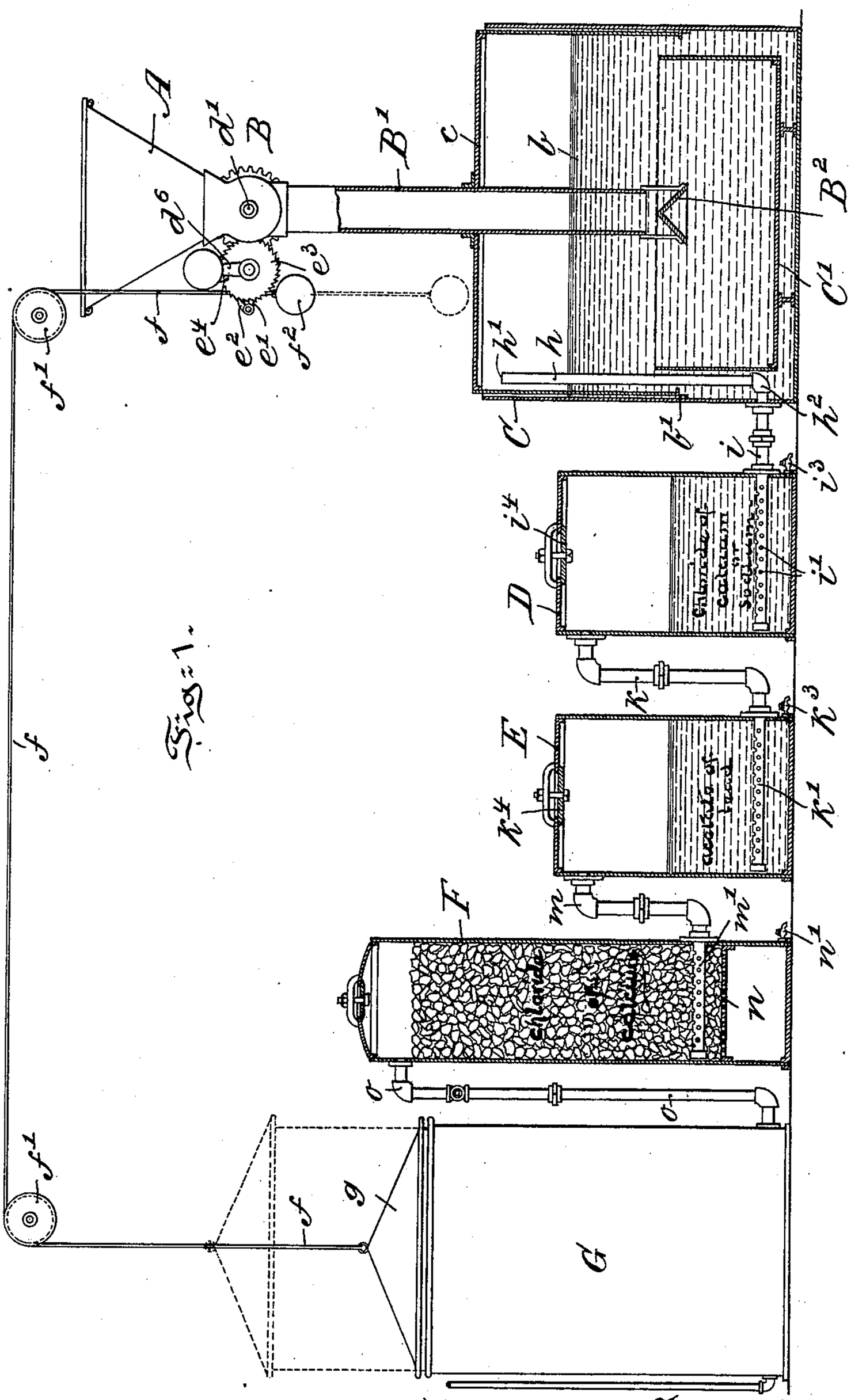
(No Model.)

3 Sheets—Sheet 1.

H. H. SUPLEE.

APPARATUS FOR GENERATING ACETYLENE GAS.

No. 606,037. Patented June 21, 1898.



Witnesses:
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(No Model.) 3 Sheets—Sheet 2.

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Fig: 2.

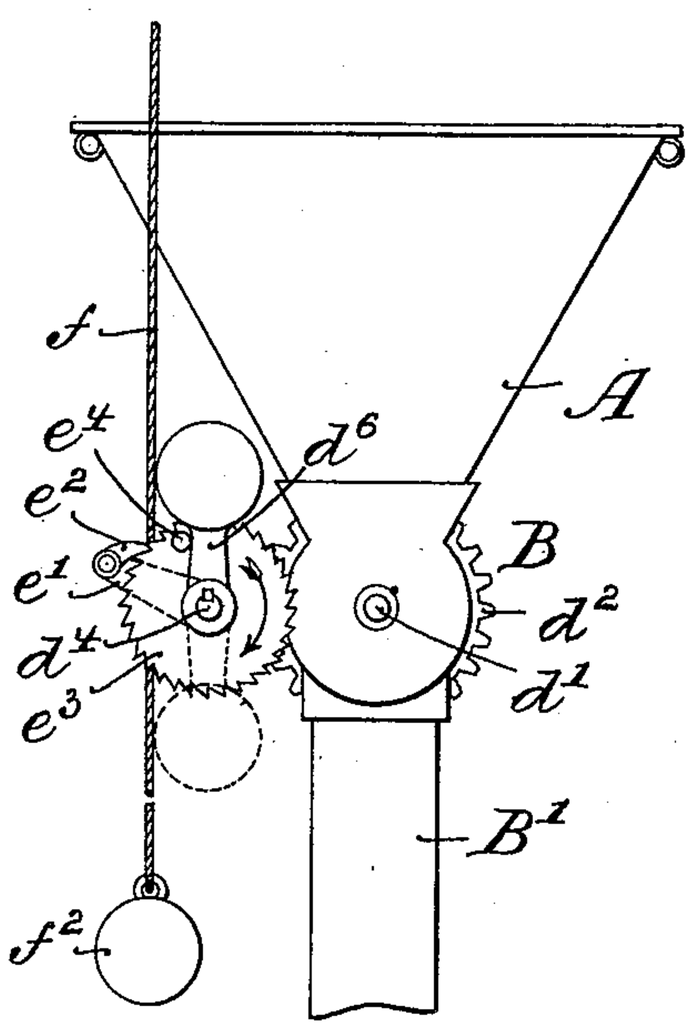


Fig: 3.

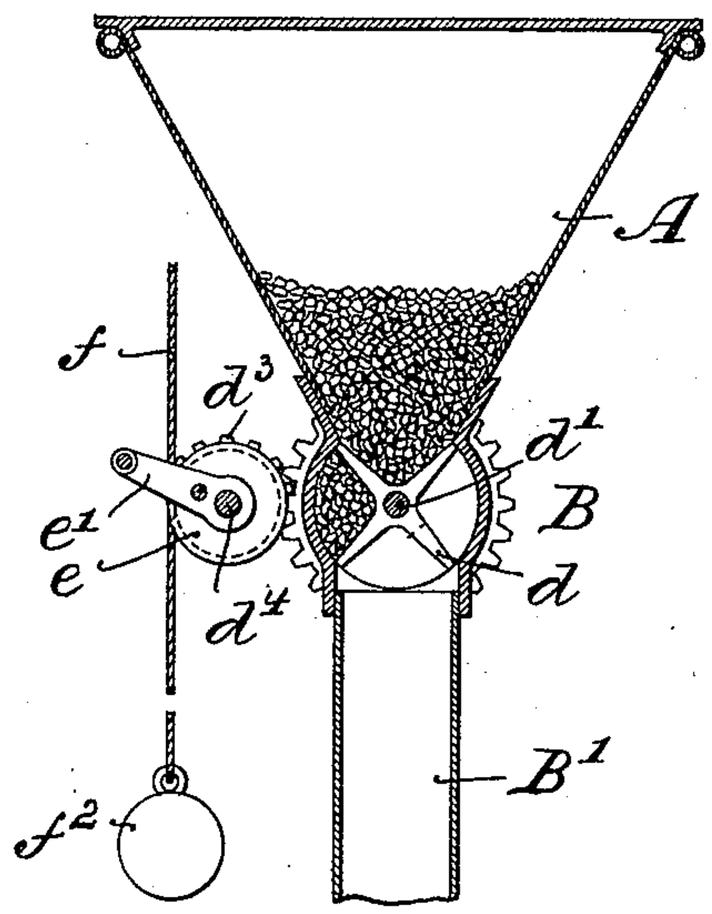
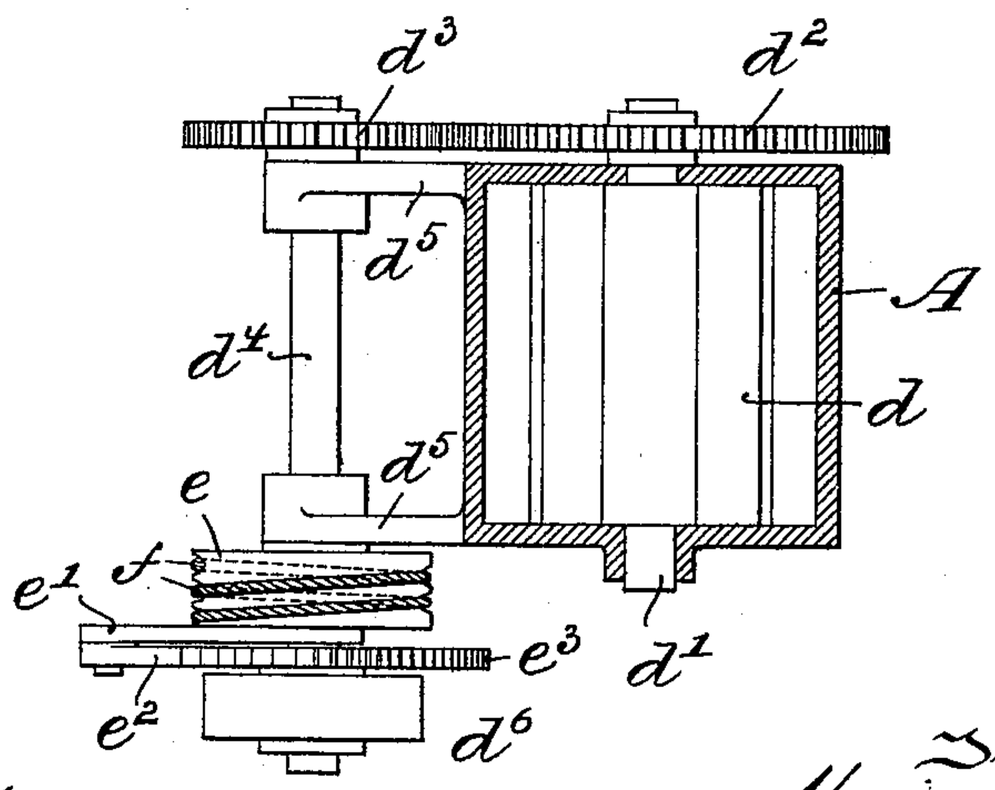


Fig: 4.



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(No Model.) 3 Sheets—Sheet 3.

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Fig. 5.

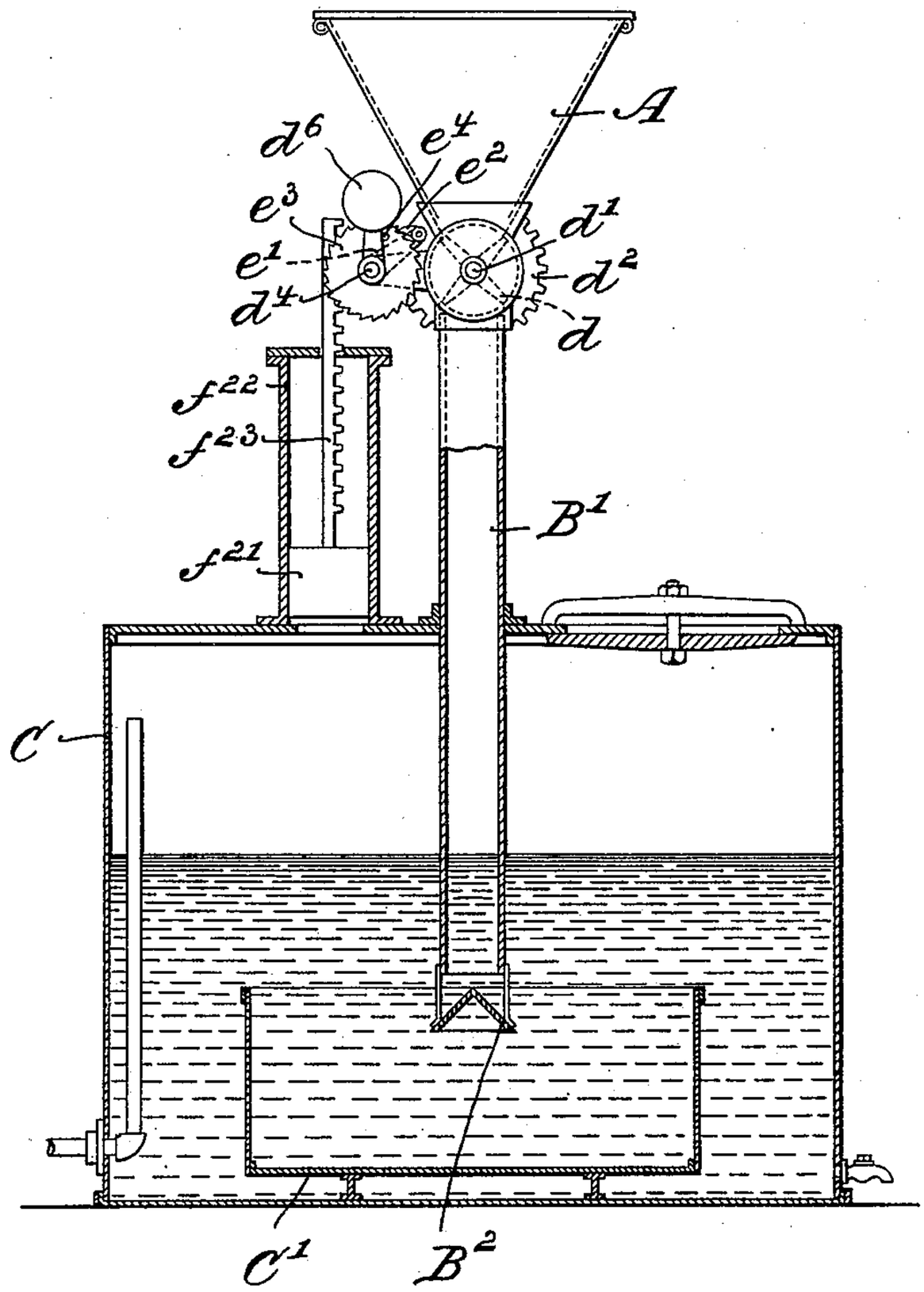


Fig. 6.

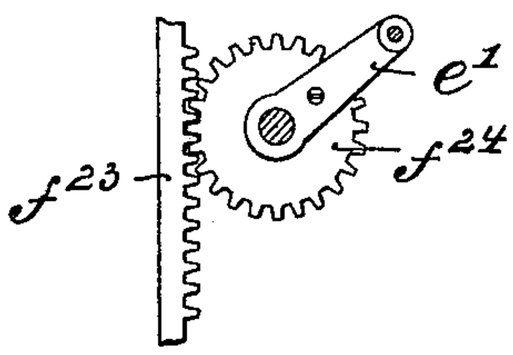
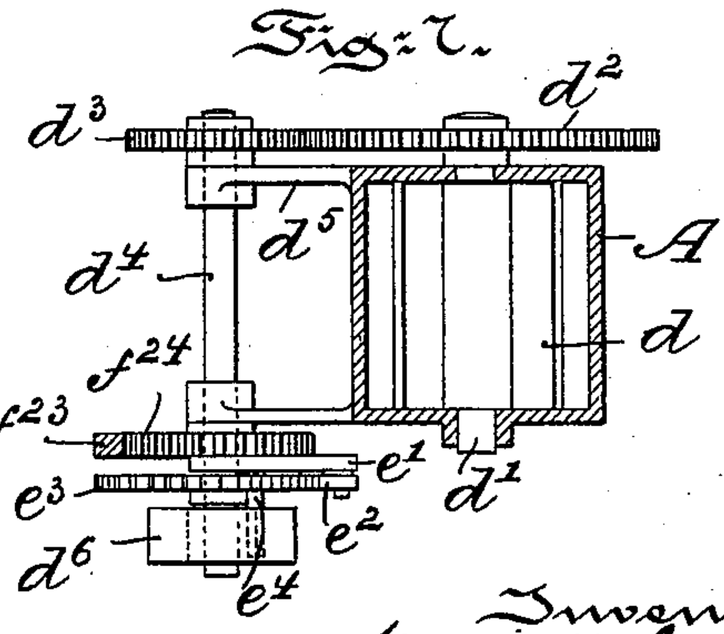


Fig. 7.



Witnesses:
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UNITED STATES PATENT OFFICE.

HENRY H. SUPLEE, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO CORNELIUS E. BAIRD, OF SAME PLACE.

APPARATUS FOR GENERATING ACETYLENE GAS.

SPECIFICATION forming part of Letters Patent No. 606,037, dated June 21, 1898.

Application filed May 24, 1897. Serial No. 637,880. (No model.)

To all whom it may concern:

Be it known that I, HENRY H. SUPLEE, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Apparatus for Generating Gas, of which the following is a specification.

My invention has relation to the production of gas for illuminating and other purposes from calcium carbid or an acetylid and a gas such as is now generally known as "acetylene gas," except that according to my invention this gas is produced in a chemically-pure state or condition, and in which the explosive character of the same as hitherto recognized is reduced to a minimum.

Heretofore acetylene gas has most generally been obtained by permitting water to flow onto calcium carbid in mass, the carbid being introduced into a closed vessel connected with a reservoir or gasometer. The chief means of regulating the production of gas in such type of generators has been the automatic regulation of the flow of water, which has generally been effected by suitable mechanism operated by the rise and fall of a movable dome of the gasometer. Such generators in practice have been found to be unsatisfactory for many reasons, and among them may be mentioned the following: First, the generation of gas does not cease upon the cessation of the flow of water, as the moist carbid continues to give off gas long after the water has been shut off, and hence proper regulation is impossible; second, the chemical action of water upon the carbid creates intense heat, which cannot disperse, since the water penetrates slowly into the interior of the lumps and thereby generates a high temperature, while the outside of the lumps is comparatively cool, gas is at the same time generated in the pores of the mass, and being exposed to this heat dangerous explosions are liable to result, and, third, the use of valves and cocks in such types of apparatus is necessary, and since these valves and cocks are exposed to the freshly-generated and unpurified gas if the valves or cocks are of brass or copper poisonous and detonating compounds of acetylene and copper are produced, and, moreover, they are speedily corroded or disintegrated and work in a very unsatisfactory manner.

The principal object of my invention is to avoid the above-mentioned objectionable features and results incident to the making and use of acetylene gas and to provide an economical, comparatively inexpensive, and efficient apparatus for the production of a reliable or safe and chemically-pure acetylene gas for illuminating and other purposes.

My invention, stated in general terms, consists of an apparatus for generating acetylene gas substantially as hereinafter described and claimed.

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 thereof, in which—

Figure 1 is a front elevational view, partly in section, of an apparatus for generating commercially or chemically pure and non-explosive acetylene gas. Fig. 2 is a front elevational view, enlarged, of the hopper or receptacle for the carbid and of mechanism for feeding by plunging the same beneath a body or volume of water in a sealed generator. Fig. 3 is a similar view, partly sectioned, certain parts being removed to more clearly illustrate a portion of the feeding mechanism. Fig. 4 is a horizontal sectional view of Fig. 2. Fig. 5 is a front elevational view, partly sectioned, of a modified form of apparatus wherein the feed mechanism is controlled directly by the generation of the acetylene gas in the generator. Fig. 6 is a front elevational view, enlarged, of the rack and pinion illustrated in Fig. 5; and Fig. 7 is a horizontal sectional view, enlarged, of the hopper and feed mechanism illustrated in Fig. 5.

Referring to the drawings, A represents a receptacle or hopper into which is introduced calcium carbid or acetylid. This hopper is provided with a feed-governor B and a tube, chamber, or chute B′, through which carbid or acetylid is precipitated or plunged beneath a body or volume of water *b*, maintained in the tank or generating-chamber C, in a manner to be hereinafter more fully explained.

The tank or generating-chamber C is pro-

vided with a removable cap *c*, the cylindrical side of which extends into the body of water *b*, as clearly illustrated in Fig. 1, to form a water-sealed cap or cover and resting at the lower end on preferably a ledge *b'*, formed on the interior wall of the tank or generating-chamber C.

The lower end of the tube, chamber, or chute B' is provided with a cone-shaped hood or base B^2, arranged so that the carbid falling by gravity from the regulated feed will be deflected by the cone-shaped hood or base B^2 directly into the body of water in the vat C', removably mounted in the generating-chamber C, preferably in the manner illustrated in Fig. 1 of the drawings, and hence to avoid dangerous instantaneous overheating or a high temperature being established, as the volume of water in and about the generating-chamber C is maintained in such condition as to prevent undue high temperatures therein and especially during the chemical action of the elements taking place in the generation of the gas for subsequent utilization after thorough purification of the same in a manner to be hereinafter fully explained.

Between the hopper A and chute, chamber, or tube B' is interposed a feed paddle-wheel *d*, provided, preferably, with four paddles or arms, the space between two of which arms is sufficiently large to hold a predetermined quantity of carbid or acetylid delivered to the space from the hopper A and falling into the same preferably by gravity. The shaft *d'* of this paddle-wheel *d* is keyed or otherwise secured to a gear-wheel d^2, which is adapted to mesh at intervals with a pinion d^3, having teeth on only half of its periphery, secured to a shaft d^4, which shaft is suitably supported in bearings d^5 adjacent to and carried by the hopper A. At preferably the opposite end of the shaft d^4 is secured a weighted arm d^6 or tumble-bob lever, and on the shaft d^4 loosely rotates a grooved wheel *e*, carrying an arm *e'* and pawl e^2. The pawl e^2 engages the toothed periphery of a ratchet e^3, loosely rotating on the shaft d^4, and this pawl is adapted when the wheel *e* and arm *e'* are turned in one direction to rotate the ratchet e^3 in the direction indicated by the arrow in Fig. 2.

Around the grooved wheel *e* is wrapped a rope or chain *f*, one end of which is secured to the movable dome *g* of a gasometer G, supplied from the tank or generating-chamber C, in a manner to be hereinafter explained, with the thoroughly-purified and non-explosive gas. The rope or chain passes over suitable pulleys or rollers *f'*, and its other end carries a weight f^2. On the face of the ratchet e^2 is formed a projection or pin e^4, arranged in the path of the weighted arm d^6. The gear-wheel d^2 and pinion d^3 are so arranged with relation to each other that one half-revolution of the pinion d^3 will cause the gear-wheel d^2 to rotate a quarter-revolution.

The operation of the mechanism above described is briefly as follows: As the dome *g* descends from the position indicated in dotted lines to that in full lines the chain or cord *f* will be tightened and the weight f^2 raised. This movement of the cord *f* will rotate the grooved wheel *e*, and the arm *e'*, through the pawl e^2, will advance the ratchet e^3, and its pin e^4 will engage the weighted arm d^6 and raise it gradually to the upright position indicated in full lines in Figs. 1 and 2 from the position indicated in dotted lines in Fig. 1. This movement of the arm d^6 is transferred through the shaft d^4 to the pinion d^3, which then turns with its plane surface out of engagement with the gear-wheel d^2 without rotating the same or the shaft *d'* and paddle *d*. When the weighted arm d^6 reaches this upright position, it indicates that the gasometer G is nearly exhausted, and a farther fall of the dome *g* through the mechanism above described will cause the weighted arm d^6 to tilt beyond the center of gravity and it will fall. The weighted arm d^6 in falling operates the pinion d^3, which has assumed a position in which its teeth mesh with those of the gear-wheel d^2, and the movement of the pinion d^3 through half a revolution will turn the wheel d^2 a quarter of a revolution, thus turning, through the shaft *d'*, the paddle *d* until the paddles discharge a certain quantity of carbid or acetylid into the tube or chute B' to be precipitated or plunged into the tank C', containing a body of water. As the carbid or acetylid passes through and into the liquid of the tank C' gas is readily generated, which finally after purification enters the gasometer G, causing the dome *g* thereof to rise. The rope *f* is relaxed and the grooved wheel *e* moves in a reverse direction, the slack being taken up by the weight f^2. This movement of the wheel *e* causes the pawl e^2, carried by the arm *e'*, to slide loosely over the ratchet e^3 without moving the same, the ratchet only being operated upon the fall of the dome *g* of the gasometer G.

In Figs. 5, 6, and 7 a modification of the feed mechanism hereinbefore described is illustrated which permits of the control of the movement of the feed directly by the gas generated in the chamber C. In this form the rope *f*, grooved wheel *e*, and weight f^2 are replaced by a weighted piston f^{21}, sliding in a cylinder f^{22}, in communication with the generating-chamber C, and carrying a rack f^{23}, adapted to operate a pinion f^{24}. The pinion f^{24} in this case carries the arm *e'* and pawl e^2, engaging the ratchet e^3, and the operation is substantially the same as described, since the rise and fall of the piston f^{21} will operate the parts in a manner similar to the rise and fall of the dome *g* of the gasometer.

In connection with the generation of the acetylene gas, my invention is especially directed to the purification of the gas prior to its delivery to the gasometer G from the generating-chamber C. One practical form or manner and means for purifying such gas is

illustrated in Fig. 1 of the drawings. Within the generating-chamber C is placed a conveying main or pipe *h*, of, preferably, cast-iron or such other material as is not affected by the gas in its impure state or condition within the chamber C. This pipe *h* has its inlet *h'* above the water-level of the chamber C and discharges at h^2, at or near the bottom of the body of water *b*, into a pipe *i*, located in the bottom of a second vessel D, containing a solution of chlorid of calcium, sodium, or other preferred matter. This pipe *i* is perforated, as at *i'*, to permit of the escape of gas in minute streams or particles into and through the solution in the bath of said vessel D. From the upper end of the vessel D extends another pipe *k*, having a perforated extension *k'*, located in the lower portion of a third vessel E, containing a solution of acetate of lead or other suitable substance or matter. These two vessels are respectively provided with draw-off cocks i^3 and k^3, at or about the bottom thereof, and with sealed caps or covers i^4 and k^4 in the tops of the same for filling or other purposes. From the top of the vessel E extends a pipe *m*, which has a perforated extension *m'*, traversing the lower part of a vessel F, containing crystallized chlorid of calcium or other preferred material in lump or other form. This vessel F has a perforated false bottom *n*, and from the upper end of the vessel extends a pipe *o*, entering the base of the gasometer G.

Acetylene gas as produced from commercial carbid contains various impurities, the principal of these being nitrogen, ammonia, phosphoreted hydrogen, arseniureted hydrogen, sulfureted hydrogen, and carbonic oxid. There are also various organic compounds produced—such as benzol, styrol, and similar substances—when the temperature of the carbid is raised; but these latter are not formed when the carbid is plunged under water, and the temperature is thereby kept from rising. The arrangement of generator already described contains a sufficiently large quantity of water to absorb much of the ammonia and sulfureted hydrogen; but the other impurities may be removed by passing the gas through a solution of chlorid of calcium or chlorid of sodium, while the last traces of sulfureted hydrogen may be removed by passing the gas through a solution of acetate of lead. The moisture entrained by the gas, which moisture in the unpurified gas is very troublesome in attacking cocks, valves, and other connections, is entirely removed by passing the gas finally through a vessel containing crystallized chlorid of calcium or an analogous substance or matter.

From the above description it will be understood that the gas generated in the chamber C and partially robbed of its ammonia and sulfureted hydrogen by the water in said chamber C is forced to pass in a divided state through the scrubber D, containing a solution of chlorid of calcium, sodium, or the like, which removes many of the impurities contained in the generated gas and conducted therewith from the generating-chamber C. From the scrubber D the partially-purified gas is forced in a divided state through a solution of acetate of lead or other preferred solution into the scrubber E, which solution removes traces of sulfureted hydrogen contained in the gas only partially purified by the solution of the scrubber D, and finally in the drying cylinder or vessel F all moisture entrained by the gas is entirely removed by the crystallized chlorid of calcium or other preferred substance or matter contained therein and escapes through the perforated bottom *n* to the base of the receptacle F, from whence it may be drained off through the cock *n'*. The gas after it leaves the scrubbers and drying-cylinder hereinbefore explained enters the gasometer in a chemically-purified condition, in which it will no longer attack brass or copper to set up a dangerous detonating or explosive compound and, moreover, is not explosive save at temperatures far above those which occur in the ordinary use of such a gas.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. An apparatus for making commercially-pure acetylene gas, comprising a generating-chamber provided with a feed-hopper having a discharge-chute, a feeding device, consisting of a wheel mounted on a shaft journaled to said chute and provided with paddles, the spaces between two being sufficient to contain a predetermined quantity of carbid delivered thereto from said hopper, a gear-wheel mounted on said paddle-wheel shaft and gearing at intervals with a pinion having teeth on half of the periphery of the same and mounted on a shaft carrying a tumble-bob lever, a ratchet-wheel mounted on said pinion-shaft, an arm carrying a pawl adapted to engage with said ratchet-wheel, means for actuating said feeding device, purifying and drying appliances a gasometer, a pipe connection from said generating-chamber with said purifying and drying appliances and gasometer, the extensions of the pipe connection in said purifying and drying appliances perforated so that in each, the gas is conducted into and through matter in liquid and crystallized form and moisture or liquid is drained off from said drying appliances from the bottom of the same, substantially as and for the purposes described.

2. An apparatus for making commercially-pure acetylene gas, comprising a generating-chamber provided with a feed-hopper having a discharge-chute, feeding devices, consisting of a wheel mounted on a shaft journaled to said chute and provided with paddles, the spaces between two of the same being sufficient to contain a predetermined quantity of carbid delivered thereto from said hopper, a gear-wheel mounted on said paddle-wheel shaft and gearing with a pinion mounted on a shaft carrying a tumble-bob lever, a ratchet-

wheel mounted on said pinion-shaft, an arm carrying a pawl adapted to mesh with said ratchet-wheel, a piston adapted to slide in a cylinder in communication with said generating-chamber, the rod of said piston provided with a rack meshing with a gear-wheel mounted on said pinion-shaft, purifying and drying appliances, a gasometer, a pipe connection from said generating-chamber with said purifying and drying appliances and gasometer, the extensions of the pipe connections in said purifying and drying appliances perforated so that in each, the gas is conducted into and through matter in liquid and crystallized form and moisture or liquid is drained off from said drying appliance from the bottom of the same, substantially as and for the purposes described.

In testimony whereof I have hereunto set my signature in the presence of two subscribing witnesses.

HENRY H. SUPLEE.

Witnesses:
J. WALTER DOUGLASS,
THOMAS M. SMITH.