PCT WORLD INTELLECTUAL PROPERTY ORGANIZATION
International Bureau

INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 : A45D 20/30 | A1

(11) International Publication Number: **WO 95/31915**

(43) International Publication Date: 30 November 1995 (30.11.95)

(21) International Application Number: PCT/GB95/01116

(22) International Filing Date: 17 May 1995 (17.05.95)

(30) Priority Data:
9410133.4 20 May 1994 (20.05.94) GB

(71) Applicant *(for all designated States except US)*: PIFCO LIMITED [GB/GB]; Failsworth, Manchester M35 0HS (GB).

(72) Inventor; and

(75) Inventor/Applicant *(for US only)*: SHARPLES, James, Henry [GB/GB]; 9 Kenilworth Close, Radcliffe, Greater Manchester M26 0HL (GB).

(74) Agent: BRAY, Lilian, Janet; L.J. Bray & Co., Raw Holme, Midgehole Road, Hebden Bridge, West Yorkshire HX7 7AF (GB).

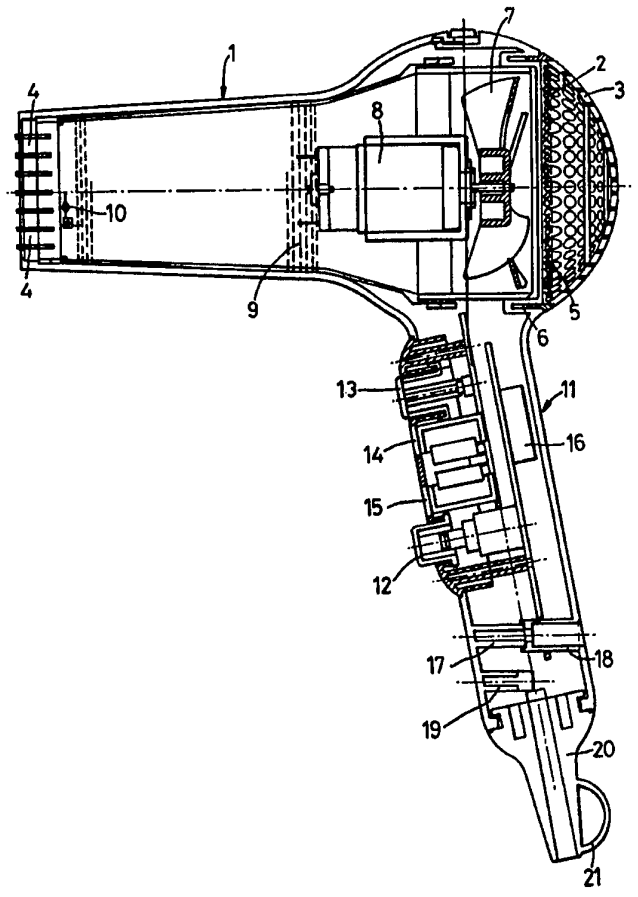
(81) Designated States: GB, JP, US, European patent (AT, BE, CH, DE, DK, ES, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: A HAIRDRYER

(57) Abstract

A hairdryer comprises a casing (1) defining an air inlet (2) and an air outlet (4) with a fan (7) for blowing air out of the casing (1) via the outlet (2). An electrical element (9) heats the air prior to its egress from the casing (1) and a temperature sensor (10) is located adjacent the outlet (4) to monitor the temperature of the egressing air. The temperature sensor (10) is linked to a microprocessor (16) which controls operation of the heating element (9) dependent on information received from the sensor (10) whereby, below a predetermined upper threshold, the temperature of the air egressing from the casing (1) is kept substantially constant at a level set by a user independently of the rate of flow of the air through the casing (1). Thus, the hairdryer has closed loop control and can, within predetermined limits, maintain the output air temperature stable within a few degrees of that selected by the user irrespective of the air throughput.



FOR THE PURPOSES OF INFORMATION ONLY

Codes used to identify States party to the PCT on the front pages of pamphlets publishing international applications under the PCT.

AT	Austria	**GB**	United Kingdom	**MR**	Mauritania
AU	Australia	**GE**	Georgia	**MW**	Malawi
BB	Barbados	**GN**	Guinea	**NE**	Niger
BE	Belgium	**GR**	Greece	**NL**	Netherlands
BF	Burkina Faso	**HU**	Hungary	**NO**	Norway
BG	Bulgaria	**IE**	Ireland	**NZ**	New Zealand
BJ	Benin	**IT**	Italy	**PL**	Poland
BR	Brazil	**JP**	Japan	**PT**	Portugal
BY	Belarus	**KE**	Kenya	**RO**	Romania
CA	Canada	**KG**	Kyrgystan	**RU**	Russian Federation
CF	Central African Republic	**KP**	Democratic People's Republic of Korea	**SD**	Sudan
CG	Congo			**SE**	Sweden
CH	Switzerland	**KR**	Republic of Korea	**SI**	Slovenia
CI	Côte d'Ivoire	**KZ**	Kazakhstan	**SK**	Slovakia
CM	Cameroon	**LI**	Liechtenstein	**SN**	Senegal
CN	China	**LK**	Sri Lanka	**TD**	Chad
CS	Czechoslovakia	**LU**	Luxembourg	**TG**	Togo
CZ	Czech Republic	**LV**	Latvia	**TJ**	Tajikistan
DE	Germany	**MC**	Monaco	**TT**	Trinidad and Tobago
DK	Denmark	**MD**	Republic of Moldova	**UA**	Ukraine
ES	Spain	**MG**	Madagascar	**US**	United States of America
FI	Finland	**ML**	Mali	**UZ**	Uzbekistan
FR	France	**MN**	Mongolia	**VN**	Viet Nam
GA	Gabon				

A HAIRDRYER

The present invention relates to hairdryers and in particular but not exclusively to hairdryers which are hand held.

Conventionally, hand held hairdryers are provided with controls capable of adjusting the power or the throughput of air in discrete increments, the number of increments being restricted by the number of switch points available. There are also hairdryers with stepless rotary control switches which give an increased number of power/throughput combinations. However, the air throughput control in such hairdryers is invariably linked at some point to the power control to prevent over-heating.

The object of the present invention is to provide a hairdryer which, within predefined limits, can deliver air at a user-selected temperature regardless of the air throughput.

According to the present invention there is provided a hairdryer comprising a casing defining an air inlet and an air outlet, a means for blowing air out of the casing via the outlet, and a means for heating the air prior to its egress from the casing, and characterised in that a temperature sensor is provided adjacent the outlet to monitor the temperature of the egressing air, and a means is provided for controlling operation of the heating means and to which the temperature sensor is linked whereby, below a predetermined upper threshold, the temperature of the air egressing from the casing is kept substantially constant at a level set by a user independently of the rate of flow of the air through the casing.

Preferably, between predetermined limits, the rate of

flow of air through the outlet can be set at a desired level by a user.

Preferably also, below said predetermined upper threshold and within said predetermined limits, the levels set by the user for the temperature of the air and for the rate of flow of the air are independently infinitely variable.

Thus, the hairdryer has closed loop control and can, within the predetermined limits, maintain the output air temperature stable within a few degrees of that selected by the user irrespective of the air throughput.

In a second embodiment, a second temperature sensor is preferably provided and linked to the control means to monitor the temperature of the air before its passage over the heating means

Preferably also, the air inlet is covered by a removable filter.

Preferably also, a warning means is provided which is operated by the control means if the rate of rise in the temperature detected by the second temperature sensor is such as to indicate that a restricted air flow is passing through the casing. Such a warning means would normally indicate that the inlet filter is clogged.

The present invention will now be described by way of example with reference to the accompanying drawings in which:-

Fig. 1 is a cross section through a first embodiment of a hairdryer according to the invention;

Fig. 2 is an electronic logic circuit of a control means forming part of the hairdryer shown in Fig. 1;

Fig. 3 is an electronic logic circuit of a control means forming part of a second embodiment of hairdryer according to the present invention;

Fig. 4 is a schematic circuit diagram of the control means for the second embodiment of hairdryer; and

Fig. 5 is a graph showing variations in air flow temperature and power consumption over time of a hairdryer according to the invention when in use under test with various control settings.

As shown in Fig. 1, a hairdryer according to the invention comprises a two-part casing 1 defining an air inlet 2, which is covered by a removable, part-spherical grille 3, and air outlet vents 4. The air inlet is covered by a filter 5, which can be cleaned or replaced by removing the grille 3, the rim of which is push-fitted into a complementary bayonet groove 6 formed in the casing 1.

Between the air inlet 2 and the air outlet vents 4 are located a fan 7 powered by a co-axial motor 8 and an electrical element 9. The element 9, in conventional fashion for a hairdryer, comprises a bank of coiled electrical resistance wires over which air is blown by the fan 7 and thereby heated before egressing through the outlet vents 4.

A temperature sensor 10 is located adjacent the outlet vents 4 so that the temperature of the air egressing from the hairdryer can be measured. In a second embodiment of the invention, as is further described below, a second temperature sensor 10' (shown schematically in Fig. 4) is

located at the edge of the bank between the element 9 and the motor 8.

The casing 1 also defines a handle 11 on which are conveniently located various user-operated controls 12, 13, 14, 15 for the hairdryer. Within the handle 11 is also located electrical circuitry (not shown) which is linked to the temperature sensor 10 for controlling operation of the motor 8, and thereby the fan 7, and the element 9. An electronic control means 16 incorporating a programmable microprocessor, which forms part of the electrical circuitry, is also located within the handle 11.

At the base of the handle 11 are provided coaxial channels 17 and 18 through which the two parts of the casing 1 can be secured together by an appropriate fastener. Similarly, a third channel 19 is provided through which a fixing means can be located for attachment of an end cap 20 for closing off the base of the handle 11. The end cap 20 is provided with an integrally formed loop 21 by which the hairdryer can be hung from a hook when not in use.

The hairdryer is intended to be powered in conventional fashion by a mains electricity supply. Two, 12 and 13, of the controls are of the push-button type and comprise respectively an on/off latching switch 12 for the electrical power supply to the hairdryer and a "cool shot" non-latching switch 13, as will be described.

The other two controls 14 and 15 comprise rotary sliding controls for control of the output air temperature and the fan speed respectively. The controls 14 and 15 are slidable over approximately 130° and between end stops defining upper and lower limits their positions are infinitely variable. Thus, within these predetermined

limits, the temperature of the output air and rate of air flow out of the outlet vents 4 are also infinitely variable by the user.

The "cool shot" switch 13 is provided so that at any time during operation of the hairdryer the user can switch off the power supply to the element 9 and demand full air output without altering the settings of the temperature control 14 or the fan speed control 15. This enables the user to blast the hair with air at ambient temperature, which is useful for setting curls. Thereafter, if it is desired to use warm air again, the switch 13 can be used to restore power to the element 9 to produce the same air temperature and fan speed as before.

As the user can set the required air output temperature and the fan speed independently, the control means 16 is required to determine, for any given settings of the switches 14 and 15, the power output of the element 9.

In a first embodiment, as shown in Fig. 1, the control means 16 is programmed to operate with a logic circuit as shown in Fig. 2. Here, when the hairdryer is switched on, as indicated at box 100, readings from the temperature sensor 10 are first used by the control means 16 to determine if there is sufficient airflow through the casing (box 106). If the air inlet 2 is for any reason blocked, for example if the grille 3 is covered or the filter 5 badly choked, then the temperature of the air surrounding the sensor 10 rises very quickly and much more rapidly than under normal circumstances when there is an adequate air flow produced via the fan 7. The rate of rise in the temperature is also deduced by the control means 16 from the readings supplied by the sensor 10 and if this rate is above normal rates, then the power supplied to the element

9 is cut off. Such an occurrence is indicated by the pathway from box 106 to box 107.

However, under normal circumstances the airflow will be sufficient to keep the temperature within the casing at an acceptable level and the control means 16 then uses readings from the temperature sensor 10 to determine whether the output air temperature is as set by the user (box 101). If it is, then the temperature is simply continuously monitored to ensure that it remains as set (box 102). If at any time the temperature is not as set by the user, then it is determined whether it is higher or lower than required (box 103) and the power supplied to the element 9 is thereby adjusted accordingly (box 104 or box 105).

It will be appreciated that this logic circuit operates, within predetermined limits, regardless of the fan speed set by the user. Should the fan speed be adjusted during operation then, if the rate of air flow is increased, the temperature of the air detected by the temperature sensor will fall as more air is passed over the element 9 so the power supplied to the element can be appropriately increased. Alternatively, if the rate of air flow is decreased, the temperature of the air detected by the temperature sensor will rise as less air is passed over the element 9 so the power supplied to the element can be appropriately reduced.

Similarly, if the hairdryer is used with attachments such as a diffuser or a nozzle, then the flow of the air egressing from the outlet vents 4 is restricted and its temperature will rise. In these circumstances, the rise will be detected by the sensor 10 and the power supplied to the element 9 can be suitably reduced.

The upper threshold can be set as appropriate for type of hairdryer in question but a suitable threshold for most purposes would be around 85°C. However, for safety reasons, the temperature of the element 9 must be also monitored in case it rises above a predetermined threshold when the radiant heat produced could endanger the casing 1. Above this predetermined upper limit, the control means 16 always operates to reduce the power supplied to the element 9 to reduce the air temperature to just below the limit.

In a modification, as temperature control via the control means 16 depends on there being an airflow over the temperature sensor 10, a self-resetting thermal cut-out (not shown) is located within the element 9 and operates to cut off the power supply to the element 9 and the motor 8 if the temperature within the hairdryer ever rises above a predetermined level, which is well above the upper predetermined threshold described above.

In the second embodiment of the hairdryer, fuzzy logic can be employed to program the control means 16. The presence of the second temperature sensor 10', which is also linked to the control means 16, permits the control means 16 to be programmed to make more detailed deductions about the rate of air flow over the element 9. A suitable logic circuit for this purpose is shown in Fig. 3. Here it will be seen that steps shown in boxes 101 to 105 are identical to those in Fig. 2 but the initial steps shown in boxes 106 and 107 in Fig. 2 are missing. These steps are replaced by two further steps inserted between box 100 and box 101. A first (box 108) of these steps determines whether the air flow over the element 9 is sufficient to prevent the temperature of the element 9 rising dangerously high. This leads to box 109 if the air flow is insufficient and in these circumstances the power to the element is reduced to zero. In the alternative, should the air flow be

sufficient a further step (box 110) determines whether the air flow is acceptable. If a restricted or partial air flow is deduced, then this is indicative of a blocked filter 5 and a warning light 22 (see Fig. 4) incorporated in the electrical circuitry of this embodiment can be switched on to alert the user (box 111). In either circumstance, the next step is as indicated in box 101 and the following circuit operates as previously described for Fig. 2.

As shown in Fig. 4, which illustrates a schematic circuit diagram of the control means 16 for this second embodiment of hairdryer, inputs 23, 24, 25, 26 are received, each via one of a series of analog-to-digital converters 27, from the temperature sensor 10, the temperature control 14, the air speed control 15, and the temperature sensor 10' respectively. Programmed into the control means 16 is a bank of predetermined information 28 which provides internal references in the form of second inputs 29, 30 for comparators 31, 32 respectively. The comparator 31 compares an input signal indicative of the air speed control setting made by the user with the internal reference signal 29 indicative of the actual rate of air flow through the casing 1. The comparator 31 is designed to provide an appropriate output signal to control the power supplied to the motor 8 via one of a series of output digital-to-analog converters 33. The comparator 32 compares the input signal from the temperature sensor 10', which is indicative of the air intake temperature, with the internal reference signal 30. If this air intake temperature is above a predetermined value, as programmed into the information bank 28, then this is indicative of a reduced air intake which is typically caused by a clogged filter 5 and the comparator 32 operates to output a signal to the warning light 22 via a digital-to-analog converter 33.

The inputs 23, 24 received via analog-to-digital converters 27 from the temperature sensor 10 and the temperature control 14 form the inputs to a comparator 34. This comparator 34 determines the difference between the two inputs and their relative level and produces an output signal which is input to a logic converter 35. The logic converter 35 also receives input from the information bank 28 and is programmed so as to be capable of producing an output signal to control operation of a current regulating circuit 36, such as a TRIAC, for the air heating element 9 via a digital-to-analog converter 33.

The logic converter 35 comprises fuzzy logic circuitry and is capable of determining the rate of change of the output air temperature and its variance from the desired temperature set by the user. Using predetermined information from the bank 28, the logic converter 35 is then able to control its output signal whereby the TRIAC 36 is appropriately controlled to maintain the air output temperature as close as possible to that set by the user. As previously described, should the rate of rise in the temperature indicated by the sensor 10 be above normal predetermined rates as stored in the bank 28, then the logic converter 35 operates to cut off all power to the TRIAC 36.

An output from the "cool shot" switch 13 is also input directly to the logic converter 35. Should the "cool shot" function of the hairdryer be operated by the user, this is detected by the logic converter 35 which can again operate to cut off all power to the TRIAC 36 for as long as the switch 13 is operated by the user. Thereafter, control of the TRIAC 36 dependent on the output received from the comparator 34 is resumed by the converter 35.

Thus, during normal operation of the hairdryer, the

control means 16 operates to vary the power supplied to the element 9 according to settings of the temperature control switch 14 and the fan speed switch 15 determined by the user. Fig. 5 is a graph showing the variation in air flow temperature at a fixed distance close to but spaced from the hairdryer outlet (the solid line), the ambient temperature (the dotted and dashed line), and the power consumption (the dashed line) over time of the hairdryer when in use under test conditions with various control settings. The graph takes the form of a contemporaneous printout of the test results with the temperature and wattage being dual scales along the abscissa and time being the scale along the ordinate. Various aspects of this graph will now be described.

The test commences at point *A* with the hairdryer switched off so the power consumption is zero. Then at point *B* the hairdryer is switched on with control settings for a low fan speed and a low air temperature. Here it can be see that the power consumption rises instantaneously to around 510 watts then falls back very slightly to remain constant at around 465 watts. The temperature of the air egressing from the hairdryer also rises very quickly to around 41°C and then remains substantially constant.

At point *C* the temperature control of the hairdryer is moved from low to high. As would be expected, the power consumption of the hairdryer rises virtually instantaneously to around 1135 watts and then remains constant. Likewise the temperature of the air also rises quickly to around 90°C and again remains substantially constant.

At point *D* the fan speed control of the hairdryer is switched from the low setting to a high setting but the temperature control is left untouched. It can be seen that,

as required, the temperature of the air remains substantially constant at 90°C. However, the power consumption of the hairdryer increases to around 1380 watts in order to supply more power to the motor 8 to raise the fan speed and also to increase the temperature of the element to compensate for the fact that a greater air flow is now passing over it.

At point *E* the controls of the hairdryer are again adjusted, this time to reduce both the temperature and fan speed to medium settings. The power consumption then drops immediately to 795 watts before rising slightly to around 828 watts before remaining substantially constant. The temperature also drops to just below 60°C where it again remains substantially constant.

At point *F* the controls of the hairdryer are left untouched but the air outlet of the hairdryer is partially restricted, for example to simulate use of an air diffuser or nozzle. At this point, the power consumption immediately drops to around 613 watts to take into account the fact that in order to keep the air temperature constant the element 9 needs to cool as the air flow over it has been slowed down. In contrast, the temperature reading shows a small upward spike as the air flow is restricted and then returns very quickly to its previous level around 60°C.

Finally, at point *G* the air outlet of the hairdryer is further restricted. Again the air temperature registers a small upward spike and then falls back to a constant level but to compensate for the further restriction in air flow, the power consumption of the hairdryer falls to around 510 watts.

Thus it can be seen that the hairdryer of the invention operates to keep the temperature of the air

egressing from the casing at a substantially constant level, as set by the user, independently of the rate of flow of the air through the outlet. The control means 16 comprising a programmable microprocessor operates to control the power consumption of the hairdryer to make this possible thus also enabling the fan speed to be set by the user as required.

CLAIMS

1. A hairdryer comprising a casing (1) defining an air inlet (2) and an air outlet (4), a means (7,8) for blowing air out of the casing (1) via the outlet (4), and a means (9) for heating the air prior to its egress from the casing (1), and characterised in that a temperature sensor (10) is provided adjacent the outlet (4) to monitor the temperature of the egressing air, and a means (16) is provided for controlling operation of the heating means (9) and to which the temperature sensor (10) is linked whereby, below a predetermined upper threshold, the temperature of the air egressing from the casing (1) is kept substantially constant at a level set by a user independently of the rate of flow of the air through the casing (1).

2. A hairdryer as claimed in Claim 1, characterised in that, between predetermined limits, the rate of flow of air through the outlet (4) can be set at a desired level by a user.

3. A hairdryer as claimed in Claim 2, characterised in that below said predetermined upper threshold and within said predetermined limits, the levels set by the user for the temperature of the air and for the rate of flow of the air are independently infinitely variable.

4. A hairdryer as claimed in any one of Claims 1 to 3, characterised in that the control means (16) compares a signal indicative of the temperature detected by the temperature sensor (10) with a signal indicative of the temperature set by the user and varies the power supplied to the heating means (9) in order to keep the temperature of the air egressing from the casing (1) substantially constant at the level set by the user.

5. A hairdryer as claimed in any one of Claims 1 to 4, characterised in that the control means (16) operates to determine the rate of rise in the temperature detected by the temperature sensor (10).

6. A hairdryer as claimed in Claim 5, characterised in that the control means (16) cuts off the power supply to the heating means (9) if the rate of rise in the temperature detected by the temperature sensor (10) is above a predetermined level.

7. A hairdryer as claimed in any one of Claims 1 to 6, characterised in that the control means (16) compares a signal indicative of a desired rate of flow of the air through the casing (1) with a reference signal indicative of the actual rate of flow of air through the casing (1) and varies the power supplied to the blowing means (7, 8) in order to keep the rate of air flow substantially constant at the level set by the user.

7. A hairdryer as claimed in any one of Claims 1 to 6, characterised in that a thermal power cut-out is provided within the casing (1) which switches off the power supply to the blowing means (7, 8) and to the heating means (9) if the temperature within the casing rises above a second predetermined threshold.

8. A hairdryer as claimed in any one of Claims 1 to 7, characterised in that the air inlet (2) is covered by a removable filter (5).

9. A hairdryer as claimed in any one of Claims 1 to 8, characterised in that a second temperature sensor (10')is provided and linked to the control means (16) to monitor the temperature of the air before its passage over the heating means (9).

10. A hairdryer as claimed in Claim 10, characterised in that a warning means (22) is provided which is operated by the control means (16) if the rate of rise in the temperature detected by the second temperature sensor (10') is such as to indicate that a restricted air flow is passing through the casing (1).

11. A hairdryer as claimed in any one of Claims 1 to 10, characterised in that the control means (16) comprises a fuzzy logic converter (35).

12. A hairdryer as claimed in any one of Claims 1 to 11, characterised in that the control means comprises a programmable microprocessor.

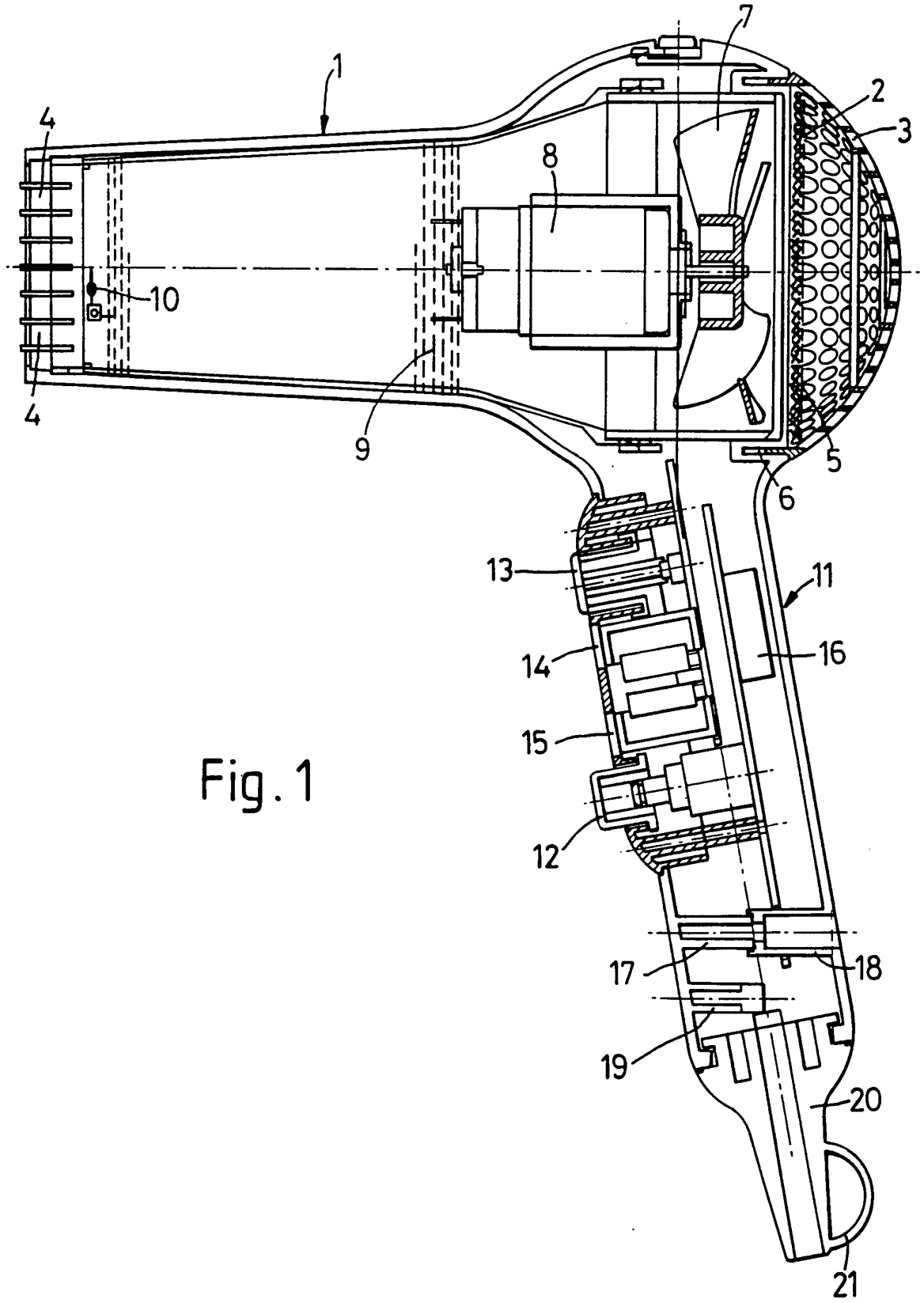


Fig. 1

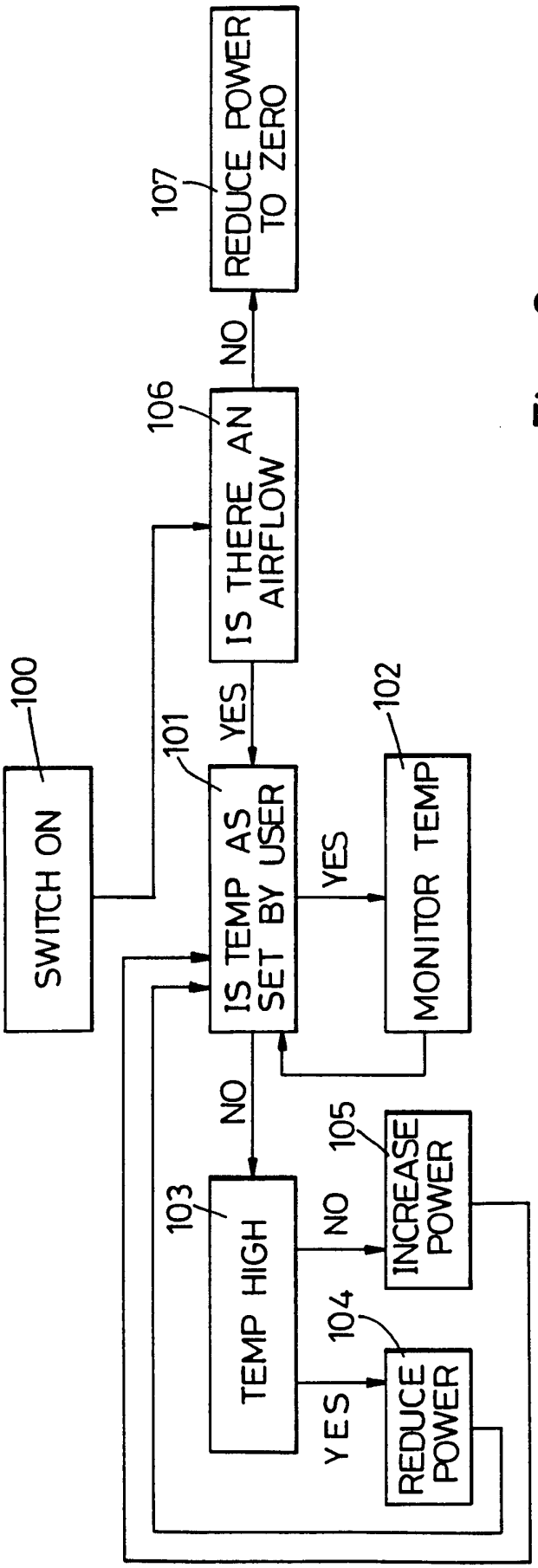

SWITCH ON
100
IS THERE AN AIRFLOW
106
REDUCE POWER TO ZERO
107
NO
YES
IS TEMP AS SET BY USER
101
MONITOR TEMP
102
YES
NO
TEMP HIGH
103
INCREASE POWER
105
NO
REDUCE POWER
104
YES

Fig. 2

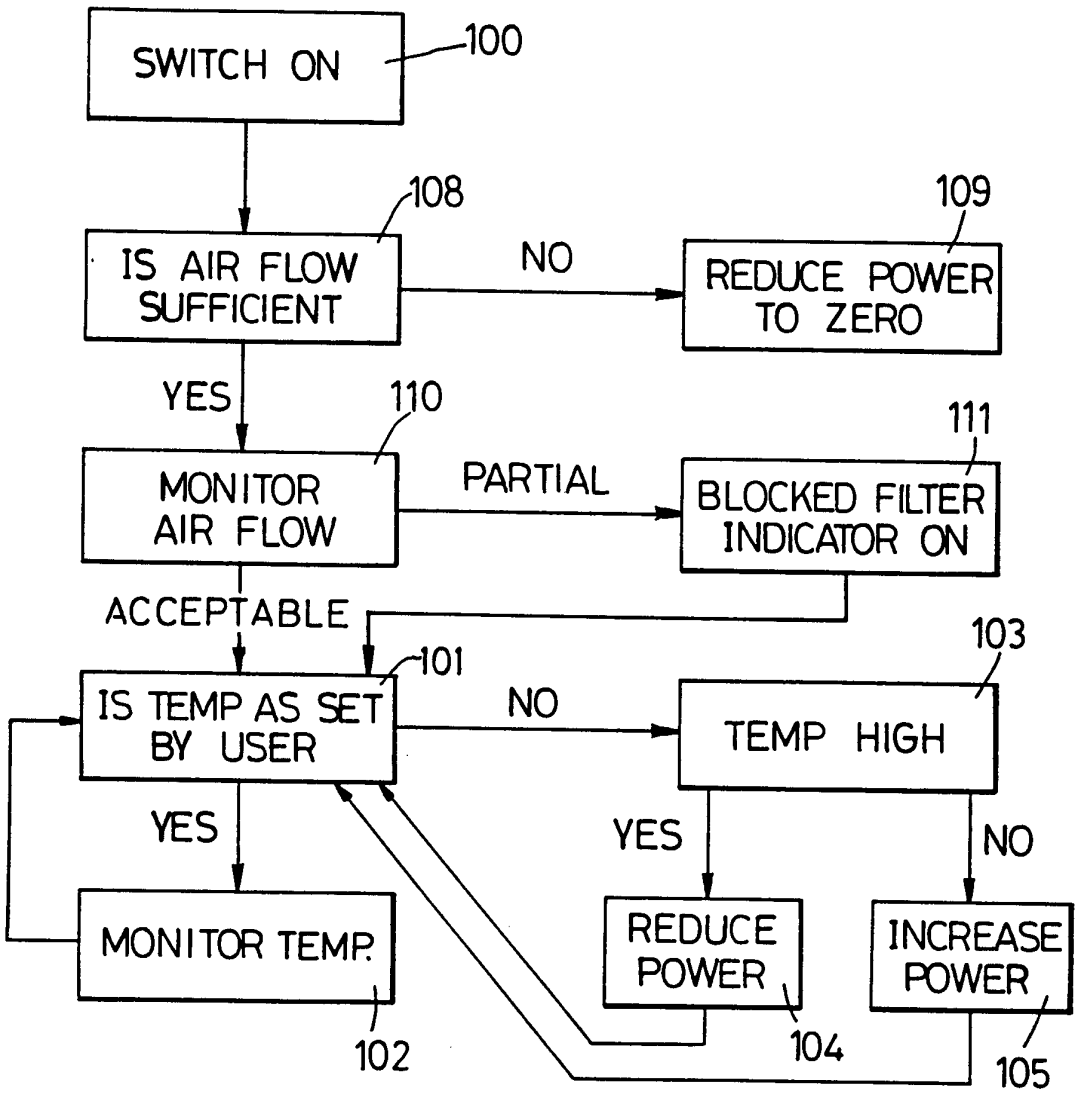

SWITCH ON
100
IS AIR FLOW SUFFICIENT
108
NO
REDUCE POWER TO ZERO
109
YES
MONITOR AIR FLOW
110
PARTIAL
BLOCKED FILTER INDICATOR ON
111
ACCEPTABLE
IS TEMP AS SET BY USER
101
NO
TEMP HIGH
103
YES
MONITOR TEMP.
102
YES
REDUCE POWER
104
NO
INCREASE POWER
105

Fig. 3

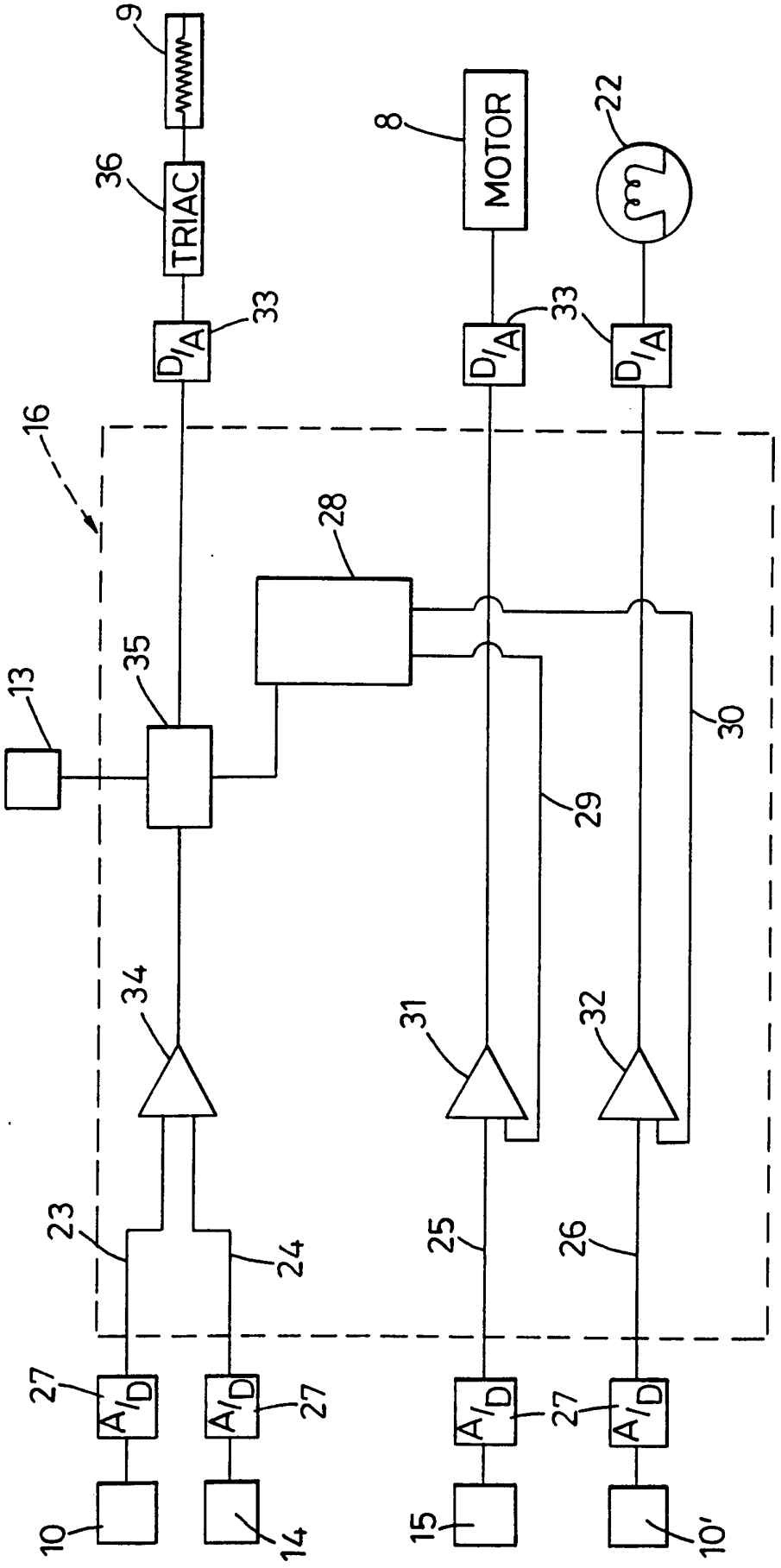

9
36
TRIAC
33
D/A
8
MOTOR
22
33
D/A
D/A
16
28
13
35
30
29
34
31
32
23
24
25
26
27
A/D
27
A/D
27
A/D
27
A/D
10
14
15
10'

Fig. 4

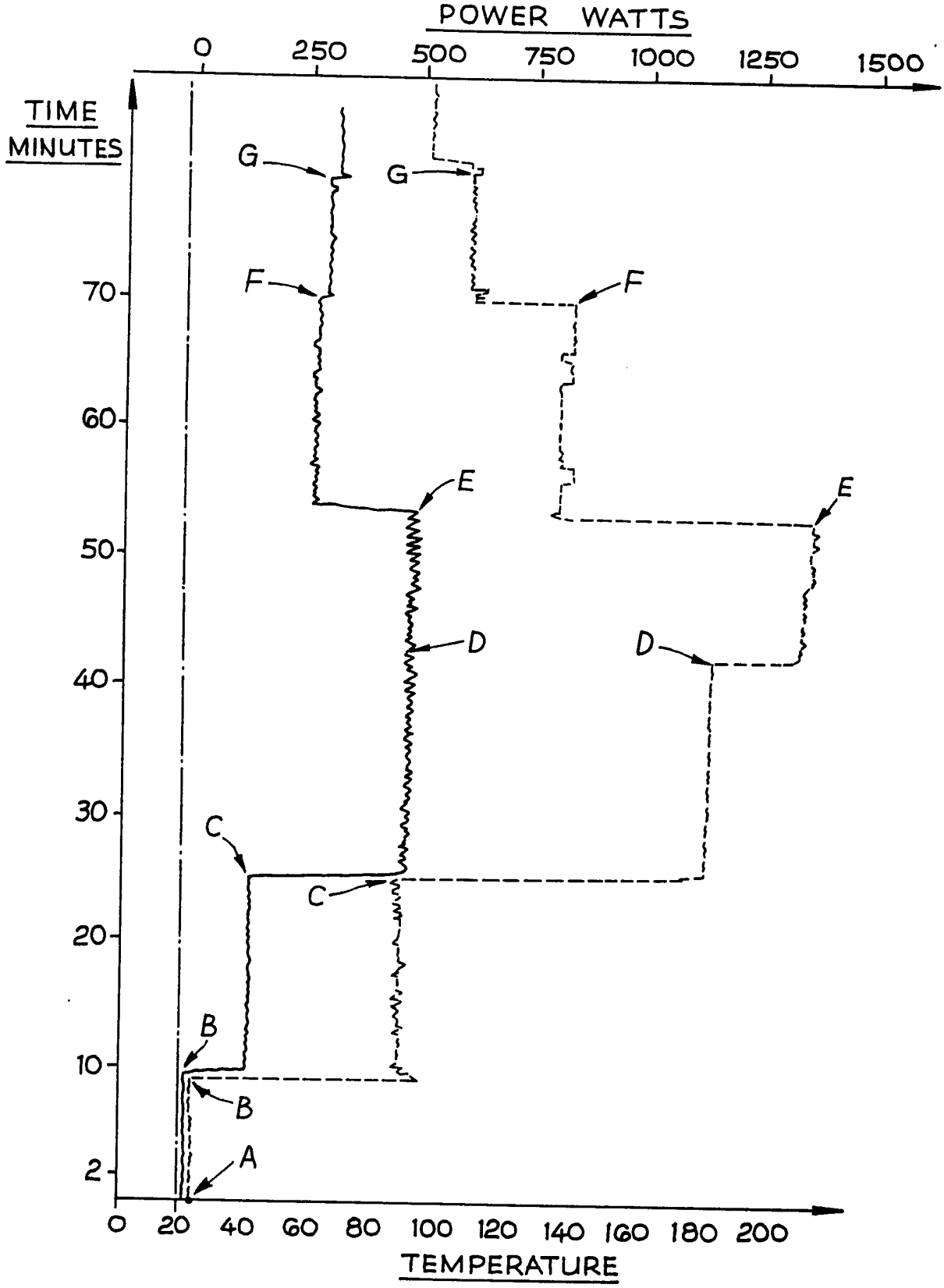

POWER WATTS
0
250
500
750
1000
1250
1500
TIME
MINUTES
70
60
50
40
30
20
10
2
G
G
F
F
E
E
E
D
D
C
C
B
B
A
0
20
40
60
80
100
120
140
160
180
200
TEMPERATURE

Fig. 5

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 95/01116

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 A45D20/30

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 A45D G05D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	CH,A,603 106 (SPEMOT) 15 August 1978 see the whole document	1-4
A		7,8

X	GB,A,2 007 877 (BRAUN) 23 May 1979 see the whole document	1,2,4
A		3,8

X	EP,A,0 035 655 (BRAUN) 16 September 1981 see page 3, line 31 - page 8, line 18; figures 1,2	1,2,4

X	US,A,4 013 083 (HELBLING) 22 March 1977 see the whole document	1

A	DE,A,37 41 775 (TELEFUNKEN) 22 June 1989 see the whole document	1,3

	-/--	

[X] Further documents are listed in the continuation of box C.

[X] Patent family members are listed in annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
15 September 1995	04. 10. 95

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Sigwalt, C

Form PCT/ISA/210 (second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

Int onal Application No
PCT/GB 95/01116

C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP,A,0 518 035 (BRAUN) 16 December 1992 see the whole document ---	1,9-11
A	US,A,4 766 913 (KLEIN) 30 August 1988 see claim 1 -----	13

1

Form PCT/ISA/210 (continuation of second sheet) (July 1992)

INTERNATIONAL SEARCH REPORT

information on patent family members

Int onal Application No
PCT/GB 95/01116

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
CH-A-603106	15-08-78	DE-A- 2738272	10-08-78
GB-A-2007877	23-05-79	DE-A- 2751833	23-05-79
		FR-A,B 2409024	15-06-79
		JP-A- 54110059	29-08-79
EP-A-0035655	16-09-81	DE-A- 3009190	24-09-81
US-A-4013083	22-03-77	US-A- 3911934	14-10-75
DE-A-3741775	22-06-89	NONE	
EP-A-0518035	16-12-92	DE-A- 4119020	10-12-92
		US-A- 5448677	05-09-95
US-A-4766913	30-08-88	NONE	