No. 679,711. Patented July 30, 1901.

E. BERG.

ACETYLENE GAS GENERATOR.

(Application filed Oct. 10, 1898.)

(No Model.)

3 Sheets—Sheet 1.

Fig. 3.

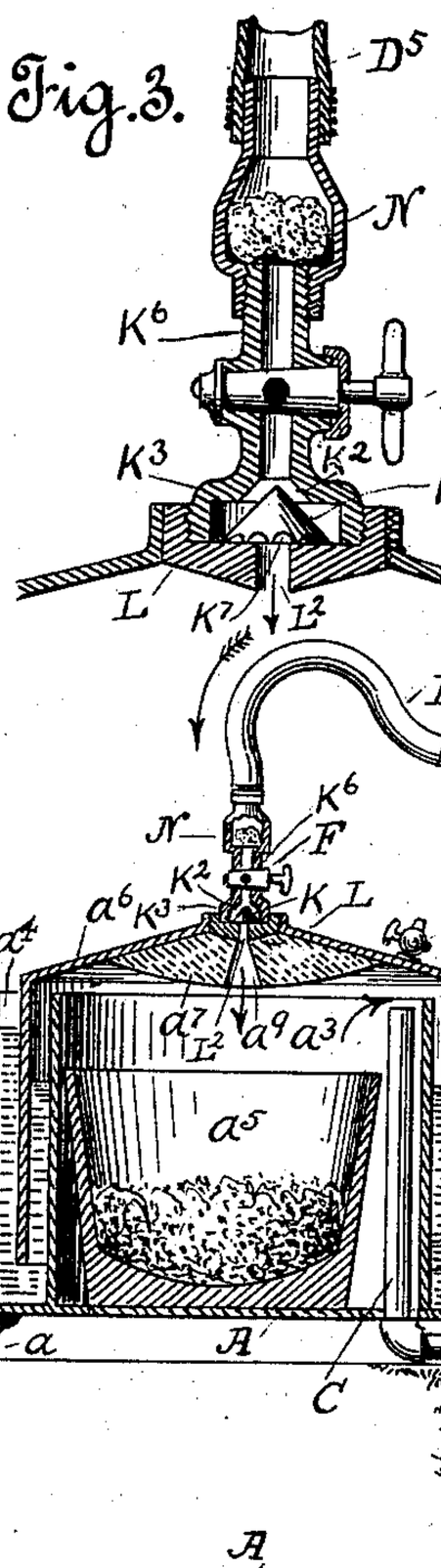


Fig. 1.

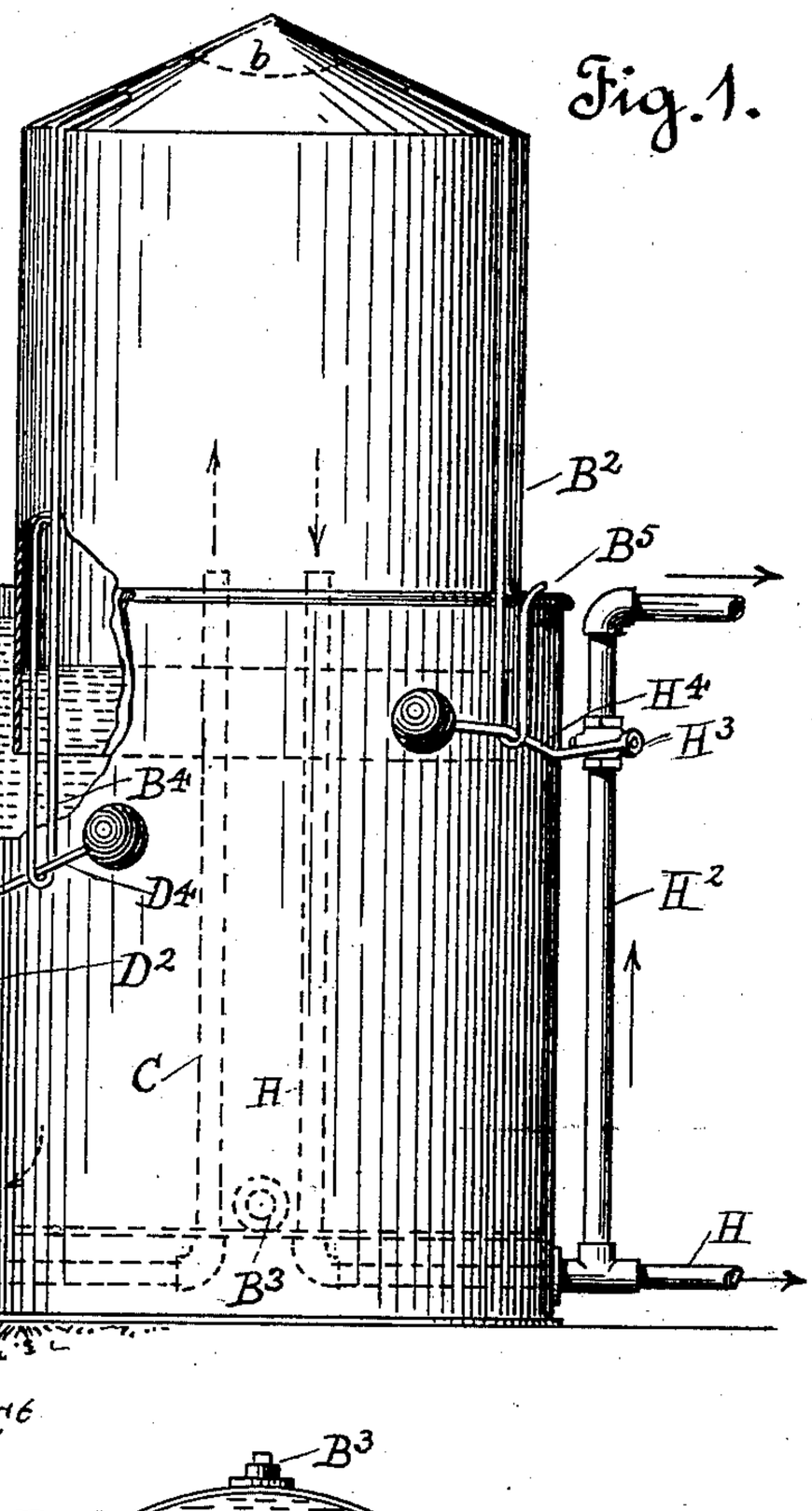
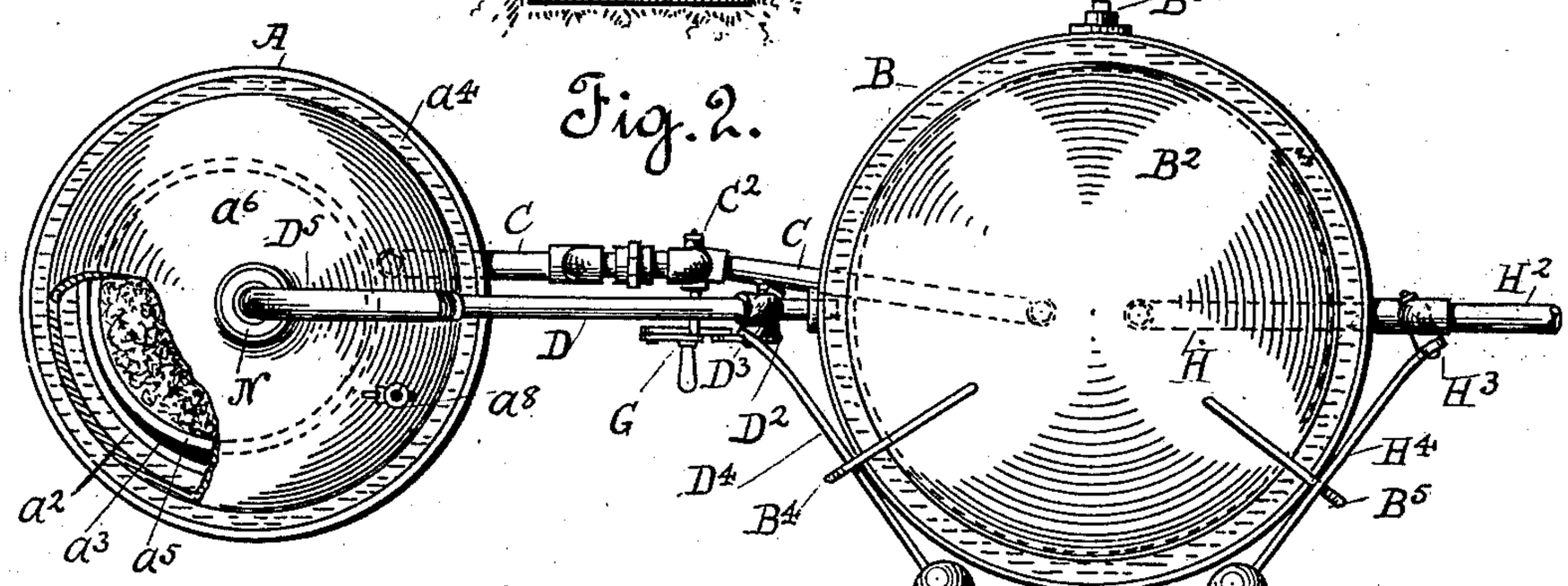


Fig. 2.



Witnesses.

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No. 679,711. Patented July 30, 1901.

E. BERG.

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(No Model.) 3 Sheets—Sheet 2.

Fig. 1.a

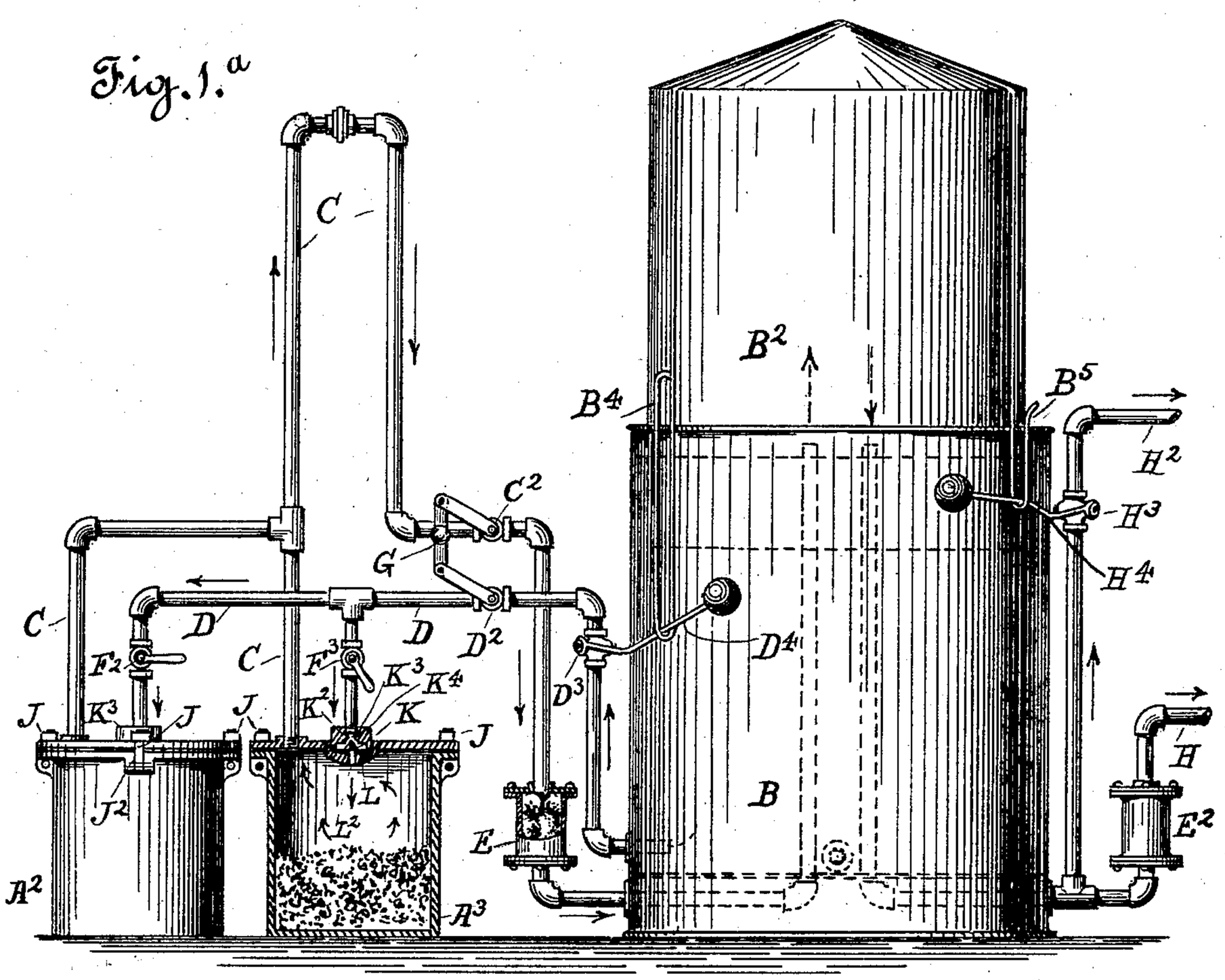
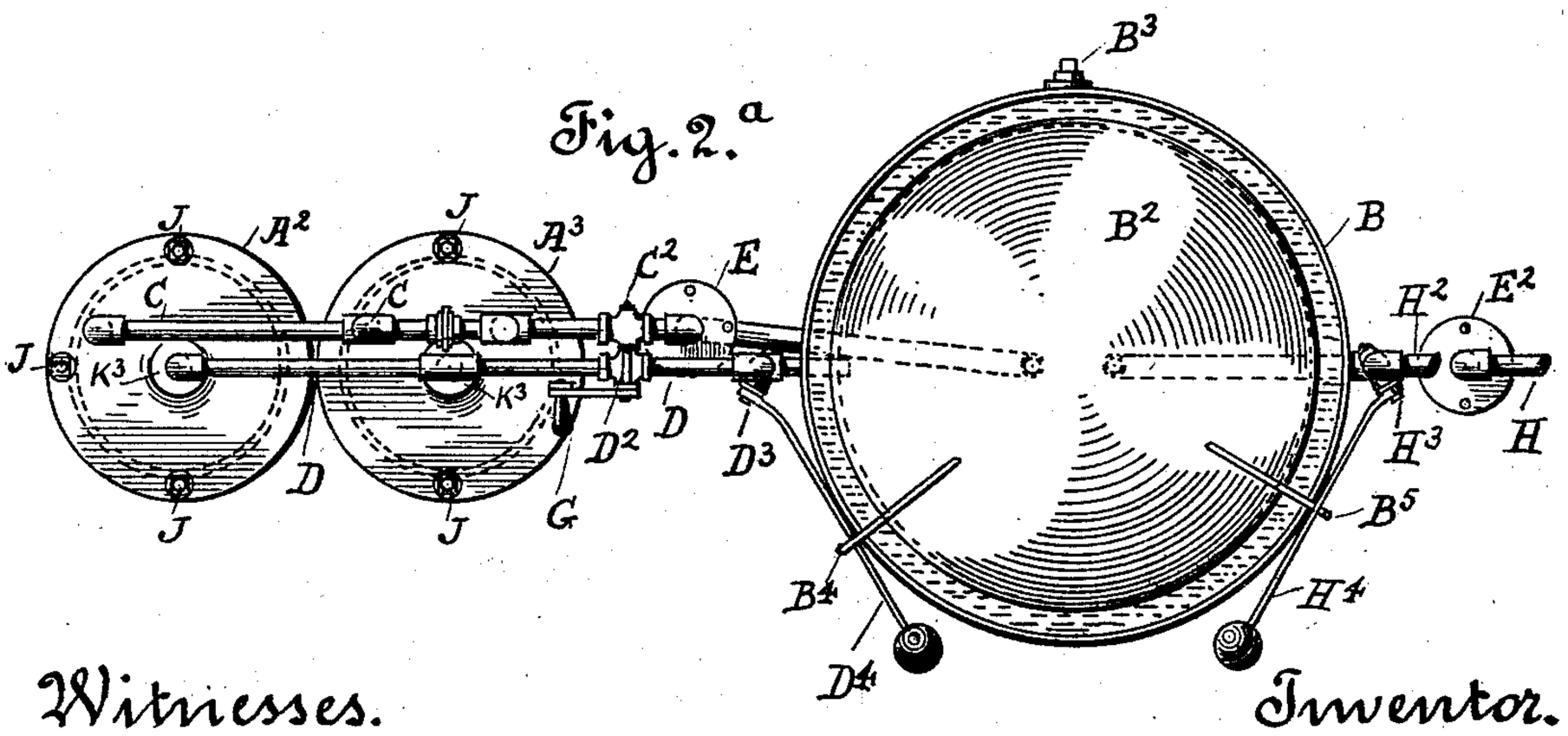


Fig. 2.a



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ACETYLENE GAS GENERATOR.

(Application filed Oct. 10, 1898.)

(No Model.)

3 Sheets—Sheet 3.

Fig. 3.ª

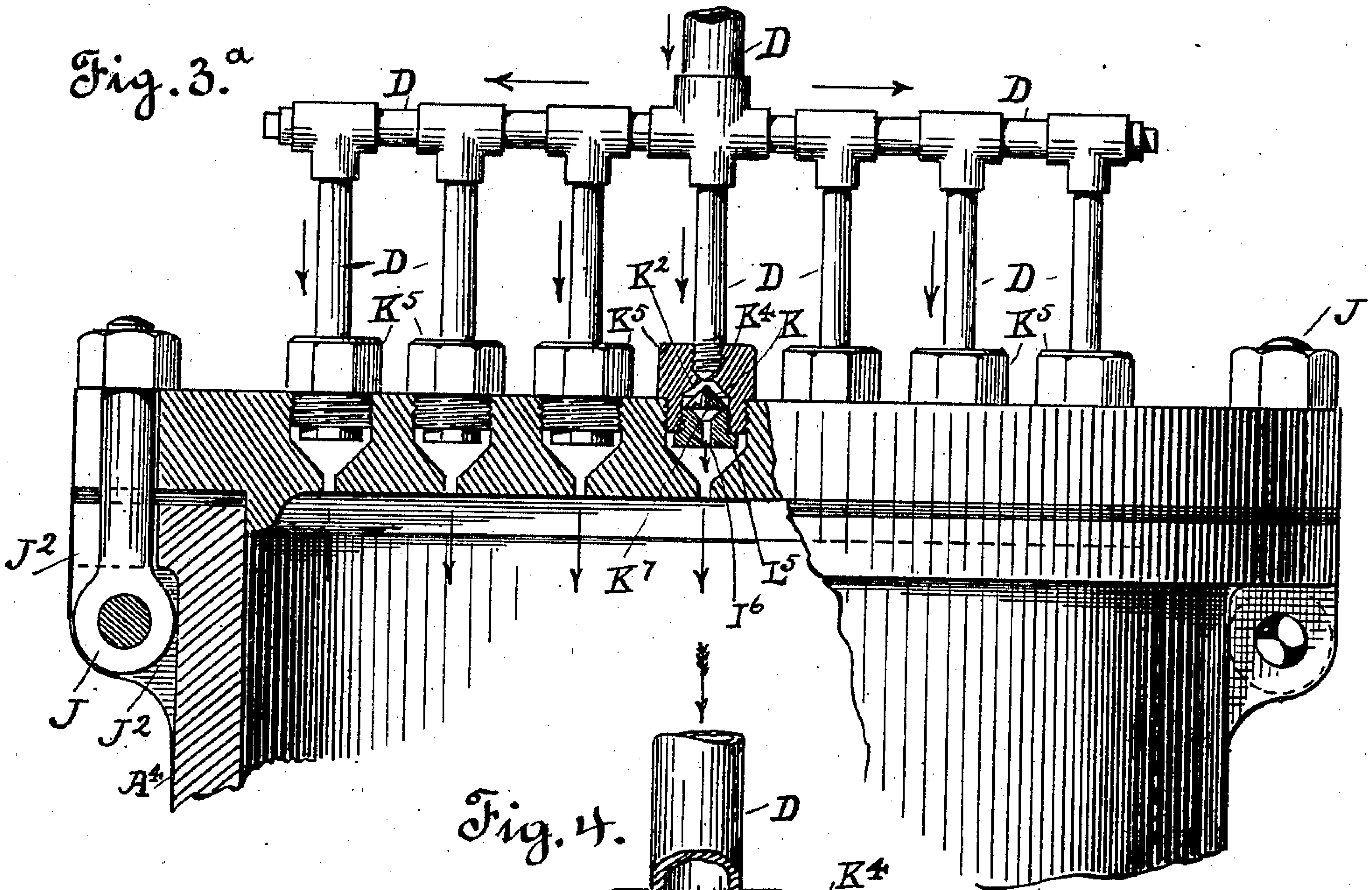


Fig. 4.

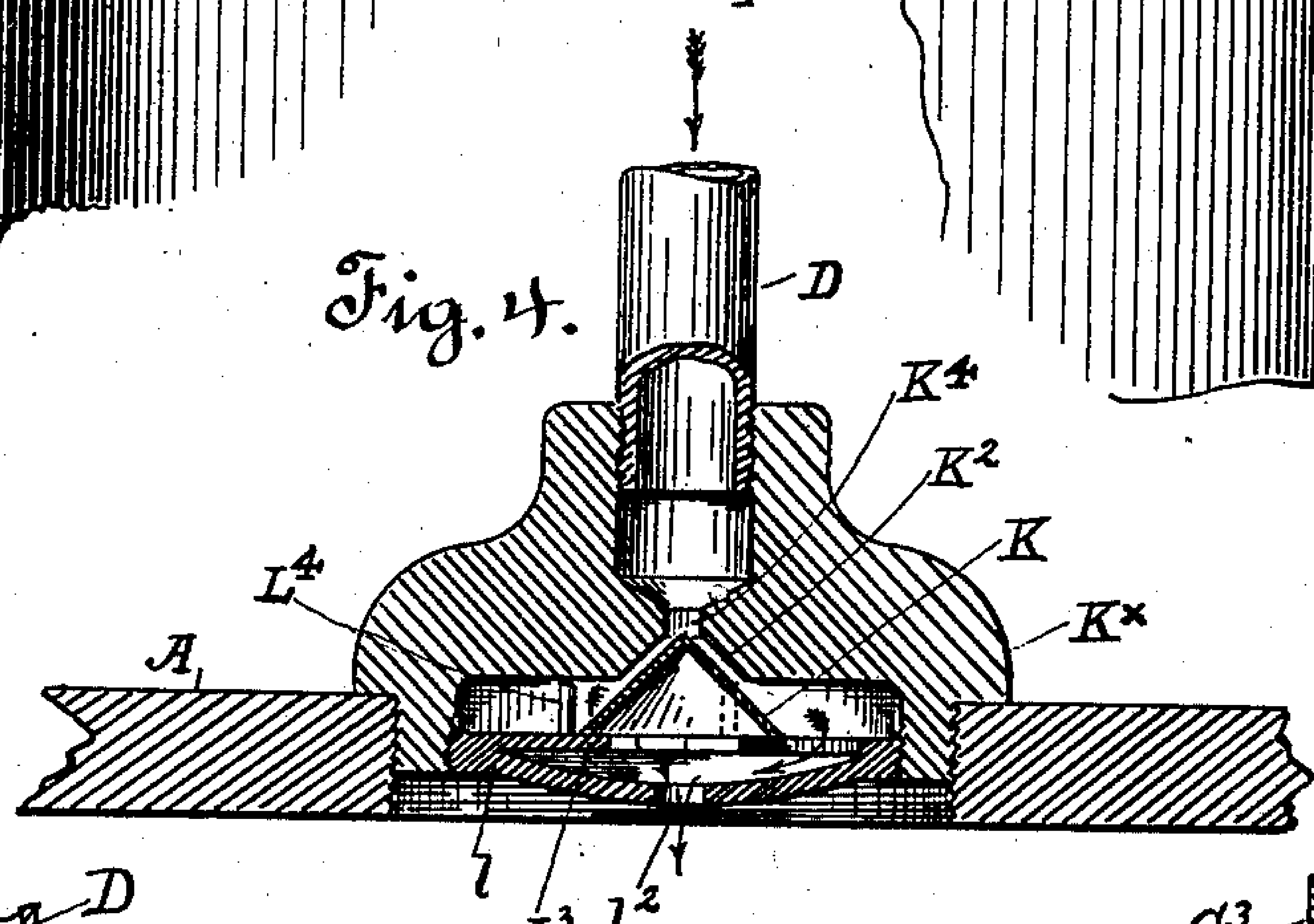


Fig. 7.

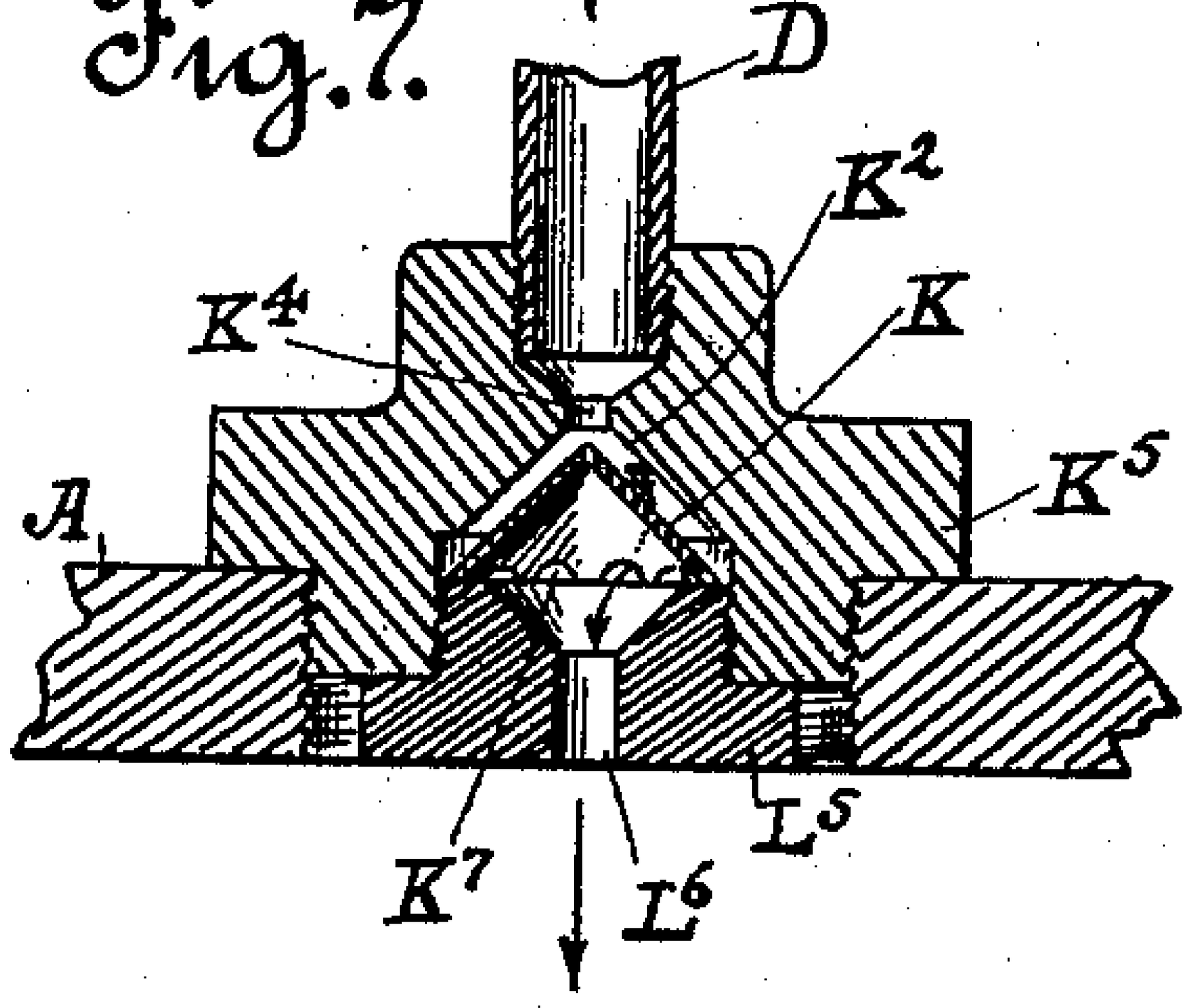


Fig. 5.

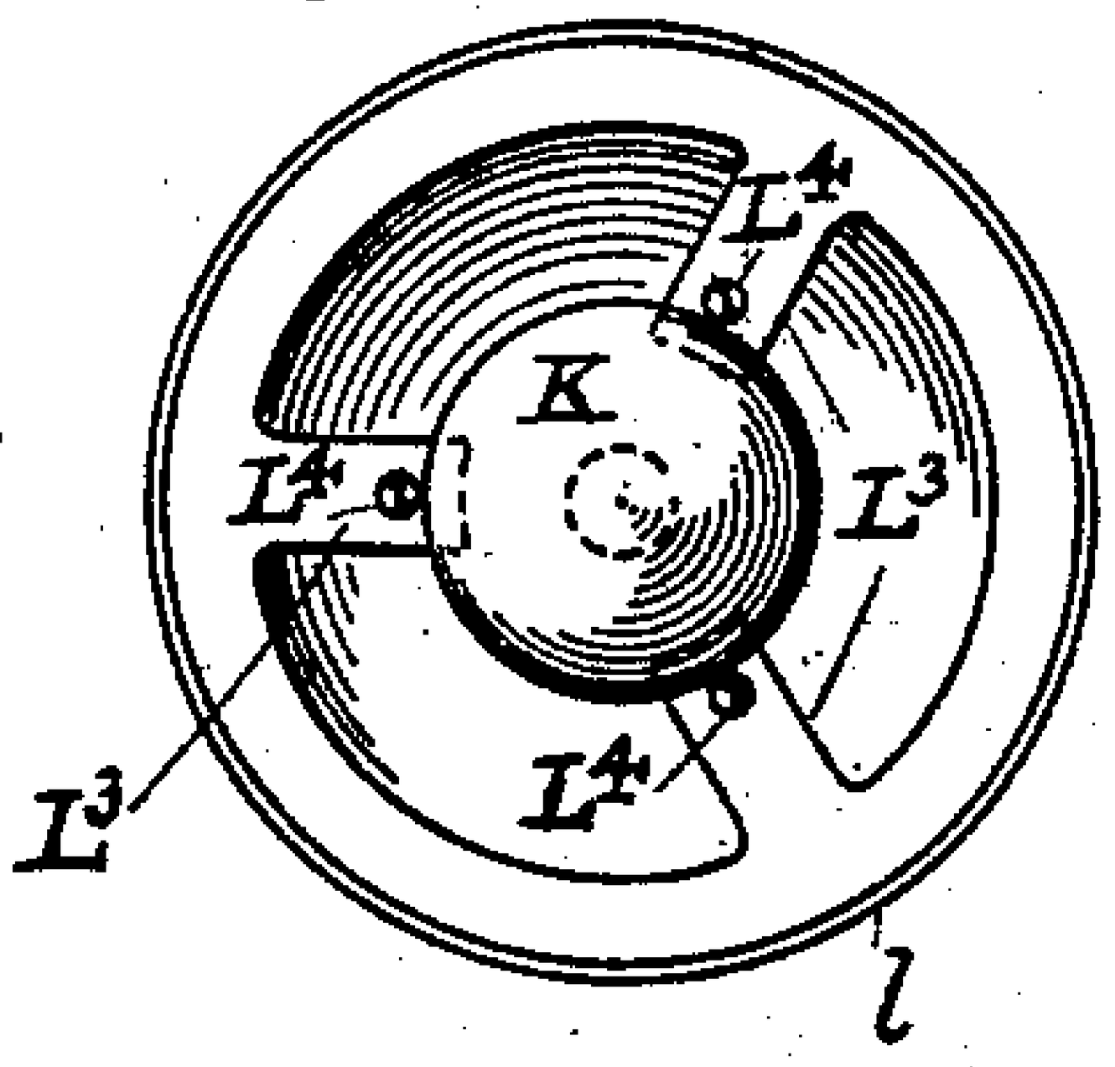
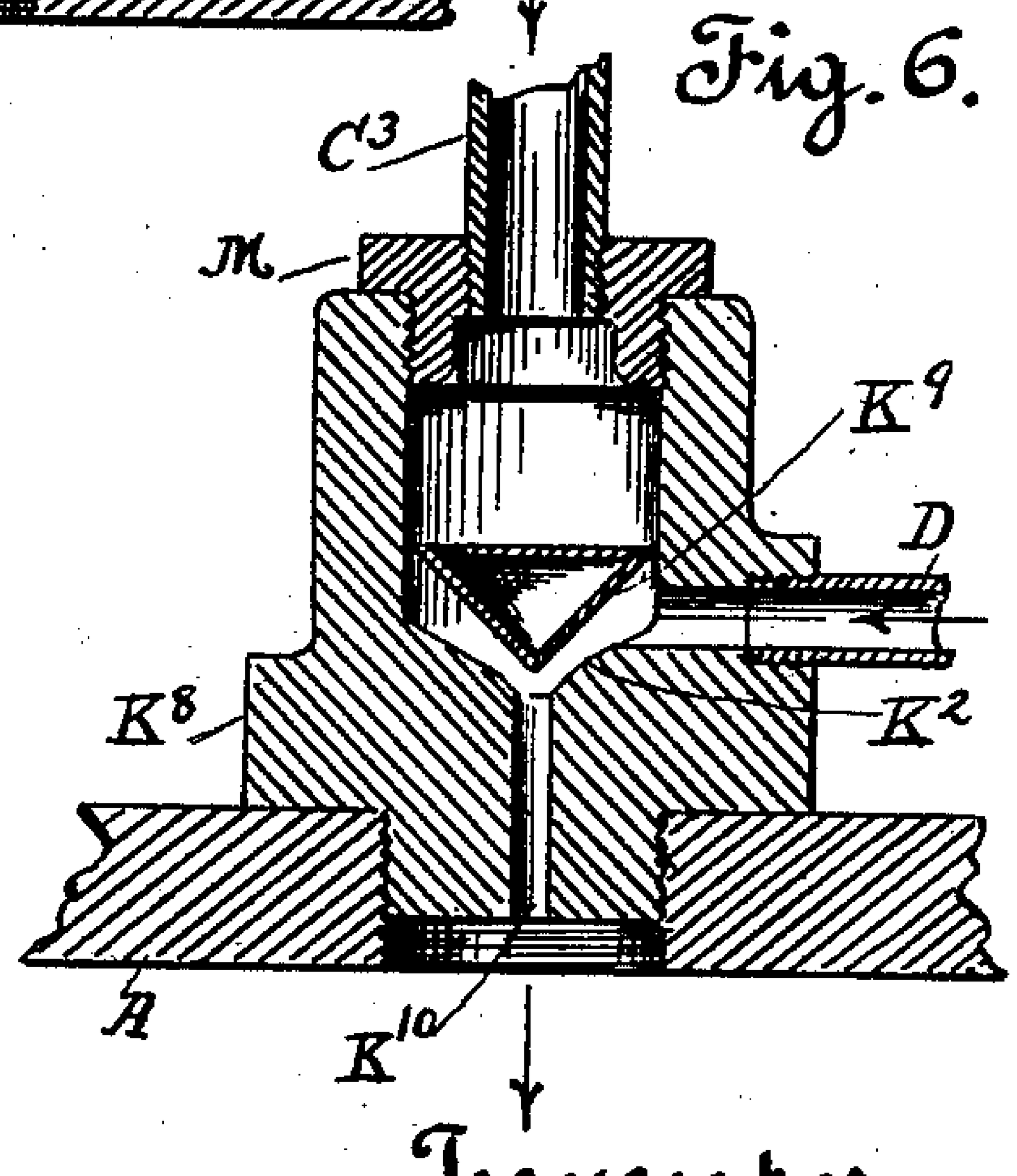


Fig. 6.



Witnesses.

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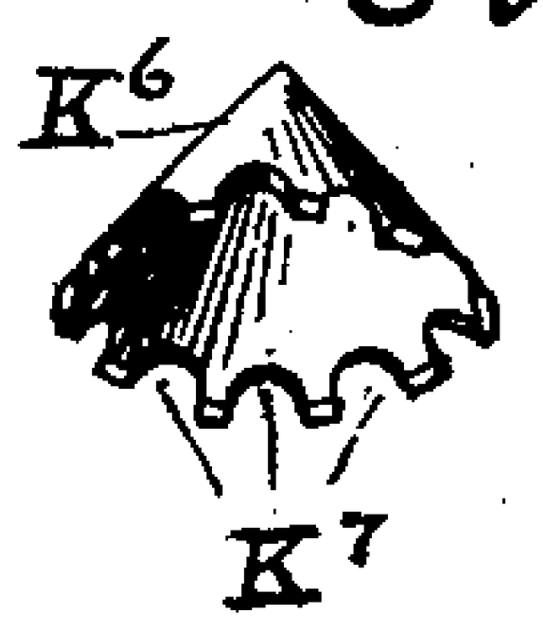
Julius T. Finch

Fig. 8.



Inventor.

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atty

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

ERIC BERG, OF SAN FRANCISCO, CALIFORNIA.

ACETYLENE-GAS GENERATOR.

SPECIFICATION forming part of Letters Patent No. 679,711, dated July 30, 1901.

Application filed October 10, 1898. Serial No. 693,170. (No model.)

To all whom it may concern:

Be it known that I, ERIC BERG, a citizen of the United States of America, and a resident of the city and county of San Francisco, State of California, have invented certain new and useful Improvements in Gas Apparatus, of which the following is a specification.

My invention relates to improvements in machines for generating gas to be used for illuminating, heating, or other purposes; and the object of this invention is to provide a safe, simple, and self-regulating apparatus that will generate gas and deliver it to a storage-tank, to a gasometer, or to the burners at a uniform pressure which has been previously determined upon and for which the machine has been adjusted.

The drawings hereto annexed show a machine particularly adapted to the generation of acetylene gas.

Figure 1 is a sectional elevation of such a machine, which comprises a generator of novel design connected by means of peculiarly-arranged pipes to a gasometer that works jointly with it and having an automatic governor-valve that controls the flow of the liquid employed in making the acetylene, which liquid is made to pass first through a filter and a regulating-cock. Fig. 2 is a top view of the construction represented by Fig. 1. Fig. 3 is a detailed view showing the above-mentioned valve, cock, and filter on an enlarged scale. Fig. 1^a is an elevation of a machine of modified construction having two generators and two purifiers, the view showing one of the said generators and one of the said purifiers in section. Fig. 2^a is a top view of the construction represented by Fig. 1^a. Fig. 3^a is a broken sectional elevation of a generator of the same kind as those shown in Fig. 1^a, but having multiple feed-pipes. Fig. 4 is a detailed view in section of a modified form of the governor-valve and parts thereto related. Fig. 5 is a top view of the governor-valve and its support of the design shown in Fig. 4. Fig. 6 is a sectional elevation of another modified form of the governor-valve and casing therefor. Fig. 7 is a detailed view in section of the governor-valve shown in Fig. 3^a and the related parts. Fig. 8 is a detailed view in perspective of the governor-valve shown in Figs. 1, 3, 1^a, 3^a, and 7.

In this specification like letters refer to the same or corresponding parts in all of the figures.

In Figs. 1 and 2, A represents the gas-generator, which consists of a vessel preferably made of galvanzed iron and cylindrical in shape and resting on small legs a or any other suitable support. This vessel has a partition a^2 running around it that forms an inner chamber a^3, within which the gas is to be generated, and a trough a^4, into which water is poured. The carbid or other material from which the gas is to be produced is placed in a pail, bucket, tub, or other suitable receptacle a^5, located inside the generating-chamber a^3. The cover for this generating-chamber consists of a bell-shaped top a^6, the downwardly-projecting flange of which dips in the water contained in the trough a^4. When no gas is made, the cover a^6 can bear on either the upper part of the generating-chamber or the bottom of the trough, or on both of them, and the water in the trough is at the same level inside and outside the cover's flange. When, on the contrary, gas is being generated, the cover a^6 is floated or raised by the natural expansion of the gas and the water then is forced up to a higher level outward, as indicated in Fig. 1, in proportion to the gas-pressure. The cover a^6 is weighted, as at a^7, for a twofold purpose—first, to prevent it from being raised too high by the pressure of the gas, and, secondly, to quickly drive the gas into the gasometer B B^2 through the stand-pipe C, that connects the latter with the generator. The weight a^7 may consist of a piece of lead or other heavy material preferably affixed to the under side of the cover a^6, as shown. A vent-cock a^8 is further provided on said cover for the purpose of allowing it to be removed readily whenever required either to clean out the generator or to put in a new charge of carbid or other gas-producing material. The suction of the water in the trough a^4 would be such as to make it difficult to remove the cover, if not to prevent its removal entirely, were a vent-cock not provided; but by using the vent-cock a^8 and opening it so as to let the air in under the cover the latter can be taken off at once and the generator can then be recharged or cleaned out with ease. The water contained

in the trough, it will be understood, forms a seal that prevents the escape of the gas from the generator except through the pipe C, that conveys it to the gasometer. This water, furthermore, is a cooling agent for the gas that is generated, the trough a^4 that holds it serving as a water-jacket for the generating-chamber a^3.

In Figs. 1^a, 2^a, and 3^a, A^2 A^3 A^4 are also gas-generators, being chambers suitable for holding carbid of calcium. There may be only one of such chambers or gas-generators, as shown in Fig. 3^a, or there may be several joined in series, as shown in Figs. 1^a and 2^a, according as the case may require. These chambers may be made of any material that will be found most useful for holding the particular chemicals or substances from which it is desired to generate gas, and they may be of any size or shape that shall be convenient at the place where the gas plant is to be set up.

B is the outer tank of the gasometer, and B^2 is the inner tank thereof. This gasometer is the same in both the constructions represented by Figs. 1, 2, 1^a, and 2^a, only in Figs. 1 and 2 the tank B^2 must be weighted less than the cover a^6 of the generating-chamber a^3 to insure the flow of the gas from said chamber to the gasometer. The weight for the tank B^2 is shown at *b*, Fig. 1. It is applied in the same manner as the weight a^7 of the cover a^6 aforesaid. The tank B is filled with water or some other suitable liquid to form a seal in the usual manner. This water will vary in level inside and outside the tank B^2, according to the pressure of the gas in the gasometer, as indicated in Fig. 1. It can be let out and the gasometer drained, as occasion requires, by removing the plug B^3, which is located in the side of the tank B, flush with its bottom.

The stand-pipe C, through which the gas generated passes to the gasometer, is the same, except as to position, for the different forms of the apparatus described herein. Its position varies according to where it is connected with the several generators. Thus in Figs. 1 and 2 it is run out from the bottom of the generator A and is located to one side of the latter. In Fgs. 1^a and 2^a it runs from the top of the generators A^2 A^3 and is located above the same, having, of course, as many branches as there are generators used. In all cases, however, the stand-pipe C takes the gas from the upper part of the generating-chamber, as shown.

In connection with the gas-pipe C, Fig. 1, I use drip-pipes C^4 C^5, that discharge into a receiver C^6, which contains water or some other liquid adapted to form a seal and to collect the impurities that are carried away with the gas while it is being conveyed to the gasometer B B^2. The drip-pipes C^4 C^5 are respectively connected by means of T-couplings C^7 C^8 to the lower ends of the main sections of the stand-pipe C and reach down to a suitable depth below the surface of the water contained in the receiver C^6. The heavier particles of matter or impurities that come out of the generator with the gas, it will be observed, drop down into the water of the receiver through the drip-pipe C^4 as the gas flows out of the generating-chamber a^3 and up the left side of the stand-pipe. The remainder of the impurities that are carried over to the right side of the stand-pipe drops into the receiver through the drip-pipe C^5. I find that with this arrangement the gas reaches the gasometer freed from a part of impurities and gives when lighted a flame that is free from soot and remarkably clear, white, and bright. The drip-pipes and receiver above mentioned may be used with or without the purifiers E E^2, hereinafter described, or either of them, as preferred. They can also be used in connection with the stand-pipe of the form of apparatus represented by Figs. 1^a and 2^a, being applied at any suitable point on the line of said pipe.

D designates a pipe by which water, or whatever liquid may be used in the process of making the gas, is delivered to the generators A A^2 A^3 A^4. In the apparatus shown in the drawings accompanying this specification the water is drawn from the gasometer to which the pipe D is connected; but this need not necessarily be so and it may be drawn from any suitable source.

C^2 and D^2 are cocks respectively upon the main pipes C and D and are connected by one swivel-lever G, which operates so that when the water-supply is turned on in the pipe D the gas-pipe C is also opened. Likewise when the gas is turned off the water is turned off also, thereby making it impossible to generate gas except there is a place for it to go to.

D^3 is a safety-cock upon the pipe D and is operated by a weighted lever D^4, which passes through the loop B^4, attached to the top of the inner tank B^2 of the gasometer, and is so arranged that when the gasometer is filled and B^2 rises the cock D^3 is closed and the water-supply shut off from the generators, thus stopping the further manufacture of gas until the tank B^2 falls sufficiently to allow the weighted lever to again open the cock.

E, Figs. 1^a and 2^a, is a purifier consisting of a suitable vessel placed intermediate of the pipe C and holding a sponge saturated with oil for the purpose of removing impurities from the gas coming from the generators before it enters the gasometer. E^2 in the same views is a purifier of similar construction with E and is used to remove whatever impurities might still be in the gas, which goes from the gasometer into the service-pipe H. The purifiers E and E^2, it will be observed, can be used as well with the form of apparatus represented by Figs. 1 and 2.

F, F^2, and F^3 are auxiliary stop-cocks employed for regulating the flow of liquid into the several generators. They are so arranged when the generators are joined in series, as

in Fig. 1ª, that either of the generators may be used without using the other. For example, in Fig. 1ª the auxiliary stop-cock F^2 is closed, and consequently the generator A^2 is not in use, while the auxiliary stop-cock F^3 is open, allowing the passage of the liquid into the generator A^3, which is working.

H is the service-pipe carrying the gas from the gasometer to the burners.

H^2 is a safety exhaust-pipe connected with the supply-pipe H and having a safety-cock H^3 similar to the safety-cock D^3, with the exception that when H^3 is open and allowing the gas to escape into the outer air D^3 is closed, thus stopping the further flow of liquid and the generation of gas until the excess of pressure is removed. The safety-cock H^3 is operated by a weighted lever H^4, which is engaged by the hook B^5, attached to the top of the inner tank B^2. In case of fire near the gasometer the gas would expand and create a great pressure, which would raise the tank B^2, thus opening the safety-cock H^3, which would at once lessen the pressure.

The generators A^2, A^3, and A^4 are supplied with covers fastened on by hinge-bolts J, as shown in Figs. 1ª, 2ª, and 3ª. These hinge-bolts are fastened to the upper part of the generator in each case and fit in notches J^2 in the generator-cover. They are so constructed that by loosening their nuts they can be swung outward and clear from the notches, thus permitting the generator-cover to be easily and quickly removed, the substance in it from which the gas has been exhausted taken out and a fresh charge placed in them, the liquid turned on, and the generation of gas resumed.

At the point where the liquid enters the generators there is a hollow conical governor-valve K, with its apex pointing upward. This valve has a ground-seat K^2. In Figs. 1, 3, and 1ª the valve K works in a casing K^3, which screws into a valve-rest L, soldered or otherwise secured in an opening prepared therefor in the generator-cover. A suitable hole L^2 is made in the center of this rest L and a similar hole a^9, registering therewith, is also made in the weight a^7, where the same is used in order to provide a suitable passage for the liquid under the valve K. Notches K^7, Figs. 3 and 8, are provided in the base of the valve K, so that the liquid may reach the holes L^2 and a^9 and enter the generator when said valve is in its lowermost position. These notches do not appear in Figs. 1 and 1ª, because in these views the valve is too small to show them distinctly.

The governor-valve K in the construction represented by Figs. 4 and 5 is supported by a rest *l*. This rest is a circular concavo-convex plate, with the concave side upward, and is fastened in the lower end of the valve-casing $K^\times$ by means of screw-threads on the outer edge of said plate engaging similar screw-threads in the inner surface of the lower end of said valve-casing. The rest *l* has a hole l^2 in its center for the purpose of allowing the liquid which has passed the governor-valve to enter the generator. The valve K does not set in the concave portion of said plate, but is supported by three projections L^3, extending from the upper edge of said plate inward and toward the center of a circle in the same plane. The diameter of the base of the conical valve K is considerably less than the diameter of the plate *l*, and thus it will be seen that when the valve is at rest upon the projections L^3 there is a space for liquid to pass around and beneath it, through the hole l^2 in the center of said plate, and into the generator. The notches K^7 are not needed in this construction. The governor-valve is held in position by three pins L^4, one of which extends upward from each of the projections L^3 and is also steadied by the apex of the valve coming in contact with the ground valve-seat K^2. The feed-pipe D in Fig. 4 is connected with the valve-casing $K^\times$ by means of screw-threads on the outer surface of said pipe engaging similar screw-threads in an opening in the top of said casing. Below the lower end of the feed-pipe D the opening in the casing $K^\times$ becomes narrow, forming a small aperture or port K^4, through which the liquid is delivered into the valve-chamber, past the valve-seat K^2, and immediately over the apex of said valve K.

Figs. 3ª and 7 represent another construction of the casing and rest for the governor-valve K. In this case the feed-pipe is connected with the valve-casing K^5, as in the construction above described, and the construction of the valve-casing is the same as that shown in Fig. 4, with the exception that its inner space is diametrically smaller, being but a little larger than the governor-valve itself, and instead of the concavo-convex plate *l* (shown in Fig. 4) the valve-rest L^5 in this construction has a plane upper surface and an aperture L^6 in its center which flares upward and through which the liquid passes into the generator. The valve K in Figs. 3ª and 7 has a notched or serrated base, the same as is shown in Figs. 3 and 8. In this modified form of my invention the liquid passes through the aperture K^4 above the apex of the valve, through the notches K^7 in the edge of the valve, and thence through the aperture L^6 in the valve-rest into the generator. The particular characteristics of this construction are that it is more simple and more massive than the form shown in Figs. 4 and 5. In this modification the guide-pins L^3 are done away with, as in Figs. 1 and 3, and the valve is kept in position by the side walls of the valve-chamber.

Fig. 6 shows still another modification of my valve-casing and also a modification of the valve. Here the feed-pipe D enters the valve-casing K^8 upon the side and near the bottom of the valve-chamber in said casing. The valve K^9 is conical in shape, but inverted

and sealed at its base to prevent the liquid from entering it, and thus making it too heavy. The valve-casing K^8 fastens into the generator-cover and has an aperture K^{10} leading from the valve-chamber into the generator. The valve is held in position by the side walls of the casing K^8, as is done in the construction show in Fig. 7. A branch C^3 of the gas-pipe C enters the top of the valve-casing K^8 above the base of the valve K^9. This pipe C^3, being smaller than the base of the valve, is connected with said valve-casing by means of a bushing M.

In the form of apparatus represented by Figs. 1 to 3 the liquid-conveying pipe D is not connected directly with the valve-casing as in the other views of the drawings. In the said figures the pipe D is coupled first with a hose or flexible tubing D^5, that connects it with a filter N, attached to an extension K^6 of the valve-casing K^3. The hose D^5 may be made of rubber or any other suitable material having the desired pliancy. It is used so that the cover a^6 of the generating-chamber a^3 may move freely up and down, according to the volume or pressure of gas contained in said chamber. It also allows the cover a^6 to be removed entirely from the generator A without disturbing the pipe D, thus making it easy to clean the generator and put in a fresh charge of carbid. The filter N performs a double function. In the first place it collects and retains the impurities that may be in the water or other liquid brought up by the pipe D and which otherwise might clog the valve K, and in the second place it operates to break the force of the fall of the column of water from pipe D upon the apex of the valve K. The filtering material placed in N may be a sponge or any other substance adapted for the purpose. As will be understood, a filter N may be used in connection with all the forms of valve-casing herein described, and the same need not be attached directly to said casings, but may be located at any intermediate point between the generator's governor-valve and the source of liquid-supply in the line of flow of the liquid.

In the construction of my invention shown in Figs. 1 and 2, and also in Figs. 1^a and 2^a, where there is but one pipe from which the liquid is fed into the generator, the governor-valve is situated in the center of the generator-cover. In the construction shown in Fig. 3^a, where there is a multiple feed-pipe, the valves for each branch of the pipe may be arranged in a straight line, in a circle, in the form of a cross, or in any other manner that may be desired.

My invention operates as follows: (Since the drawings show a machine particularly adapted to making acetylene gas, I will explain its workings in the manufacture of that gas; but I do not restrict my invention to the generation of acetylene gas.) Calcium carbid is placed in either form of generator after removing the generator-cover, as previously described. The cover is then replaced, and the swivel-lever G is pressed down, thus turning on the water or other liquid in the feed-pipe D and also opening the cock C^2, which permits the gas to pass from the generator through the pipe C and through the purifier E into the gasometer, or, if there is no gasometer, it can go directly to the burners. After the water leaves the pipe D it passes through the filter N and thence trickles down past the governor-valve K into the generator, and there it enters into combination with the calcium carbid, and acetylene gas is generated. The gas escapes from the generator by means of the pipe C, which rises perpendicularly to a considerable height from the generator, so as to give the gas some chance to cool before entering the gasometer and also to enable the heavier impurities that may be in it to fall down into the receiver C^6. As the gas enters the gasometer the inner tank B^2 rises. The gas is further cooled upon entering the gasometer, owing to the pipe C rising through the water contained therein. The gasometer may be dispensed with, if desired, and the burners may be attached directly to the gas-pipe C and will still give a steady light, because the governor-valve is so constructed as to insure a constant generation of gas at a uniform pressure. This construction built on a small scale and with the gasometer omitted would amount to an acetylene-gas lamp. I therefore wish it distinctly understood that my invention contemplates the use of said governor-valves in such lamps, as well as in other forms of gas apparatus or generators, with or without a gasometer or storage-tank. The force of gravity acting upon the cone-valve itself and the weight of the column of water in the pipe D normally keep the valve down, and thus permit the water to pass into the generator; but as soon as the water comes in contact with the carbid it generates the gas, which immediately exerts a pressure on the under surface of the valve and has a tendency to raise it. As the pressure of the gas increases the valve is raised in proportion to the increased pressure. The valve is always raised when the gas is at a working or normal pressure, in which case it remains suspended between its seat and the rest below it; but when the gas is generated at a pressure above the normal then it lifts the valve and seats it in the opening above, thus entirely shutting off the supply of water. As soon, however, as the pressure is lessened the valve drops back again and allows the water to again flow. When the storage-tank or gasometer is full or when the pressure in the generator is above that for which the apparatus has been gaged, then the valve becomes firmly seated and so remains seated until part of the gas is drawn off, when it will again begin to operate. The amount of pressure given to the gas is regulated by the weight of the governor-valve. Thus if we desire a pressure of one-fourteenth of a pound

to the square inch and the valve exhibits one square inch of surface it would be necessary for the cone to weigh one-fourteenth of a pound less the weight of the column of water in D resting upon it. If the pressure rose above one-fourteenth of a pound, it would seat the valve and shut off the water, as before described. The water passing around the valve and its seat keeps it always lubricated and clean and insures efficient work. In operation it is found that the generation of the gas is inclined to be unsteady, and consequently the valve is kept constantly working up and down. The result of this working of the governor-valve is that the gas is generated at a steady pressure and only in proportion to the consumption. When the gas is drawn from the generator, the pressure is lessened, the valve falls back, and more gas is created. By supplying the water to the carbid only in proportion to the amount of gas used it creates a dry gas, which is much better for illuminating purposes than a wet gas, and it extracts more gas from the given amount of carbid than would be obtained if the water were applied rapidly or all at once.

The capacity of my apparatus is determined by the size and number of the generators used and by the amount of carbid placed in them. If the generators are large, it would be advisable to use the multiple feed-pipe, as shown in Fig. 3ª, in which case each branch of the feed-pipe would have a separate valve and all would be working at the same time. There may be several generators arranged in series, as shown in Figs. 1ª and 2ª, and they may all be working at once or some of them may be thrown out of use by closing the auxiliary stop-cocks F^2 and F^3.

Having now described my invention, what I claim, and desire to secure by Letters Patent of the United States, is—

1. In an apparatus of the nature described, a governor consisting of a loosely-supported hollow conical valve having its apex turned toward and adapted to close the passage through which the liquid is led to the gas-producing material, and its base arranged so as to be acted upon and moved by the gas that is produced by the action of the liquid on the material, substantially as described.

2. In an apparatus of the nature described, the combination of a gas-generator, a liquid-supply passage leading to said generator, a hollow gravitating valve having a closed top turned toward said supply-passage, and closed to the passage of gas therethrough located to normally permit the entrance of water to said generator and adapted to be acted upon by pressure of gas in the generator to lift said valve to close said passage and shut off the liquid-supply, substantially as described.

3. In an apparatus of the nature described, the combination of a generator, a valve-chamber, a liquid-supply passage entering the top of said valve-chamber, a hollow conical valve located in said chamber below said passage, said chamber communicating with said generator through a passage located directly below said hollow valve, said valve adapted to be lifted by gas-pressure in the generator to close said upper passage, substantially as described.

4. An apparatus of the nature described, comprising a generator, a valve-casing, a suitably-guided conical valve therein having a notched edge, the point of said valve controlling the port in said casing, a support for the conical valve having a suitable passage leading from the notched edge thereof, and a pipe discharging liquid into the valve-casing and through it into the generator, substantially as described.

5. In an apparatus of the nature described, the combination of a generator, a liquid-supply pipe for the generator, a valve-casing through which said supply passes, a conical valve in said casing below the entrance-opening, a concavo-convex plate in said casing and having a central exit-opening and projections on said plate forming supports for said valve over said exit-opening, said valve adapted to be lifted and close said entrance-opening by gas-pressure in said generator, substantially as described.

6. An apparatus of the nature described, comprising a generator, a pipe discharging liquid into the same, a valve-casing through which the liquid passes, a conical valve in said casing, an apertured concavo-convex plate secured to the casing under the valve therein and having inward projections on which said valve can bear, and guide-pins on said projections by the sides of the valve, substantially as described.

7. An apparatus of the nature described, comprising two or more generators, a liquid-conveying pipe connected with each generator, conical valves acting under gas-pressure and respectively adapted to control the several generator-inlets, said valves being pointed toward the incoming liquid, and cocks controlling the flow of liquid through the connections of the liquid-conveying pipe with each generator, the same allowing the generators to be worked singly or jointly, substantially as described.

8. An apparatus of the nature described, comprising a generator, a gasometer, a pipe arranged to convey liquid from the gasometer to the generator, an outwardly-pointed hollow conical valve controlling the flow of the liquid into the generator, and adapted to be raised by the gas-pressure acting on the base of the valve and an outlet-pipe conveying the gas from the generator to the gasometer, substantially as described.

9. An apparatus of the nature described, comprising a generator, a gasometer, a gas-conveying pipe connecting the same, a source from which liquid is supplied, a pipe to convey the liquid to the generator, a gas-raised outwardly-pointed hollow conical valve controlling the flow of the liquid through the

generator-inlet, a stop-cock in the liquid-conveying pipe, and a mechanism connected with the gasometer whereby the said stop-cock is shut off by the rise of said gasometer when it has reached a predetermined height, substantially as described.

10. A generator of the nature described, having a plurality of inlets arranged in any suitable order or form, a gas-raised outwardly-pointed hollow conical valve controlling each inlet, means to convey a liquid to the generator through the several inlets past the valves therein, and an outlet for the gas, substantially as described.

Signed by me at San Francisco, California, this 29th day of September, 1898.

ERIC BERG. [L. S.]

Witnesses:
L. P. F. WALLER,
A. F. HARASZTHY.