(No Model.)

V. POPP.

METHOD OF UTILIZING COMPRESSED AIR FOR PRODUCING MOTIVE ENERGY.

No. 456,595. Patented July 28, 1891.

Fig. 1.

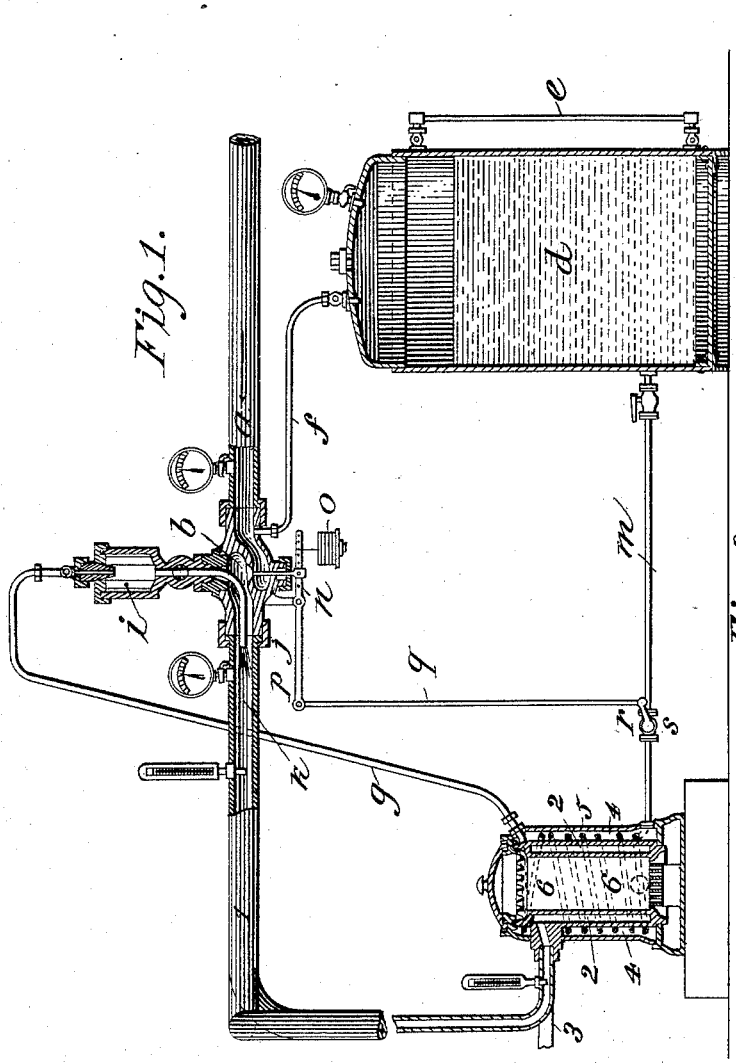
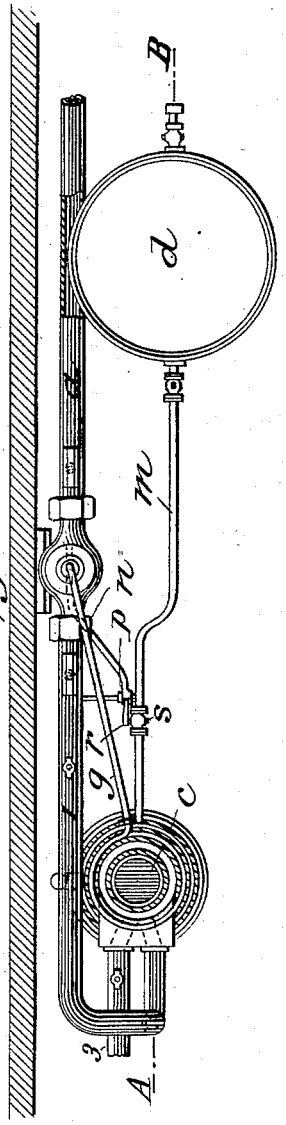


Fig. 2.



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UNITED STATES PATENT OFFICE.

VICTOR POPP, OF PARIS, FRANCE.

METHOD OF UTILIZING COMPRESSED AIR FOR PRODUCING MOTIVE ENERGY.

SPECIFICATION forming part of Letters Patent No. 456,595, dated July 28, 1891.

Original application filed April 9, 1889, Serial No. 306,619. Divided and this application filed April 24, 1890. Serial No. 349,380. (No model.) Patented in France November 8, 1888, No. 180,938; in Belgium November 14, 1888, No. 83,946; in England November 22, 1888, No. 17,006; in Italy December 31, 1888, XLVIII, 493, and in Spain January 25, 1889, No. 8,900.

To all whom it may concern:

Be it known that I, VICTOR POPP, a citizen of France, residing at Paris, France, have invented certain new and useful Improvements in Methods of Utilizing Compressed Air for Producing Motive Energy, (for which I have received Letters Patent in the following countries: in France November 8, 1888, No. 180,938; in Belgium November 14, 1888, No. 83,946; in Italy December 31, 1888, No. 493, Vol. 48; in England November 22, 1888, No. 17,006, and in Spain January 25, 1889, Vol. 7, p. 600, No. 8,900,) of which the following is a specification, this application being a division of my application No. 306,619.

My invention relates to a method or process for the production of motive energy through the combined expansive force of compressed air and steam or other suitable vapor or gas produced from liquid by means of heat. In a system of transmission of energy by means of air which has been compressed by an original force and conducted to a distant point where its energy is to be utilized for motive purposes it is well known that it is desirable and economical to heat the air before it is admitted to the motor, there being thus imparted to the air a higher degree of expansibility and at the same time less tendency to freezing at the outlet-ports of the motor. I make use of this fact to heat at the same time, and preferably by the same apparatus, a supply of water or other fluid that by the action of the heat will be converted into an expansible gas or vapor. This heated liquid is injected in the form of a spray into the compressed air before it is utilized in the motor, and by the heat of the air the fluid becomes a vapor, which adds its expansive force to that of the air. By this process, which is especially applicable to steam and compressed air, I obtain a much higher pressure at a very slight increase of cost, and at the same time give a much-needed lubrication to the interior of the motor.

This present application relates to the method which I employ both generally and in its specific details, and while I have shown one form of apparatus by which the method may be carried into operation, it is understood that the said apparatus is not claimed herein, being only for the purpose of illustration, and being shown and claimed in a separate application pending herewith.

This apparatus is illustrated in the accompanying drawings, in which—

Figure 1 is an elevation, partly in section; and Fig. 2 is a plan, partly in section.

In this apparatus a supply of compressed air is provided, which is always maintained at a constant pressure and introduced to the apparatus by means of pipe *a*. The air then passes through the automatic regulating-valve *b*, which by means of adjustable weights causes a certain obstruction to the passage of the air from pipe *a*, the function of the valve being described hereinafter. The water or other liquid to be injected is contained in a reservoir *d*, provided with a gage-glass *e* or other suitable device for indicating the level of the liquid. The reservoir is hermetically closed and its contents subjected to the same constant pressure as that in pipe *a* by means of a connecting-pipe *f*, which opens into the pipe *a* in front of the valve *b*. The reservoir *b* is provided with a screw-plug, which can be replaced by a union forming the end of the delivery-pipe of a small pump, hereinafter referred to. This reservoir *d* is connected by a pipe *m* to a heater, which serves at the same time to heat the compressed air. This heater receives the compressed air before it is admitted to the motor. The air passes by a pipe 1 into a series of passages, which in a well-known manner compel the air to pass in a long circuit around the furnace and then by a pipe 3 to the motor. This chamber for heating the air is marked 2 and is surrounded by a casing 4, outside of which is a coil of pipe *k*, through which the water from reservoir *d* passes and is heated. The water is forced through the coil by reason of the obstruction which the valve *b* offers to the free passage of the air out of pipe *a* through the main route. The pipe *f*, leading to the water, and the water being then forced through the heater and by the pipe *g* to the opposite side of the valve *b* a by-path is afforded around the said valve, and the force with which the air will tend to pass through this by-path is

regulated by the weight O, by which valve *b* is adjusted. After passing through the coil the liquid goes by means of a pipe *g* into a receiver *i*, provided with means for rendering visible the volume of discharge. From this receiver the heated liquid passes into an atomizer or spraying device *j*, which opens into the pipe 1 containing the compressed air. The atomized liquid is drawn along with the compressed air, which is thus saturated with moisture before entering the heater. The commingled air and liquid pass together into the heater, where the water is converted into steam, and passes with the air through the pipe 3 into the motor, where the combined expansive force of air and steam is utilized.

Since the pressure forcing the water through the heating-coil and into the air-pipe varies according to the consumption of air from pipe 1, the amount of liquid injected will to a great extent be varied automatically to correspond with the requirements of the work; but I prefer to regulate the flow automatically by connecting the automatic valve *b* by means of a lever and connecting-rod with the regulating-cock *s* in pipe *m*. By this arrangement the flow of liquid is exactly regulated. Pressure-gages and thermometers are placed on the reservoir and different pipes. In order that the water in the reservoir may be renewed, the exhaust-pipe of the motor may be led to a condenser and a pump may return the water from the condenser to the reservoir *d* by means of a screw-plug above referred to.

By the apparatus above described the steam and the air are combined, so as to produce a co-operative effect in the production of motive energy, the usual effect of the compressed air supplied being increased with but small cost.

In place of water, any other suitable liquid or substance may be employed, which may be injected into the air and transformed by heat into a gas or vapor and thus united with the pressure of the air.

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

The method of producing motive force, which consists, first, in compressing air by an independent engine and transmitting it to a distant place where motive force is desired; second, heating the compressed air and water or similar vaporizable liquid in independent receptacles at the said place; third, mingling the air with steam or similar fluid vapor, and, fourth, utilizing the combined expansive energy of the air and vapor in a motor.

VICTOR POPP.

Witnesses:
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