2 Sheets--Sheet 1.

J. HOCK.

Petroleum Dynamic Engines.

No. 151,129. Patented May 19, 1874.

Fig. 1.

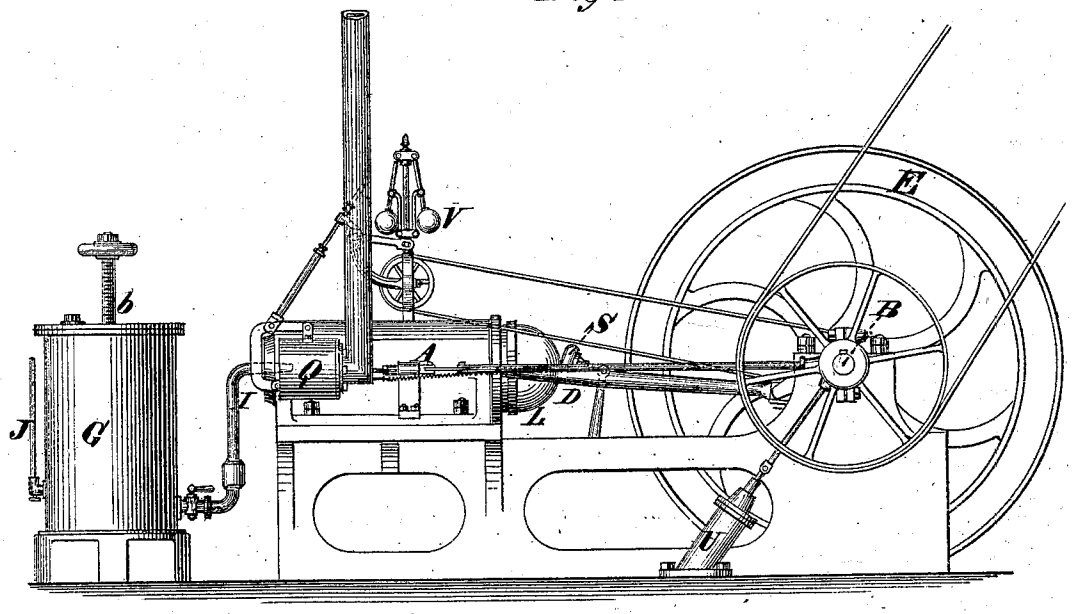
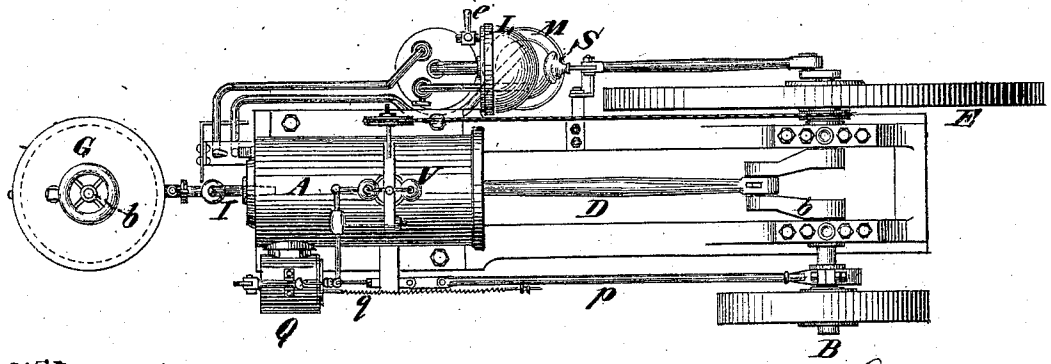


Fig. 2.



Witnesses
John Becker
Fred Haynes

Julius Hock
by his Attorneys
Brown & Allen

2 Sheets--Sheet 2.

J. HOCK.

Petroleum Dynamic Engines.

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Fig. 4.

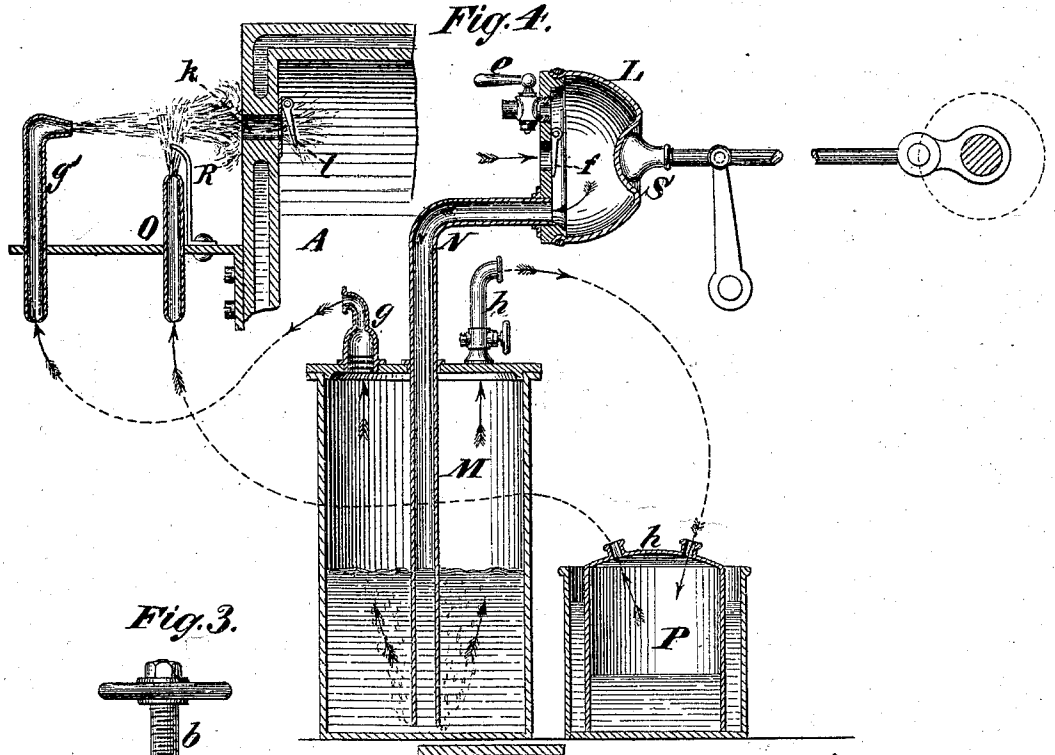


Fig. 3.

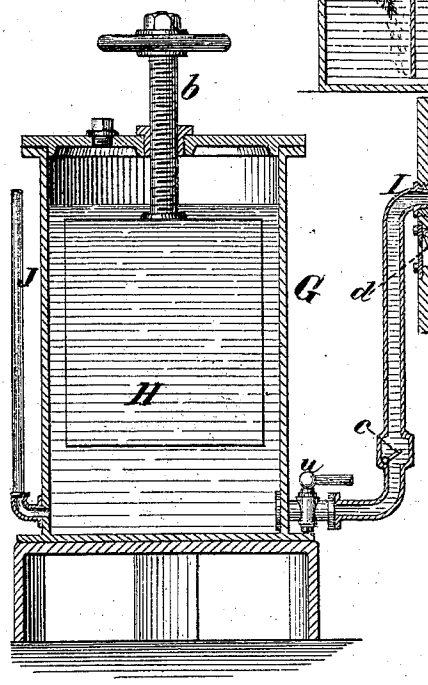
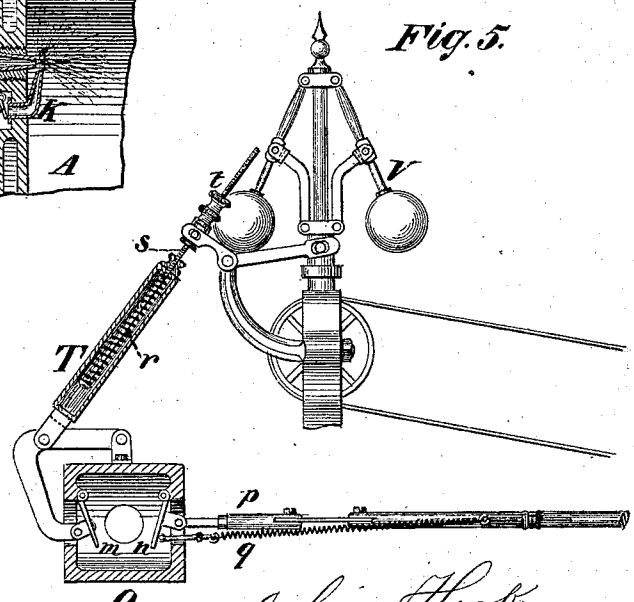


Fig. 5.



Witnesses.
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UNITED STATES PATENT OFFICE.

JULIUS HOCK, OF VIENNA, AUSTRIA.

IMPROVEMENT IN PETROLEUM DYNAMIC ENGINES.

Specification forming part of Letters Patent No. **151,129**, dated May 19, 1874; application filed February 19, 1874.

To all whom it may concern:

Be it known that I, JULIUS HOCK, of the city of Vienna, in the Empire of Austria, have invented certain Improvements in Petroleum Dynamic Engines, of which the following is a specification:

This invention, which is more especially designed as a cheap motor for light work in factories and elsewhere, but is also applicable for other purposes, relates to that description of dynamic machines or engines for which Letters Patent No. 140,021 were issued, August 1, 1872, to Charles Errani and Richard Anders, and in which the power is derived from the utilization of the expansive property of hydrocarbon liquids, such as petroleum reduced to a spray, and mixed with atmospheric air and ignited, to produce the necessary expansion. The invention consists in a combination, with such a motor, of a hydrocarbon-gas generating apparatus operated or controlled by the motor to supply the flame, as required, by which the sprayed petroleum mixed with air used to drive the engine is ignited, thus adapting the motor to places where there is no independent supply of gas, and automatically proportioning the amount of gas used to the work performed by the motor. This part of the invention includes a novel construction of said generator and its igniting attachments. This invention also consists in a combination, with a spraying device, of a tank for holding the petroleum, fitted with a plunger for adjusting the supply of petroleum and speed of the engine, by varying the height of the column which supplies the petroleum-injector. The invention likewise consists in a novel combination, with the cylinder of the engine and its petroleum-injector, of an air-nozzle, having an automatic valve for atomizing the petroleum by the action of the engine-piston. The invention furthermore consists in a combination, with the engine-cylinder and its spraying attachment, of an independent air-valve controlled by a spring capable of adjustment by hand or by governor, for supplying the cylinder with air, and checking or controlling the discharge of petroleum from the injector, and thereby regulating the speed of the engine.

The motor, which occupies but little space, and is preferable in many respects to an ordinary steam-engine or gas-motor, also more economical in point of fuel, is constructed, so far as its mechanical details are concerned, similar to an ordinary steam-engine, including a cylinder having a reciprocating piston, a crank deriving its motion from the engine, a fly-wheel on the main shaft, and valve-gear operated by the engine. As in the invention of Errani and Anders, hereinbefore referred to, such engine may either be of single or double effect, but is shown in the drawing as composed of a single cylinder, the piston of which is actuated during only a portion of its stroke by the ignition of the mixture of sprayed hydrocarbon liquid and common air, and the motion continued or kept up during the remainder of the stroke by the impetus given to the fly-wheel of the engine.

Figure 1 represents a side elevation of my improved petroleum dynamic engine; Fig. 2, a plan thereof; Fig. 3, a detail view in vertical section of the petroleum-supply tank with its attached injector and spraying device connected with the engine-cylinder; Fig. 4, a detail view of the gas-generating and igniting devices; and Fig. 5, a view of certain air-valves and the devices for controlling them.

A is the cylinder of the motor; B, its main shaft, and C its crank. D is the rod connecting the crank with the engine-piston, and E the fly-wheel of the engine. The petroleum is fed to the motor from an air-tight close tank or reservoir, G, which contains a more or less immersed plunger, H, that may be operated by a screw, *b*, from the outside and that, accordingly as it is raised or lowered, varies the height of the column or level of the petroleum in the tank to meet waste, and to regulate, within certain limits, the speed of the engine by controlling the supply of petroleum to the injector I. A glass gage, J, may be attached to the tank to indicate the level of the petroleum therein. The upright pipe, forming part of the petroleum-injector I, is screwed into the back head of the engine-cylinder, and, at its opposite or lower end, is connected with the petroleum-tank G, and is enlarged at a suitable distance from the tank to accommodate a valve, *c*, opening upward. Arranged in the back end of the engine-cylinder are one or more curved air pipes or nozzles, K, having a valve, *d*,

opening inward. This attachment completes the atomizer or spraying device, and may be variously disposed, as the engine-piston moves forward or away from it, to break up, by the suction of air through it, the petroleum into a spray. L is the air-compressor, which consists of a partially-spherical bag of india-rubber securely fastened to an iron plate, in which is an opening that is closed by a cock, *e*, for the purpose of fully, or more or less, opening and closing the compressor to the atmosphere. Said compressor is also fitted with a valve, *f*, opening inward, for automatically supplying the air to keep up the action of the compressor. A buffer, S, worked by an eccentric on the main shaft of the engine, serves to compress the flexible cover or bag of the compressor, and to compress the air, as required, during which action the valve *f* closes, but opens again to admit air, when the buffer S retires. M is the hydrocarbon-gas generator of the engine, for furnishing the gas to produce combustion of the sprayed petroleum mixed with air in the engine-cylinder. This gas-generator serves to evaporate naphtha or a petroleum of light, say, about .69°, specific gravity. A pipe, N, is led from the air-compressor L to the bottom of the gas-generator M to convey air into the naphtha, for the purpose of evaporating the same, whereby carbonized air or illuminating-gas is obtained. Said gas leaves the generater at an outlet, and by a pipe, *g*, and is ejected at a nozzle, *g'*, in regular intervals, and so that the same is ignited by a flame emitted from a burner, O. The gas-supply to the burner is obtained by leading a portion of the generated gas, by means of a pipe or connection, *h*, into a gasometer or receiver, P, from whence it is fed at a constant pressure to the burner by a pipe or connection, *i*. R is a shield to protect the flame of the burner from being extinguished by the back action of the engine-piston, or otherwise. The gas from the nozzle *g'* horizontally crosses the flame from the burner opposite an opening, *k*, covered by a valve, *l*, in the back of the cylinder, and through which the flame, in the forward motion of the engine-piston, enters to ignite the sprayed petroleum mixed with air. The length of the horizontal flame, caused by the ignited gas from the nozzle *g'*, depends upon the length of the stroke of the buffer S, as regulated by the position on the main shaft of the eccentric which drives the buffer, whereby the flexible cover of the compressor is more or less compressed.

The means for introducing air into the engine-cylinder to mix with the sprayed petroleum in rear of the piston, and for subsequently discharging the products of combustion, is more clearly shown in Fig. 5 of the drawing. Near to and connected with the cylinder of the engine or motor is a valve-chest, Q, containing two oppositely-arranged valves, *m n*, opening inward. The valve *n* serves the purpose of discharging the products of combustion from the engine-cylinder, which is effected when the engine-piston is making its back-stroke. Said valve *n* is then forced open by means of a rod, *p*, operated by a cam on the engine-shaft, and is quickly closed by a spring, *q*.

A slide or puppet valve might be substituted for the hinged valve *n*. A pipe may be connected with the opening covered by this valve to convey the discharged products of combustion to the atmosphere or to and through pipes for room-heating or other warming purposes.

The valve *m* admits the necessary supply of air to the cylinder to mix with the sprayed petroleum, and serves to regulate the quantity of petroleum introduced into the cylinder during the forward stroke of the engine-piston by more or less retarding the flow from the injector. This valve *m* closes by its weight, and its closing action is increased by the action of a spiral spring, *r*, inclosed by a sleeve, T. This spring encircles a rod, *s*, having a button on its lower end, while the upper end of said rod has a screw-thread on which is fitted a nut, *t*, to increase or diminish the tension of the spring. When the piston of the engine moves forward the air and ignited gas are brought by suction into the cylinder.

By reducing tension of the spring *r* air only will enter into the cylinder. By increasing the tension of said spring to an extent in excess of one atmosphere, the valve *m* remains closed, and no air, excepting what is admitted by the valve *d*, but petroleum alone, is forced into the cylinder.

U is a force-pump for supplying water to a jacket around the cylinder. The cooling may be effected in different ways to insure the proper lubrication of the motor.

The engine is set in motion by opening the cock *e*, starting the fly-wheel E, and lighting the gas emitted from the burner O. During the forward motion of the engine-piston the valves *d* and *m* admit air, and the injector I a small amount of petroleum, which is atomized by the air passing or being drawn into the cylinder through the nozzle K, and is consequently mixed with the air. After the engine-piston has moved a quarter stroke the buffer S presses the flexible cover of the compressor L inwardly. This causes a jet of carbonized air to be emitted from the nozzle *g'*, which air is ignited by the flame of the burner O, and the flame entering the cylinder ignites the mixture of combustible gases contained therein. The pressure created by the combustion of gases closes all the valves and forces the piston forward to the end of its stroke, after which the fly-wheel of the engine reverses its motion, and the operation is repeated as before.

If the motion of the engine is too rapid the governor V, attached to the engine and connected to the valve *m* through the intervention of the spring *r* and rod *s*, diminishes the tension of the spring and partly releases the valve *m*, thereby admitting more air to the

cylinder. Consequently the supply of petroleum is reduced and the speed of the engine slackened. The contrary action takes place when the engine works too slow.

When the cock *e* is completely open the air compressed in the compressor L escapes through said cock; consequently no gas will be emitted from the injector *g'*, and the motor will cease to move. The same result may be obtained by closing a cock, *u*, in the pipe which supplies petroleum to the injector I.

I claim—

1. The combination of the tank G and its adjustable plunger H with the atomizer or spraying devices of the engine, substantially as and for the purpose herein set forth.

2. The combination, with the atomizer I K, of the gas-generator M, and its attached burner O, and the air-valve *m*, automatically controlled by the governor V of the engine, essentially as and for the purposes herein set forth.

3. The combination of the air-supply valve *m*, spring *r*, and rod *s*, sleeve T and governor V with the petroleum-injector I of the atomizer, essentially as specified.

4. The combination, with the cylinder A and the petroleum-injector I, of the air-nozzle K, having an automatically-operating valve, *d*, substantially as shown and described.

5. The combination of the air-compressor L with the gas-generator M, the gasometer P, the nozzle *g'*, the burner O, and the cylinder A, having an aperture, *k*, controlled by a valve, *l*, essentially as and for the purpose herein set forth.

JULIUS HOCK.

Witnesses:
CHS. DEICKE,
W. STOCKINGER.