No. 703,071. Patented June 24, 1902.

# W. D. LUCE.

## WEIGHT MOTOR FOR GAS MACHINES.

(Application filed Mar. 25, 1901.)

(No Model.) 2 Sheets—Sheet 1.

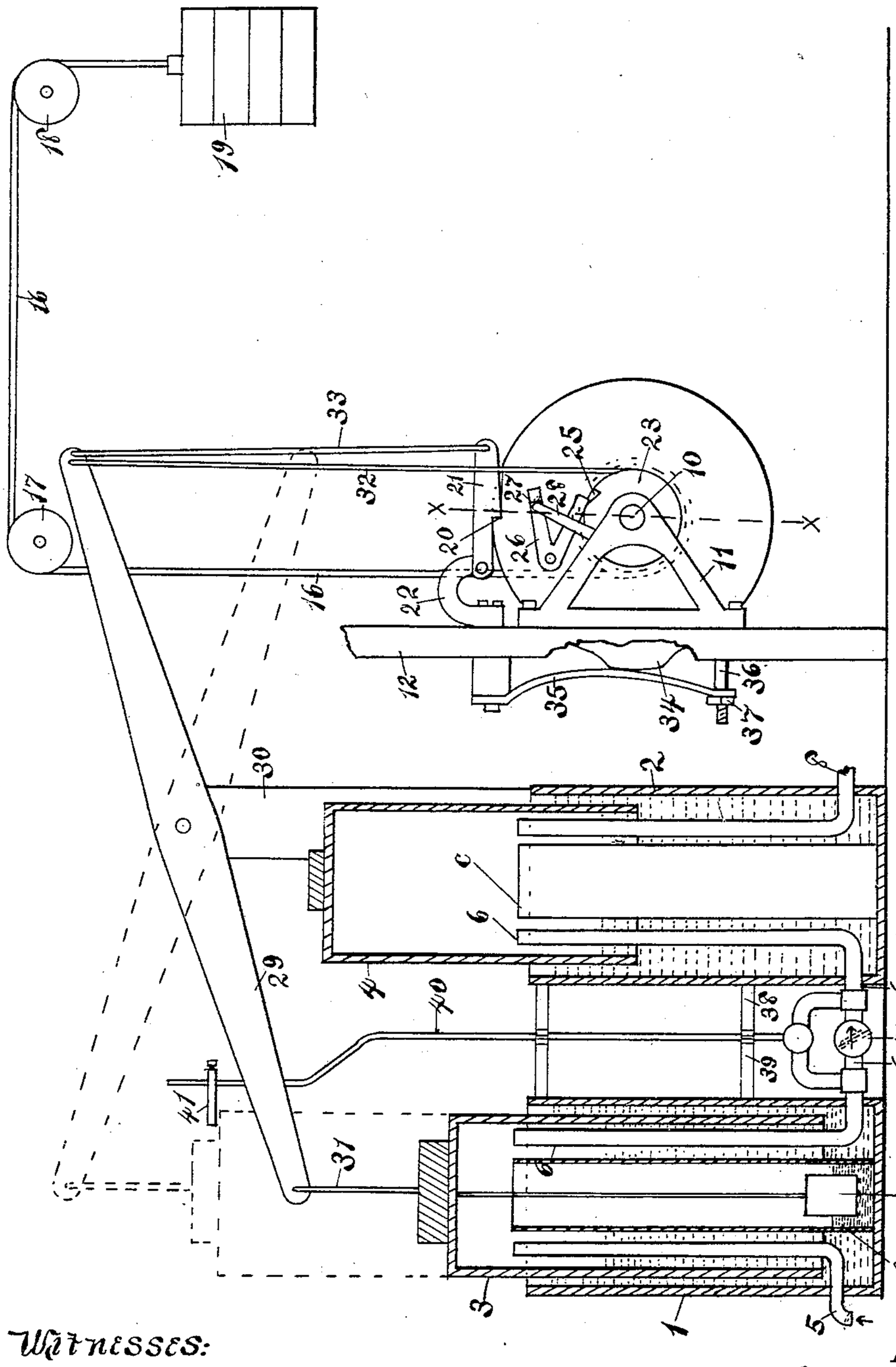


Fig. 1.

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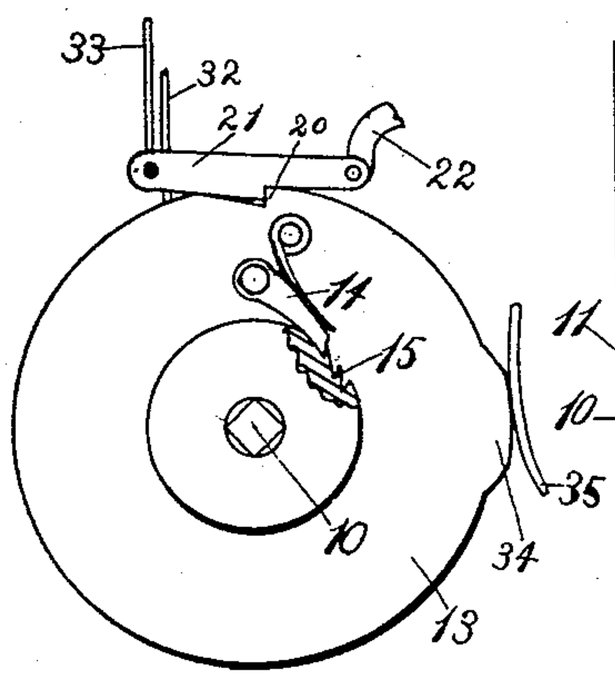


Fig. 2

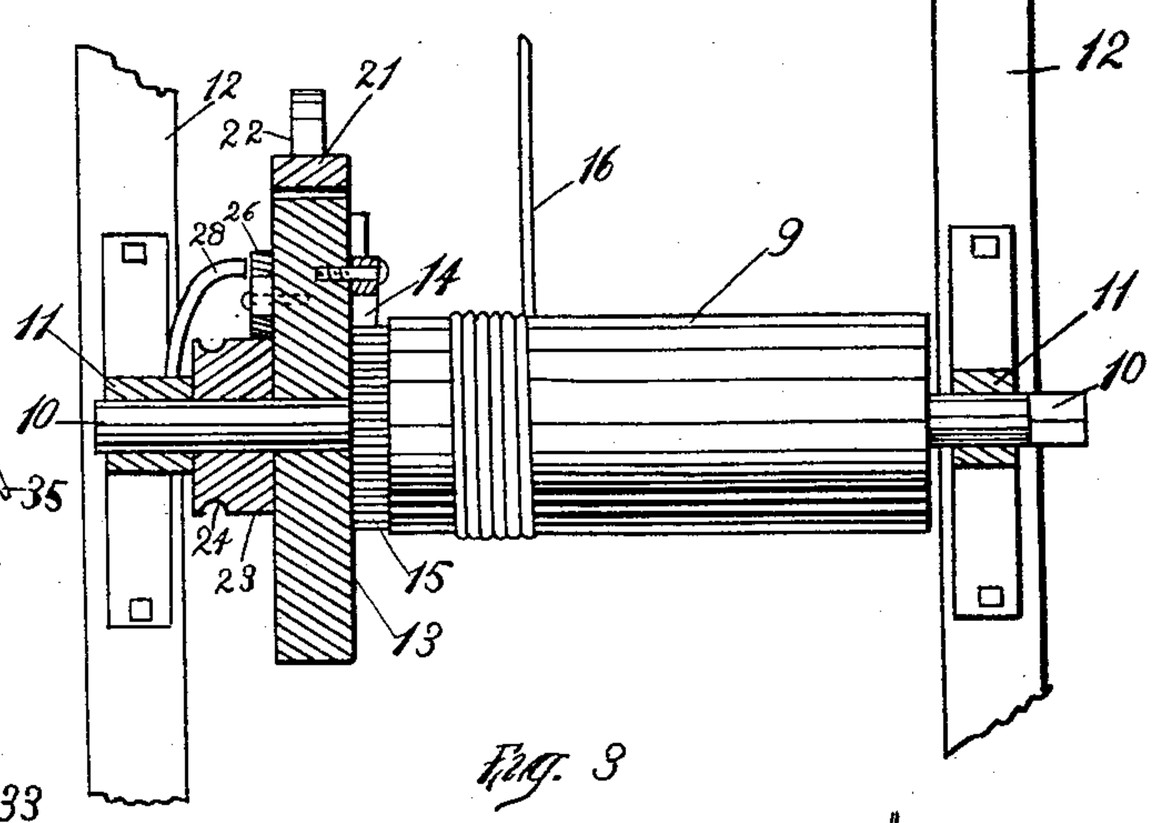


Fig. 3

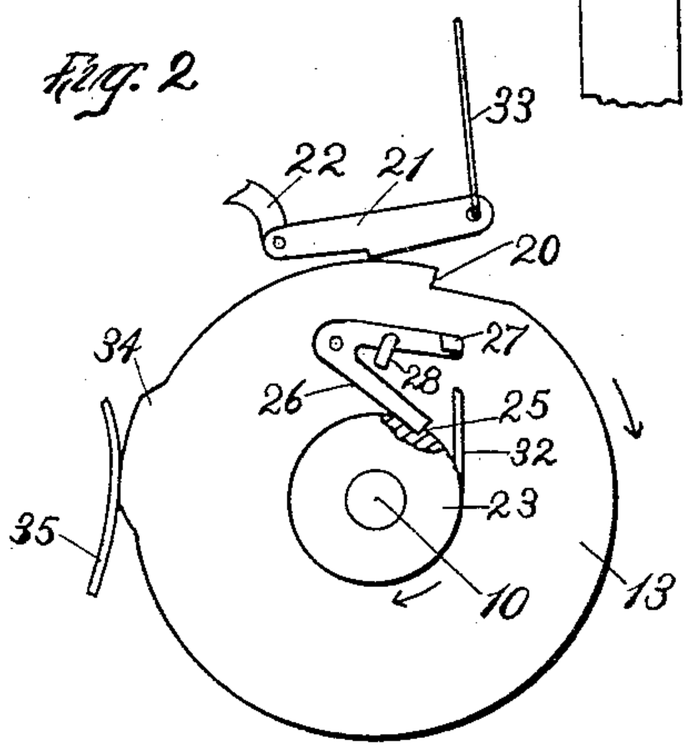


Fig. 4

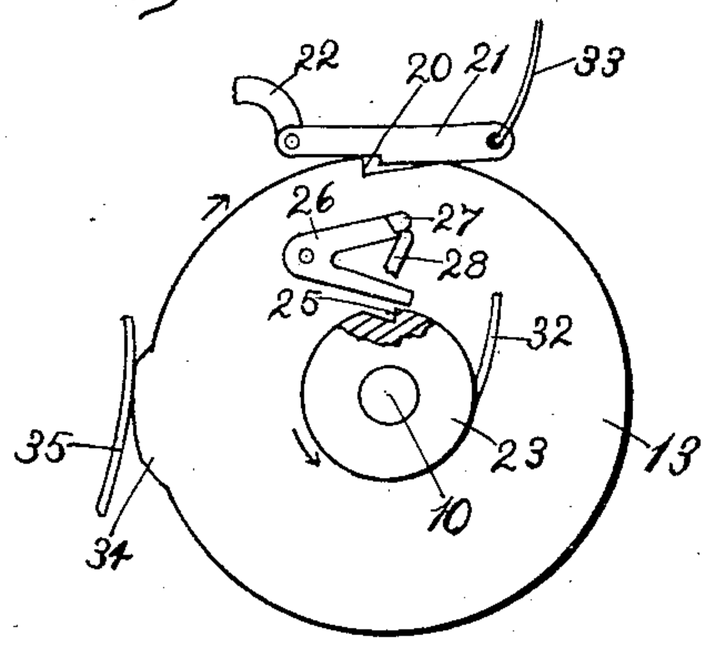


Fig. 5

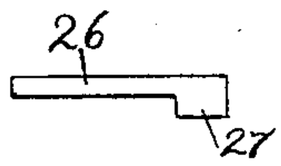


Fig. 6

Witnesses
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# UNITED STATES PATENT OFFICE.

WILLIAM D. LUCE, OF HAVERHILL, MASSACHUSETTS.

## WEIGHT-MOTOR FOR GAS-MACHINES.

SPECIFICATION forming part of Letters Patent No. 703,071, dated June 24, 1902.

Application filed March 25, 1901. Serial No. 52,691. (No model.)

*To all whom it may concern:*

Be it known that I, WILLIAM D. LUCE, a citizen of the United States, and a resident of Haverhill, in the county of Essex and State of Massachusetts, have invented certain new and useful Improvements in Weight-Motors for Gas-Machines, of which the following is a specification.

This invention relates particularly to a weight-motor for lifting the bell of a gas-machine according to the requirements of the latter, so that after the apparatus has been wound up the machine will continue in operation without attention for any desired length of time within reasonable limits.

The object of my invention is to produce a simple and efficient apparatus which will liberate a weight at suitable intervals and thereby cause the same to lift the bell of a gas-machine to a predetermined height at corresponding intervals, the apparatus being adapted to liberate the bell, so that it may sink as soon as it has been lifted to the desired height. I accomplish this object by the apparatus illustrated in the accompanying drawings, in which—

Figure 1 is a side elevation of the entire apparatus. Fig. 2 is a view of the right-hand end of the releasing mechanism. Fig. 3 is a front view thereof, partly in section, on line *x x* of Fig. 1. Figs. 4 and 5 are views of the left-hand end thereof, showing two positions. Fig. 6 is a detail view of the upper side of one of the pawls.

In Fig. 1 I show in a general way a well-known form of gas-machine, which consists of a generating-tank 1 and a holding-tank 2, and each tank is provided with a suitable weighted bell or inverted cup 3 and 4, respectively, and is partially filled with water to form the usual water seal. Tank 1 is provided with an air inlet-pipe 5, having an inwardly-opening check-valve therein. A suitable pipe 6, having a check-valve 7 therein, connects said bells, said check-valve 7 permitting a free flow of gas from bell 3 to bell 4. Bell 4 is provided with a discharge-pipe 8, which is connected to the distributing system. The operation of this machine is as follows: The lower end of bell 3 is provided with a basket *a*, containing zinc, and tank 1 is provided with a chamber *b*, containing sulfuric acid, so arranged that when bell 3 sinks to nearly its lowest point the zinc will be submerged in the acid, and hydrogen gas will thus be generated in the bell. The bell 3 is then immediately lifted, stopping further generation of the hydrogen and drawing in atmospheric air through pipe 5, so that the two gases will become mixed in said bell 3. Tank 2 is provided with a chamber *c*, containing a suitable hydrocarbon, so that when bell 3 is released its weight will force the mixed air and hydrogen through pipe 6, past check-valve 7, into the bell or holder 4, where it is charged with hydrocarbon vapor, which escapes from chamber *c*. The gas which is thus manufactured is then discharged into the distributing system in the usual manner.

In order that bell 3 may be automatically lifted by a weight after it has sunk to its lowest point and then be released and force the mixed air and hydrogen into tank 2, I provide the apparatus hereinafter described.

The drum 9 of a windlass is secured to shaft 10, which is journaled in bearings 11, they being secured to suitable supports 12. A wheel 13 is journaled on said shaft 10 and is provided with a spring-pressed pawl 14, which engages a series of ratchet-teeth 15 on said drum. A cable 16 is secured to said drum, passes up over pulleys 17 and 18, and has a weight 19 secured to its end. One end of said shaft 10 is made square, so that a handle for turning the drum may be applied thereto. Said wheel 13 is provided with a notch or single ratchet-tooth 20, and a pawl 21 is pivoted at one end to a fixed bracket 22 in such a position that it may engage said notch and hold the wheel against rotating in a direction to unwind the cable 16 from the drum 9. Bracket 22 is preferably made of a stiff spring, for reasons which will hereinafter appear. A drum 23 is journaled on shaft 10 next to wheel 13, said drum 23 being provided with a cable-groove 24 and a single ratchet tooth or notch 25. An angular-shaped pawl 26, having a lateral projection 27, is pivoted to one side of wheel 13 in such a position that it may engage said notch 25. A tripping-finger 28 is secured to bracket 11 in such a position that it may engage said projection 27 of pawl 26 in certain positions of the latter.

A lever 29 is pivoted on a standard 30, and

a cable 31 is secured to the top of bell 3 and to one end of said lever 29. A cable 32 is secured to the opposite end of said lever and to the drum 23 in its groove 24. A light cable 33 is also secured to the same end of lever 29 as that to which cable 32 is secured and to the outer end of said pawl 21.

The operation of the parts thus far described is as follows: The wheel 13 is fixed so that its notch 20 is engaged by the pawl 21, as shown in Fig. 1. The drum 9 is then rotated, winding on the cable 16 and lifting the weight 19, the pawl 14 permitting rotation of drum 9, so as to wind on the cable without rotating wheel 13. When the weight has been raised to the desired height, the pawl 14 will lock with its ratchet 15 and will hold wheel 13 against rotation in the direction which will unwind the cable 16 from drum 9. The weight 19 will therefore be held in its raised position by pawl 21. The lengths of cables 32 and 33 are such that when the bell 3 has nearly reached its lowest position the cable 33 will be drawn taut and the cable 32 will be almost completely unwound from drum 23, rotating the latter on shaft 10, so that its notch 25 will be slightly in front of the end of pawl 26 and in position to be immediately engaged thereby should the pawl 26 be moved forward. Upon the bell 3 being lowered slightly farther, the pawl 21 will be lifted out of engagement with notch 20, permitting the weight 19 to rotate the drum 9 and wheel 13 in the direction of the arrows in Fig. 4. The pawl 26 will immediately come into engagement with notch 25, (see Fig. 4,) so that parts 9, 13, and 23 will all be locked and will rotate forward together, winding the cable 32 upon the drum 23, lifting the bell 3 up to the dotted position shown in Fig. 1. The circumference of the drum 23 in its groove 24 is such that when said drum has made one rotation the bell 3 will have been lifted to the desired height. As the wheel 13 approaches the original position (shown in Fig. 1) the finger 28 will engage the under side of projection 27 on pawl 26, lifting the latter out of engagement with notch 25, as shown in Fig. 5, so that drum 23 is free to rotate backwardly in the direction of the inner arrow in Fig. 5, thus permitting the bell 3 to sink. The position of finger 28 is such that it will lift pawl 26 just before pawl 21 comes into engagement with notch 20, (see Fig. 5,) so that immediately after drum 23 is disconnected from wheel 13 said pawl 21 and tooth 20 will engage, preventing the cable 16 from unwinding further. The spring-bracket 22 takes up the force of the blow of tooth 20 as it strikes pawl 21, avoiding the liability of breaking the parts. The bell 3 will then sink slowly, forcing the air and hydrogen therein into tank 2, and the parts finally all return to the position shown in Fig. 1, after which the operation will be repeated.

The speed at which bell 3 will be lifted depends on the size of the air-passage 5, a partial vacuum being formed in the bell as soon as it has been raised a short distance. The bell 3 will therefore be lifted a short distance with a jerk upon the release of wheel 13 unless some means is provided which will prevent the too-rapid movement of the parts until this partial vacuum has had opportunity to form. I therefore provide wheel 13 with a projection 34, which is curved on its face to correspond with an arc drawn from the center of shaft 10 and secure a brake-spring 35 at the end of support 12, so that its middle portion may bear against the projection 34 in certain positions of the latter. A bolt 36 is secured in support 12, and a nut 37 on said bolt is adapted to press said spring against said projection and give it the desired tension. These parts 34 and 35 are arranged so that the projection will come into engagement with the spring just before the pawl 21 locks the wheel 13. (See Fig. 5.) When the pawl 21 is lifted, the spring 35 will retard the rapid rotation of the wheel 13 until a partial vacuum is formed in the bell 3, which will be sufficient to prevent the too-rapid movement of the bell. When the bell 3 reaches its highest point, this partial vacuum will be retained unless some means are taken to prevent it, so that the atmospheric pressure on the top of the bell, combined with the weight thereon, will cause the bell to drop back suddenly into the water seal of tank 1 when the drum 23 is liberated, splashing the water out into the room in which the tank is located. To obviate this objection, I provide a by-pass 38 around the check-valve 7 and locate a valve 39 in said by-pass, which is adapted to permit a return flow about said check-valve. Said valve 39 is provided with an elongated suitably-guided stem 40, which carries an arm 41, the latter being adjustably secured to the upper end thereof. The position of said arm 41 is adjusted so that when the bell 3 has been lifted nearly to its highest point its upper end will engage said arm and open said valve 39, so that a free flow of gas is permitted from tank 2 to tank 1, restoring the pressure inside the bell 3 to such an extent that when the bell is liberated it will simply drop back a short distance without any splashing, forcing back the gas into tank 2 and slightly compressing the gas in bell 3.

It is very desirable that the enlargement 34 on wheel 13 be of sufficient length to engage the brake-spring 35 for a short distance before wheel 13 is brought to rest; otherwise the equalization of the pressure in the bells at the last part of the upward movement of bell 3 will permit it to be lifted too rapidly and cause the tooth 20 of the wheel 13 to engage the pawl 21 with too much force. Such a sudden stoppage would be liable to break the engaging parts or prevent the pawl from holding the wheel.

From the foregoing description it will be evident that although the above-described controlling apparatus may be used in connec-

tion with a gas-machine of the character referred to with particular advantage, yet it is capable of use in many other relations, which need not be here enumerated.

The various changes may be made without departing from the spirit of my invention. For example, a spring similar to an ordinary clock-spring may be substituted for the winding-drum 9, weight 19, and connecting-cable. The means for supplying gas to the bell 3 at the end of its upward movement are only shown in a general way, and various other means which will accomplish the same result may be substituted with equal advantage, and the pressure in the bell 3 may be increased by introducing outside air instead of drawing it from the holder, although I consider the latter method preferable.

Having described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is as follows:

1. A gas-machine having a water-sealed bell, means for raising and lowering said bell comprising a shaft, means which act to rotate the same in one direction, a locking means for said shaft which is adapted to prevent rotation thereof, means for automatically causing said locking means to release said shaft when the bell sinks to a predetermined level so that the shaft is permitted to rotate, means for automatically connecting said shaft to said bell as it is rotated, and means for automatically disconnecting said shaft from said bell when the latter has been lifted to a predetermined height, so that it is permitted to sink, said locking means being adapted to again lock said shaft when the bell is liberated.

2. A gas-machine having a water-sealed bell, means for raising and lowering said bell comprising a shaft, means which act to rotate the same in one direction, a locking means for said shaft which is adapted to prevent rotation thereof, a winding-drum which is adapted to rotate freely in both directions, connections between said drum and bell whereby the latter will be lifted when the former is rotated in one direction, means for automatically causing said locking means to release said shaft when said bell is lowered to a predetermined point, means for automatically connecting said shaft to said drum so that the drum will be rotated by the shaft and will lift said bell, means for automatically disconnecting said shaft and drum when the bell has been lifted to a predetermined height, so that the drum may rotate in the opposite direction and permit said bell to sink, said locking means being adapted to relock the shaft when the latter is disconnected from said drum.

3. In combination with the cup or bell of a gas-machine which is adapted to draw in and discharge gas as it is raised and lowered, means for raising and lowering said cup, comprising a shaft, means which act to rotate the same, a wheel which is connected to said shaft, a single ratchet-tooth thereon, a pawl which is pivoted to a fixed support and is adapted to engage said tooth and hold said shaft against rotation, a winding-drum which is journaled on said shaft, a pawl which is pivoted on said wheel and is adapted to engage said winding-drum so as to lock said shaft and drum together when said shaft is rotated, a cable connecting said drum and cup, means for lifting the pawl first named when said cup is at a predetermined point, permitting said shaft to rotate and lift said cup, and a fixed finger which is adapted to engage said second-named pawl and lift the same out of engagement with said drum when the latter has nearly made one complete rotation, said first-named pawl being liberated so that it may engage the tooth of said wheel and lock said shaft immediately after said winding-drum is disconnected therefrom.

4. In combination with a cup or bell of a gas-machine which is adapted to draw in and discharge gas as it is raised and lowered, means for raising and lowering said cup, comprising a shaft, means which act to rotate the same, a locking device which is adapted to prevent rotation of said shaft, a drum which is adapted to rotate on said shaft, means for automatically connecting said shaft and drum when the shaft is rotated, connections between said cup and drum which are adapted to lift the cup when the drum is rotated, means for releasing said shaft when said cup sinks to a certain position, whereby the latter may be lifted, means for disconnecting said shaft and drum when they have made nearly one complete rotation, said locking device being adapted to lock said shaft when it has completed its rotation.

5. An apparatus of the character described comprising a shaft, means which act to rotate the same in one direction, means for locking said shaft against rotation, an inverted cup, means for causing the same to draw in and discharge gas when it is raised and lowered, connections between said shaft and cup whereby the cup will be lifted when said shaft is permitted to rotate, and a brake which is adapted to retard the rotation of said shaft during the first part of its rotation after it is unlocked.

6. An apparatus of the character described comprising an inverted cup, means for causing the same to draw in and discharge gas when it is raised and lowered, a shaft, means which act to rotate the same in one direction, means for locking said shaft against rotation and for unlocking the same when said cup reaches a predetermined position, a segmental projection which is concentric with said shaft and connected thereto, and a brake which is in position to engage said projection immediately upon the unlocking of said shaft whereby the speed of rotation of said shaft may be retarded during the initial part thereof.

7. A gas-machine comprising a tank containing a liquid, an inverted cup which is

suspended therein, means for lifting said cup so as to draw a gas therein at a predetermined rate, means for admitting an additional flow of gas into said cup as it finishes its upward movement, and means for permitting said cup to sink into said tank immediately thereafter.

8. A gas-machine comprising a tank containing a suitable liquid, an inverted cup which is suspended therein, lifting means for said cup, means for controlling said lifting means so that the latter may act to lift said cup and permit the same to sink into said tank under predetermined conditions, means for permitting said cup to draw in a gas at a predetermined rate as it is lifted, and means for permitting an additional flow of gas into said cup as it finishes its upward movement.

9. A gas-machine comprising a tank containing a liquid, an inverted cup which is suspended therein, lifting means for said cup, means for controlling said lifting means so that the latter may act to lift said cup and permit the same to sink into said tank under predetermined conditions, means for permitting said cup to draw in a gas at a predetermined rate as it is lifted, a gas-holder, a passage connecting said cup and holder having a check-valve which is arranged to prevent a return flow from said holder to said cup, a by-pass about said check-valve having a normally closed valve therein, and means for opening said by-pass valve which are adapted to be operated by said cup as it finishes its upward movement.

In testimony whereof I have affixed my signature in presence of two witnesses.

WILLIAM D. LUCE.

Witnesses:
LOUIS H. HARRIMAN,
JOHN F. NEAL.