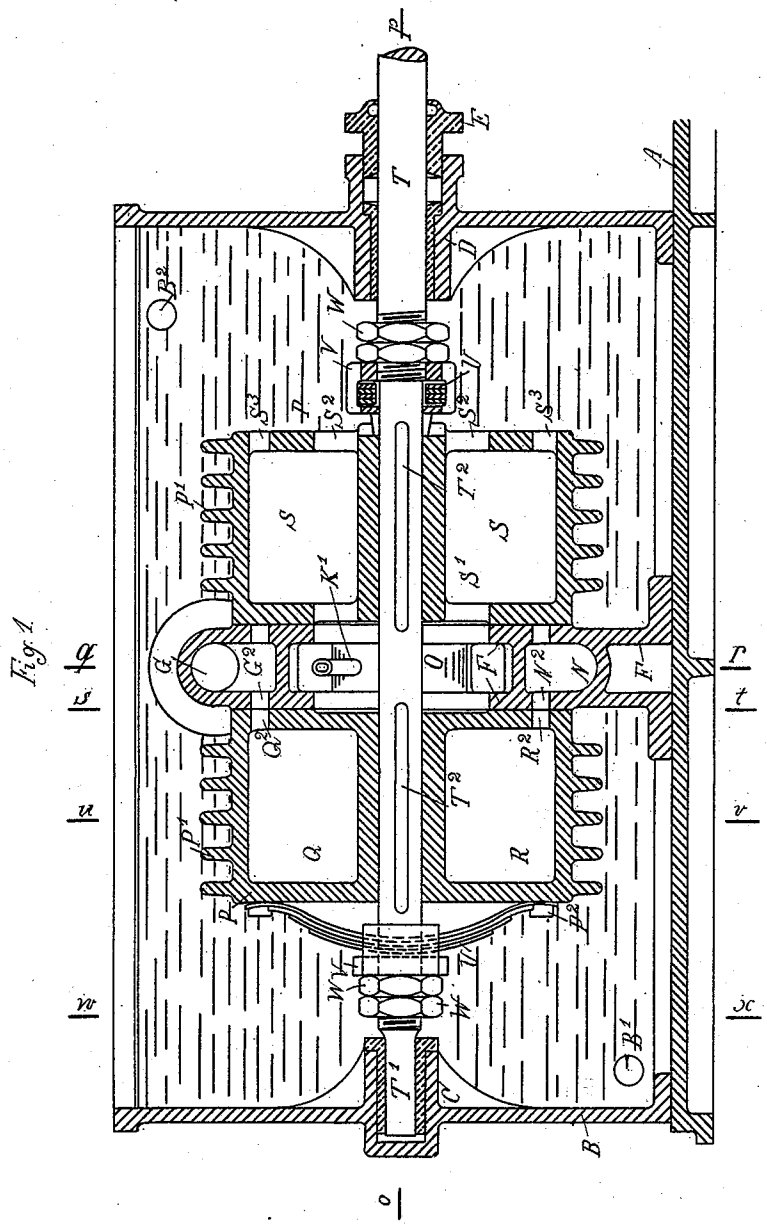
(No Model.) 6 Sheets—Sheet 1.

J. M. K. PENNINK.

HIGH AND LOW PRESSURE GAS GENERATOR.

No. 550,526. Patented Nov. 26, 1895.

Fig. 1.



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(No Model.) 6 Sheets—Sheet 2.

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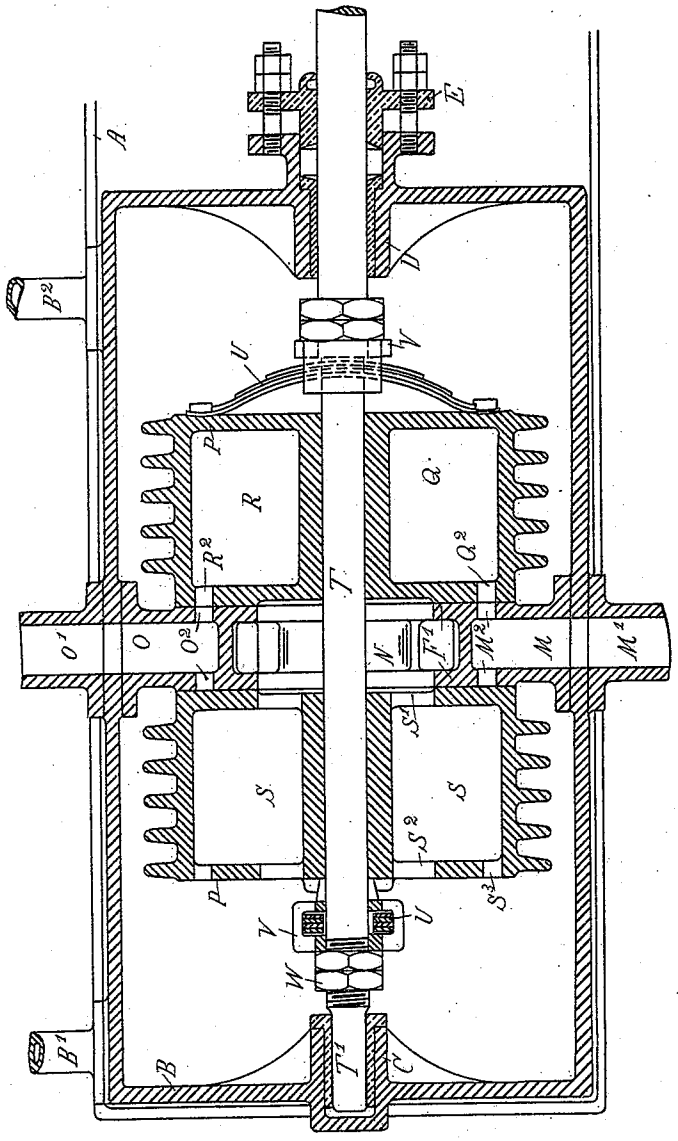
HIGH AND LOW PRESSURE GAS GENERATOR.

No. 550,526. Patented Nov. 26, 1895.

Fig. 2.



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(No Model.) 6 Sheets—Sheet 3.

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HIGH AND LOW PRESSURE GAS GENERATOR.

No. 550,526. Patented Nov. 26, 1895.

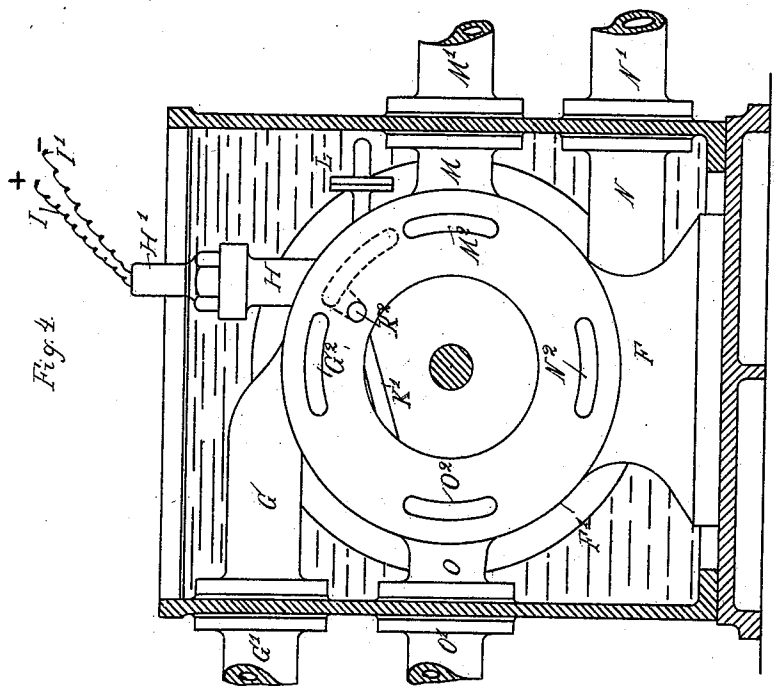

Fig. 4.

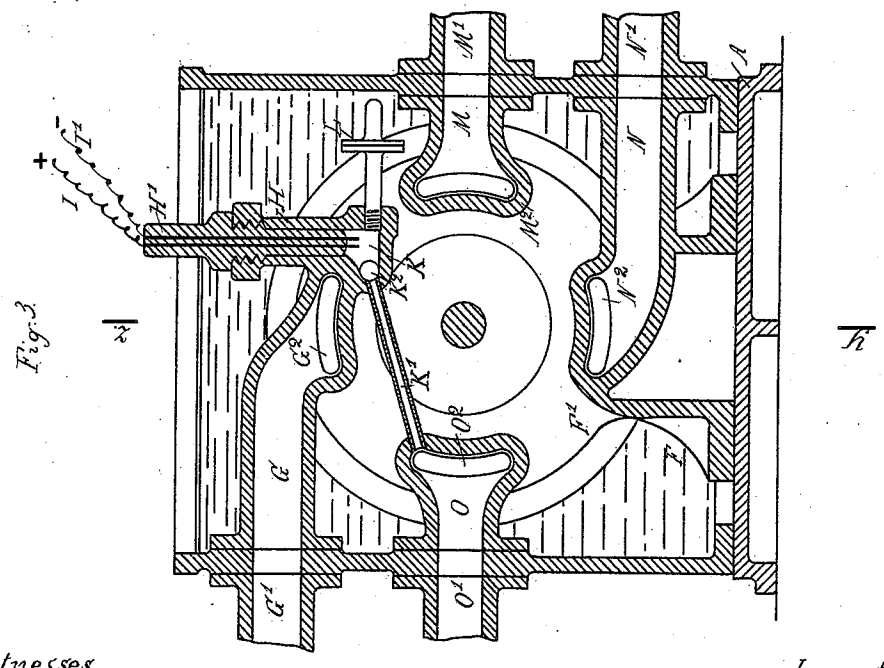

Fig. 5.

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(No Model.) 6 Sheets—Sheet 4.

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HIGH AND LOW PRESSURE GAS GENERATOR.

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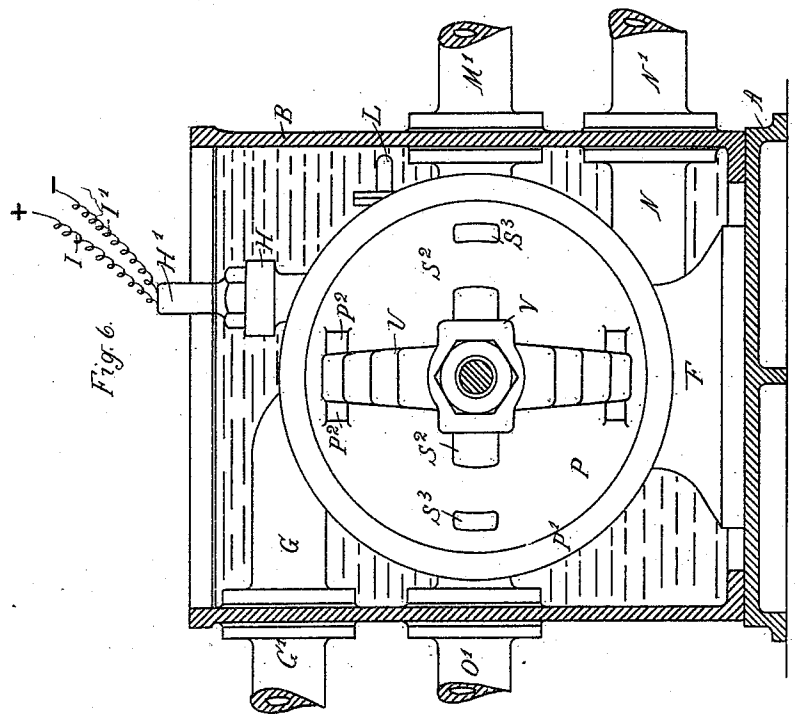

Fig. 6.

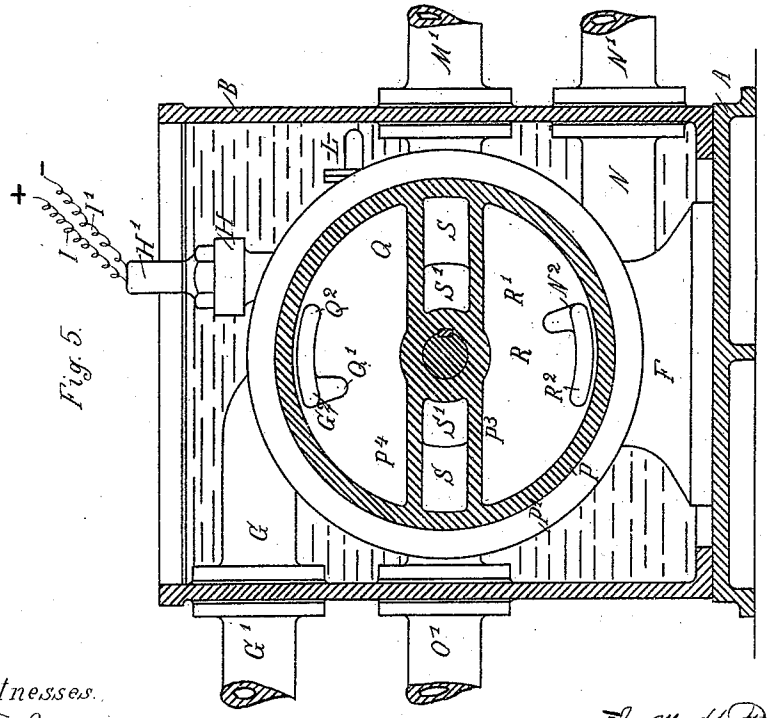

Fig. 5.

Witnesses.
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(No Model.) 6 Sheets—Sheet 5.

J. M. K. PENNINK.

HIGH AND LOW PRESSURE GAS GENERATOR.

No. 550,526. Patented Nov. 26, 1895.

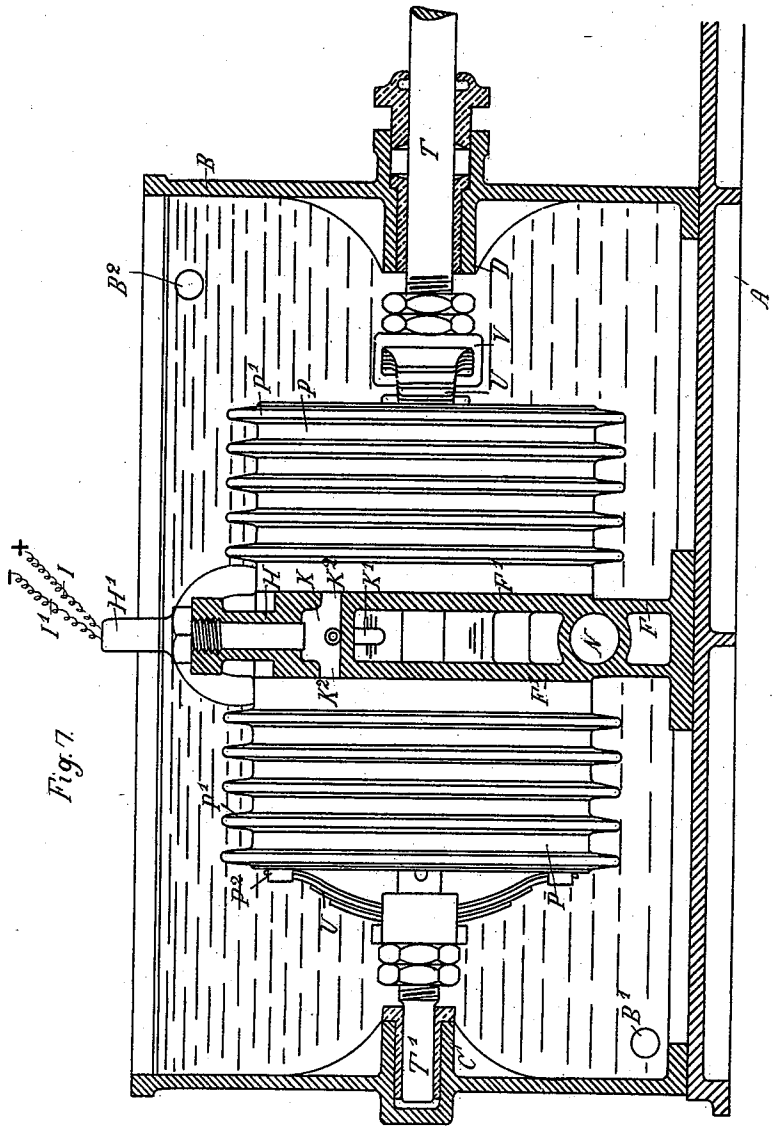

Fig. 7.

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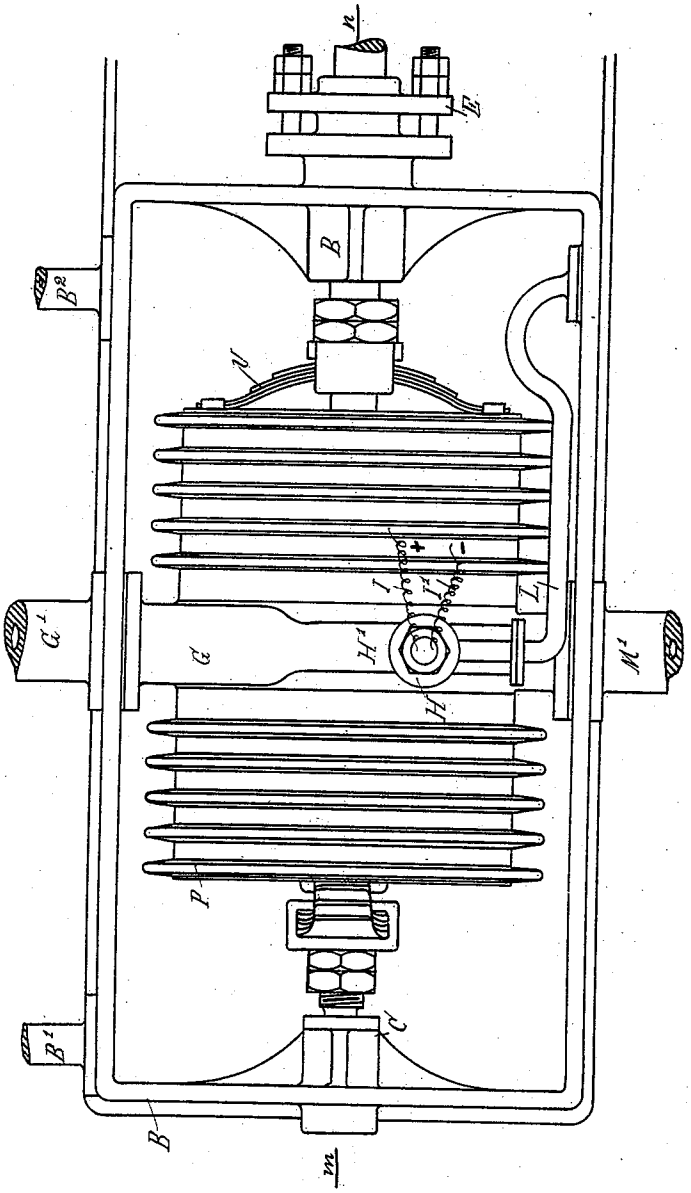
(No Model.) 6 Sheets—Sheet 6.

J. M. K. PENNINK.

HIGH AND LOW PRESSURE GAS GENERATOR.

No. 550,526. Patented Nov. 26, 1895.

Fig. 6.



Witnesses.
A. J. Birney
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Inventor:
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UNITED STATES PATENT OFFICE.

JOHAN MATHIAS KAREL PENNINK, OF HAARLEM, NETHERLANDS.

HIGH AND LOW PRESSURE GAS-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 550,526, dated November 26, 1895.

Application filed March 13, 1895. Serial No. 541,634. (No model.)

To all whom it may concern:

Be it known that I, JOHAN MATHIAS KAREL PENNINK, a citizen of the Kingdom of the Netherlands, residing at Haarlem, in the Netherlands, have invented a new and useful High and Low Pressure Gas-Generator, of which the following is a specification.

My invention relates to an apparatus into which compressed explosive mixture, say, of combustible gas and air or a similar mixture is continually fed, whereupon the mixture is successively exploded in certain chambers of revolving drums and the explosion products escape partly into a first line of pipes and partly into a second line of piping. The products of the explosion being nearly continually discharged into the said two pipe systems, a stream of high-pressure gas is obtained by the first pipe-line and a stream of low-pressure gas by the second pipe-line. These two kinds of gas are separately conducted in a similar manner as steam or compressed-air to sundry engines, injectors, and so on, for the purpose of driving or acting the same. I attain this object by the mechanism illustrated by the accompanying six sheets of drawings, of which—

Figure 1 is a vertical longitudinal section of the apparatus, taken in the plane of the line *m n* in Fig. 8; Fig. 2, a horizontal section taken in the plane of the line *o p* in Fig. 1; Fig. 3, a vertical cross-section on the line *g r* in Fig. 1; Fig. 4, a vertical cross-section on the line *s t* in Fig. 1; Fig. 5, a vertical cross-section on the line *u v* in Fig. 1; Fig. 6, a vertical cross-section on the line *w x* in Fig. 1; Fig. 7, a vertical longitudinal section, the middle part of which is taken in the plane of the line *y z* in Fig. 3 and the end parts in the plane of the line *m n* in Fig. 8. Fig. 8 is a top view of the apparatus.

Similar letters refer to similar parts throughout the several views.

The box B, erected on the ground plate A, is filled up with water or some suitable fluid and serves as a cooler. The cold fluid enters the box at B′, and the warmed fluid leaves it at B^2.

Inside the box B is the casing F, having an inlet-piece G, forming a gas-receptacle, three outlet-pieces M N O, and on both sides annular faces F′, Fig. 4, cast on. As Figs. 1 to 4 show, the casing F has spaces or cavities to allow of the cooling-fluid flowing through. The annular faces F′ F′ have lengthy openings G^2 M^2 N^2 O^2, Fig. 4, communicating with the inlet and outlet pieces G M N O, the said openings being set at certain angles (here ninety degrees) to each other. At the casing F is also arranged the piece H, the cavity K of which serves as an igniting-chamber. In each annular face F′ an opening K^2, Figs. 4 and 7, is made, which is at a different distance from the center than the openings G^2 M^2 N^2 O^2 and leads into the igniting-chamber K. Into the piece H, Fig. 3, the tap H′, with the embedded igniting-wires I I′, is introduced.

A suitable arrangement in any of the known manners is provided for, whereby electrical sparks are kept passing over at the ends of the igniting-wires I I′ in the chamber K. This chamber at the same time communicates with the outlet-piece O by means of a narrow pipe K′, the purpose of which will be explained later on. For draining off any oil or grease that may get into the chamber K the pipe L is employed.

The box B is provided with suitable bearings C and D for the shaft T, the one bearing, D, being supported by the stuffing-box E. The shaft T is to be driven from some engine, pulley, gear-wheel, or other source, and its speed should be determined by trials or experiment.

On the shaft T are mounted on both sides of the casing F the two drums P P, which can be shifted lengthwise and are obliged by the feathers T^2 T^2 to partake in the revolution of the shaft T. They are pressed against the faces F′ F′ of the casing F by means of the springs U U. The several flat pieces of the springs U U are kept together in the center by the locks V V, each secured and pressed forward on the shaft T by two nuts W W. The ends of the springs U U are placed between suitable projections P^2 P^2, Fig. 6, on the drums P P to prevent them from shifting.

Each drum P is provided externally with annular ribs P′, Figs. 1 and 5, to increase thereby its cooling-surface. The drum P is internally divided by the partition-walls P^3 P^4, Fig. 5, into the two gas-chambers Q R and the two cooling-spaces S S. The latter communicate with the spaces of the casing F

by means of the openings S′ S′ and with the outside by the openings S^2 S^2 S^3 S^3, Figs. 1, 2, and 6. Thus the cooling-fluid is allowed to enter the cooling-spaces S S, during the revolution of the drums P, through the openings S′ S^2 and to leave at those S^3. At the face touching the casing F each drum P is provided with openings Q^2 and R^2, leading into the gas-chambers Q and R, respectively. These openings Q^2 and R^2 correspond to those G^2 M^2 N^2 O^2 at the casing F, and are increased by the curved cuts Q′ R′, Fig. 5, of such a shape that these correspond more or less to the openings K^2, Fig. 4, leading into the igniting-chamber K, as is indicated by the dotted lines in Fig. 4. The two drums P are so placed on the shaft T that their partition-walls P^3 P^4 are at right angles to each other. Then the openings Q^2 R^2 of the one drum are at an angle of ninety degrees to those of the other drum, as Figs. 1 and 2 show.

The apparatus is worked in the following manner: In some compressor of any kind a mixture of combustible gas and air or another explosive mixture is compressed up to a certain pressure—say three or four atmospheres.

The compressed mixture is then conducted to the apparatus by means of the piping G′, Fig. 3, and enters the inlet-piece G. For the sake of clearness only the gas-chamber Q of the left drum P, Fig. 1, is now taken into consideration. When during the revolution of the drum P the opening Q^2 comes over that G^2, Figs. 4 and 5, at the casing F, the gas-chamber Q is filled up with compressed explosive mixture from the inlet-piece G. The drum P, moving on, the communication between the chamber Q and the piece G is intercepted and the curved cut Q′ of the opening Q^2 comes now over the opening K^2, Fig. 4. In this moment some of the mixture escapes from the chamber Q into the igniting-chamber K and is there ignited by the electrical sparks, when an explosion will occur. Then the products will have a very high pressure—say ten or fifteen atmospheres. As the drum P is revolving further, the communication between the chamber Q and the igniting-chamber K is soon intercepted and that between the chamber Q and the first outlet-piece M established. Then a part of the explosion products will be discharged from the chamber Q into the piece M and the adjoining piping M′ until the communication is again intercepted. Soon after this the opening Q^2 of the drum comes over that N^2, Fig. 4, of the casing F, when the other part of the explosion products will be discharged into the second outlet-piece N and the adjoining piping N′ until the communication between the chamber Q and the piece N is interrupted. Afterward the said opening Q^2, Fig. 4, comes over that O^2 of the third outlet-piece O, when the rest of the explosion products is exhausted from the chamber Q into that piece O and its piping O′. When the drum again attains its original position, the whole of the described occurrences will be repeated during the following revolution. The same is the case with respect to the other gas-chamber R of the drum P and also to the two chambers Q R of the other drum. Thus during a revolution of the shaft T the compressed explosive mixture is admitted successively into the four drum-chambers and there exploded, whereupon the explosion products are discharged from each chamber, one after the other, so that a nearly uninterrupted supply of high-pressure gas is obtained by the main pipe M′ and equally a nearly uninterrupted supply of low-pressure gas by the other main pipe N′. To equalize the pressure of these two gas streams, they may be first passed through suitable spacious vessels and the like ere they are led off to their destinations. The pressure inside the igniting-chamber K being very high (ten or fifteen atmospheres) after each explosion requires to be reduced in order to enable some of the compressed mixture (of, say, three or four atmospheres) from the following drum-chamber to enter the igniting-chamber K. For this reason the above-mentioned narrow pipe K′ is inserted between the igniting-chamber K and the outlet-piece O to enable the explosion products in the chamber K to at once escape.

Where it is preferred, a clack or other valve may be inserted between the inlet-piece G and the piping G′, Fig. 3, to prevent explosion products from entering this piping and mixing with the compressed explosive mixture.

The drums P P are shown with two gas-chambers Q R and one opening Q^2 or R^2 leading to each of same. Where it is so preferred, however, the number of the drum-chambers and of the openings leading to them may be altered.

The openings G^2 M^2 N^2 O^2 at the casing F are shown to be alike and set at right angles to each other. They may, however, be made of different sizes and therefore set at angles different from ninety degrees. In this manner it is possible to secure, for example, a greater supply of high-pressure gas than that of low-pressure gas, and vice versa. The construction of the cooling-box B may be altered to suit the ground-plate A, the shaft T, and the joints of the pipes. The narrow pipe K′ may be provided with a cock or valve to regulate the emission of the explosion products from the igniting-chamber K.

Having fully described my invention, I declare that what I claim, and desire to secure by Letters Patent, is—

1. The combination, with a gas receptacle, and an igniting chamber, of a plurality of outlet pipes, and means for conducting gas from the receptacle to the igniting chamber and thence to each of the outlet pipes in succession, substantially as set forth.

2. The combination, with a gas receptacle, and an igniting chamber, of an outlet pipe,

and a rotary device for conducting gas from the receptacle to the igniting chamber and thence to each of the outlet pipes, substantially as set forth.

3. The combination, with a gas receptacle, and an igniting chamber, of a plurality of outlet pipes, and a rotary device for conducting gas from the receptacle to the igniting chamber and thence to each of the outlet pipes in succession, substantially as set forth.

4. The combination, with a gas receptacle, and an igniting chamber, of an outlet pipe, and a series of rotating devices for conducting gas from the receptacle to the igniting chamber and thence to the outlet pipe, whereby an intermittent stream of ignited gas is introduced into the outlet pipe, substantially as set forth.

5. The combination, with a gas receptacle, and an igniting chamber, of a plurality of outlet pipes, and a series of rotating devices for conducting gas from the receptacle to the igniting chamber and thence to the outlet pipes in succession, whereby an intermittent stream of ignited gas is introduced into the pipes, that entering each pipe being at a different pressure from that in the other pipes, substantially as set forth.

6. The combination, with a centrally-arranged gas receptacle having lateral openings, of a pair of rotary drums arranged one on each side of said gas receptacle and provided with openings arranged to register intermittently with the lateral openings in the gas receptacle, an outlet pipe arranged to register intermittently with the openings in the drums, and means for igniting the gas as the drums rotate, substantially as set forth.

7. The combination, with a centrally-arranged gas receptacle having lateral openings, and a pair of rotary drums provided with openings arranged to register intermittently with the lateral openings in the receptacle, of an igniting device, and a plurality of outlet pipes arranged in the path of the openings in the drums, substantially as set forth.

8. The combination, with a centrally-arranged gas receptacle, having lateral openings, a pair of drums arranged one on each side of said receptacle and also provided with openings arranged to register intermittently with the lateral openings in the receptacle, and a rotary shaft on which both drums are mounted, of an igniting device, and an outlet pipe arranged in the path of the openings in the drums, and means for cooling the drums, substantially as set forth.

9. The combination, with a gas receptacle, and a drum arranged on one side of the receptacle, of a shaft on which the drum is mounted, and means for yieldingly holding the drum against the gas receptacle, substantially as set forth.

10. The combination, with a gas receptacle, and a drum arranged on one side of the receptacle, of a shaft on which the drum is mounted, a nut threaded onto the shaft, and a spring arranged between the nut and drum, whereby the latter is adjustably and yieldingly held in contact with the gas receptacle, substantially as set forth.

11. The combination, with a central casing having a gas receiving chamber, and a cooling chamber provided with an opening, of a rotary drum provided with a hollow partition, and an opening adapted to register with the opening leading to the cooling chamber, whereby the cavity in the partition is put in communication with the cooling chamber, substantially as set forth.

12. The combination, with a central casing having a gas-receiving chamber, and a cooling chamber provided with an opening, of a rotary drum having a hollow partition provided with an opening arranged to register with the opening leading to the cooling chamber and with an opening extending outward, and a tank in which the drum and central casing are located, said tank being arranged to contain a cooling liquid, substantially as set forth.

13. In a high and low pressure gas generator, the combination of a casing F having suitable pieces G M N O and openings in the faces F′ for admitting compressed explosive mixture and discharging exploded high pressure gas, low pressure gas and rest of explosion products, with a shaft T driven from some source, two drums P on both sides of said casing F and mounted on said shaft T, having chambers with openings for receiving compressed explosive mixture and discharging same exploded, springs U pressing said drums P against the faces F′ of said casing F, an igniting chamber K with two wires I I′ to ignite the mixture in said drums by means of electrical sparks, a narrow pipe K′ for letting off the explosion products from said igniting chamber and a cooling box B inclosing said casing F and said drums P, substantially as set forth.

14. In a high and low pressure gas generator, the combination of a casing F having an inlet piece G for compressed explosive mixture and three outlet pieces M N O for high pressure gas, low pressure gas and rest of explosion products respectively, also annular faces F′ on both sides with openings G^2 M^2 N^2 O^2 leading into said inlet and outlet pieces, with a shaft T, two drums P on said shaft T and on both sides of said casing F, the said drums being internally divided into chambers Q R and provided with openings Q^2 R^2 leading thereto, the said openings Q^2 R^2 corresponding to those at said casing F and being increased by curved cuts Q′ R′ and an igniting chamber K, arranged between said inlet piece and first of said outlet pieces, the said annular faces F′ of said casing F having each an opening K^2 leading into said igniting chamber K and corresponding to said curved cuts Q′ R′ of said openings Q^2 R^2 at said drums P, substantially as described and set forth.

15. In a high and low pressure gas genera-

tor, the combination of a casing F having suitable pieces G M N O and openings in the faces F′ for admitting compressed explosive mixture and discharging exploded high pressure gas, low pressure gas and rest of explosion products, with a shaft T driven from some source, two externally ribbed drums P on both sides of said casing F and mounted movable on said shaft T and partaking in its revolution, having chambers with openings for receiving compressed explosive mixture and discharging same exploded, springs U pressing said drums P against the faces F′ of said casing F, and a cooling box B inclosing said casing F and said drums P, substantially as set forth.

16. In a high and low pressure gas generator, the combination of a casing F having suitable pieces G M N O and openings in the annular faces F′ for admitting compressed explosive mixture and discharging exploded high pressure gas, low pressure gas and rest of explosion products respectively, two drums P on both sides of said casing F, having chambers with openings for receiving compressed explosive mixture and discharging same exploded, an igniting chamber K, the annular faces F′ of said casing F having each an opening K^2 leading into said igniting chamber K and corresponding to curved cuts Q′ R′ at the openings of said drums P, two wires I I′ introduced into said igniting chamber K to ignite the mixture in said drums P by means of electrical sparks and a narrow pipe K′ for letting off the explosion products from said igniting chamber K, substantially as set forth.

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

JOHAN MATHIAS KAREL PENNINK.

Witnesses:
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AUGUST SIEGFRIED DOCA.