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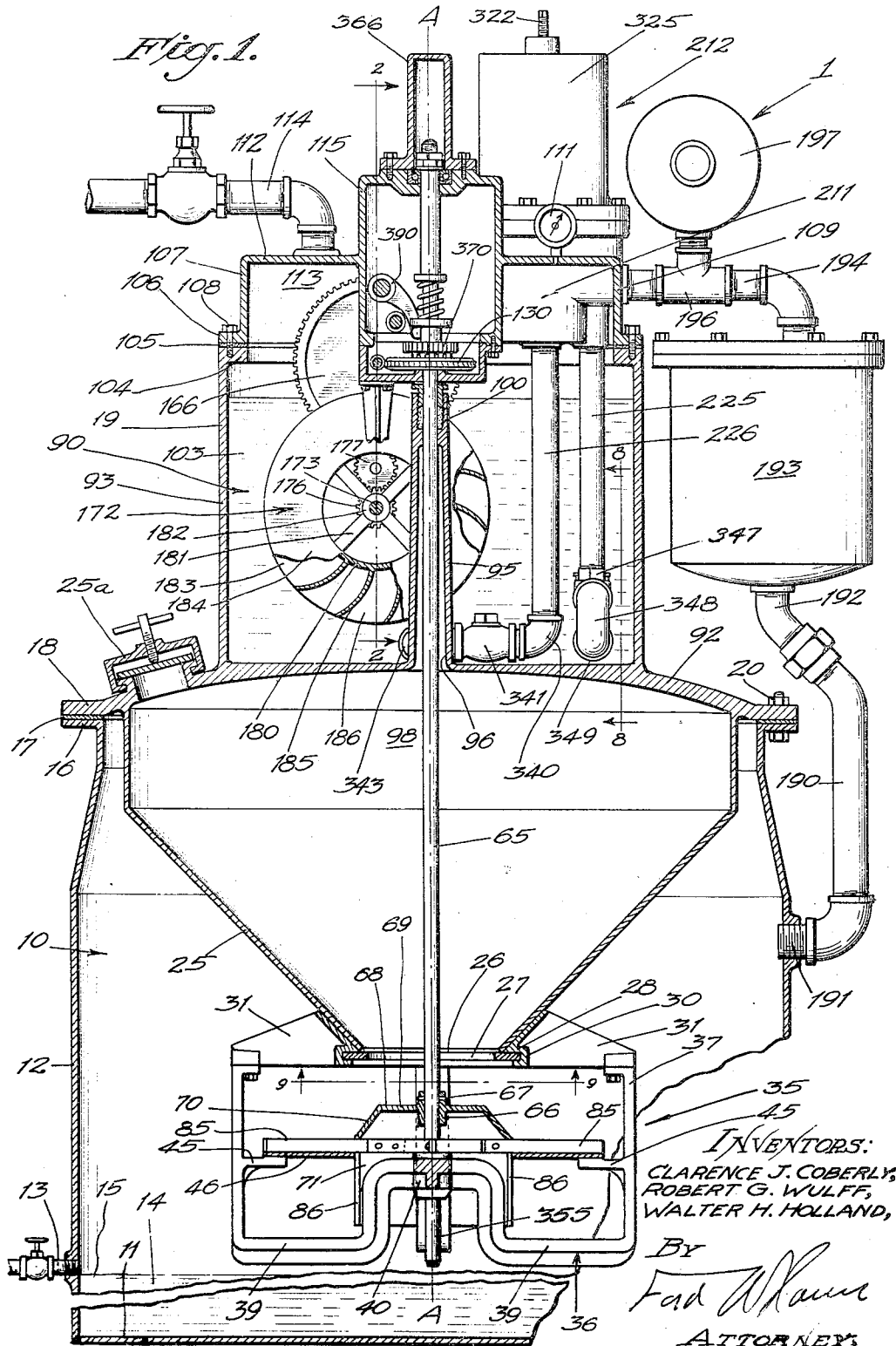
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1,723,679

ACETYLENE GENERATOR

Filed July 3 1926

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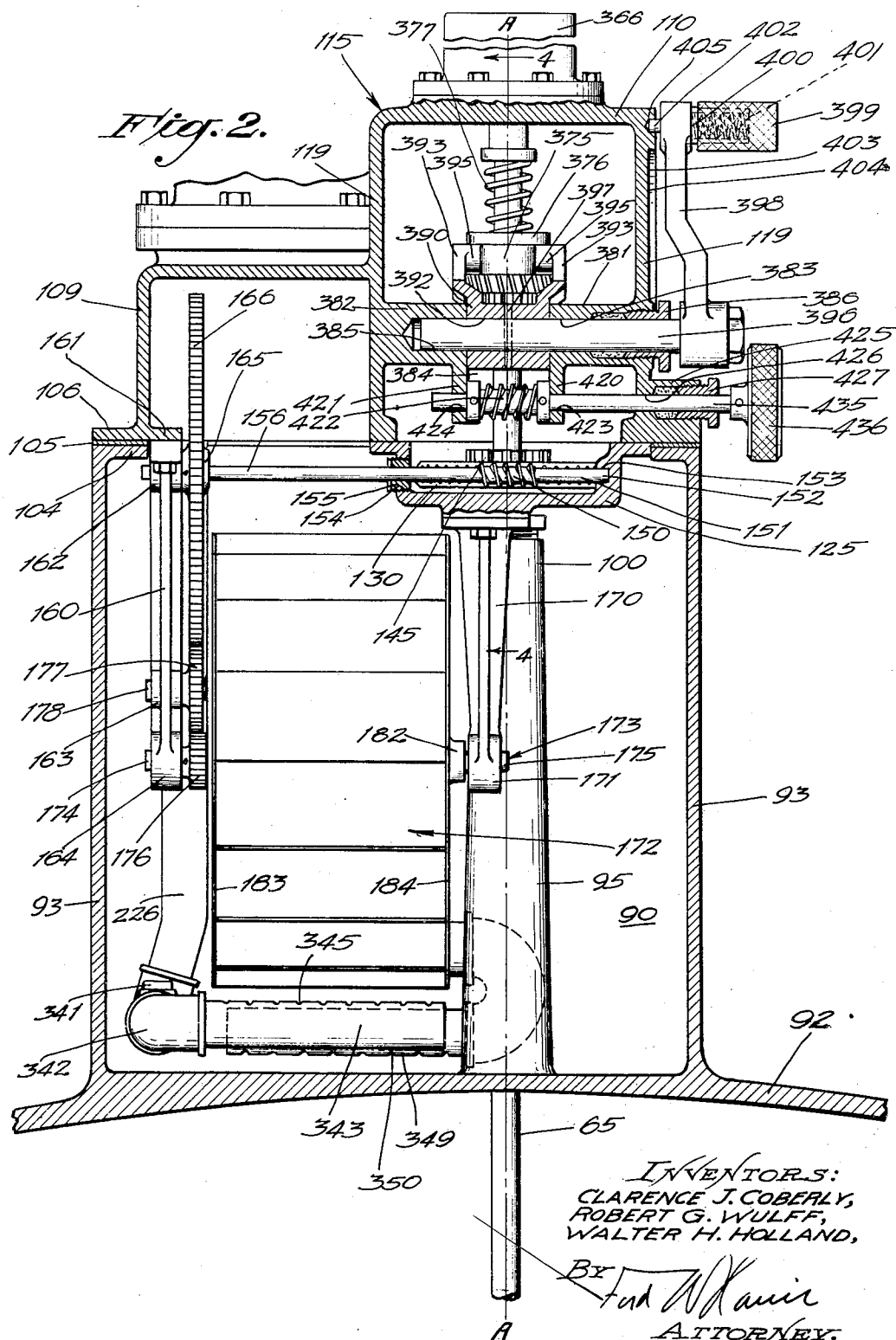
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ACETYLENE GENERATOR

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Fig. 3.

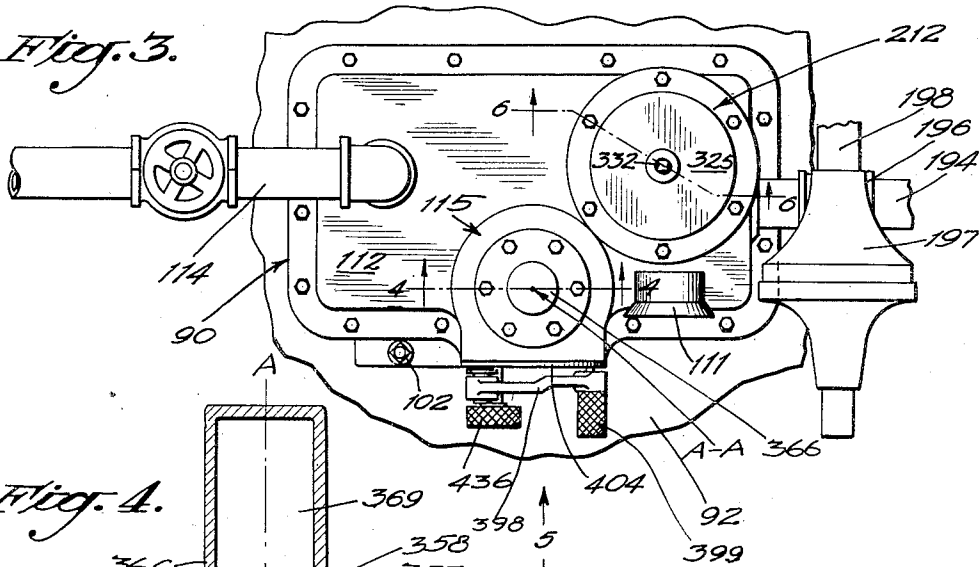


Fig. 4.

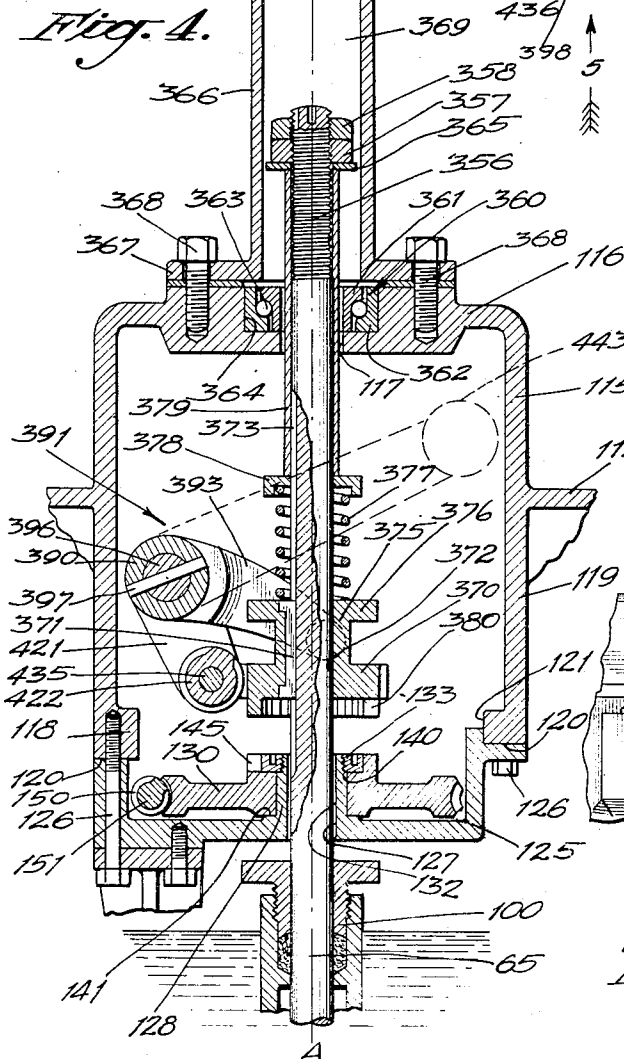
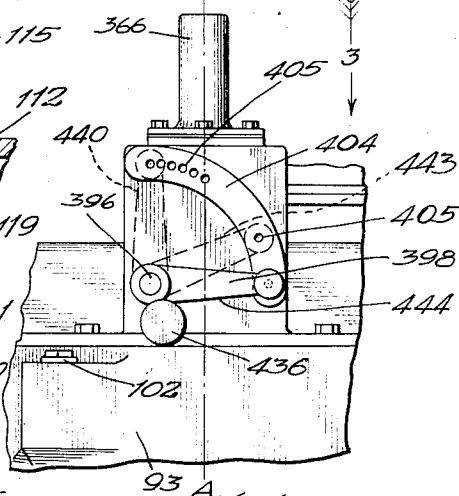


Fig. 5.



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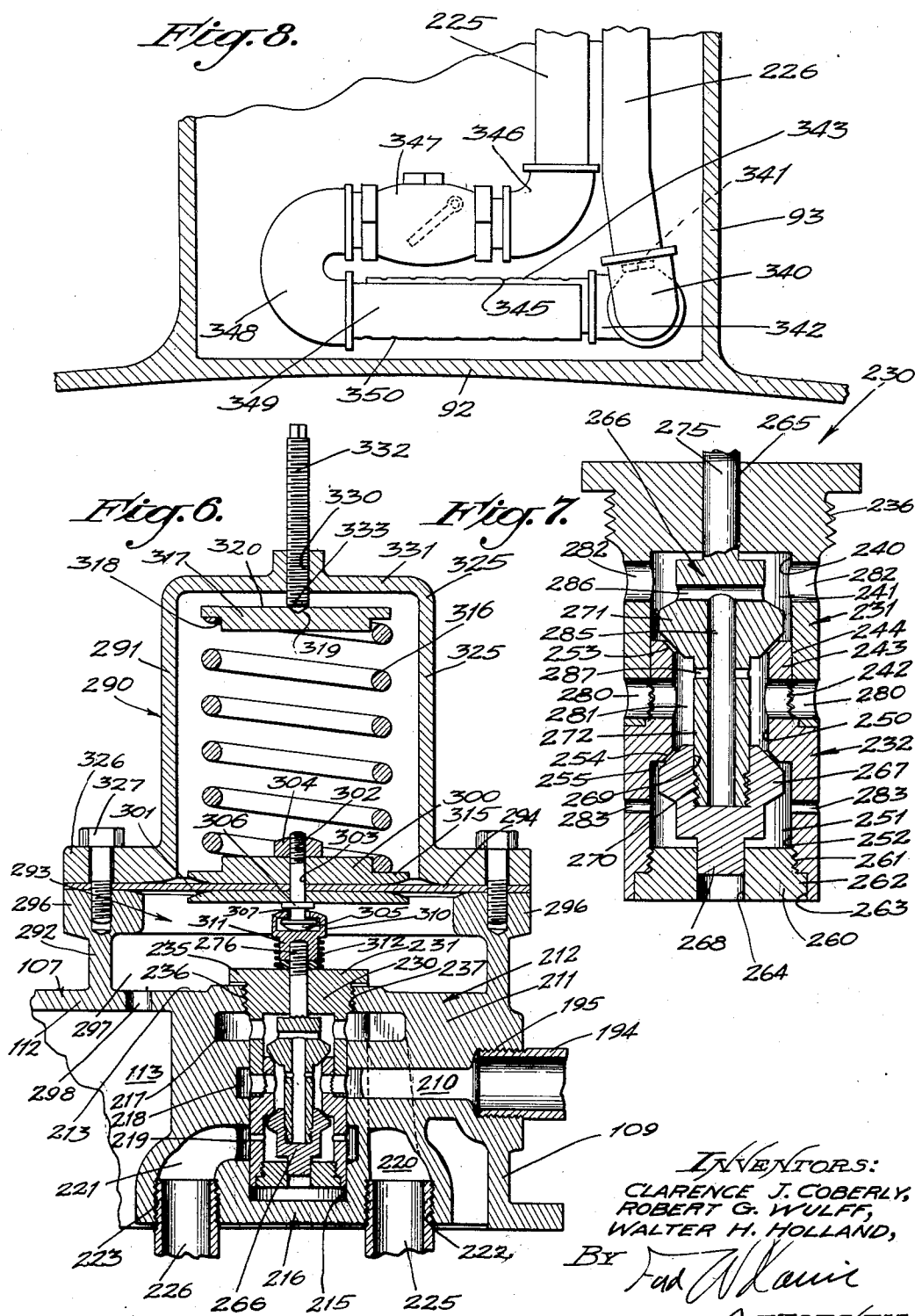
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ACETYLENE GENERATOR

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5 Sheets-Sheet 4



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ACETYLENE GENERATOR

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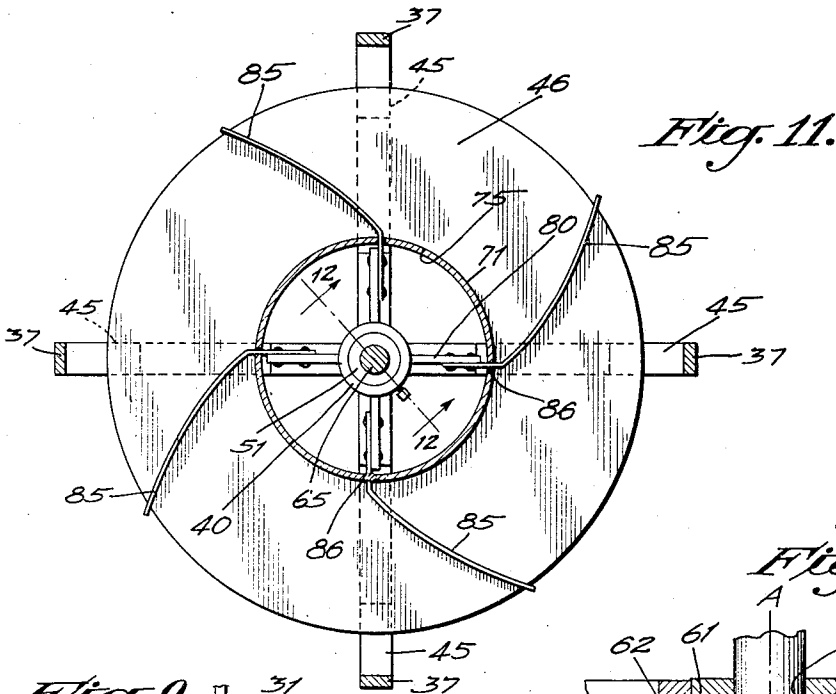


Fig. 11.

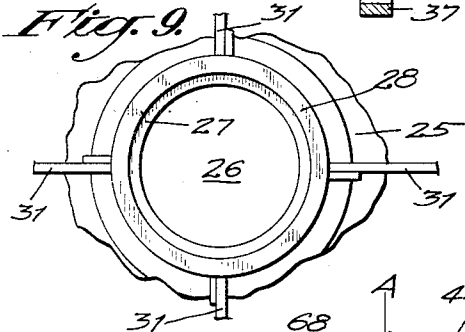


Fig. 9.

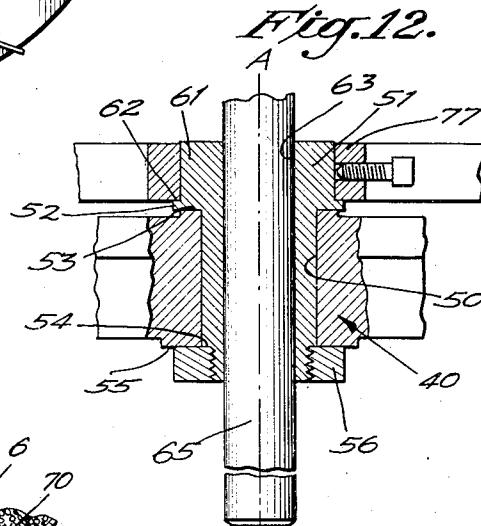


Fig. 12.

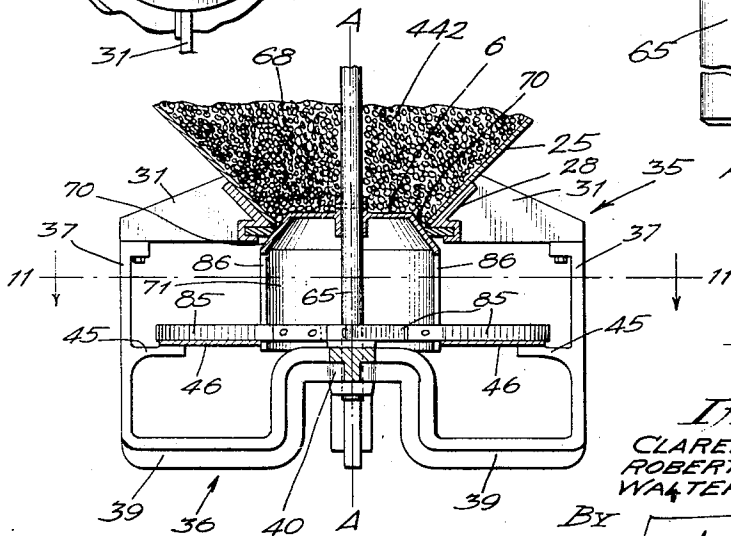


Fig. 10.

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UNITED STATES PATENT OFFICE.

CLARENCE J. COBERLY, ROBERT G. WULFF, AND WALTER H. HOLLAND, OF LOS ANGELES, CALIFORNIA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO UNION CARBIDE AND CARBON RESEARCH LABORATORIES, INC., A CORPORATION OF NEW YORK.

ACETYLENE GENERATOR.

Application filed July 3, 1926. Serial No. 120,379.

This invention relates to oxyacetylene welding equipment, and it relates particularly to an acetylene generator.

A common form of acetylene generator has a generating chamber containing water into which calcium carbide is fed by suitable feeding mechanism in order to generate acetylene gas.

Torches (or other apparatus which burn acetylene) operate more satisfactorily if the acetylene gas is at a uniform pressure; hence it is desirable that the gas pressure in the generator be kept reasonably uniform.

It is accordingly an object of this invention to provide an acetylene generator having a mechanism for operating the feed mechanism, in order to feed carbide into the generating chamber in a manner to maintain the acetylene gas pressure reasonably uniform.

It is another object of this invention to provide in an acetylene chamber a feeding means operated by mechanism, having a novel form of valve which is operated by the pressure of the acetylene gas, for supplying a sufficient amount of gas to the feeding mechanism which is gas-operated so that it will feed carbide into said generating chamber at a rate to keep the gas pressure of the generator within said maximum and minimum pressures.

It is another object of this invention to provide an acetylene generator having an operating mechanism in which the feeding means may be continuously operated when gas is being uniformly drawn from the generator.

It is an object of this invention to provide an acetylene chamber having manually operable means for operating the carbide feeding means thereof.

It is another object of this invention to provide an acetylene generator having manually operable means for disconnecting the gas motor and feed means. This arrangement provides a means for arresting the feeding of carbide to the generating chamber at any time during the operation of the generator.

The carbide hopper is in direct communication with the generating chamber which contains water. The generated gas usually contains some moisture. It is desirable to keep this gas from the carbide when the generator is not in use so that the carbide will not be deteriorated by the moisture contained in the gas.

It is an object of this invention to provide an acetylene generator having a valve for optionally closing the opening between the generating chamber and the carbide hopper.

It is a further object of this invention to provide an acetylene generator having means for causing said valve to close said opening, which means also disengages said feeding means from the gas motor and the manually operable means.

It is another object of this invention to provide an acetylene chamber having a valve adapted to close the passage between the carbide hopper and the generating chamber, and means for adjusting the open position of said valve so as to vary the exact size of said passage, thus accommodating the chamber to different sizes of carbide.

It is a still further object of this invention to provide an acetylene chamber having a feeding means and a valve for closing the passage between the carbide hopper and the generating chamber, and a shaft for operating both the feeding means and the valve.

It is a still further object of this invention to provide a carbide feeding means having a fixed table upon which carbide from the carbide hopper is deposited, and flexible arms adapted to traverse the surface of the table in a manner to yielding engage the carbide lying thereon and to sweep it from the table at a uniform rate.

Other objects and advantages of this invention will be apparent in the following specification and accompanying drawings in which,

Fig. 1 is a fragmentary vertical section taken through a preferred embodiment of our invention.

Fig. 2 is a fragmentary vertical sectional view taken on the line 2—2 of Fig. 1, showing

ing the shaft for actuating the carbide valve and feed mechanism, the shaft being raised so as to close the carbide valve.

Fig. 3 is a fragmentary plan view of the improved acetylene generator of our invention taken in the direction of the arrow 3 in Fig. 5.

Fig. 4 is a fragmentary section taken on the lines 4—4 of Figs. 2 and 3.

Fig. 5 is a fragmentary front elevational view of the generator showing manual control means for the carbide valve and feed mechanism.

Fig. 6 is a fragmentary vertical sectional view on the line 6—6 of Fig. 3.

Fig. 7 is an enlarged sectional view of the valve seat shell and control valve shown in Fig. 6.

Fig. 8 is a fragmentary vertical sectional view showing the motor-actuating and idle outlets for gas entering the motor chamber and being taken on the line 8—8 of Fig. 1.

Fig. 9 is a fragmentary horizontal sectional view taken on the line 9—9 of Fig. 1, and showing an under plan view of the rubber carbide valve seat.

Fig. 10 is a fragmentary vertical sectional view similar to the lower portion of Fig. 1 and showing the carbide valve in closed position.

Fig. 11 is a horizontal sectional view taken on the line 11—11 of Fig. 10 and showing the carbide feeding mechanism in plan.

Fig. 12 is a vertical sectional view taken on the line 12—12 of Fig. 11 and showing the mounting of the valve actuating shaft in its lower bearing.

Referring to the drawings in detail, the acetylene generator 1 shown in Fig. 1 has a gas generating tank 10 formed by a bottom 11 and a continuous side wall 12. A valved nipple 13 is tapped into the wall 12 through which water 14 is admitted into the tank 10 to the level 15 of the nipple 13. An annular horizontal flange 16 is provided at the upper end of the wall 12 which supports a connecting flange 18 of a cover casting 19. Bolts 20 pass through holes in the flange 16 and 18 and tightly clinch these flanges together upon a gasket 17, thus forming a gas-tight joint.

The cover casting 19 has a carbide bunker or hopper 25 formed integrally therewith and depending downwardly therefrom inside the gas generating tank 10. This carbide hopper 25 is frusto-conical in shape and is concentrically disposed about a vertical axis A—A of the generator 1. A fluid-tight manhole construction 25^a is provided in the cover 19 for filling the hopper 25 with carbide. At the lower end of the hopper 25 and concentric therewith is a carbide valve opening 26 having a concentric circular valve seat 27 disposed in an annular recess 28, opening centrally and formed in a mouth

casting 30, which is welded or otherwise secured to the hopper 25 about the opening 26. The valve seat 27 is formed of a resilient material, which is preferably rubber.

Extending radially outwardly from the mouth casting 30 are supporting arms 31 from which there depends a carbide valve and feed mechanism 35. The mechanism 35 has a frame casting 36, vertical members 37 of which are bolted at their upper ends to the supporting arms 31. The members 37 depend downwardly a uniform distance, where they turn inwardly to form offset braces 39 which unite integrally with a hub casting 40 which is concentric with the axis A—A.

Projecting inwardly from the medial portions of the vertical members 37 are feed floor attaching lugs 45, to the upper faces of which an annular plate forming a feed floor 46 is attached. This annular floor 46 is concentrically disposed about the axis A—A.

Referring to Fig. 12, the casting hub 40 is provided with an axial bore 50. A bushing 51 is adapted to be rotatably received in the bore 50 and has a flange 52 which engages an upper face 53 of the hub 50 to limit the downward movement of the bushing 51. The bushing 51 is turned down at the lower end to form a shoulder 54 which projects slightly lower than the lower face 55 of the hub 40. Threads are formed on the turned-down lower portion of the bushing 51 and a nut 56 run thereon to bear tightly against the shoulder 54; thus the bushing 51 is rotatable in the hub bore 50, but has no appreciable end play due to engagement of the bushing's flange 52 with the upper hub face 53 and the juxtaposition of the nut 56 relative to the lower hub face 55.

The upper end of the bushing 51 is turned down to provide a cylindrical bushing head 61 and a shoulder 62 at the lower end thereof. The bushing 51 is provided with an axial bore 63 in which a vertical shaft 65 is slidably received. The axial bore 63 being concentric with the generator axis A—A, the shaft 65 is also concentric therewith.

A carbide valve hub 66 surrounds the shaft 65 above the hub 40 and is rigidly secured thereto by a pin 67. A frusto-conically shaped carbide valve shell 68 is formed concentrically upon the hub 66. This shell has a flat circular head portion 69 extending radially from the hub 66 and a conical seating portion 70 formed about the flat head portion. A cylindrical apron 71 extends vertically downward from the periphery of the conical valve portion 70 and is of such diameter as to slidably and rotatably fit into a central opening 75 in the annular feed floor 46.

A ring hub 77 having an axial opening 78

fits down over the bushing head 61 against the shoulder 62, and a set screw 79 is provided to rigidly secure the ring hub 77 thereto. Radially projecting from the ring hub 77 are arms 80 formed integrally therewith. Rigidly fastened on the ends of the arms 80 are flexible sweeps 85. These sweeps 85 project outwardly from the arms 80 through axial slots 86 in the apron 71. The shoulder 62 of the bushing head 61 is on the same level as that of the feed floor 46 which is disposed about the carbide valve apron 71. The sweeps 85 after passing out of the slots 86 in the apron 71 extend across the feed floor 46 and, as shown in Fig. 10, are bent to a position trailing to the left substantially tangentially from the apron 71.

A motor tank 90 is formed integrally with the cover casting 19 and has a floor 91 formed by a substantially horizontal portion 92 of the cover 19 and walls 93 rising from the cover 19.

Formed integrally with the floor 91 of the motor tank 90, and coaxially with the generator axis A—A is a hollow column 95. The column has a vertical axial opening 96 which communicates at its lower end with a carbide chamber 98, formed beneath the cover casting 19 by the cooperation of the carbide hopper 25 and the horizontal portion 92 of the cover 19. The upper end of the opening 96 communicates with the space within the motor tank 90 and is provided with a stuffing box 100, the purpose of which will be described later.

A screw plug 102 controls a water inlet formed in the wall 93, as shown in Figs. 3 and 5, through which water 103 is admitted into the tank 90 up to the level of this opening into the tank. Since this level is slightly below the top of the hollow column 95, no water has access to the upper end of the opening 96 in this column.

A continuous flange 104 is formed on the upper edge of the walls 93, which supports a continuous flange 106 of a dome casting 107. Cap screws 108 secure a gasket 105 between the flange 106 and the flange 104 so as to form a fluid-tight joint therebetween.

The dome casting 107 has side walls 109 rising from the flange 106 to the periphery of a rectangular deck plate 112 with which the side walls 109 cooperate to form a gas reserve chamber 113. A valved service outlet pipe 114 is provided in the deck plate 112 to communicate with the gas reserve chamber 113. A pressure gauge 111 is provided in the deck plate 112 opening into the reserve chamber 113.

A cylindrically shaped transmission housing 115 is formed integrally with the deck plate 112 so as to be disposed concentrically with the generator axis A—A. The housing 115 has an upper head 116 having an opening 117 therein concentric with the axis

A—A. A flange 118 is provided at the lower edge of the vertical housing wall 119, the lower face 120 of which surrounds a large opening 121 communicating between the interior of the housing 115 and the gas reserve chamber 113 on the same level as the lower face of the dome flange 106.

A transmission housing floor plate 125 covers the opening 121, being secured to the flange 118 by cap screws 126. An opening 127 is formed in the floor plate 125 concentric with the axis A—A. A hollow stub shaft 128, formed integrally with the floor plate 125 about the opening 127, extends upwardly into the housing 115 and rotatably receives a worm gear 130 on the outer cylindrical surface 131 thereof. An axial opening 132 is provided through the stub shaft 128 co-extensive with the opening 127.

A circular nut 133 is threadedly received upon the upper end of the stub shaft 128 and is turned down tightly against a shoulder 140 formed on the stub shaft. Thus positioned, the nut 133 cooperates with a narrow shoulder 141 formed about the shaft 90 128 on the floor plate 125 to retain the gear 130 for rotation about the shaft 128 without permitting appreciable end play thereon. A concentric series of equally spaced clutch dogs 145 is provided upon the gear 130 to project upwardly therefrom outside of the periphery of the nut 133.

Referring to Figs. 1 and 2 a worm 150 which engages the worm gear 130 is formed upon a horizontal shaft 151, an end 152 of which rotates in a bearing 153 formed in a wall of the floor plate 125. Opposite this bearing 153 a tapped opening 154 is provided in the transmission housing floor plate 125 through which the shaft 151, carrying the worm 150, may be admitted to the housing 115. This opening is then closed by a threaded bearing plug 155 which is slipped over the end 156 of the shaft 151 and screwed into the tapped opening 154.

A bearing standard 160 is rigidly secured to a lug 161 which projects inwardly into the gas pressure chamber 113 from a dome wall 109. The standard 160 projects vertically downwardly and has bearings 162, 163 and 164 provided thereon.

The end 156 of the shaft 151 passes through and is rigidly secured to the hub 165 of a large diameter gear 166. The shaft end 156 then projects through and journals in the bearing 162.

A standard 170 is rigidly secured to the bottom of the floor plate 125 and projects downwardly. A bearing 171 is provided at the lower end thereof which is disposed coaxially with the bearing 164 on a horizontal axis.

A gas rotor wheel 172 is disposed within the motor tank 90 between the standards 160 and 170. The wheel 172 is rigidly built

up on a shaft 173, an end 174 of which journals in the bearing 164 and an end 175 of which journals in the bearing 171. When so mounted, the rotor 172 is almost completely submerged in the water 103 in the motor tank 90.

On the end 174 of the shaft 173 between the rotor 172 and the bearing 164 is fixed a pinion driving gear 176. This pinion 176 meshes with a small idler gear 177 which is mounted upon a stub shaft 178 disposed in the bearing 163, and which meshes in turn with the large gear 166 which is rigidly fixed upon the worm shaft 151. Thus, rotation of the rotor 172 is transmitted through the gears 176, 177 and 166, the shaft 151 and the worm 150 to the worm gear 130.

As shown in Fig. 1, the rotor 172 has a cylindrical wall 180 which is secured to the ends of arms 181 extending radially from hubs 182 which are rigidly fixed upon the shaft 173. Annular walls 183 and 184 extend radially outwardly from the edges of the cylindrical wall 180 forming an annular channel. Curved partitions 185 are disposed in this channel to form pockets 186. These are so shaped as to retain a gas released in the water 103 under the right hand side of the rotor 172, as it is shown in Fig. 1, until the rotor has rotated sufficiently to position the retaining pockets 186 successively at the top of the rotor 172, where the gas will be released into the gas pressure chamber 113. While so retained in the pockets 186 the gas exerts a lifting force on the partitions 185 and causes the rotation of the rotor 172.

A gas conduit 190 communicates at its lower end 191 with the interior of the gas generating tank 10, and at its upper end 192 with a gas filter 193. From the gas filter 193 a conduit 194 leads, as will be seen in Fig. 6, to an opening 195 in the wall 109 of the dome casting 107. A T-fitting 196 disposed in the conduit 194 communicates with a safety valve 197 (of conventional type), which has an escape conduit 198, shown in Fig. 3, which leads from the safety valve 197 to a remote place where acetylene gas may safely be exhausted for diffusion in the atmosphere.

Referring now to Fig. 6, the opening 195 in the wall 109 communicates with an inlet duct 210 cored out of the body 211 of a gas pressure motor control valve 212 which is cast integrally with the dome casting 107, as shown. The upper face 213 of the valve body 211 is level with the top of the dome deck 112 and the body 211 extends downwardly therefrom almost to the level of the lower face of the dome casting flange 106. A vertical bore 215 is formed in the body 211 from the upper face 213 thereof, to such depth that a wall of metal 216 integral with the body 211 remains to close the bottom of

the bore. Annular channels 217, 218 and 219 are cored out of the body 211 concentrically with respect to the bore 215 and communicating therewith at the upper, medial and lower portions thereof, respectively. A gas inlet duct 210 communicates with the annular channel 218. Gas outlet ducts 220 and 221 communicate, respectively, between channels 217 and 219 and threaded openings 222 and 223 in the bottom of the body 211. Pipes 225 and 226 are threadedly received into openings 222 and 223, respectively, and project vertically downwardly into the motor tank 90.

The surface of the bore 215 is ground to a true cylinder. A cylindrical valve seat shell 230 is provided, the outer surface of which is ground to a cylinder of such diameter that it fits neatly into the bore 215. The shell 230 is formed in upper and lower halves 231 and 232. The upper half-shell 231 is provided with a hexagonal head 235 having threads 236, which are aligned with a tapped opening 237 in the body 211 at the upper end of the bore 215, and which are threadedly received therein when the shell 230 is inserted into and turned in the bore 215. An axial bore 240 is formed in the upper half-shell 231, which opens downwardly and is closed at the upper end by the head 235. This bore 240 forms an upper valve chamber 241. The mouth 242 of the bore 240 is tapped to receive a threaded valve seat nipple 243 provided upon the upper end of the lower half-shell 232 and concentric therewith. The nipple 243 has a cylindrical face 244 ground to a true cylinder to fit neatly into the bore 240 when the nipple 243 is screwed into the threaded mouth 242 of the bore 240. The neat fit of the surface 244 of the nipple 243 in the bore 240 of the upper half-shell 231 aligns the lower half-shell therewith in perfect axial co-extension. This assures that the cylindrical outer surfaces of the upper and lower half-shells 231 and 232 will be secured together to form a single continuous cylinder, which may be easily slid into the bore 215 of the valve body 211.

The valve seat nipple 243 has a concentric bore 250 formed therein which connects the upper valve chamber 241 with a lower valve chamber 251 formed by a concentric bore 252 formed upwardly in the lower half-shell 232. An upper valve seat 253 is formed in the upper mouth of the nipple bore 250. A lower valve seat 254 is provided in the shoulder 255 between the lower end of the bore 250 and the upper end of the bore 252 in the half-shell 232.

The bore 252 is closed at the lower end by a screw plug 260 which threadedly engages with the tapped end of the bore 252 at 261. The plug 260 has a cylindrical head 262 ground to accurately fit a cylindrical

recess 263 concentrically provided in the lower end of the lower half-shell 232. An axial bore 264 is formed in the plug 260. A vertical bore 265 is formed concentrically in the upper half-shell head 235.

A gas control valve 266 is concentrically disposed within the valve seat shell 230. The gas control valve 266 has a lower valve 267 centrally disposed in the lower valve chamber 251 and from which a cylindrical guide stub 268 projects downwardly into accurate sliding engagement within the bore 264 in the plug 260. An axial hole 269 is bored downwardly into the lower valve 267 and has threads 270 in the lower portion thereof. An upper valve 271 is disposed concentrically in the upper valve chamber 241 and has a hollow stem 272 projecting downwardly therefrom to a threaded end which is screwed into the threads 270 at the lower end of the hole 269. The cylindrical outer surface of the stem 272 accurately fits a smooth upper portion of the hole 269 and thus aligns the axis of the stem 272 with the axis of the lower valve 267. An operating guide rod 275 projects upwardly from the upper valve 271 through the bore 265 in the upper half-shell head 235, making a neat sliding fit therein. The upper end of the rod 275 is threaded at 276.

Large ports 280 bored through the upper half-shell 231 and the nipple 243, when these parts are screwed together, provide communication between the annular channel 218 and an inter-valvular chamber 281 formed by the bore 250. Large ports 282 in the upper half-shell 231 communicate between the upper valve chamber 241 and the annular chamber 217. Small ports 283 formed in the lower half-shell 232 communicate between the lower valve chamber 251 and the annular chamber 219. The hollow stem 272 has a central passageway 285 therein. Small ports 287 connect the inter-valvular chamber 281 with the passageway 285, while ports 286, formed in the upper valve 271, open from the passageway 285 into the upper valve chamber 241.

The length of the hollow stem 272 is such that the upper and lower valves 271 and 267 are spaced apart a sufficient distance to permit the gas control valve assembly 266 a slight degree of end play between its two positions in which the upper and lower valves 271 and 267, respectively, make sealing contact with their seats 253 and 254.

Actuating means for the gas control valve 266 is provided in a pressure responsive diaphragm mechanism 290. This mechanism is contained in a housing 291 having lower walls 292 formed upon the dome deck plate 112 to provide a well 293 concentrically disposed above the control valve 266. A diaphragm 294, formed of a yieldable fabric,

and preferably a rubberized canvas, covers the upper opening of the well 293, resting on a bead 296 provided at the upper edge of walls 292. A diaphragm pressure chamber 297 is thus formed, which communicates through a port 298 with the gas reserve chamber 113. Upper and lower reinforcing washers 300 and 301 are disposed centrally above and below the diaphragm 294 and are clamped together upon the diaphragm by a special bolt 302 which passes upwardly through a central hole 303 formed in the washers and the diaphragm and receives a nut 304 upon its upper end. The head 305 of the bolt 302 is spaced from a shoulder 306 formed upon the stem of the bolt, thus providing an annular channel 307 between the head and the shoulder. Projecting into the channel 307 are fingers 310 which are formed integrally upon a cap nut 311 which is screwed upon the threaded end 276 of the gas control valve stem 275.

A compression spring 312 is disposed about the cap nut 311. This spring bears downwardly against the valve shell head 235 and upwardly against the fingers 310. This spring 312 is small in size, but highly tempered and tends to support the control valve 266 in its upper position.

The upper reinforcing washer 300 is annularly recessed to form a diaphragm spring seat 315 on which rests a spring 316. A cap plate 317, having a seat 318, reposes upon the upper end of the spring 316 and has a centering recess 319 formed in the upper face thereof.

The housing 291 is completed by a bell 325 having a connecting flange 326 provided at its lower edge which rests upon the peripheral portions of the diaphragm 294 opposite the bead 296. Cap screws 327 rigidly clamp the diaphragm 294 between the flange 326 and the bead 296. The bell 325 covers the spring 316 and has a threaded hole 330 centrally provided in its head 331. A spring pressure adjusting screw 332 is screwed downwardly in the hole 330 and has a pointed lower end 333 which projects into the centering recess 319 and bears against the spring cap plate 317. Screwing the screw 332 in or out of the hole 330 will thus cause the spring 316 to apply a greater or less downward pressure upon the diaphragm 294.

Referring now to Figs. 1, 2, 6 and 8, the pipe 226 projects downwardly into the tank 90 and connects, through an elbow 340, a check valve 341 and suitable interconnecting nipples with an elbow 342, which communicates with a power gas outlet manifold 343. The manifold 343 is submerged in the water 103 adjacent the bottom 91 of the tank 90. It is located, as shown in Fig. 1, under the rotor 172 to the right of and parallel with

the axis thereof. Openings 345 are provided in the manifold 343 which open upwardly.

The pipe 225 projects downwardly into the water 103 in the tank 90 to a point adjacent the bottom 91 thereof. Here it connects through an elbow 346, a check valve 347, and suitable interconnecting nipples, with a return bend 348 which connects with an idle gas outlet manifold 349 having ports 350 opening downwardly therefrom. The manifold 349 is disposed in the water 103 adjacent the bottom 91 of the tank 90, but is entirely out from under the rotor 172, as shown in Fig. 1.

The lower end 355 of the shaft 65, which is disposed coaxially relative to the axis A—A of the generator 1, slidably bears in the bore 63 of the bushing 51 and extends a slight distance below the hub 40 in which the bushing 51 is rotatably mounted. Above the bushing 51 the shaft 65 projects vertically upward through the hub 66 of the carbide valve 68, through the carbide valve opening 26, through the carbide chamber 98, through the vertical opening 96 in the column 95, through the stuffing box 100 with which it makes a fluid-tight fit, through the opening 127 in the transmission housing floor plate 125, through the length of the transmission housing 115 and out through the top 116 thereof through the opening 117.

The upper end 356 of the shaft 65 is threaded, as shown in Fig. 4, to receive a carbide valve supporting and adjusting a nut 357 and a lock nut 358. A ball bearing 360 having upper and lower races 361 and 362 and balls 363 disposed therebetween rests in a counterbore 364 formed concentrically about the opening 117 in the upper surface of the transmission housing head 116. When the shaft 65 is lowered so that the carbide valve 68 is open, as shown in Fig. 1, the weight of the shaft 65 and carbide valve 68 is supported by the nut 357 resting upon a washer 365 which rests in turn upon the upper race 361 of the ball bearing 360.

A bell housing 366 has a flange 367, which cap screws 368 secure in a gas-tight joint to the head 116. This housing provides a passageway 369 through which the assembly upon the upper end 356 of the shaft 65 may project upwardly for a purpose which will be described later.

A gear 370 is slidably disposed upon the shaft 65 in the transmission housing 115 above the gear 130. A key 371 is seated in the bore 372 of the gear 370 and projects into a key seat 373 formed vertically in the shaft 65. A clutch spool 375 is formed on the gear 370 to extend upwardly from the hub portion thereof and having a head flange 376 formed at the upper end of the spool. A spring 377 is disposed about the shaft 65

and rests upon the head flange 376. A cap washer 378 rests upon the upper end of the spring 377 and supports a lifting sleeve 379, sheathing the shaft 65 and extending upwardly from the washer 378 to engagement with the lower face of the washer 365. A concentric series of clutch dogs 380 is formed on the under side of the gear 370. When the shaft 65 is in lowermost position, the dogs 380 intermesh with the dogs 145 formed upon the gear 130, causing the shaft 65 to be locked to the gear 130 for rotation therewith.

As shown in Fig. 2, axially aligned internal bosses 381 and 382 project horizontally from opposite sides of the cylindrical wall 119 of the transmission housing 115. An axial hole 383 is bored through the outside wall 119 into the boss 381, the drill projecting across a gap 384 between the opposed ends of the bosses 381 and 382 and drilling a hole 385 in the boss 382 co-axial with the hole 383. The outer end of the hole 383 is counterbored and threaded to receive a stuffing gland 386. The hub 390 of a clutch yoke 391 is adapted to fit in the opening 384 and has a bore 392 which is aligned with the holes 383 and 385. The clutch yoke 391 has arms 393 which are formed upon the hub 390 to project outwardly into the transmission chamber 115 on opposite sides of the clutch spool 375.

Fingers 395 are formed at the outer ends of arms 393 to project inwardly beneath the head flange 376 of the clutch spool 375.

A shaft 396 is inserted, from the outside, into the hole 383, and through the bore 392, in the hub 390, into the hole 385. A pin 397 secures the hub 390 rigidly upon the shaft 396. The packing gland 386 is tightened to form a fluid-tight joint about the shaft 396.

A crank 398 having a handle 399 is rigidly secured to the outer end of the shaft 396. This handle is mounted upon a sleeve 400 formed upon the crank 398 so as to be yieldably urged inwardly by a spring 401. A stop lug 402 is adapted to move integrally with the handle 399 and be urged by the spring 401 against the face 403 of a quadrant 404, shown in Fig. 5, which is provided on the outside wall 119. Openings 405 are formed in the face of the quadrant in the path taken by the lug 402 when the crank 398 is moved to rotate the shaft 396.

As shown in Fig. 2, when opposite an opening 405, the lug 402 is urged therein by the spring 401. This locks the crank 398 in place until the lug 402 is withdrawn by pulling the handle 399 outwardly.

As shown in Figs. 2 and 4, bearing lugs 420 and 421 project downwardly from the inner ends of bosses 381 and 382, respectively. A worm 422 having an axial bore there-through is disposed between the lugs 420 and

421 which have bearing openings 423 and 424 co-extensive with the bore of the worm 422. A boss 425 is provided upon the lower outside portion of the outside wall 119 and a hole 426 bored therein co-axial with the openings 423 and 424. The mouth of the hole 426 is counterbored and threaded to receive a gland 427. A shaft 435 is inserted through the gland 427 into the hole 426 and projects inwardly through the opening 423, through the bore of the worm 422 and through the opening 424. The worm 422 is secured rigidly upon the shaft 435.

For a purpose to be described later, the diameter and pitch of the worm 422 are such, and the position of its mounting is such, that when the gear 370 is disposed on the shaft 65 opposite the worm 422 the latter will fit into operative engagement with the teeth of the gear 370.

A hand wheel 436 is rigidly secured upon the outer end of the shaft 435, for manually rotating the same.

The operation of our invention is as follows:

Water is admitted to the generating tank 10 and to the motor tank 90 as previously described.

By moving the crank 398 upwardly from the position in which it is shown in full lines in Fig. 5, the shaft 396 is rotated to the left, the clutch yoke arms 393 are swung upwardly causing the fingers 395 to engage the head plate 376 and lift the gear 370 upwardly so the dogs 380 disengage with the dogs 145. As the gear wheel 370 rises, the spring 377 is compressed against the washer 378 until its upward pressure lifts the shaft 65 upwardly and draws the carbide valve 68 into fluid-tight engagement with its rubber valve seat 27, as shown in Fig. 10. In order to accomplish this seating of the valve 68 the gear 370 must be raised by the yoke 391 above and out of engagement with the worm 422, as it is shown in Fig. 4 and into the position in which it is shown in Fig. 2. Having applied enough upward pressure to the spring 377 so it is holding the carbide valve 68 tightly seated against the rubber seat 27, the lug 402 is released into an adjacent opening 405 to retain the crank 398 in an upward position such as shown by dotted lines 440, and thus hold the shaft 65 in uppermost position.

The carbide hopper 25 is now filled with calcium carbide 442 through the manhole 25^a, this being again tightly closed.

The crank 398 is now moved down from the position 440 to the dotted line position 443 shown in Fig. 5 and the lug 402 is allowed to drop into the opening 405 adjacent this position 443. The gear 370 will now be held in engagement with the worm 422, as shown in Fig. 4, and the carbide valve 68 will hang slightly below its seat 27, permit-

ting carbide 442 to fall through the opening 26 and over the valve head 68 upon the annular feed table 46.

The hand wheel 436 is now manually rotated to the right, this slowly rotating the shaft 65 to the right through the engagement of the worm 422 with the gear 370. The shaft 65 rotates the carbide valve 68 which increases the discharge of carbide 442 through the opening 26 onto the table 46. Also, as the apron 71, formed on the valve 68, rotates therewith, edges of the slots 86 engage the sweeps 85, which project through these slots, and draw them so they continuously sweep the upper surface of the annular feed table 46. The sweeps 85 thus gradually brush any carbide rocks which fall upon the table 46 off the outer edge thereof so that they drop into the water 14 disposed below in the gas generating tank 10.

The contact of the carbide 442 with the water 14 produces acetylene gas which fills the generating tank 10 and finds outlet therefrom through the conduit 190 through which it passes to the filter 193 and thence through the conduit 194 to the passageway 210, shown in Fig. 6. From the passageway 210 the gas enters the annular channel 218 and from there passes through the ports 280 into the inter-valvular chamber 281. Due to the valve 266 being urged by the spring 316 into lowermost position, the upper valve 271 is tightly seated; therefore, the gas may now escape from the chamber 281 through the small ports 287, the passage 285, and the ports 286 to the upper valve chamber 241, and it may also escape between the lower valve 267 and its seat 254 into the lower chamber 251.

As previously described, the upper valve chamber 241 communicates through the large ports 282, the annular chamber 217, the channel 220, the pipe 225, the elbow 346, the check valve 347, the return elbow 348, and interconnecting nipples, with the idle gas escape manifold 349. The gas which escapes from the inter-valvular chamber 281 into the upper valve chamber 241 is discharged out of the idle manifold 349 and idly rises to the surface of the water 103 in the water tank 90. Also, as previously described, the chamber 251 communicates through the small ports 283, the annular channel 219, the pipe 226, the elbow 340, the check valve 341, the elbow 342, and interconnecting nipples with the working gas manifold 343. Thus, all the gas escaping from the inter-valvular chamber 281 around the lower valve into the chamber 251 is discharged out of the working manifold 343, is then caught in the pockets 186 of the rotor 172, and by its buoyant effect turns the rotor. As previously described, the rotation of the rotor 172 is transmitted to the

worm gear 130 through the train of gears 176, 177 and 166, the shaft 151 and the worm 150 causing the gear 130 to turn at a very low ratio relative to the rotor 172.

5 The manual rotation of the shaft 65, by turning the hand wheel 436, need now no longer be continued and the crank 398 is now released from its position 443 and is allowed to move down to its lowermost position 444 shown in Fig. 5. This allows the
10 gear 370 to move down from the position in which it is shown in Fig. 4 to where it is shown in Fig. 1 with the shaft 65 locked to the gear 130 for rotation thereby. Thus
15 the shaft 65 is rotated, and the feeding of carbide 442 into the water 14 in the generating tank 10 is thereafter accomplished by a portion of the gas which has been generated thereby which is allowed to escape
20 through the working manifold 343 under the right hand side of the rotor 172.

It has been found that only a small portion of the gas generated by the feeding of carbide into the water 14 at a given rate
25 needs to be utilized for turning the rotor 172 in order to maintain the feeding of carbide at the given rate. The rate at which gas is drawn off through the service outlet 114 may vary so that gas will be generated
30 at a rate which exceeds the mean rate at which it is being drawn off, thus building up the gas pressure in the reserve chamber 113.

It is to keep this gas pressure within fixed limits that the pressure-responsive diaphragm mechanism 290 is provided and connected, as previously described, with the gas control valve 266.

At the initial generating of gas in the generator when the gas pressure in the reserve chamber 113 is practically at atmospheric,
40 the greater pressure of the large spring 316 over that of the small spring 312 holds the valve 266 in extreme downward position. As previously noted, this closes the upper
45 valve 271 and opens the lower valve 267, allowing a large proportion of the gas generated to be diverted to the working gas manifold 343. This causes the rotor 172 to rotate at a speed above normal, thus feeding
50 carbide at an abnormal rate into the water 14. The gas, thus generated, quickly builds up the gas pressure in the reserve chamber 113. The pressure in the diaphragm chamber 297 corresponds to that in
55 the reserve chamber 113 due to the communication port 298 provided therebetween. Therefore, when the gas pressure in the reserve chamber 113 has risen to a predetermined point, the diaphragm 294 will be
60 forced upwardly against the pressure of the spring 316, which will draw the valve 266 upwardly, moving the lower valve 267 toward its seat 254 and moving the upper valve 271 away from its seat 253. This will

diminish the proportion of the generated gas
65 which is diverted to the turning of the rotor 172 and increase the proportion allowed to escape idly into the reserve chamber 113. This will cause the rotor 172 to rotate at a
70 decreased rate, this obviously causing the rate at which carbide is fed to decrease and the generating of gas will hence correspondingly decrease. Should no gas be drawn
75 from the service outlet 114 for a period, the gas pressure in the chambers 113 and 297 would build up until the lower valve 267 would be drawn tightly against its seat 254, thus stopping any of the gas generated from being diverted to the rotor 172. This would
80 cause the rotor 172 to cease rotation and the feeding of carbide and consequent generation of gas would also cease, when the carbide already in the water 14 had completed its chemical affinity with the water. The
85 service outlet 114 may, therefore, remain closed an indefinite period and the gas pressure in the reserve chamber 113 and the generating tank 10 be maintained below a predetermined maximum.

Means for externally adjusting this maximum pressure are provided in the screw 332
90 by which the cap 320 may be forced a varying distance downwardly from the head 331, thus regulating the pressure exerted downwardly upon the diaphragm 294 by the
95 spring 316. This spring pressure must be balanced by the gas pressure in the diaphragm chamber 297 before the gas pressure can raise the diaphragm 294 and close the valve 267, thus causing the generating of
100 gas to stop.

When the flow of gas out through the service outlet 114 is started again after having been stopped, the pressure will rapidly
105 decrease in the reserve gas chamber 113 and the diaphragm chamber 297, allowing the diaphragm 294 to be forced downwardly by the spring 316, thus causing the valve 267 to open. As the pressure in the generating
110 tank 10 will have also been approaching the maximum when the valve 267 was closed, gas will now flow up from the tank 10 into the inter-valvular chamber 281 and through the open valve 267 to turn the rotor 172 and recommence the feeding of carbide and the
115 generating of gas.

If this release of pressure in the reserve chamber 113 by draughts from the service outlet 114 is sudden, and the pressure in the reserve chamber 113 is thereby lowered considerably below that in the generating tank 10, a rush of gas into the inter-valvular chamber 281 will occur when the valve 266
120 has been returned to lowermost position due to the decreased pressure in the reserve chamber 113. It is to prevent this rush of gas being diverted entirely through the lower valve 267 and causing the rotor 172

to feed an excessive amount of carbide (when the pressure in the generating tank is already high) that the by-pass around the upper valve 271 formed by the openings 287, 285 and 286 is provided. This by-pass allows a considerable proportion of the gas entering the inter-valvular chamber 281 to pass to the idle escape manifold 349 even though the upper valve 271 is closed and the lower valve 267 is open. Thus the generating tank 10 is relieved of its maximum pressure and a normal generation of gas is recommenced.

During the normal operation of our generator, gas is drawn from the service outlet 114 at a substantially uniform rate. For each specific rate of flow of gas through the service outlet 114 a specific pressure will be built up and maintained in the reserve chamber 113. This specific pressure will be such as to raise the diaphragm 294 and draw the valve 266 upwardly so that only enough gas will pass by the valve 267 to the rotor 272 to turn the rotor at a speed at which it will feed just sufficient carbide to maintain the specific pressure in the reserve tank 113. These specific pressures will differ according to the adjustment of the screw 332 and the consequent varying pressure of the spring 316 upon the diaphragm 294.

A vital feature of our invention is the means manually operable from the exterior of the generator for disengaging the carbide feeding mechanism from the rotor 172 and forming a fluid-tight seal between the generating tank 10 and the carbide hopper 25.

As before described, when the crank 398 is in the position 444, shown in Fig. 5, the shaft 396 is turned so that the clutch yoke 390 is disposed downwardly as shown in Fig. 1, and the shaft 65 is locked to the gear 130 through the clutch formed between the gear 130 and the gear 370. The shaft 65 carrying the carbide valve 68 is also disposed downwardly, opening the carbide port 26 and permitting the carbide 442 to fall therethrough to be fed from the table 46 by the sweeps 85 when these are rotated with the valve 68 by the rotor 172.

When it is desired to stop the generating of gas and close the opening 26, the crank 398 is moved upwardly and set in the position 440. This rotates the shaft 396 and the clutch yoke 390 to the position in which they are shown in Fig. 2. The clutch fingers 395, engaging the clutch spool head 376, lift the gear 370, and compress the spring 377 which, through the washer 378, the sleeve 379, the washer 365, and the nut 357, lift the shaft 65 until the conical face 70 of the carbide valve 68 engages the rubber valve seat 27, provided in the opening 26, as clearly shown in Fig. 10.

The rotor 172 is thus disconnected from

the shaft 65, and the opening 26 is closed.

It has been the practice to use a carbide valve in acetylene generators having a conical upper face coextensive to the conical seating face. This is a very unsatisfactory arrangement as when an attempt is made to close the valve, the carbide directly above the valve is wedged outwardly against the valve seat. This makes it almost impossible to make a tight joint between the valve and the seat. The horizontal center position of our carbide valve lifts the superimposed carbide vertically upward when the valve is closed, thus relieving the pressure of carbide against the seat 27. This reduced carbide pressure makes a seat of resilient material, such as rubber, possible and enables us to form a gas-tight joint between the valve 68 and the seat 27. Such a joint is of vital importance to the economy and safety in operating an acetylene generator as it preserves the store of unused carbide in the hopper 25 from disintegration by exposure to the vapor from the water 14 in the generating tank 10, and thus prevents the building up of gas pressure in the generator when it is not being used. Acetylene gas being highly explosive when stored under high pressure, this feature of our invention is of great value.

The outside manual control for selectively establishing a geared connection between the carbide feed mechanism and either the manual operating means or the gas operating means is also a very valuable feature of our generator contributing as it does to the quick starting of the generator. Also, the combination with the manual gear shifting mechanism of means for forming a gas-tight closure in the feed opening between the carbide hopper and the generator, so that a single movement of the crank 398 both disengages the carbide feed mechanism from its actuating means and seals off the remaining carbide from access to any moisture, is a very valuable feature in that it makes our generator "fool proof" because of the simplicity with which it is controlled.

Carbide of various sizes may be used in our generator because of the provision of the easily removable cap 366, shown in Fig. 4, which gives quick access to the nuts 358 and 357 by which the distance of the carbide valve 68 below its seat 27, when it is lowered to be operated by the rotor 172, may be varied. For the smaller sizes of carbide this opening is decreased as they tend to flow more readily than the larger carbide through an opening of given size.

It is likewise obvious that the valve 68, described and illustrated as frusto-conical, may be of full conical configuration, without departing from the spirit of the carbide feeding mechanism.

We claim as our invention:

1. In an acetylene generator, the combination of a frusto-conical carbide valve and feeding mechanism comprising a carbide hopper having a gravity feed opening, a valve seat holder adapted to retain yieldable material in the form of a flat ring in said opening, a yieldable ring therein, a frusto-conical valve disposed below said opening and adapted to engage said seat at its inner edge to close said opening, a shaft secured to said valve and through which said valve may be rotated beneath said opening to cause the discharge of carbide therefrom or raised to close said opening, and means for operating said valve through said shaft, said last mentioned means comprising automatically driven means for rotating said valve, manual means for rotating said valve and manual means for raising said valve to close said opening.

2. In an acetylene generator, the combination of a carbide valve and feeding mechanism comprising: a carbide hopper having a gravity feed opening; a valve seat in said opening; a valve disposed below said opening and adapted to engage said seat to close said opening; an apron extending downwardly from the periphery of said valve and having vertical slots therein; an annular shelf disposed about said apron; a spider rotatably mounted within said apron; arms projecting from said spider through the slots in said apron and across the face of said annular shelf; means for rotating said valve; and means for lifting said valve to close said opening.

3. A combination as defined in claim 2 in which said spider arms are flexible.

4. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; a yieldable packing member surrounding said opening; a valve member disposed beneath said opening; means for raising said valve member to form a moisture-tight seal between said generating tank and said carbide bunker; and means for feeding into said generating tank carbide discharged through said opening, said feeding means being disposed out of the path of movement of said valve.

5. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; a valve member disposed beneath said opening between the mouth of the bunker and a table when in open position and adapted to control the passage of carbide therethrough; and a feeding mechanism including a table element and a sweeping element adapted to be rotated relative to each other, the carbide being transferred from said valve to said table partially by gravity.

6. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; a valve member disposed beneath said opening between the mouth of the bunker and a table when in open position and adapted to control the passage of carbide therethrough; a feeding mechanism including a table element and a sweeping element adapted to be rotated relative to each other, the carbide being transferred from said valve to said table partially by gravity; and a shaft for operating said valve and rotating one of said feeding mechanism elements relative to the other.

7. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; yieldable packing member surrounding said opening; a rotatable valve member disposed beneath said opening; means for raising said valve member to form a moisture-tight seal between said generating tank and said carbide bunker; and means for feeding into said generating tank carbide discharged through said opening, said feeding means being disposed out of the path of movement of said valve.

8. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; a rotatable valve member disposed beneath said opening between the mouth of the bunker and a table when in open position and adapted to control the passage of carbide therethrough; and a feeding mechanism including a table element and a sweeping element adapted to be rotated relative to each other, the carbide being transferred from said valve to said table partially by gravity.

9. In an acetylene generator, the combination of: a gas generating tank; a carbide bunker having a valve opening communicating with said generating tank; a valve for controlling said opening; a carbide feeding mechanism associated with said valve; a shaft for operating said valve and said feeding mechanism; a gas operated motor; means for connecting said motor to said shaft for driving said feeding mechanism; means for manually driving said feeding mechanism through said shaft; and manually operated shifting means for disengaging the motor from driving relation with said shaft and engaging the last aforementioned means with said shaft.

10. A combination as defined in claim 9 in which the shifting means is manually operable to disengage said shaft from both motor and manual feeding mechanism operating means, and to move said shaft to close said valve.

11. A combination as defined in claim 2 in which means is provided for adjusting the open position of said valve to vary the size of said gravity feed opening. In testimony whereof, we have hereunto set our hands at Los Angeles, California, this 22nd day of June, 1926.

5 12. A combination as defined in claim 9 in which the means for controlling the valve opening also disengages said feeding mechanism from the gas motor and the manually operable means.

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