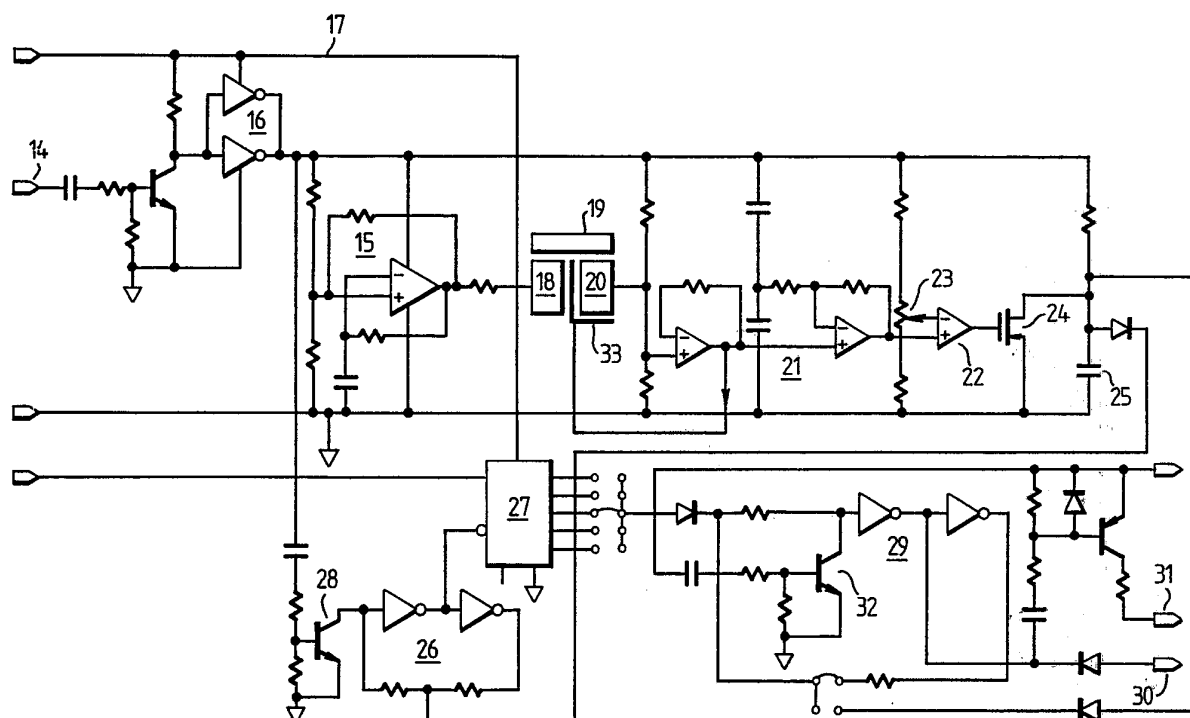




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(21) International Application Number: PCT/GB90/00321 (22) International Filing Date: 1 March 1990 (01.03.90) (30) Priority data: 8904690.8 1 March 1989 (01.03.89) GB (71) Applicant (for all designated States except US): MARCONI ELECTRONIC DEVICES LIMITED [GB/GB]; Dod-dington Road, Lincoln LN6 3LF (GB). (72) Inventors; and (75) Inventors/Applicants (for US only) : HARDEN, Paul [GB/GB]; 80 Ridge Nether Moore, Swindon, Wiltshire SN3 6ND (GB). GREEN, Paul, Michael [GB/GB]; 70 Rod-bourne Road, Swindon, Wiltshire SN2 1DH (GB).		(74) Agent: HOSTE, Colin, Francis; The General Electric Company, plc, GEC Patent Dept. (Wembley Office), Hirst Research Centre, East Lane, Wembley, Middlesex HA9 7PP (GB). (81) Designated States: AT (European patent), AU, BE (Euro-pean patent), CH (European patent), DE (European pa-tent), DK (European patent), ES (European patent), FI, FR (European patent), GB (European patent), IT (Euro-pean patent), LU (European patent), NL (European pa-tent), SE (European patent), US. Published <i>With international search report.</i> <i>Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.</i>

(54) Title: ELECTRONIC MONITORING ARRANGEMENT**(57) Abstract**

In an electronic monitoring arrangement for, say, a home curfew system, unauthorised removal of a subject's ankle transmitter unit is arranged to give an indication to a central control unit in response to a change in capacitive coupling between electrodes normally positioned in close proximity to the subject's ankle.

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Electronic Monitoring Arrangement

The present invention relates to the electronic monitoring of the location of movable objects, and in particular although not exclusively to the monitoring of the location of tagging units which can be attached to persons. Each tagging unit may be arranged to communicate with a nearby terminal, either at regular intervals or in response to request signals from that terminal, to confirm that it is still within a predetermined locality.

It may be the intention that a tagging unit in use remains attached for a given period to the person to whom it is assigned, in which case it is desirable that an indication be given if the unit is detached from the person during that period.

According to the present invention a personal portable signalling unit for an electronic monitoring arrangement, the unit being arranged to be secured closely adjacent a carrier's body, includes an electric oscillator circuit, coupling means capacitively to couple an output of said oscillator circuit to an oscillatory signal detector circuit, and means to give an indication if the level of said oscillatory signal reaching said detector circuit from said oscillator circuit by way of said coupling means changes from a predetermined level or range of levels.

Electronic monitoring arrangements in accordance with the present invention will now be described by way of example with reference to the accompanying drawings, of which:-

Figure 1 shows diagrammatically part of the electric circuit of a portable signalling unit of one embodiment;

Figures 2 and 3 show diagrammatically two different dispositions of component parts of a portable signalling unit of the embodiment shown in Figure 1;

Figure 4 shows diagrammatically part of the electric circuit of a portable unit of a second embodiment, and

Figure 5 shows diagrammatically a wrist strap arrangement for this embodiment.

Referring to the drawings an electronic monitoring arrangement in accordance with the invention comprises one or more portable signalling units 1, shown diagrammatically in Figures 2 and 3, which take the form of packages or "tags" which may be strapped to the ankle of a person so as to enable the location of that person to be monitored. Typically a person may be required to remain within a designated locality during certain periods, and compliance may be verified by arranging for the tag to transmit short-range radio signals or the like to a nearby terminal unit, (not shown) which in turn may forward the signals by way of a telephone line to a central monitoring unit (not shown). The transmissions may either take place periodically, say every two minutes, or may be effectively continuously. If the person leaves the designated locality the strength of the signal received at the terminal unit falls below a threshold value and so effectively ceases. This triggers an alarm at the central monitoring unit so that appropriate action can be taken.

In order to guard against unauthorised removal of the tag from the person's ankle the electric circuit shown in Figure 1 is provided. The circuit comprises an oscillator 2 which is arranged to generate an oscillatory signal of a frequency in the range, say, 50 to 100KHz which is applied to one electrode of a capacitor 3, in

the form of a pair of thin copper plates (not shown) formed on a flexible substrate 4, Figures 2 and 3.

Oscillatory signals passed by the capacitor 3 are applied by way of an amplifier 5 to a detector 6, and the output of this detector is arranged to trigger a latch circuit 7 to provide tamper signal and power latching signals by way of respective interface stages 8 and 9.

When the tag is in normal use the plates or electrodes of the capacitor 3 are held close to the wearer's ankle, in which position the oscillatory signal generated by the oscillator 2 is largely diverted to earth through the wearer's body and very little is coupled to the amplifier 5. A unidirectional voltage level is provided for the input to the amplifier 5 from a circuit 10.

If the tag is removed from the ankle the level of oscillatory signal coupled through the capacitor 3 rises, so that a positive-going output signal from the detector 6 triggers the latch circuit 7, which then remains operated until power is removed entirely from the circuit.

An indication that the tag has been removed is passed by the interface 8 to the transmitter circuit of the tag, shown as integer 11 in Figures 2 and 3. At the same time the power supply to the anti-tamper circuit represented in Figure 1 is latched from its normally intermittent mode of application so as to be permanently applied, so that the indication of removal is given continuously.

When it is required the power latch is de-activated by means of a magnetic clip which is placed around the casing of the tag and which operates a reed switch to turn off the power supply. Correct orientation of this clip may be ensured by means of an indent in the casing which is arranged to match a protrusion on the clip.

As shown in Figures 2 and 3 the extra circuitry of Figure 1, represented as the integer 12, maybe placed either alongside the transmitter circuit 11 or between the transmitter circuit 11 and the

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battery unit 13 of the tag. Alternatively the extra circuitry may be made integral with the transmitter circuit 11.

Referring now to Figure 4, in a second embodiment an energising voltage signal is applied to a terminal 14 for, say, one sixth of a millisecond every forty milliseconds to energise an oscillator 15, operating at a frequency of, say, 30 KHz by way of buffers 16 from a positive supply line 17. An output signal comprising each time some five cycles at 30KHz from the oscillator 15 is applied to a transmitter electrode 18 which is capacitively coupled by way of an electrode 19, extending through the wrist strap to a receiver electrode 20.

The signal from the receiver electrode 20 is passed by way of an amplifier 21 to a threshold detector 22 where, in normal operation, the five cycles of 30KHz signal exceed the threshold set at a variable voltage tap 23 so that a series of five positive pulses are produced at the drain of a field effect transistor 24 effectively to hold a capacitor 25 discharged during each series of pulses.

If the wrist strap has been cut or tampered with such that the 30KHz signal at the receiver electrode 20 is missing or reduced in amplitude below the required threshold value at the detector 22, the capacitor 25 charges to a positive voltage and a latch circuit 26 operates to supply a pulse to a counter 27. The latch circuit 26 is reset each time the energising voltage is applied to the oscillator 15, by way of a transistor stage 28, so that each time the received burst of 30KHz signal fails to exceed the threshold value at the detector 22 the latch circuit 26 applies a pulse to the counter 27.

The counter 27 is arranged to be reset, say, every two and a half minutes, but within that period the counter 27 reaches a count of, say, 128 a further latch circuit 29 is set, to provide a tamper indication at an output terminal 30 and a signal at a terminal 31 to cause the monitor transmit (not shown) to operate repeatedly for a predetermined period.

The latch circuit 29 prevents the tamper indication from being removed for example by replacing the wrist strap with some other conductor, and the circuit 29 can only be reset by a signal applied to a transistor 32.

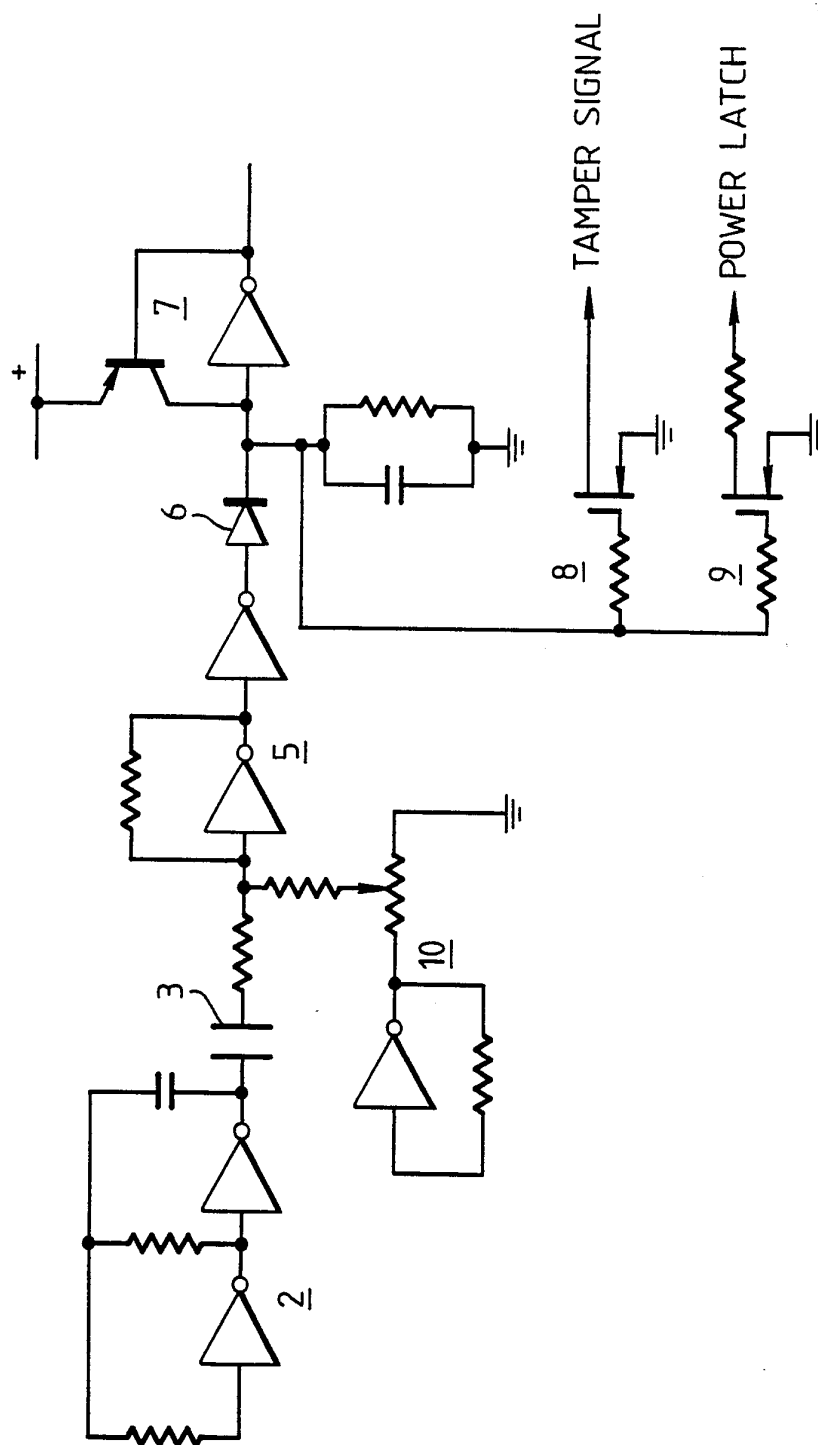
A guard plate 33 is positioned between the receiver electrode 20 and the battery unit 13 of the portable unit, and is fed with 30kHz signal from a point in the amplifier 21, such as to prevent required signals at the receiver electrode 20 from being shunted to the battery unit 13.

Referring now to Figure 5 the transmitter and receiver electrodes 18 and 20 extend up the sides of the body of the portable unit, and the ends of the electrode 19 of the wrist strap are held closely adjacent these electrodes. The guard plate 33 lies between the receiver electrode 20 and the battery unit 13.

CLAIMS

1. A personal portable signalling unit for an electronic monitoring arrangement, the unit being arranged to be secured closely adjacent a carrier's body, including an electric oscillator circuit, coupling means capacitively to couple an output of said oscillator circuit to an oscillatory signal detector circuit, and means to give an indication if the level of said oscillatory signal reaching said detector circuit from said oscillator circuit by way of said coupling means changes from a predetermined level or range of levels.
2. A personal portable signalling unit in accordance with Claim 1 wherein said coupling means comprises a conductor extending through a strap for securing the unit to the carrier's body, the conductor being arranged to be capacitively coupled at one end to an output of said oscillator circuit and at the other end to said oscillatory signal detector circuit.
3. A personal portable signalling unit in accordance with Claim 2 wherein the ends of said strap extend for said capacitive coupling away from the carrier's body up respective sides of said portable unit.

1/3



2/3

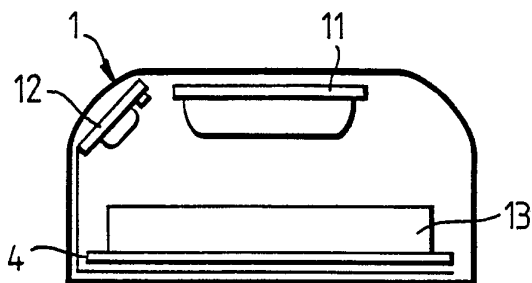


Fig. 2.

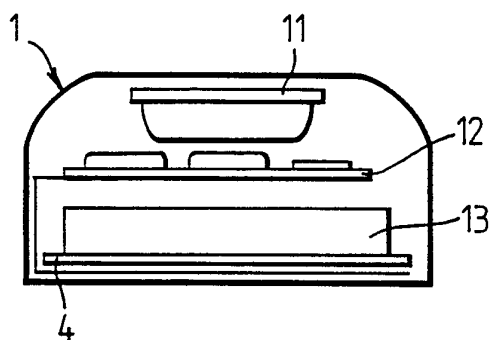


Fig. 3.

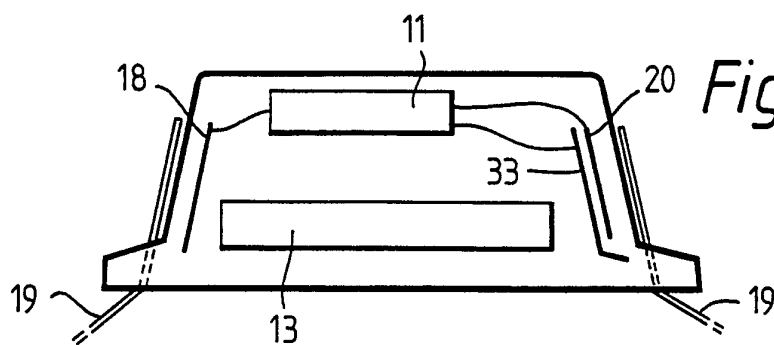
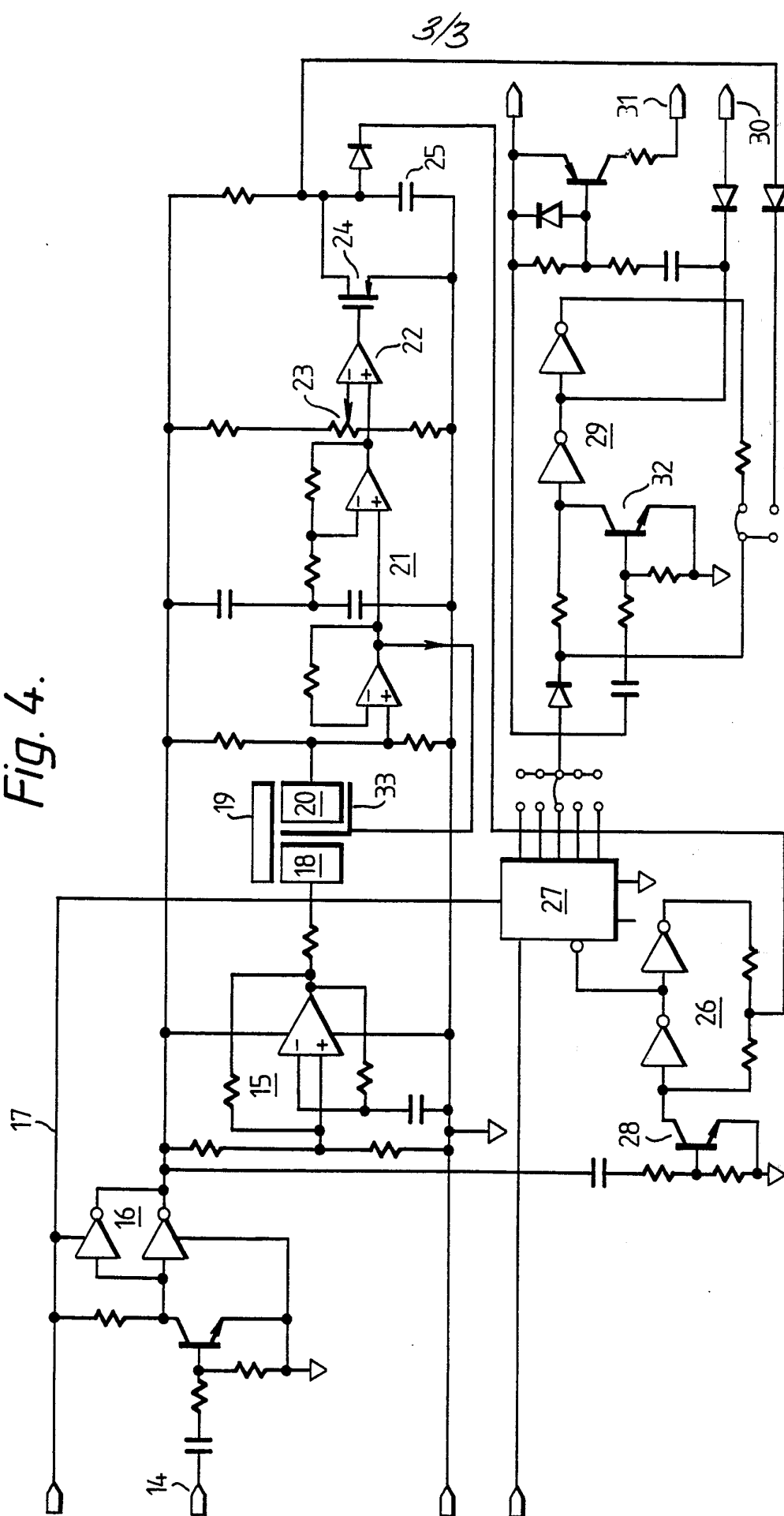


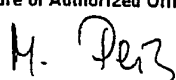
Fig. 5.

Fig. 4.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 90/00321

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) ⁶		
According to International Patent Classification (IPC) or to both National Classification and IPC		
IPC5: G 08 B 13/22, 25/00		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
IPC5	G 08 B	
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III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	US, A, 4785291 (C.C. HAWTHORNE) 15 November 1988, see the whole document --	1-2
X	US, A, 4777477 (R.R. WATSON) 11 October 1988, see the whole document --	1-2
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IV. CERTIFICATION		
Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report	
11th June 1990	27. 06. 90	
International Searching Authority	Signature of Authorized Officer	
EUROPEAN PATENT OFFICE	 <div style="border: 1px solid black; padding: 2px; display: inline-block;">M. PEIS</div>	

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.PCT/GB 90/00321**

SA 35077

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the European Patent Office EDP file on 07/05/90
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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US-A- 4785291	15/11/88	NONE	
US-A- 4777477	11/10/88	NONE	
US-A- 4736196	05/04/88	NONE	
US-A- 4598275	01/07/86	CA-A- 1247706 EP-A- 0125143	27/12/88 14/11/84

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