(No Model.) 4 Sheets—Sheet 1.

F. W. RACHHOLZ.

GAS ENGINE.

No. 301,009. Patented June 24, 1884.

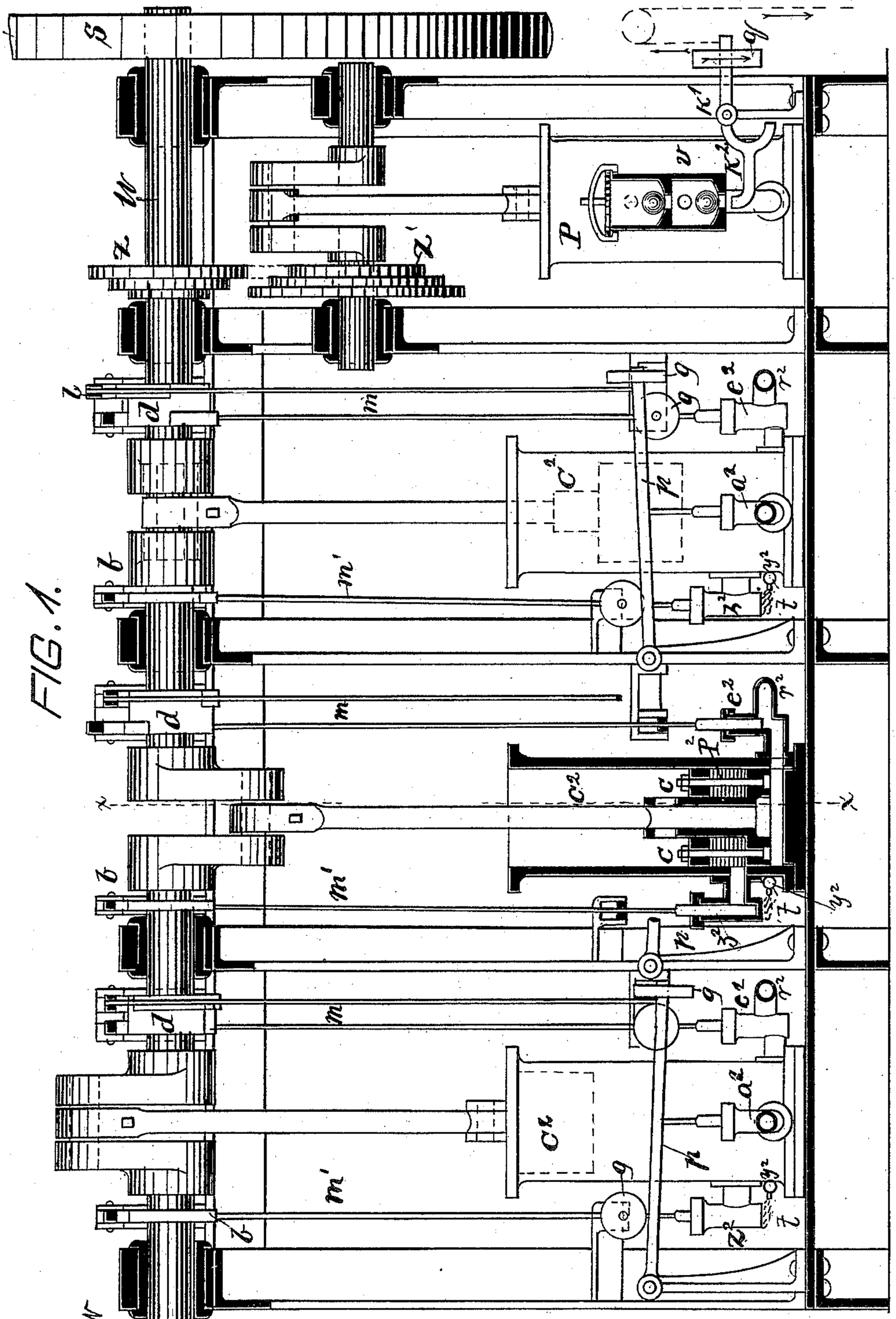

FIG. 1.

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By L. L. Wright
Att'y

(No Model.)

4 Sheets—Sheet 2.

F. W. RACHHOLZ.

GAS ENGINE

No. 301,009. Patented June 24, 1884.

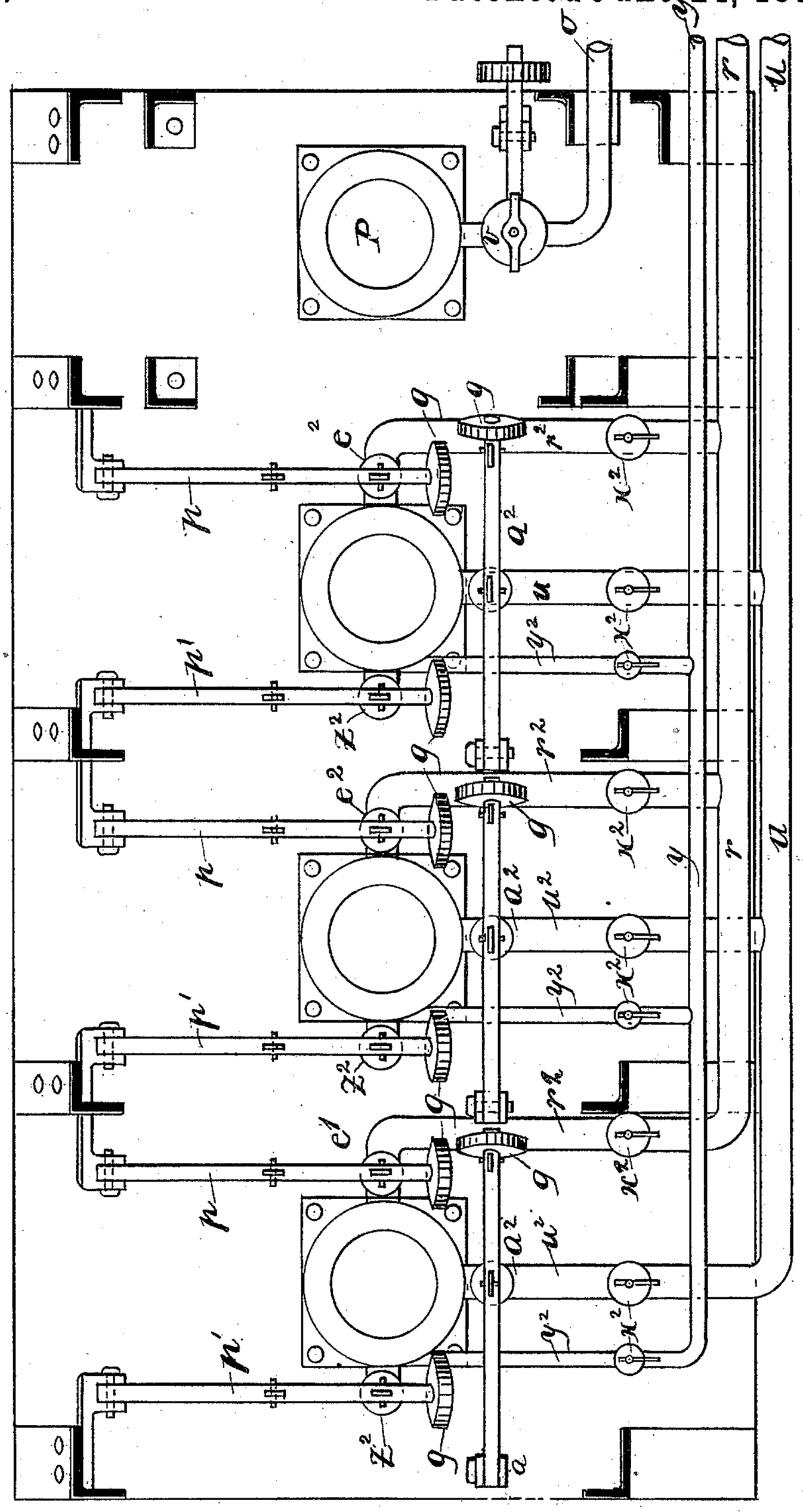

FIG. 2.

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(No Model.)

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GAS ENGINE.

No. 301,009. Patented June 24, 1884.

FIG. 3.

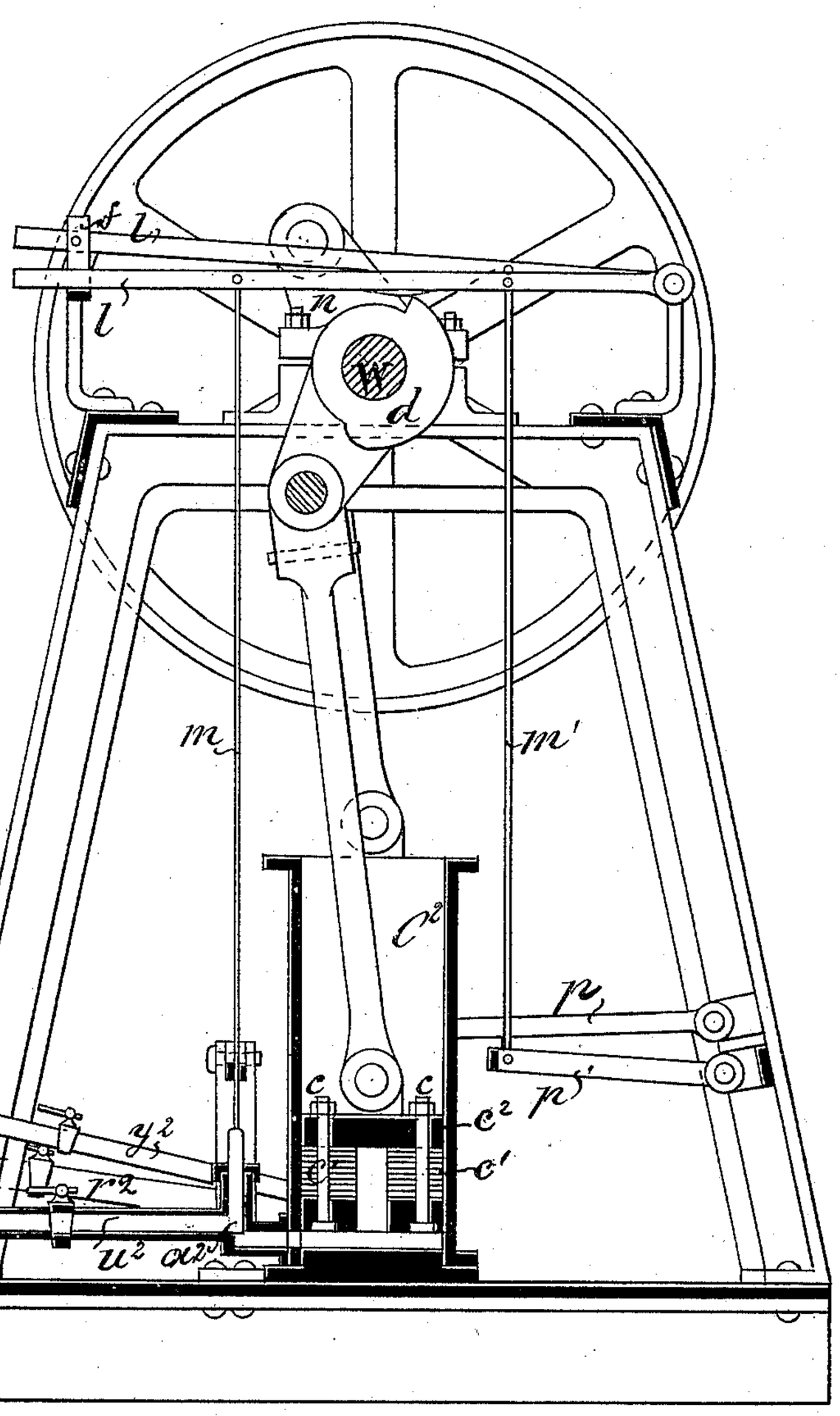
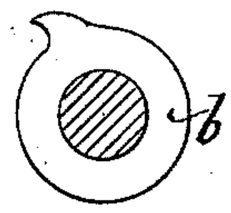


FIG. 4.



Witnesses.

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(No Model.) 4 Sheets—Sheet 4.

F. W. RACHHOLZ.

GAS ENGINE.

No. 301,009. Patented June 24, 1884.

FIG. 5.

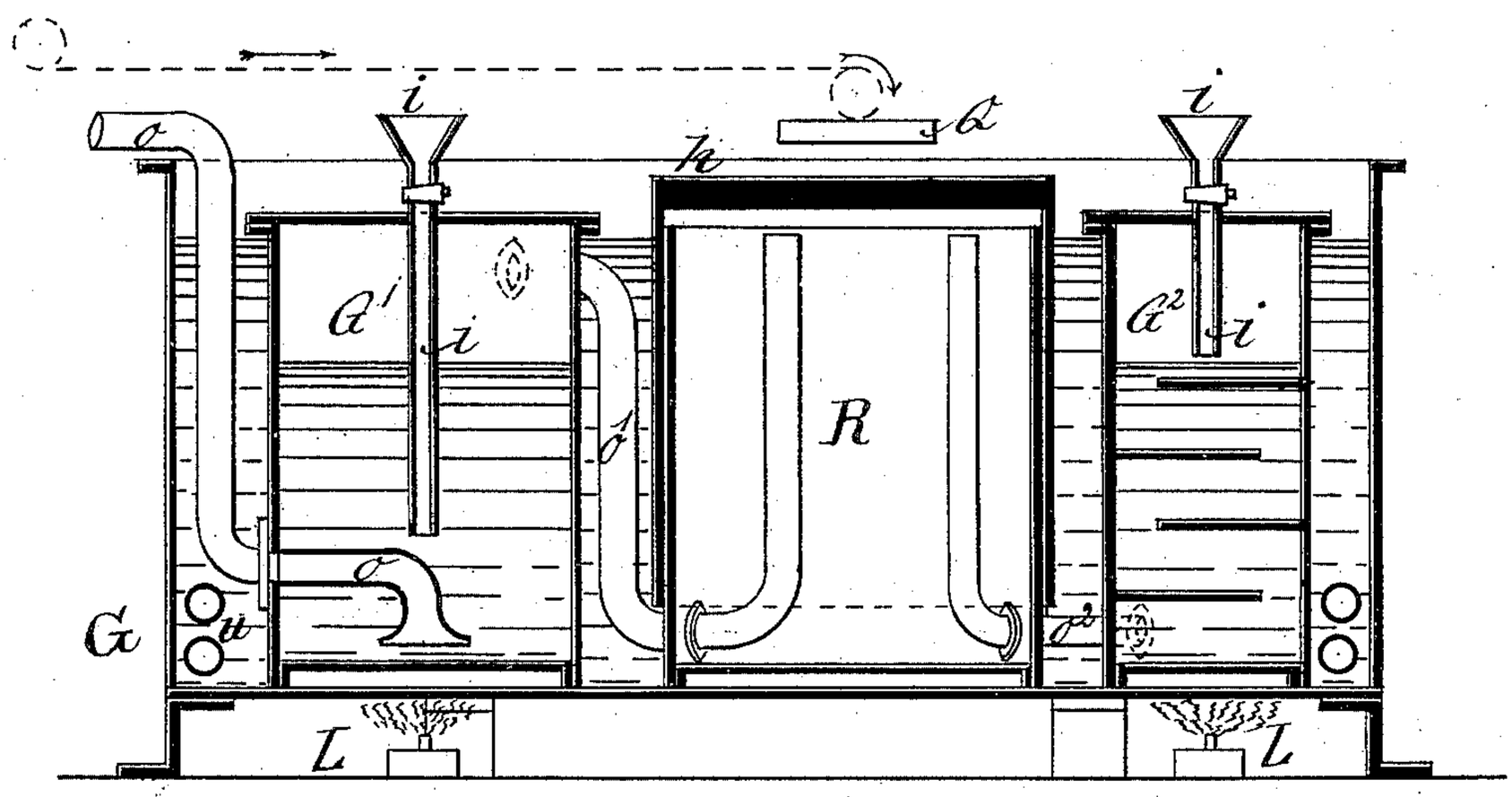
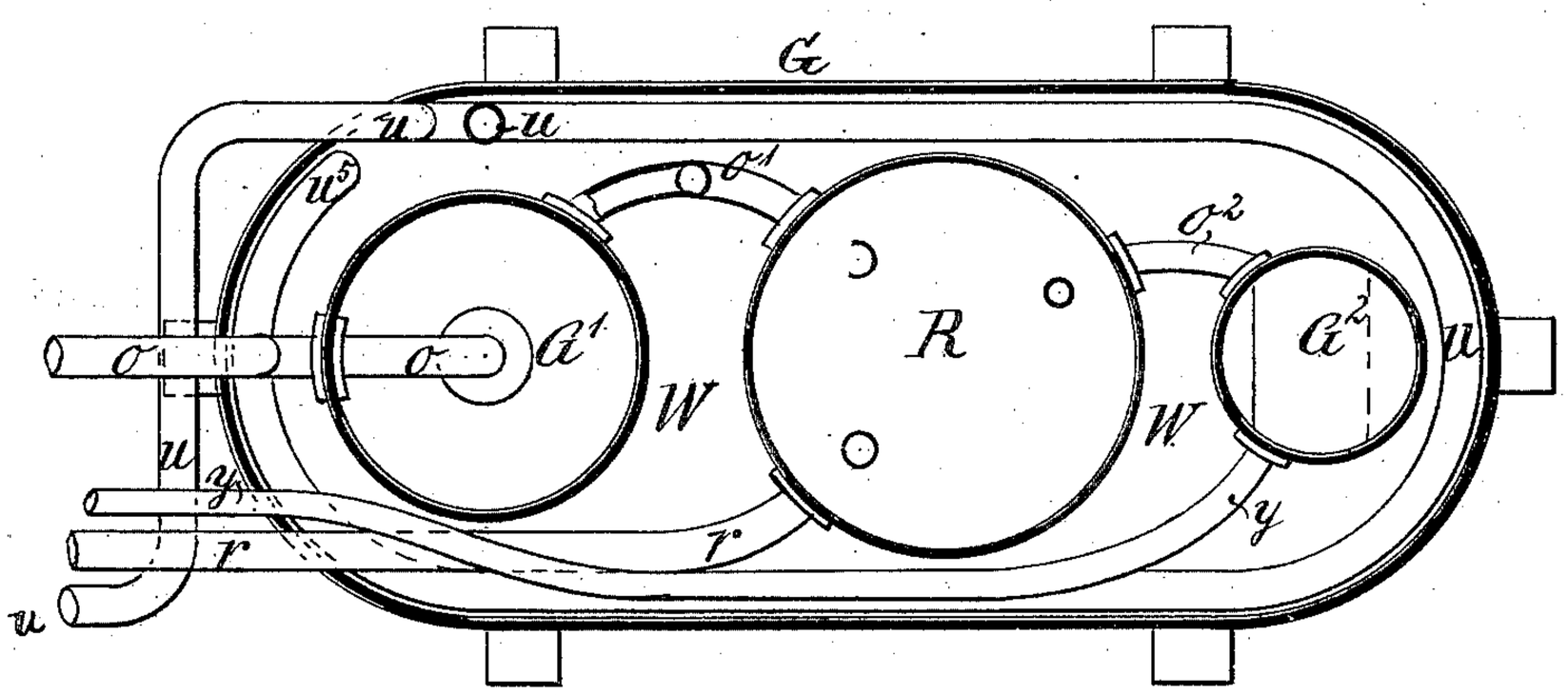


FIG. 6.



Witnesses:
C. A. Snow
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Inventor:
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UNITED STATES PATENT OFFICE.

FRIEDRICH WILHELM RACHHOLZ, OF DRESDEN, SAXONY, GERMANY.

GAS-ENGINE.

SPECIFICATION forming part of Letters Patent No. 301,009, dated June 24, 1884.

Application filed October 6, 1883. (No model.)

To all whom it may concern:

Be it known that I, FRIEDRICH WILHELM RACHHOLZ, of the city of Dresden, in the Kingdom of Saxony and German Empire, have invented certain new and useful Improvements in a Gas-Engine, whereby the said engine produces its own gas from oil waste, of which the following is a specification.

My invention relates to improvements in an oil-gas engine, whereby the said engine produces its own gas from oil waste.

The object of my said invention is to construct a gas engine or motor which shall generate the gas consumed by the said engine or motor and automatically prevent or exclude all danger of explosion. The preparation of the charge is carried out by forcing or pressing atmospheric air through hydrocarbons, or mixtures of the same—such as petroleum, rock-oil, naphtha, kerosol, rhigol, gasoline, canadol, benzine, ligroine, petroline, petroleum-ether, spirits of petroleum, &c.—the volatile products of which, when mixed with air, form explosive mixtures, or when mixed with less air, form inflammable gases. All hydrocarbons which can be employed for this purpose and their mixtures are known under the general denomination of "oil-gases." The automatic avoidance of all danger of explosions occurring is effected by arranging or locating the oil-receptacles in a warm-water bath.

Figure 1 is an elevation of part of the apparatus, showing three similar engines and an air-pump, one of the engines and one part of the air-pump and part of the main frame being shown in section. Fig. 2 is a top view of said apparatus, the upper part of the frame being removed. Fig. 3 is a vertical transverse section through the apparatus, taken in the plane indicated by dotted lines $x\ x$ on Fig. 1. Fig. 4 is a view of the cam or tappet b. Fig. 5 is a vertical section through the gas-generator. Fig. 6 is a top view of the same.

I will first describe the apparatus for preparing the explosive gas.

P, Figs. 1 and 2, illustrates an air-pump which is driven by the motor or engine, and which is provided with a valve, v. This pump communicates, by means of a pipe, O, with the reservoir G′, near its bottom, which latter is intended to contain the gas, oil, or hydrocarbon fluid. The air which is forced into said reservoir ascends through the fluid therein, and is saturated with volatile oil-gas products. This mixture is explosive, and escapes from the upper part of the reservoir G′, through a pipe, O′, into the gas-holder R for the gas-mixture. From this gas-holder R this gas-mixture passes through a pipe, O^2, into the lower part of a reservoir, G^2, provided with deflecting-partitions, wherein the gas-mixture absorbs an additional quantity of volatile products from the hydrocarbon. These gas products pass out of the upper part of the reservoir G^2 through a pipe, y, (shown in Figs. 2 and 6,) which communicates with the engine-cylinders, hereinafter described. The funnels i, provided with cocks, serve to charge the reservoirs G′ G^2 with oil.

It is well known that hydrocarbons absorb heat when they are converted into gas form, so the temperature of the same is reduced; but as the volatilization ceases when the temperature is lowered to a certain degree, it is necessary to provide warmth, which can be effected by applying flame (say a lamp, L) beneath a tank, G, containing water, or by employing the products of combustion which escape from the engine cylinder or cylinders, by means of a pipe, u,, part of which is submerged in the water in tank G. It will thus be seen that I heat the oil in reservoirs G′ G^2 in an indirect manner, and prevent the possibility of overheating the oil-gas in said reservoirs. In order that the production of this mixture of air and gas shall depend on the consumption, the gas-holder R is provided with a vertically-movable hood, h, which rises by a greater production than consumption of gas, and sinks when the consumption is greater than the production. The water in the tank G serves as a closure to the reservoir to prevent the escape of gas therefrom. In combination with said movable hood h, I employ a safety device to exclude the entrance of more atmospheric air into reservoir G′ as soon as the hood h rises nearly to a dangerous height. At such height a weight, Q, is arranged, as shown in Fig. 5, suspended by a rope or chain (indicated in dotted lines,) passed over and under pulleys, and attached to one arm of a bifurcated lever, K′, to which arm a counterbalancing-weight, q, is applied. (See Fig. 1.)

This lever K′ has its fulcrum on a standard of the engine-bed, and its upturned arm is adapted to enter the suction part of the valve *v* of the air-engine P, and to raise this valve from its seat. When this valve *v* is thus raised, the air drawn into the cylinder of the air-pump by the downstroke of its piston will escape through the said suction part instead of through the pipe O and into the reservoir G′ and gas-holder R. If only a single-acting air-pump is employed, the supply of gas-mixture will be subjected to frequent variations, in order to prevent which I prefer to employ a double-acting air-pump, or two pumps in which the pressure and suction operate alternately.

I have represented by Figs. 1 and 2 three engines of similar construction, and I prefer to employ at least two of them, connected to a single three-throw crank-shaft, W, by means of the pitman-rods of the pistons, as shown in Fig. 1; but it will be obvious from what follows that a single engine only may be employed. When the several parts of the apparatus occupy the positions shown in Fig. 1, the fly-wheel S on crank-shaft W is given a forward turn, so that the piston is raised in the cylinder C^2 and sucks explosive gas-mixture through the inlet-valve e^2 and pipes r r^2, out of the gas-holder R. After valve e^2 closes—say at about one-third of the charge of the cylinder C^2—and after the igniting-valve z^2 has been suddenly opened for a moment and sucks in the flame *t*, burning near said valve, and explodes the gas in the cylinder, then the expansion of the gas will cause the piston to complete its upward stroke. The flame *t* is from a burner applied to the branch y^2 of a pipe *y*, communicating with the upper part of the reservoir G^2, as above described, which branch is provided with a regulating cut-off valve. The explosion arising from the ignition of the gas-mixture causes an expansion of said gas, which drives the piston R^2 upward to its highest point, at which time an outlet-valve, a^2, in the branch u^2 of the return-pipe *u* is opened. The momentum of the shaft W and fly-wheel S, which are set in rotation by the ascent of the piston P^2, as above described, returns this piston and drives out of cylinder C^2 the products of combustion, which escape through pipes u^2 *u* into the coil in the water-tank G. As soon as the outlet-valve a^2 is closed, and the inlet-valve e^2 is simultaneously opened, the piston P^2 again rises, first sucks explosive gas-mixture into the cylinder C^2, and then, when the inlet-valve e^2 is closed and the igniting-valve z^2 momentarily opened, another explosion of the gas in said cylinder takes place and the piston P is again caused to rise. This operation is continuously repeated. The opening of the valves a^2 and e^2 is effected by means of the cam *d* on crank-shaft W, acting through rods *m* and the loaded lever *p*. The opening of the valve z^2 is effected by means of the cam *b* on said crank-shaft, acting through the medium of rod *m′* and a loaded lever, *p′*, while the said valves are closed suddenly by weight *g*, applied to said levers, as shown in Fig. 2.

In order to provide for an increased consumption of gas by a corresponding production of the same, I employ a cone-stepped pulley, Z, on the crank-shaft W, and a similar but reversed cone-stepped pulley, Z′, on the crank-shaft of the air-pump, as shown in Fig. 1, using an endless shifting belt (indicated by dotted lines, Fig. 1) for transmitting motion from the shaft W to the air-engine crank-shaft.

It will be observed that by shifting the belt from a larger to a smaller pulley on shaft W, and from a smaller to a larger pulley on the crank-shaft of the air-pump, or vice versa, a differential speed of this pump can be obtained; or, in other words, the air-pump can be driven at a faster or slower speed, as may be required. It is obvious that the production of the gas depends on the speed given to the air-pump.

The extra cylinders C′ C^2 are provided with the same appliances as the cylinder C^2, and for this reason similar parts have similar letters of reference.

The crank-shaft W is provided with three cranks set on a third stroke, so that when three engines are used, as shown, they will work smoothly. When only one or two of the engines are in operation, the valves of the engine not working will be disconnected from their cams on shaft W, thus preventing wear on such valves. When the levers *l*, the free ends of which are guided, as shown at *f*, Fig. 3, are raised so high that their projections or noses are removed from contact with the cams *b* and *d*, pins or springs are arranged so that said levers are prevented from descending to the position shown in the drawings Fig. 3. The weights *g* are held by the connecting-rods, and the closing of the valves by the same is prevented, when desired. When it is desired to run only one or two of the engines, the cocks in the pipes u^2 y^2 r^2 of the engines or engine not working must be closed.

The piston P^2 of each cylinder C^2 is so constructed that its packing can be expanded without removing the piston from its cylinder. This is done by simply tightening the nuts *c* on the bolts *c′*, which nuts press on a disk, c^2, on the expansible packing. I use a similarly-structed piston in the air-pump P.

Having described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. In gas-motors, the combination, with an air-pump and one or more engines, constructed substantially as described, of the hot-water tank G, the reservoirs G′ G^2, the gas-holder pipes forming communications between the same, the pipes communicating with the engine, their automatic valves, and a gas-pipe communicating with the reservoir G^2, and terminating in a burner near the inlet-valve z^2 to the piston-cylinder C^2, substantially as described.

2. In combination, gas-generators and a gas-holder, and a hot-water tank, G, therefor, the

pipes O r y, provided with valves, one or more engines, and an air-pump, all constructed and adapted to operate substantially as and for the purposes described.

3. The combination, with the air-pump valve v, of the forked lever K′, the counterbalancing-weight q on one arm of this lever, the chain and pulleys, the weight Q, and the vertically-movable hood of the gas-holder, all constructed and adapted to operate substantially in the manner and for the purposes described.

4. The combination of one or more engines, pipes r r^2 w^2 u, communicating with these engines, and an explosive-gas-making apparatus in a warm-water tank, automatic-working valves applied to these pipes, and a gas-jet pipe communicating with the reservoir G^2, substantially as described.

5. The combination, with the gas-motors, the gas-generators, and the communicating pipes, of the air-engine, the crank-shaft thereof, the crank-shaft W, and the stepped-cone pulleys Z Z', all constructed and arranged substantially as described.

FRIEDRICH WILHELM RACHHOLZ.

Witnesses:
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C. R. SCHMIDY,
Both of Dresden.