(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 798 514 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
01.10.1997 Bulletin 1997/40

(51) Int Cl.[6]: **F23Q 3/00**

(21) Application number: **97301144.8**

(22) Date of filing: **21.02.1997**

(84) Designated Contracting States:
AT CH DE FR IT LI NL

(30) Priority: **02.03.1996 GB 9604552**

(71) Applicant: **IMI PACTROL LIMITED**
Skelmersdale Lancashire, WN8 9PS (GB)

(72) Inventor: **Faulkner, Barry Peter**
Warrington, Cheshire WA2 OEL (GB)

(74) Representative: **Lane, Michael John et al**
IMI Plc,
Patents and Licensing Department,
P.O. Box 216
Witton, Birmingham B6 7BA (GB)

(54) Improvements relating to spark igniters

(57) A spark igniter for a gas-fired appliance, such as a boiler, comprises a pair of electrodes (11, 12) and a circuit (2), under the control of a microprocessor (3), that can generate, during each ignition process, successive bursts of sparks between the electrodes (11, 12), the duration, e.g. about 200 ms, of each burst of sparks being significantly less than the time period, e.g. about 1 second, that elapses before the next burst of sparks is generated. Generation of ignition sparks in such a way enables the igniter to comply with EU electromagnetic compatibility requirements (Fig 1).

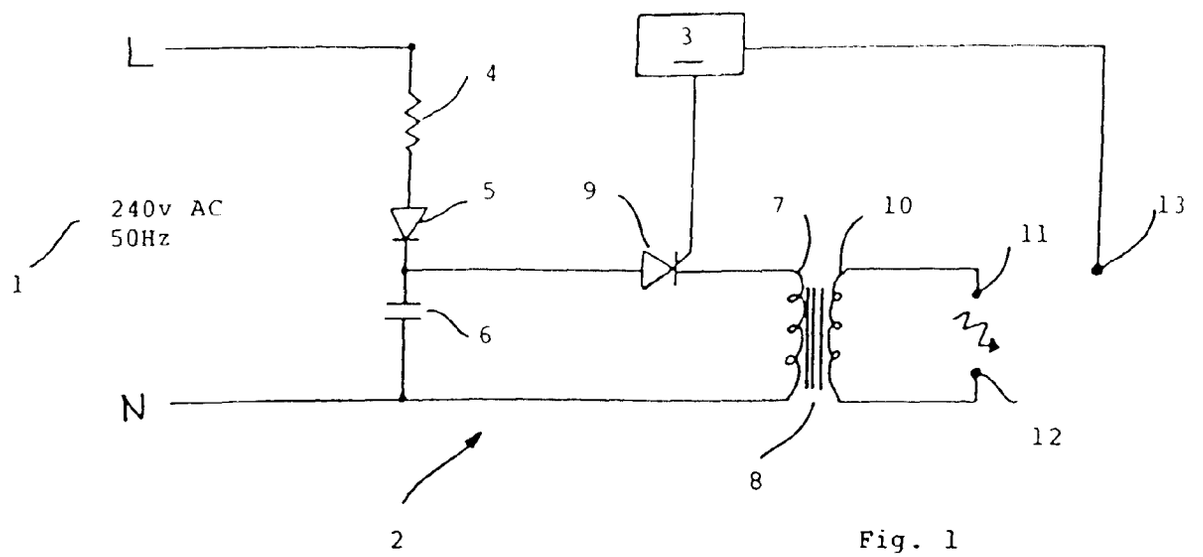

Fig. 1

EP 0 798 514 A2

Description

This invention relates to spark igniters and especially, but not exclusively, to spark igniters for use in gas-fired appliances such as boilers.

It is well known to ignite the gas burner of a boiler using a spark igniter. In some types of boiler, the spark igniter serves to ignite a pilot flame which in turn ignites the gas issuing from the boiler's main burners. In other types, the spark igniter serves directly to ignite the main burner. The present invention is concerned especially, although not exclusively, with the latter type.

In directly spark-ignited boilers, it is customary, when the boiler is to be fired up, to arrange for the igniter to produce a series of sparks over an extended period of time of several seconds at relatively high, constant frequency, typically 50 Hz (ie., in the UK, at mains frequency). Such an arrangement has a number of disadvantages. First it is necessary for the igniter to produce sparks for an extended pre-determined period of time because ignition may not occur immediately. This means that the igniter control circuitry during the ignition process is under some stress and so has to comprise relatively high grade, and thus expensive, components.

Secondly, each spark produces conducted and radiated electromagnetic emissions which can give rise to interference (or so-called electromagnetic compatibility) problems. In order to deal with that problem, it is known to use appropriate filters and screens but this of course adds significantly to production costs.

It is an object of the present invention to provide a spark igniter which is less costly to produce and which, in particular, may comply with electromagnetic compatibility requirements such as those of EC Directive 89/336/EEC and BSI 1992/2372 without the need for filters and screens.

According to one aspect of the present invention, there is provided a spark igniter for a gas-fired appliance including a pair of electrodes and circuit means to generate sparks between the electrodes, characterised in that the circuit means is adapted to be able to generate, during each ignition process, successive bursts of sparks between the electrodes at a mark : space ratio of less than 30%, the mark : space ratio being defined as

$$\frac{T_1}{T_1 + T_2} \times 100\%$$

wherein T_1 is the time duration of each burst of sparks and T_2 is the time interval between successive bursts of sparks.

Preferably, T_1 is equal to or less than about 200 ms, for example within the range of from about 10 to 200 ms and T_2 is equal to or greater than about 1 second, for example within the range of from 1 to 5 seconds. Advantageously, the mark : space ratio is between 15 and 20% and to that end, in a particularly preferred embodiment, T_1 is about 200 ms and T_2 is about 1 second, i. e. the mark : space ratio is about $^1/_6$ or about 16.7%.

The sparks in each burst are preferably generated at a constant frequency, for example mains AC frequency. Thus, at say 50Hz, each burst will comprise ten sparks within a time interval T_1 of 200 ms, although as few as two sparks, or more than ten, may be produced in any one burst.

A spark igniter of the invention may additionally include flame sensing means associated with the circuit means and which, for example during a time interval T_2 when no sparks are being generated, serves to sense whether or not gas ignition has occurred in the preceding spark generating period T_1. If the flame sensing means senses that ignition has taken place, the spark generation process may be arranged automatically to terminate immediately. Thus, for example, if ignition takes place during the first burst of sparks, the flame sensing means will sense this and cause termination of the spark ignition process during the immediately following interval T_2. In that event, only one burst of sparks will have been generated, but in the event that ignition fails to occur, as sensed by the flame sensor, a further burst of sparks will be generated after time T_2 has elapsed, and so on.

A spark igniter of the invention may comprise a pair of dedicated electrodes arranged adjacent to the main gas burner (or to a pilot burner) but alternatively the ground electrode may be constituted by the metal body of the burner itself (or of the pilot burner).

The circuit means may include a known spark producing circuit controlled, for example, by a digital or analogue square wave generator such as an appropriately programmed microprocessor or an oscillator circuit.

The present invention also provides a gas-fired appliance, for example a gas boiler, including a spark igniter as defined above.

An embodiment of the invention will now be described in more detail, by way of example only, with reference to the accompanying drawings in which:

Fig 1 is a schematic diagram of the spark igniter, and

Fig 2 is a graph of the spark pattern generated by the igniter of Fig 1.

Referring first to Fig 1, this shows a conventional spark igniter circuit that is, however, under the control of a microprocessor. The circuit comprises a 240 volt, 50 Hz AC power source 1 which powers a spark generating circuit designated generally 2 and a microprocessor 3.

The circuit 2 comprises, as is conventional, a resistor 4 (typically 10 K ohms), a diode 5 and a capacitor 6 (typically .47 uF) connected in series across the power source 1. The primary coil 7 of a step-up transformer 8 is connected across the capacitor 6 via a solid state switch 9 such as a thyristor or triac. The secondary coil

10 of the transformer 8 is connected across a pair of spaced electrodes 11, 12 located adjacent to the burner of the gas appliance, such as a boiler (not shown).

When the switch 9 is closed, a high voltage potential of typically around 15 KV is generated across the electrodes 11, 12 thereby producing an ignition spark. Operation of the switch 9 is controlled, in accordance with the invention, by the microprocessor 3 which provides output voltage signals to the switch 9 in accordance with a pre-determined time-dependant pattern.

For example, and referring additionally to Fig 2, when there is a "burner on" command as determined by, say, a thermostat forming part of a hot water/heating system, the microprocessor 3 during the first 200 ms time period T_1 of the ignition process causes the switch 9 to open and close ten times, that is to say at the 50 Hz frequency corresponding to that of the AC power source 1. Each time the switch 9 opens during each alternate AC half cycle, the capacitor 6 recharges and each time it closes a spark is produced across the electrodes 11, 12. Thus, during that period T_1 a burst often sparks will be produced across the electrodes 11, 12. The microprocessor 3 then causes the switch 9 to remain open for a pre-determined time period of about 1 second (T_2) during which time a flame sensor 13 senses whether or not gas ignition has occurred. If the sensor 13 detects that ignition has taken place, the microprocessor 3 will terminate the production of sparks after just one burst of sparks. If, however, ignition has not taken place, the microprocessor 3 causes production of a further burst often sparks over a second 200 ms period T_1, and so on until ignition or safety shut down/lockout occurs.

Preferably, the ignition sequence described above is arranged to commence after any air in the gas feed pipe connected to the burner has been purged out pursuant to a "burner on" command. This may be achieved by arranging, for example by way of the microprocessor 3, for generation of the initial burst of sparks to be delayed for a short period of time, appropriate to the appliance in question, pursuant to the "burner on" command.

As spark production using a spark igniter of the invention is discontinuous, the various electronic components are subjected to relatively low stresses which means that less expensive components may be used.

Further, interference caused by electromagnetic emissions is reduced and compliance with electromagnetic compatibility requirements may readily be achieved without the need to use filters and screens.

Claims

1. A spark igniter for a gas-fired appliance including a pair of electrodes (11, 12) and circuit means (2, 3) to generate sparks between the electrodes (11, 12), characterised in that the circuit means (2, 3) is adapted to be able to generate, during each ignition process, successive bursts of sparks between the electrodes at a mark : space ratio of less than 30%, the mark : space ratio being defined as

$$\frac{T_1}{T_1 + T_2} \times 100\%$$

wherein T_1 is the time duration of each burst of sparks and T_2 is the time interval between successive bursts of sparks.

2. A spark igniter according to claim 1 wherein the mark : space ratio is between 15 and 20%.

3. A spark igniter according to claim 1 or claim 2 wherein T_1 is between about 10 ms and 200 ms and T_2 is between about 1 second and 5 seconds.

4. A spark igniter according to any one of claims 1 to 3 wherein T_1 is about 200 ms and T_2 is about 1 second.

5. A spark igniter according to any one of claims 1 to 4 wherein the sparks in each burst are generated at a constant frequency.

6. A spark igniter according to claim 5 wherein the sparks in each burst are generated at mains AC frequency, eg about 50 Hz.

7. A spark igniter according to any one of claims 1 to 6 further including flame sensing means (13) associated with the circuit means (2, 3) for sensing, during or after generation of a burst of sparks, whether or not gas ignition has occurred, the circuit means (2, 3) being adapted to terminate the spark generation process in response to the presence of a flame being sensed by the flame sensing means (13).

8. A spark igniter according to any one of claims 1 to 7 wherein said circuit means (2, 3) includes a solid state on/off switch (9) for controlling the generation of the sparks and means to control the state of the switch (9) so that it can cause generation of successive bursts of sparks in the manner aforesaid.

9. A spark igniter according to claim 8 wherein said means to control the state of the switch (9) is an appropriately programmed microprocessor (3).

10. A gas-fired appliance, for example a boiler, including a spark igniter as claimed in any one of claims 1 to 9.

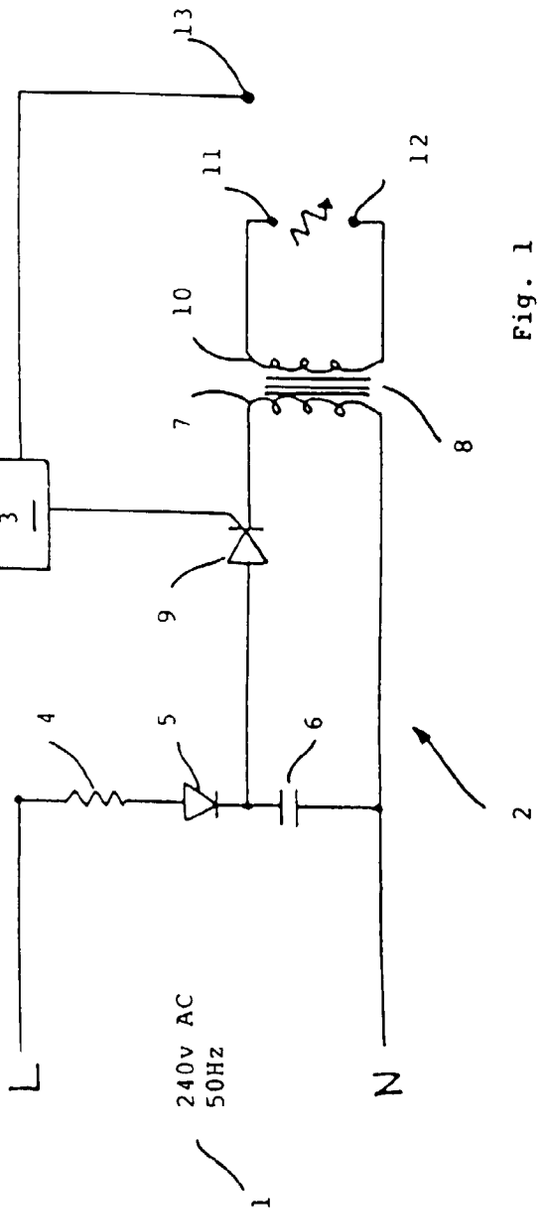
L
N
240v AC
50Hz
1
2
3
4
5
6
7
8
9
10
11
12
13

Fig. 1

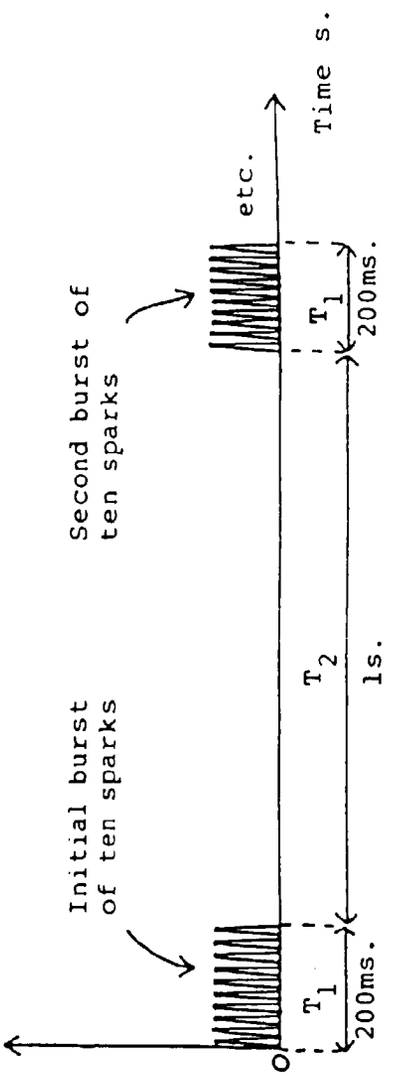
Spark
Amplitude
Initial burst
of ten sparks
Second burst of
ten sparks
etc.
Time s.
O
T_1
200ms.
T_2
1s.

Fig. 2