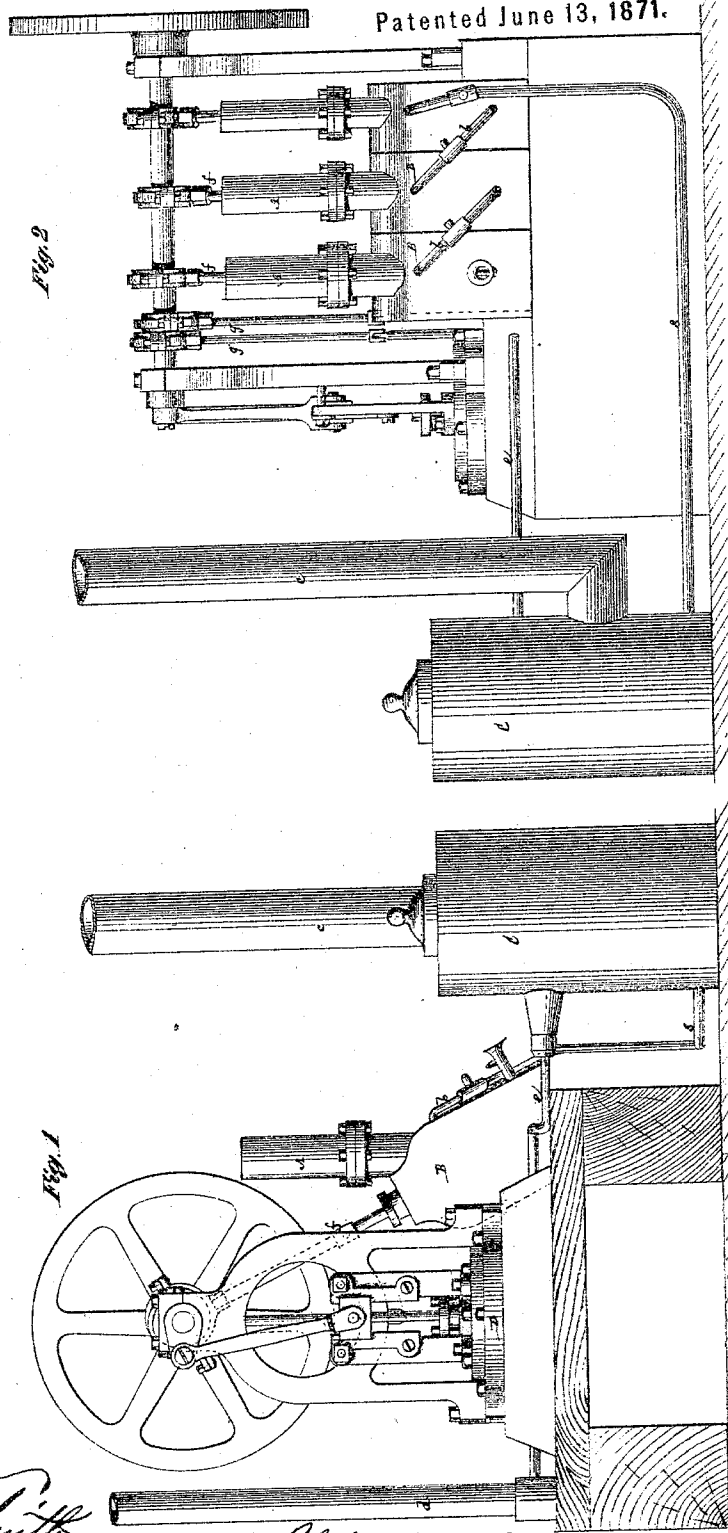


R. M. MARCHANT.

Improvement in Processes of Obtaining Motive Power.

No. 115,877.

Patented June 13, 1871.



Witnesses.

Fred Hayner

W. Morris Smith

Robert M. Marchant
by his attorney *Penn. Lombard & Co*

UNITED STATES PATENT OFFICE.

ROBERT MUDGE MARCHANT, OF LONDON, ENGLAND.

IMPROVEMENT IN PROCESSES OF OBTAINING MOTIVE POWER.

Specification forming part of Letters Patent No. 115,877, dated June 13, 1871.

To all whom it may concern:

Be it known that I, ROBERT MUDGE MARCHANT, of London, England, have invented a new and useful Process of Obtaining Motive Power, of which the following is a full, clear, and exact description, reference being had to the accompanying drawing forming part of this specification, and which represents a view, in perspective, of an engine with the necessary apparatus attached employed in obtaining motive power according to my improved process.

This invention consists in compressing aeriform fluids, including atmospheric air, (which latter will here be selected by way of illustration,) in progressive stages, and the passing of it at each stage through water, whereby the air is saturated during its compression, and then passing such saturated compressed air through a heater, from whence it passes in a highly-expanded condition to the cylinder of the engine, where it is utilized for the production of power with marked economy in fuel.

The engine itself may be similar to any ordinary steam-engine, and the construction and arrangement of the apparatus generally be varied to suit the application of my improved process to stationary, marine, or locomotive engines, as the case may be. But, in carrying out the invention, it is necessary that there should be employed a series of pumps operating upon the general principle described in Letters Patent of the United States, No. 110,380 and No. 112,060, issued to me on the 20th day of December, 1870, and 21st of February, 1871, in which the plungers of the pumps used to compress the air work under water which is confined under or between a volume or volumes of the air under compression, by causing the air to pass or be delivered by the beat of each pump and by its lighter specific gravity through the water from below to a storage chamber or pipe, for transfer of the air from pump to pump, and for final use, as required. This compression of the air in stages, each successive pump acting upon the air previously compressed by a preceding pump, is essential to the economical working of the invention, as is also the saturation of the air, which not only serves to prevent the heating of the pumps by absorption by the water of the heat given out during compression, but when the saturated condensed air reaches or leaves the last pump in the se-

ries or reservoir connected therewith, an atmosphere or medium air is produced that contains the necessary elements of the power to be applied, and that is in appearance what may be termed a "white cloud," which consists of the compressed air, of the steam expressed by the saturation of the air when under further compression at each stage of pumping, and of the saturation not so already expressed by steam. This white cloud enters the heater at a determined pressure, and here the remaining saturation is converted into gas, and expansion is given to the already compressed gas. From the heater the cylinder of the engine is supplied with its motive power by means of a suitable valve or valves, and here, apart from the increase of power which is obtained by the expansion of the compressed gas in the heater, the additional heat communicated by the heater serves to prevent that freezing effect which would otherwise take place by the sudden liberation and expansion of the compressed air within the cylinder.

The pumps are, preferably, worked by the engine which they serve to supply with motive power, and by the stage process of condensing the air there is the smallest attainable consumption of power in the mechanical manufacture of the gas at the pressure at which it is determined to submit it to the increasing action of heat, each successive pump working in an atmosphere already stored by a preceding pump, and hence only meeting with a resistance due to the difference between the pressures within them. The consumption of fuel is, therefore, mainly applied to a superheating process, and pressures hitherto practically unattainable are so attained and rendered applicable in the most economical manner by expansive action, and a less space suffices for machinery and fuel to obtain an equal motive power.

The pumps may be of any suitable construction and be variously arranged; but it is preferred that the air charge in each chamber of the pumps shall be placed over the water in such chamber, so that all pressure tending to leakage shall be exercised by water on the joints, with which joints the air is precluded from coming in contact by the difference of its gravity.

One arrangement for maintaining the re-

quired uniform level of the water in the chambers is by duly proportioning the upper spaces which the water in said chambers occupies to the size of the pumps, which are made to pass water forward, as may be necessary, to keep up the supply as decreased by evaporation; also, by the arrangement of the suction-pipes, which at one uniform level pass such water as required at that level.

It is preferred to pack the piston of the engine and pump-buckets with cork cut into ribs of such size as shall not be crushed by the pressure put on them, but shall, on the contrary, retain their elasticity, such cork being steeped in a suitable preparation, so as to form a uniform mass when under pressure.

The charging to start the motive power, as described, may be effected by constructing the heater with a coil for the passage of the saturated condensed air through it, and temporarily shutting off communication between said coil and the pressure-pumps, and pumping into the coil a sufficient quantity of water to produce steam by which to work the engine till the necessary charge of condensed air has been produced by the pumps to work the engine under my improved process, when communication should be opened between the coil and the last pump in the series, or the reservoir connected therewith.

Referring to the accompanying drawing, in which Figures 1 and 2 are views at right an-

gles to each other, and which represent the invention under one form of application, by way of illustrating it as hereinbefore described—

A A are the chambers, which are successively charged by the pumps with saturated condensed air of progressive pressure as produced by the stage process hereinbefore referred to; B B, the pump-chambers underneath; and *b b*, the pipes which connect each successive pump with the preceding one. C is the heater, provided with a chimney, *c*. D is the cylinder of an engine operated by my improved process; *d*, its exhaust-pipe; *s*, the pipe by which the saturated condensed air is taken from the last pump to the heater; and *e*, the pipe by which the saturated air is conveyed from the heater to the cylinder of the engine or its valve-chest. *f f*, the connecting-rods working the pump-rods; and *g g* the eccentric rods to tappet-motion for operating the engine-valve.

What is here claimed, and desired to be secured by Letters Patent, is—

The process, herein described, of obtaining motive power by compressing air in progressive stages and passing it at each stage through water, and finally passing it through a heater, and from thence to the cylinder of an engine, substantially as specified.

R. M. MARCHANT.

Witnesses:

I. C. NEWBURN,
GEO. BACON.