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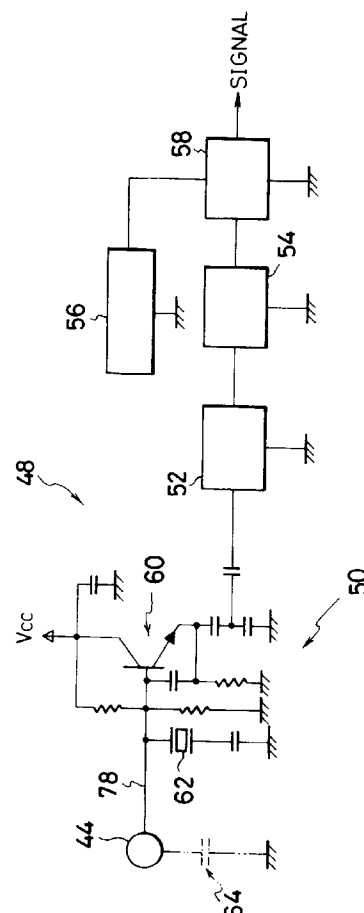
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(54) **Apparatus for detecting a person seated on a toilet seat.**

(57) The invention provides an apparatus for detecting a person on a toilet seat. A crystal oscillator 62 is connected to the base of a transistor 60 of a high frequency oscillating circuit 50. An electrode 44 is provided on the toilet seat, so that when someone sits on the seat, a capacitance 64 is created by the person, parallel to the crystal oscillator 62. The output signal of oscillating circuit 50 passes through a band pass filter 52, is averaged by an averaging circuit 54, and is compared with a reference voltage from a circuit 56 by a comparison circuit 58. When no-one is sitting on the toilet seat, the signal level of oscillation circuit 50 is high, but when a person sits on the toilet seat 40, the capacitor 64 causes the oscillator signal level to become low, and the comparison voltage inputted into comparison circuit 58 becomes lower than the reference voltage. Thus, the comparator 58 output indicates when a person is sitting on the toilet seat. As long as the area of contact between the person and the toilet seat is larger than a certain predetermined size, detection is accomplished, irrespectively of whether or not the person is seated in a correct posture.

FIG.3



This invention relates to an apparatus for detecting a person seated on a toilet seat.

A conventional apparatus of this kind for detecting a person seated on a toilet seat will be described with reference to Figs. 4 and 5.

Two heaters 12 and 14 are disposed in the left half and the right half respectively of a toilet seat 10. These heaters 12 and 14 are connected to each other in series through an inductor 16, and are supplied with electricity from a commercial mains electricity supply 18. Reference numeral 20 denotes a switch for operating the heaters. A high frequency signal voltage from a high frequency oscillator circuit 22 is applied across the series line-up of the heaters 12 and 14. The above-mentioned inductor 16 has almost no resistance with respect to the 50Hz-60Hz frequency commercial mains electricity, but with respect to the high frequency signal the inductor 16 has a very high resistance and performs as an insulator in practice. Therefore, when there is not a person on the toilet seat 10, the signal from the high frequency oscillator circuit 22 is not inputted into the detection circuit 24.

When a person sits on the toilet seat 10, a capacitor 26 is created parallel to the inductor 16 by the person's body, as shown by dashed lines in Fig. 5, and the high frequency signal is conducted through the heaters 12 and 14. As a result, the high frequency signal is inputted into the detection circuit 24, and the person on the toilet seat is detected. Reference numeral 28 denotes a band pass filter which only passes high frequencies and which blocks off the low frequency 50Hz-60Hz mains current, and reference numeral 30 denotes an inductor which performs a function similar to that of the inductor 16.

The conventional apparatus for detecting a person seated on a toilet seat described above has the disadvantage that when a person sits on the front end of the toilet seat (in a so-called 'shallow' seated position), and when a person makes contact with only one side of the toilet seat (a so-called 'one-side' seated position), the above-mentioned capacitor 26 is not created and therefore the presence of the person is not detected.

An object of the present invention is to provide an apparatus for detecting a person seated on a toilet seat which can reliably detect the person even when he/she sits thereon in an unusual manner.

The present invention provides apparatus for detecting a person seated on a toilet seat, comprising an oscillator circuit and detector means for detecting an output from the oscillator circuit, characterised in that the apparatus further comprises electrode means mountable on the toilet seat and coupled to the oscillator circuit, the arrangement being such that, when a person sits on the toilet seat, the electrode means and the person provide a capacitance to ground which alters the output from the oscillator circuit, the detector means being arranged to output a signal to

indicate that a person is seated on the toilet seat on detecting said alteration in the output of the oscillator circuit.

In a preferred system, the oscillator circuit is a high frequency oscillator circuit containing an oscillator of which one of the output connections is grounded and the other is connected to an amplifier which amplifies the output of the oscillator. The apparatus may further comprise a comparison circuit which outputs a 'person seated' signal when the output voltage of the high frequency oscillator circuit is lower than a reference value. The electrode may be mounted inside or on an under surface of the toilet seat, which may be on the inside of the seat, if hollow. The electrode produces an electrostatic capacitance between the oscillator and the ground through the body of a person seated on the toilet seat.

In preferred apparatus, when a person sits down on the toilet seat, a capacitance is created parallel to the oscillator by the body of the person, which causes the high frequency signal voltage outputted by the oscillator circuit to become small, and the presence of a person seated on the toilet seat may then be detected by the voltage of this high frequency signal being compared with a reference voltage. That is to say, when there is no person seated on the toilet seat, the signal voltage is higher than the reference voltage, and when a person sits down on the toilet seat the signal voltage becomes lower than the reference voltage.

The person seated on the toilet seat is detected without fail whenever the area of contact between the person and the toilet seat exceeds a predetermined size, detection is accomplished irrespectively of whether the person sits in a normal manner on the toilet seat or not.

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

Fig. 1 is a plan view of a toilet seat provided with an apparatus for detecting a person seated on the toilet seat according to a preferred embodiment of the present invention;

Fig. 2 is a cross-sectional view taken along the line II-II in Fig. 1;

Fig. 3 is a circuit diagram of the apparatus of the embodiment;

Fig. 4 is a plan view of a toilet seat provided with a conventional apparatus for detecting a person seated on the toilet seat; and

Fig. 5 is a circuit diagram of the conventional apparatus.

A toilet seat 40 is provided with a hollow interior 42, and an electrode 44 is stuck onto the ceiling (under) surface of this hollow interior 42. This electrode 44 might for example consist of a sheet of a metal such as aluminium. A heater element 46 is mounted on this electrode 44. This heater element 46 is con-

nected to the mains electricity supply 70 via inductors 72 and 74 and a switch 76, and switching this switch to ON causes the heater element 46 to give off heat and warm up the toilet seat 40. Instead of providing an aluminium sheet or similar for the electrode 44, the heater element 46 may be used as the electrode.

As shown in Fig. 3, an apparatus 48 for detecting a person seated on a toilet comprises a high frequency oscillator circuit 50, a band pass filter 52 for allowing only high frequency signals to pass, an averaging circuit 54 for rectifying the high frequency signal arriving through the band pass filter 52 into a direct current and carrying out smoothing on the direct current, and a comparison circuit 58 for comparing the output voltage of this averaging circuit 54 with a reference voltage from a reference voltage generator device 56.

The high frequency oscillator circuit 50 consists essentially of an NPN-type transistor 60 and a crystal oscillator 62 connected between the base of the transistor 60 and the ground. The electrode 44 is connected by a lead wire 78 to the output connection on the side of this oscillator 62 opposite from the grounded side.

With an apparatus for detecting a person seated on a toilet seat constructed in this way, when there is not a person seated on the toilet seat 40, no electrostatic capacity exists between the electrode 44 and the ground, so that the output voltage of the oscillator 62 that is inputted into the base of the transistor 60 is high. Accordingly, the high frequency signal voltage outputted to the band pass filter 52 from the high frequency oscillator circuit 50 is high. As a result of this, the voltage inputted into the comparison circuit 58 is substantially higher than the reference voltage 56.

When a person sits on the toilet seat 40, a capacitance 64 is created between the electrode 44 and ground, as shown by dashed lines in Fig.3, and the amplitude of the output voltage of the oscillator 62 that is inputted into the base of the transistor 60 becomes small. As a result, the amplitude of the high frequency oscillator circuit 50 becomes small, and the value of the comparison voltage outputted to the comparison circuit 58 from the averaging circuit 54 becomes lower than the reference voltage. This causes the level of the output signal of the comparison circuit 58 to be reversed, and detection is accomplished.

In this detection apparatus, when a person makes contact with the toilet seat 40 in such a way that the contact area is larger than a predetermined area, without fail the output signal of the high frequency oscillator circuit 50 becomes lower and the presence of the seated person is detected. In other words, with this detecting apparatus, whatever the manner in which a person sits on the toilet seat, the person is detected accurately, so far as the area of contact between the person and the toilet seat is larger than the predetermined size.

Based on the output of the comparison circuit 58

the presence or otherwise of a person seated on the toilet seat is detected, and this information can be used in the control of the operation of devices such as a device for washing the user's buttocks with warm water, a fan for removing fetid air from inside the toilet bowl, and a warm air blower for drying the user's buttocks.

As described above, using the detecting apparatus according to the present invention, when the area of contact between a person and the toilet seat becomes larger than a certain predetermined size, the presence of the person seated on the toilet seat can be detected without fail, irrespectively of whether or not the person is seated in a correct manner on the toilet seat.

Various modifications could be made to the above arrangement. For example, an oscillating circuit could be used whose output signal frequency is varied by the capacitance 64, and this change in frequency could be used to detect a person sitting on the toilet seat.

Claims

1. Apparatus for detecting a person seated on a toilet seat (40), comprising an oscillator circuit (50) and detector means (58) for detecting an output from the oscillator circuit (50), characterised in that the apparatus further comprises electrode means (44) mountable on the toilet seat (40) and coupled to the oscillator circuit (50), the arrangement being such that, when a person sits on the toilet seat (40), the electrode means (44) and the person provide a capacitance (64) to ground which alters the output from the oscillator circuit (50), the detector means (58) being arranged to output a signal to indicate that a person is seated on the toilet seat (40) on detecting said alteration in the output of the oscillator circuit (50).
2. Apparatus according to claim 1, wherein the electrode (44) is a sheet of metal mounted on an under surface of the toilet seat (40).
3. Apparatus according to claim 1, wherein the toilet seat is provided with a heater, said heater constituting said electrode.
4. Apparatus according to any preceding claim, wherein said capacitance to ground (64) lowers the output level of the oscillator circuit (50).
5. Apparatus according to any preceding claim, wherein said detector means (58) detects the output voltage of the oscillator circuit (50).
6. Apparatus according to any preceding claim,

wherein the detector means comprises a comparator (58) for comparing the output of the oscillator circuit (50) with the output from a reference signal generator (56).

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7. Apparatus according to any preceding claim, wherein the oscillator circuit (50) is a high frequency circuit comprising an oscillator (62) and an amplifier (60) for amplifying the output of the oscillator (62).

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8. Apparatus according to any preceding claim, wherein the detector means includes means (54) for rectifying the output of the oscillator circuit (50) into a direct current and for smoothing the direct current.

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9. A toilet seat having a heater element mounted thereon, characterised in that said seat has a separate electrode means mounted thereon for use in apparatus according to any preceding claim.

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10. An apparatus for detecting a person seated on a toilet seat, comprising:

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a high frequency oscillator circuit containing an oscillator and an amplifier for amplifying the output of the oscillator, one of the output connections of the oscillator being grounded;

a comparison circuit for outputting a 'person seated' signal when the output voltage of the high frequency oscillator circuit is lower than a reference voltage; and

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an electrode, mounted inside the toilet seat and connected to the output connection of the oscillator that is not grounded;

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wherein when a person sits on the toilet seat, the electrode and the person produce an electrostatic capacitance between the oscillator and the ground, which reduces the output voltage of the oscillator circuit.

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FIG.1

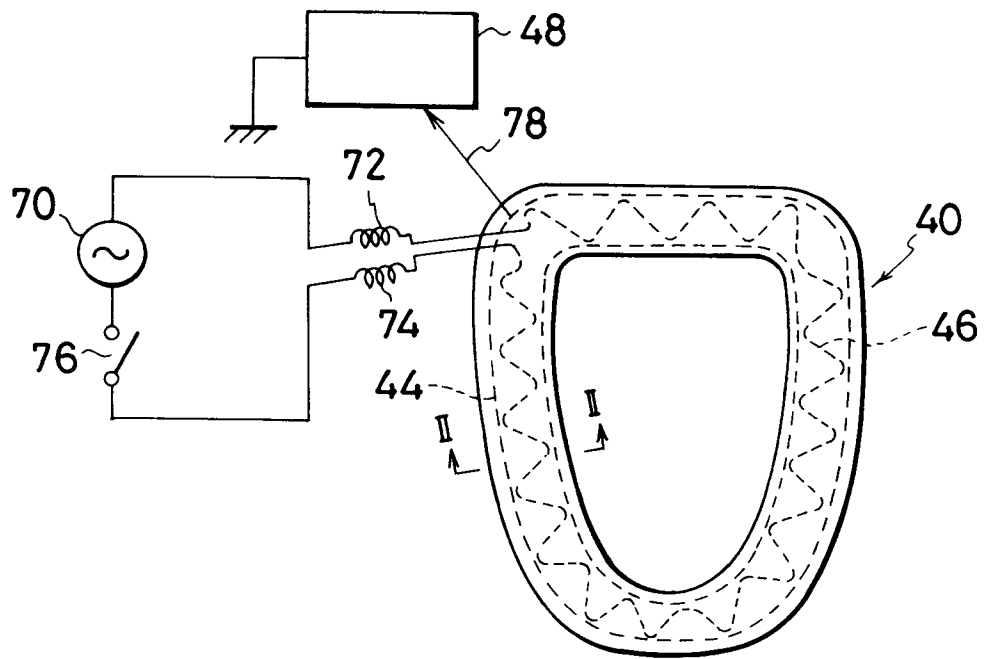


FIG.2

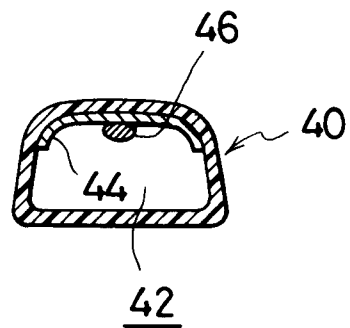


FIG. 3

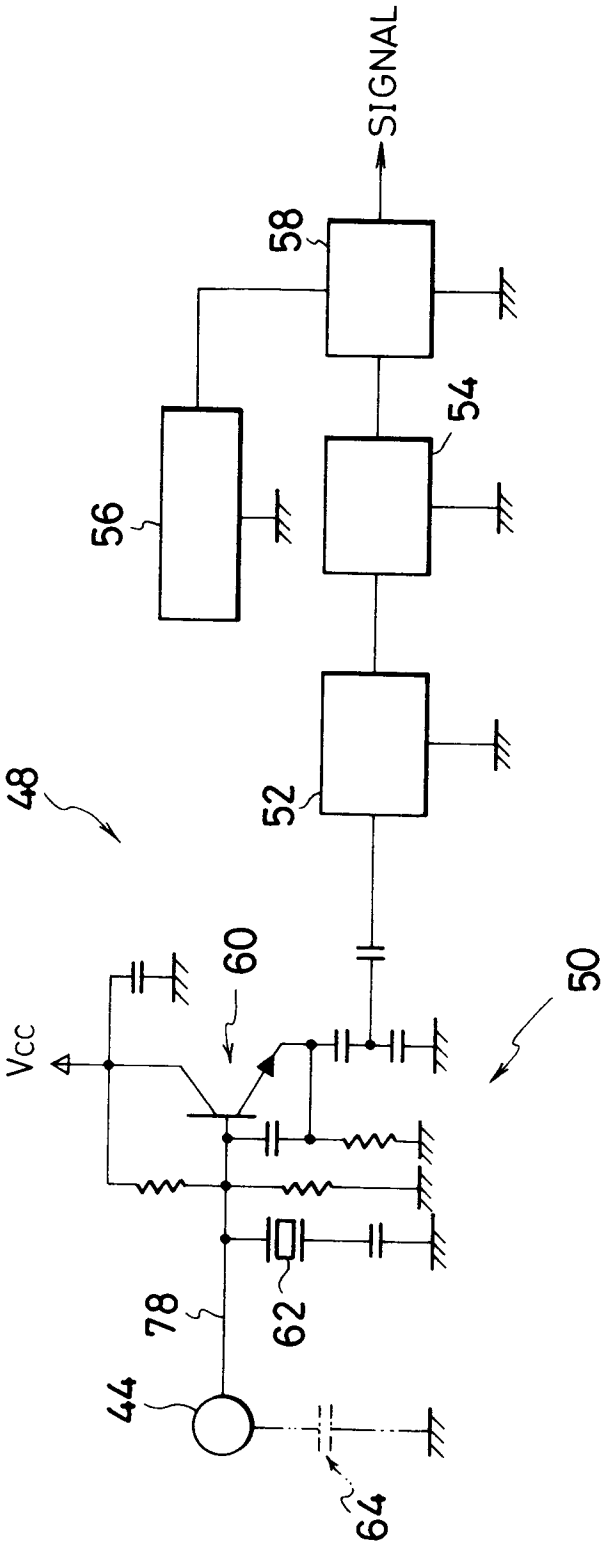


FIG. 4

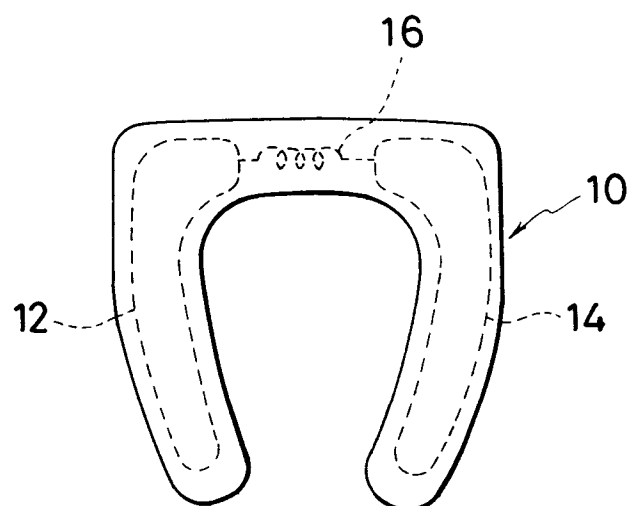
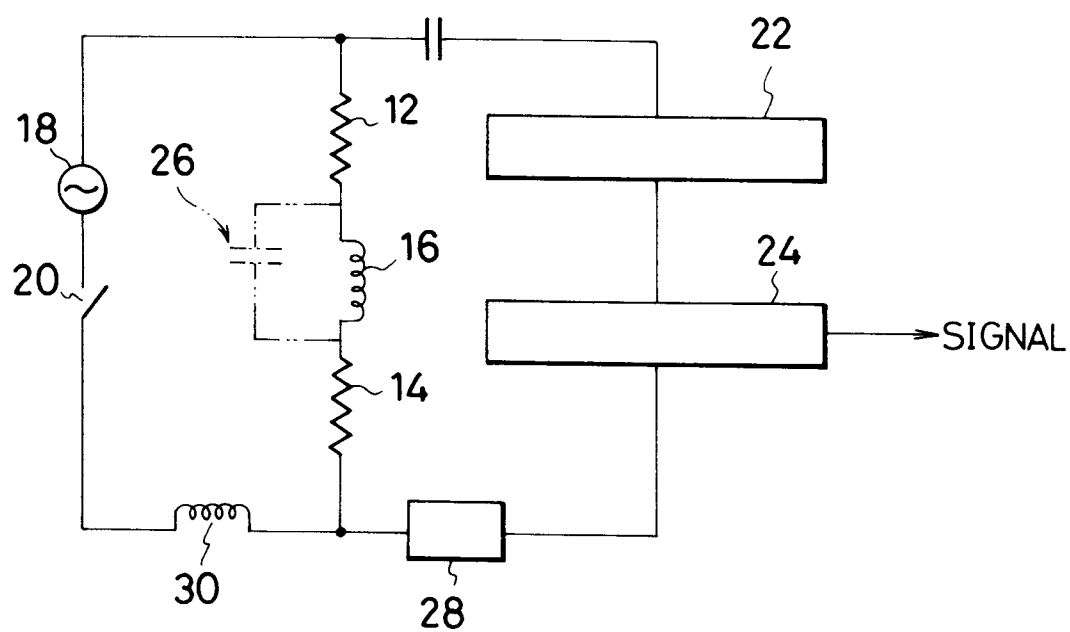


FIG. 5





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 93 30 6041

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)
Y	US-A-4 841 583 (OHARA ET AL.) * the whole document * ---	1-10	G08B21/00
Y	EP-A-0 441 381 (AISIN SEIKI KABUSHIKI KAISHA) * the whole document * ---	1-10	
A	WO-A-88 08595 (COLEMAN ELECTRONIC DESIGNS LTD) * abstract; claims * ---	1-10	
A	US-A-4 887 024 (SUGIYAMA ET AL) -----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.5)
			G08B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 November 1993	Examiner REEKMANS, M
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