

A. BÜCHI.
 HYDROCARBON POWER PLANT.
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Patented Oct. 24, 1911.

2 SHEETS—SHEET 1.

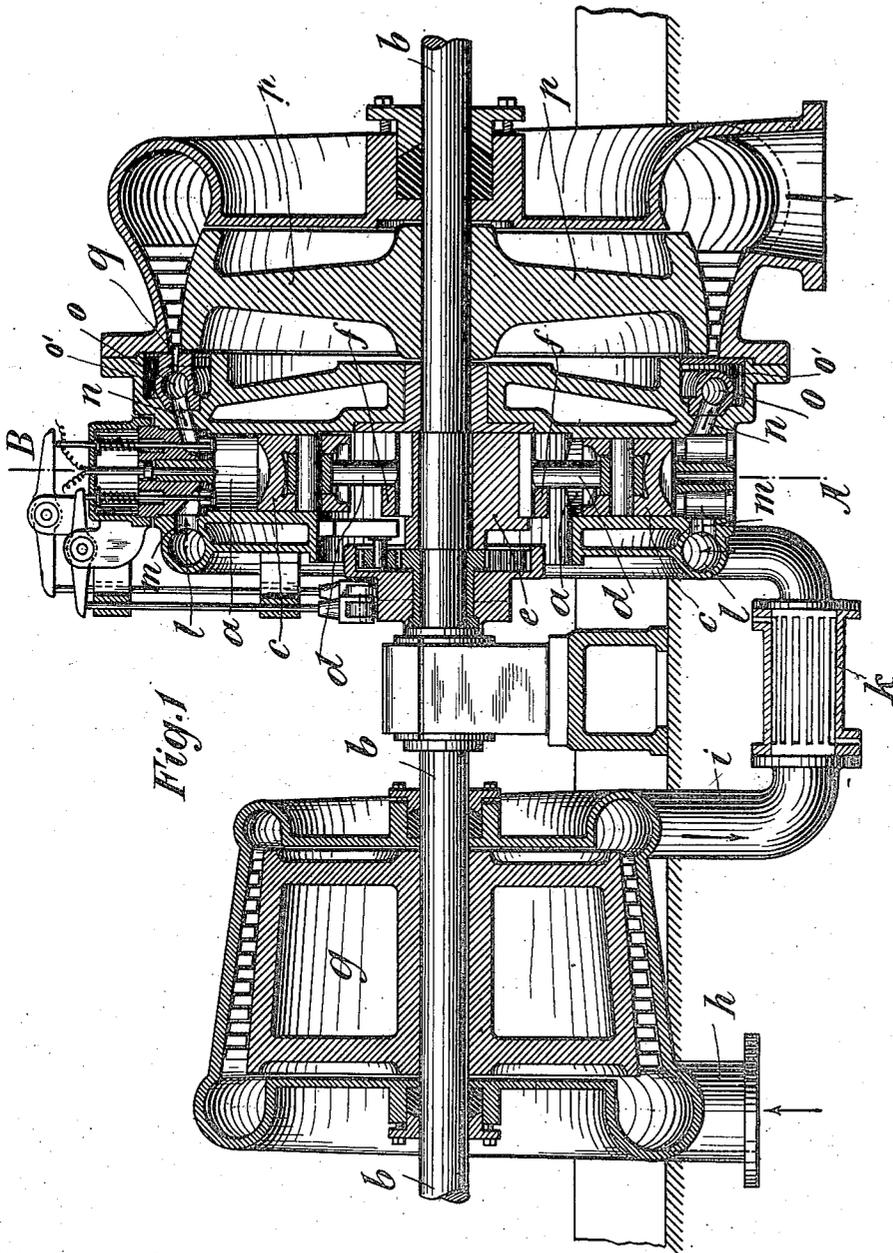


Fig. 1

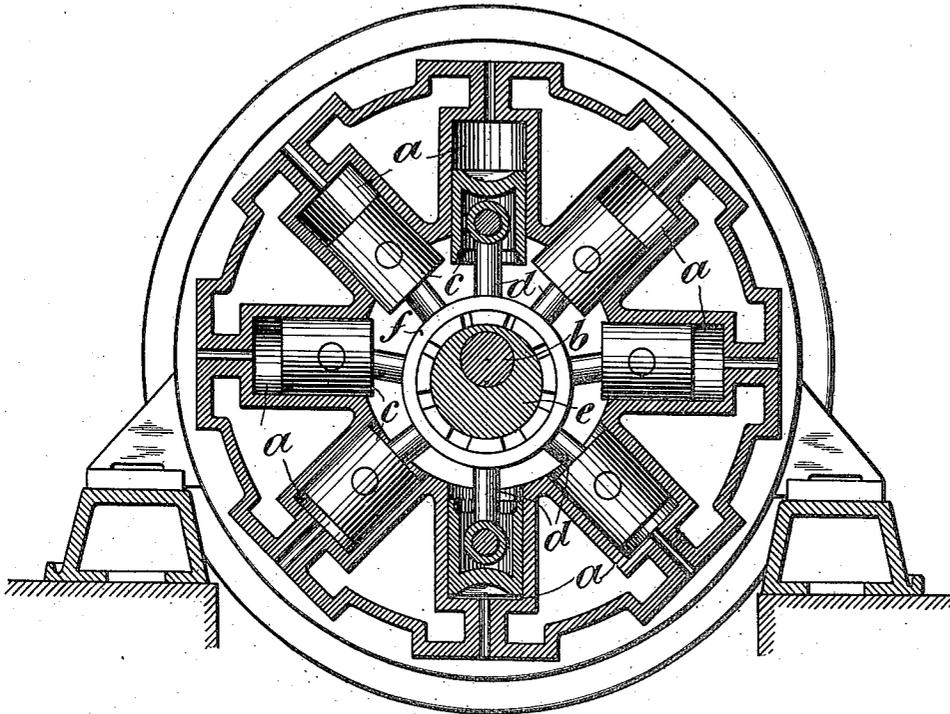
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Fig. 2



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UNITED STATES PATENT OFFICE.

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HYDROCARBON POWER PLANT.

1,006,907.

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To all whom it may concern:

Be it known that I, ALFRED BÜCHI, a citizen of the Republic of Switzerland, residing at Winterthur, Switzerland, have invented certain new and useful Improvements in Hydrocarbon Power Plants; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to letters or figures of reference marked thereon, which form a part of this specification.

The subject of my invention is a power plant for gaseous, liquid or solid fuels, in which the gases of combustion are brought to a temperature suitable for a turbine. This is done according to the present invention by the pressure of the explosive gases being transmitted in a piston-cylinder system by an explosion- or combustion-process to the main shaft, and by the waste gases then flowing to a single or multiple step turbine, the expansion in the piston-cylinders being continued until the thus ensuing diminution of temperature of the combustion-gases, accompanied by the generation of energy, admits of their being fed to the turbine without water injection being needed. In the improved plant, moreover, there is connected in front of the piston-cylinder system a compressor which compresses the charging-mixture and cools it on the passage to the piston-cylinder system, for the purpose of obtaining as high a degree of compression as possible in the piston-cylinders, while avoiding self-ignitions with the explosion process.

One form of construction of the invention is illustrated in the accompanying drawings, in which—

Figure 1 is a vertical section, and Fig. 2 a section on the line A—B of Fig. 1.

The plant here shown comprises a system of four-cycle explosive piston-motors having eight water-jacketed working-cylinders *a* disposed symmetrically and with respect to their axes radially around a horizontal shaft *b*. In these cylinders are located the working-pistons *c*, connected to the rods *d* which are secured to the part *e* carried by the shaft *b*. This part *e* is a disk secured eccentrically to the shaft and against whose periphery the inner ends of the rods *d* abut; and

to connect the rods to the disk a ring *f* is passed around the ends of all the rods in such manner as to admit of the said rod ends sliding on the disk in the direction of its periphery.

g is a turbine-compressor, the running-wheel of which is mounted on the shaft *b*; *h* is the suction and *i* the delivery pipe, the latter being connected with and delivering gas mixture to and through a cooling apparatus *k*. This apparatus which is of any desired or well known construction communicates with an annular compression chamber *l*, and this again through passages *m* with the heads of the working-cylinders *a*.

n are passages connecting the heads of the cylinders with an annular collecting-chamber *o*, which is located between the working-cylinders and a working-turbine having several step-speeds whose running-wheel *p* is mounted on the shaft *b*. The collecting-chamber *o* is provided with nozzles *q* directed toward the first speed-step of the running-wheel *p* and is inclosed in or surrounded by a heat insulating chamber *o'*.

The method of operation of the new plant is as follows: The turbine-compressor draws in charging mixture at *h* and forces it through *i* at a pressure of several atmospheres, whereupon the charging mixture is cooled, which depending upon the nature of the fuel is mixed with fuel before or behind the compressor, is cooled down in the apparatus *k* and thus enters the compression chamber *l* in cooled condition. Out of the latter the charging mixture already compressed and mixed with, let it be assumed, gaseous fuel, during the first stroke of the four-cycle explosive piston-motors is drawn by the pistons through the passages *m* and cylinder heads into the working-cylinders. During the second stroke it is submitted in the cylinders to a second compression; during the third stroke it is ignited to perform work in the piston-motors; and during the fourth stroke it is expelled from the cylinders by the pistons and conducted as exhaust gas through the passages *n* into the collecting chamber *o*. From this chamber the exhaust gases pass through the nozzles *q* to the blades of the turbine which has the running-wheel *p*, for the purpose of doing work in the same. The working pressures on the pistons *c* are transmitted to the shaft *b* by the parts *d e* and *f* as rotary motion. As is

apparent from the above the ignition of the combustible mixture takes place in the piston-motor cylinders (which are such as to resist high temperatures), and the working-gases work first in the piston-motors and then as exhaust gases in the working-turbine. In some prior explosive turbines the working-gases are conducted at substantially the high combustion temperature of the explosive mixture direct to the turbines, and the blades in consequence of this high temperature which they can not withstand get damaged; or the working gases directly after ignition are cooled, for instance by the introduction of steam or air into the same, so that there is a considerable loss of energy. With the new plant, on the other hand, it is seen from the above that a means is at disposal whereby, with rational utilization of the fuel, the working gases can be conducted to the turbine at such temperature as to insure that the turbine blades do not get injured. The preliminary compression and the succeeding cooling of the combustible mixture are for the purpose of enabling as high a degree of compression as possible in the working-cylinders of the piston-motors, so that the combustible mixture may be subjected to a working process which is theoretically as favorable as possible. The nozzles q are so constructed that they convert the pressure of the exhaust gases entering the chamber o into velocity, which may be done wholly or in part. In order to insure the most satisfactory working of the plant, the exhaust gases should be introduced as continuously as possible into the collecting chamber o , that is, the conditions of pressure and temperature in the nozzle chamber should be as far as possible constant for a given load.

It is obvious that the number and dimensions of the working-cylinders of the piston-motors must be selected according to the size of the plant to be erected.

In the example described it is assumed that the fuel is fed to the plant in gaseous form, but it can be employed in another form, such as liquid, vapor, or spray, depending upon the construction of the plant.

Having now particularly described and ascertained the nature of the said invention and in what manner the same is to be performed, I declare that what I claim is:

1. In combination, a shaft, a system of internal combustion-motors mounted symmetrically around the same, a working turbine mounted on said shaft, a collecting chamber located between the motor system and the turbine and connected by passages with the working-cylinders of the motors, means to prevent heat from escaping from this chamber, nozzles in the collecting chamber, directed toward the turbine, a compressor turbine whose running-wheel is mounted on the

shaft, a suction pipe conducting to the compressor, and a delivery pipe from the compressor to said system of internal combustion motors.

2. In combination, a shaft, a system of internal combustion-motors mounted symmetrically around the same, a working turbine mounted on the shaft, a collecting chamber located between the motor system and the turbine and connected by passages with the working-cylinders of the motors, means to prevent heat from escaping from said chamber, nozzles in the latter directed toward the turbine, a compressor turbine whose running-wheel is mounted on the shaft, a suction pipe conducting to the compressor, a delivery pipe from the compressor to said system of internal combustion motors, and a cooling apparatus in said delivery pipe.

3. In combination, a shaft, a system of internal combustion-motors mounted symmetrically around the same, a working turbine mounted on the shaft, a collecting chamber located between the motor system and the turbine and connected by passages with the working-cylinders of the motors, means to prevent heat from escaping from said chamber, nozzles in the latter directed toward the turbine, a compressor turbine whose running-wheel is mounted on the shaft, a suction pipe conducting to the said compressor, a delivery pipe from the compressor to said system of internal combustion motors, a cooling apparatus in said delivery pipe, and an annular compression chamber communicating with the delivery pipe and with the working cylinders.

4. In a hydrocarbon power plant, in combination, a turbine compressor for compressing combustion air or mixture, an apparatus for cooling the air or mixture during or after compression, a chamber in which the cooled air or mixture is pressed, a system of internal combustion motors in which the compressed air or mixture is introduced, submitted to further compression, ignited and expanded, a collecting chamber in which the exhausts from said internal combustion motors are delivered, nozzles in the collecting chamber, and a working turbine in successive communication, said nozzles being directed toward the turbine, substantially as described.

5. In a hydrocarbon power plant, in combination, a turbine compressor for compressing the air or mixture during or after compression, a chamber in which the air or mixture is pressed, a system of internal combustion motors in which the compressed air or mixture is introduced, submitted to further compression, ignited and expanded, a collecting chamber in which the exhausts from said internal combustion motors are delivered, means to prevent heat from escaping from this chamber, nozzles in the col-

lecting chamber, and a power turbine operated from the nozzles, substantially as described.

5 6. In combination, a shaft, a system of internal combustion motors mounted symmetrically around the same, a power turbine mounted on said shaft, a collecting chamber located between said motor system and the turbine and connected by passages
10 with the working cylinders of the motors, means to prevent heat from escaping from said chamber, nozzles in the collecting chamber directed toward the turbine, a turbine compressor having a running wheel mounted
15 on said shaft to compress combustion air or mixture, a suction pipe conducting to said compressor, a delivery pipe from the compressor to said system of explosion motors, and a cooling apparatus in said delivery
20 pipe for cooling the combustion air or mixture during or after compression, substantially as described.

7. In combination, a shaft, a system of explosion piston-motors mounted symmetrically around the same, a working-turbine mounted on the said shaft, a collecting chamber located between the said motor system and the turbine and connected by passages with the working cylinders of the
25 motors, nozzles in the collecting chamber, directed toward the turbine, a turbine compressor whose running-wheel is mounted on
30 the said shaft, a suction pipe conducting to the said compressor, and a delivery pipe from the compressor to said system of explosion motors, and a cooling apparatus in said delivery pipe, and an annular compression chamber communicating with the delivery pipe and with the said working-cylinders, substantially as described.

the said shaft, a suction pipe conducting to the said compressor, and a delivery pipe from the compressor to said system of explosion motors, and a cooling apparatus in said delivery pipe, substantially as described.

8. In combination, a shaft, a system of explosion piston-motors mounted symmetrically around the same, a working-turbine mounted on the said shaft, a collecting chamber located between the said motor system and the turbine and connected by passages with the working-cylinders of the motors, turbine nozzles in the collecting chamber, directed toward the turbine, a turbine compressor whose running-wheel is mounted on the said shaft, a suction pipe leading to the said compressor, and a delivery pipe from the compressor to said system of explosion motors, a cooling apparatus in the said delivery pipe, and an annular compression chamber communicating with the delivery pipe and with the said working-cylinders, substantially as described.

In testimony that I claim the foregoing as my invention, I have signed my name in presence of two subscribing witnesses.

ALFRED BÜCHI.

Witnesses:

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A. LIEBERKNECHT.