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SAFETY IGNITION SYSTEM FOR GAS BURNERS

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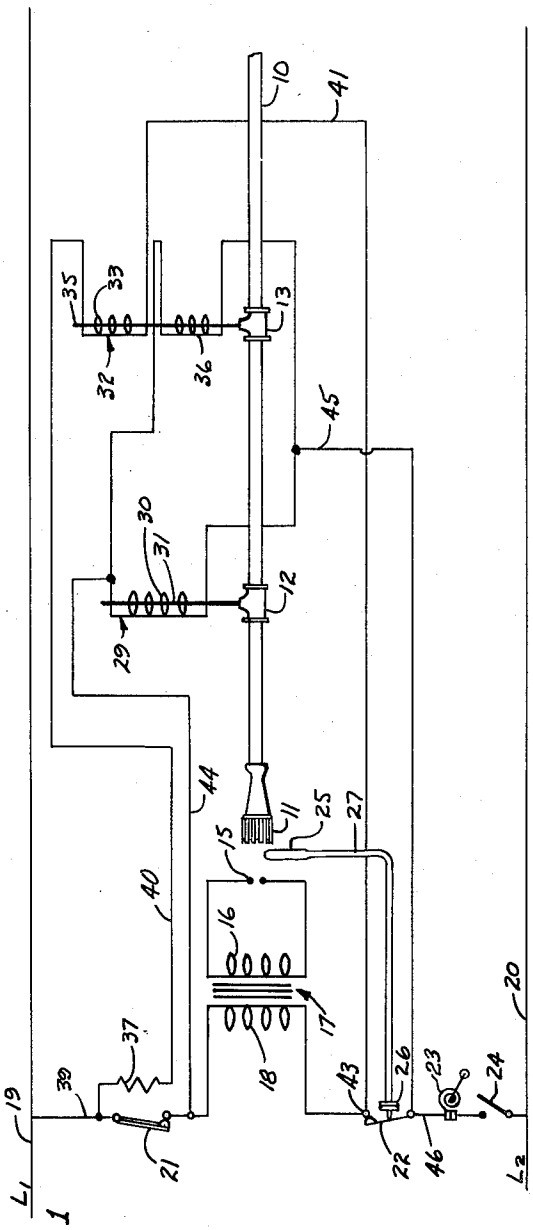


Fig 1

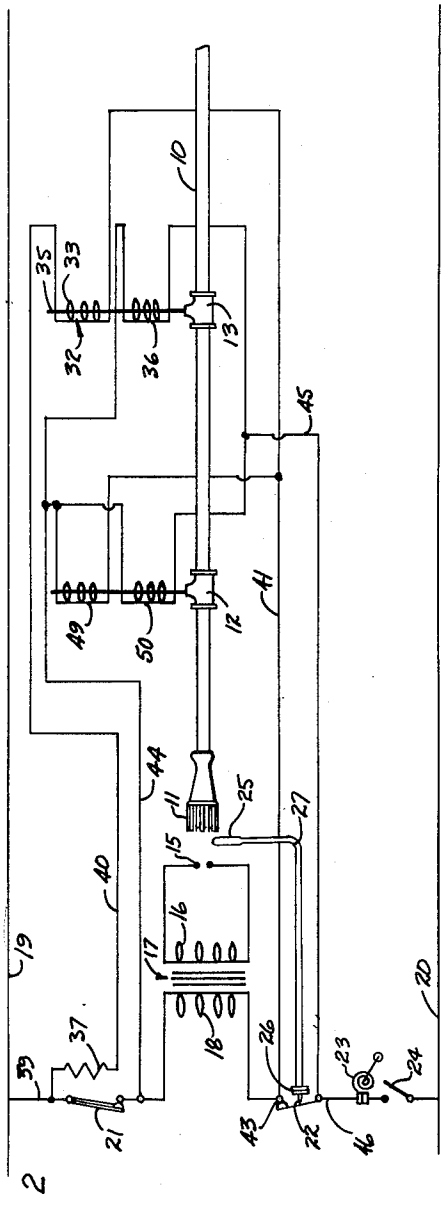


Fig 2

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SAFETY IGNITION SYSTEM FOR GAS BURNERS

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This invention relates to an improved safety ignition and control system for gas burners and the like, in which the gas burner is electrically ignited.

A principal object of the invention is to provide a new and improved gas burner safety ignition and control circuit so arranged as to prevent the passage of gas to the burner unless the system is in a safe condition for ignition.

A further object of the invention is to provide a safety igniter and control system for gas burners igniting the burner by an electric spark, in which the ignition device is deenergized upon failure of any of the component parts of the system as well as low or no gas pressure.

Still another object of the invention is to provide a safety ignition and control system utilizing a spark igniter for igniting the gas burner, so arranged as to deenergize the igniter upon lighting of the gas burner and to hold the igniter from being reenergized when the gas flame has gone out, except when the system is in a safe condition for igniting.

A still further object of the invention is to provide a safety igniter control circuit for gas burners and the like, in which the burner is supplied with gas through two valves in series, and in which a means is provided to open one of the valves upon energization of the igniter, and other means is provided to hold the valve open as the second valve is open and the system is in a safe condition for ignition of the main gas burner.

Stil another object of the invention is to provide a safety gas igniter and control system in which the burner is ignited by a spark igniter and gas is supplied to the burner through two electrically operated valves, in which at least one of the valves is opened by a solenoid coil energized upon energization of the igniter and is held open by a hold in solenoid coil energized through the contacts of a time delay relay, and deenergized to effect closing of the valve upon opening of the time delay relay, effected by failure of the pilot to ignite.

These and other objects of the invention will appear from time to time as the following specification proceeds and with reference to the accompanying drawing wherein:

FIGURE 1 is a diagrammatic view of an automatic safety igniter and gas burner control system constructed in accordance with the invention; and

FIGURE 2 is a diagrammatic view, diagrammatically illustrating a modification of the invention.

In the embodiment of the invention illustrated in the drawing, a main gas line **10** is shown as supplying gas to a gas burner **11** under the control of two valves **12** and **13**, connected in said gas line in series on the supply side of the main gas burner, and herein shown as being solenoid operated.

An igniter **15**, which may be an electrically energized igniter, such as a spark igniter, a glow coil and the like is positioned adjacent the burner **11** for igniting the burner upon the supply of gas thereto. The igniter **15** is herein shown as being a spark igniter and may be a well known form of spark plug, or may be of any other form effective to ignite the gas issuing from a gas burner.

The igniter **15** is energized through a secondary **16** of a transformer **17**, having a primary **18** energized through main power lines **19** and **20** through a normally closed time delay switch **21**, a flame detector switch **22**, and adjustable thermostatic switch **23** and a timer switch **24**.

The timer switch **24** may be closed upon the setting of the timer to an "on" position. Said timer switch and the timer for opening said switch at the termination of a predetermined time interval, may be of any well known form, no need not herein be shown or described in detail.

The thermostatic switch **23** is provided to open when the temperature reaches a predetermined value, to deenergize the burner circuit and effect closing of the valves **12** and **13**, and to then close when the temperature has been reduced below this predetermined value. Said thermostatic switch may be adjusted to open at various desired temperatures and may be of any well known form, and is no part of the present invention so need not herein be shown or described further.

The flame detector switch **22** may also be of any well known form, and is illustratively shown as being a bulb and capillary tube type of thermostatic switch, although it may be a rod and tube type of thermostatic switch or may be of various other forms, effective to open a circuit by the heat of the burner flame. As herein shown, a bulb **25** is positioned adjacent the burner in heat sensing relation with respect to the burner flame and is connected with a pressure operated bellows or operator **26** through a capillary tube **27**. An expansible liquid or vapor in the bulb **25** may expand within said bulb by the heat of the burner flame to operate the operator **26** and effect opening of the flame detector switch **22** and deenergization of the transformer **18** and spark igniter **15**, upon the lighting of the gas issuing from the burner.

The valve **12** is shown as being opened by a solenoid **29** including a solenoid coil **30** and an armature **31**.

The valve **13** is shown as being opened by a pull-in solenoid **32** including a pull-in coil **33** and an armature **35**.

The valve **13** is shown as being held open by a solenoid coil **36** connected in parallel with the coil **31** and encircling the armature **35** and serving as a holding coil **36**. The pull-in coil **33** and the holding coil **36** may be wound on the same cores, if desired.

The time delay relay **21** may be of the bi-metal type, heated by a resistor heater coil **37** and opening in a predetermined time interval, which may be from **45** to **60** seconds, after the energization of the heater coil **37**.

The heater coil **37** and pull-in coil **33** are energized through a conductor **39** connected with the main line conductor **19** and through a conductor **40** connecting the heater coil **37** with the pull-in coil **33**. A conductor **41** leading from the pull-in coil **33** is connected with a contact **43** of the flame detector switch **22** and is connected with the conductor **20** through the flame detector switch **22**, the thermostatic switch **23** and the timer switch **24**. The heater coil **37** and the pull-in coil **33** will thus be deenergized upon opening of the flame detector switch **22** effected by the heat of the pilot flame, or upon opening of the thermostatic switch **23** or the timer switch **24**.

The solenoid coil **30** for opening the valve **12**, and the holding coil **36** for holding the valve **13** open are energized through the contacts of the time delay switch **21** through a conductor **44** connecting the coils **30** and **36** in parallel, and through a conductor **45** connected with a conductor **46**, connected with the conductor **20** through the thermostatic switch **23** and the timer switch **24**.

The coils **30** and **36** are thus energized upon closing of the timer switch **24** and remain energized as long as the time delay switch **21** is closed, and until opening of the thermostatic switch **23** or the timer switch **24**.

In FIGURE 1 of the drawings the various components of the system are shown in their "off" position, the timer switch **24** being opened to prevent the energization of any of the components of the system, and the gas valves **12** and **13** being closed.

Upon closing of the timer switch **24** the transformer

18 will be energized through the time delay switch 21, the flame detector switch 22, the thermostatic switch 23 and the timer switch 24. This will effect the energization of the spark igniter 15. The heater coil 37 and pull-in coil 33 will also be energized through the flame detector switch 22, the thermostatic switch 23 and the timer switch 24. The valve 13 will then open. At the same time the solenoid coil 30 and the holding coil 36 will be energized through the contacts of the time delay switch 21, the thermostatic switch 23 and the timer switch 24. The two valves 12 and 13 will then open and the burner will ignite, provided there is no failure in any part of the system.

Upon lighting of the burner, the flame detector switch 22 will open in a delayed time interval, which may be in the order of 30 seconds. The heater coil 37 and the pull-in coil 33 as well as the transformer 18 will then be deenergized, the holding coil 36 holding the valve 13 open.

In case the burner should fail to ignite, the resistor heater 37 will effect the opening of the time delay switch 21. This will deenergize the transformer 18 and spark igniter 15. It will also deenergize the solenoid coil 30 and the holding coil 36. The valve 12 will then close and the flow of gas to the burner will stop. The pull-in coil 33 and resistor heater 37 will, however, remain energized through the flame detector switch 22, the thermostatic switch 23 and the timer switch 24. The valve 13 will then remain open, but no gas can pass through the burner 11, since the valve 12 is closed.

Failure of the burner to ignite may be due to either a burned out or faulty igniter, a faulty transformer, low or no gas pressure or poor contact pressure at the flame safety switch. In any of these faulty conditions, however, the time delay relay 21 acts as a safety switch to deenergize the igniter and stop the flow of gas to the main burner, and to hold the burner circuit open until the faulty condition has been corrected.

In case the resistor heater 37 should be burned out, when the timer switch 24 is closed, the pull-in coil 33 will not be energized. The coil 30 and the holding coil 36 will, however, be energized, but the valve 13 will remain closed and there can be no flow of gas to the main burner until the burned out heater coil has been replaced.

Upon a power interruption due to a power failure, resetting of the timer or the opening of the dryer door, where the circuit may be used for heating a clothes dryer or the like, the holding coil 36 will immediately be deenergized. The valve 13 will then close. If the current flow should be resumed prior to the closing of the flame detector switch 22, the valve 13 will remain closed blocking the flow of gas to the burner 11. The transformer 18 will also be deenergized. The valve 12 will open as the current flow is resumed. The valve 13, however, will remain closed until the flame detector switch 22 has moved to its closed position. At this time the transformer 18 will be energized and the valves 12 and 13 will open.

If the flame detector switch 22 should fail to open, the heater coil 37 will effect opening of the time delay switch 21. The transformer 18 and the solenoid coil 30 will then be deenergized. The valve 12 will then close to block the flow of gas to the main burner 11.

If the flame detector switch 22 should fail to reclose upon the completion of a heating cycle, as it is attempted to start a new heating cycle, the solenoid 30 and the holding coil 36 will be energized in the manner previously described. The pull-in coil 33, however, cannot be energized, since the flame safety switch opens the circuit to this coil. The valve 13 then will not open and there will be no flow of gas to the main burner until the flame detector switch 22 closes.

In the form of the invention illustrated in FIGURE 2, I have shown the same components and same general system as in FIGURE 1. Like part numbers will, therefore, be applied to like parts shown in FIGURE 1, and new part numbers will only be applied to the new parts.

In the modified form of the invention illustrated in FIGURE 2, the valve 12 is provided with a pull-in coil 49 and a holding coil 50. The two coils 49 and 50 may be like the coils 33 and 36 for the valve 13 and extend about an armature 51 for the valve 12, to effect opening of the valve 12 and to hold said valve open as the pull-in coil 49 is deenergized.

The pull-in coil 49 is energized through the time delay switch 21, the conductor 44, the conductor 41 and the contact 43 of the flame detector switch 22. The holding coil 50 is energized through the time delay switch 21, the conductor 44, the conductor 45, the thermostatic switch 23 and the timer switch 24.

The two coils 49 and 50 will both be deenergized upon opening of the time delay switch 21. The pull-in coil 49, however, is deenergized when either the time delay switch 21 or the flame detector switch 22 is open. The holding coil 50 will, however, hold the valve 12 open upon opening of the flame detector switch 22, until either the thermostatic switch 23 or the timer switch 24 opens, unless the time delay switch 21 should open due to a failure in the system.

The provision of the individual pull-in coils for each valve, energized and deenergized through different control circuits, and both deenergized upon lighting of the burner, therefore, obviates the possibility of the two valves 12 and 13 sticking open upon a failure in the system.

As an example, where it may be attempted to start the burner circuit and the flame detector switch 22 may not close, due to a failure in this switch, neither of the valves 12 nor 13 could open, since the pull-in coils 49 and 33 are energized through the switch arm of the flame detector switch. Therefore, if dirt should lodge on the seat of the valve 13, the valve 12 would still prevent the leakage of gas to the burner 11. If dirt should lodge on the seat of the valve 12, the valve 13 would prevent the supply of gas to the burner.

The holding coil for the valve 12 is thus an added safety feature, preventing the valve 12 from opening unless or until the flame detector switch 22 is in its closed position and thereby preventing the leakage of gas to the burner where one valve or the other may be held open by dirt on the seat thereof.

It will be understood that various modifications and variations in the present invention may be effected without departing from the spirit and scope of the novel concepts thereof, as defined by the claims appended hereto.

I claim as my invention:

1. A gas burner igniter and control circuit comprising a gas supply line, a gas burner connected in said supply line, two gas valves connected in said supply lines on the supply side of said gas burner in series with said burner, an electrically energizable igniter, an energizing circuit for said igniter including a normally closed time delay switch and a flame detector switch opening by the heat of the burner flame, electrically energizable heater means for effecting opening of said time delay switch in a predetermined time delay interval, electrically energizable means for opening one of said valves, connected in series with said electrically energizable heater means for opening said time delay switch, and energized through said flame detector switch when closed, electrically energizable means for holding said valve open upon opening of said flame detector switch, electrically energizable means for opening the other of said valves, said electrically energizable means for holding said one valve open and for opening the other of said valves being connected in parallel and being energized through said time delay switch and remaining energized upon opening of said flame detector switch, whereby failure of the burner to ignite will effect opening of said time delay switch and closing of at least one of said valves.

2. A safety gas burner ignition and control circuit comprising a gas supply line, a burner connected to said supply line, an electrically operated valve on the supply side of said burner, a second electrically operated valve in series with said first valve on the supply side of said burner, electrically energizable igniter means for igniting said burner, an electrical energizing circuit, a time delay switch, electrically energizable means connected in said energizing circuit to effect opening of said time delay switch in a predetermined time interval, electrically energizable means for said igniter means connected in said energizing circuit through said time delay switch, individual electrically energizable means for opening said valves, the electrically energizable means for opening said first mentioned valve being connected in said energizing circuit in series with said electrically energizable means for opening said time delay switch, the electrically energizable means for opening said second valve being connected in said energizing circuit through said time delay switch, electrically energizable means for holding said first mentioned valve open upon deenergizing of the electrically energizable means for opening said valve, a flame detector switch connected in series with said time delay switch and said electrically energizable means for energizing said spark igniter, said electrically energizable means for holding said first mentioned valve open being connected in said energizing circuit through said time delay switch independently of said flame detector switch, and said electrically energizable means for opening said first mentioned valve being deenergized upon opening of said flame detector switch by ignition of the gas issuing from said burner.

3. In a gas burner igniter and control circuit, a gas supply line having a main gas burner therein and two valves connected in series in said gas supply line on the supply side of said main gas burner, electrically energizable igniter means for igniting said main gas burner, a transformer having a secondary connected with said igniter means for energizing said igniter means and having a primary, two main line conductors, an energizing circuit from said conductors to said primary including a time delay switch in series with said primary and a flame detector switch, said flame detector switch opening by the heat of the burner flame, a heater coil for opening said time delay switch, a solenoid coil for opening a first of said gas valves, an energizing circuit from said conductors to said solenoid coil through said heater coil and said flame detector switch, a solenoid coil for opening a second of said valves, a holding coil for said first gas valve for holding said gas valve open upon the deenergization of the solenoid coil for opening said valve, said solenoid coil for opening the second of said valves and said holding coil being connected with said main line conductors in parallel and through said time delay switch, and said last mentioned solenoid coil and said holding coil being deenergized upon opening of said time delay switch upon failure of the burner to ignite, whereby at least one of said valves will close upon failure of the pilot to ignite.

4. In a safety gas burner igniter and control circuit, a gas supply line having a gas burner connected thereto and having two valves connected therein in series on a supply side of said burner, electrically energizable igniter means for igniting said gas burner, at least two main line conductors, an energizing circuit from said conductors to said igniter means including a time delay switch, a flame detector switch and a thermostatic switch connected in series across said conductors, a heater coil for effecting the opening of said time delay switch upon a predetermined time delay interval, individual solenoid coils for each of said valves for opening said valves, individual holding coils for each of said valves for holding said valves open, a first of said solenoid coils being energized in series with said heater coil, said flame detector switch and said thermostatic switch, a second of said solenoid coils being energized in series with said time delay switch, said flame detector switch and said thermostatic switch, each of said solenoid coils being deenergized by opening of said flame detector switch by the heat of the flame of said gas burner, whereby a complete recycling of the circuit will be required to open said valves upon a circuit failure, and said holding coils being energized by said main line conductors in series with said time delay switch and said thermostatic switch and holding said valves open upon deenergization of said solenoid coils and accommodating closing of said valves upon a circuit failure.

5. In a gas burner igniter and control circuit, a gas supply line, a gas burner connected in said gas supply line and two electrically operated valves connected in series in said gas supply line on the supply side of said gas burner, electrically energizable igniter means for igniting said burner, two main line conductors, an energizing circuit from said conductors to said electrically energizable igniter means including a time delay switch and a flame detector switch, said flame detector switch opening by the heat of the burner flame, a heater coil for opening said time delay switch, a solenoid coil for opening a first of said valves, and an energizing circuit from said conductors to said solenoid coil including said heater coil and said flame detector switch, a holding coil for holding said first valve open, a solenoid coil for opening a second of said valves, an energizing circuit from said main line conductors to said last mentioned solenoid coil and to said holding coil through said time delay switch, said time delay switch opening upon failure of the burner to ignite and thereby deenergizing and effecting closing of at least one of said valves upon failure of the burner to ignite.

References Cited in the file of this patent

UNITED STATES PATENTS

2,430,373	Strobel	Nov. 4, 1947
2,479,779	Ray	Aug. 23, 1949
2,812,806	Morrison	Nov. 12, 1957