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

(11) Publication number : **0 437 352 A1**

(12) EUROPEAN PATENT APPLICATION

(21) Application number : **91300151.7**

(51) Int. Cl.[5] : **F23N 5/12**

(22) Date of filing : **09.01.91**

(30) Priority : **09.01.90 GB 9000460**

(43) Date of publication of application :
17.07.91 Bulletin 91/29

(84) Designated Contracting States :
BE DE FR IT NL

(71) Applicant : **POTTERTON INTERNATIONAL LIMITED**
Portobello Works Emscote Road
Warwick CV34 5QU (GB)

(72) Inventor : **Kinge, Richard Arthur George**
12 Parsonage Close, Bishops Tachbrook
Leamington Spa, Warwickshire. CV33 9SD (GB)

(74) Representative : **Lawrence, Brian Richard**
59 Shenfield Place
Shenfield Brentwood Essex CM15 9AH (GB)

(54) Gas burner arrangements.

(57) A gas burner arrangement particularly for a fully pre-mix burner for a condensing boiler comprises a main gas burner 1 and an associated pilot gas burner 9, flame detector electrodes 11,12 for monitoring flames produced by the main and pilot gas burners 1 and 9 respectively, and a flame detector 17 operable on the outputs from the flame detector electrodes for monitoring main and pilot flames, an arrangement 20,21 being provided for changing the sensitivity of the flame detector 17 in dependence upon whether a main flame or a pilot flame is being monitored.

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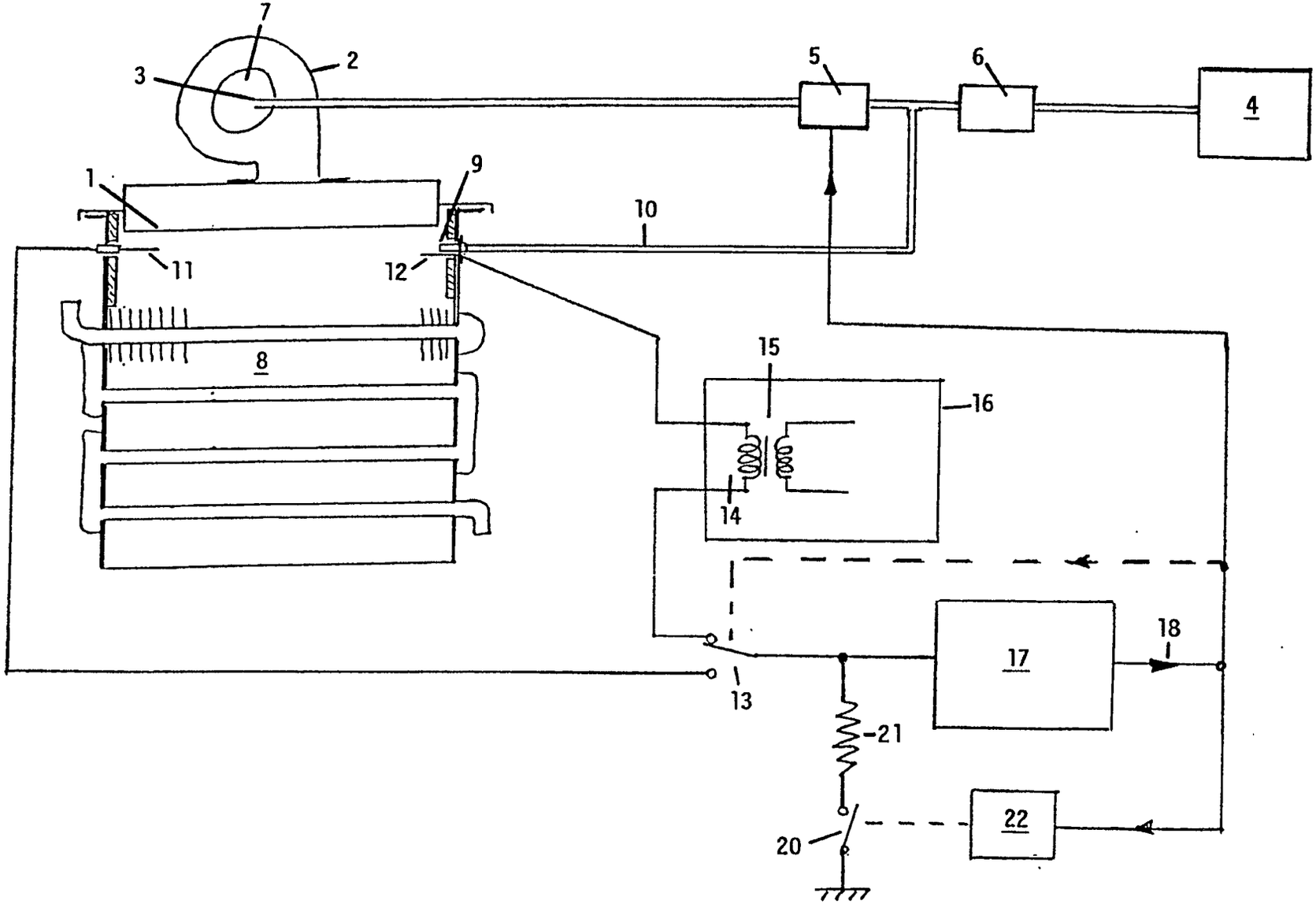
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GAS BURNER ARRANGEMENTS

This invention relates to gas burner arrangements and is particularly concerned with flame detection in fully pre-mix gas burners such as are used in gas heating appliances.

Flame detection, employing the "rectification" technique, has been successfully used on gas heating appliances for many years. The "size" of a flame can usually be determined by the magnitude of the current flow with a good degree of accuracy, such that, for example, a pilot flame may be guaranteed to be large enough to safely ignite a main flame before the main gas burner supply is initiated.

Since with conventional partially aerated burners, the pilot flame remains alight whilst the main burner is firing, the continual monitoring of the pilot will indicate any problem with the gas supply to the system since both the pilot flame and main gas burner will be simultaneously affected.

With the introduction of fully pre-mix gas burners predominantly on condensing appliances, where the air and gas supplies are combined completely prior to their application to the burner, a new set of problems are created which impact on the use of electronic flame detection.

Conventional partially aerated burner systems operate by inducing a proportion of the air as primary aeration, the balance being provided as secondary aeration. Provided that there is more than enough air flowing through the arrangement, then proper combustion is obtainable.

The fully pre-mix burner system, on the other hand, requires a combustible mix of air and gas to be applied to the burner, within a fairly narrow range of air/gas ratio. Too little air can result in excessive surface temperature, whilst too much air can produce flame lift and eventual extinction.

From these two different approaches to burning gas it may be seen that the fully pre-mix burner is less tolerant of a wrong mix. The conventional partially aerated system, however, is more tolerant of reduced gas pressure, since automatically less air is used at the point of combustion and increased gas pressure causes little problem as long as the excess air supply limit is not passed.

Fully pre-mix burners are very well suited to the downward firing arrangement which is usually required on condensing appliances, where the condensate water would fall on to a conventional burner and quench the flame. Side effects are often produced by the fully pre-mix arrangement where the velocity of the air/gas mix, emanating from the burner orifice holes, can disturb or even extinguish the pilot flame. This particular problem prohibits the use of a conventional single electrode flame detector mounted in the pilot flame, since the current is not maintained once the main burner has lit and the pilot flame is extinguished.

It is an object of the present invention to provide an improved form of gas burner arrangement which is particularly suitable for fully pre-mix gas burners.

According to one aspect of the present invention there is provided a gas burner arrangement comprising a main gas burner and an associated pilot gas burner, flame detector electrode means for monitoring flames produced by said main gas burner and said pilot gas burner, and flame detector means operable on the output of said flame detector electrode means for detecting the presence of the flames produced by said gas burners, means being provided for changing the sensitivity of said flame detector means in dependence upon whether a main gas burner flame or a pilot gas burner flame is being monitored.

Preferably, the sensitivity of said flame detector means is greatest when a pilot burner flame is being monitored and is least when a main gas burner flame is being monitored.

In carrying out the invention it may be arranged that the arrangement comprises means for initially supplying gas to said pilot gas burner, means for igniting said pilot gas burner and means operable in dependence upon the output of said flame detector means for supplying gas to said main gas burner.

In one preferred arrangement said flame detector electrode means comprises a single electrode for monitoring flames produced by said main gas burner and said pilot gas burner, and in another preferred arrangement said flame detector electrode means comprises a first electrode for monitoring the flames of said pilot gas burner, and a second electrode for monitoring the flames of said main gas burner, switch means being provided for selectively applying the output from said first and second electrodes to said flame detector means.

Advantageously, means for shunting the input of said flame detector means will be provided to reduce the sensitivity thereof, and further switch means may be provided for connecting a shunting resistance across the input of said flame detector means, said further switch means being operable in dependence upon the output of said flame detector means, delay means preferably being provided for delaying the operation of said further switch means relative to the output of said flame detector means.

Preferably, spark generator means will be provided operable in conjunction with said flame detector means for causing said pilot gas burner to be ignited.

An exemplary embodiment of the invention will now be described reference being made to the accompanying single figure drawing which depicts a gas burner arrangement in accordance with the pre-

sent invention.

The gas burner arrangement depicted in the drawing takes the form of a fully pre-mix, downwardly firing, gas burner for use, for example, in a condensing boiler used for heating water for central heating and domestic hot water purposes. Only those parts of the condensing boiler which are necessary to describe the gas burner arrangement have been included.

The gas burner arrangement depicted in the drawing comprises a main gas burner 1 in the form of a multi-apertured plate which is supplied from above with a pre-mix of gas/air from a fan 2. The fan 2 is provided with a gas inlet 3 which is supplied with gas from a gas supply 4 via a main (solenoid) valve 5 and a pilot (solenoid) valve 6. The gas inlet 3 to the fan 2 is provided in the vicinity of the "eye" 7 thereof, and it is arranged that air is arranged to be drawn into the fan 2 in the vicinity of the "eye" 7 thereof from the surroundings.

Below the main gas burner 1 is disposed a heat exchanger 8 through which the products of combustion from the burner 1 are forced, and through which water to be heated is circulated in the normal manner.

The main gas burner 1 is provided with a pilot gas burner 9 which is supplied with gas from the gas supply 4 via the pilot valve 6 and pipe 10.

The main gas burner 1 is also provided with a flame detector electrode 11 which is arranged to extend across the burner 1 and into the flames produced thereby. The pilot gas burner 9 is similarly provided with a flame detector electrode 12 which is arranged to extend into the flame produced by the pilot gas burner 9.

The output of the flame detector electrode 11 is connected to one input of a two-way switch 13 which may be of any convenient form e.g. electronic, mechanical, etc. The output of the flame detector electrode 12 is connected to the other input of the two-way switch 13 via a winding 14 of a transformer 15 which forms part of a spark generator circuit of known form shown generally at 16. The output from the switch 13 is connected to a "rectification" type flame detector 17 of known form which affords an output 18 when a flame is detected at the pilot gas burner 9 or the main gas burner 1. The flame detector 17 may conveniently operate on the principle of causing an alternating voltage to be half-wave rectified by the outputs from the flame detector electrodes 11 and 12, as the case may be, a comparison being made of successive half-cycles to determine whether a flame is present or not.

The output 18 from the flame detector 17 is used to operate the main valve 5 as will hereinafter be explained and is also used to operate the two-way switch 13 so that once a pilot flame has been detected, the input to the flame detector 17 is switched to the main flame detector electrode 11 in order to monitor the flame of the main gas burner 1.

Because of the different intensities of the flames from the main gas burner 1 and the pilot gas burner 9, in order to be able to make use of a single flame detector 17, it is necessary to be able to control its sensitivity. This is achieved by using the output 18 from the flame detector 17, when a pilot flame has been detected, to cause a switch 20 to be closed to connect a shunt resistor 21 across the input of the flame detector 17, the switch 20 being operated by the output 18 from the flame detector 17 via a delay circuit 22 as will hereinafter be described.

The gas burner arrangement which has been described operates as follows :

The pilot gas valve 6 is closed to supply gas to the pilot gas burner 9. At the same time the spark generator 16 is energised in a conventional manner to cause a succession of sparks to be generated at the pilot flame detector electrode 12, to cause the pilot gas burner 9 to be ignited. The flame of the pilot gas burner 9 is detected by the flame detector 17 via the switch 13 and causes the output 18 indicative of a flame being present to be generated. The output 18 is used to turn on the main gas valve 5 to supply gas to the fan 2 and the gas/air pre-mix which is supplied to the main gas burner 1 is ignited by the flame of the pilot gas burner 9. As has been explained, operation of the main gas burner 1 may cause the flame of the pilot gas burner 9 to become extinguished or rendered unreliable and to overcome this the output 18 from the flame detector 17 is used to operate the two-way switch 13 whereby the flame detector 17 monitors the output from the flame detector electrode 11 associated with the main gas burner 1.

In order to take account of the different outputs from the flame detector electrodes 11 and 12, the output 18 from the flame detector 17 causes the switch 20 to be operated whereby the shunting resistor 21 is connected across the input of the flame detector 17 to cause its sensitivity to be decreased.

Upon establishment of the flame at the main gas burner 1, there will be a period whilst the burner 1 is reaching its stable operating condition. During this time it is necessary to ignore the output from the flame detector electrode 11. This is effectively achieved by means of the delay circuit 22 which delays operation of the switch 20 so that the sensitivity of the flame detector 17 is not reduced until some time after the main gas burner 1 has been ignited, in order to allow it to stabilise.

Although in the gas burner arrangement which has been described use has been made of separate flame detector electrodes 11 and 12 for monitoring the flames of the main gas burner 1 and the pilot gas burner 2 respectively, it is possible to replace them with a single electrode which extends across the pilot flame and also across the main flame, thereby obviating the need for the two-way switch 13. Such an

arrangement is particularly suitable for use in applications where the pilot valve is positively extinguished.

Although the gas burner arrangement which has been described is particularly suitable for use in fully pre-mix gas burners for condensing boilers, it should be appreciated that the invention has much wider application and could be applicable to any gas burner arrangement incorporating main and pilot gas burners and requiring a single flame detector for its operation.

Claims

1. A gas burner arrangement comprising a main gas burner and an associated pilot gas burner, flame detector electrode means for monitoring flames produced by said main gas burner and said pilot gas burner, and flame detector means operable on the output of said flame detector electrode means for detecting the presence of the flames produced by said gas burners, means being provided for changing the sensitivity of said flame detector means in dependence upon whether a main gas burner flame or a pilot gas burner flame is being monitored.

2. An arrangement as claimed in claim 1, in which the sensitivity of said flame detector means is greatest when a pilot burner flame is being monitored and is least when a main gas burner flame is being monitored.

3. An arrangement as claimed in claim 1 or claim 2, comprising means for initially supplying gas to said pilot gas burner, means for igniting said pilot gas burner and means operable in dependence upon the output of said flame detector means for supplying gas to said main gas burner.

4. An arrangement as claimed in any preceding claim, in which said flame detector electrode means comprises a single electrode for monitoring flames produced by said main gas burner and said pilot gas burner.

5. An arrangement as claimed in any of claims 1 to 3, in which said flame detector electrode means comprises a first electrode for monitoring the flames of said pilot gas burner, and a second electrode for monitoring the flames of said main gas burner.

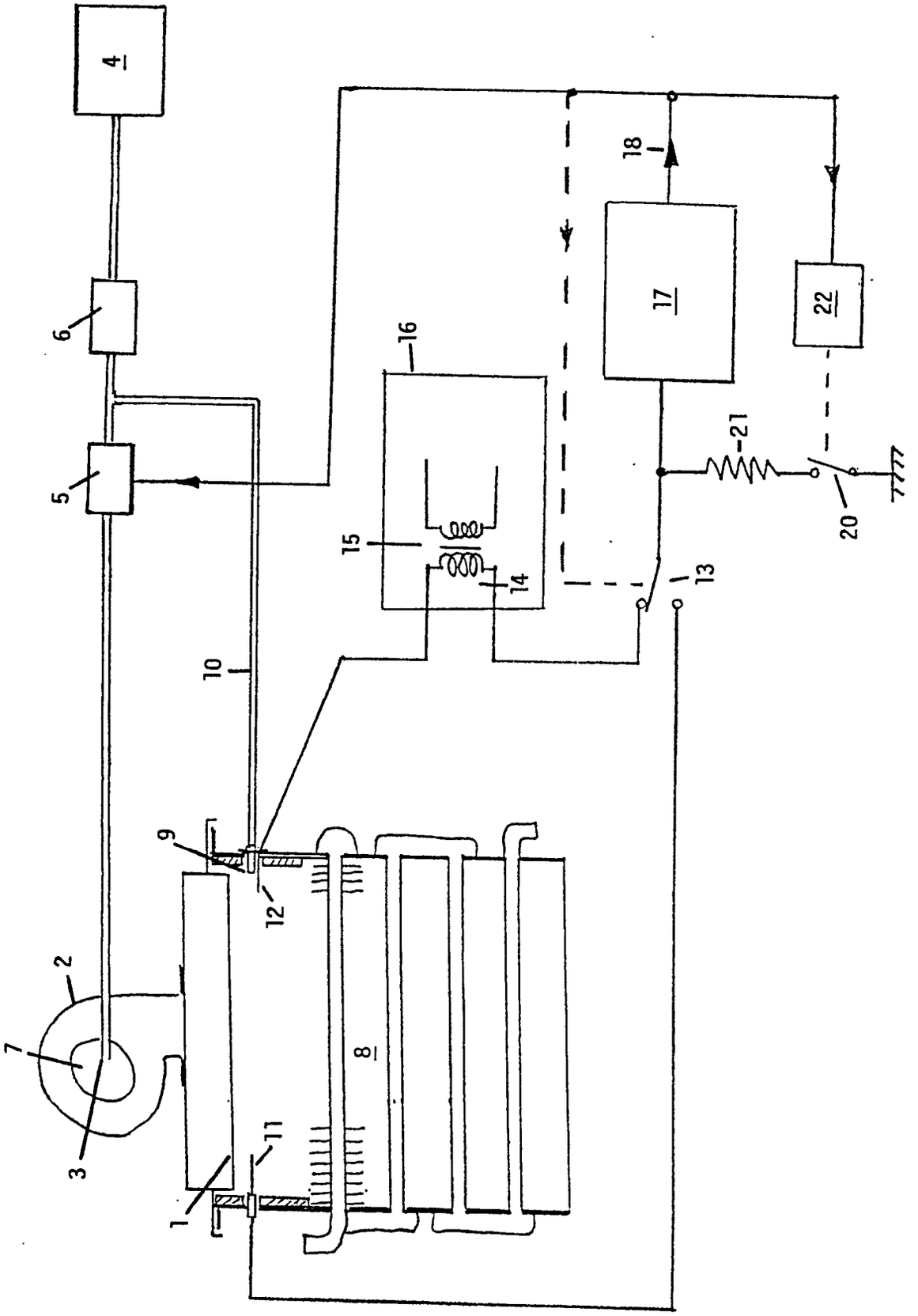
6. An arrangement as claimed in claim 5, comprising switch means for selectively applying the outputs from said first and second electrodes to said flame detector means.

7. An arrangement as claimed in any preceding claim, comprising means for shunting the input of said flame detector means to reduce the sensitivity thereof.

8. An arrangement as claimed in claim 7, comprising further switch means for connecting a shunting resistance across the input of said flame detector means, said further switch means being operable in dependence upon the output of said flame detector means.

9. An arrangement as claimed in claim 8, comprising delay means for delaying the operation of said further switch means.

10. An arrangement as claimed in any preceding claim, comprising spark generator means operable in conjunction with said flame detector electrode means for causing said pilot gas burner to be ignited.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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 0151

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
A	GB-A-780422 (SCULLY SIGNAL) * page 1, lines 11 - 37 * * page 9, line 99 - page 10, line 44; figures *	1	F23N5/12
A	PATENT ABSTRACTS OF JAPAN vol. 6, no. 138 (M-145)(1016) 27 June 1982, & JP-A-57 62324 (SHARP) 15 April 1982, * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 6, no. 101 (M-135)(979) 10 June 1982, & JP-A-57 33723 (MATSUSHITA) 23 February 1982, * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 12, no. 137 (M-690)(2984) 26 April 1988, & JP-A-62 258928 (MATSUSHITA) 11 November 1987, * the whole document *	1	
A	PATENT ABSTRACTS OF JAPAN vol. 9, no. 194 (M-403)(1917) 10 August 1985, & JP-A-60 57125 (MATSUSHITA) 02 April 1985, * the whole document *	1	TECHNICAL FIELDS SEARCHED (Int. Cl.5) F23N

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	12 MARCH 1991	KOOIJMAN F.G.M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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EPO FORM 1503 03.82 (P0401)