Oct. 7, 1930. P. DORSEY 1,777,297

AUTOMATIC ACETYLENE GENERATOR

Filed Dec. 29, 1921 3 Sheets-Sheet 1

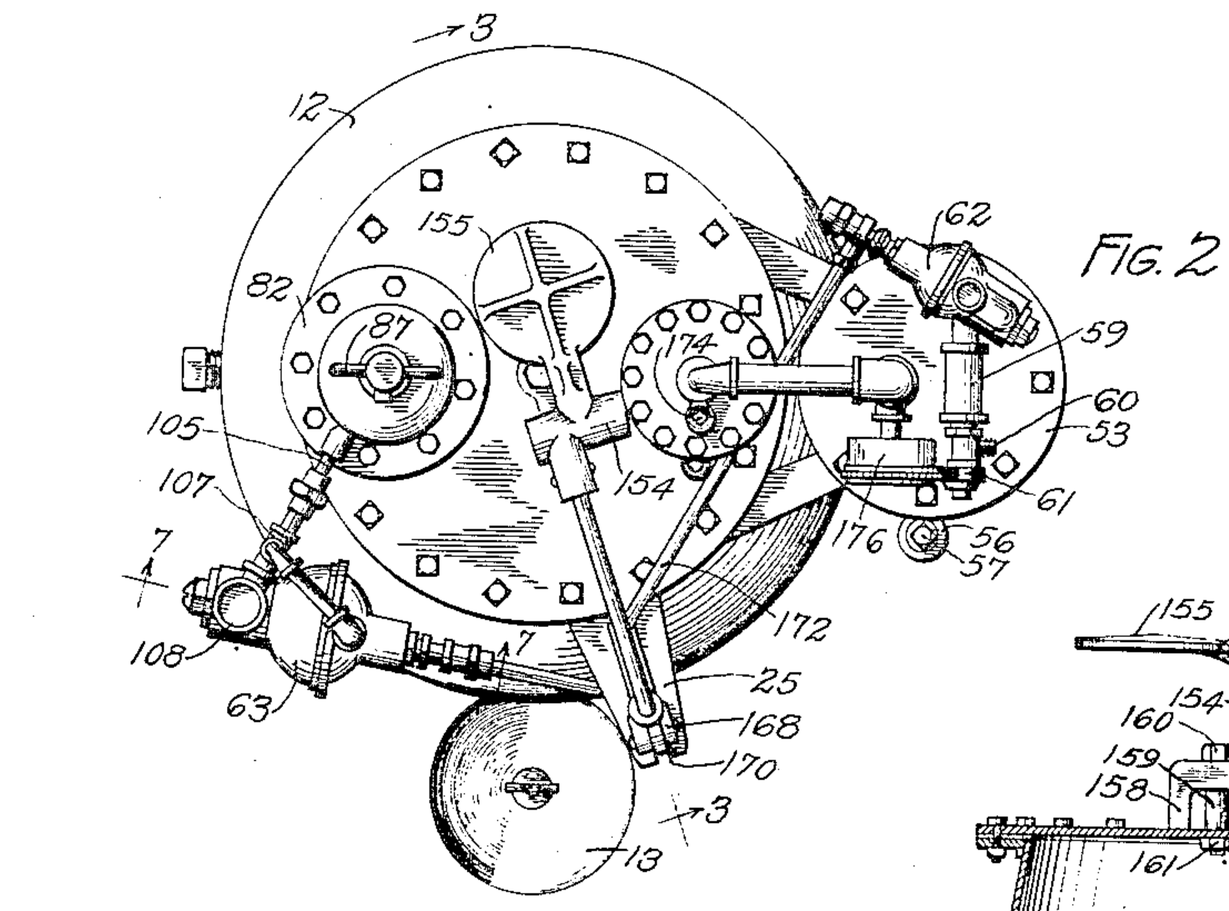

FIG. 2

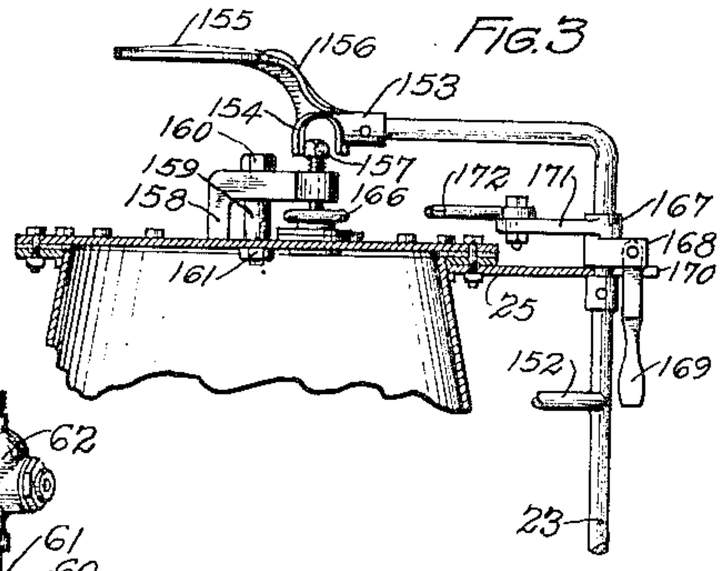

FIG. 3

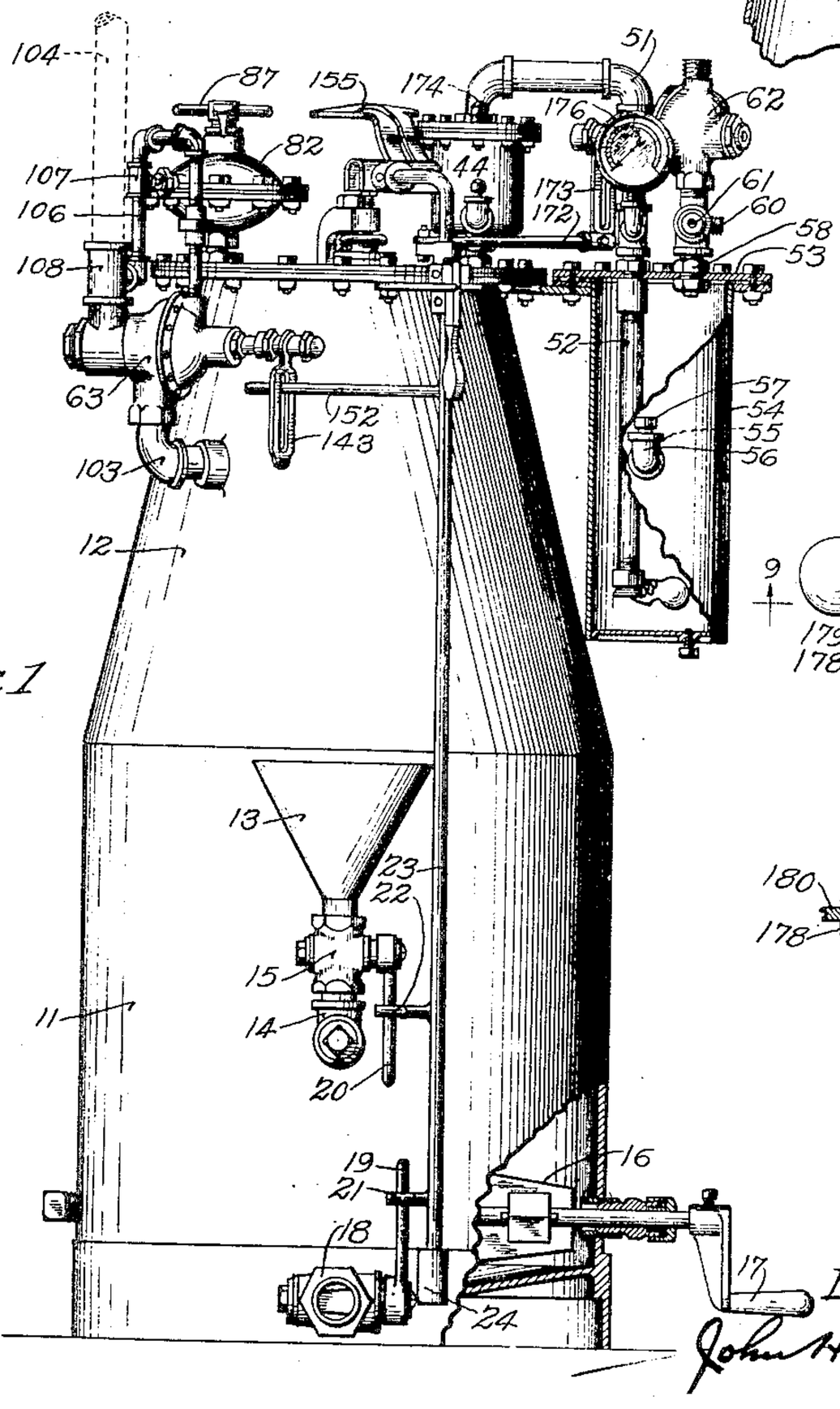

FIG. 1

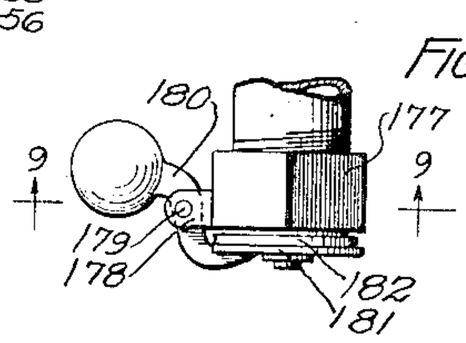

FIG. 8

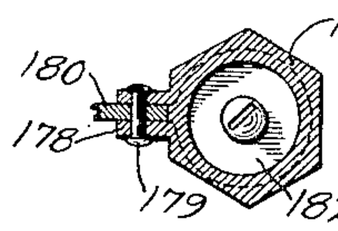

FIG. 9

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AUTOMATIC ACETYLENE GENERATOR

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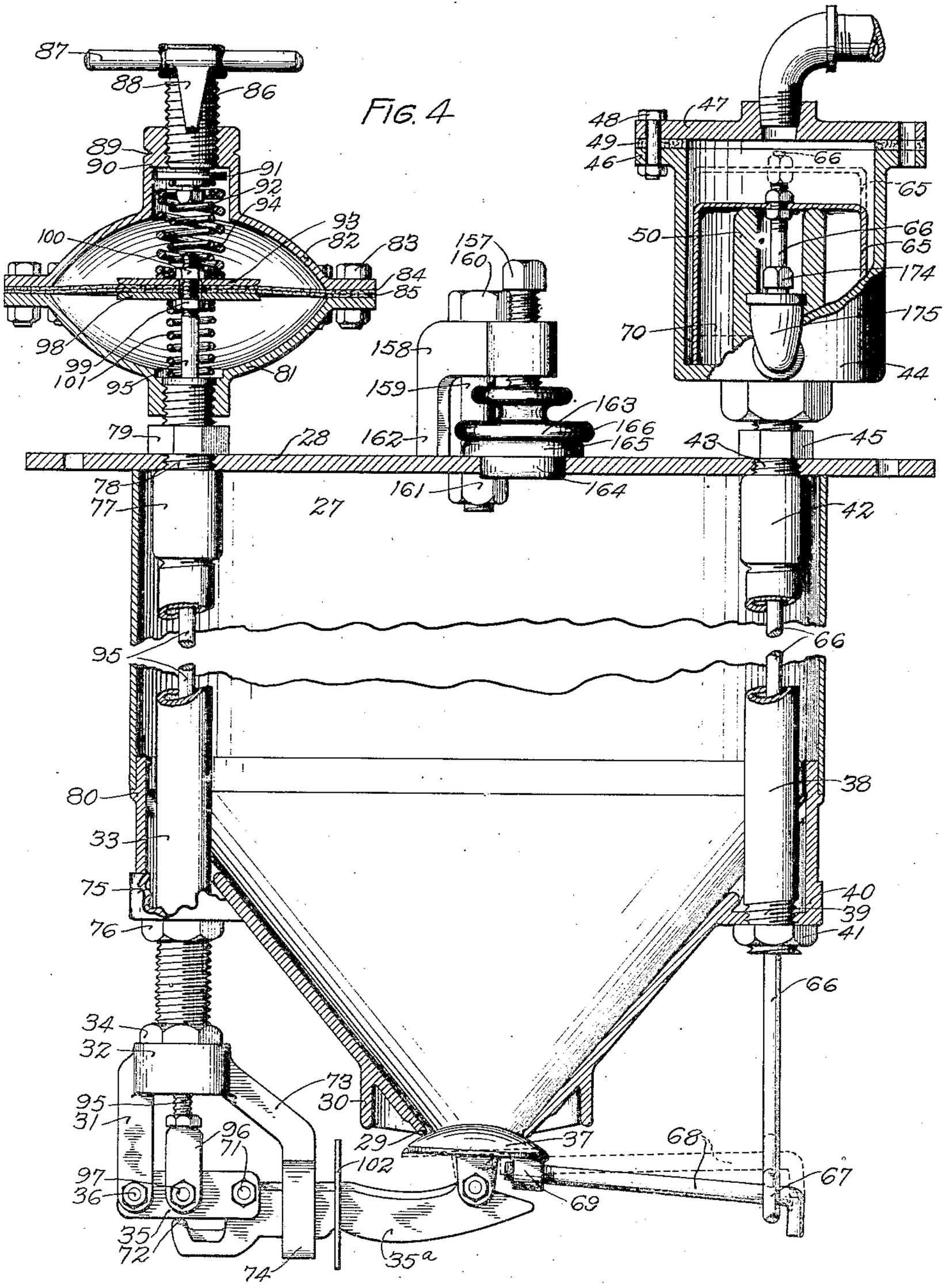
FIG. 4



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Oct. 7, 1930. P. DORSEY 1,777,297

AUTOMATIC ACETYLENE GENERATOR

Filed Dec. 29, 1921 3 Sheets-Sheet 3

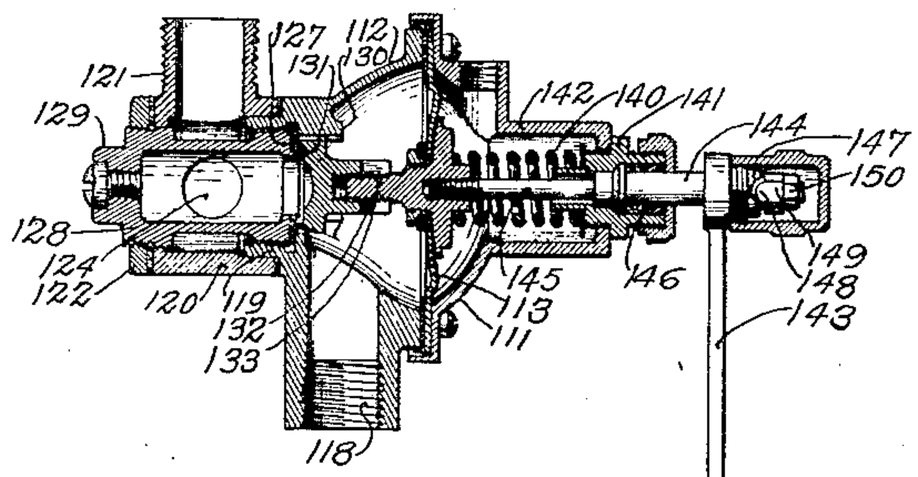

FIG. 7

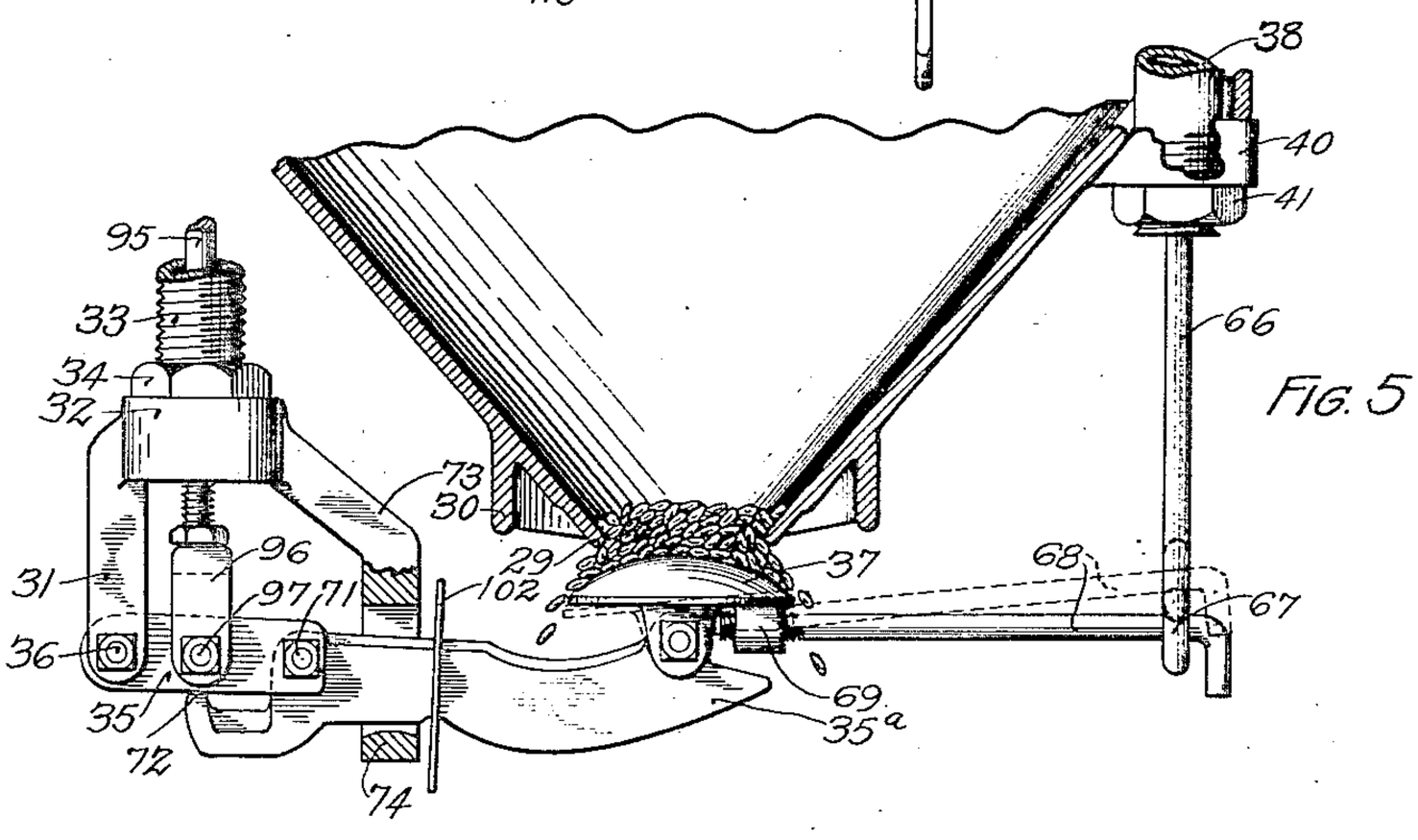

FIG. 5

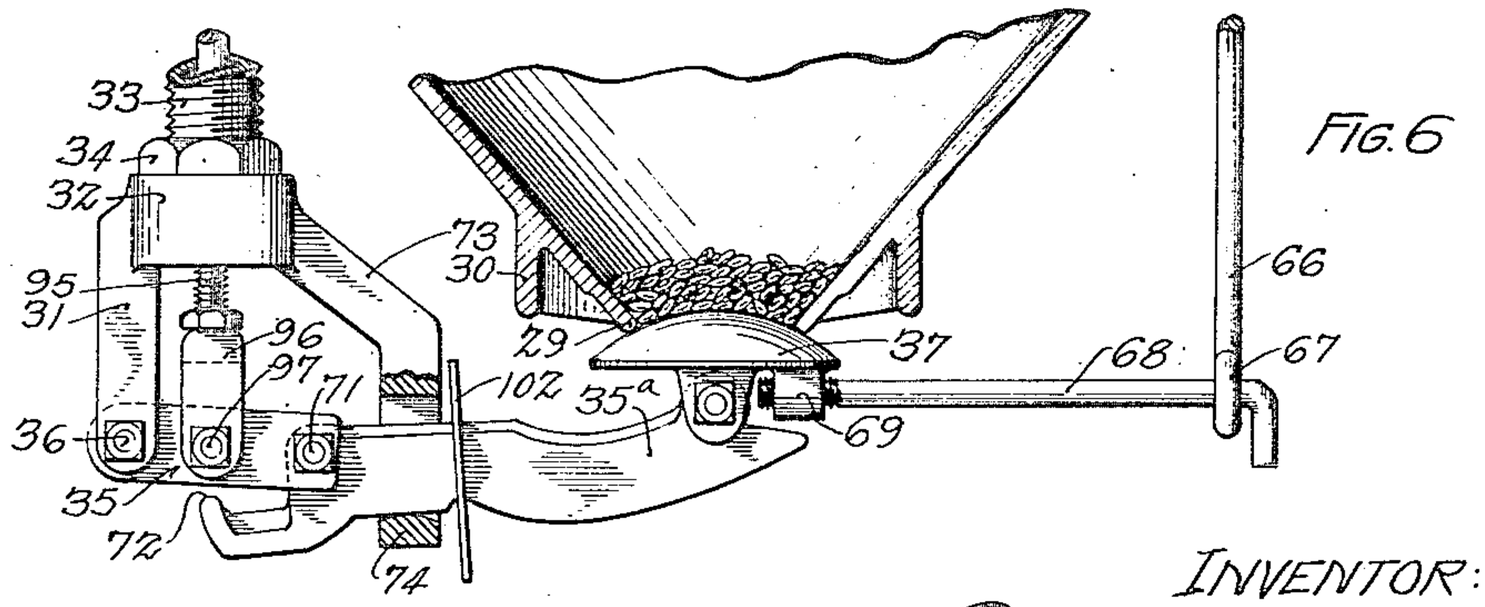

FIG. 6

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Patented Oct. 7, 1930 1,777,297

UNITED STATES PATENT OFFICE

PARMER DORSEY, OF WICHITA, KANSAS, ASSIGNOR TO THE IMPERIAL BRASS MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS

AUTOMATIC ACETYLENE GENERATOR

Application filed December 29, 1921. Serial No. 525,566.

My invention is concerned with a novel feeding mechanism primarily designed for dry chemicals to be employed in generating gas, such as the calcium carbide used in acetylene generators, which feeding mechanism supplies gas at a sufficient pressure to operate any or all of a plurality of torches, and which is so sensitive and accurate in its operation that no gasometer is needed, but it maintains the desired pressure at all times simply by the immediate response of the apparatus to any increase or diminution in the amount of gas being consumed.

To this end, I employ the novel expedient of utilizing the flow of gas in small units from the apparatus as it is consumed as the direct means of positively feeding the carbide so that the amount fed is always directly proportional to the gas consumed, even if the interval of time considered be quite small, as it is so sensitive in its operation that the movement of the carbide ceases instantly if the flow of gas stops and is resumed as soon as the flow starts again, and its rapidity of feed increases as soon as there is an increased flow and in direct proportion to the increase of flow.

My invention is further concerned with such a feeding apparatus as I have described in combination with an adjustable pressure regulating apparatus which determines the pressure at which the gas shall be furnished to the burners, and which when once adjusted, operates automatically to insure the gas being furnished always at the specific pressure for which it is set.

My invention is further concerned with a novel method of and apparatus for keeping the gas at or below a certain desired pressure which operates in a novel manner. In similar devices patented prior to my invention where the feed is actuated by the passage of the gas being used, when the gas pressure gets above a certain limit, the gas is by-passed around the feeding mechanism which is absolutely stopped, with the result that the vapor arising from the heated water in which the carbide is being discharged slacks the carbide in the feeding mechanism and produces a sticky mass that tends to prevent its starting up again when the pressure falls to a point where it should cease to be by-passed and it should begin to operate the feeding mechanism. By my improved method, the gas consumed is not by-passed when the pressure rises above the limit, but it continues to operate the feeding mechanism which however, although still operating, does not permit any of the carbide to be discharged into the water. Although the feeding mechanism continues to operate, the exit from the carbide hopper is kept closed so that the vapor cannot get to the carbide, and if it did, the continued movement of the feeding mechanism would prevent its clogging up and thus preventing the feeding from starting up again when the pressure falls below the set point.

My invention is further concerned with a safety device associated with the pressure regulating device, which will serve automatically to shut off the carbide of calcium feed in case the pressure regulating device becomes disabled, as by breaking the pressure regulating diaphragm, or in case the vent valve is opened to release the pressure in the generator.

My invention is further concerned with a simple attachment whereby the pressure relief valve which permits the acetylene in the generating tank to escape must be opened before either the carbide or the water supply can be renewed or the sludge cleaned out.

My invention is finally concerned with certain novel features and details of the construction of such gas generating apparatus as will be fully described in the specification and particularly pointed out in the claims.

To illustrate my invention, I annex hereto three sheets of drawings, in which the same reference characters are used to designate identical parts in all the figures, of which,—

Fig. 1 is a front elevation of the complete apparatus, with portions of the casing broken away;

Fig. 2 is a top plan view of the same;

Fig. 3 is a vertical section on the line 3—3 of Fig. 2;

Fig. 4 is a vertical section, on an enlarged scale, through the carbide holder and its asso-

ciated valve mechanism, the feed valve being shown as locked from operation;

Fig. 5 is a view of the lower part of the mechanism shown in Fig. 4, but with the valve in feeding position;

Fig. 6 is a view similar to Fig. 5, but with the valve locked in its non-feeding position at the other extreme of the movement of the pressure regulating device from that shown in Fig. 4;

Fig. 7 is a vertical section, on an enlarged scale, on the line 7—7 of Fig. 2;

Fig. 8 (Sheet 1) is a side elevation, on an enlarged scale, of a valve in the flash-back chamber; and

Fig. 9 is a view of the same on the line 9—9 of Fig. 8.

In carrying out my invention in its preferred form, I employ a generating tank 11, strongly constructed of sheet metal, and preferably consisting of the cylindrical lower portion and a truncated, conical upper portion 12. The water in the generating tank normally stands at a level substantially that of the top of the funnel 13 by which the water supply is renewed, said funnel being connected by a T 14 with the interior of the tank, and being controlled by the shut-off cock 15. The bottom of the tank will be provided with the customary agitator 16 for the sludge, which co-operates with the bottom thereof and has the handle 17, by which it is turned, extended out through a suitable packed bearing in one side of the casing. The bottom of the tank has the flush-out cock 18, and the handle 19 of the flush-out cock and the handle 20 of the water-supply cock, when they are closed, stand in the path of the hooks 21 and 22 carried by the vertical locking rod 23 journaled in a bearing 24 at the bottom of the tank and in a bearing piece 25 projecting from the top of the tank. Except for the rod 23, the parts so far described may be of a construction already known in the art.

The carbide feeding mechanism

Referring now to Figs. 4, 5 and 6, the carbide hopper 27 is secured on the under side of the top 28 of the casing, and preferably consists of the main cylindrical portion, preferably composed of sheet metal, and the truncated, conical bottom portion, preferably a casting, which terminates in a circular feeding aperture 29. The bottom portion is preferably provided with an annular flange 30 extending downward on the outside thereof to prevent any moisture which may condense on the outside of the upper portion of the hopper from running down to the feeding aperture and moistening the carbide at that point. Suitably supported below the bottom of the hopper, as by a fork 31, forming a part of a bracket 32, threaded onto the lower end of the pipe 33 and secured by the lock nut 34, is the lever 35, which is fulcrumed in the fork 31 at 36. For the purpose of the present description, this lever may be considered as an ordinary lever or arm having the mushroom-shaped valve 37 loosely pivoted on its outer end so that the valve is free to rock thereon, as indicated in the dotted-line position of Figs. 4 and 5, Fig. 5 representing the position of the valve 37 when the apparatus is feeding. The carbide employed is granular and of a certain small size, and with the parts shown in the full-line position of Fig. 5, some particles of the carbide rest on the top of the valve 37 and are caught between it and the edges of the feeding aperture 29. If this valve 37 is not moved, no feeding action can occur.

To move this valve in accordance with the flow of the gas from the generator, I preferably employ the following mechanism: A tube 38 extends vertically upward adjacent the edge of the carbide holder, its lower threaded end passing through an aperture 39 formed in the offset 40, and is locked in place by a set nut 41. While the tube itself might be extended up through the top of the hopper, I preferably thread its upper end into the double-nut connection 42, into the upper end of which is threaded the short pipe 43 which extends up through an aperture in the top 28 of the casing, and is threaded into the bottom of the vibrator casing 44. A lock nut 45 on the threaded section 43 serves to secure the parts in position. The vibrator casing 44 preferably takes the form of a cup having an outwardly projecting flange 46 at its top, with which co-operates a cover cap 47 secured thereto by screws 48, a tight joint being secured by interposing the packing ring 49. A tube 50, preferably formed integral with the casing 44, extends upward from its bottom concentrically with the tubes 38 and and 43. A short pipe (see Figs. 1 and 2) is secured in the cap 47 and is connected by the elbow 51 with the pipe 52, which is passed by an air-tight joint through the top 53 of the flash-back chamber 54, which also serves as a gas-purifying chamber, and the pipe 52 extends to a point near the bottom of said chamber. This chamber 54 is filled with water or some suitable gas-washing liquid to the water level 55, which water level may be initially determined by the filling cup 56 secured in the side of the casing and closed by the cap 57 screwed into the top thereof. A pipe 58 opening into the top of the flash-back chamber is provided at its upper end with a T 59, one end of which is connected to a nipple 60 for a hose leading to a torch, the passage of the gas from the nipple being controlled by the valve 61. The other end of the T is connected to the safety valve 62, the construction of which will be described at length in connection with the main safety valve 63 secured to the body of the tank.

With the connections thus far described, it will be obvious that the generated gas from the tank 11 will flow up through the tubes 38 and 43 into the casing 44, and on through the tube 52 up through the purifying liquid, and finally out through the nipple 60 to the torch, provided the valve 61 is open and the torch is operating. While I have shown the apparatus as provided with a nipple for one torch only, in the larger sizes, the T 59 is constructed as a header and furnishes nipples for a plurality of torches. It will also be apparent that all the gas delivered for use must pass through the casing 44, and that it will pass at a rate that depends entirely on how fast the gas is being used.

To utilize the passing gas to vibrate the valve 37, I place in the casing 44 an inverted cup or bell 65, which has a rod 66 secured centrally in the inverted bottom thereof, and extending down through the tubes 43 and 38 and terminating in the eye 67, through which extends a turned-down end of the link 68, the other end of which is screwed into the lug 69 formed on the under side of the valve 37. The chamber 44 has a liquid seal 70 therein, preferably composed of water, and it will be obvious that the gas rising through the tube 38 under a continually increasing pressure, raises the bell 65 until ultimately it is lifted high enough to break the seal, when the gas under increased pressure in the bell is suddenly released into the casing 44 and the bell falls, again closing the seal so that the compression of the gas in the bell is immediately resumed, and thus the movement of the bell up and down continues at a rate that will vary directly as to amount of the gas being consumed. This upward and downward movement of the bell is transmitted through the rod 66 to the valve 37, and causes the same to vibrate, and thus shake out a small quantity of the carbide every time the bell is lifted sufficiently to break the seal. If the valve 61 is closed, or the torch shut off so that the gas ceases to flow, it will be obvious that the feeding of the carbide stops immediately, and the feed of the carbide is so frequent and the amount fed at each time so small as compared with the volume of water in the reservoir, that the pressure does not vary substantially so long as the position of the lever 35 remains unchanged, and, furthermore, the small rate of feed with the large volume of water and the exposed radiating surface of the tank prevent the apparatus from ever being materially heated, so that I have found by practice that it can be run indefinitely without overheating.

The pressure regulating mechanism

Instead of having the lever 35 consisting of a single rigid bar, I preferably provide it with a joint formed by the rivet 71 co-operating with the fork forming the inner end of the short section of the lever 35, and with the adjacent end of the long section 35^a of the lever, to the outer end of which the valve 37 is loosely pivoted, as heretofore described. The section 35^a of the lever has the tail piece 72 co-operating with the under side of the short section of the lever 35, so that when the lever is pulled up, as shown in Fig. 4, the two parts will move together rigidly, whereas it is possible for them to break the joint slightly when the lever is shoved down, as shown in Fig. 6. An arm 73 of the bracket 32 has a loop 74 in its lower end, through which the arm 35^a extends, so that when the lever 35 is thrust down, as seen in Fig. 6, the adjacent under edge of the section 35^a engages the bottom of the loop, which now acts as a fulcrum for that part 35^a of the lever which acts independently and has its inner end thrust up, as shown in Fig. 6, until the valve 37 is seated against the feeding aperture 29, and any further feeding is prevented.

The tube 33 passes up into the carbide holder through an opening in the bottom of the boss 75 corresponding to and preferably diametrically opposite to the boss 40, and that end is locked in place by the lock nut 76. This tube 33 might extend up through the top 28 of the casing, but I preferably terminate it in the double nut 77, which is threaded onto the short tube 78 extending through an aperture in the top of the casing and having a lock nut 79 to secure the tube 78 relative to the carbide holder. It will be noted that the extension forming the truncated conical bottom of the carbide holder is provided with an annular flange 80 forming a seat for the sheet-metal cylindrical portion, so that by the use of the tubes 33 and 38 and the lock nuts 41, 45, 76 and 79, the parts are clamped together.

The upper end of the short tube 78 is threaded into an aperture in the lower half 81 of the casing for the pressure regulating device, the upper half 82 thereof being connected thereto by screws and bolts 83, and the pressure-regulating diaphragm is preferably formed of two disks, 84 and 85, which are preferably formed of leather and rubber, respectively, and have their edges secured by being clamped between the peripheries of the halves 81 and 82 of the casing. Threaded into an aperture in the top section 82 of the casing is the adjusting screw 86, which is preferably provided with a handle 87, and a pointer 88, the tip of which is brought into register with an annular groove 89 formed in a cylindrical boss 90 constituting the top of the section 82 when the pressure regulating device is adjusted to begin the feeding operation. The reduced lower end of the screw 86 is provided with a disk 91, which cooperates first with the upper end of the helically-coiled expanding spring 92 extend-

ing down to the disk 93 secured on top of the diaphragm, and, second, with the top of the larger and stiffer helically-coiled expanding spring 94, surrounding the spring 92, and like it seated on the top of the disk 93. A rod 95, extended down through the tube 33 and having on its lower end the fork 96 by which it is pivoted by the pin 97 to the lever 35, has its threaded upper end passed through apertures in the diaphragms 84 and 85, the disk 93 and the corresponding disk 98 on the under side of the diaphragm 85, a pair of nuts 99 and 100 co-operating with the threaded end of the rod 95 serving to secure the parts together and to bring the diaphragm in its proper vertical adjustment relative to the lever 35. A weaker helically-coiled expanding spring 101 is placed between the disk 98 and the top of the tube 78, and opposes the action of the springs 92 and 94.

When the apparatus is not in use, the screw 86 is turned out, as indicated in Fig. 4, until there is no tension on the springs 92 and 94, in which case the spring 101 comes into action and forces the diaphragm up until the lever 35 is drawn up to the limit of its movement, in which the valve 37 is seated against the feeding aperture 29 and the carbide feed is locked from operation. When the feeding is to begin, the screw 86 is turned until the spring 92 is compressed enough for the disk 91 to engage the spring 94, and the compression of these combined springs overcomes the tension of the spring 101, with the result that the diaphragm is eventually lowered until the valve 37 is unseated from the feeding aperture 29. As soon as this unseating is sufficient to allow the carbide to pass between the edges of the aperture and the top of the valve, the generation of the gas begins, and it will be obvious that the further down the screw 86 is forced, the more carbide can escape until the under side of the section 35[a] of the lever engages the bottom of the yoke 74, as seen in Fig. 6, at which time the continued downward movement of the rod 75 forces the valve 37 upward, so that by turning the screw 86 down far enough, the parts assume the position shown in Fig. 6, with the carbide feed locked, as before. When the screw is in an intermediate position, between the two locking positions, the valve 37 will stand at a certain distance from the aperture 29, thus allowing a certain amount of the carbide to be fed out at each movement of the cup 65. If the pressure becomes too high, the diaphragms 84 and 85 are moved up against the pressure of the springs 92 and 94, and the lever 35 is lifted, bringing the valve 37 closer to the edge of the aperture 29, thus diminishing the amount of the carbide that will be fed out at each movement of the bell 65. On the other hand, if the pressure gets too low, the springs 92 and 94 will thrust the diaphragm down below the normal position for which it is set, moving the lever 35 down and carrying with it the valve 37 so as to increase the quantity of carbide that is fed at each movement of the bell 65. This forms a very sensitive pressure regulating apparatus, which, combined with the feeding mechanism controlled by the amount of gas consumed, produces a steadiness and reliability of operation that is not found in any other acetylene-generator apparatus with which I am acquainted.

A very marked benefit in the operation of these devices results from the fact that the feeding mechanism never stops its operation while the gas is being consumed. As above noted, if the pressure tends to get too high, the valve 37 is brought close to the aperture 29, and the amount of carbide fed at each movement of the bell 65 is reduced, thus correcting the tendency. If by any accident, such for instance as opening up the feed too high in starting it, the pressure actually gets too high, the valve 37 is brought into actual contact with the aperture 29, and no carbide can be fed, although the feeding mechanism continues to operate; i. e. the valve 37 is swung on its pivot by the continual reciprocation of the cup 65 as the gas is drawn off in use. This keeps the grains of carbide (about the size of grains of wheat) that are in contact with the valve agitated, and if the vapor of water arising from the container should get into the bottom of the hopper 27, between the valves 37 and the aperture 29, and tend to slack the adjacent carbide, it cannot clog up the opening because it is kept in motion by the continued swinging of the valve 37. In similar devices of the prior art, where the gas used is by-passed when the pressure becomes excessive, and all movement of the feeding mechanism is stopped, the more or less exposed carbide is slacked by the vapor arising from the water which becomes heated, sometimes to the steaming point, by the chemical reaction due to the carbide falling therein. This slacking of the carbide, if the gas used is by-passed for a long enough time, as where very little is being consumed, may cause the feeding mechanism to be clogged to the extent that it will not resume operation automatically when the pressure falls below the by-passing limit.

Safety devices

As before stated, when the screw 86 is in either extreme position, the carbide feed is locked from operation, and in starting up the feed where there is no pressure, the screw can be turned up and down, thereby raising and lowering the valve 37 until sufficient carbide has been delivered to start up the pressure so that the operation can begin, and the

feed continued by the reciprocation of the bell 65, when the torch is used.

In case of an accident to the diaphragms 84, 85, such as a rupture, the gas will rise through the rupture, thus equalizing the pressure on both sides, in which case the pressure of the springs 92 and 94 will be sufficient to overcome the pressure of the spring 101 and force the link 95 downward to the position shown in Fig. 6, where the lever section 35ª engages the bottom of the loop 74 and swings the valve 37 up to its closed position. I have found that sometimes there is a tendency for the carbide to be discharged into the loop 74, and thus interfere with the operation of the lever, and to prevent the possibility of this, I form or secure upon the lever section 35ª the disk or shield 102, which deflects any carbide discharged toward the loop 74 away from it.

For the purpose of reducing the pressure in the generating tank in case it should become excessive, I employ the pressure relief valve 63, previously mentioned, which is suitably connected by short pipes and the elbow 103 with the interior of the generating tank, as shown. The outlet pipe 104 from the safety valve is led to some point outside the building, where the discharge of acetylene-gas fumes cannot possibly do any harm; and to allow the escape of the gas and the consequent locking of the carbide-feeding mechanism in case of the rupture of the diaphragms 84 and 85, I connect by short pipes 105 and 106 and the T 107 the upper half of the pressure-regulator casing with the T 108, which connects the pipe 104 with the pressure relief valve 63.

While I might employ any suitable form of a safety valve, I preferably employ the form illustrated in Fig. 7, which is the same as that shown in an application of myself and Robert D. McIntosh, No. 491,651, filed August 12, 1921. This pressure relief valve has a casing consisting of two halves, 111 and 112, each half being circular in cross section through most of its length, and the two castings having their adjacent ends hollowed out to form a chamber on each side of the diaphragm 113, which is clamped between the annular flanges carried by the peripheries of the two halves. The casing 112 is provided with an internally-threaded inlet 118 connected to the elbow 103. Located concentrically on the casing 112 is an annular seat or flange 119, on which is adjusted in any desired position the outlet sleeve 120, which has a threaded outlet extension 121 on one side thereof, which extension is connected to the T 108. This sleeve 120 is secured at any desired angle by simply turning the sleeve on its seat, where it is secured by a lock nut 122 co-operating with the treads on the outer end of the hollow plug 124, the threaded inner end of which is screwed into the outlet passage formed in the casing 112. An annular channel is formed in the inner end of the plug and has seated therein the annular valve seat 127, which is composed of rubber or some similar substance or composition. The hollow cylindrical plug 124 has openings 128 in its sides so that the gas can pass out through the port 121 in any position of the plug, which has its outer end 129 made square or hexagonal so that a wrench can be applied thereto. The inner face of the chamber in the casing 112 has formed therein three projections 130, one only of which is seen, which serve to guide the valve 131 to its seat 127, this valve preferably taking the form of a sharp flange on the edge of a disk secured on the internally-threaded split sleeve 132, which is adjusted on the reduced, threaded end 133 of the diaphragm-engaging plug which has the disk-shaped end with its face adjacent the diaphragm curved, as shown, to cooperate with the diaphragm, which is held against it by a lock nut screwed on a threaded portion and engaging a washer, which in turn engages a packing ring, which is thus clamped against the diaphragm 113. The diaphragm 113 is shaped somewhat like the end of an oil can so that it tends to remain in either the open or closed position of the valve, once it has passed the center between the two positions.

For the purpose of applying the desired pressure to the outer face of the diaphragm 113, a helically-coiled expanding spring 140 is interposed between the adjacent face of the disk and the adjusting plug 141, threaded into the end of the tubular extension 142 of the half 111 of the casing.

The mechanism thus far described furnishes a safety release valve, but in order that the same may be released manually, it is provided with a handle 143, secured on the end of a sleeve 144 surrounding the stem 145 which is secured in the disk associated with the diaphragm 113. This sleeve 144 is journaled in a stuffing nut 146, which is threaded into the extension 142 of the casing, and in order that the turning of the handle 143 shall withdraw the rod 145, and thus open the valve, I provide on the hub of the handle a pair of diametrically opposed, substantially semicircular recesses 147, which co-operate with complementary lugs 148 formed on the nut 149 locked on the end of the rod 145 by the lock nut 150. A cap 151 threaded onto the hub of the handle 143 serves to cover the cam mechanism thus described. With this construction, it will be obvious that in the position of the parts shown in Fig. 7, which is the normal position, with the handle 143 extending vertically downward, the safety valve is closed, but is free to be opened by excessive pressure on the diaphragm 113. When the handle 143 is swung in either direction from the vertical, the recesses 147

acting on the lugs 148 serve to cam the stem 145 outward to open the valve manually. The tension of the spring 140 is adjusted for any desired pressure, such as fifteen pounds to the square inch, and as soon as that pressure is reached, the pressure on the diaphragm 113 is sufficient to overcome the pressure of the spring 140 on the opposite side enough to lift the valve off its seat, and thus allow the gas to escape. The spring action of the diaphragm 113 serves to cause the valve to open quickly and allow the rapid escape of the gas.

The handle 143 is, as seen in Fig. 1, slotted, and the vertical rod 23 previously mentioned has an arm 152 extending into the slot, so that when the shaft 23 is turned to permit the handles 19 and 20 to be turned to open their respective valves, the safety valve is opened, so that the accumulated gas in the tank will be discharged and the cleaning and refilling can proceed without danger.

I preferably employ this same rod 23 to prevent the carbide chamber being filled until the safety release valve is opened, and for this purpose I turn over the upper end of the rod 23, as shown, at right angles and secure it in the projection 153 of a casting which is composed of a channel portion 154 and a disk-like extension 155, which is raised some distance above the portion 154 by the connecting neck 156. The channel 154 extends over the screw bolt 157 that is threaded through the end of the L-shaped piece 158, best shown in Fig. 3, which rests on the sleeve 159 surrounding the bolt 160, which is threaded through the top 28 of the casing and is secured by a nut 161 on the lower end thereof. The downwardly extending arm 162 of the L-shaped piece 158 engages the top 28 of the casing, and the bolt 157 is turned down into a recess formed in the center of the top of the plug 163, which is seated in the filling aperture 164, the joint being preferably made air tight by interposing the rubber gasket 165 between the flange 166 forming a part of the plug 163 and the edge of the aperture 164. When the rod 23 is in its locking position prior to the opening of the safety relief valve, the channel-shaped portion 154 extends over the bolt 157 and prevents the latter being screwed up to release the plug and permit of the hopper being filled. The extension 155 is so shaped and located that when the screw 86 is in its operative position, it will be in the path of the extension 155 and prevent the rod 23 being turned to its releasing position, and consequently before the rod can be so turned, the screw 86 has to be turned down far enough so that the parts are brought into the position shown in Fig. 6, where the carbide feed is securely locked against any possible further delivery of the carbide while the safety devices are open.

I preferably provide the locking rod 23 with a hub 167 just above the bearing piece 25, and this hub has a pair of ears 168 projecting therefrom, between which are pivoted the operating handle 169, which is normally swung down into a recess 170 formed in the end of the bearing piece 25, so that the rod 23 is held locked in its safety position, and before it can be turned, the handle 169 has to be turned up out of the locking recess. I also preferably provide on this hub 167 an arm 171, which is pivotally connected by a link 172 with the handle lever 173 of the safety release valve 62, which corresponds in its construction with the more fully described main safety-release valve 63, so that when the shaft 23 is turned, the safety release valve 62 is also opened and releases the gas in the flash-back casing 54.

The water 70 for the sealing liquid in the vibrator casing 44 may be poured therein through an aperture formed in the top of the casing and normally closed by the plug 174. The level of the sealing liquid may be determined by the angular pipe 175 screwed into the side of the lower portion of the casing and having its upper end closed by a screw plug. A pressure gauge 176 is connected with the pipe 52, and shows the pressure of the gas as supplied to the torch. The pipe 52 has secured to the bottom thereof the check valve shown in Figs. 8 and 9, which preferably consists of the hexagonal nut 177 screwed onto the bottom of the pipe 52 and having a valve seat formed on the bottom thereof. A pair of ears 178 extending from the side of the nut furnishes the bearings for the pivot 179 of the lever 180, having the weight on the outer end thereof, while its inner end takes the form of a disk 181 having secured thereon a rubber washer 182 which co-operates with the valve seat. The gas flows down through the tube 52 and opens the hydraulic check valve just described, as much as may be necessary, and rising through the water washes and cools the gas. This check valve also serves as a seal to prevent any possible back firing affecting the generator, as if the torch should back fire and explode the gas in the cylinder 54, it could not force the water back up through the pipe 52, and thus permit the flame to get to the gas in the generator.

While I have shown and described my invention as embodied in the form which I at present consider best adapted to carry out its purposes, it will be understood that it is capable of modifications, and that I do not desire to be limited in the interpretation of the following claims except as may be necessitated by the state of the prior art.

What I claim as new, and desire to secure by Letters Patent of the United States, is:

1. In an apparatus for feeding dry chemicals to generate gas, the combination

with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, a valve supported below an annular outlet from the hopper so that some of the chemical is caught and held between the edge of the outlet and the valve, a member on which the valve is loosely supported, adjustable to and from the outlet so as to vary the rate of the discharge of the chemical, and means for jarring the valve without moving the member to displace some of the chemical each time a measured quantity of gas passes through the conduit.

2. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a conduit through which the generated gas is delivered, means for gradually feeding the contents from one holder to the other positively actuated by the flow of the gas through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of the feed at each actuation according to the adjustment of the pressure responsive device.

3. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a conduit through which the generated gas is delivered, means for gradually feeding the contents from one holder to the other positively actuated each time a measured quantity of gas passes through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of the feed at each actuation according to the adjustment of the pressure responsive device.

4. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a conduit through which the generated gas is delivered, means for gradually feeding the contents from one holder to the other positively actuated at intervals varying in frequency directly as the rate of flow of gas through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of the feed at each actuation according to the adjustment of the pressure responsive device.

5. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a single valve cooperating with a single valve seat for controlling the feed from one holder to the other, a movable member subject on one side to the pressure of the generated gas, a spring acting against its other side, and connections from the movable member to the valve to control the pressure of the gas generated, said connections being so constructed that the valve will be moved to its closing position if the gas pressure ceases to oppose effectively the action of the spring.

6. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a single valve cooperating with a single valve seat for controlling the feed from one holder to the other, a movable member subject on one side to the pressure of the generated gas, a spring acting against its other side, and connections from the movable member to the valve to control the pressure of the gas generated, said connections being so constructed that the valve will be moved to its closing position at either of the extremes of the possible movement of the movable member.

7. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, mechanism for feeding the chemical from the hopper to the tank actuated at intervals by the movement of the gas through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of chemical fed at each actuation according to the adjustment of the pressure responsive device.

8. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, mechanism for feeding the chemical from the hopper to the tank positively actuated each time a measured quantity of gas passes through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of chemical fed at each actuation according to the adjustment of the pressure responsive device.

9. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, mechanism for feeding the chemical from the hopper to the tank positively actuated at intervals varying in frequency directly as the rate of flow through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of chemical fed at each actuation according to the adjustment of the pressure responsive device.

10. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, a valve supported below an annular outlet from the hopper so that some of the chemical is caught and held between the edge of the outlet and the valve, means for jarring

the valve to displace some of the chemical each time a measured quantity of gas passes through the conduit, an adjustable pressure responsive device, and connections from the pressure responsive device to the feeding mechanism to determine the amount of chemical fed at each actuation according to the adjustment of the pressure responsive device.

11. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a valve seat between them, a valve co-operating with said seat, a jointed lever by which the valve is supported, means connected to the lever to move it to and fro, and an abutment for the lever so that the valve will be moved to closing position at the limit of the movement of the lever in either direction.

12. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a valve seat between them, a lever having a joint therein which can break if the lever is moved in one direction but which is held from breaking if it is moved in the other direction, a valve loosely supported on the end of the lever, and connection to the lever between its fulcrum and the joint for moving it in either direction.

13. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a valve seat between them, a lever having a joint therein which can break if the lever is moved in one direction but which is held from breaking if it is moved in the other direction, a valve loosely supported on the end of the lever, a secondary fulcrum for the lever between the joint and its load end, a pressure responsive device, and connections from the pressure responsive device to the lever between its fulcrum and the joint so that the valve will be moved to its closing position when the pressure responsive device is forced to either extreme of its movement.

14. In an acetylene generator, the combination with a generator tank, of carbide feeding means, a portion of said means consisting of a casing adapted to contain a liquid through which the gas drawn from the tank passes, a bell in the casing beneath the lower edge of which the gas escapes in bubbles through the liquid in the casing in which the edge of the bell is immersed as it passes out of the casing, a gas purifying chamber adapted to contain a liquid, a pipe extending from the top of the casing to near the bottom of the gas purifying chamber, and a check valve on the end of the pipe in the gas purifying chamber adapted to prevent any rapid upward movement of the liquid therein.

15. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a valve seat between them, a lever having a joint therein which can break if the lever is moved in one direction but which is held from breaking if it is moved in the other direction, a valve supported on the end of the lever, an auxiliary fulcrum for said lever, and a shield on the lever, means for moving the lever thereby to vary the distance between the valve and its seat, serving to deflect any discharge from the valve away from the auxiliary fulcrum.

16. In an apparatus for generating gas under pressure, the combination with a holder for the solid material, of a holder for the liquid, a port through which the contents of one holder is gradually discharged to be brought into contact with the contents of the other holder, a valve cooperating with said port to regulate the discharge, a pressure responsive device containing a fixed abutment and a diaphragm open at one side to the gas under pressure and containing a weak spring on said side and a strong spring on the other side, said weak spring re-acting between the diaphragm and said abutment, connections from the diaphragm to the valve serving to move the valve to its closed position at either extreme of the movement of the diaphragm, and means for regulating the tension of the stronger spring.

17. In an apparatus for generating gas under pressure, the combination with a holder for the solid material, of a holder for the liquid, a port through which the contents of one holder is gradually discharged to be brought into contact with the contents of the other holder, a valve cooperating with said port to regulate the discharge, a pressure responsive device containing a fixed abutment and a diaphragm open at one side to the gas under pressure and containing a weak spring on said side and a strong spring on the other side, said weak spring re-acting between the diaphragm and said abutment, connections from the diaphragm to the valve serving to move the valve to its closed position at either extreme of the movement of the diaphragm, and means to move said diaphragm to one extreme in opposition to the tension of said weaker spring.

18. In an apparatus for generating gas under pressure, the combination with a holder for the solid material, of a holder for the liquid, a port through which the contents of one holder is gradually discharged to be brought into contact with the contents of the other holder, a valve cooperating with said port to regulate the discharge, a pressure responsive device containing a fixed abutment and a diaphragm open at one side to the gas under pressure and containing a weak spring on said side and a strong spring on the other side, said weak spring re-acting between the diaphragm and said abutment, connections from the diaphragm to the valve serving to move the valve to its closed position at either extreme of the movement of

the diaphragm, and a screw bolt threaded through the casing of the pressure responsive device and adapted to engage the end of the stronger spring and compress the same as it is screwed into the device.

19. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, means for gradually feeding the contents of the carbide holder to the water holder, a pressure regulator responsive to the pressure of the generated gas in the water holder, a vent cock for said water holder, and connections from the pressure regulator to the feeding means to stop the latter when the vent cock is opened.

20. In an apparatus for feeding dry chemicals to generating gas, the combination with a hopper, of a generating tank, means for feeding the chemical from the hopper to the tank, a pressure regulator responsive to the pressure of the gas in the tank, a vent cock for said tank, and connections from the pressure regulator to the feeding means to stop the latter when the vent cock is open.

21. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, means for delivering the gas from the gas tank for use, means for feeding the carbide from the hopper to the generating tank, a vent cock for discharging the gas from the generating tank independently of the gas delivery means, a flush out cock, a water replenishing cock, each of said cocks having a swinging handle by which it is opened and closed, and a vertical rod mounted to be rotated in its bearings and having radial projections therefrom co-operating directly with, but unconnected to, the handles of the flush out and water replenishing cocks, so that the vent cock must be moved from its closed position before the other cocks can be moved from their closed position.

22. In an apparatus for generating acetylene gas, the combination with a hopper, of a generating tank, means for delivering the gas from the tank for use, means for feeding the carbide from the hopper to the generating tank, a vent cock for discharging the gas from the generating tank independently of the gas delivery means, a charging closure for the hopper, a flush out cock, a water replenishing cock, each of said cocks having a swinging handle by which it is opened and closed, and a vertical rod mounted to be rotated in its bearings and having radial projections therefrom cooperating directly with, but unconnected to, the handles of the three cocks and the charging closure so that the vent cock must be opened before the other cocks and the charging closure can be opened.

23. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a single conduit through which all the generated gas is delivered, mechanism for gradually feeding the contents from one holder to the other positively actuated by the flow of the gas through the conduit, an adjustable pressure-responsive device, and connections from the pressure-responsive device to the feeding mechanism to control the feed so as to keep the pressure constantly below the limit set by the adjustment of the pressure-responsive device.

24. In an apparatus for generating gas from small particles of a solid chemical by the application of a liquid thereto, the combination with a holder for the solid, of a holder for the liquid, means for gradually feeding the contents of one holder to the other in which other holder the gas is generated positively actuated by the passage of the gas being used, a single conduit through which all the generated gas is delivered from said other holder, an adjustable pressure-responsive device connected to said other holder, and connections from the pressure-responsive device to the feeding means to control the capacity of said feeding means in accordance with the pressure in said other holder, so that when the pressure is low it feeds fast, and slows up the rate of feed as the pressure increases, so that the pressure cannot reach the set limit.

25. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which the gas is delivered from the tank, a mushroom-shaped valve located below a circular opening in the bottom of the hopper so as to form an annular outlet so that some of the chemical is caught and held between the edge of the outlet and the valve, and means controlled by the gases, passing through said conduit for rocking the valve on its stem and thereby displacing some of the chemical each time a measured quantity of gas passes through the conduit.

26. In an apparatus for feeding dry chemicals to generate gas, the combination with a hopper, of a generating tank, a conduit through which all the gas used is delivered from the tank, a valve supported below an annular outlet from the hopper so that some of the chemical is caught and held between the edge of the outlet and the valve, and means connected with said conduit for separating all the gas passing therethrough into small quantities and for jarring the valve to displace some of the chemical each time a measured quantity of the gas passes through the conduit.

27. In an apparatus for generating gas from small particles of a solid chemical by the application of a liquid thereto, the combination with a holder for the solid, of a holder for the liquid, mechanism for gradually feeding the contents of one holder to the other, in which other holder the gas is

generated, positively actuated by the passage of the gas being used, a single conduit through which all the generated gas is delivered from said other holder, an adjustable pressure-responsive device connected to said other holder, and connections from the pressure-responsive device to the feeding mechanism to prevent any further delivery by the feeding mechanism when a certain pressure is reached although it still continues to operate.

28. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a conduit through which only the generated gas is delivered, mechanism for gradually feeding the contents from one holder to the other positively actuated by the flow of the gas through the conduit, an adjustable pressure-responsive device, and connections from the pressure-responsive device to the feeding mechanism to prevent any further delivery of the carbide when a certain pressure is reached although the feeding mechanism continues to be operated.

29. In an apparatus for generating acetylene gas, the combination with a carbide holder, of a water holder, a conduit through which only the generated gas is delivered, mechanism for gradually feeding the contents from one holder to the other positively actuated by the flow of the gas through the conduit, an adjustable pressure-responsive device, and connections from the pressure-responsive device to the feeding mechanism to move part of the feeding mechanism so as to prevent any further actual feeding of the carbide when a certain pressure is reached although the feeding mechanism continues to be operated.

In witness whereof, I have hereunto set my hand, this 27th day of December, 1921.

PARMER DORSEY.