

12

EUROPEAN PATENT APPLICATION

21 Application number: **87310158.8**

51 Int Cl. 4: **H05B 3/82**

22 Date of filing: **18.11.87**

30 Priority: **15.12.86 GB 8629920**
04.03.87 GB 8705051

43 Date of publication of application:
27.07.88 Bulletin 88/30

94 Designated Contracting States:
DE ES FR IT

71 Applicant: **Redring Electric Limited**
Redring Works
Peterborough PE2 9JJ(GB)

72 Inventor: **Welsh, Alan Wilfred**
38 New Road
Oundle Peterborough(GB)
Inventor: **Cheetham, Trevor William**
1 Deer Park Sawtry
Huntingdon Cambridgeshire(GB)

74 Representative: **Kirby, Harold Victor Albert**
The General Electric Company, p.l.c. Central
Patent Department Wembley Office GEC
Research Centre East Lane
Wembley Middlesex HA9 7PP (GB)

54 Immersion heater:

67 In an immersion heater, especially for a washing machine in which a heating element (1) is insertable through an opening of a vessel designed to contain liquid to be heated, the element (1) has brazed to it a housing (4) also insertable through the opening and arranged to contain a disc type thermal sensor (6), which is connected in series with the heating element (1) and is arranged to cut off the supply of current thereto on reacting a predetermined temperature.

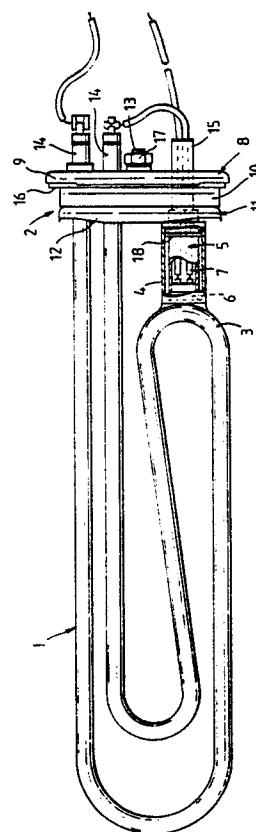


Fig. 1.

EP 0 275 635 A1

Immersion Heaters

This invention relates to immersion heaters, more especially for washing machines, of the kind incorporating a sheathed wire electric heating element supported by a mounting head comprising a pair of relatively rigid plates having a sandwiched between them a block of resilient material, such that on insertion of the element through a co-operating opening in the wall of a vessel designed to contain a liquid to be heated, the block of resilient material can be compressed between the plates to seal against the wall of the vessel around the opening.

In order to provide a safeguard against overheating it has been proposed to incorporate, either within the insulation of the heating element itself or a separate elongate tube also supported by the mounting head, a single operation thermal cutout, or alternatively an expansion rod designed to operate a microswitch. Such protective arrangements are especially necessary where the heaters are fitted to washing machines having drums formed of plastics material which can be easily damaged when subjected to excessive heat. However the protective devices referred to above are expensive, and an object of the invention is to provide a simple, less expensive protective device which is especially suitable for such a purpose.

According to the invention an immersion heater of the kind referred to comprises a metal housing brazed to the heating element, and of dimensions such that it can be inserted through said co-operating opening in the vessel wall, so as to lie within the said vessel when the immersion heater is fitted thereto and, removably sealed within said housing, a disc type thermal sensor connected in series with the heating element and operative to cut off the supply of current thereto on reaching a predetermined temperature.

Such thermal sensors can be made in relatively small dimensions, for example of the order of 13 mm in diameter, and besides being highly efficient are considerably less expensive than the forms of thermal protective devices used on washing machine immersion heaters at the present time.

The thermal sensor may be in the form of a manually resettable unit. The heater in such a case will include means for enabling the sensor to be manually reset to the closed condition, following the operation thereof, when the temperature of the heating element has fallen below said predetermined temperature.

The means for resetting the sensor is conveniently in the form of a plunger, this preferably being spring biased away from the sensor so that it does not interfere with the opening operation of the

sensor.

Alternatively, the thermal sensor can be single a operation unit or an automatically resettable unit. Preferably the sensor is carried by a probe which is insertable within the housing and carries a resilient seal, for example an O-ring seal, which bears against the inner surface of the housing to form a fluid-tight enclosure for the sensor, the probe having a tubular stem projecting therefrom and being sealed in a fluid-tight manner through the head of the immersion heater for carrying leads from the sensor to the exterior of the vessel.

An embodiment of the invention will now be described by way of example with reference to Figures 1 to 5 of the accompanying schematic drawings, in which

Figure 1 illustrates a plan view of the heater in which the sensor used is of the automatically resettable or single operation type.

Figure 2 represents an enlarged part-sectional view of the heater of Figure 1 viewed in the same direction.

Figure 3 illustrates a plan view of the heater, in which the sensor used is of the manually resettable type.

Figure 4 represents an enlarged part-sectional view of the heater of Figure 3 viewed in the same direction and,

Figure 5 represents a transverse cross section along the line A-A of Figure 4.

Thus referring to the drawings, the immersion heater illustrated in Figures 1 and 2 comprises a sheathed wire electric heating element 1 having two limbs supported by a mounting head 2 from which they extend parallel to each other for approximately half their length, the looped end 3 of the element being bent back towards the mounting head 2 to terminate a short distance from it as shown in Figure 1. To this looped end 3 there is brazed the closed end of a short hollow cylindrical housing 4 of zinc coated stainless steel, the open end of which is directed towards the mounting head.

A hollow tubular probe 5 (Figure 2), carrying a disc type thermal sensor 6 at its end, is fitted into the housing 4 so that the sensor is closely adjacent the inner surface of its closed end, leads 7 to the sensor passing outwards through the hollow stem 15 of the probe, which extends through, and is supported by, the mounting head 2.

An O-ring 18 fits within a groove in the external surface of the probe 5 and bears against the inner surface of the housing 4 when the probe is fitted therein, so as to form a liquid-tight enclosure for the thermal sensor 6 and the connections thereto.

The mounting head 2 itself is of known construction comprising an outer elongate plate 8 of zinc coated mild steel with a peripheral flange 9 within is seated a block 10 of rubber, and an inner elongate plate 11 of zinc coated stainless steel, also having a peripheral flange 12, seated against the opposite side of the block, which is thereby sandwiched between the plates 8, 11.

The inner plate 11 has a stud 13 welded to the centre of its base and extending through openings in both the block 10 and plate 8. The two ends 14 of the heating element 1 extend through openings in the inner plate 11 as well as in the block 10 and the plate 8, as does the stem 15 of the probe. In use the immersion heater is arranged to be fitted into a corresponding opening in the wall of the outer drum of a washing machine, the dimensions of the opening being such that the main part of the block 10 is a close fit within the opening, a flange 16 around the end of the block adjacent the outer plate bearing against the outer surface of the wall around the opening. A nut 17 is then tightened on to the stud so as to compress the rubber block 10 between the two plates 8, 11 and urges its sides into engagement with the edge of the opening to form a water-tight seal, the block also being compressed onto the ends 14 of the heating element and on to the stem 15 of the probe.

The cross-sectional dimensions of the inner plate 11 are such that the plate can pass through the opening in the wall of the washing machine drum, and the external diameter of the thermal sensor housing 4, for example of the order of 18 mm, is such that the housing can also pass through the openings, when fitting the immersion heater to the drum.

The thermal sensor 6 is connected in series with the heating element 1, and incorporates a switch operable to cut off the current to the heater when the heater temperature rises to, say, $110^{\circ}\text{C} \pm 3.5^{\circ}\text{C}$.

The use of a thermal sensor has the advantage of cheapness and reliability, and not only serves to control the water temperature in the washing machine but, in addition, provides an efficient protection in the event of an excessive temperature rise, for example in the event of a 'boil-dry' situation; a separate safety device for such a purpose, which is commonly attached to washing machine drums, can therefore be dispensed with, resulting in an appreciable cost saving. Moreover, owing to its close association with the heater, it functions more quickly and efficiently in response to an excessive temperature rise of the heater, in a 'boil-dry' situation, than the currently used drum-mounted thermally operated devices referred to above.

The heater shown in Figures 3 and 4 is similar to that shown in Figures 1 and 2, with the same

parts denoted by the same reference numerals, but in this case, it incorporates a manually resettable sensor incorporating a switch operable to cut off the current to the heater at a given temperature. When the heater temperature has subsequently fallen below the operating temperature, in order to reset it, the sensor is provided in known manner with a depressable button 19 (Figure 4) projecting from its rear surface. A plunger 21 extends through the hollow probe 5, with its inner end adjacent the button 19, and its outer end projecting from the end of the probe stem 15. In Figure 3, the plunger is fitted with a knob 22 at its outer end and is held out of contact with the sensor button by a spring 23 acting between the knob 22 and the end of the stem 15.

The plunger 21 is shaped as shown in Figure 5 to accommodate the leads 7, and is tapered towards its outer end to prevent complete withdrawal from the probe stem 15. Other means of achieving this can, however, be employed if desired. The ends of the spring 23 may be secured to the probe stem 15 and to the knob 22.

Alternatively, the sensor used may be automatically resettable, incorporating a switch operable to cut off the current to the element when the water temperature rises to 90°C and to close automatically when the temperature falls to, say, 60°C .

It will however be appreciated, that, instead of an automatically or manually resettable sensor, a single operation sensor could be employed to break the circuit through the heating element. A sensor of this type would cut off the current when the heater temperature rises to 120°C and closes when the temperature falls to around -10°C .

Claims

1. An immersion heater of the kind referred to comprising a metal housing (4) brazed to a heating element (1) and of dimensions such that said housing (4) can be inserted through a co-operating opening in the vessel wall so as to lie within said vessel when the immersion heater is fitted thereto and characterised in that a disc type thermal sensor (6), removably sealed within said housing (4) is connected in series with the heating element (1) and is operative to cut off the supply of current thereto on reaching a predetermined temperature.

2. An immersion heater as claimed in Claim 1 wherein said sensor (6) is manually resettable.

3. An immersion heater as claimed in Claim 2 wherein means for resetting said sensor (6) consists of a plunger (21).

4. An immersion heater as claimed in Claim 1 wherein said sensor (6) is automatically resettable.

5. An immersion heater as claimed in Claim 1 wherein said sensor (6) is a single operation sensor.

6. An immersion heater as claimed in any preceding Claim wherein said sensor (6) is carried by a probe (5) inserted within the housing (4), said probe (5) having a tubular stem (15) projecting therefrom and being sealed in a fluid-tight manner, through a mounting head (2) for the immersion heater, for carrying leads (7) from said sensor (6) to the exterior of the vessel.

7. An immersion heater as claimed in Claim 3 wherein said plunger (21) extends through a hollow probe (5) which carries lead (7) from said sensor (6) to the exterior of the vessel, said probe (5) being inserted within the housing (4) and having a tubular stem (15) projecting therefrom.

8. A immersion heater as claimed in Claim 6 or 7 wherein said probe (5) carries a resilient seal (18) which bears against the inner surface of the housing (4) to form a fluid-tight enclosure.

25

30

35

40

45

50

55

4

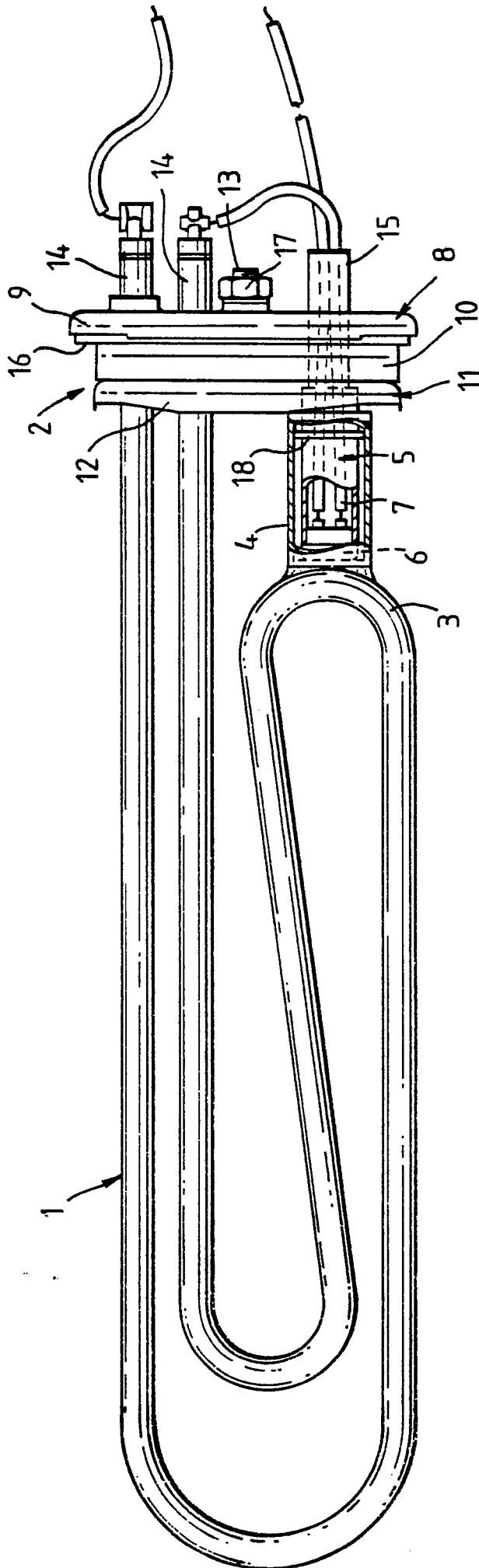


Fig. 1.

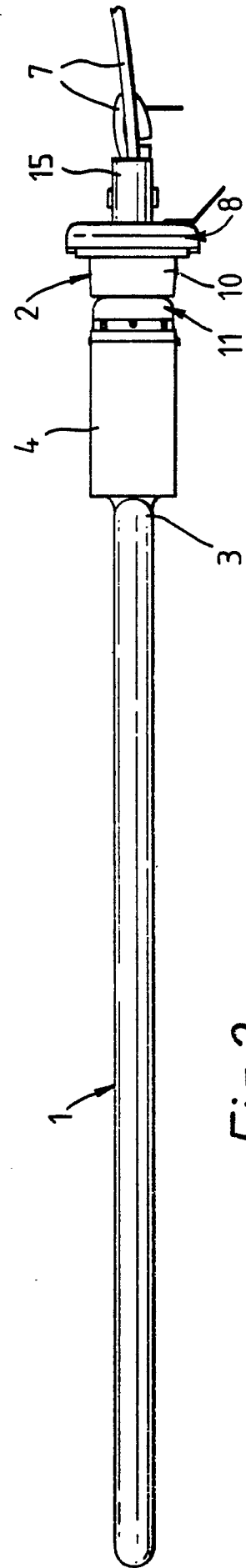


Fig. 2.

Fig.3.

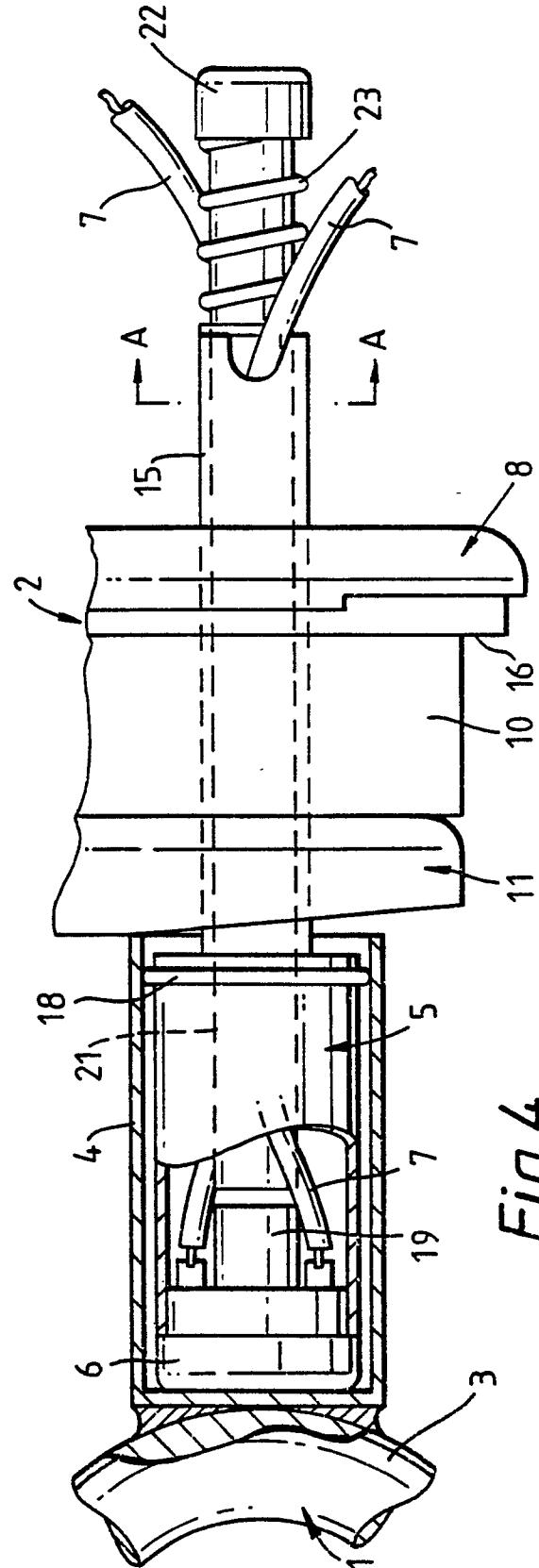
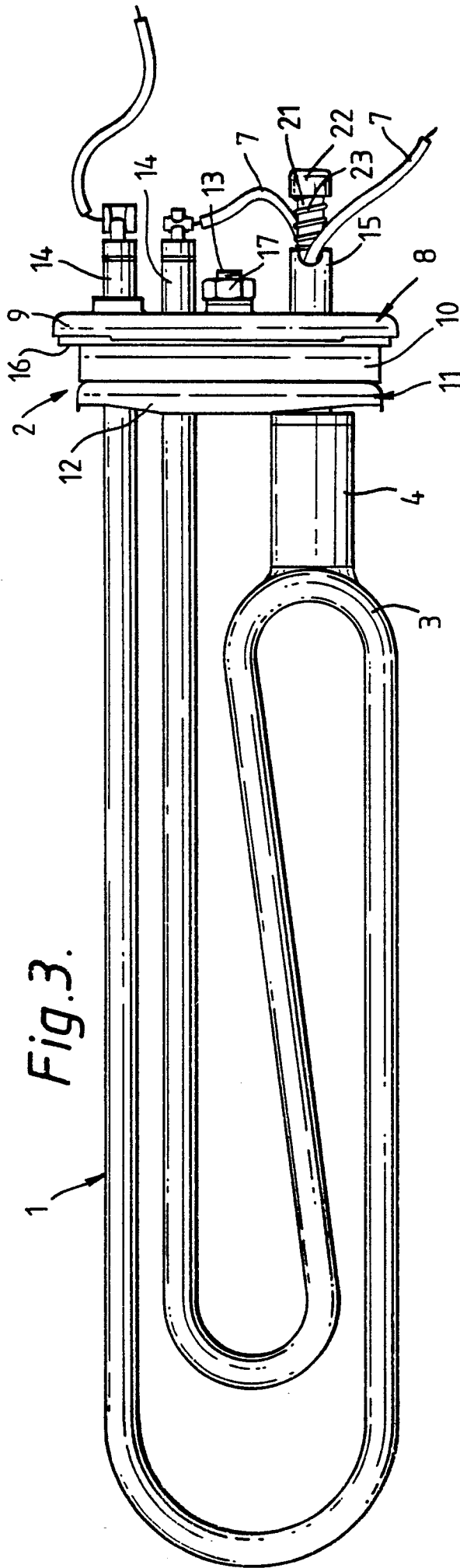


Fig.4.

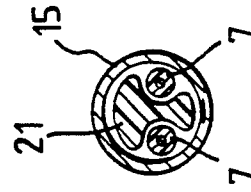


Fig.5.



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. 4)
X	EP-A-0 157 277 (EMIDE-METALLINDUSTRIE) * Page 13, paragraph 2; page 14, line 3 - page 15, line 22; page 23, lines 5-25; figures 1-4, 14 *	1-3, 5-7	H 05 B 3/82
A	GB-A- 924 829 (G.E.C.) * Page 1, line 84 - page 2, line 7; figures 1, 2 *	1, 6	
A	DE-A-2 552 625 (ELPAG)		
A	US-A-2 172 495 (BULPITT)		
A	GB-A-2 142 809 (REDRING ELECTRIC)		
			TECHNICAL FIELDS SEARCHED (Int. Cl. 4)
			H 05 B 3/00
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 24-03-1988	Examiner RAUSCH R.G.
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			