

(No Model.)

3 Sheets—Sheet 1.

O. BOMBORN.
VAPORIZER FOR PETROLEUM ENGINES.

No. 578,034.

Patented Mar. 2, 1897.

Fig: 1.

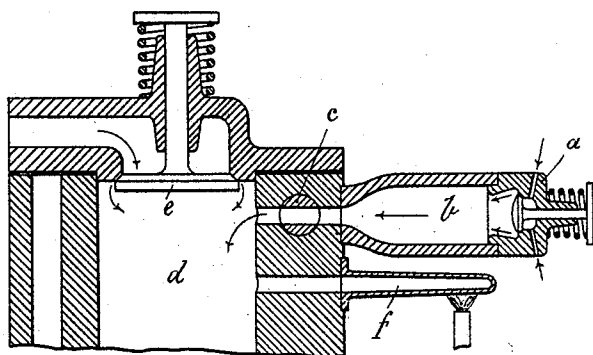
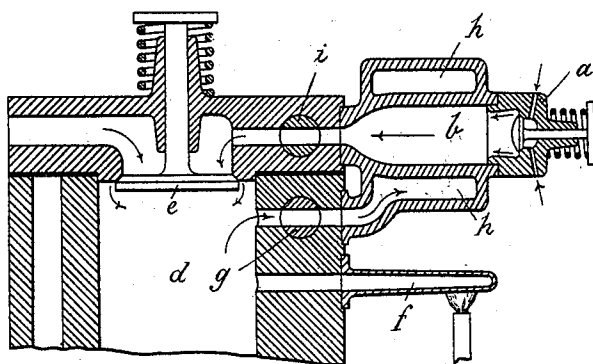


Fig: 2.



Witnesses:
Thomas M. Smith.
Richard C. Maxwell.

Inventor:
Oswald Bomborn,
By J. Walter Douglas.
Attorneys.

(No Model.)

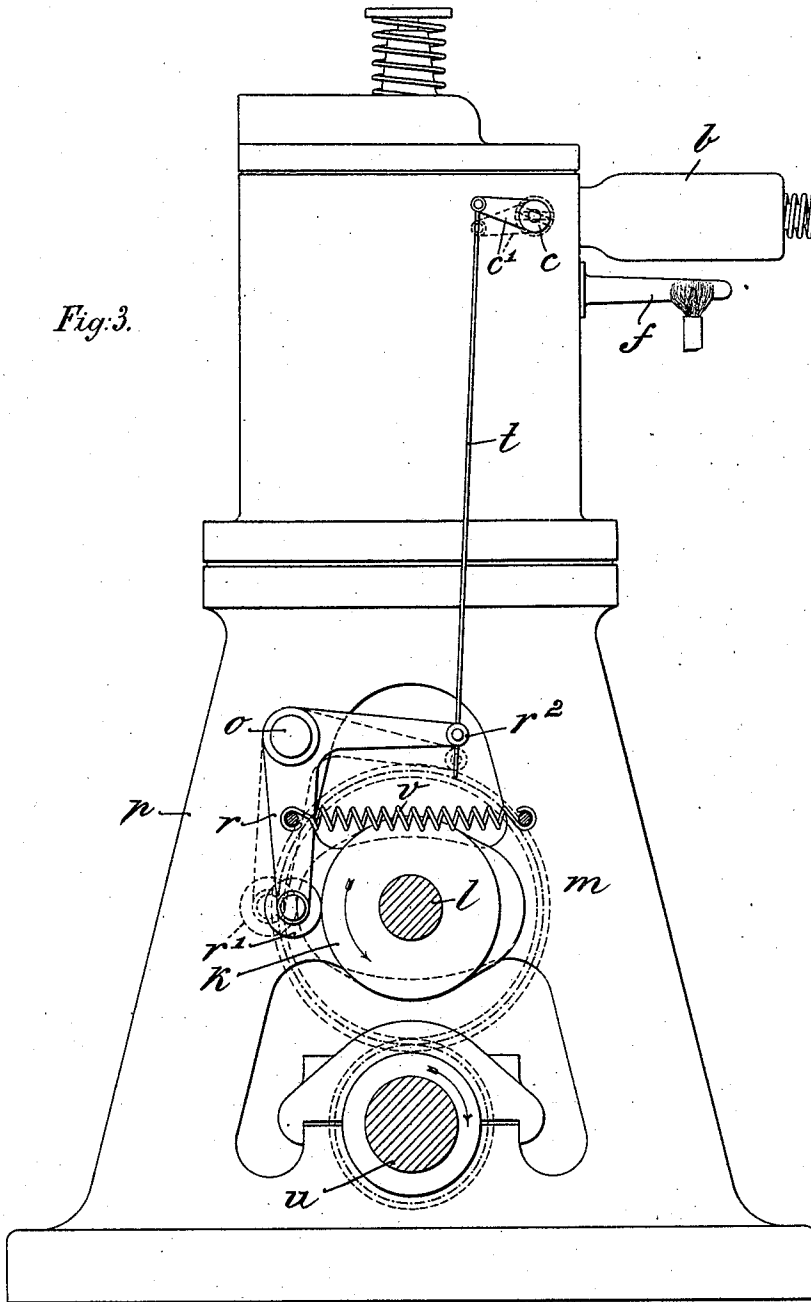
3 Sheets—Sheet 2.

O. BOMBORN.
VAPORIZER FOR PETROLEUM ENGINES.

No. 578,034.

Patented Mar. 2, 1897.

Fig. 3.



Witnesses:
Thomas M. Smith.
Richard C. Maxwell.

Inventor:
Oswald Bomborn,
By J. Walter Douglas
Attorney.

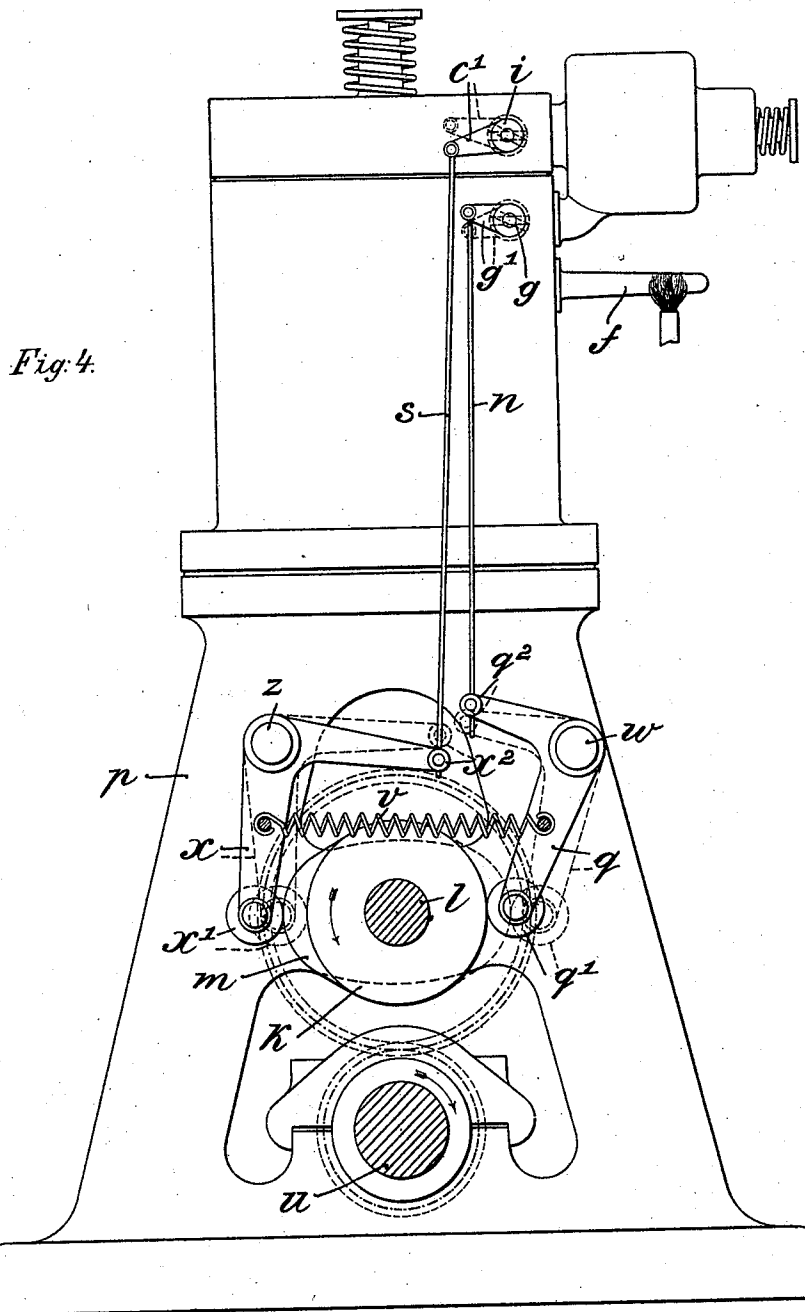
(No Model.)

3 Sheets—Sheet 3.

O. BOMBORN.
VAPORIZER FOR PETROLEUM ENGINES.

No. 578,034.

Patented Mar. 2, 1897.



Witnesses:
Thomas M. Smith,
Richard C. Maxwell.

Inventor:
Oswald Bomborn,
By J. Walter Douglass
Attorney.

UNITED STATES PATENT OFFICE.

OSVALD BOMBORN, OF MAGDEBURG-BUCKAU, GERMANY.

VAPORIZER FOR PETROLEUM-ENGINES.

SPECIFICATION forming part of Letters Patent No. 578,034, dated March 2, 1897.

Application filed May 23, 1896. Serial No. 592,733. (No model.) Patented in Germany May 21, 1896, No. 87,462.

To all whom it may concern:

Be it known that I, OSVALD BOMBORN, a subject of the Emperor of Germany, and a resident of Magdeburg-Buckau, in the Empire of Germany, have invented certain new and useful Improvements in Vaporizers for Petroleum-Engines, (for which I obtained German Letters Patent No. 87,462, dated May 21, 1896,) of which the following is a specification.

My invention relates to a vaporizer for petroleum-engines, its arrangement being such that the hot gases resulting from each explosion are utilized for heating the vaporizer, and this without danger of the gases or mixture of vapor and air being ignited within the vaporizer. To effect this, the valve-opening between the vaporizer and cylinder, in which the explosion takes place, is closed during the period of compression—that is, during the upward stroke of the piston—opening again only after each charge is exploded and the resulting hot gases admitted into the vaporizer. The latter may be heated either by allowing such gases to pass directly into same or indirectly by admitting the gases into a chamber surrounding the vaporizer.

The nature and scope of my invention will be more fully understood from the following description, taken in connection with the accompanying drawings, forming part hereof, and in which—

Figure 1 is a section of a petroleum-engine provided with the improved vaporizer arranged for being heated by the hot exploding gases direct embodying features of my invention. Fig. 2 is a similar view showing the arrangement of the vaporizer for indirect heating. Fig. 3 is a side view, partly sectioned, of the apparatus illustrated in Fig. 1 and illustrating the mechanism for the timing of the opening and closing of the valve leading to the mixing-chamber; and Fig. 4 is a similar view of Fig. 2, illustrating the mechanism for timing the opening and closing of valves leading to the mixing and heating chambers.

In the construction of Fig. 1 the quantity of petroleum necessary for forming the vapor enters the vaporizing-chamber through the spring-controlled valve *a* at each period of suction—that is, at each downward stroke of the piston. The hot walls of the chamber *b*

vaporize the petroleum, and these vapors pass then through the valve *c* into the cylinder *d*, and thus mix with the air which enters through the valve *e*. On the return of the piston such mixture of petroleum-vapors and air is compressed, and the valves *e* and *c* at the same time are closed. The compressed mixture is now ignited in any suitable manner, for instance, as shown, by means of an igniting-tube *f*; and the hot gases resulting therefrom pass from the cylinder *d*, through the now open valve *c*, into the vaporizer *b*, and thus heat the latter.

In Fig. 2 the petroleum passes through the valve *a* into the vaporizer *b*. As soon as the valve *i* opens the vapors generated in the chamber *b* mix with the air entering the cylinder *d* through the valve *e*. The vaporizer *b* is surrounded by a chamber *h*, which is brought into or is cut out of communication with the cylinder *d* by means of the valve *g*—that is, after each explosion the valve *g* opens and admits the hot gases for heating the vaporizer and closes again before the mixture ignites. The mixture of vapors and air is compressed in the usual manner on the return of the piston, the valves *e* and *g* at the same time are closed, while such compressed mixture is ignited in any suitable manner—for instance, by means of the pipe *f*.

It will thus be seen that after each charge is ignited the valve *g* opens and admits the hot gases into the chamber *h*, which gases thus heat the walls of the vaporizer *b*, and that after each charge of petroleum to be vaporized the cock *i* opens and allows the petroleum vapors formed to mix with the air entering through the valve *e*, such mixture then passing into the cylinder *d* at each downward stroke of the piston.

In Fig. 3 *k* is a cam keyed onto the shaft *l*, the projection *m* of which cam acts upon or engages when the shaft is in rotation a roller *r'* of a bell-crank lever *r*, pivoted on a stud *o* to the frame *p* of the engine, so that such lever is oscillated on its stud, reciprocating the end *r''*, which is pivotally secured to a rod *t*, jointed to a lever *c'* of the valve *c*, which is thus rocked for being opened, as indicated by dotted lines, or closed, as shown in full lines. The lever *r* is, in connection with a spring *v*, attached to the frame *p*, so

that the roller r' is in permanent contact with the cam k , which is mounted on the shaft l in such manner that the projection m is engaging the roller r' just at the moment the charge in the cylinder, after the compression
5 having been completed, is ignited, so that at this moment the valve c is opened.

In the modification shown in Fig. 4 two bell-crank levers q and x are arranged on
10 pivots w and z , respectively, at the frame p , the rollers q' and x' of which levers, controlled by a spring v , attached to each lever, are acted upon by the cam k on the shaft l . The ends q^2 and x^2 of the levers are pivotally
15 connected with the rods n and s , respectively, which are jointed to the levers g' and c' of the valves g and i , respectively.

In Fig. 4 the dotted lines represent the position which the valve i occupies when closed,
20 and corresponds with the position occupied by the valve g when open, while the full lines represent the position which the valve g occupies when closed, and corresponds with that occupied by the valve i when open.

25 When the shaft l rotates at half the speed of the crank-shaft u , the cam m alternately engages the rollers q' and x' , so that by means of the bell-crank lever q the valve g is opened at the end of the compression-stroke of the
30 piston during or immediately after the ignition of the charge in the cylinder, while the valve i is opened by means of the bell-crank lever x after the evaporation of the charge of the fluid oil fed to the vaporizer.

35 Having thus described the nature and ob-

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

1. In an explosive-engine, the combination of the working cylinder, a vaporizing-chamber and ignition-chamber, a passage from the
40 cylinder to the vaporizing-chamber, a valve controlling said passage and means for so timing the operation of said valve that the same shall open momentarily immediately after the explosion, whereby the hot products
45 of combustion may heat the vaporizer, substantially as and for the purposes described.

2. In an engine of the character described, the combination of a cylinder, a vaporizing-chamber in communication therewith, a heating-chamber surrounding said vaporizing-chamber and in communication with the cylinder, with a valve controlling the inlet from
50 the vaporizing-chamber to the cylinder, a valve controlling the outlet from the cylinder to the heating-chamber, and means for timing the operation of both valves, whereby the valve from the vaporizing-chamber is opened after the explosion in the cylinder and the
60 outlet-valve to the heating-chamber is opened after the evaporation of the charge in said cylinder, substantially as and for the purposes described.

In witness whereof I have hereunto signed my name in the presence of two subscribing
65 witnesses.

OSVALD BOMBORN.

Witnesses:

JULIUS MUTH,
M. C. MUTH.