FUEL BURNER POWER FAILURE BRIDGE

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ABSTRACT OF THE DISCLOSURE
A fuel burner is operatively connected to a burner primary control means and operates in response to the condition of a controller. The burner primary control means is of a type which includes a direct current power supply means to supply all of the necessary operating power for its amplifiers and control relays. Connected to the burner primary control means is a power storage means that obtains direct current power from the direct current power supply means of the burner primary control means and which stores this power over a period of time. In the event of a momentary power loss to the burner primary control means, the power storage means feeds direct current power back to the primary control means keeping it energized for a short interval.

CROSS REFERENCE TO RELATED APPLICATIONS
The present invention is an improvement applicable to the invention disclosed in application Ser. No. 685,193, filed Nov. 22, 1967, now Pat. No. 3,449,055, in the name of J. C. Blackett and titled "Burner Control Apparatus with Prepurge Timing."

BACKGROUND OF THE INVENTION
Much of the safety control equipment for fuel burners is being designed and manufactured utilizing solid state circuitry that is energized by a direct current power supply within the control equipment. Due to the nature of the solid state circuits and power supplies, any momentary loss of the primary alternating current electric power to the safety or primary control causes the control to become deenergized and to in turn operate relay contacts that open circuit the alternating current power source to the main burner valves and various other associated equipment. These momentary power losses occur on most commercial power systems and can cause nuisance occurrences such as shutdowns or recycles of burners in both heating applications and in process control. Also, momentary changes in limit controls can cause nuisance occurrences that are undesirable. These nuisance shutdowns can be very expensive and are very undesirable in certain applications. A power failure loss of only a few cycles can cause modern burner primary controls to operate thereby shutting down the associated burner. In most cases, the burners themselves do not respond as rapidly as their control equipment and it is desirable to provide a means for bridging very short power failures by keeping the burner primary controls energized for a short period of time. The present invention is directed to a very simple expedient to provide the necessary bridging of nuisance power failures by the addition of a simple power storage means.

SUMMARY OF THE INVENTION
The present invention is directed specifically to the addition of a direct current power storage means to a burner primary control so that the power storage means can obtain a standby amount of power during the operation of the burner primary control means and which is obtained slowly enough so that the direct current power supply means is not overtaxed. This energy is in turn made available immediately upon loss of power to the burner primary control means to prevent the burner primary control means from becoming deenergized for a short period of time thereby bridging nuisance power losses.

The present invention also involves connecting a power storage means to the burner primary control means in only certain applications where this type of equipment is desired without adding the burden of cost of this type of equipment to all of the similar equipment that is sold where no power bridging requirement is needed. The size and type of power storage means also can be selected to provide varying capacities so that various lengths of power outages can be accounted for.

BRIEF DESCRIPTION OF THE DRAWING
The drawing is of a complete fuel burner control system of a commercially available type with the power storage means connected thereto.

DESCRIPTION OF THE PREFERRED EMBODIMENT
An alternating current supply line is connected between conductors 10 and 11 to supply conventional alternating current to the disclosed system. Conductor 10 passes through a limit control 12 that is conventionally used in fuel burner control systems. The limit 12 in turn is connected to a controller 13 that can be momentary or two position manually operated or can be in the form of a thermostatically operated device. Controller 13 is connected by conductor 14 to a burner primary control means 15 which generally includes relay contact means 16, a direct current power supply means 17, a direct current fan relay 18, and direct current amplifiers and control relays 20. The burner primary control means 15 is of the type disclosed in application Ser. No. 685,193, filed on Nov. 22, 1967 and entitled "Burner Control Apparatus with Prepurge Timing" by James C. Blackett. This burner primary control means is also known as the R-4795 as manufactured and sold by Hapco (Well Inc., Minneapolis, Minn.

The conductor 14 is connected to a conductor 21, transformer 22, and conductor 23 which completes the primary energizing circuit for the transformer 22. Conductor 23 is directly connected to the alternating current supply line conductor 11. With the arrangement so far disclosed it is obvious that when the limit 12 and controller 13 are in their proper positions, the transformer 22 receives alternating current power to energize the direct current power supply means 17 which in turn powers the balance of the burner primary control means 15.

A fuel burner means is generally disclosed at 25 and includes a fan 26, pilot valve 27, an ignition means 28, a main fuel valve 30, and a flame detector 31. The elements 26, 27, 28, 30 and 31 make up part of a conventional fuel burner means and their individual functions will not be detailed as they are well known in the art. The fan 26, the pilot valve 27, the ignition means 28, and the main valve 30 are connected to the burner primary control means 15 through the contact means 16 and the contact means 16 is operated by the direct current fan relay 18 and the direct current amplifier and control relays 20. The operation will be described briefly later in the present disclosure.

An air switch 32 is connected between a pair of terminals 33 and 34 and is responsive to air being moved by the fan 26. The air switch 33 is conventional and completes a normal and operative fuel burner control system.

Under normal operating conditions when the controller 13 is energized either manually or automatically, power is supplied to transformer 22 which in turn supplies power to the direct current power supply means 17 and the direct current fan relay 18 along with the direct current amplifi-
The direct current fan relay 18 immediately operates to supply power through contact means 16 to the fan 26. The fan 26, being energized, starts to move air in the system. As soon as an adequate air flow is developed, air switch 32 closes and supplies the energy from the direct current power supply means 17 to the direct current amplifier and control relays 20. This then operates the proper sequence of relays and contact means 16 so that the pilot valve 27 is opened to supply fuel to an ignition means 26, where the fuel is ignited. When the fuel is ignited, the flame detector 31 operates through the direct current amplifier and control relays 20 to cause the main valve 30 to be energized for complete operation of the fuel burner control system. In the event of a momentary loss of just a few cycles of the alternating current supply, the direct current power supply means 17 loses its energizing source and the direct current fan relay 18 and the direct current amplifier and control relays 20 become deenergized. This period of time is very short and can be substantially shorter than the response time of the fuel burner means 25. If the power failure between conductors 10 and 11 is only a few cycles in duration a nuisance shutdown on the fuel burner means 25 occurs. As has been previously mentioned this nuisance type of shutdown is very undesirable in certain types of applications, particularly process control. In order to avoid this type of nuisance shutdown the direct current power storage means 40 has been added. Its structure and operation will now be described.

The power storage means 40 includes a large capacitor 41 connected in series with a parallel combination of a resistor or impedance means 42 and a diode 43. A conductor 44 connects the common connection of the resistor 42 and the diode 43 to terminal 34, which is connected directly to the direct current power supply means 17. The capacitor 41 is connected by conductor 45 to a terminal 46, which is grounded in the burner primary control means 15 and which is common to the direct current power supply means 17. The terminal 46 is utilized for various connections and is normally available on the burner primary control means 15.

With the power storage means 40 connected to the burner primary control means 15, the operation is as follows. When controller 13 indicates that the fuel burner means 25 is to be operated, power is applied to conductor 14 and the burner primary control means 15. At this same time the direct current power supply means 17 becomes active and supplies a direct current potential to the direct current relay 18 and terminal 34 where the air switch 32 and the conductor 44 are connected. The resistor 42 in the power storage means 40 limits the current drawn into the capacitor 41 to a low value thereby avoiding loading down the direct current power supply means 17. The resistor 42 supplies an impedance to limit the charging rate of the capacitor 41. Under normal operating conditions the capacitor 41 becomes fully charged after a short period of operation of the burner primary control means 15.

Under normal operating conditions the burner primary control means 15 is not excessively loaded by the power storage means 40 and operates the fuel burner means 25 in a normal fashion. Capacitor 41 takes on a full charge bringing it up to the level of the direct current power supply means 17. This charge having been limited by the impedance of resistor 42 is relatively slow but only takes, in fact, a matter of a few seconds of operation of the burner primary control means 15. In the event of a momentary power failure to the lines 10 and 11, the capacitor 41 immediately begins to discharge through the diode 43 to the terminal 34 and into the burner primary control means 15 to supply the necessary energy to hold the direct current relay 18 and the direct current amplifier and control relays 20 in their energized position. Since the diode 43 parallels the impedance or resistor 42, the resistor 42 is not in the circuit during the discharge operation of the capacitor 14. By this means, the capacitor 41 is available to supply immediate energy to the burner primary control means 15 in the event of a momentary power loss.

It is obvious from the present disclosure that a very simple power storage means has been provided which does not load down the direct current power supply means 17 during normal operation and which is immediately available to bridge momentary power failures. The selection of the components within the power storage means 40 can be made to bridge varying lengths of power failures by the selection of the size of the capacitor and whether in fact a resistor 42 and diode 43 are used.

In the present invention it is obvious that many modifications could be made in the structure of the power storage means 40, and the applicant in the present case wishes to be limited in the scope of his invention solely by the appended claims.

The embodiments of the invention in which an exclusive property or right is claimed are defined as follows:

1. An apparatus for insuring continued operation of a fuel burner control system during momentary power failures, including: fuel burner means adapted to be operated from an alternating current supply line; burner primary control means connected to said supply line and adapted to be connected to said fuel burner means to operatively control said fuel burner means in response to controller means; said burner primary control means including direct current power supply means for operation of said primary control means; and direct current power storage means which includes capacitor means in series with impedance means to allow said capacitor means to be slowly charged from said direct current power supply means and rapidly discharged to operate said burner primary control means during an alternating current supply line failure.

2. An apparatus for insuring continued operation of a fuel burner control system as described in claim 1 wherein said impedance means includes a parallel combination of a resistor and a diode to allow said capacitor means to be slowly charged from said direct current power supply means and rapidly discharged to operate said burner primary control means during a short alternating current supply line failure.

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