(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 018 237**
A1

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **80301346.5**

(22) Date of filing: **24.04.80**

(51) Int. Cl.³: **G 10 H 1/26**, A 63 H 33/30, A 63 H 3/52

(30) Priority: **24.04.79 GB 7914191**

(43) Date of publication of application: **29.10.80 Bulletin 80/22**

(84) Designated Contracting States: **AT BE DE FR GB IT NL SE**

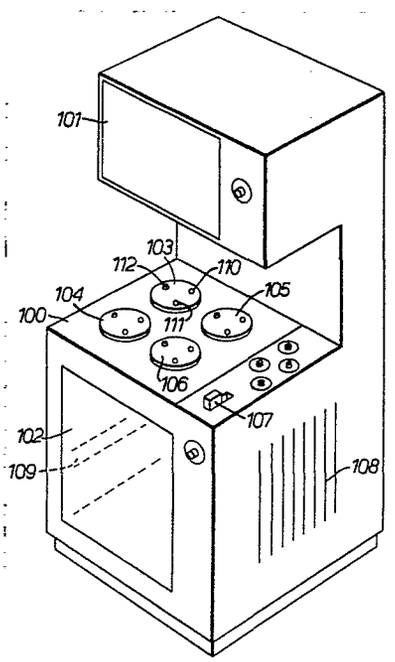
(71) Applicant: **ROVEX LIMITED, 119-123, Great Portland Street, London, W.1. (GB)**

(72) Inventor: **Hopkins, Norman Keith, Orchard House Whynstones Road, Ascot, SL5 9HW (GB)**
Inventor: **Klyne, Lawrence, 179B Haverstock Hill, London, N.W.3. (GB)**
Inventor: **Castle, Rodney Richard, 9A St.John's Place, Canterbury, Kent (GB)**

(74) Representative: **Abbott, David John et al, Abel & Imray Northumberland House 303-306 High Holborn, London, WC1V 7LH (GB)**

(54) Sound generating electronic arrangement as well as a model cooker and a doll's house incorporating such an arrangement.

(57) An electronic circuit arrangement having a first part and a plurality of second parts which may be connected or coupled to it. Each second part has the result of introducing an electrical component of a different value to the first part circuit and thereby initiates a particular action or set of actions. In one embodiment of the arrangement it is incorporated in a doll's cooker (100) having contacts (110, 111) which are bridged by model saucepans (113) and introduce particular values of resistance (114). A microcomputer responds to the different values of resistance to generate output pulses which when amplified and reproduced sound like cooking noises or noises associated with the particular cooking utensils such as the whistle of a kettle.



EP 0 018 237 A1

SOUND GENERATING ELECTRONIC ARRANGEMENT

The present invention relates to a sound generating electronic arrangement which is particularly suitable for incorporation in toys such as, for example, accessories for doll's houses but which may also be used in other ways.

In order to add realism to toys and models it has been proposed to incorporate in them some sound generating means which when energised produces a sound resembling that produced by the full scale item when in operation. However, for small models of household appliances for use in doll's houses it would be difficult to produce an adequate sound generator within the space available and in addition the cost of the model would be increased considerably by the addition of the sound generating means. It is an object of the present invention to provide an electronic arrangement capable of overcoming this difficulty.

According to the present invention there is provided a sound generating electronic arrangement having a first part and a plurality of alternative second parts having different values of a physical property and which can be brought separately into electrical association with the first part so that the physical property introduces an electrical component of a particular value into the first part the first part being so arranged to respond to the particular value of electrical component introduced by the

particular second part which is in electrical association with it to execute one or more operations characteristic of the particular second part at least one of which operations result in the generation of a sound.

The first part may include a microprocessor circuit and a further circuit arrangement responsive to the value of the electrical component provide an input to the microprocessor circuit representative of that value. The microprocessor circuit responds to the input to select among alternative routines in its programme. The programme of the microprocessor may be arranged to generate a succession of pulses at each of one or more outputs for producing a particular sound and the microprocessor circuit may include an amplifier and a loud speaker for reproducing that sound. The programme may also be arranged to generate a succession of pulses at each of one or other outputs for modulating the amplitude of the particular sound and the microprocessor circuit may include gain control means responsive to the other outputs and effective to shape the envelope of the particular sound.

In one example of the invention the first part may be a microprocessor circuit incorporated in a doll's house or an item of furniture for a doll's house having a socket for a plug and the second part may be, for example, a model record player, food mixer, coffee grinder, vacuum cleaner or washing machine, having a plug to fit into the

socket of the first part. The insertion of the plug into the socket is arranged to cause an electrical component of a particular value to be connected to the microprocessor to cause it to execute a corresponding sequence of operations resulting in the output of an electrical signal to a loudspeaker so that it produces a sound characteristic of the particular household implement the model of which is plugged in. For example, the record player may result in a tune being played, the food mixer or coffee grinder may result in the generation of an appropriate whirring or grinding sound and the vacuum cleaner or washing machine may result in the appropriate sound for such an implement.

In another example of the invention the first part may be a model cooker having, for example, a plurality of simulated heating rings on a hob on which may be placed model frying pans, pressure cookers, kettles or saucepans, and the placing of a pan on a heating ring would result in the connection of an electrical component of a particular value to a microprocessor circuit to cause it to generate the appropriate cooking sound or whistling as from a kettle or hissing from a pressure cooker. The cooker may also incorporate an oven having an electrical contact actuated by the insertion of a baking tray to activate a timer and produce a buzzing sound as from an oven timer after a period of, say, 10 seconds representing the cooking time for a

model cake or joint of meat in the oven.

In a further embodiment of the invention the first part may be a microprocessor circuit associates with a mechanical locking mechanism and the second part an item having a particular electrical or magnetic property for influencing a circuit connected to the microprocessor and causing it to release the lock if an item having the correct value of electrical or magnetic property is used or to produce an alarm signal if an item having an incorrect electrical or magnetic value is used.

Each second part may have a resistance value which is characteristic of the particular part so that the microprocessor circuit is able to distinguish which second part is connected to it and produce the appropriate response. The measurement of resistance value by the microprocessor could be performed using the techniques used for resistance measurement in a digital multi-purpose meter, that is to say passing a current through the resistance to charge a capacitor until the voltage on the capacitor reaches a threshold value and timing the period necessary for the threshold value to be reached thus providing a signal, for example, in the form of a number in a counter which can be used to select the appropriate response. Instead of using resistance the second part could have capacitors of different values which could be connected to the microprocessor circuit.

If capacitors of different values are employed then these could be connected to a resonant circuit to modify its frequency and the total number of cycles of the frequency counted during a predetermined interval of time used to provide a measure of the capacitance. In a further alternative the second part could incorporate a piece of ferrite material which when placed adjacent to a coil connected to an oscillator associated with the microprocessor circuit would alter the frequency of the oscillator so that the identity of the second part could be indicated by the number in a counter in the manner similar to that described above. In yet another alternative the second part could consist of an electrically conductive plate with an insulating cover of a particular thickness so that when the plate is placed across two plates lying side by side and connected to an oscillator circuit it would result in a capacitance of a particular value being established between the two plates and thereby influence the frequency of the oscillator. If the second part were to consist of a plug for insertion into a socket the plug could be provided with pins of lengths dependent on the nature of the second part so that when the plug is inserted into the socket a corresponding value of resistance, capacitance or inductance is set up in a circuit connected to the microprocessor to select the appropriate response.

Preferably the microprocessor circuit is arranged to be capable of generating several sounds at the same time if more than one second part is brought into electrical association with it. This may be achieved by the use of a scanning program in the microprocessor to enable it to identify two or more second parts at substantially the same time and respond accordingly.

The first part may be arranged to produce a visible output in addition to a sound output. Thus, for example where the first part is a model cooker a red light emitting diode could be arranged under each heating ring on the hob so that the diode emits red light when a pan is placed on the particular ring thereby simulating a red hot ring on the hob.

Instead of a microprocessor circuit being used to identify which second part is placed in electrical association with it and then to produce an appropriate response including the generation of a specific sound, there may be provided a circuit including components such as a counter, an integrator and an oscillator dedicated to the particular tasks required. In such an arrangement the sounds could be generated by means of a counter sequentially and cyclically reading from a selected block of addresses of a read-only memory in which are stored samples obtained from the particular sound required.

The first part may be arranged to switch to a quiescent state after it has produced one or more responses

to one or more second parts which have been kept in electrical association with it for a predetermined time, say 30 seconds, without change. This is of particular value in saving battery power where the invention is embodied in a toy since a child might forget that the toy had been activated and leave it in that state for some time.

In order that the invention may be fully understood and readily carried into effect it will now be described with reference to the accompanying drawings, of which:

FIGURE 1 is a diagram showing the general arrangement of a model cooker in which an embodiment of the invention may be incorporated;

FIGURE 2 shows partly in cross-section a model cooking utensil on a heating ring of the model cooker of Figure 1;

FIGURE 3 is the circuit diagram of an embodiment of the invention suitable for incorporation in the model cooker of Figure 1;

Figure 4 is a flow diagram showing part of the operation of the circuit of Figure 3;

Figure 5 shows an alternative arrangement for sensing the different types of cooking utensils which may be placed on the cooker of Figure 1;

Figure 6 is the circuit diagram showing how the arrangement of Figure 5 might be used;

Figure 7 shows another alternative arrangement for sensing the different types of cooking utensils;

Figure 8 is the circuit diagram showing how the arrangement of Figure 7 might be used;

Figure 9 is a diagram showing how a plug pin could be used to provide a resistance depending on the length of the pin; and

Figure 10 is a block circuit diagram of an alternative to part of the circuit of Figure 3.

Figure 1 shows an embodiment of the invention in the form of a model cooker which is arranged to produce cooking noises, that is to say noises either of the cooking process where such occur or sounds associated with the cooking process such as the hissing of steam escaping from a pressure cooker or a sound or a cooker timer alarm, which sounds are associated with cooking. The cooker has a casing 100 incorporating an upper grill/oven 101 and a lower oven 102 together with four heating rings 103, 104, 105 and 106 on a hob. An on/off switch 107 is located on the hob next to the rings. Imitation control knobs are moulded on the casing 100. A grille 108 is moulded into a flank of the casing 100 to permit sound from a loudspeaker located within the casing to escape. The lower oven 102 has formed in its sidewalls grooves 109 for receiving a shelf or a baking tray on which model food can be placed. The upper grill/oven 101 may also be provided with such grooves. Switches may be provided within the ovens 101 and 102 responsive to the insertion of a shelf or baking tray or even an item of food to be cooked to provide a signal for operating a light representing the heating element for the oven being switched on and it may also be used to initiate a process in the electronic circuit arrangement incorporated within the cooker to produce a timer alarm after a predetermined interval of time, for example 10 seconds. Taking the ring 103 as an example, the

rings 103 to 106 all being of the same form, this is provided with two raised electrical contacts 110 and 111 and a pillar 112 of insulating material and of the same height as the contacts 110 and 111. The contacts are connected to the electronic circuit arrangement within the cooker in a manner to be described later.

Figure 2 shows a pan 113 placed on the hob 103 and resting on the contacts 110 and 111 and the pillar 112. These three points of support for the pan ensure that it rests firmly on the contacts 110 and 111 and can make good electrical connection thereto. In this embodiment of the invention the pan 113 is provided with a resistive coating 114 over the recessed underside of the pan so that when the pan is placed on the ring 103 a particular value of resistance connects the contacts 110 and 111.

Four alternative models of cooking utensils are available for placing on the rings 103 to 106, and each model utensil has a recessed base of the type shown in Figure 2 and a resistive coating on that base which connects with the two electrical contacts of a ring when placed on the ring. The resistance set up between the contacts by the placing of the utensil on the ring is different for the different model utensils, and this difference in resistance value is used by the electronic circuit arrangement within the cooker to select which sound is to be produced by the loudspeaker. For example, the placing of a model frying pan on a ring may result in the emission of a hissing and spitting sound mimicking

the sound of frying. The placing of a model saucepan on a ring would result in the generation of a bubbling sound together with an occasional hiss representing the spillage of water onto a hot ring. The model pressure cooker would result in an intermittent or wavering hiss representing the escape of steam through the pressure control valve. The kettle would result in the generation of a bubbling noise followed by a whistle rising in frequency. The circuit may also be arranged to produce a whistle varying in frequency when the kettle is removed from a ring. Preferably the circuit arrangement is such that it can respond simultaneously to the presence of two or more utensils on the hob to produce a combination of the sounds.

The model cooker shown in Figure 1 may also incorporate a light emitting diode or other red light emitting device in each of the rings on the hob so that when a cooking utensil is placed on the ring a red glow is produced beneath the utensil representing a red hot heating element. The upper grill/oven may be arranged to support a rotatable shaft representing a rotisserie and an externally accessible wheel may be coupled to the shaft to enable the shaft to be rotated.

Referring now to Figure 3 which shows the circuit diagram of the electronic circuit arrangement incorporated in the model cooker shown in Figure 1, this circuit may be formed on a single printed circuit member mounted

within the casing 100 of the cooker together with a battery for operating it and a loudspeaker for producing the sound; the loudspeaker may, if desired, be mounted separately from the printed circuit member. The circuit is powered by a 9 volt battery 1 which is connected to the circuit by means of a switch 2 represented in Figure 1 by the item 107. The switch 2 is connected through a reverse polarity protection diode 3 to a conductor 4. The other terminal of battery 1 is connected to a zero volt conductor 5 so that the 9 volts of the battery appear between the conductors 4 and 5. A light emitting diode 6 is connected in series with a resistor 7 from the conductor 4 to the conductor 5 to provide an indication when the switch 2 is on. The conductor 4 is connected through a three terminal voltage regulator 8 to a conductor 9 so that a regulated 5 volt supply appears on the conductor 9. A capacitor 10 connected from the conductor 9 to the conductor 5 acts as a reservoir and to decouple the conductor line.

The main component of this circuit is a microcomputer 11 which in this example is of the type PIC 1655 manufactured by the General Instruments Microelectronics Corporation. The component 11 has 28 terminals, respectively labelled P1 to P28, of which terminals P1, P2 and P3 are connected to the conductor 9, P4 and P5 are connected to the conductor 5, P6, P7, P16, P17, P24, P25 and P26 are not used, and the remainder will be

referred to in the following description. To facilitate understanding of the operation of the circuit it should be borne in mind that terminals P6 to P9 correspond to the four stages of a four-bit input register, terminals P10 to P17 correspond to the eight stages of an eight-bit output register, and terminals P18 to P26 correspond to the stages of an eight-bit input/output register, which in the present example is used as an output register only. Other features of the PIC 1655 microcomputer to which reference will be made are the fact that it has a built-in clock generator, a program read-only memory containing 512 words each of 12 bits in which the program to be executed by the microcomputer is stored, a terminal (P28) for effecting the power up reset and a real time clock counter for timing operations.

The electrical contacts of the four hobs 103 to 106 of Figure 1 are represented in Figure 3 by the letters A, B, C and D, and one contact of each of these hobs is connected to the terminal 9 through a respective resistor 12, 13, 14 or 15. The other contacts of these hobs are connected to the contacts P10 to P13 respectively of the component 11 and are also connected via respective diodes 17 to 20 to the terminal P9 of the component 11. For reference purposes resistor 16 is connected from the conductor 9 to the terminal P14 of the component 11 and also through a diode 21 to the terminal P9. The terminal P9 is directly connected to the terminal P15 of the

component 11 and to the zero volt conductor 5 through a capacitor 23 in parallel with the resistor 22. Lights 24 and 27 respectively for the lower and upper oven compartments of the model cooker are connected in series with switches 26 and 28 respectively from the conductor 4 to the conductor 5. A resistor 25 is connected in parallel with the lamp 24 and the junction of the terminal P26 with the lamp 24 is connected to the terminal P8 of the component 11. Terminals P20, P19 and P18 of the component 11 are connected through resistors 29, 30 and 31 and 32 in series to a conductor 35. The junction of the resistors 31, 32 is connected to the conductor 5 through a capacitor 33 and a capacitor 34 is connected in parallel with the resistor 32. A p-n-p transistor 36 is connected with its emitter-collector path joining the conductor 35 to the conductor 5. The base of the transistor 36 is connected to a conductor 37 which is connected to a resistor 38, and resistor 39, diode 40 and diode 41 respectively to the terminals P23, P22 and P21 of the component 11. These three terminals are also connected through respective resistors 42, 43 and 44 to the conductor 9. The conductor 35 is connected via a capacitor 46 and resistors 47 and 48 in series to the conductor 5. The junction of the resistors 47 and 48 is connected to an input of an integrated circuit amplifier 49, the other input of which is connected to the conductor 5. The amplifier 49

is connected to receive its power supply from conductors 4 and 5 and produce an output which is applied via a capacitor 50 to a loudspeaker 51. A tone control circuit consisting of capacitor 52 in series with the resistor 53 is connected from the output of the amplifier 49 to the conductor 5. The conductor 4 is provided with a decoupling capacitor 54 to prevent spurious noise signals being transmitted via the power supply conductor 4 to the amplifier 49. The internal clock generator of the component 11 is connected so that its frequency can be set by components connected to the terminal P27 and these components consist of a variable resistor 57 in series with a fixed resistor 58 connected from the conductor 59 to the terminal P27 and the capacitor 59 connected from the terminal to the conductor 5. The power up reset is provided by resistor 55 in series with capacitor 56 connected from the conductor 9 to the conductor 5, the junction of the components 55 and 56 being connected to the terminal P28 of the component 11.

The values and output numbers of the components are given in the following table:

1. 9 volt battery
2. switch
3. 1N4001
4. -
5. -
6. light emitting diode
7. 1 kΩ
8. 78L05
9. -
10. 0.047 µF
11. PIC 1655
12. 2k7Ω
13. 2k7Ω
14. 2k7Ω
15. 2k7Ω
16. 18kΩ
17. 1N4148
18. 1N4148
19. 1N4148
20. 1N4148
21. 1N4148
22. 220 kΩ
23. 0.047 µF
24. lamp
25. 10 - 100 kΩ
26. switch
27. lamp
28. switch
29. 180 kΩ
30. 39 kΩ
31. 39 kΩ
32. 12 kΩ
33. 0.22 µF
34. 0.01 µF
35. -
36. BC 212
37. -
38. 330 Ω
39. 18 kΩ
40. 1N4148
41. 1N4148
42. 10 kΩ
43. 3k9Ω
44. 3k9Ω
45. 220 µF
46. 1 µF
47. 33 kΩ
48. 10 kΩ
49. LM386N
50. 220 µF
51. 8Ω loudspeaker
52. 22 nF
53. 10Ω
54. 33 µF
55. 560 kΩ
56. 0.1 µF
57. 10 kΩ variable
58. 6k9Ω
59. 47 pF

In the operation of the circuit shown in Figure 3, when the switch 2 is closed, assuming that the battery 1 is connected in the correct polarity, the light emitting diode 6 emits light to indicate that the circuit is on. The voltage across the capacitor 56 rises relatively slowly so as to maintain the terminal P28 at a low potential for at least 20 milliseconds after the power supply has been applied to the component 11, thus resetting the program counter within the component 11 to its maximum value so that it is ready to start the program from the beginning. The components 57, 58 and 59 are chosen so that the clock generator runs at about 250 kHz. Until a resistor is connected to bridge one of the pairs of contacts A, B, C and D (as a result of a model utensil being placed on one of the rings 103 to 106 - Figure 1), or the switch 26 is closed (resulting from the insertion of a baking tray into the lower oven 102 - Figure 1), no sound is produced from the loudspeaker 51 because no output appears at any of the terminals P18 to P23. However, the program in the component 11 is running at this time and results in the terminals P10, P11, P12, P13 and P14 becoming "high" for about 1 millisecond each in succession. In between one of the terminals P10 to P14 becoming high and the next of those terminals in the sequence becoming high, the terminal P15 is held "low". Disregarding for the moment the effect of the terminal P15 and with no utensil on any of the rings, current can flow

from the conductor 9 into the capacitor 23 only via the resistor 16 and only for the 1 millisecond period during which the terminal P14 is high. The values of the resistor 16 and the capacitor 23 together with the output current from the terminals P14 and P15 of the component 11 result in the voltage across the capacitor 23 rising from zero to above 2.4 volts, corresponding to the high threshold of the component 11 within about half a millisecond. The program in the component 11 starts the internal real time counter when the terminal P14 goes high and the value registered by this counter when the terminal P9 goes high is read from the counter and used as a reference value. It will be appreciated that the total registered by the counter represents the time taken for the capacitor 23 to charge from zero volts to 2.4 volts. The reference value is required because of variations in component values which would render the identification of utensils placed on the hobs less accurate. The values of the resistances provided by the utensils when placed on the rings are different for the different utensils and all are less than the resistance of the resistor 16 by more than the value of any of the resistors 12 to 15, all of which are equal. Therefore, the time taken for the capacitor 23 to charge to 2.4 volts is shorter than half a millisecond when one of the terminals P10 to P13 is high and a utensil is placed on one of the rings. Suppose a utensil were placed on

the ring A, then when the terminal P10 is high current will flow from the conductor 9 through the resistor 12 to the base of the utensil and the diode 17 to charge the capacitor 23. The program is arranged to store totals counted by the real time counter from the start of the interval for which the terminals P10 to P14 are high and lasting until the voltage on the capacitor 23 reaches 2.4 volts, i.e. the high threshold voltage. These totals are subjected to correction in response to the reference value derived from the current flowing through the resistor 16, which correction may be achieved by subtracting the totals resulting from each of the four rings A, B, C and D from the reference value. The digits of lower significance of the differences so produced may be neglected to allow a certain tolerance in the values and the remaining digits are checked with a table of values stored in the computer program so as to identify which utensil or utensils are placed on the cooker. The information relating to utensils on the cooker may be stored in a single register by 1's in particular digit places of the register and the program may be arranged to refer to these digits using a conditional jump operation to include or exclude parts of the program which result in the generation of sounds appropriate to the utensil.

In a similar way the input applied to the terminal P8 of the component 11 determines whether or not the lower oven is in use and whether the oven timer program is to be executed or not. The insertion of a baking tray into the lower oven causes the closure of the switch 26 which causes the lamp 24 to light up and the voltage applied to the terminal P8 to become low, that is to say less than 0.65 volt. The information as to whether the oven timer routine is to be executed may be stored as a 1 in the same register as stores the information as to which utensils are on the hob of the cooker.

The sound generation outputs from the component 11 fall into two groups. The outputs from terminals P18, P19 and P20 form the sounds themselves by the generation of 1's and 0's at the outputs, the 1's being produced at frequencies corresponding to the particular sounds required. The capacitors 33 and 34 serve to smooth the output from the terminal P18 so as to produce a more tone-like sound. The output at the terminal P19 being connected to the conductor 35 through a resistance of relatively low value provides a louder sporadic sound, for example like crackling, and the output from the terminal P20 being connected to the conductor 35 through the resistor 29 of relatively larger value produces a background noise which may take the form of a hissing resulting from a random selection of relatively high

frequencies produced by the pulses at the terminal P20. The outputs from the terminals P21, P22 and P23 are used to perform envelope shaping of the signals generated at the conductor 35 by producing a voltage across the capacitor 45 which controls the resistance of the emitter-collector path of the transistor 36. If the transistor 36 is of high resistance then there is substantially no attenuation of the signal on the conductor 35; on the other hand, if the transistor 36 is of low resistance the signal on the conductor 35 is heavily attenuated. The output at the terminal P23 of the component 11 being connected to the capacitor 45 through the resistor 39 produces a relatively slowly varying voltage going positively or negatively on the capacitor 45 depending on whether the output at the terminal P23 is a 1 or 0. The output at the terminal P22 when low draws a large current from the capacitor 45 if it is sufficiently positively charged and reduces the positive charge relatively rapidly. In a similar way when the output at the terminal P21 is high the voltage on the capacitor 45 becomes positive relatively rapidly. It is therefore possible to use outputs on the terminals P21, P22 and P23 to effect both slow and rapid changes in the voltage on the capacitor 45 and to provide corresponding amplitude control of the signal on the conductor 35. The signal resulting from the outputs on the terminals P18 to P20 as modulated by the outputs on terminals P21 to P23 is amplified by the amplifier 49

and reproduced as corresponding sounds by the loudspeaker 51.

The program stored in the component 11 will include a number of sub-routines resulting in the generation of pulses at the terminals P18 to P23 to produce the cooking sounds required. The sub-routines are selected in response to the type of utensil placed on the hob of the cooker and whether or not the lower oven is in use, using, for example, conditional jump instructions.

It should be noted that the particular microcomputer suggested for the component 11, the PIC 1655, has instructions for manipulating single bits which are particularly useful in producing pseudo-random intervals between pulses applied to the terminal P20, for example, to produce a hissing sound. It should be borne in mind that a relatively high frequency of pulse repetition at the terminal P20 will result in a louder sound being produced (at a higher frequency) than a low rate of repetition of pulses will produce (at a lower frequency).

Modifications may be made to the circuit of Figure 3 to suit alternative uses for the arrangement. In addition, other types of microcomputer or microprocessors than the PIC 1655 could be used. Although the microcomputer could be used to actuate a red light under a pan placed on the heating ring to simulate a red hot ring, a simpler arrangement would be to mount

the pillar 112 on a microswitch so that the weight of a pot or pan on the ring would actuate the switch and thereby energise a lamp connected in series with it. Such an arrangement would not provide a gradually increasing energisation of the lamp which could be achieved in response to an output of the microcomputer which would simulate the slow heating up of the ring.

Figure 4 is a flow diagram showing the scanning of the rings A, B, C and D by the microcomputer 11. It should be noted that the count obtained for the resistance connected to the ring N is subjected to the correction in response to the reference value obtained via the contact P14 of the microcomputer 11 before comparison of the corrected value with the four thresholds. Clearly if more or fewer types of pan than four are to be used in conjunction with the cooker, the number of thresholds would be modified correspondingly to provide the necessary distinction between the types of pan. The flags set in response to the thresholds are the "ones" stored in the particular single register referred to above and would be used in conjunction with conditional operations to determine the routines of the program which are performed and therefore the noises produced and possibly also the light outputs.

Figure 5 shows an alternative to the resistive sensing method described above with respect to Figures 1, 2 and 3 and shows the use of an electrically conductive plate 201 which may be incorporated in or formed by a part of model pot or pan. The plate 201 is covered by a thin film 202 of dielectric material. Either the area of the plate 201 or the thickness of the film 202 or both is variable from one type of pan to another. The heating ring itself is provided with two D-shaped plates 203 and 204 so that when a pan is placed on the ring a capacitance is set up between two plates the value of which depends on the area of the plate 201 and the thickness of the dielectric film 202. This variation in capacitance may be used as shown in Figure 6 to vary the resonant frequency of an LC circuit and therefore the output frequency of an oscillator.

In Figure 6 an oscillator 205 includes a resonant circuit formed by an inductor 206 and capacitor 207 formed as shown in Figure 5 by the placing of a model pan on a ring of the cooker. Although there would be some variation in capacitance with an alignment of the plate 201 with the plates 203 and 204 on the cooker, it can be arranged that the variation between the capacitance characteristic of individual pans is greater than the capacitance variation resulting from misalignment of the pan, for example by making the D-shaped plates 203 and 204 of much smaller size than the plate 201.

The output of the oscillator 205 would be applied to a counter which may be incorporated in a microcomputer so that the number of cycles of the oscillation which occurred during a predetermined period of time would be counted and thereby provide an indication of the identity of the pan.

Figure 7 shows another alternative method of sensing the identity of the utensil in which the ring on the hob is provided with a flat coil 210 and the utensils have pieces of magnetic material 211 incorporated in their bases so that when the utensil is placed on the ring the inductance of the coil 210 is varied accordingly. Preferably the magnetic material is a ferrite.

Figure 8 shows how the variation in the inductance of the coil 210 would be used to adjust the resonant frequency of a resonant circuit connected to an oscillator. An oscillator 212 has a resonant circuit formed by the coil 210 of Figure 7 and the magnetic material 211 which is represented diagrammatically in Figure 8 by a block 215. The variation in resonant frequency resulting from the placing of the utensil on a ring would appear as a change in the output frequency of the oscillator 212 and could be measured by the counting technique described above with reference to Figure 6.

The oscillators 205 (Figure 6) and 212 (Figure 8) will produce outputs of much higher frequency when no pan is placed on the ring and the counter may be arranged to

disregard counts in excess of a certain threshold value as an indication that there is no utensil on the ring.

The invention may also be embodied in a doll's house or an item of furniture for a doll's house provided with a socket for a plug. The first part of the electronic circuit arrangement would be embodied in the doll's house or the item of furniture and the second part in this instance would comprise a model domestic appliance having a cable with the plug on the end which may be plugged into the socket. In one example of this embodiment of the invention the pins of the plugs of different appliances are of different lengths, and this difference in length is used by the first part to identify which appliance is plugged in. One manner in which this could be achieved is illustrated in Figure 9 which shows part of the wall of the doll's house or of the item of furniture at 220 having two holes 221 and 222 for receiving the pins 223 and 224 of a model plug 225 connected by cable 226 to a model domestic appliance not shown. Attached to the wall 220 is a variable resistor 227 having an arm 228 mounted on a shaft, which arm is biassed by a spring 229 towards the hole 222 in the wall 220. When the plug 225 is inserted into the socket formed by the holes 221 and 222 in the wall 220, the pin 224 projects through the wall and rotates the shaft of the variable resistor 227 to an angle dependent on the length of the pin 224, thereby

setting up a resistance between the terminals 230 and 231 of the variable resistor 227 which may be used as described above to identify the appliance which has been plugged in and produce the corresponding sound.

Clearly other physical dimensions could be used in place of the length of the plug pins to identify which plug is inserted and these different dimensions could be used in a manner similar to that described with reference to Figure 9 to produce a resistance which depends on the magntiude of the particular dimension. Instead of a variable resistance a variable capacitor or inductor could be used, the inductor employing a suitable ferrite slug which is moved in response to the varied dimension of the plug. Instead of rotary variable components rectilinear components could be used.

Figure 10 shows in block diagrammatic form an alternative to the circuit of Figure 3 which uses specific components in place of the microcomputer. The circuit of Figure 10 operates in response to a single resistive input instead of four such inputs as does the circuit of Figure 3. In Figure 10 current from a supply conductor 250 is applied to a terminal 251 on a heating ring of a model cooker. The ring has a second terminal 252. The terminals 251 and 252 are bridged by the resistive base of a model pot or pan represented by the component 253. The terminal 252 is applied to one input of a comparator 254 and through a resistor 255 to a second input of the

comparator 254. This second input of the comparator 254 is connected through a capacitor 256 to earth. The capacitor 256 is shunted by a resistor 257 and a switch 258. The output of the comparator 254 is applied to the input of a bistable 259 of which the Q output is applied to a start input of a counter 260 and the $\overline{Q}$ output is applied to a reset input of the counter 260 and to control the switch 258. The second input of the comparator 254 is also applied to a Schmitt trigger circuit 261 the output of which is applied to a stop input of the counter 260 and to a read control input of a threshold and selector circuit 262 which receives as inputs signals corresponding to the count achieved in the counter 260. The counter 260 counts pulses from an oscillator 263 and the output of the selector 262 is applied to a sound generator 264. The output of the comparator 254 after inversion by the inverter 265 is applied to stop the generation of sound by the generator 264.

In the operation of Figure 10 unless a pan is on the ring no current flows through the resistor 255 so that the comparator 254 produces a zero output with the result that the generator 264 is prevented from producing a sound. When the pan is placed on the ring current flows through its resistive base 253 and the resistor 255 to charge the capacitor 256. When the voltage on the capacitor 256 reaches threshold value the Schmitt trigger 261 produces an output signal. The current through the resistor 255 causes the comparator 254 to produce a 1 output

which sets the bistable 259 so that its Q output causes the counter 260 to start counting pulses from the oscillator 263. This counting process is stopped when the Schmitt trigger 261 produces its output so that the count registered in the counter 260 corresponds to the time taken for the capacitor 256 to be charged to the threshold value which is clearly dependent on the value of the resistor 253. The count recorded in the counter 260 is transferred to the threshold and selector circuit 262 which compares the count with the threshold values and produces an output indicating what type of pan is placed on the ring, which indication is applied to the sound generator 264 to cause it to produce a sound appropriate to the particular pan. The sound generator 264 continues to produce the sound until the pan is removed when the bistable 259 reverts to the 0 state producing an output on its $\overline{Q}$ output which resets the counter 260 to zero and causes the switch 258 to short-circuit the capacitor 256,thereby discharging it. The purpose of the resistor 257 is to provide a continuous small current through the resistor 255 as long as a pan is on the ring so that the comparator 254 produces a 1 output for the whole of this period and maintains the output from the sound generator 264.

The circuit of Figure 10 could be modified to respond to inputs from a plurality of rings using a multiplexing switch at the input to the circuit, that is to say at the first input to the comparator 254.

Although the invention has been described with respect to specific embodiments in the form of toys, the invention could be applied to, for example, a burglar alarm arrangement in which the first part is associated with a lock and the second part forms the whole or part of a key for releasing the lock. The first part of the circuit may be arranged to respond to a correct key by releasing the lock or enabling the lock to be released by the key and to respond to an incorrect key by sounding an alarm and preventing the lock from being released.

Other methods of sensing the identity of a utensil (or other second part) could used. For example, electrically conductive regions of differing conductivities or dimensions could be incorporated in the utensils, and responses obtained from these using a technique employed in a metal detector. One such technique relies on the reduction in the inductance of a coil carrying a high frequency alternating current when a non-ferrous conductor is brought into the field of the coil; the circuit of Figure 8 could be used in this case. Another technique makes use of the unbalancing of the coupling of a high frequency signal from a transmitter coil to a receiver coil due to the distortion of the field of the transmitter coil by the electrical conductor. In yet another sensing method, each utensil (or other second part) includes a resonant circuit tuned to a particular frequency which, when placed on a ring of the cooker, (or electrically associated with the first part in some other way) is linked to an oscillator causing it to oscillate at the particular frequency which can then be ascertained as described above with reference to Figure 6.

WHAT IS CLAIMED IS:

1. A sound generating electronic arrangement having a first part and a plurality of alternative second parts having different values of a physical property and which can be brought separately into electrical association with the first part so that the physical property introduces an electrical component of a particular value into the first part, the first part being so arranged to respond to the particular value of electrical component introduced by the particular second part which is in electrical association with it to execute one or more operations characteristic of the particular second part, at least one of which operations result in the generation of a sound.

2. An arrangement according to claim 1 wherein the first part includes a microprocessor circuit and a further circuit arrangement responsive to the value of the electrical component to provide an input representative of the value to the microprocessor circuit to select among alternative routines in a program of the microprocessor.

3. An arrangement according to claim 2 wherein the program of the microprocessor is arranged to generate a succession of pulses at each of one or more outputs for producing a particular sound and the microprocessor circuit includes an amplifier and a loudspeaker for reproducing the particular sound.

4. An arrangement according to claim 3 wherein the program of the microprocessor is arranged to generate a succession of pulses at each of one or more other outputs for modulating the amplitude of the particular sound and the microprocessor circuit includes gain control means responsive to the other outputs and effective to shape the envelope of the particular sound.

5. An arrangement according to claim 2, 3 or 4 wherein the first part can be associated with a plurality of second parts simultaneously and the further circuit is responsive to the values of the electrical component introduced by the plurality of second parts to apply corresponding inputs to the microprocessor circuit, the program of the microprocessor being arranged to scan those inputs and produce appropriate routine selection signals.

6. An arrangement according to claim 5 wherein the microprocessor circuit includes a further input which when energized causes the operation of a particular further routine in the program of the microprocessor.

7. An arrangement according to any preceding claim wherein the second parts include resistors of different value which are connected to the first part when the second parts are electrically associated with it.

8. An arrangement according to any of claims 1 to 6 wherein the second parts include capacitors of different value which are connected to the first part when the second parts are electrically associated with it.

9. An arrangement according to any of claims 1 to 6 wherein the second parts include electrically conductive plates and the first part includes two plates side by side so that when a second part is electrically associated with the first part there is produced a capacitance of a particular value between the side by side plates.

10. An arrangement according to any of claims 1 to 6 wherein the second parts include pieces of magnetic material such as ferrite and the first part includes a coil to which the magnetic material of a second part is placed adjacent when the particular second part is electrically associated with the first part.

11. An arrangement according to any of claims 1 to 6 wherein the second parts include elements of different dimensions and the first part includes means responsive to the dimension of the element of second part in electrical association with the first part to adjust the value of the electrical component of the first part correspondingly.

12. An arrangement according to claim 11 wherein the electrical component is a variable resistor the slider of which is moved by the element of the second part when in electrical association with the first part.

13. An arrangement according to any of claims 1 to 10 wherein the first part is embodied in a model cooker, the second parts are embodied in model cooking utensils and the second parts are brought into electrical association with the first part by being placed on heating rings on

the hob of the cooker, thereby to cause the first part to produce a sound characteristic of the utensil or utensils placed on the hob when in use.

14. An arrangement according to claim 13 wherein each heating ring on the hob of the model cooker has two spaced electrical contacts, the spacing being the same for all the rings, and each model utensil has a layer of resistive material beneath its base, the resistive material beneath the bases of different utensils being arranged to set up different resistance values between the two contacts when contacted thereby.

15. An arrangement according to claim 13 or 14 wherein the model cooker includes an oven with a switch actuable by a shelf or baking tray when slid into the oven to activate a timer circuit or program which produces a simulated timer alarm sound after a predetermined interval of time.

16. An arrangement according to claim 11 or 12 wherein the first part is embodied in a doll's house or an item of furniture for a doll's house, the first part including a socket for a plug, the second parts are embodied in model domestic appliances having plugs with a prong or prongs of different length for the different appliances, and the socket includes means responsive to the length of the prong or prongs of an inserted plug of an appliance to cause the first part to generate a sound resembling that of the particular appliance when in operation.

17. An arrangement according to any of claims 1 to 12 wherein the first part is embodied in a lock, a second part is embodied in a key for the lock, and the first part is such that when the correct key is used the lock is released but if an incorrect key is used an alarm signal is produced.

18. A sound generating electronic arrangement substantially as described herein with reference to Figures 3 and 4 of the accompanying drawings or modified as described with reference to Figures 5 and 6, 7 and 8 or 10.

19. A model cooker incorporating an arrangement according to any of claims 1 to 10 or 18, substantially as described herein with reference to Figures 1 and 2 of the accompanying drawings.

20. A doll's house or an item of furniture for a doll's house with model domestic appliances incorporating an arrangement according to any of claims 1 to 6, 11, 12 or 18, substantially as described herein with reference to Figure 9 of the accompanying drawings.

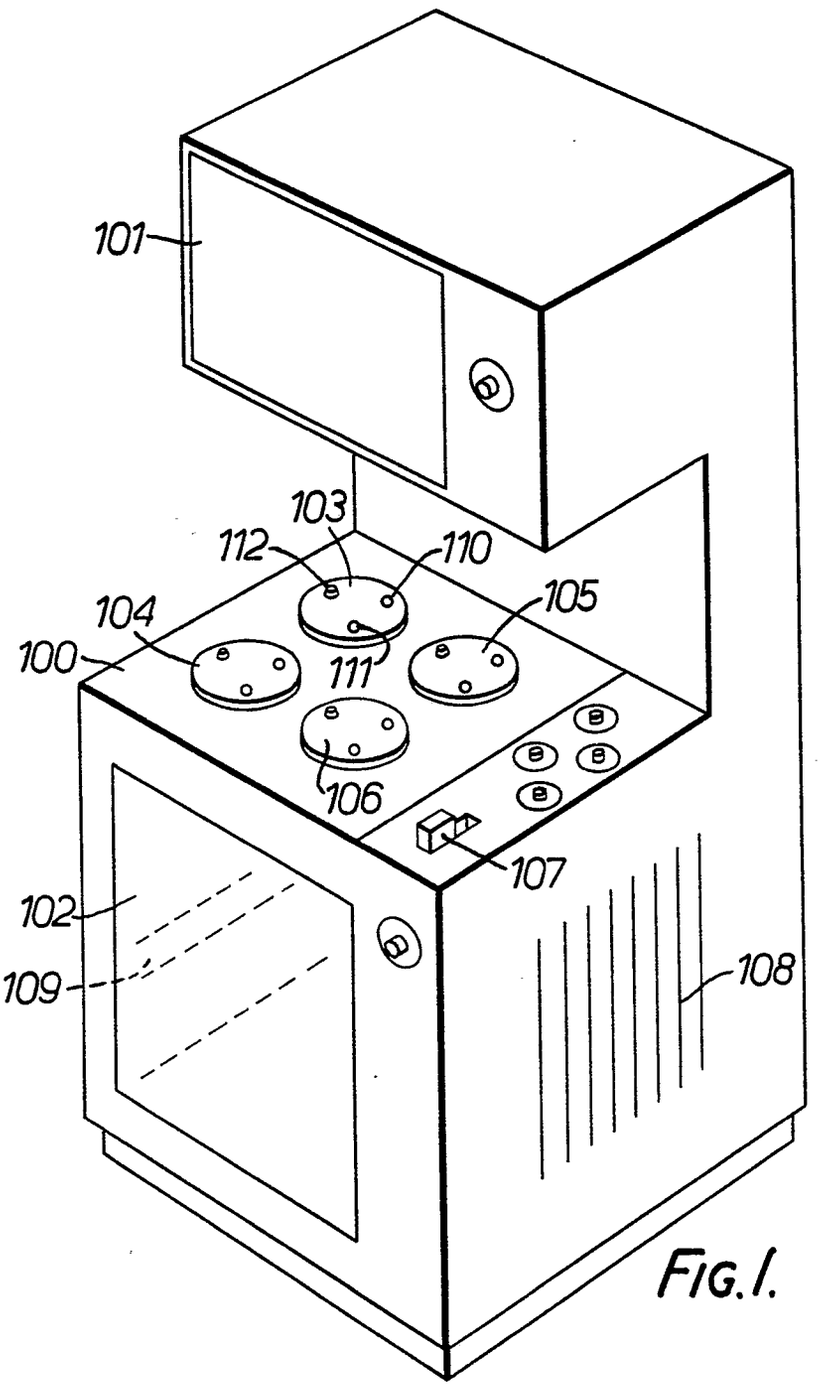

101
103
112
110
104
105
100
111
106
107
102
109
108

FIG. 1.

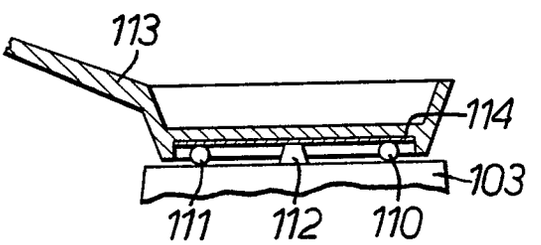

113
114
103
111
112
110

FIG. 2.

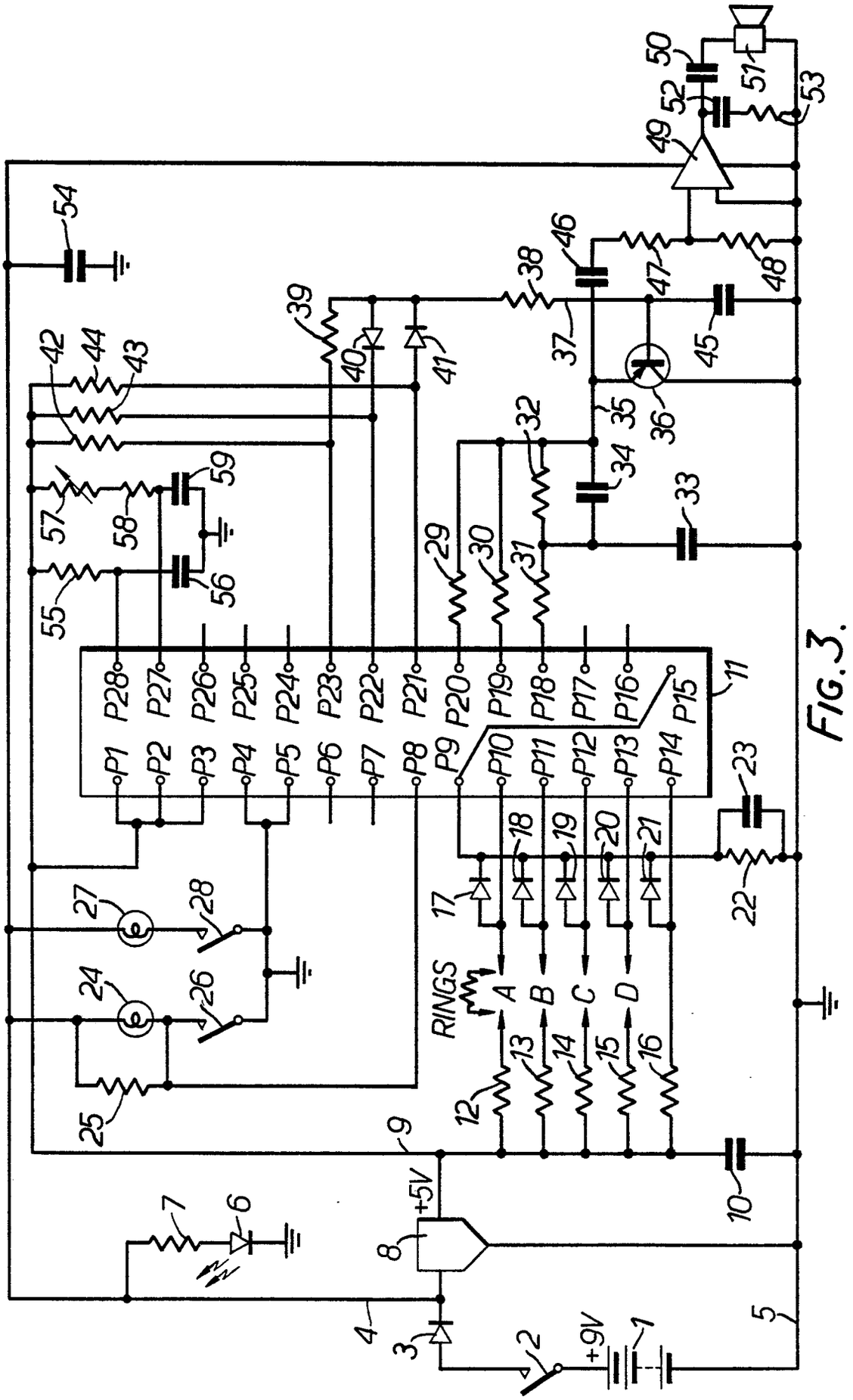

+9V
+5V
RINGS
A
B
C
D
P1
P2
P3
P4
P5
P6
P7
P8
P9
P10
P11
P12
P13
P14
P15
P16
P17
P18
P19
P20
P21
P22
P23
P24
P25
P26
P27
P28

FIG. 3.

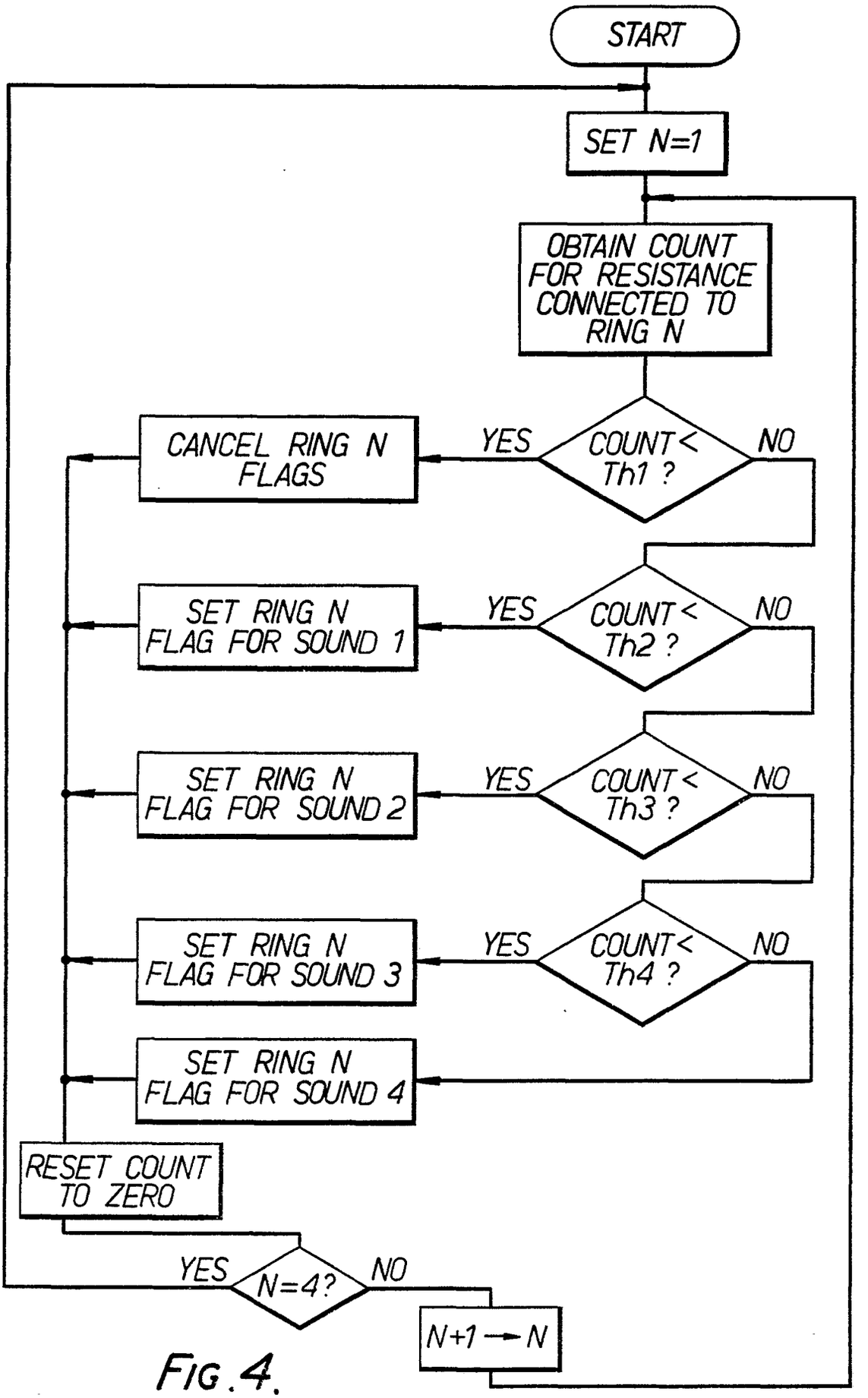

START
SET N=1
OBTAIN COUNT FOR RESISTANCE CONNECTED TO RING N
COUNT < Th1 ?
YES
NO
CANCEL RING N FLAGS
COUNT < Th2 ?
YES
NO
SET RING N FLAG FOR SOUND 1
COUNT < Th3 ?
YES
NO
SET RING N FLAG FOR SOUND 2
COUNT < Th4 ?
YES
NO
SET RING N FLAG FOR SOUND 3
SET RING N FLAG FOR SOUND 4
RESET COUNT TO ZERO
N=4?
YES
NO
N+1 → N

FIG. 4.

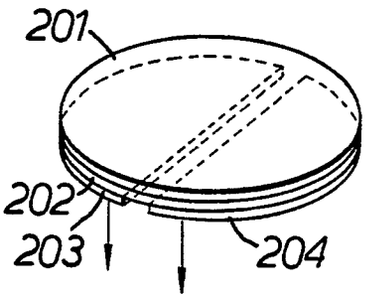


FIG. 5.

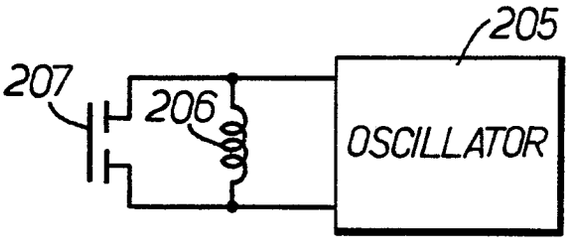


FIG. 6.

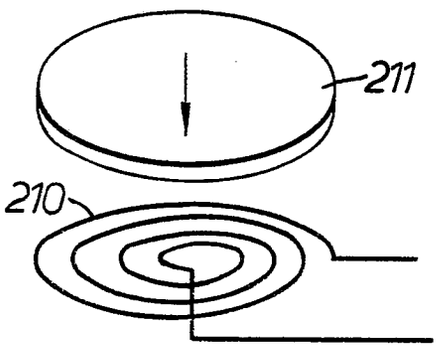


FIG. 7.

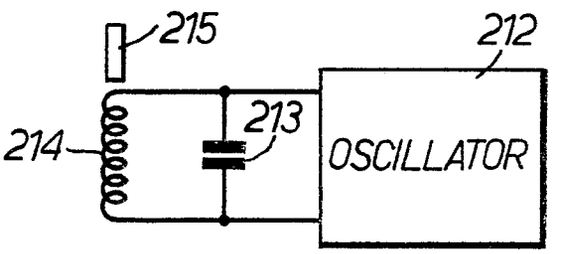


FIG. 8.

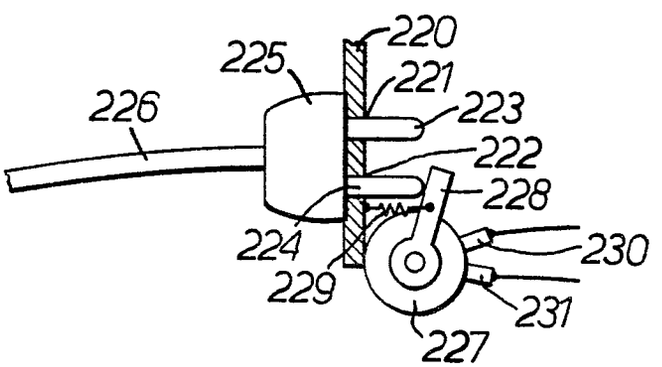


FIG. 9.

0018237

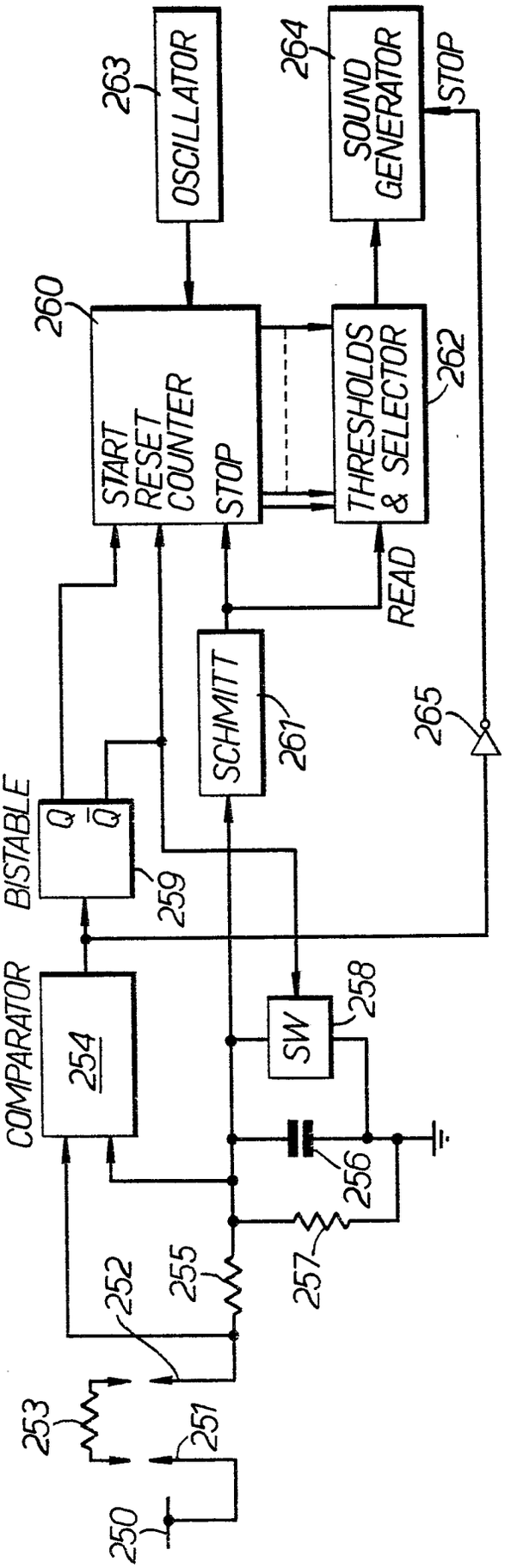


FIG. 10.

European Patent Office

EUROPEAN SEARCH REPORT

Application number 0018237

EP 80 30 1346

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim
X	ELECTRONICS, vol. 50, no. 13, 23th June 1977, pages 31-32 New York, U.S.A. "T1 makes noise in games, toys" * Pages 31-32 *	1,5,7, 8
	ELECTRONICS WEEKLY, no. 878, 13th July 1977, page 6 I.P.C. Electrical-electronic Press L.T.D. LONDON, G.B. P. GREGG: "The who pays the piper calls the tune" * Page 6 *	1-3
P	US - A - 4 177 657 (AYDIN) * Figure 4; column 10, line 26 - column 11, line 12 *	1,17
A	US - A - 3 664 060 (LONGNECKER)	1
A	ELEKTOR, vol. 3, no. 12, December 1977, pages 12-46, 12-47 Elektor publishers LTD Elektor house Canterbury, G.B. BOLLE: "Music box"	1,7

CLASSIFICATION OF THE APPLICATION (Int. Cl. 3)

G 10 H 1/26
A 63 H 33/30
A 63 H 3/52

TECHNICAL FIELDS SEARCHED (Int.Cl. 3)

A 63 H
G 10 H
E 05 B

CATEGORY OF CITED DOCUMENTS

X: particularly relevant
A: technological background
O: non-written disclosure
P: intermediate document
T: theory or principle underlying the invention
E: conflicting application
D: document cited in the application
L: citation for other reasons

&: member of the same patent family, corresponding document

K The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
The Hague	29-07-1980	HERBELET

EPO Form 1503.1 06.78