3 Sheets--Sheet 1.

GEORGE B. BRAYTON.

Improvement in Gas Engines.

No. 125,166. Patented April 2, 1872.

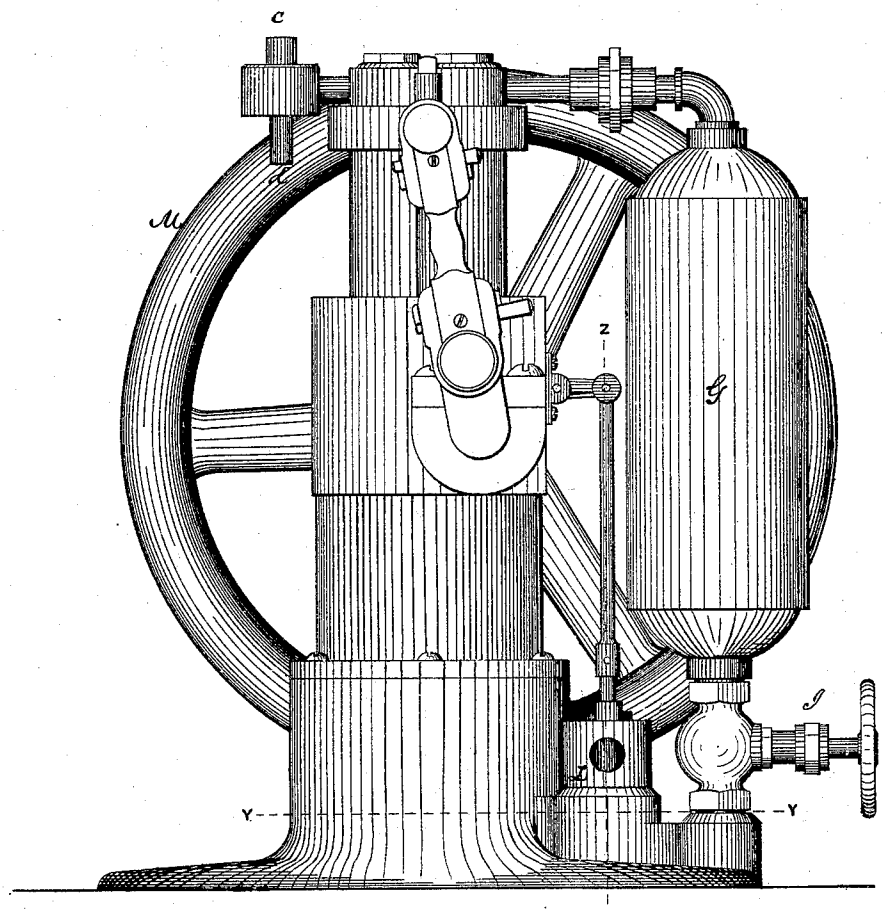
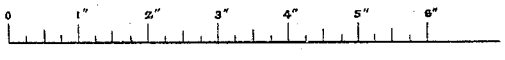


FIG. 1.



WITNESSES.

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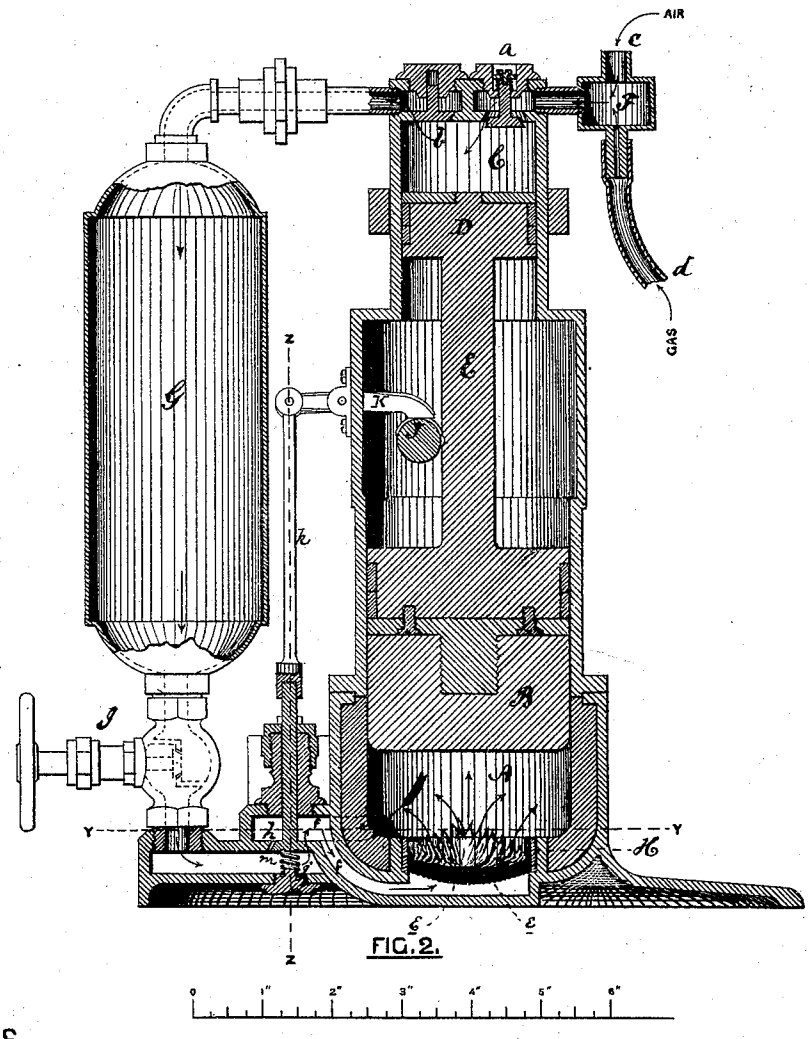

FIG. 2.

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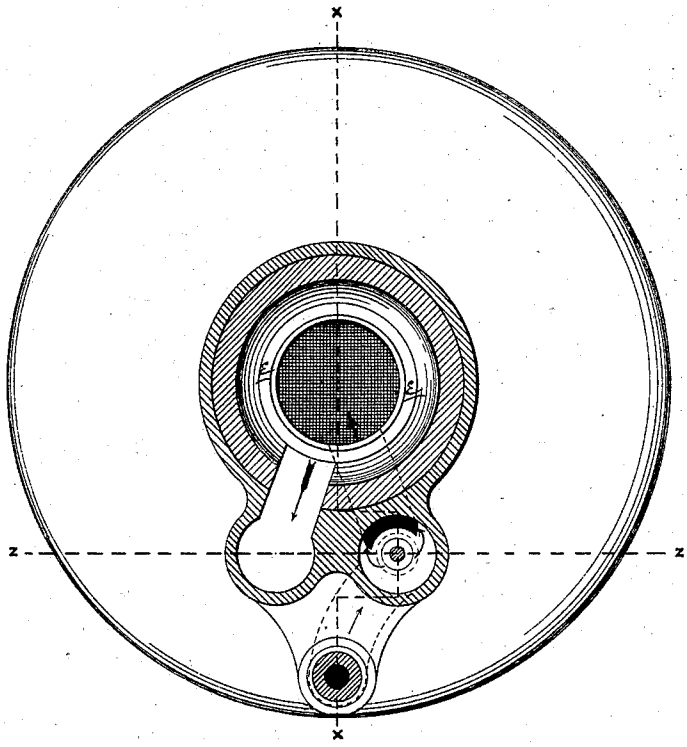


FIG. 3.

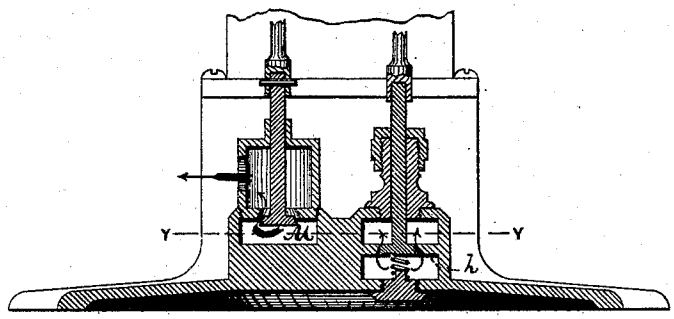
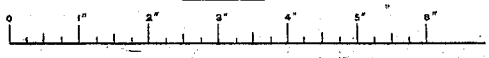


FIG. 4.



WITNESSES.

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Peter F. Hughes

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UNITED STATES PATENT OFFICE.

GEORGE B. BRAYTON, OF BOSTON, MASSACHUSETTS.

IMPROVEMENT IN GAS-ENGINES.

Specification forming part of Letters Patent No. 125,166, dated April 2, 1872.

To all whom it may concern:

Be it known that I, GEORGE B. BRAYTON, of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Gas-Engines; and I do hereby declare that the following specification, taken in connection with the drawing making a part thereof, is a full, clear, and exact description of the same.

Figure 1 is a side elevation. Fig. 2 is a vertical section on the line *x x* of Fig. 3. Fig. 3 is a horizontal section on the line *y y* of Figs. 2 and 4. Fig. 4 is a vertical section on the line *z z* of Figs. 2 and 3.

The drawing is made on a scale, with reference to the model, of six inches to the foot.

The invention hereinafter described relates to a means for making practically available, as a motive-power, those compounds which result from the mixture of gases obtained from light hydrocarbons with atmospheric air. It has for a long time been known that such compounds were capable of developing, upon ignition, an immense degree of force, and various attempts have been made to employ them as motive agents for working machinery. My invention is embodied in a structure which provides, first, for maintaining an accumulation of a limited quantity of the gaseous compound under considerable but uniform pressure in the reservoir, the supply to the reservoir being always proportioned to the consumption of the engine, and the gaseous compound mixed only as it is introduced to the reservoir; and, secondly, for introducing a jet of the mixed compound so under pressure, while in the act of changing its volume as the result of ignition, into a cylinder, to act with its expansive force upon a moving piston.

In the drawing I have represented a single-acting engine, arranged to exhibit my improvement. To construct a double-acting engine, operated by this motive-power, would require changes of arrangement, which any competent constructor would understand, but would not involve any change in principle.

Referring to Fig. 2, A is the cylinder proper of the engine, which is fitted with a piston, B. As the piston is exposed to the direct action of the ignited and heated gases it should be made of or protected by some material, as, for instance, soap-stone, capable of sustaining, without injury, a high degree of heat. The cylinder itself should also be incased with a water-tight jacket of metal, and enough larger in diameter than the cylinder to allow of a water-space between the two, through which water should be made to circulate. A convenient way for effecting this will be to connect a tank of water, which may be located at any convenient place, with the water-space by two pipes, one entering near the top and the other near the bottom of the same, as in the common arrangement for establishing a water-circulation. The cylinder A is, in this instance, surmounted by an air-pump, the barrel of which is C. It is furnished with a piston, D, attached to the rod E, common to it and the piston B. This air-pump is supplied with a proper induction-valve, *a*, and eduction-valve, *b*, of any preferred construction and arrangement. F is a chamber, provided with two inlets, *c* and *d*. The former admits admospheric air, and the latter, by means of any suitable tube or conducting-pipe, is connected with a supply of common illuminating gas or other carbureted hydrogen, as, for instance, the volatile constituents of petroleum oils. The capacity of these two inlets may be regulated by means of a screw-valve applied to each, so that the relative quantities of air and gas to be admitted at the same time to the chamber F may be varied at pleasure. In general the proper proportions will be found to be twelve parts of air, by volume, to one of carbureted hydrogen to make a compound, which upon ignition will be followed by a complete combustion; but, in practical operation differences in chemical constituents of the gas employed will probaly require variations in the required proportions of atmospheric air. It is obvious that the movement of the piston D of the air-pump will, at each downward stroke, draw into the barrel C a charge of gaseous compound through the valve *a*, and that upon the upward-stroke of the piston the same charge will be forced through the eduction-valve *b* into the reservoir G. This reservoir should be constructed of strong boiler-plate, or of the best mixtures of iron used in casting ordnance. It should be made with reference to sustaining a constant internal pressure of at least sixty pounds to the

square inch. It should be furnished with a pressure-gauge, and with a safety-valve, arranged to open when the pressure from any cause exceeds the prescribed limit. It is not to be understood that any large volume of the gaseous compound is to be collected and retained within the reservoir G. Its interior capacity need not be more than twice the cubical contents of the cylinder A; but, nevertheless, of sufficient size to enable the air-pump (which should be properly proportioned to that end) to maintain within the reservoir a uniform maximum of pressure.

The arrangement of devices which I employ for applying the gaseous compound to work the engine are as follows: In a suitably-formed recess or chamber, H, formed at the bottom of the cylinder A, below the range of the down-stroke of the piston, I place any convenient number of wire-gauze diaphragms, *e*. These I call the "interceptors," because they serve to guard the passages through which the gas is supplied to the engine, and cut off the flame after the gas has been ignited from the supply which is flowing from the reservoir when the valve-connection is opened, and are so located that all gas consumed in working the engine must pass through them. I is a screw-valve, which, when opened, allows the gaseous compound to flow into the conducting-passage *f*, with which and the recess or chamber H, spanned by the interceptors, a communication is made, when the valve *h* is opened. The valve *h* is opened for every up-stroke of the piston B by means of the revolving-cam J on the main shaft, which causes the lever K to vibrate and work the valve-rod *k*, which is pivoted to such lever. The configuration of the cam J determines the length of time that the valve *h* shall remain open, and the spring *j* causes the valve to close upon the instant that the cam ceases to hold it open.

As previously indicated, I intend to apply the gaseous compound to work the piston while it is undergoing expansion after ignition. I have therefore to provide for maintaining a constant flame upon the upper surface of the interceptors which will serve to fire each charge of gas so soon as it passes through the diaphragms of wire-gauze, and upon its first entrance to the cylinder. For this purpose I make a small V-shaped channel, *m*, in the edge of the valve *h*, or, which would be better, make a vent through the valve-seat and regulate its area by a check-valve. This allows a small quantity of the gas to flow at all times to the interceptors, which, being ignited, will burn tranquilly and with a lambent flame upon the upper surface of the interceptors, and constitute a living torch at the entrance of the cylinder to fire each charge of gaseous mixture in succession.

Let it now be supposed that the engine is to be put into operation. The reservoir G should be filled with gaseous compound to the desired pressure. This may be done by revolving the balance-wheel by hand if the engine be of small capacity, or a separate air-pump for charging the reservoir may be used in case the engine is too large to be readily revolved by hand. The screw-valve I is now opened and a lighted taper is inserted through the exhaust-port L, Fig. 1. The small supply of gas admitted through the channel *m* in the valve *h* has struggled through the meshes of the gauze interceptors, and upon the taper being applied to it will burn quietly. The valve *h* is now opened by a starting-bar or other convenient means, and a charge of gas, under the pressure in the reservoir, rushes against the under side of the interceptors, and upon reaching the flame playing upon their upper surface is fired thereby. While in the state of expansion consequent upon ignition it exerts not a spasmodic or explosive force upon the piston, but a true pressure due to expansion on account of the fact that the piston is at the very commencement of its stroke when the expanding gas begins to act upon it, and the quantity of gaseous mixture during its period of admission is in proportion to the extent of the movement of the piston, and is put into the state of expansion upon passing the interceptors and entering the cylinder. The piston having completed its upward stroke, the momentum of the balance-wheel M, (Fig. 1,) which, by means of the common crank and links shown at Fig. 1, is connected in any convenient way with the piston, which causes the piston to descend again, the injection-valve *h* being now closed. While the piston is descending a cam on the main shaft, acting upon a lever (Fig. 1) similar to that which works the valve *h*, opens the exhaust-valve M (Fig. 3) in a well-understood way. The exhaust-passage in the several figures is indicated by a broad black-feathered arrow. It would naturally be supposed that the flame caused by igniting explosive gas under pressure upon the surface of the wire-gauze interceptors would be forced back through the interceptors and ignite the gaseous compound in the passage *f*, connecting with the reservoir, and explode the contents of the latter. Many months of experiment with a working-engine subjected to every variety of conditions likely to occur in daily use have proved to me that a series of wire-gauze diaphragms (six or more) perfectly intercept the flame and render danger from accident impossible; and that the flame has no tendency to turn backward is proved from the condition of the gauze after long use in showing no evidence of being even slightly burned. I have also repeatedly caused the gaseous compound in the reservoir to be fired, and the safety-valve in every instance has prevented the slightest injury to the apparatus. In case it is preferred to make use of any of the light hydrocarbons obtained from petroleum or other sources, as, for instance, naphtha, on account of the greater cheapness of the material over illuminating gas, it will be found most convenient to allow

the fluid having the necessary constituents to be dropped upon or absorbed by a sponge placed in a vessel so that it can readily vaporize, and in that state be pumped off from the vessel by the air-pump, in combination with atmospheric air, into the reservoir for supplying the engine.

I have described the reservoir G as containing the mixed gases. It is, however, entirely practicable to employ two reservoirs, one of which shall contain the carbureted hydrogen and the other atmospheric air, the contents of both being condensed by pressure and mixed only as the charge from each reservoir enters the chamber H. Such arrangement would be more complicated in the machinery necessary to be used than the one described, requiring, as it would, induction-valves appropriate to each reservoir; but it would insure nearly absolute safety in the use of such gaseous agents of force.

I do not limit myself to the construction or arrangement of the several parts of the engine as described, inasmuch as the improvements which constitute my invention can be applied to engines of various forms.

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

The following apparatus or organisms, in combination: A pumping-engine, for condensing air and gas; a reservoir for containing such agents, either separated or when mixed, and a cylinder and working-piston, provided with suitable automatic valve-gear, operating induction and eduction valves, when such cylinder is furnished with a perforated partition whose office is to maintain a torch to fire the successive charges of gaseous mixture as they are entering the cylinder and prevent the back action of the ignited charge, substantially as described.

GEO. B. BRAYTON.

Witnesses:
JOHN D. THURSTON,
PETER F. HUGHES.