

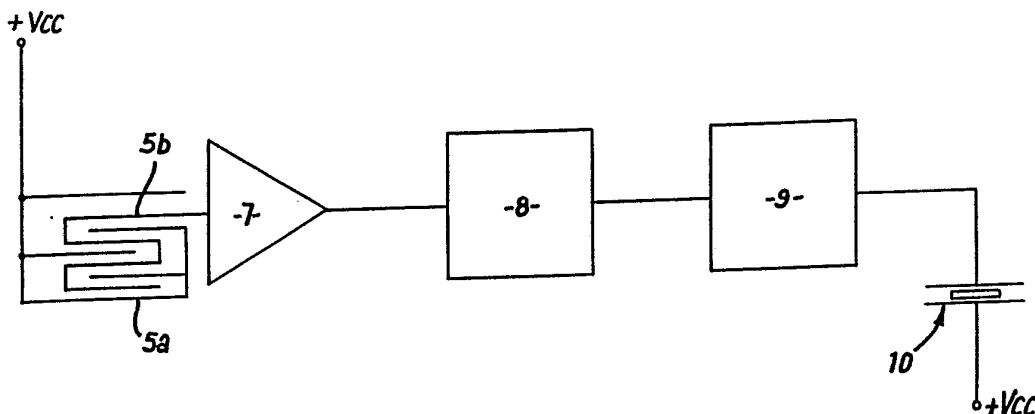


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<p>(21) International Application Number: PCT/GB91/00749 (22) International Filing Date: 10 May 1991 (10.05.91) (30) Priority data: 9010606.3 11 May 1990 (11.05.90) GB (71)(72) Applicants and Inventors: LUNDY, William [GB/GB]; LUNDY, Irene, Marcia, Brownlie, Walker [GB/GB]; 3 Lawson Drive, Ardrossan KA22 7JG (GB). BLAIR, Alexander [GB/GB]; 213 Glasgow Street, Ardrossan KA2 8JT (GB). (74) Agent: PACITTI, Pierpaolo, A., M., E.; Murgitroyd and Company, Mitchell House, 333 Bath Street, Glasgow G2 4ER (GB).</p>	<p>(81) Designated States: AT (European patent), AU, BE (European patent), CA, CH (European patent), DE (European patent), DK (European patent), ES (European patent), FR (European patent), GB (European patent), GR (European patent), IT (European patent), JP, LU (European patent), NL (European patent), SE (European patent), US. Published <i>With international search report.</i></p>
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(54) Title: MOISTURE DETECTION GARMENT



(57) Abstract

A moisture detection garment for use in toilet-training babies, or for use with incontinent, comprises a moisture detection sensor in circuit with an audible or visual alarm which sounds when the sensor detects that the garment is wet.

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1 "Moisture Detection Garment"

2

3 This invention relates to a moisture detection garment,
4 particularly for use in the detection of the emission
5 of urine or wet faeces.

6

7 An indication of a person passing urine or wet faeces
8 can be extremely useful in toilet training young
9 children or retraining adults who have suffered from an
10 accident resulting in incontinence. Such an indication
11 is also of value to a person who is physically disabled
12 and has no control of bowel or bladder movement. Such
13 an indication would allow that person or the nursing
14 staff caring for him to change dressings which would
15 then result in less likelihood of sores developing.

16

17 The introduction of a garment which is easily applied
18 and which provides either a visual or audio signal to
19 indicate the passing of urine or wet faeces would
20 represent a considerable improvement.

21

22 According to the present invention there is provided a
23 moisture detection garment comprising a garment, at
24 least part of which is formed into pants, and a
25 detector; the detector comprising a moisture detector

1 sensor in circuit with an alarm.

2

3 Preferably, the detector further includes an integrated
4 circuit timer adapted to be triggered by said sensor
5 and to activate said alarm.

6

7 Preferably, said alarm operates for a first
8 predetermined period after being activated by said
9 timer. Preferably, said alarm can only be reactivated
10 after said timer has entered a stand-by mode at the end
11 of a second predetermined period following the
12 triggering of the timer. Preferably also, said second
13 predetermined period commences only after said sensor
14 ceases to detect an alarm condition.

15

16 Preferably, power is constantly applied to the circuit,
17 and may be provided by a battery.

18

19 Preferably, the sensor comprises a dual interleaved
20 sensor. Most preferably, the integrated circuit timer
21 is triggered by conductivity of the sensor rising above
22 a pre-determined level.

23

24 Preferably, no external controls are provided for the
25 user. The moisture detection garment may be laundered
26 and re-used without losing its moisture detection
27 properties.

28

29 Further according to the present invention there is
30 provided a moisture detection garment comprising a
31 garment, at least part of which is formed into pants,
32 and a detector; the detector comprising a moisture
33 detector sensor in circuit with an alarm and
34 manually operable switching means.

35

1 Preferably, the switching means are covered by a
2 membrane and include a light emitting diode (LED) which
3 indicates when the detector is activated.

4

5 Preferably, the sensor is in the form of two separate
6 metallic members provided as copper strips.

7

8 Preferably, the copper strips are not coated with a
9 protective coating or lacquer.

10

11 Preferably, two end tabs protrude from the detector,
12 each carrying one connection to one of the two copper
13 strips to enable connection to the detector's internal
14 printed circuit board (PCB). The end tabs may be
15 between 13mm and 3mm in length and tin coated to allow
16 either solder or pressure connection. Separation
17 between the strips may be in the range of 1.5mm to
18 0.75mm.

19

20 Preferably, the circuit and the copper strips are
21 located on a flexible PCB made of, for example, a
22 polyester of approximately 25mm square.

23

24 Most preferably, the detector is located in the crotch
25 of the pants, and the circuit may be an integral part
26 of the garment. The circuit may be removable.

27

28 The detector may be approximately 24mm long x 24mm wide
29 x 12mm deep, excluding the sensor.

30

31 An embodiment of the present invention will now be
32 described, by way of example, with reference to the
33 accompanying drawings in which:-

34

35 Fig. 1 is a schematic view of a moisture detection

1 garment in accordance with a first embodiment of
2 the present invention;
3 Fig. 2 is a schematic diagram of a detector
4 circuit of the embodiment of Fig. 1;
5 Fig. 3 is a circuit diagram of the sensing and
6 alarm circuitry of Fig. 2; and
7 Fig. 4 is a circuit diagram of the sensing and
8 alarm circuitry of a preferred embodiment of the
9 invention.

10

11 Fig. 1 shows a moisture detection garment in the form
12 of a pair of pants 1; the pants 1 having a moisture
13 detector 2, and a switching means 3. The activation of
14 the switching means 3 activates the detector 2. The
15 garment 1 further includes an audio alarm which is
16 activated when moisture is detected.

17

18 The switching means 3 also includes a light emitting
19 diode 4 which indicates when the detector 2 is
20 activated.

21

22 The sensor is in the form of two separate copper strips
23 5a and 5b which are separated by a gap of 1.5mm to
24 0.75mm.

25

26 The copper strips 5a and 5b are positioned on a
27 flexible polyester PCB 6. The detector 2 includes two
28 end tabs of between 13mm and 3mm in length which
29 protrudes from the detector 2 enabling connection of
30 the detector 2 to the copper strips 5a and 5b either by
31 solder or pressure connection.

32

33 The copper strips 5a and 5b are not coated with any
34 protective coating or lacquer, as this would hinder
35 their ability to detect moisture.

1 The detector 2 containing the sensor element 5a and 5b
2 and the electronics is approximately 65 millimetres by
3 50 millimetres by 13.5 millimetres in dimension with a
4 1.5 millimetre wall. Also the detector 2 has a front
5 panel consisting of a membrane covered switching means
6 3. The rear of the detector is fitted with an
7 adhesive-backed flexible PCB 6 for moisture detection
8 which feeds the connectors through a fine slot on the
9 back of the case which is sealed with an epoxy resin,
10 the detector 2 being fixed to the garment 1 with a
11 strong adhesive.

12
13 The detector 2 will withstand vigorous hand or machine
14 washing due to its construction and is not required to
15 be removed for this function.

16
17 When in use, the garment is worn by a person and the
18 press stud 4 is closed to activate the sensor 2. When
19 moisture is detected an audio alarm may be activated.

20
21 Fig. 2 shows a schematic diagram of the detector and
22 alarm circuit. When the circuit 8 is completed by
23 moisture at the wires 5a and 5b a signal is produced
24 which is amplified in the amplifier 7. The signal is
25 passed through a timer circuit and oscillator circuit 9
26 to the piezo-electric element 10 of a loudspeaker which
27 produces a signal.

28
29 Fig. 3 shows a more detailed embodiment of the circuit
30 of Fig. 2.

31
32 Fig. 4 is a circuit diagram of the sensing and alarm
33 circuitry of a particularly preferred embodiment of the
34 invention.

35

1 Power is applied to the circuit constantly (i.e. it has
2 no on/off switch as in the first embodiment), the
3 quiescent power requirement of the circuit being very
4 small, such that a battery life of several months may
5 be expected.

6

7 The circuit of Fig. 4 comprises a dual interleaved
8 sensor 12 similar to that of the previous embodiment
9 connected to an integrated circuit timer 14 (suitably
10 ICM 7555 CMOS timer), which controls the operation of a
11 mask-programmable melody generator 16, which in turn
12 drives a piezo-electric sounder 18. The circuit is
13 powered by a battery (not shown, suitably a lithium
14 CR2340 button cell).

15

16 The timer 12 is triggered and activates the melody
17 generator 16 whenever the conductivity of the sensor
18 rises above a threshold determined by resistors R1 and
19 R2 (suitably 1 and 10Mohm respectively). The melody
20 generator 16 operates for a period determined by its
21 programming and then stops and returns to its quiescent
22 mode. Once the conductivity of the sensor 12 falls
23 back below the threshold level, the timer 14 enters a
24 stand-by mode for a period determined by capacitor C1
25 (suitably 33uF), during which it cannot re-trigger the
26 melody generator 16. Once the alarm has been
27 triggered, it cannot be re-triggered until the
28 conductivity of the sensor 12 drops and the stand-by
29 period has elapsed. Accordingly, the battery will not
30 be drained by the alarm sounding periodically if the
31 garment remains wet for an extended period (e.g. while
32 being laundered).

33

34 No controls are provided for the user as none are
35 necessary. The alarm and stand-by periods are

1 predetermined, and the device does not have to be
2 switched on and off. The battery may be replaceable,
3 or rechargeable or the device can simply be discarded
4 once its battery dies.

5

6 DIMENSIONS. Dimensions may vary to suit application
7 specifications, but in general would approximate the
8 dimensions below:

9

10 Length - 24mm \pm 0.5mm

11 Breadth - 24mm \pm 0.5mm

12 Height - 12mm \pm 1.0mm

13

14 All dimensions are dependent on components used, the
15 main components effecting the dimensions being :

16

17 a) Battery

18 b) Piezo Sounder.

19

20 The sensor has not been included in these dimensions as
21 it is assumed that the sensor will take the form of a
22 strip or pad manufactured in a flexible material
23 approximately 1mm thick to the end users requirements.

24

25 The detector is slipped between the gusset bi-layer in
26 underwear and sewn in during manufacture of the
27 garment. The sensor is provided on the surface of the
28 garment to directly contact the body.

29

30 Alternatively, the sensor may be manufactured to form
31 part of the gusset, or lie just below the upper layer
32 of the gusset. Thus the shape and positioning of the
33 sensor part of the detector is variable to suit
34 requirements.

35

1 The preferred embodiment of the invention thus provides
2 a re-usable garment incorporating a moisture detector
3 which can be laundered along with the garment and the
4 battery selected to give a few months life or long-term
5 wear over a year or more.

6

7 Modifications and improvements may be incorporated
8 without departing from the scope of the invention.

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1 CLAIMS:

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3 1. A moisture detection garment comprising a garment,
4 at least part of which is formed into pants, and a
5 detector; the detector comprising a moisture detector
6 sensor in circuit with an alarm.

7

8 2. A moisture detection garment as claimed in Claim
9 1, wherein the detector further includes an integrated
10 circuit timer adapted to be triggered by said sensor
11 and to activate said alarm.

12

13 3. A moisture detection garment as claimed in Claim
14 2, wherein said alarm operates for a first
15 predetermined period after being activated by said
16 timer.

17

18 4. A moisture detection garment as claimed in Claim
19 3, wherein said alarm can only be reactivated after
20 said timer has entered a stand-by mode at the end of a
21 second predetermined period following the triggering of
22 the timer.

23

24 5. A moisture detection garment as claimed in Claim
25 4, wherein said second predetermined period commences
26 only after said sensor ceases to detect an alarm
27 condition.

28

29 6. A moisture detection garment as claimed in any one
30 of the preceding claims, wherein power is constantly
31 applied to the circuit.

32

33 7. A moisture detection garment as claimed in Claim
34 6, wherein the power is provided by a battery.

35

1 8. A moisture detection garment as claimed in any one
2 of the preceding claims, wherein the sensor comprises a
3 dual interleaved sensor.

4

5 9. A moisture detection garment as claimed in Claim
6 2, wherein the integrated circuit timer is triggered by
7 conductivity of the sensor rising above a
8 pre-determined level.

9

10 10. A moisture detection garment as claimed in any one
11 of Claims 2 to 9, wherein no external controls are
12 provided for the user.

13

14 11. A moisture detection garment as claimed in Claim
15 1, in which manually operable switching means are
16 provided.

17

18 12. A moisture detection garment as claimed in Claim
19 11, wherein the switching means are covered by a
20 membrane.

21

22 13. A moisture detection garment as claimed in Claim
23 11 or Claim 12, wherein the switching means include a
24 light emitting diode (LED) which indicates when the
25 detector is activated.

26

27 14. A moisture detection garment as claimed in any one
28 of the preceding claims, wherein the sensor is in the
29 form of two separate metallic members.

30

31 15. A moisture detection garment as claimed in Claim
32 14, wherein the metallic members are copper strips.

33

34 16. A moisture detection garment as claimed in Claim
35 15, wherein the copper strips are not coated with a

1 protective coating or lacquer.

2

3 17. A moisture detection garment as claimed in Claim
4 16, wherein two end tabs protrude from the detector,
5 each carrying one connection to one of the two copper
6 strips to enable connection to the detector's internal
7 printed circuit board (PCB).

8

9 18. A moisture detection garment as claimed in Claim
10 17, wherein the end tabs are between 13mm and 3mm in
11 length and are tin coated to allow either solder or
12 pressure connection.

13

14 19. A moisture detection garment as claimed in Claim
15 15, wherein separation between the strips is in the
16 range of 1.5mm to 0.75mm.

17

18 20. A moisture detection garment as claimed in Claim
19 17, wherein the circuit and the copper strips are
20 located on a flexible PCB.

21

22 21. A moisture detection garment as claimed in Claim
23 20, wherein a polyester PCB of approximately 25mm
24 square is used.

25

26 22. A moisture detection garment as claimed in any one
27 of the preceding claims, wherein the detector is
28 located in the crotch of the pants.

29

30 23. A moisture detection garment as claimed in any one
31 of the preceding claims, wherein the circuit is an
32 integral part of the garment.

33

34 24. A moisture detection garment as claimed in any one
35 of the preceding claims, wherein the circuit is

1 removable.

2

3 25. A moisture detection garment as claimed in any one
4 of the preceding claims, wherein the detector is
5 approximately 24mm long x 24mm wide x 12mm deep,
6 excluding the sensor.

7

8 26. A moisture detection garments as claimed in any
9 one of the preceding claims, wherein the moisture
10 detection garment can be laundered and re-used without
11 losing its moisture detection properties.

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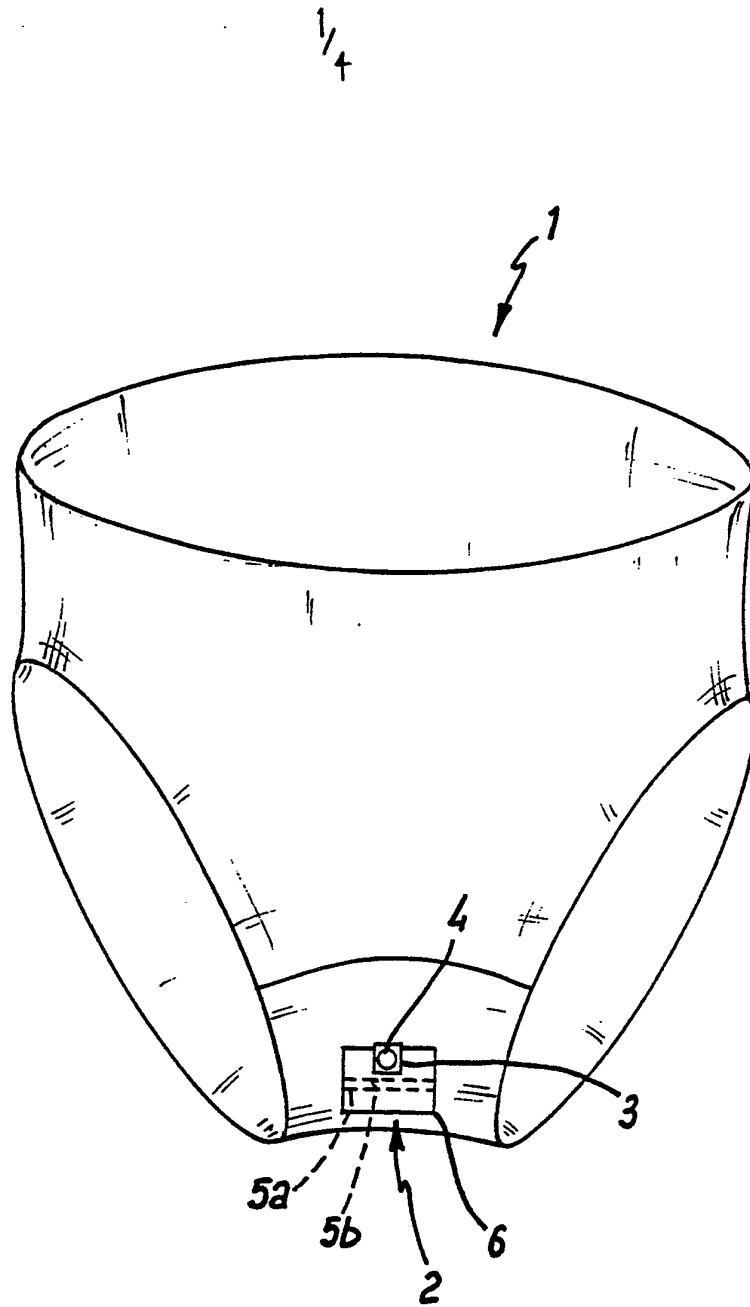


FIG. 1

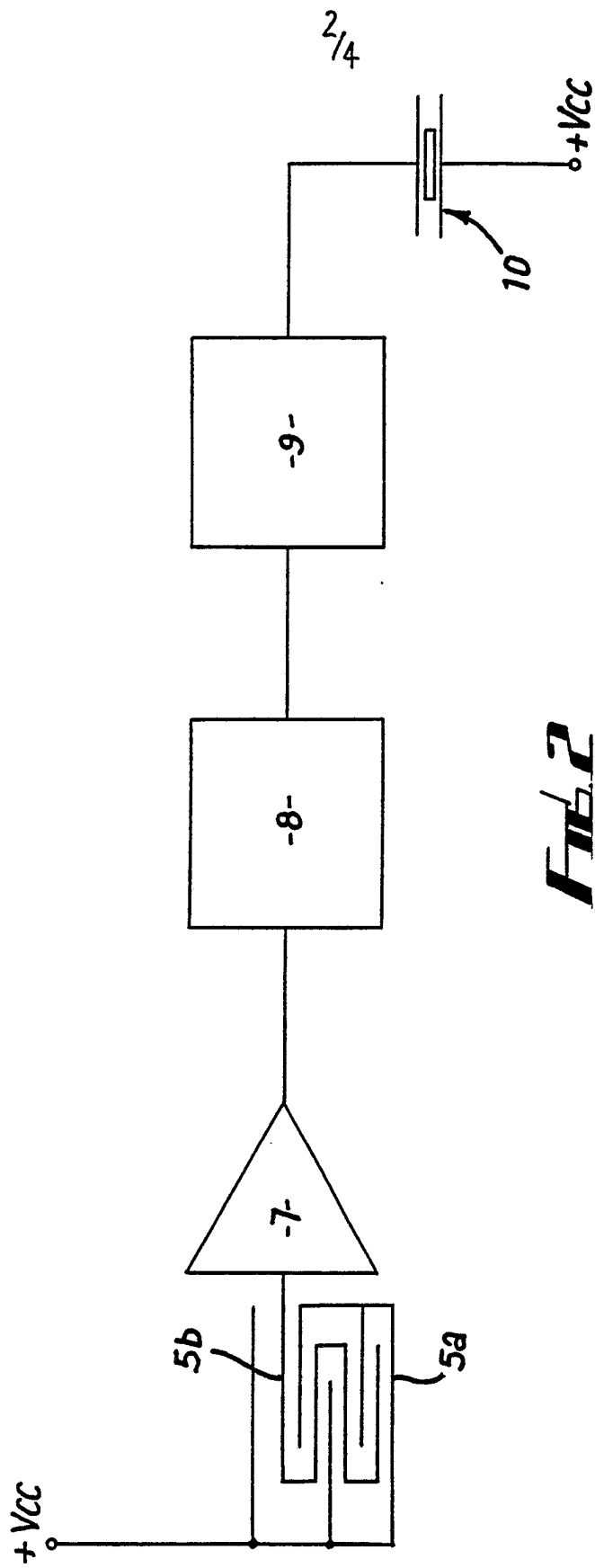
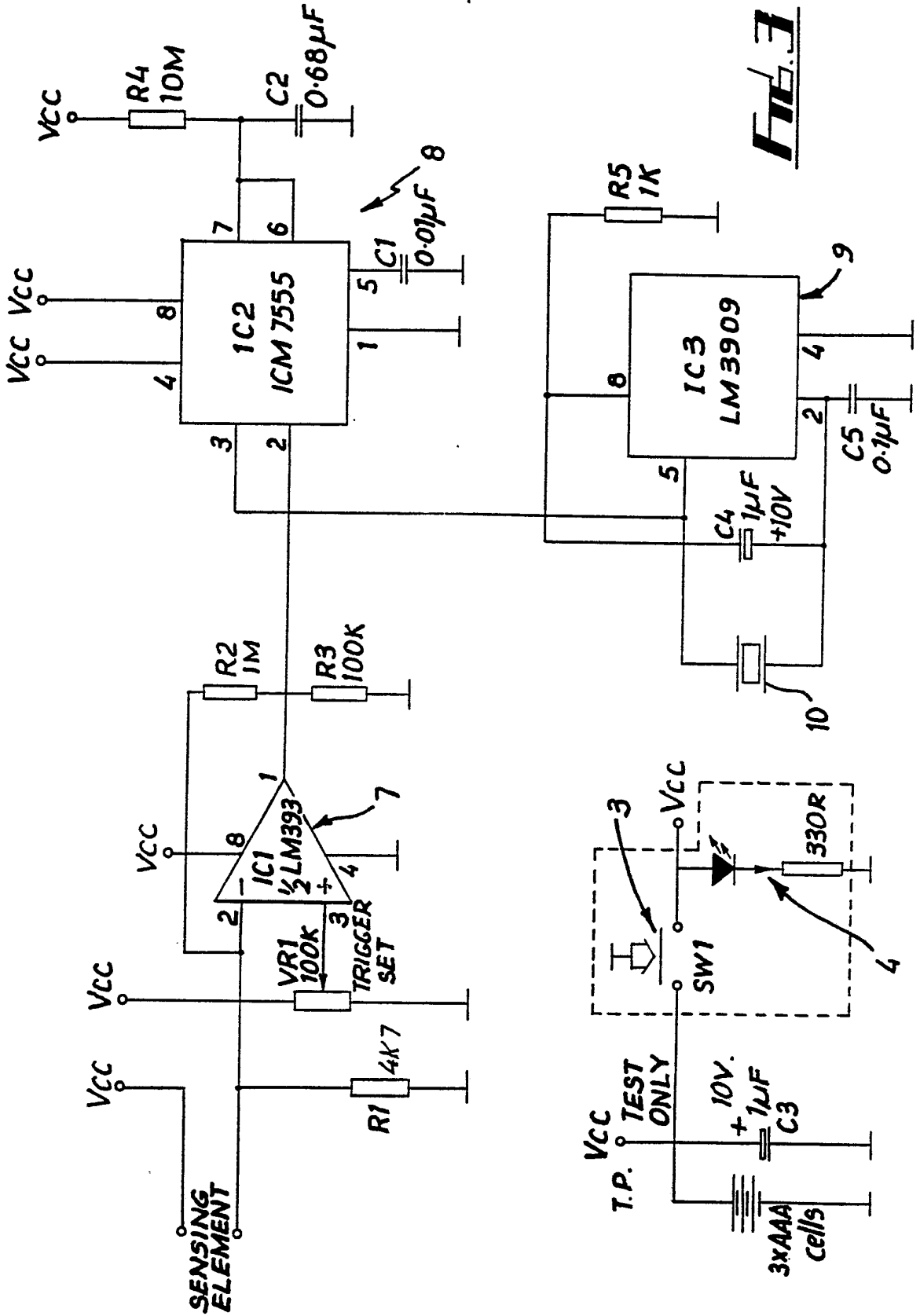


FIG. 2



SUBSTITUTE SHEET

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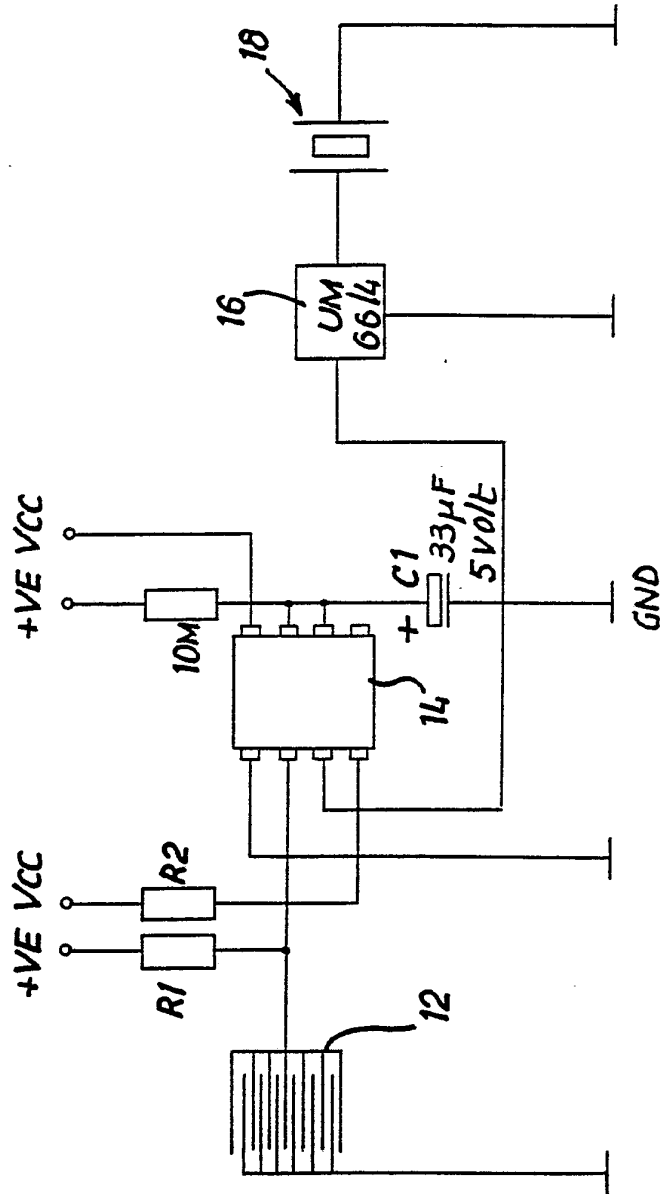
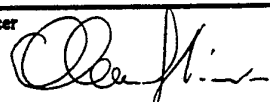


FIG. 4

INTERNATIONAL SEARCH REPORT

PCT/GB 91/00749

International Application No

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 Int.Cl. 5 A61F5/48		
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁷		
Classification System	Classification Symbols	
Int.Cl. 5	A61F	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁸		
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹		
Category ¹⁰	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	EP,A,0 270 048 (H. STEGAT) June 8, 1988 see the whole document ---	1,7,8,9, 10,11, 12,14,17
X	US,A,4 796 014 (J. T. CHIA) January 3, 1989 see figures 1-5 ---	1-3, 7-11,13, 22,24
X	US,A,4 640 276 (TSENG JING-SHENG) February 3, 1987 see the whole document ---	1,6-10, 25
X	EP,A,0 095 180 (NAE WAE ELECTRIC CO.) November 30, 1983 see the whole document ---	1,2, 6-10,14
	-/--	
<p>¹⁰ Special categories of cited documents:</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"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)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> <p>"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</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"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.</p> <p>"A" document member of the same patent family</p>		
IV. CERTIFICATION		
Date of the Actual Completion of the International Search 22 AUGUST 1991	Date of Mailing of this International Search Report 11.09.91	
International Searching Authority EUROPEAN PATENT OFFICE	Signature of Authorized Officer ARGENTINI A. 	

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)		
Category °	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No.
X	US,A,2 874 695 (C.V. VANIMAN) February 24, 1959 see column 3, line 22 - line 30 see column 5, line 26 - line 63; figures ---	1,9,10, 14-19, 23,24,26
A	US,A,4 069 817 (FENOLE ET AL.) January 24, 1978 see column 3, line 25 - line 37; figures 3,5 ---	1-26

**ANNEX TO THE INTERNATIONAL SEARCH REPORT
ON INTERNATIONAL PATENT APPLICATION NO.**

GB 9100749
SA 47462

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 The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

22/08/91

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EP-A-0270048	08-06-88	DE-A- 3640900	09-06-88
US-A-4796014	03-01-89	None	
US-A-4640276	03-02-87	None	
EP-A-0095180	30-11-83	US-A- 4484573	27-11-84
US-A-2874695		None	
US-A-4069817	24-01-78	None	