G. BAEHR.

METHOD OF AND APPARATUS FOR PREVENTING GAS EXPLOSIONS.

APPLICATION FILED OCT. 20, 1909.

1,015,929.

Patented Jan. 30, 1912.

2 SHEETS—SHEET 1.

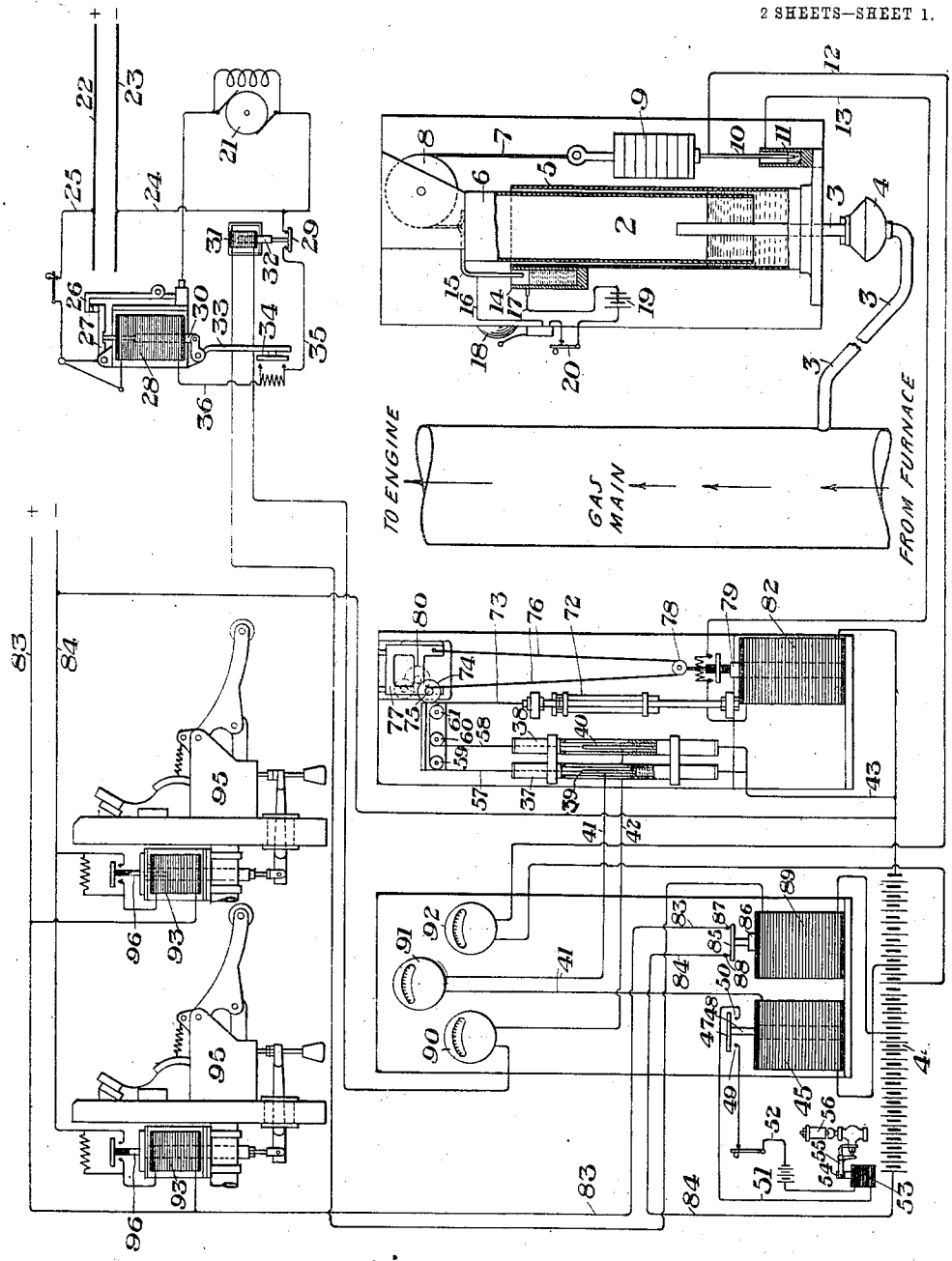

Fig. 1.

WITNESSES

R. A. Balderson

Walter Tamariss

INVENTOR

Geo. Baehr.

by Bakewell, Byrnes & Carnelee.

his Attys

G. BAEHR.

METHOD OF AND APPARATUS FOR PREVENTING GAS EXPLOSIONS.

APPLICATION FILED OCT. 20, 1909.

1,015,929.

Patented Jan. 30, 1912.

2 SHEETS—SHEET 2.

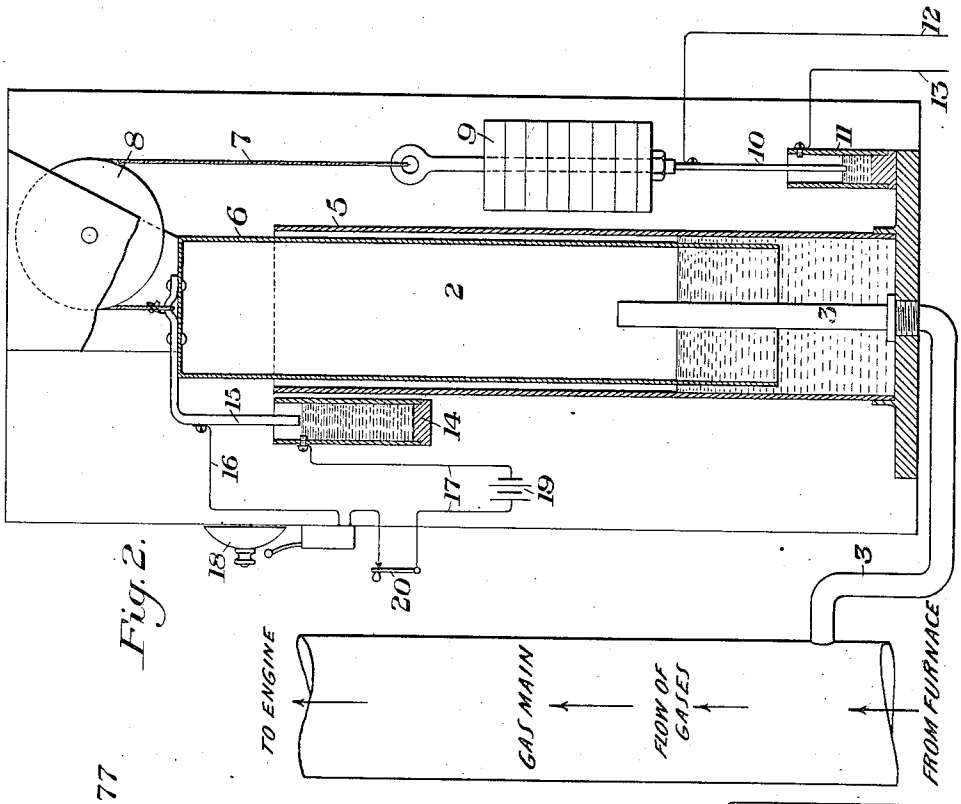

Fig. 2.

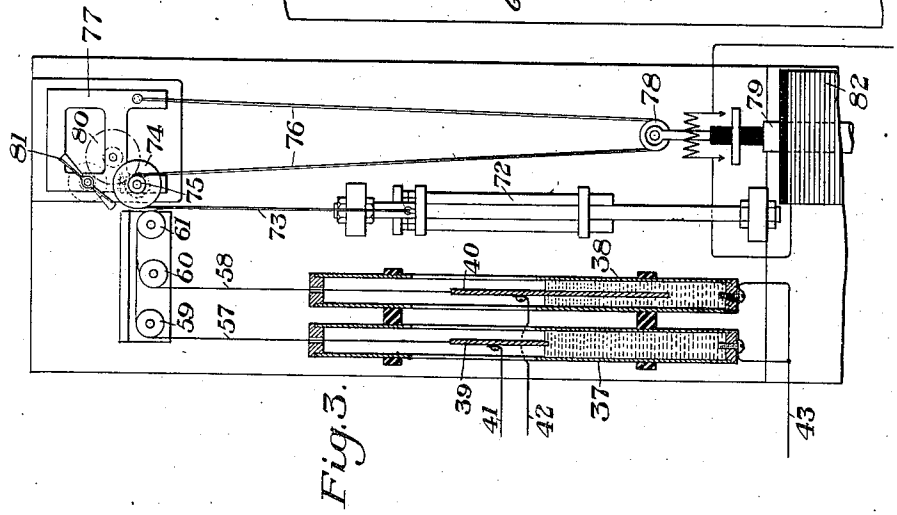

Fig. 3.

WITNESSES

R. A. Baldwin

Walter Famariss

INVENTOR

Geo. Baehr.

by Bakewell Baynes & Parmelee.

his Attys.

UNITED STATES PATENT OFFICE.

GEORGE BAEHR, OF AMPERE, NEW JERSEY, ASSIGNOR TO NATIONAL TUBE COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF NEW JERSEY.

METHOD OF AND APPARATUS FOR PREVENTING GAS EXPLOSIONS.

1,015,929. Specification of Letters Patent. Patented Jan. 30, 1912.

Application filed October 20, 1909. Serial No. 523,708.

To all whom it may concern:

Be it known that I, GEORGE BAEHR, of Ampere, county of Essex, and State of New Jersey, have invented a new and useful Apparatus for Preventing Gas Explosions, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is a side elevation, partly diagrammatic and partly in section showing one form of apparatus as constructed and arranged and applied for use on a gas main in accordance with my invention. Fig. 2 is a sectional elevation, on a larger scale showing a detail of part of the apparatus illustrated in Fig. 1; Fig. 3 is a view similar to Fig. 2, showing another part of the apparatus illustrated in Fig. 1.

My invention relates to the handling and conducting of combustible gases and more particularly relates to the handling and conducting of such gases evolved in the operation of blast furnaces, from such furnaces to the place in which they are utilized in generating steam, electricity, for heating or other purposes.

In handling or conveying such gases there is a constant danger of explosions caused by the admission into the gas mains of air by leakage or otherwise in sufficient quantities to form an explosive mixture and the occurrence of such explosions often result in great damage to the apparatus and surrounding property and even in the loss of life.

The object of my invention is to provide means by which the liability of such explosions is overcome and prevented and means by which approach to the point at which an explosive mixture can form is first indicated and, after a predetermined interval of time, an explosion is automatically rendered impossible and liability of damage to the apparatus is prevented.

Another object of the invention is to provide means by which the return of the gases to normal conditions during the time allowed to elapse after approach to the danger line has been indicated, will cause the continued operation of conveying the gases without delay in supplying gases to the place of use.

A further object of the invention is to provide means by which, when the approach to the time at which an explosion can occur, is continued for a definite time after indicating that the danger line has been reached, the gas engines operated by gases from the mains will be automatically stopped.

A still further object of the invention is to provide means by which electric generators driven by such engines are cut out from the bus bars of the power station and damage thereto when stopped, caused by current supplied by other independently driven generators and connected with the feed wires leading from gas engine driven generators, is prevented.

In the drawings 2 indicates a pressure actuated device, which is in effect a small gasholder or gasometer and which is connected by the pipe 3 to a gas-main leading from a source of gas supply to a place of use for the gases conducted through the gas main. The gas main, connecting a blast furnace, gas producer or other source of gas supply with the engine cylinders of a gas engine, the blast furnace stoves, or other place of use, is equipped with the usual explosion doors, dust catchers, cleaning doors, valves, gas washers, or scrubbers, etc., as found necessary or desirable, which, being of any preferred construction, are not shown and need not be further described.

The pipe 3 connecting the gasometer 2 with the gas main is provided at a suitable point in its length with a choke valve 4. This valve which normally remains open, is arranged when sudden increases in pressure occur in the gas main to close and shut off the gas supply to the gasometer 2 and prevent disarrangement of its movable parts or possible damage to the gasometer. The end of the pipe 3 projects upwardly within the gasometer above the level of the oil or other fluid maintained therein in making a sealed joint between the stationary chamber or vessel 5 and the movable bell 6, forming part of the gasometer. The gasometer bell

6 is suspended from one end of a flexible connection 7 which passes over the pulley or wheel 8 and is provided on its other end with a counterweight 9. Secured to the lower end of the weight 9 is a depending rod or bar 10 which extends downwardly and into the mercury cup 11 located beneath the counterweight. Mercury is kept in the cup 11 and the cup is connected to and forms one terminal of an electric circuit formed by the wires 12 and 13, the rod 10 on the weight 9 forming a terminal for the wire 12 and the circuit being completed at such times as the rod 10 is lowered into contact with the mercury in the cup 11 for a purpose described hereinafter.

Secured to the side of the vessel or chamber 5 is a cup 14 which also contains mercury and above this cup is a depending rod or bar 15 which is secured to and moves vertically with the counter-balanced gasometer bell 6. The ends of the wires 16 and 17 which form a circuit through the electric bell 18 and battery or other source of current 19 are attached to the cup 14 and rod 15, this rod being arranged to complete the circuit when a change in the pressure of the gases in the main permits the gasometer bell 6 to fall so as to lower the end of the rod 15 into the mercury in the cup 14. A switch 20 is provided to cut out the electric bell 18 when desired.

In the gas washing or scrubbing plants used for cleaning such combustible gases, a rotary washer is usually employed which is driven by an electric motor. Such rotary washers are practically pressure pumps, as they are adapted to increase the pressure of the gases in the gas main on the discharge side, over that on the inlet side of the washers.

As shown in Fig. 1 of the drawings 21 indicates a motor for driving such rotary gas washer or washers. The line wires 22 and 23 are connected to the motor by the wires 24 and 25 through the contacts 26 and 27 of the magnetic switch. The solenoid coil 28 on the switch is also connected by a shunt circuit through the bridge piece 29 with the feed wires 22, 23, the pivoted contact 27 on the switch being held in engagement with its opposing contact 26 by means of the upper end of the solenoid core 30 when the coil 28 is energized. A solenoid coil 31 having a core 32 is arranged so that the bridge piece 29 on the lower end of the core 32 is held in position to complete the shunt circuit through the coil 28, when the coil 31 is energized and to break this circuit when the circuit through the coil 31 is broken. The lower end of the core 30 is connected to one arm of the bell crank 33 which is pivoted to the support for the solenoid coil 28 and the other arm is provided on its lower end, with a bridge piece 34. This bridge piece is arranged to contact with and bridge the gap between the terminals of the wires 35 and 36 forming the shunt circuit through the coil 28 to the motor 21 and cut out the resistance 37 in this circuit, while moving the core 30 to bring the contacts 26 and 27 of the magnetic switch into engagement after the solenoid coil 31 has been deënergized and the bridge piece 29 on the core 32 has been moved in breaking the circuit through the switch coil 28.

The timing device forming part of the apparatus is provided with mercury cups 37 and 38 and rods 39 and 40 forming mercury switches which are connected respectively by the wires 41 and 42, and the wire 43 through the battery 44 or other source of current to the solenoid coils 31 and 45.

The switch formed by the cup 37 and rod 39 is arranged to break the circuit passing through it when the timing device starts to operate and in this way deënergizes the coil 45. When this solenoid coil is deenergized, the bridge piece 47 on the end of the solenoid core 48 bridges the gap between the contacts 49 and 50 and completes the circuit through the wires 51 and 52 so as to energize the coil 53, and move the solenoid core 54 which in turn moves the whistle valve lever 55 connected to it and causes the whistle 56 to sound an alarm when this circuit is broken.

The rod 40 projects downwardly into the mercury in the cup 38 of the other mercury switch for some distance and contact between the rod 39 and the mercury is not broken for a predetermined interval of time after the other rod 39 has been raised a sufficient distance to break the circuit and cause the whistle 56 to sound its alarm. The rods 39 and 40 are suspended above their respective mercury cups 37 and 38 from one end of flexible connections 57 and 58 which pass over the pulley 59, 60 and 61 and are secured by one of their ends to the counterweight 72. The weight 72 is secured to one end of a flexible connection 73 which is attached by its other end to the larger drum 74 on the escapement mechanism.

Secured on its shaft and arranged to rotate in one direction with the drum 74 and shaft is secured a second drum 75, smaller in diameter as shown on which one end of a flexible connection 76 is secured, which is adapted to be wound and unwound, when the drums 74, 75 are rotated. The flexible drum connection 76 is secured to the frame 77 of the escapement mechanism after having been led around the pulley 78 which is on one end of the solenoid core 79.

The drum shaft on which the drums 74 and 75 are mounted is connected by suitable slow down gearing 80 to the vane 81 which, in connection with the weight 72 regulates the speed at which the rods 39 and 40 are

lifted from the mercury in the cups 37 and 38.

A ratchet device on the slow down mechanism permits the weight 72, after descending to be quickly raised by the core 79 when the coil 82 of the solenoid becomes energized. The solenoid coil 82 is normally energized in holding the weight in its raised position and maintaining the rods 39 and 40 in contact with the mercury in the cups 37 and 38.

When the apparatus is employed in connection with an electric power station having generators driven by gas engines or partly by gas engines and partly by steam engines, the gas engine ignition circuit formed by the wires 83 and 84 through the battery 44 is completed by a bridge piece 85 on the end of a solenoid core 86 which engages with terminals or contacts 87 and 88 on the ends of these wires. The solenoid core 86 is arranged to normally hold the bridge piece 85 in position to complete the ignition circuit through the contacts 87 and 88 when the coil 89 is energized.

Ammeters 90, 91 and 92 are provided on the different circuits, having suitable marks on their dials to indicate the normal current and any deviation, such as would be caused by the batteries approaching exhaustion, heating of the coils, or other reason, will be indicated to the operator and cause an investigation to be made.

The ignition circuit formed by the wires 83 and 84 is also connected through the solenoid coils 93 on the circuit breakers 95, on the feed wires leading from the generators in the power house to the bus bars. The coils 93, are arranged when energized to hold their cores 96 in the position shown in the drawings. When the ignition circuit is broken by deënergizing the coil 89 and thereby dropping the bridge piece 85 on its core 86 the coils 93 are thereby deënergized. This causes the cores 96 to drop, and through the lever mechanism by which they are connected to the circuit breakers 95 will trip these circuit breakers and cut out the generators from the main line and in this way prevent damage to the generators when not being driven by current supplied by other generators which are continued in operation.

It will be noted that the different circuits are arranged so that a break in any circuit will cause the mechanism controlled thereby to be actuated and in this way call attention to the fact that the apparatus is not in its normal working condition.

In the operation of the apparatus, a change in pressure of the gases is transmitted through the pipe 3 into the gasometer 2 and when it falls below the normal pressure the gasometer bell 6 is lowered in the vessel 5 forming part of the gasometer.

When the gasometer bell 6 begins to descend, the rod 15 on this bell is brought into contact with the mercury in the cup 14 and a circuit is completed through the electric bell 18 causing an alarm to be sounded and warning the attendant that a change in the pressure of the gases has occurred.

The downward movement of the bell 6 necessary to complete a circuit through the mercury cup 14 and rod 15 will also raise the weight 9 by which the bell 6 is counterweighted, and lift the rod 10 on the lower end of the weight 9 out of the mercury in the cup 11 beneath the rod so as to break the circuit through the wires 12, 13 and deenergize the solenoid coil 82 forming part of the timing device and release the solenoid core 79. When the core 79 is so released, the counterweight 72 starts to descend and lift the core 79, through the drums 74, 75 and connections and the slow down gearing 80 operatively connected to the vane 81 of the escapement mechanism.

Downward movement of the weight 72 causes the rods 39, 40 to lift and, at the beginning of the upward or lifting movement of these rods, the rod 39 is moved out of the mercury in the cup 38 and the circuit through the wires 41 is broken and the solenoid coil 45 is deënergized. The coil 45 is arranged when energized to hold the bridge piece 47 on the upper end of its core 48 out of engagement with the terminals or contacts 49, 50 and when deënergized, the core 48 drops with the bridge piece 47 which completes the circuit through the wires 51, 52 connected to the solenoid core 53 forming part of the operating mechanism of a whistle and through the core 54 and lever 55 the whistle is caused to blow and by another alarm warn the operatives that the pressure of the gases is changing. The bell 18 is usually located in the motor house or adjacent to the gas washing plant and the whistle in the electric power station or plant containing the gas engines; these locations ordinarily being widely separated.

The escapement mechanism governing the speed at which the counterweight descends, is arranged to permit lowering of the weight 72 to its extreme position in a definite length of time, (in one instance five minutes being the interval set upon). When such interval has elapsed after the alarms have sounded to warn the operators that the pressure in the main was falling and the pressure has continued to become less and the gases have not resumed their normal pressure, the counterweight 72 will have moved sufficiently to lift the rod 40 out of the mercury in the cup 38 and break the circuit through the rod 40 and cup 38, the breaking of this circuit causing the solenoid coils 31 and 89 to become deënergized.

The deënergizing of the coils 31 and 89 permits their cores 32 and 86 to drop so as

to move the bridge pieces 29 and 85 on the ends of these cores out of engagement with the terminals of the wires 24, 25 forming the shunt circuit through the core 28. When the solenoid core 32 is dropped, the bridge piece 29 on its lower end is moved to break the shunt circuit through the coil 28 and deënergize this coil, which forms part of the magnetic switch controlling the operation of the washer motor 21 and permit the core 30 to drop. When the core 30 drops the movable contact 27 is disengaged from the contact 26 of the magnetic switch, breaking the circuit leading to the motor 21 and stopping this motor and the rotary gas washer or washers driven thereby.

The solenoid coils 93 on the circuit breakers 95 are connected in parallel with the wires 83 and 84 forming the gas engine ignition circuit at a point relative to the solenoid core 86 so that when the ignition circuit is broken, by dropping of the bridge piece 85 on this core 86, the circuit breakers 95 are tripped and the generators driven by the gas engines are cut out from the bus bars simultaneously with the stopping of the gas engine.

Should the gases in the main resume their normal pressure after the lowering of the pressure in the gas main is indicated before the rod 40 is lifted from the mercury in the cup 38, so as to break the circuit formed by it and bring all of the operations to a standstill, the rod 39 will again be brought into engagement with the mercury in the cup 37 completing the circuit through it and the wires 41, 42. Such return of the gases to their normal pressure also causes the gasometer bell 6 to lift and by breaking contact between the rod 15 and the mercury in the cup 14, stop the ringing of the electric bell 18. The same movement of the gasometer bell 6 causes the rod 10 on the bell counterweight 9 to complete, through the mercury in the cup 11, a circuit through the wires 12, 13 and again energize the solenoid coil 82. The energizing of this coil will cause its core 79 to lower so as to lift the counterweight 72 on the timing device and lower the rod 39 in the mercury cup 37 to again complete and maintain the circuit formed by the wires 41, 43. The completion of this circuit through the coil 45 causes its core 48 to raise and lift the bridge piece 47 and, breaking the circuit through the cores 51, 52, stop the blowing of the whistle.

The advantages of my invention will be appreciated by those skilled in the art. The occurrence of explosions in the gas mains is prevented in a simple and effective manner and approach to the point at which it is possible for an explosion to occur is indicated for any desired length of time before such point is reached.

When the gases have reached such pressure that air will enter the gas mains and form an explosive mixture, the flow of gases through the mains is prevented. The engines using the gases are stopped and electric generators driven by such gas engines are cut out from the bus bars connecting them with other independently driven generators. When the gases resume their normal pressure after having reached the point where approach to the danger line is indicated, the apparatus mechanically continues to operate without attention from the operator.

Modifications in the construction and arrangement of the parts may be made without departing from my invention.

I claim:

1. In apparatus of the character described, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, means operated by variations in the gas pressure for stopping the flow of gases and mechanism arranged to break the ignition circuit of a gas engine connected to said gas main when the flow of gases is stopped.

2. In apparatus of the character described, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, means actuated by a change in the gas pressure for controlling the passage of gas through the main, and mechanism arranged to simultaneously indicate approach of the gases to the pressure at which the flow is stopped.

3. In apparatus of the character described, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, means actuated by a change in the gas pressure for controlling the passage of gas through the main and mechanism arranged to indicate simultaneously at a plurality of points approach of the gases to the pressure at which the flow is stopped.

4. In apparatus of the character described, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, means actuated by change in the gas pressure for controlling the passage of gases through the main, and means for actuating a circuit breaker connected to a gas engine driven generator when the flow of gases is stopped.

5. In apparatus of the character described, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, means actuated by a change in the gas pressure for controlling the passage of gases through the main, mechanism arranged to break the ignition circuit of a gas engine connected to said gas main and means for actuating a circuit breaker connected to a gas engine driven generator when the flow of gases is stopped.

6. In apparatus of the character de-

scribed, a gas main or holder arranged to conduct gases from a source of supply to a gas engine, and means actuated by a change in the gas pressure for controlling the passage of gases through the main and for sounding an alarm at a plurality of points when the flow of gases is stopped.

In testimony whereof, I have hereunto set my hand.

GEO. BAEHR.

Witnesses:
JOHN FOX,
CHAS. J. BOYD.