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(71) Applicant : **MOORWOOD VULCAN LIMITED**
Green Lane
Ecclesfield, Sheffield S30 3ZY (GB)

(72) Inventor : **Snowball, Malcolm R.**
"Woodside", 4 The Gables, The Plain
Epping, Essex (GB)

(74) Representative : **Adams, William Gordon et al**
RAWORTH, MOSS & COOK 36 Sydenham Road
Croydon Surrey CR0 2EF (GB)

(54) Cooker hobs.

(57) A glass ceramic cooker hob (10) comprising an induction heater (26) mounted on the underside thereof and arranged to heat the contents of a suitable utensil placed on a heating area (12, 14) of the hob. A plurality of illuminable devices such as incandescent lamps or light emitting diodes (20) is arranged under the hob around the heating area to define the area. A circuit is provided to energise the illuminable devices so that the intensity of the light emitted is dependent upon the power dissipated.

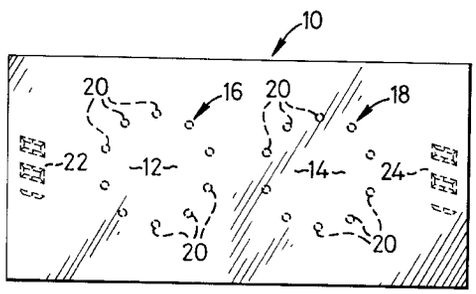

Fig. 1

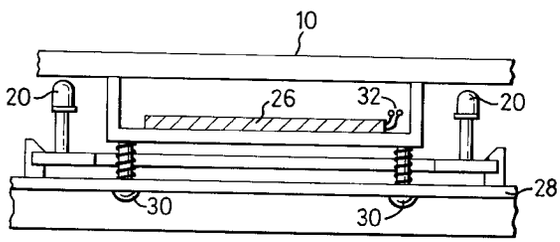

Fig. 2

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This invention relates to cooker hobs and concerns transparent or transluscent hobs which will be referred to hereinafter as glass ceramic cooker hobs.

Glass ceramic cooker hobs are now well known and have an advantage to the user that they present a flat, continuous surface which is relatively easy to clean. The heating areas, or zones, on the hob are generally indicated by etched or otherwise formed lines on one surface as decided by the hob manufacturer. In practice, that is all that is provided apart from a surface pattern, although it is also possible to obtain hobs which provide a visual indication in the form of a lamp which is illuminated to indicate that its associated heating area is hot. For example, in the case of a hob with four heating areas there may be four lamps arranged in a square to one side of the hob and arranged to be illuminated when the heater at its associated heating area is on. The lamp may be arranged to remain illuminated to indicate that the heating position of the hob is still hot after the heater has been switched off.

GB.1,346,574 discloses a glass ceramic hob comprising a resistive heating element for the or each heating area of the hob, whereby, in use, heat is transferred from the heating element to a cooking utensil placed on the heating area by way of the hob. One disadvantage of such a hob is that it is not clearly apparent to the user whether a particular heating area is hot. In such a hob it is important to provide an indication that such an area is hot not only for safety reasons but also for economic reasons to indicate that the heating element is energised. To indicate the heated area a source of illumination, such as a tungsten lamp is arranged to illuminate the or part of the heated surface. The light source can be arranged to illuminate a peripheral region of the heated area or a small number of discrete areas around the region to provide a clear indication to the user that the area is hot.

The heating means is invariably electrically energised and some, such as halogen heaters, will illuminate their associated heating area, the intensity of the illumination increasing with the power applied to the heating means.

Induction heaters are being introduced for use with cooker hobs, wherein the primary of the heater is mounted below the heating area of the hob and a suitable metal cooking utensil placed above the heating area acts as the secondary. Food in the utensil is cooked but the hob is not heated as is the case with, for example, radiant heaters. Thus, the safety risks are reduced but the user still has to look at the setting of the control to determine the amount of heat being developed in the utensil.

An object of the present invention is to provide such a hob with means for indicating which heating area is in use and in a development, some indication of the magnitude of the power being applied thereto.

According to the invention there is provided a glass ceramic cooker hob comprising induction heater means for heating the contents of a utensil placed on a predetermined heating area on the hob, means for indicating the heating area comprising a plurality of illuminable devices arranged around said area, and means for energising said illuminable devices. The illuminable devices may be arranged at or near the periphery of the heating area, for example substantially in a circle.

The illuminable devices may, preferably, be light-emitting diodes.

The means for energising may be arranged to energise the illuminable devices when power is supplied to the heating means.

The means for energising may be arranged to energise the illuminable devices at a first level when no power is supplied to the heating means and at a second level when power is supplied to the heating means.

The means for energising may be arranged to energise the illuminable devices at a variable level in dependence upon the magnitude of power supplied to the heating means.

The means for energising may be arranged to energise the illuminable devices in a predetermined sequence and the devices may be illuminated sequentially at a rate dependent upon the magnitude of the power supplied to the heating means.

The invention may further include a combination of two or more of the arrangements of the next preceding six paragraphs.

The invention will now be described by way of example with reference to the accompanying drawing, in which:

Fig.1 shows a plan view of a glass ceramic hob according to an embodiment of the invention,

Fig.2 is a side view of part of the hob of Fig.1 to a different scale,

Fig.3 is a circuit diagram of two light-emitting diode (LED) rings for the hob of Fig.1.

Fig.4 is a block circuit diagram of another LED drive circuit.

Fig.5 is a block circuit diagram of a further LED drive circuit.

Fig.6 is a schematic circuit diagram for a digital indicator for use with the hob of Fig.1.

Fig.7 is a circuit diagram of a further LED drive circuit.

In the drawings, like parts are given like references. Referring to Figs.1 and 2, there is shown a glass ceramic hob 10 suitable for use with the usual utensils such as pans (not shown).

Two heating areas 12, 14 are generally defined, in use, by two sets 16, 18 of light emitting diodes 20 mounted below the hob and which when energised shine through the hob 10 as shown.

Two alpha-numeric displays 22, 24 are also pro-

vided below the hob and their purpose will be described hereinafter.

Each heating area is provided with a similar heating means, one 26 of which is shown in outline in Fig.2.

The heating means comprises an inductance heater primary coil 26 resiliently mounted on a support bracket 28 by way of spring loaded bolts 30. Means 32 is provided for supplying current to the coil 26.

In use, a utensil of a suitable metal placed on the heating position will act as the secondary and food or other material placed in the utensil will be heated in known manner.

Fig. 3 shows a circuit diagram of an energising means for the LED's 20 of the heating positions 12, 14.

The circuit 32 comprises a d.c. power supply 34 having input terminals 36, 38 for connection to the 240V a.c. mains supply and output terminals 40, 42 arranged to supply a 24 volt d.c. supply to the two sets of L.E.D.'s. Each L.E.D. is coupled in series with a 1 K ohm resistor 21 and the L.E.D./resistor combination for each set is connected in parallel across the d.c. supply, so that as shown they provide a constant level of light through the hob 10 to the user. The d.c. supply to the L.E.D.'s can be switched on and off in any convenient way, for example, by way of a switch (not shown) in the a.c. live connection to the input terminals 36, 38; the switch being closed when power is supplied to the primary 26 of the induction heater.

Referring now to Fig.4, there is shown a circuit for energising a ring 16 or 18 in a manner dependent upon the power supplied to the associated heating means.

A filtered and smoothed bridge rectifier circuit 44 having input terminals 36, 38 for connection to the 240V a.c. mains has output terminals 46, 48 for connection to the ring circuit 16 (or 18).

Across the terminals 46, 48 is connected a 2.2 K ohm resistor 50 and a 15V zener diode 52 which supplies a stabilised 15 Volt supply to a square wave oscillator circuit shown within the broken line 54 and designed to have a pulse repetition frequency (p.r.f.) of about 300 Hz.

The oscillator comprises an integrated circuit amplifier 56 which could be, for example, one quarter of an integrated circuit type LM.324 (quad voltage comparator) as manufactured by National Semiconductor Corporation (N.S.C.) and is configured to operate as a square wave oscillator. By virtue of a feedback loop comprising diodes 58, 60 and variable resistor 62 the mark-space ratio of the square wave output can be varied substantially continuously over a wide range. Thus the current through the L.E.D.'s 20, which can be ultrabright L.E.D.'s type HLMP-D105 as manufactured by Hewlett Packard, is controlled by an NPN tranmsistor 64 having its base coupled to the output of the oscillator 54 as shown. The mark-space ratio of the signal applied to the base of transistor 64 and therefore the current to the L.E.D.'s 20 can be varied by variation of the resistance of resistor 62.

The control shaft of the resistor 62 is connected physically to the user's power control (not shown) for the induction heater which would normally be mounted on the front panel or near the top of the hob, such that as the heating power is increased the current through and therefore the brightness of the L.E.D.'s increases in sympathy therewith, for example, the illumination can be increased or decreased in a manner somewhat analagous to that of a gas ring. Thus, the user has an immediate indication of the power to be dissipated in a utensil placed on the associated heating position.

Referring now to Fig.5, there is shown a circuit for energising a ring 16 or 18 in a manner dependent upon the power supplied to the associated heating means.

The 15 Volt d.c. output from rectifier 44 is coupled to a variable p.r.f. square wave oscillator shown within the broken line 70 and comprising an amplifier 72, which may be one fourth part of an integrated circuit type LM.324, connected as shown to provide a square wave output variable between 0.1Hz and 5Hz.

The output of the oscillator 70 is coupled to the input of a divide by 10 circuit 74, which may be an integrated circuit type C.D.4017 (decade counter/divider) as manufactured by N.S.C.

Each of the ten L.E.D.'s 20A to 20J in a ring is coupled by way of serial resistors 76, 78 respectively between the positive and negative d.c. lines to energise the L.E.D.'s to a "half bright" level of illumination. Each of the L.E.D.'s 20A to 20J in the ring is also coupled to an associated NPN transistor 80A to 80J which is effectively arranged in parallel with associated resistor 78A to 78J. The base electrodes of the transistors are coupled to appropriate outputs of the divider 74.

In use when power is supplied to the associated heater 26, the output of the oscillator 70 is coupled by way of the divider 74 sequentially to the transistors 80A to 80J which are switched on in turn effectively to short circuit the associated resistor 78 and increase the current through and therefore the brightness of the associated L.E.D., "full brightness".

Thus, when the heating power is off the L.E.D.'s are all illuminated at "half brightness" and when heating power is supplied, the L.E.D.'s are illuminated at "full brightness" and sequentially around the ring at a frequency dependent upon p.r.f. of the oscillator 70.

By coupling the adjustment control of the variable resistor 82 which controls the p.r.f. of oscillator 70 to the user's power control for the heater the p.r.f. can be varied so as to increase with increase in heating power. Thus, as the power is increased the L.E.D.s are fully illuminated sequentially around the ring at a

rate which increases with increase in power to give the user an immediate indication of the heat to the transferred to the contents of a utensil placed on the heating position.

Referring now to Fig.6 there is shown a block circuit diagram of a digital indicator for use with the invention.

Means, such as a current transformer 84 arranged around the current supply lead 86 to the induction coil 26, is provided to generate a voltage across resistor 88 dependent upon the heating current. The voltage developed across resistor 88, which can conveniently be 1 volt for each amp flowing in line 86, is coupled by way of a 50 ohm impedance coaxial cable to the input of a voltage measuring device, such as an analog to digital converter or a digital voltmeter 90 having a three digit display 96. The display 96 can be arranged to display the converted voltage as 0 - 100 (another as 0 -9) or any other convenient manner.

The display 96 which can typically be a L.E.D. display can be mounted beneath the glass ceramic hob to be visible thereto to the user. The current transformer 84 could typically be a No.27 Ferrite Bead (Ferronics 11-122-B) wound with 25 turns of No. 30 enamelled wire.

Other alpha-numeric displays can be provided to provide information useful to the user, including a clock, a timer which can count up from zero, a timer which can count down to zero from a preset time and so on.

A timer could additionally be used to control the power to a heating position during a cooking operation and switch off the current to the heating coil at the end of a preset period.

Fig.7 shows another arrangement for energising a plurality of incandescent lamps or L.E.D.'s 20. A current transformer 98 arranged around the current supply lead 86 to the induction coil 26 is provided to generate a voltage across a resistor 100 which is dependent upon the heating current. The voltage developed across resistor 100 is coupled by way of a co-axial cable 102 to the base of a Darlington transistor 104 connected as an emitter follower circuit, the emitter being arranged to energise the devices 20. Thus, the devices 20 are energised at a power level dependent upon the current through the induction heater primary circuit 26.

It is also possible to drive the devices directly from the current transformer.

Claims

1. A glass ceramic cooker hob comprising induction heater means for heating the contents of a utensil placed on a predetermined heating area on the hob, means for indicating the heating position comprising a plurality of illuminable devices arranged around said heating area, and means for energising said illuminable devices.

2. A hob according to claim 1, wherein the illuminable devices are arranged substantially at or near the periphery of the heating area.

3. A hob according to claim 1 or 2, wherein the illuminable devices are light-emitting diodes.

4. A hob according to claim 1, 2 or 3, wherein the means for energising is arranged to energise the illuminable devices when power is supplied to the heating means.

5. A hob according to claim 1, 2, 3 or 4, wherein the means for energising is arranged to energise the illuminable devices at a first light intensity when power supplied to the heating means is less than a predetermined magnitude and at a second, higher light intensity when the power supplied to the heating means is greater than said predetermined magnitude.

6. A hob according to any one of the preceding claims, wherein the means for energising is arranged to energise the illuminable devices at a variable level in dependence upon the magnitude of power supplied to the heating means.

7. A hob according to any one of the preceding claims, wherein the means for energising is arranged to energise the illuminable devices in a predetermined sequence and the devices are illuminated sequentially at a rate dependent upon the magnitude of the power supplied to the heating means.

8. A hob according to any one of claims 1 to 4, wherein the illuminable devices associated with a heating area are coupled in parallel and the means for energising comprises a d.c. power supply coupled across the or each parallel connected plurality of illuminable devices.

9. a hob according to claim 8, wherein the d.c. power supply comprises a rectifier circuit having a.c. input terminals and further comprising means for coupling an a.c. supply to said terminals when power is supplied to said induction heater means.

10. A hob according to claims 6, wherein the illuminable devices associated with a heating area are coupled in parallel and the means for energising comprises a square wave oscillator having an output coupled to a parallel connected plurality of illuminable devices and means for varying the mark-space ratio of the square wave output sig-

nal.

11. A hob according to claim 11, wherein the means for varying the mark-space ratio of the square wave signal is coupled to means for varying the power to the associated heater means whereby the intensity of illumination emitted by the illuminable devices is varied in dependence upon the magnitude of the power supplied to the heater means.

12. A hob according to claim 7, wherein the means for energising comprises an oscillator having an output coupled energise individual ones of said illuminable devices whereby said devices are energised in a predetermined sequence.

13. A hob according to claim 12, wherein the oscillator is a variable frequency oscillator and comprising means for varying the frequency of oscillation in dependence upon the magnitude of the power supplied to the heater means.

14. A hob according to claim 7, 12 or 13, and dependent upon claim 5, wherein the means for energising the illuminable devices at said first level comprises means for coupling a d.c. voltage at a first magnitude to each of said illuminable devices when the power supplied to the heating means is less than the predetermined magnitude and for coupling the d.c. voltage at a second, higher magnitude when the power supplied to the heating means is greater than said predetermined magnitude.

15. A hob according to any one of the preceding claims, comprising an illuminable information display means and means for illuminating said display.

16. A hob according to claim 8, wherein the display means comprises alpha or numeric or both alpha and numeric characters.

17. A hob according to claim 6, comprising a current transformer arranged around a current supply lead to heater means, the current transformer output terminals being coupled to said illuminable devices.

18. A hob according to claim 17, further comprising an emitter follower circuit and wherein said current transformer terminals are coupled to the base of said emitter follower and the emitter is coupled to said illuminable devices.

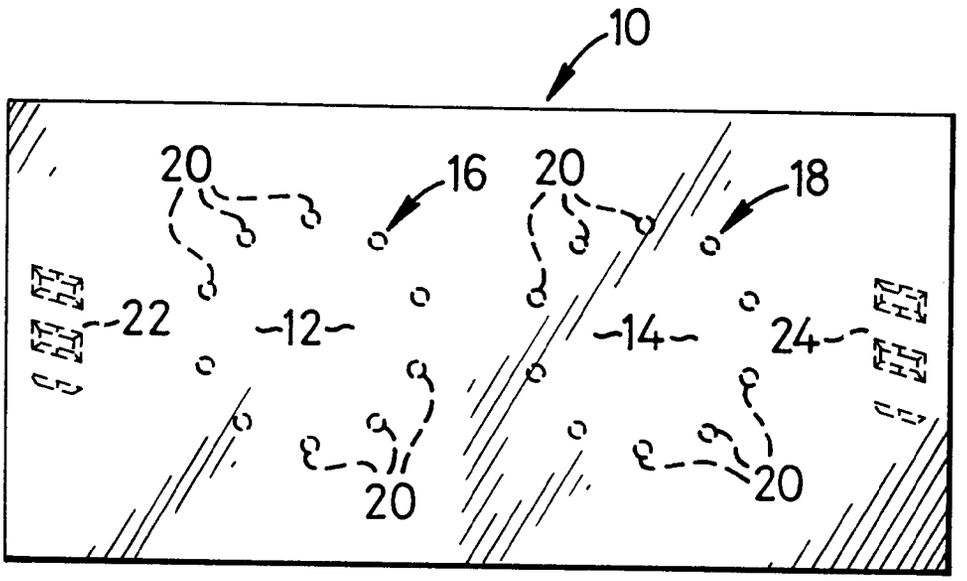

Fig. 1

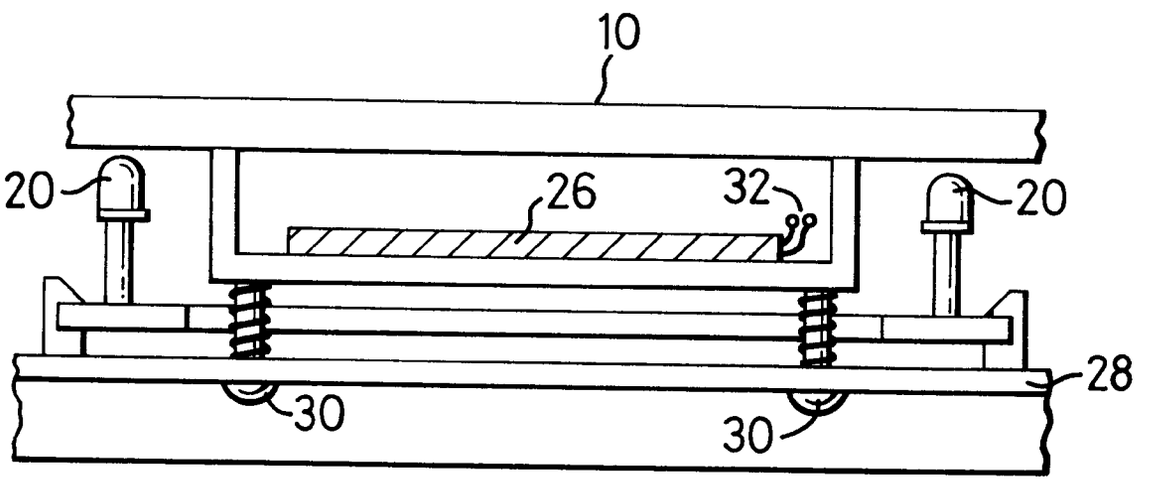

Fig. 2

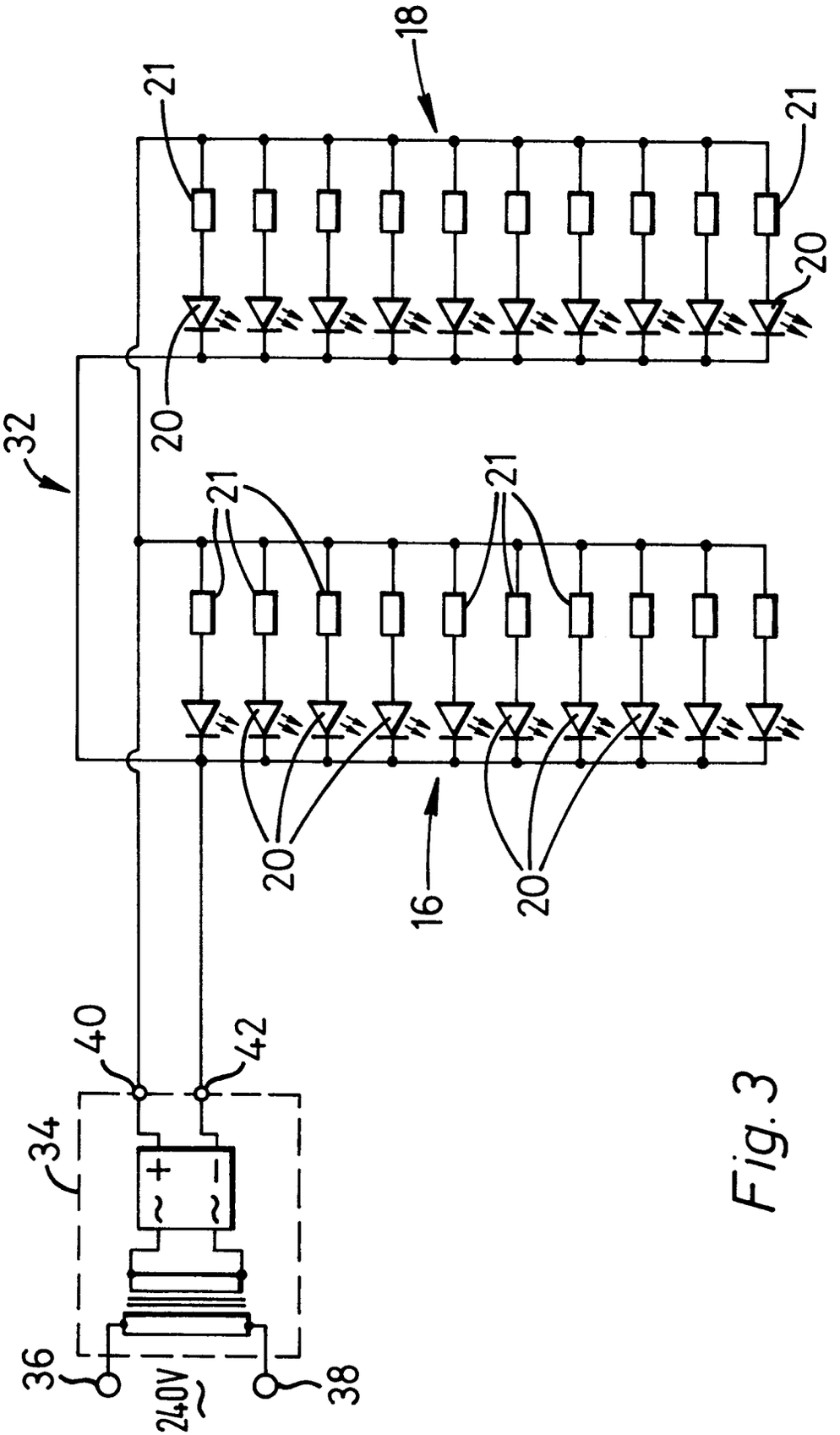

Fig. 3

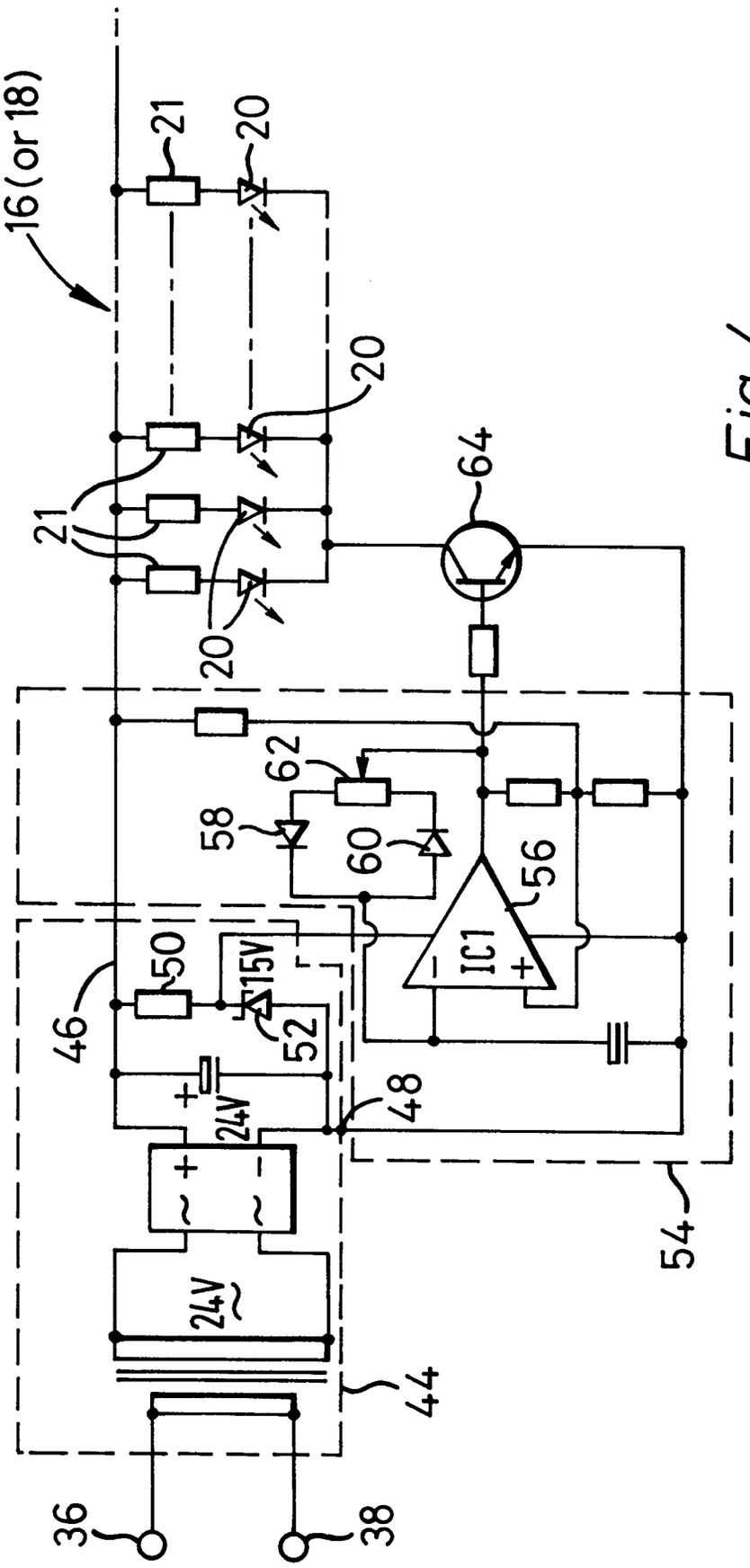
16 (or 18)
21
20
20
21
20
64
62
58
60
56
IC1
50
15V
52
46
48
24V
24V~
44
54
36
38

Fig. 4

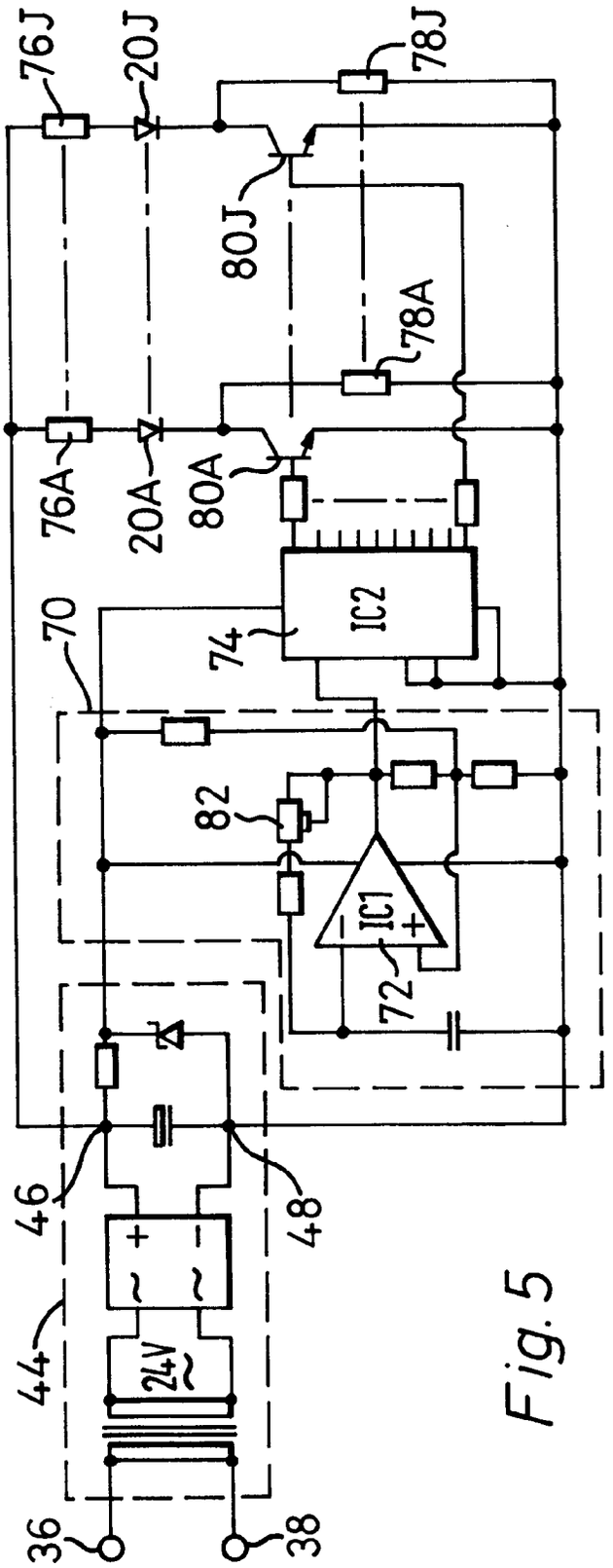
76J
20J
78J
80J
78A
76A
20A
80A
IC2
74
70
82
IC1
72
46
48
44
24V
36
38

Fig. 5

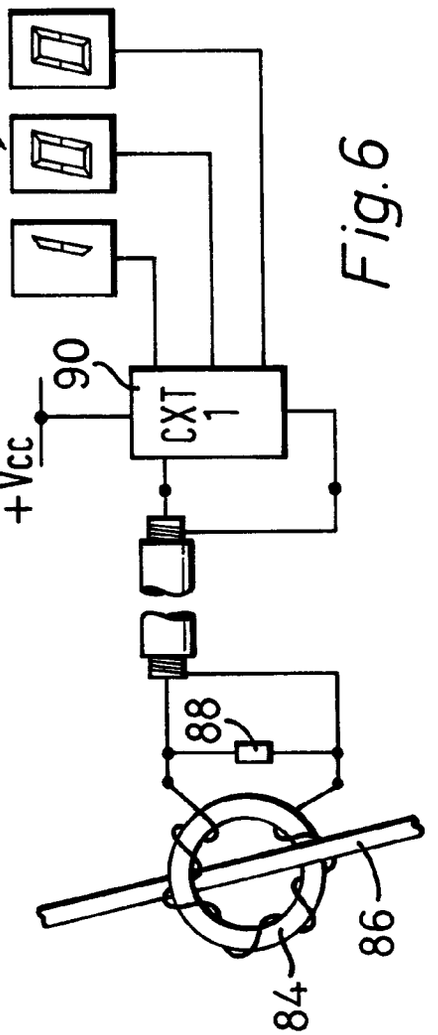
96
90
+Vcc
CXT
1
88
84
86

Fig. 6

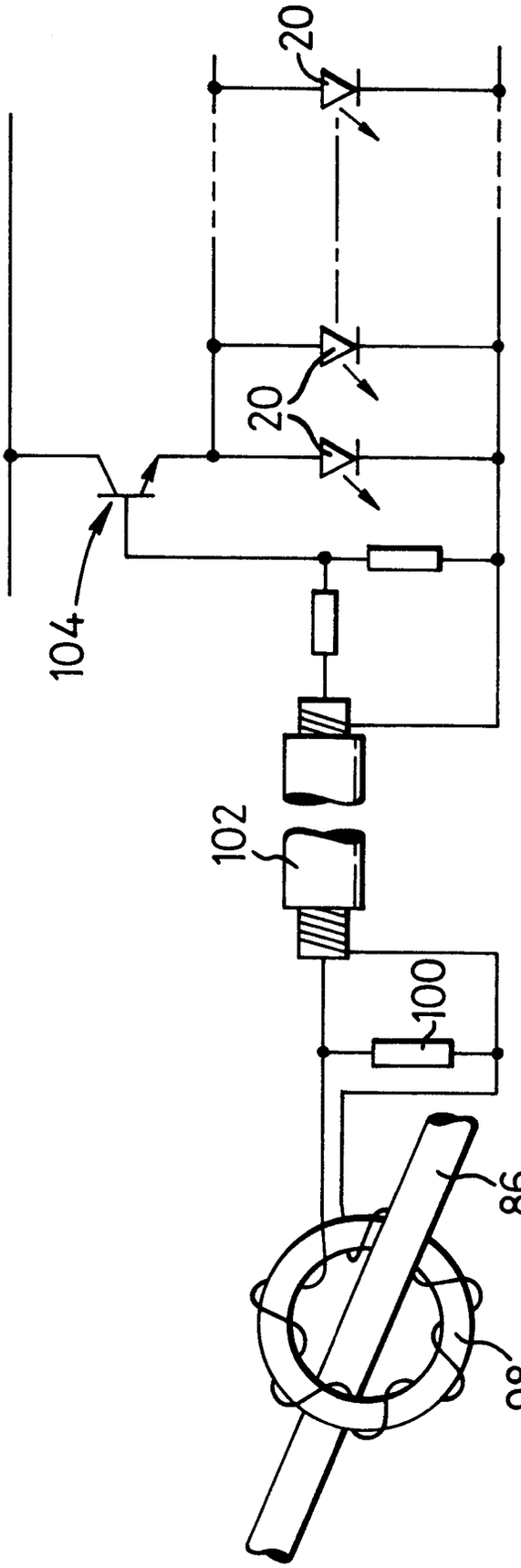

Fig.7

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EUROPEAN SEARCH REPORT

Application Number

EP 91 30 9687

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	DE-A-3 217 850 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * page 4, paragraph 3 * ---	1,2,4	F 24 C 15/10 H 05 B 3/74
P,Y	EP-A-0 438 656 (BOSCH-SIEMENS HAUSGERÄTE GMBH) * claims 1,2,11,18 * ---	1,2,4	
A	EP-A-0 359 028 (E.G.O. ELECTROGERÄTE BLANC U. FISCHER) * column 8, line 23 - column 9, line 8 * -----	6	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

F 24 C
H 05 B

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	17-01-1992	PIEPER C

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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L : document cited for other reasons

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