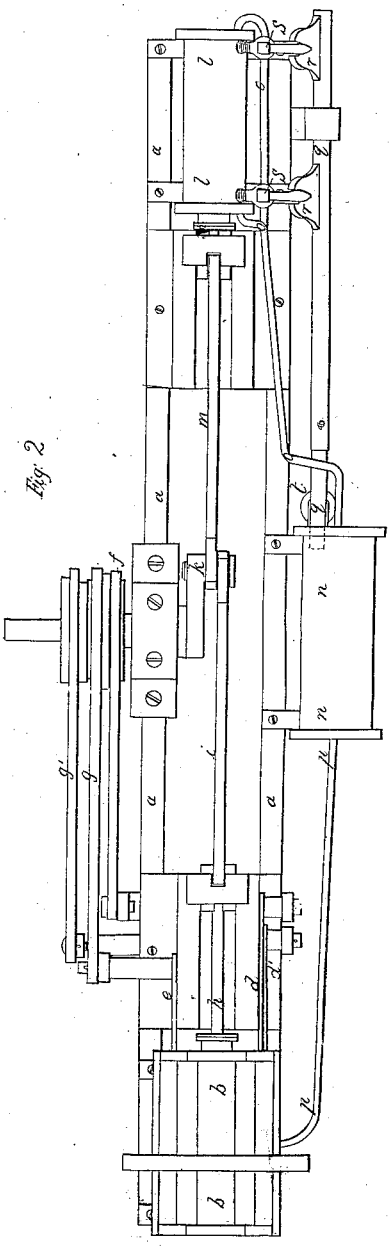


Fig. 2



UNITED STATES PATENT OFFICE.

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

AIR-ENGINE.

Specification of Letters Patent No. 9,739, dated May 11, 1853.

To all whom it may concern:

Be it known that we, JAMES A. WOODBURY, of Winchester, in the county of Middlesex, JOSHUA MERRILL, of Boston, in the county of Suffolk, and GEORGE PATTEN, of Charlestown, in the county of Middlesex, all in the State of Massachusetts, have invented a new and useful Atmospheric Engine, 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 invention by which it 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 improved engine. Figure 1 is an elevation of the same. Fig. 2 is a plan or top view.

We are well aware that experiments have recently been made with a view to the use of the natural atmosphere as a propelling agent, by the application of caloric, as it is well known that air, when under the influence of about 480 degrees of heat, becomes expanded to double its original volume. Our invention or discovery consists in the application of caloric to air, while in a highly compressed state, by which its expansive force will be greatly increased, by the same amount of heat, 480°, as is required to double the volume of the ordinary atmosphere. We have ascertained by practical experiments, that if air be highly compressed in a receiver and then subjected to about 480 degrees of heat, that its expansive force will be increased to double the amount exerted by the same prior the application of heat. Thus it will be perceived that by increasing the amount of air forced into the receiver, the pressure which it exerts can be doubled by the same and constant degree of heat above stated, whatever may be the pressure exerted in the first place, by the cold compressed air, the degree of pressure which can be attained, depending entirely upon the density of the compressed air, while the amount of caloric applied remains the same.

The most essential parts of our engine consist of a cylinder of the same construction as an ordinary steam engine, an air pump, and a receiver for containing the compressed air and to which the heat is applied.

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

b b is the cylinder with a supply and discharge valve which are worked respectively by the valve rods *d*, *e* connected to the eccentrics *f*, *g*.

h is the piston rod and *i* the connecting rod attached to the crank *k*. On the opposite end of the bed piece is placed a double acting air pump *l l*, which is worked by the connecting rod *m*, also attached to the crank *k*. This air pump is to be of half the cubic capacity of the cylinder *b b*.

n n is the air receiver one end of which communicates with the air pump *l l* by the pipe *o o*, and the other end with the cylinder *b b* by the pipe *p p*. Heat is applied to the receiver *n n*, so as to always keep it at a temperature of about 480°, or that amount above the temperature of the air. The cut off valve is worked by the rod *d'* operated by the eccentric *g'*, after the common mode of working in steam engines.

The operation of the engine is as follows.—The amount or about the amount of heat above stated, being applied to the receiver *n n*, the natural atmosphere in the said receiver, will be expanded to double its volume, and will be transmitted through the pipe *p p* with the cylinder *b b*, and operate the piston, thereby exerting a sufficient force to start the engine. Motion is thus imparted through the crank *k* and connecting rod *m* to the piston of the air pump *u*, which will force a quantity of cold air proportionate to its capacity, through the pipe *o o* into the hot receiver. The cold compressed air thus forced into the receiver, immediately becomes expanded to double its original volume, and the increased pressure, consequent upon this expansion, is diffused through the receiver *n n* and pipe *p p* to the piston head of the cylinder *b b*, the supply of air being cut off at the proper time (the time of cutting off depending upon the degree of compression of the air) to give it its greatest expansive force, by the cylinder valves operated in the usual mode practiced in steam engines. The more highly compressed the air is, the earlier we cut off. It may be observed in this connection, that the air forced into the receiver *n n*, should be at as low a temperature as possible, and this

result may be effected by passing a supply pipe from the air pump through water or by some other similar device.

A proper valve is placed in the pipe *o*, *o*, which opens when the air is forced from the air pump, and then immediately closes.

In case the expansion of the natural atmosphere in the receiver *n n* is not sufficient to start the engine, an additional quantity can be forced in by a hand pump.

In order to equalize the pressure in the receiver *n n*, and prevent its becoming too great, we have adopted a peculiar arrangement of mechanical devices for effecting this result, as follows.—One end of the sliding rod *q q*, enters the receiver *n n*. At the opposite end are two standards or projections *r*, *r* which embrace the handles of two stop cocks *s*, *s* which communicate with the interior of the pump at opposite ends of the same. When a sufficient pressure is exerted in the receiver *n n* to overcome the inertia of the weight *t*, the air in the said receiver pressing against the end of the sliding rod *q q*, causes the said rod to slide along and open the stop cocks *s*, *s* as shown in Fig. 1. The stop cocks being thus opened, air will be drawn into the pump through one and forced out through the other, and vice versa, without being forced into the receiver *n n* until the surplus pressure is removed, when the stop cocks are closed by the weight *t*. The present pump is thus saved from working except to the exact extent required of it to keep up a uniform pressure in the receiver.

The receiver *n n* instead of being placed horizontally as shown in the drawings, can be set up in a vertical position and the heat applied to the end, the receiver in this case having interior pipes or flues like a common steam boiler.

We are aware that atmospheric and gas engines of various descriptions have long been known and that in some instances heat has been applied to highly compressed air, and also to highly compressed gases generated under pressure; but in no case within our knowledge has the use of air or gas as a motive power been made or contemplated upon the principles of our invention. One of the well known modes of using highly compressed air as a motive power is that, in which no heat is employed, the air being used directly from large receivers into which it has been highly compressed. Another mode is that in which air has been heated and cooled or expanded and contracted after the manner of a low pressure or condensing steam engine. Another mode is where highly compressed air has been heated and cooled in its passage through the engine the air in this case being used as a circulating medium, as in the old Stirling engine. That is, the same air and heat are used over and over, the receiver for condensed air being only at certain times supplied by small air pumps to replace the amount lost by leakage. In our invention the air is used in a highly compressed state and heated in the receiver, to the full extent of the heat to be applied, and maintained in the receiver at a uniform pressure or nearly so, by the continued action of an air-pump which is about one half the capacity of the working cylinder more or less, and the heated compressed air is worked expansively and alternately upon opposite sides of a piston after the manner of a common high-pressure steam engine; and in working our heated compressed air expansively, it is important to regulate our cut off according to the degree of compression of the air. Our mode also of regulating the pressure to uniformity in the receiver we regard as novel and specially simple and efficient in combination with our receiver and pump. It not only serves to keep the pressure uniform, but it economizes power by causing the expenditure of more or less force in pumping according to the necessities of the engine.

We do not therefore claim the employment of atmospheric air in a compressed state generally as a motive power, nor do we claim its employment under the conditions of heating and cooling or expanding and contracting with varying pressures, as in other atmospheric engines hitherto essayed, nor do we claim merely the heating or expanding and cooling or contracting of highly compressed air for the purposes of a motive power, nor do we even claim the heating of highly compressed air to act as a motive power, except under the principles of arrangement and operation as set forth in our specification to wit, an air pump or pumps for condensing the air, a receiver for the condensed air in which the air is to be maintained at a uniform pressure, and a working cylinder of suitable construction (with the necessary appendages of valves and parts to operate the same) and using the air expansively, substantially in the manner and for the purposes described.

We therefore do claim as our invention—

1. The mode substantially as specified of using air as a motive power, said mode consisting in the employment of a receiver in which air is to be highly compressed, heated, and maintained at or about a uniform pressure, a suitable working cylinder and piston with the ordinary appendages, an air pump or pumps worked by the engine for supplying the receiver; when the same are connected or combined with suitable devices as set forth for cutting off and working the air expansively, and according to the degree of compression of the air; all substantially as herein set forth.

2. We also claim in connection with such an engine the device for regulating the pressure of the air in the receiver, and economizing the power of the engine, said device consisting of the weighted bar entering the receiver through a stuffing box and connected at its opposite end with the stop cocks attached to the chambers of the air pump; substantially as described, intending to use any known means for accomplishing the two fold purpose of regulating the pressure of air in the receiver and opening the pump chambers to the atmosphere so that the pump shall be relieved from unnecessary labor.

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Witnesses:
JOSEPH GAVETT,
HENRY F. CONANT.