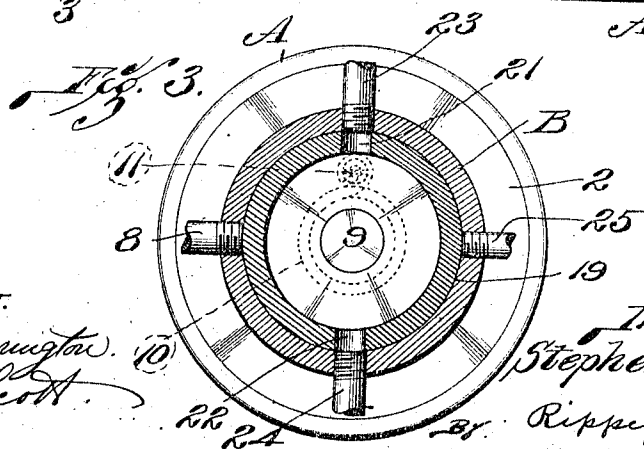
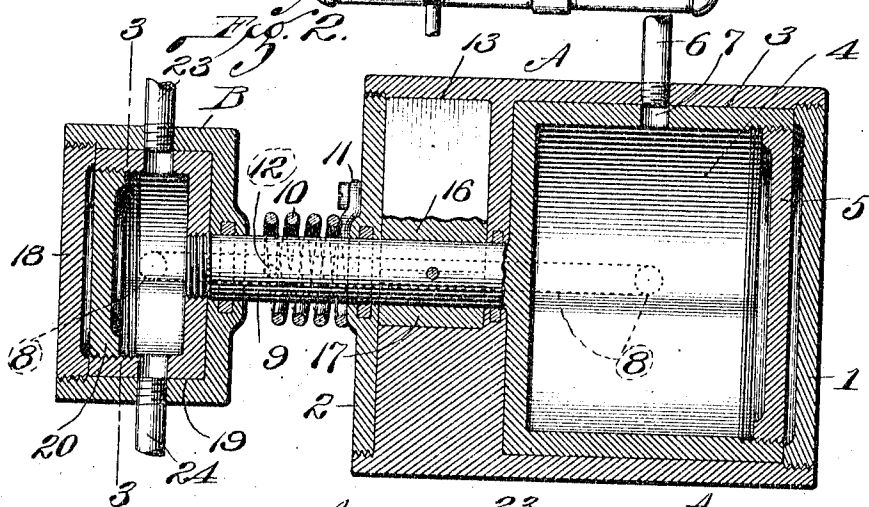
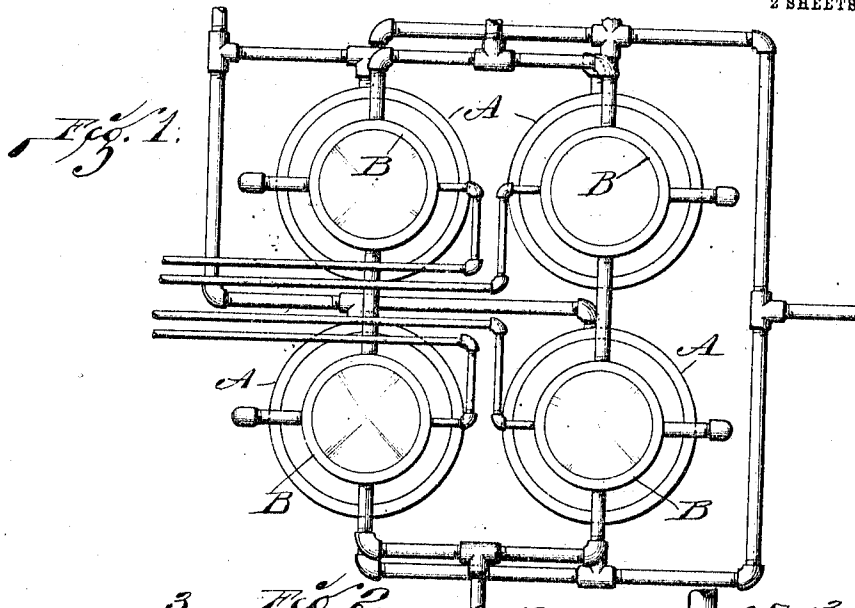


1,055,332.

S. S. KRAYER.
GAS ENGINE STARTER.
APPLICATION FILED FEB. 19, 1912.

Patented Mar. 11, 1913.

2 SHEETS-SHEET 1.



WITNESSES:

E. M. Huntington.
Wm. A. Scott.

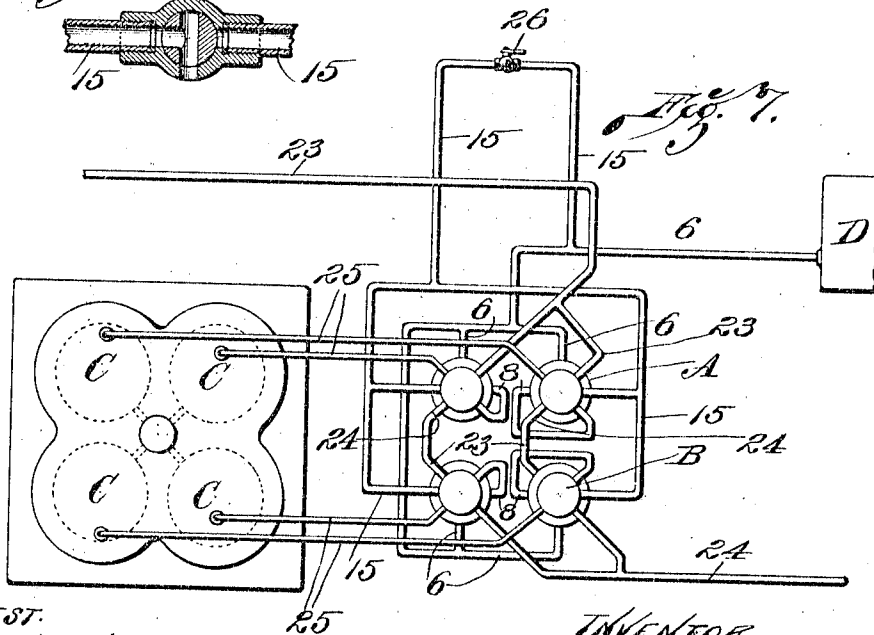
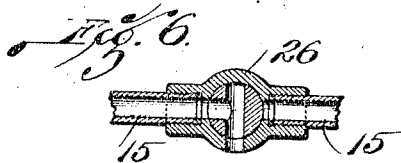
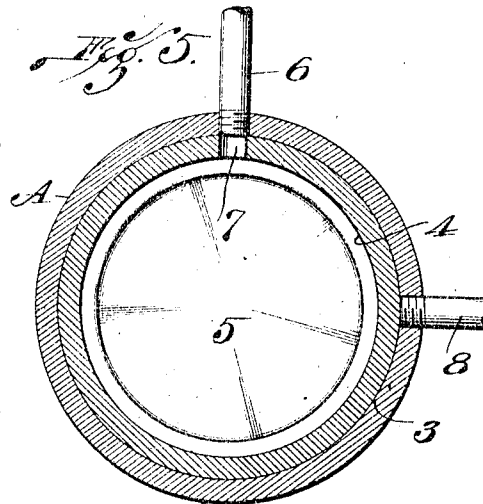
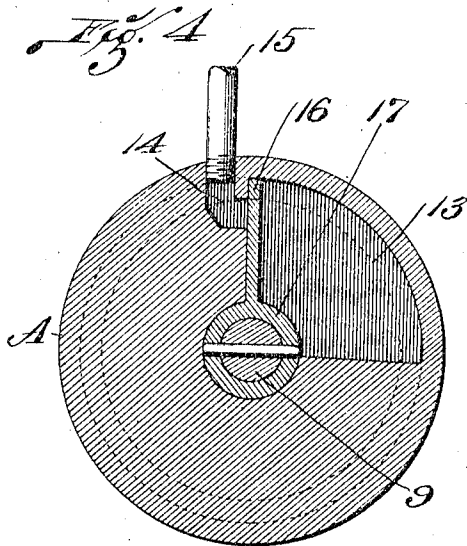
INVENTOR:
Stephen S. Krayer
By *Ripley & Ruppel*

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2 SHEETS—SHEET 2.



ATTEST.
S. M. Harrington.
J. H. Scott.

INVENTOR.
Stephen S. Kraye,
BY Rippey & Ringland ATTOR.

UNITED STATES PATENT OFFICE.

STEPHEN S. KRAYER, OF ST. LOUIS, MISSOURI.

GAS-ENGINE STARTER.

1,055,332.

Specification of Letters Patent.

Patented Mar. 11, 1913.

Application filed February 19, 1912. Serial No. 678,517.

To all whom it may concern:

Be it known that I, STEPHEN S. KRAYER, a citizen of the United States, residing at the city of St. Louis, State of Missouri, have invented a new and useful Gas-Engine Starter, of which the following is a specification.

This invention relates to gas engine starters and is designed to be used as a supplemental starting device in combination with any hydro-carbon engine of the internal combustion type, and is particularly applicable for use in connection with engines designed for automobiles or motor vehicles.

An object of the invention is to provide an apparatus for the purpose mentioned, whereby a measured quantity of explosive liquid may be mixed with a measured quantity of air to produce a predetermined quantity of carbureted air which may be directly introduced into the several cylinders of the engine under pressure, and exploded by any of the usual devices for such purpose, effectively to start the operation of the engine. To this and other ends I have designed, combined, and arranged the several coöperating parts in the manner hereinafter shown, described and claimed.

In the accompanying drawings, in which like characters of reference indicate like parts throughout the views, Figure 1 is an end elevation of my improved starting apparatus, with pipe connections arranged for use with a four cylinder engine. Fig. 2 is a vertical longitudinal section of one unit comprising the liquid and an air chamber, constituting the measuring and gas mixing device for a single cylinder. Fig. 3 is a transverse section on the line 3—3 of Fig. 2, showing a portion of the liquid chamber, with the liquid inlet and outlet passages and the air inlet and carbureted air outlet passages, and the rotary valve element for controlling all of said passages. Fig. 4 is a transverse sectional view, showing the air controlled device for operating the valves in the liquid chamber and in the air chamber. Fig. 5 is a transverse sectional view showing the air inlet to the air measuring chamber and the outlet passage therefrom and the rotary valve for controlling said passages. Fig. 6 is a longitudinal sectional

view of a valve interposed in the passage leading from the compressed air tank to the valve controlling device illustrated in Fig. 4, and Fig. 7 is a diagrammatic view showing the pipe connections for operatively connecting four measuring and mixing units with a four cylinder engine and with the liquid and compressed air supply.

For each cylinder comprising the engine, a separate air and liquid measuring and mixing unit is provided and in Figs. 1 and 7 of the drawings I have shown a preferred arrangement of piping for connecting the series of units with a four cylinder engine and with each other. Each unit is substantially the same in structure and it is obvious that by a simple rearrangement of the pipe connections that the apparatus may be adapted for use with an engine of any number of cylinders. As the invention resides primarily in the liquid and air measuring and mixing device and the means for operating the same, I will first describe its structure and then suggest a preferred method for connecting the several units together making them adaptable as a starting device for any engine comprising any number of cylinders. The air chamber and the air operated mechanism for controlling the valves in the liquid and air chamber of each unit are inclosed in a casing A, which is provided with removable heads 1 and 2. One end of the casing A is tubular in form constituting a cylindered chamber 3 and has mounted therein a revoluble chamber 4, of such diameter that its outer periphery fits closely against the inner surface of the tubular portion 3 of the case A. The chamber 4 is provided with a head-plate 5 which has threaded engagement with the inner wall of said chamber 4 so that by adjusting the said head-plate 5, the capacity of the chamber may be increased or diminished. A pipe 6, which constitutes the compressed air inlet pipe, is arranged in a threaded orifice in the wall of chamber 3 and communicates with the chamber 4 through an opening 7 therein, when said opening 7 registers with the opening of the pipe 6, which will be the case when the chamber 4 is in normal position. The second pipe 8, which constitutes the

air outlet pipe from the chamber 4 is arranged in a threaded orifice through the wall of the chamber 3 in circumferential alinement with the pipe 6 and ninety degrees in advance of said pipe 6. As the chamber 4 is rocked, or rotated, the port 7 will register with the pipe 8, thereby permitting the compressed air contained within the chamber to pass out through the said pipe 8.

The chamber 4 is mounted on the rock shaft 9 arranged in bearings in the case A and in the case B. A spring 10, one end of which is attached to the case A at 11 and the other end thereof to the shaft 9 at 12, maintains the shaft 9 in such a position that the pipe 6 and the port 7 register. The end of the case A opposite to the chamber 4 is formed with a quadrantal chamber 13; a passage 14 extends from the chamber 13 to the periphery of the case A and with the pipe 15 constitutes a compressed air inlet to the chamber 13; a valve plate 16 is supported by a sleeve 17 fast on the shaft 9 and normally held in position to close the passage 14, by the action of the spring 10.

The case B is cylindrical in form and is provided with a removable head 18 and has mounted therein the tubular chamber 19, which is also provided with an adjustable head plate 20. Through the walls of the chamber 19 are openings 21 and 22, constituting respectively, liquid inlet and outlet ports. The orifices 21 and 22 are in circumferential alinement and are arranged opposite to one another as clearly shown in Fig. 3. In normal position the port 21 registers with the end of the liquid inlet pipe 23 and the port 22 registers with the liquid outlet pipe 24. It is clear, therefore, that in the normal adjustment of the chamber 19, liquid entering through the passage 21—23 will freely flow through the chamber 19 and from thence it will pass through the outlet passage 22—24. The chamber 19 is also rigidly mounted on the shaft 9 and as the shaft 9 is rocked the ports 21 and 22 will be brought into registration with pipes 25 and 8, respectively. The pipe 25 constitutes a passage from chamber 19 to the cylinder C of the engine, and the pipe 8 constitutes a passage from the chamber 4, so that when the port 7 is brought into registration with one end of the pipe 8, the opposite end of the pipe will be in registration with the port 22 and the air will pass from the chamber 4 and mix with the liquid contained in the chamber 19 and be forced out through the pipe 25 as carbureted air to the cylinder of the engine.

By referring to Figs. 1 and 7, the operation of the device in connection with a four cylinder engine will be apparent. Air pressure from a compressed air tank D, passes from the said tank through the pipe 6 and

is introduced into the several chambers 4, through the ports 7, which are normally open and as the outlet passages from said chambers are normally closed, an air pressure will be maintained in the chambers 4 while the devices are in normal adjustment. In each of said chambers 19 the fuel liquid passes from any suitable source of supply through the pipe 23 into the several chambers 19, from thence it flows through the pipe 24 to the usual carbureter or mixing device. Each chamber 19 is normally filled and contains a sufficient quantity of liquid to generate a supply of gas sufficient to start the operation of the respective cylinders, with which it is connected. The pipe 15 is also connected with the pipe 6 which communicates with the compressed air tank D, but in normal condition the passage of air therethrough is prevented by the closure of the three way valve 26 interposed in said pipe 15, so that normally there will be no pressure against the plate 16. In starting the engine with my present device the valve 26 is opened, causing the compressed air to pass through the lower portion of pipe 15 and enter the passage 14, thereby moving the plate 16 downwardly, which action causes the shaft 9 to rock instantly through an arc of ninety degrees, causing the port 7 to be brought into instant registration with one end of the pipe 8 and at the same time closing the air inlet 6. In the chamber 19 the ports 21 and 22 are simultaneously closed and the passages 8—22 and 21—25 are opened, permitting the flow of compressed air into and through the chamber 19, thence after mixing with the fuel liquid through the passage 25 to the cylinders, supplying the cylinders of the engine with gas under pressure, which may be exploded to start the engine. After the initial operation of the engine the valve 26 is again closed and the air pressure upon the plate 16 is immediately relieved, permitting the shaft 9 and its carried parts to be returned to normal position by the spring 10, thereby opening the air passage in the chamber 4, and the liquid inlet and outlet passages in the chamber 19.

I am aware that there may be several changes in details of construction and arrangements of the parts, without departure from the spirit and scope of my invention. I do not limit myself, therefore, to exact details, but

What I claim and desire to secure by Letters Patent is:—

1. A starting device for a hydro-carbon engine, comprising an air chamber, a liquid chamber, means for maintaining an air pressure in said air chamber, means for maintaining liquid in said liquid chamber and automatic means for causing said air contained in said air chamber, to pass

through the liquid chamber, effectively to generate a predetermined quantity of carbureted air, substantially as described.

2. In a device of the character described
 5 an air chamber, a source of compressed air supply, a passage from said air supply to said chamber, a second chamber for containing liquid, a liquid inlet passage to said second named chamber and a liquid outlet
 10 passage from said chamber; a passage from said air chamber to said liquid chamber, a gas outlet passage from said liquid chamber, and an air operated mechanism for closing said air inlet passage to said air
 15 chamber and said liquid inlet and outlet passages from said liquid chamber, and open said passage from said air chamber to said liquid chamber and said gas outlet passage, substantially as described.

3. In a starting device the combination
 20 with an air supply and a hydro-carbon liquid supply, of an air chamber communicating with said air supply, a liquid container in communication with said liquid
 25 supply, a passage from said air chamber to said liquid container, a passage from said liquid container to an engine cylinder, and a valve operated by fluid pressure to shut
 30 off said liquid supply and said air supply and to open the passages from said air chamber to said liquid container, and from said liquid container to said engine cylinder.

4. A device of the character described, comprising a casing, a revoluble chamber
 35 mounted in said casing, a shaft on which said chamber is mounted, a spring actuating said shaft, a plate carried by said shaft, an air inlet to said chamber, an air outlet from said chamber, a liquid container, an air pas-
 40 sage from said air chamber to said liquid container, means for exerting air pressure against said plate effectively to rock said shaft and thereby close the air inlet to said
 45 air chamber and open the passage from said air chamber to said liquid container, substantially as specified.

5. A device of the character described, comprising a casing, a revoluble chamber
 40 mounted in said casing, a shaft journaled in said casing on which said chamber is mounted, a second casing, a chamber revolubly mounted in said second casing and being at-
 45 tached to said shaft, a spring actuating said shaft in one direction, a plurality of passages communicating with said chambers,
 50 and means for actuating said shaft effectively to open and close said passages, substantially as described.

6. A starting device comprising a plu-
 55 rality of air chambers and a plurality of hydro-carbon liquid containers, intercommunicating passages between said liquid containers through which liquid from a
 60 common source flows, air inlet passages to each of said air chambers, passages con-

necting said air chambers and liquid containers in pairs, and means whereby the air contained in the air chamber of each pair may be passed through the liquid contained in the liquid containers of each pair
 70 and thence to the cylinders of an engine, substantially as specified.

7. A starting device comprising an air pressure tank, an air chamber, a passage leading from said pressure tank to said air
 75 chamber, a container arranged to hold a hydro-carbon liquid, a passage from said air chamber to said liquid container, and means for causing said chamber to revolve effectively to close the air supply and open
 80 the passage leading from said chamber to said liquid container, comprising a shaft whereon said chamber is mounted, a vane carried by said shaft, a by-pass passage from said pressure tank, a valve in said pas-
 85 sage operable effectively to permit air from said pressure tank to impinge against said vane, substantially as described.

8. A starting device comprising an air chamber and liquid container, an intercom-
 90 municating passage between said air chamber and said liquid container, an air inlet to said chamber, liquid inlet and outlet passages for said liquid container and means operated by the source of air supply, effective
 95 to cause the air to pass from said air chamber through the liquid contained in the said liquid container, and simultaneously therewith to cut off the air and liquid supply, substantially as specified.

9. In a device of the character described, the combination with an air chamber, a
 100 liquid container and an intercommunicating passage therebetween, of an air passage to said air chamber, a liquid passage to said liquid container, and a fluid operated valve
 105 for controlling said two last named passages, substantially as specified.

10. The combination with an engine cylinder, a hydro-carbon liquid container, and
 110 a passage between said cylinder and container, of an air chamber, a passage between said air chamber and said liquid container, and a fluid operated valve for controlling said passages, substantially as specified.

11. A starting device comprising an air chamber, a liquid container, a passage be-
 120 tween said container and chamber, an air inlet passage to said chamber, a liquid inlet passage to said container, and a valve operable effectively to open the passage between said chamber and container and simultaneously therewith to cut off the air and liquid supply, substantially as specified.

12. A starting device comprising an air pressure tank, an air chamber, a passage leading from said pressure tank to said air
 125 chamber, a liquid container, a supply passage leading to said liquid container, a pas-

130

sage from said air chamber to said liquid container, and means for moving said liquid container and said air chamber effectively to close the air supply and the liquid supply and open the passage leading from said air chamber to said liquid container, substantially as specified.

In witness whereof, I have signed this specification in the presence of two subscribing witnesses.

STEPHEN S. KRAYER.

Witnesses:

NELSON THOMAS,
L. C. KINGSLAND.