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Gregory

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[54] **CATALYTIC IGNITION SYSTEM**

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[52] **U.S. Cl.** **431/268**; 48/196; 204/129

[51] **Int. Cl.**[2] **F23Q 11/04**

[58] **Field of Search** 431/268, 2; 48/196; 204/129

[56] **References Cited**

UNITED STATES PATENTS

180,588	8/1876	Hufeland et al.	431/268
3,518,036	6/1970	Staats et al.	431/268

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Attorney, Agent, or Firm—Dominik, Knechtel, Godula & Demeur

[57] **ABSTRACT**

An improved catalytic pilot ignition system which utilizes a short-circuited, air-starved, electrochemical cell or battery comprising a metal electrode and an inert electrode, such as zinc and carbon electrodes, or metal-air battery such as a zinc-air battery, which will produce a small but sufficient flow of pure hydrogen gas. When such a battery is short-circuited, the current often rises to a level above that which can be supplied with atmospheric air. When this happens, hydrogen is evolved. The evolution of hydrogen ceases immediately when the short-circuited current is interrupted. If a zinc-air battery is operated without access to the air, any current drawn from the cell will produce hydrogen at the air electrode.

25 Claims, 2 Drawing Figures

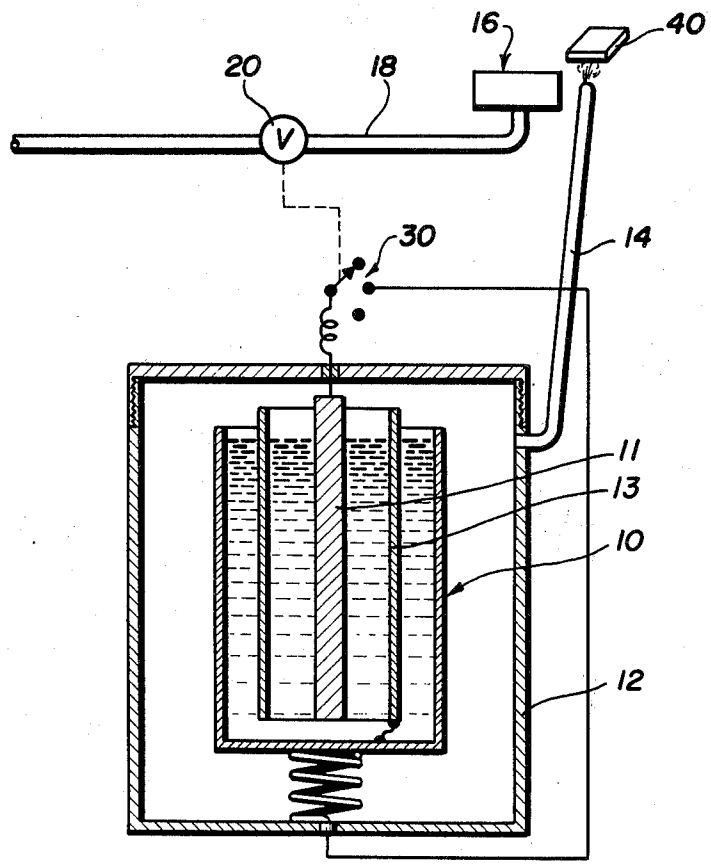


FIG.1

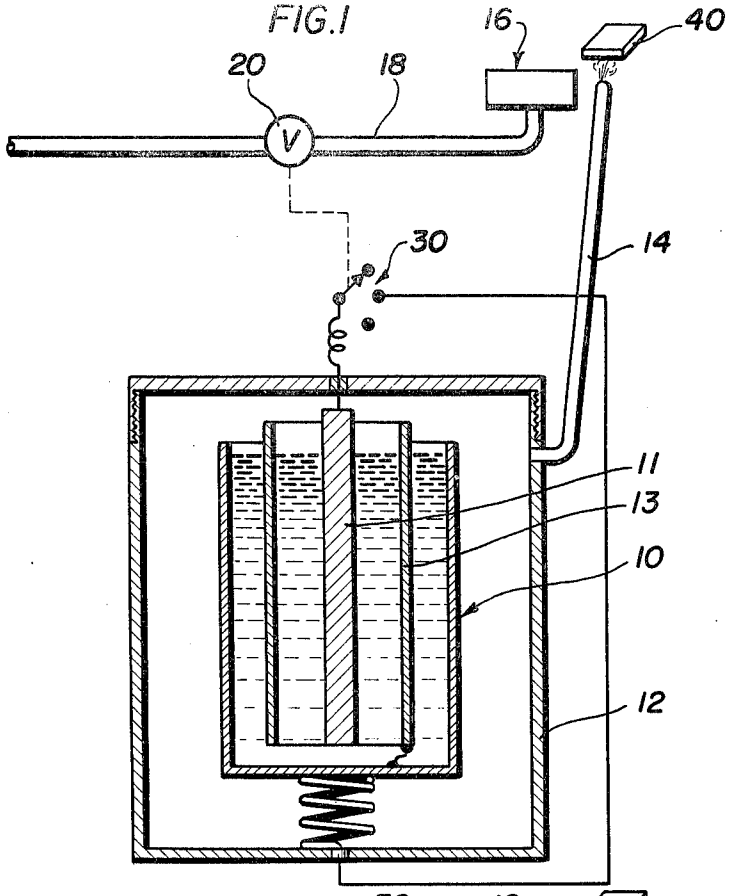
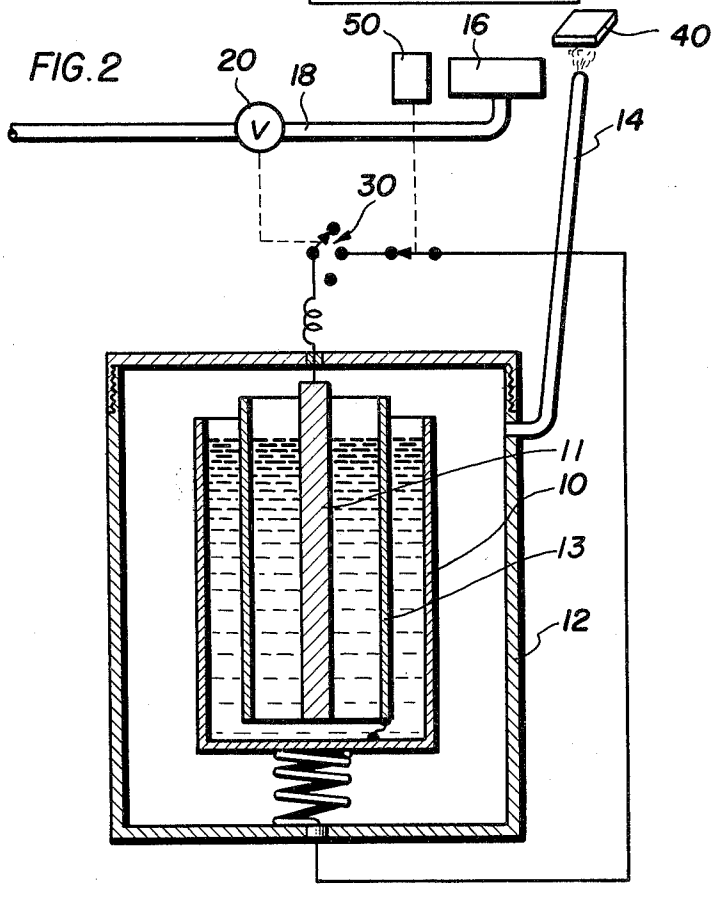


FIG.2



CATALYTIC IGNITION SYSTEM

This invention relates to an improved ignition process for ignition of gas-fueled appliances.

Conventional ignition systems for gas-fueled commercial and residential appliances generally rely upon standing pilots, electrically heated wires (glow coils) or spark-generating devices. Standing pilots continually consume fuel gas and are unattractive from the standpoints of operating expense, energy conservation and maintenance. Anonymous air currents, liquid spills or fuel supply interruptions require pilot relighting, and unlit pilots constitute a hazard when undetected. A safety shut-off device must be incorporated into the pilot system for untended burners. Furthermore, nitrogen oxides emissions from standing pilots in enclosed living areas are becoming a concern because of recent environmental and health studies. Spark ignition and glow coil systems overcome some of these problems, but spark generators are expensive and glow coils have not proven reliable. Moreover, ignition delay problems have been reported for some glow coil and spark systems. Ignition delay can be a serious problem in large commercial burners, in forced-draft furnaces and in confined or restricted volume combustion chambers, and it can be an annoyance on open, natural draft burners.

In U.S. Pat. No. **3,518,036,** issued June, **1970,** there is disclosed an electrically controlled electrolysis cell that furnishes hydrogen and oxygen to a methane pilot stream. The pilot stream then is ignited by a cold solid catalyst affixed in operative relationship to a gas pilot, which in turn, ignites a burner. Oxygen enhances the hydrogen reaction at the catalyst surface. Control and switching devices are provided to energize and de-energize the electrolytic cell and to control the flow of gases to the catalyst surface and pilot. The major components of the system are an AC power source, a transformer, a rectifier, the sealed electrolysis cell with electrodes and liquid electrolyte, pilot gas tubing, the catalyst surface and an electrical switch for operating the electrolysis cell and gas flow to the gas burner.

The present invention relates to an improved catalytic pilot ignition system providing simplifications and better economics than the above system. The system is based on a short-circuited, air-starved, electrochemical cell or battery comprising a metal electrode and an inert electrode, such as zinc and carbon electrodes, or metal-air battery, such as a zinc-air battery, which will produce a small but sufficient flow of pure hydrogen gas. More particularly, when such a battery is short-circuited, the current often rises to a level above that which can be supplied with atmospheric air. When this happens, hydrogen is evolved. The evolution of hydrogen ceases immediately when the short-circuit current is interrupted. If a zinc-air battery is operated without access to the air, any current drawn from the cell will produce hydrogen at the air electrode.

In accordance with the present invention, the battery is placed in a sealed container with a small capillary tube leading to a burner port or ports. At the end of the capillary tube is placed a catalytic surface, such as platinum black. When the gas valve is turned on, the battery is short-circuited, and a burst of hydrogen flows down the tube and ignites on the catalyst. If desired, a suitable circuit can be provided to sense whether the gas burner is lit and immediately interrupt the circuit on the battery so that the battery life is conserved.

Accordingly, it is an object of the present invention to provide an improved apparatus and ignition process for igniting gas-fueled appliances.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings, in which:

FIG. **1** is a diagrammatic view generally illustrating the construction and electrical circuitry of an exemplary pilot ignition system; and

FIG. **2** is a diagrammatic view illustrating an alternative arrangement of the electrical circuitry thereof.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, the catalytic pilot ignition system can be seen to include a battery **10** which is disposed within a sealed container **12.** The battery **10** may be an electrochemical battery having a metal electrode **11** and an inert electrode **13,** such as, for example, a zinc electrode and a carbon electrode which when short-circuited and air-starved will evolve hydrogen. Alternatively, the battery **10** may be a metal-air battery, such as, for example, a zinc-air, aluminum-air, sodium-air, potassium-air, iron-air, or any metal having a higher electrochemical potential then hydrogen. A specific example of a zinc-air battery which can be used is the METAIR battery of the type manufactured and sold by the Energy Conversion Limited, Basingstoke, Hampshire, England, or its equivalent.

The catalytic pilot ignition system further includes a main gas burner **16** which is coupled to a main burner gas supply line **18** which is coupled to a source of natural gas (not shown). The supply line **18** includes a control valve **20** which is operative to control the flow of natural gas to the main gas burner **16,** and which is coupled to and operative to open and close the normally open switch **30.** The control valve **20** has three positions, an off position, an ignition position and a burner position. When in its off position, the flow of natural gas to the main gas burner **16** is cut off and the switch **30** is opened. When it is operated to the ignition position, natural gas is permitted to flow to the main gas burner **16,** and the switch **30** is closed to cause ignition of the main gas burner **16,** in the manner described below. After ignition, the control valve **20** is operated to its normal operating position and, in this position, the flow of natural gas continues, but the switch **30** is again opened.

A catalyst **40** is positioned with respect to the main gas burner **16** such that the gas flowing from it is impinged upon the catalyst **40.** It is generally well-known that some catalysts are adversely effected by the heat or some combustion products. If the particular catalyst used is of this nature, it should be properly protected. This may be accomplished in several suitable fashions, for example, by affixing the catalyst **40** to a bimetallic element which upon being heated, is adapted to move the catalyst out of the pilot flame.

A capillary tube **14,** or the like, is coupled with the battery **10** and is extended to the catalyst **40,** so that hydrogen produced by the battery flows down the tube **14** and is ignited on the catalyst **40.**

The operation of the catalytic ignition system can be generally described as follows. Control valve **20** is manually operated to its ignition position, to permit natural gas to flow to the main gas burner **16** and to close the normally opened switch **30.** When switch **30** closes, the battery is short circuited, and a burst of hydrogen flows down the capillary tube **14** and ignites on the catalyst **40.**

Once the main gas burner **16** is ignited, the control valve **20** is operated to its burner position, which operation opens the switch **30** and hence the short circuit on the battery **10.** When the short circuit on the battery is interrupted, the generation and flow of hydrogen through the capillary tube **14** to the catalyst **40** is stopped. The main burner flame, however, remains lit. By interrupting the short circuit on the battery, once the main gas burner **16** is ignited, battery life is conserved.

To turn off the main gas burner **16,** the control valve **20** is merely operated to its off position. In this position, the switch **30** remains open and the short circuit on the battery **10** is interrupted.

An alternative electrical circuit is illustrated in FIG. **2.** In this circuit, a temperature sensor **50** is affixed in close proximity to the main gas burner **16** and is adapted to open a normally closed switch **52** when the main gas burner **16** ignites, to interrupt the short circuit on the battery **10.** The temperature sensor **50** can be and preferably is coupled to and adapted to operate a conventional flame safety valve, in the event the gas burner fails to ignite or is blown out or otherwise extinguished. The normally closed switch **52** is connected in a series circuit with the switch **30** which functions to short circuit the battery **10.** The control valve **20,** in this case, also can be merely a two position valve, having an off position and a burner position, since the switch **52** functions to open the short circuit on the battery **10.** In all other respects, the ignition system operates in the above-described fashion.

The catalyst **40** can be any catalyst that is active with hydrogen, such as, for example, platinum or palladium. The catalyst **40** can be affixed to a refractory surface such as alumina, silica, zirconia, thoria, any mixture of refractory materials, and even metals, such as platinum itself, if desired. Furthermore, it is generally well-known that some catalyst will cause reaction to proceed faster and will heat up to a temperature sufficient to ignite the gas mixture (the natural gas and hydrogen) quicker than others when hydrogen is impinged on them. This reaction rate also is dependent on numerous other factors, such as the surface area of the catalyst, the orifice size and the flow rate of the gas mixture, to mention but a few of them. Accordingly, once the catalyst is selected, the required orifice size, the flow rate of the gas mixture and the proper proportion of natural gas and hydrogen to provide ignition can be determined experimentally.

It will thus be seen that the objects set forth above among those made apparent from the preceding description, are efficiently attained and certain changes may be made in carrying out the above process and in the construction set forth. Accordingly, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. In combination with a catalytic pilot ignition system having a gas burner coupled to a source of natural gas, control valve means for controlling the flow of natural gas from the source to the burner, and a catalyst active with hydrogen positioned with respect to the gas burner to ignite the natural gas flowing from the source to the gas burner when hydrogen is impinged on the catalyst, the improvement comprising a short-circuited, air starved, battery for producing the hydrogen impinged on said catalyst.

2. The combination of claim **1,** wherein said battery comprises an electrochemical battery having a metal electrode and an inert electrode which when short-circuited and air-starved evolves hydrogen.

3. The combination of claim **2,** wherein said electrochemical battery comprises a zinc electrode and a carbon electrode.

4. The combination of claim **1,** wherein said battery comprises a metal-air battery.

5. The combination of claim **4,** wherein said metal-air battery comprises a zinc-air battery.

6. The combination of claim **4,** wherein said metal-air battery comprises an aluminum-air battery.

7. The combination of claim **4,** wherein said metal-air battery comprises a sodium-air battery.

8. The combination of claim **4,** wherein said metal-air battery comprises a potassium-air battery.

9. The combination of claim **4,** wherein said metal-air battery comprises a iron-air battery.

10. The combination of claim **4,** wherein said metal-air battery comprises any metal having a higher electrochemical potential than hydrogen.

11. The combination of claim **1,** further including means for interrupting the short-circuit on the battery.

12. The combination of claim **1,** further including contact means operated by said control valve means to short-circuit said battery only when said control valve means is operated to direct a flow of natural gas from said source to said burner.

13. The combination of claim **3,** wherein said control valve means is further operable to interrupt the short-circuit on said battery and to maintain the flow of natural gas from said source to said burner when the natural gas is ignited.

14. The combination of claim **3,** further including means for interrupting the short-circuit on said battery when said natural gas flowing to said burner is ignited.

15. The combination of claim **5,** wherein said means for interrupting the short-circuit on said battery comprises a normally closed contact and temperature sensing means operable to open said normally closed contact.

16. A catalytic pilot ignition system for igniting natural gas comprising, in combination: a gas burner coupled to a source of natural gas; control valve means for controlling the flow of natural gas from said source to said burner; a catalyst active with hydrogen positioned with respect to said gas burner such that hydrogen impinged on said catalyst is ignited and in turn ignites natural gas flowing from said burner, a metal-air battery within a sealed container having tube means extending therefrom to impinge hydrogen produced by said metal-air battery on said catalyst; and means for short-circuiting said metal-air battery to produce hydrogen.

17. The system of claim 16, wherein said means for short-circuiting said metal-air battery comprises contact means operated by said control valve means.

18. The combination of claim 17, wherein said control valve means is further operable to interrupt the short-circuit on said metal-air battery and to maintain the flow of natural gas from said source to said burner when the natural gas is ignited.

19. The combination of claim 17, further including means for interrupting the short-circuit on said metal-air battery when said natural gas flowing to said burner is ignited.

20. The combination of claim 19, wherein said means for interrupting the short-circuit on said metal-air battery comprises a normally closed contact and temperature sensing means operable to open said normally closed contact.

21. A catalytic pilot ignition system for igniting natural gas comprising, in combination: a gas burner coupled to a source of natural gas; control valve means for controlling the flow of natural gas from said source to said burner; a catalyst active with hydrogen positioned with respect to said gas burner such that hydrogen impinged on said catalyst is ignited and in turn ignites natural gas flowing from said burner, an electrochemical battery having a metal electrode and an inert electrode within a sealed container having tube means extending therefrom to impinge hydrogen produced by said electrochemical battery on said catalyst; and means for short-circuiting said electrochemical battery to produce hydrogen.

22. The system of claim 21, wherein said means for short-circuiting said electrochemical battery comprises contact means operated by said control valve means.

23. The combination of claim 22, wherein said control valve means is further operable to interrupt the short-circuit on said electrochemical battery and to maintain the flow of natural gas from said source to said burner when the natural gas is ignited.

24. The combination of claim 22, further including means for interrupting the short-circuit on said electrochemical battery when said natural gas flowing to said burner is ignited.

25. The combination of claim 24, wherein said means for interrupting the short-circuit on said electrochemical battery comprises a normally closed contact and temperature sensing means operable to open said normally closed contact.

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