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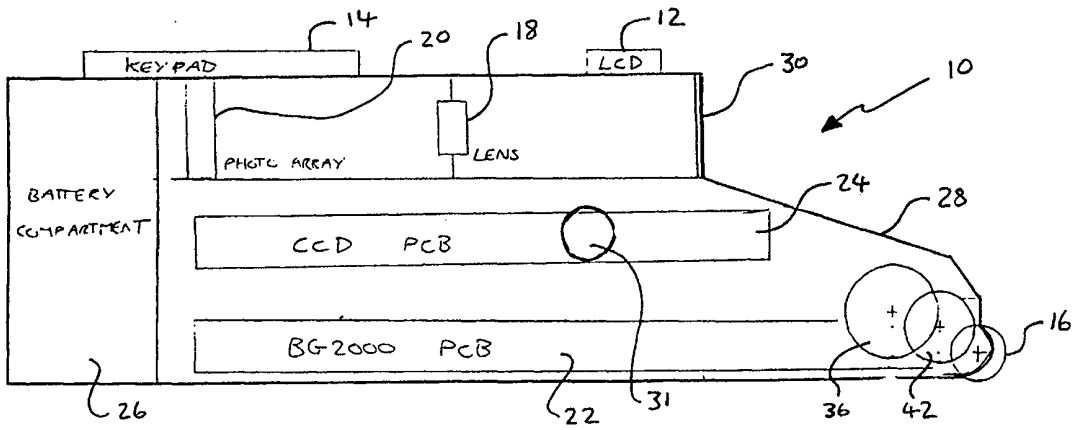
(54) Title: CONTENTS MEASURING APPARATUS AND METHOD AND STOCK CONTROL SYSTEM



(57) Abstract

A hand–held device for measuring the contents of containers and for use as part of a stock control system includes a barcode reader and a friction roller (16) and associated rotary encoder for measuring the distance from the top or bottom of a container to the surface of contents stored within the container. The measured distance is correlated with barcode information to calculate the contents of the container. The device may include on–board data storage and data–processing to perform volume calculations, or barcode information and distance measurements may be transmitted to a host data–processing system. The device is particularly suited for stock control purposes in licensed premises.

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Contents Measuring Apparatus and Method and Stock Control System

The present invention relates to apparatus and methods for determining the contents of containers. The invention is intended particularly, but not exclusively, for measuring the contents of containers such as bottles for stock-taking purposes.

Effective stock control is a long-standing problem in the licensed trade, particularly with regard to "broken stock"; i.e. bottles of spirits or the like which have been opened and partially used. Stock-taking methods with regard to such stock generally involve visual estimates of the remaining contents of partially-used bottles, and are notoriously inaccurate. The adoption of more accurate measurement methods is hampered by the fact that the bottles in question are commonly stored in gantries, fitted with "optic" dispensing devices, or on shelves etc.

It is an object of the present invention to provide improved apparatus and methods for measuring and logging the contents of containers such as bottles.

In accordance with a first aspect of the invention, there is provided apparatus for measuring the contents

of containers comprising a unit adapted for hand-held use and including:

measuring means for determining the distance from the top or bottom of a container to the surface of contents stored within the container; and

identifying means for identifying the type of a particular container being measured; characterised in that:

said measuring means comprises a friction roller and rotary encoding means associated with said friction roller.

Preferably, said identifying means comprises bar code reading means for reading standard retail bar codes applied to the containers to be measured.

Preferably, the bar code reading means is disposed in fixed spatial relationship with the friction roller of said measuring means.

Preferably, the apparatus further includes:

data storage means for storing data relating to a plurality of different types of container the contents of which the apparatus is to be used to measure; and

data processing means for calculating the amount of the contents of said particular container from said distance, the type of the container, and the stored data relating to the relevant type of container.

Preferably, said data storage means comprises memory means storing a database of information correlating measured linear distances with equivalent volumes for each type of container.

Preferably, the apparatus further includes wireless transceiver means whereby said device may communicate

with a host data processing system.

Preferably, the apparatus is adapted to transmit data representing said distance and/or the type of container to said host system.

In accordance with a second aspect of the invention, there is provided a stock control system comprising apparatus in accordance with the first aspect of the invention, in combination with a host data processing system.

Preferably, said host system includes data storage means for storing data relating to a plurality of different types of container the contents of which the apparatus is to be used to measure; and

data processing means for calculating the amount of the contents of said particular container from said distance, the type of the container, and the stored data relating to the relevant type of container.

Preferably, said data storage means is adapted to store a database of information correlating measured linear distances with equivalent volumes for each type of container.

In accordance with a third aspect of the invention, there is provided a method of measuring the contents of a container comprising:

measuring the depth of the contents of the container by means of a friction roller and associated rotary encoder means;

reading a bar code on the container to obtain details of the container; and

correlating said measured depth and said details with previously stored information regarding the

container type, and calculating the volume of said contents therefrom.

Preferably, the method is implemented by means of apparatus in accordance with the first aspect of the invention and/or a system in accordance with the second aspect of the invention.

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

Fig. 1 is a schematic, sectional side view of a first embodiment of a contents measuring device in accordance with the invention;

Fig. 2 is a schematic perspective view of the device of Fig. 1;

Fig. 3 is a block diagram illustrating the major components of the device of Fig. 1;

Figs. 4a, 4b and 4c are, respectively, plan, side and front views of a gear train mechanism forming part of the device of Fig. 1;

Fig. 5 is a schematic, sectional side view of a second embodiment of a contents measuring device in accordance with the invention;

Fig. 6 is a schematic plan view of the device of Fig. 5; and

Fig. 7 is a block diagram illustrating the major components of the device of Fig. 5 and an associated data processing system.

Referring now to the drawings, a measuring device embodying the invention comprises a battery powered, hand-held unit 10 including a visual display 12, such as a liquid crystal display (LCD), for data readout by the user and a keypad 14 or the like for data input and for controlling the operation of the device. The display 12 might suitably comprise a 16 character by 4 line display unit.

The device further includes distance measuring means comprising a friction roller 16 forming part of a rotary encoder assembly and bar code reading means including a lens 18 and photo array 20. The main electronic components for the device are mounted on a first printed circuit board (PCB) 22, and the electronics specific to the bar code reader are mounted on a second PCB 24. Power is supplied by batteries contained in a battery compartment 26.

The components of the device are enclosed in a housing 28, of a size and shape suitable for hand-held (single-handed) operation. The friction roller 16 is located at the front and bottom edge of the housing 28, for rotation about a horizontal, transverse axis. The bar code reading lens 18 and photo array 20 are located in the top portion of the housing, with a protective window 30 facing the front of the device (i.e. the optical axis of the bar code reading optics is substantially parallel to the longitudinal axis of the device and at right angles to the axis of rotation of the roller 16). The display 12 and keypad are located on the top surface of the housing 28 and the battery compartment 26 is in the rear portion of the housing 28. A control switch 31 is located on one side of the housing 28 for controlling the operation of the device.

Rotary encoders are well known and will not be described in detail herein. The preferred embodiment employs an optical type rotary encoder, using an infra red transmitter device 32 and infra red receivers 34 (Fig. 3). A slotted wheel 36 is disposed between the transmitter 32 and receivers 34, so that rotation of the wheel results in a pulsed output from the receivers 34. The number of pulses output by the receivers provides an indication of the number of revolutions of the slotted wheel 36.

The friction roller 16 is coupled to the slotted wheel 36 so that rotation of the friction roller causes rotation of the slotted wheel. Accordingly, the distance travelled by the roller when the device 10 is moved along a surface can be calculated from the number of pulses output from the receivers 34. Preferably, the roller 16 has a first toothed gear wheel 38 mounted on its shaft 40 for rotation therewith (Figs. 4a, 4b, 4c). Rotational movement of the roller 16 is transmitted to the slotted wheel 36 by the first gear 38 engaging a second toothed gear wheel 42 mounted on second shaft 44, which in turn engages a third toothed gear wheel 46 mounted on a third shaft 48 which also mounts the slotted wheel 36. The shafts 40, 44 and 48 are all substantially parallel to one another. The gear train connecting the roller to the slotted wheel is advantageous in preventing dust or other debris or contaminants picked up by the roller 16 being transferred to the slotted wheel 36 and possibly interfering with the optical path between the IR transmitter 32 and receivers 34.

The bar code reader (collectively identified by numeral 50 in Fig. 3) comprises a standard set of components for reading standard retail bar codes and will not be

described in detail herein. The bar code reading optics are mounted in fixed spatial relationship with the roller 16. If the roller 16 is placed in contact with an object when a bar code on the object is to be read, then the bar code reading optics will be (approximately) at a known distance from the bar code. This enables a relatively low-specification bar code reading system to be employed, reducing the cost and complexity of the device as a whole.

The main PCB 22 includes a microprocessor 52 and memory 54. The IR transmitter 32 and receivers 34 may be located on the PCB 22 at its forward edge, adjacent the slotted wheel 36, together with associated amplifiers 56 for amplifying the outputs from the receivers 34. The display 12, keypad 14, bar code reader 50 and amplifiers 56 are all connected to the processor 52. The memory 54 contains a database of information correlated with bar code information and also acts as a data-logging store.

The roller 16 and rotary encoder can thus be used to measure linear distances, calculated by the processor 52 from the pulsed output from the amplifiers 56. These distances can be correlated with information obtained from the bar code reader 50 and stored in the memory 54 to calculate a volume corresponding to a linear distance.

For measuring the contents of bottles in a bar environment or the like, the device is used as follows.

The operator places the roller 16 in contact with the surface of a bottle adjacent the standard retail bar code label on the bottle and depresses the control switch 31. The bar code is read and decoded, and the

brand and package size can be displayed for verification purposes. The roller 16 is then run vertically along the surface of the bottle to measure the distance between the top or bottom of the bottle and the surface of the liquid contained therein. The system software is adapted to detect the direction of motion of the roller, so that measurements can be made of bottles mounted upside down in a gantry with an optic dispensing device and bottles free-standing on a supporting surface.

The bar code information yields the product brand and the size of the bottle. The system database stores information for each brand and bottle size, allowing a volume to be calculated from a distance travelled along the surface of the bottle. The calculated volume is then stored along with the product brand and bottle size, for stock control purposes. The software can also allow for additional liquid volume held in the optic dispenser of a gantry-mounted bottle. Reverse movement of the device during a measurement can also be detected and compensated for.

The bar code reader can also be used to collect data relating to "unbroken" stock (unopened bottles) and any other stock items having retail bar codes. Unreadable bar codes can also be keyed in manually. Information regarding bottles without bar codes can also be keyed in manually, allowing at least an estimate to be made of the contents of such bottles. Other stock control data can also be input manually via the keypad. The device can thus be used as the basis of a complete stock control system for a bar or similar business operation.

For measuring the contents of bottles, the device

relies on the liquid level within the bottle being visible to the operator. A very few types of bottle may be so opaque that this is not possible, requiring manual input of an estimated volume. The device might further be provided with a light source to illuminate the bottle, to assist in viewing the liquid level in semi-opaque bottles. However, the large majority of brands encountered in practice will present no difficulty in this regard.

The rotary encoder may be configured to provide any required degree of resolution/accuracy. A system providing 4 counts per millimetre is easily achievable, giving accuracy substantially better than 1% for spirit bottles and the like. The system software may also compensate for the "dead zone" arising from the roller 16 abutting a horizontal supporting surface. The path followed by the roller along the surface of the bottle would have to deviate substantially from the vertical before such deviation would have any significant influence on the accuracy of the measurement.

The device may further be provided with standard data ports (not shown) allowing connection to a separate computer, printer or other device. This allows collected data to be downloaded from the unit and new database information to be uploaded to the device.

The use of a friction roller/rotary encoder to determine the depth of liquid in the bottles is particularly advantageous. Other possible distance measuring techniques such as optical (laser) or acoustic (ultrasonic) systems, or even manual measurement have various disadvantages in practice. The use of a friction roller is reliable and is particularly suitable for measuring the contents of

gantry-mounted bottles. The device requires no further tuning or calibration after manufacture.

The friction roller 16 of the described embodiment is a free-wheeling roller. However, it could be positively driven by an electric motor or the like if required.

Figs. 5 to 7 illustrate an alternative, preferred embodiment of a measuring device in accordance with the invention. The basic principle of operation of this embodiment is substantially similar to the first embodiment, but with a number of differences as shall be described below.

The device again comprises a hand-held unit 110 having a housing 128, visual display 112, keypad 114, friction roller 116, bar code reader 118, a first, main PCB 122, a second PCB 124 associated with the bar code reader 118, a battery compartment 126 and main control switch 131, broadly similar to those of the first embodiment.

In this case, the housing 128 has an enhanced ergonomic design comprising a handle portion 202, a head portion 204 and a nose portion 206, suitably formed from moulded plastic material. The visual display 112 is located on a top surface of the head portion 204, the keypad 114 on a top surface of the handle portion 202 and the control button 131 is located between the visual display 112 and keypad 114. The contact wheel 116 is located in the nose portion 206 at the forward and lowermost extremity of the unit 110. The bar code reader 118, PCBs 122 and 124 and battery compartment 126 are enclosed within the housing 128. The friction roller 116 again forms part of a rotary encoder assembly which may be similar to that of the first embodiment, including a similar gear train. In this

embodiment, the slotted integrating wheel and electronic components specific to the rotary encoder are mounted on a further PCB 208, located in the nose portion 206 of the housing 128, rather than being incorporated into the main PCB 122.

In this embodiment, the window of the barcode reader 118 faces out of one side of the device (i.e. the optical axis of the bar code reading optics is substantially at right angles to the longitudinal axis of the device and parallel to the axis of rotation of the roller 16). This improves the ergonomics of the device for efficient single-handed operation.

The present embodiment may include memory means providing an on-board database of information correlated with bar code information and acting as an on-board data-logging store as in the previous embodiment. However, it is preferred that the device includes wireless transceiver means 210, including an antenna 212, most preferably radio transceiver means, whereby the device may communicate in a dynamic, interactive manner with a host computer system or other information processing system such as a "smart" till, point-of-sale (POS) system or the like. In this way, the device may form an integrated part of a sophisticated stock control system, which may be networked on a local or wide-area basis by any suitable communications channels. RF screening such as indicated at 213 may be incorporated into the device in order to isolate the transceiver module 210 from the other electronic components as required.

Fig. 7 is a block diagram illustrating the main components of the device and of a host system. The device includes the distance measuring means 116/208,

barcode reader 118, keypad 114, display 112, CPU 152 and transceiver module 210. The host system might typically comprise a computer having a CPU 214, local data storage 216, input/output devices such as a keyboard 218 and visual display unit (VDU) 220, a transceiver module 222 for communicating with the hand-held device and, where applicable, onward connections to local or wide-area networks 224.

In an integrated system of this type, it is unnecessary for the hand-held device to store a complete database of product information on-board, does not need to calculate volumes from distance measurements, does not need to store the results of such calculations, and does not require periodic uploading and downloading of data. The necessary database information, data-processing and data-logging can be performed by the computer or wider system with which the device is in communication. It is only necessary for the device to transmit the relevant barcodes and associated measurements to the local host (unbroken stock items only require the barcode information or other data identifying the item to be transmitted). Of course, the device/system could operate in a variety of different ways; e.g. with an on-board cache of database information and limited on-board data processing and logging, rather than being in constant two-way communication with the local host.

In an alternative embodiment, the hand-held device might be adapted simply to log distance measurements and barcode data which can be downloaded periodically to a host system by any suitable means (wireless or otherwise), the host system containing the required product information database and performing the necessary data-processing to calculate volumes from

distance measurements.

This type of interaction with a host system enables the device to operate with an unlimited range of stock without requiring expensive on-board memory and data-processing resources.

Improvements and modifications may be incorporated without departing from the scope of the invention as defined in the Claims appended hereto.

Claims

1. Apparatus for measuring the contents of containers comprising a unit adapted for hand-held use and including:

measuring means for determining the distance from the top or bottom of a container to the surface of contents stored within the container; and

identifying means for identifying the type of a particular container being measured; characterised in that:

said measuring means comprises a friction roller and rotary encoding means associated with said friction roller.

2. Apparatus as claimed in Claim 1, wherein said identifying means comprises bar code reading means for reading standard retail bar codes applied to the containers to be measured.

3. Apparatus as claimed in Claim 2, wherein the bar code reading means is disposed in fixed spatial relationship with the friction roller of said measuring means.

4. Apparatus as claimed in any preceding Claim, further including:

data storage means for storing data relating to a plurality of different types of container the contents of which the apparatus is to be used to measure; and

data processing means for calculating the amount of the contents of said particular container from said distance, the type of the container, and the stored data relating to the relevant type of container.

5. Apparatus as claimed in any preceding Claim,

wherein said data storage means comprises memory means storing a database of information correlating measured linear distances with equivalent volumes for each type of container.

6. Apparatus as claimed in any preceding Claim, further including wireless transceiver means whereby said device may communicate with a host data processing system.

7. Apparatus as claimed in Claim 6, wherein the apparatus is adapted to transmit data representing said distance and/or the type of container to said host system.

8. A stock control system comprising apparatus as defined in any preceding Claim, in combination with a host data processing system.

9. A system as claimed in Claim 8, wherein said host system includes data storage means for storing data relating to a plurality of different types of container the contents of which the apparatus is to be used to measure; and

data processing means for calculating the amount of the contents of said particular container from said distance, the type of the container, and the stored data relating to the relevant type of container.

10. A system as claimed in 9, wherein said data storage means is adapted to store a database of information correlating measured linear distances with equivalent volumes for each type of container.

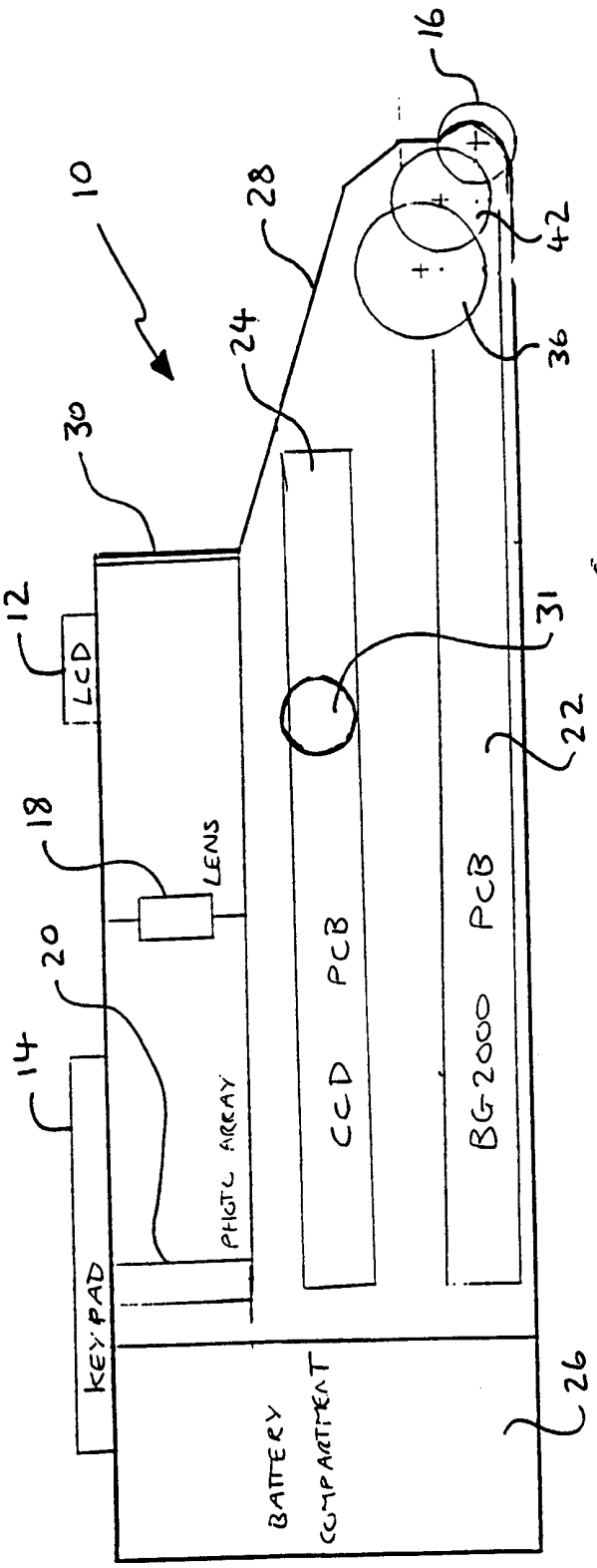
11. A method of measuring the contents of a container comprising:

measuring the depth of the contents of the container by means of a friction roller and associated rotary encoder means;

reading a bar code on the container to obtain details of the container; and

correlating said measured depth and said details with previously stored information regarding the container type, and calculating the volume of said contents therefrom.

12. A method as claimed in Claim 11, implemented by means of apparatus as claimed in any one of Claims 1 to 7 and/or a system as claimed in any one of Claims 8 to 10.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CCD PCB
BG-2000 PCB
BATTERY COMPARTMENT

FIG. 1

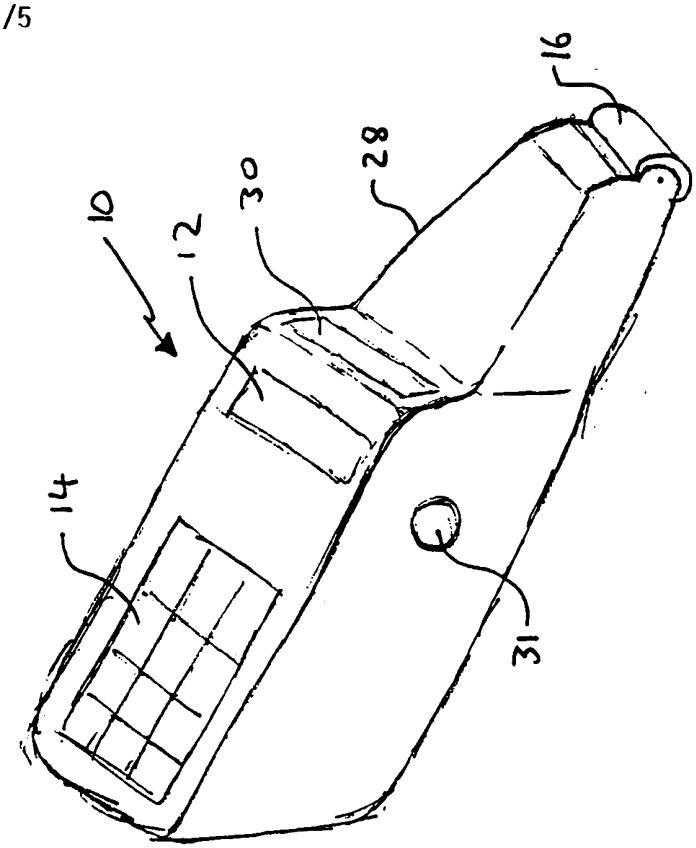
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FIG. 2

FIG. 3

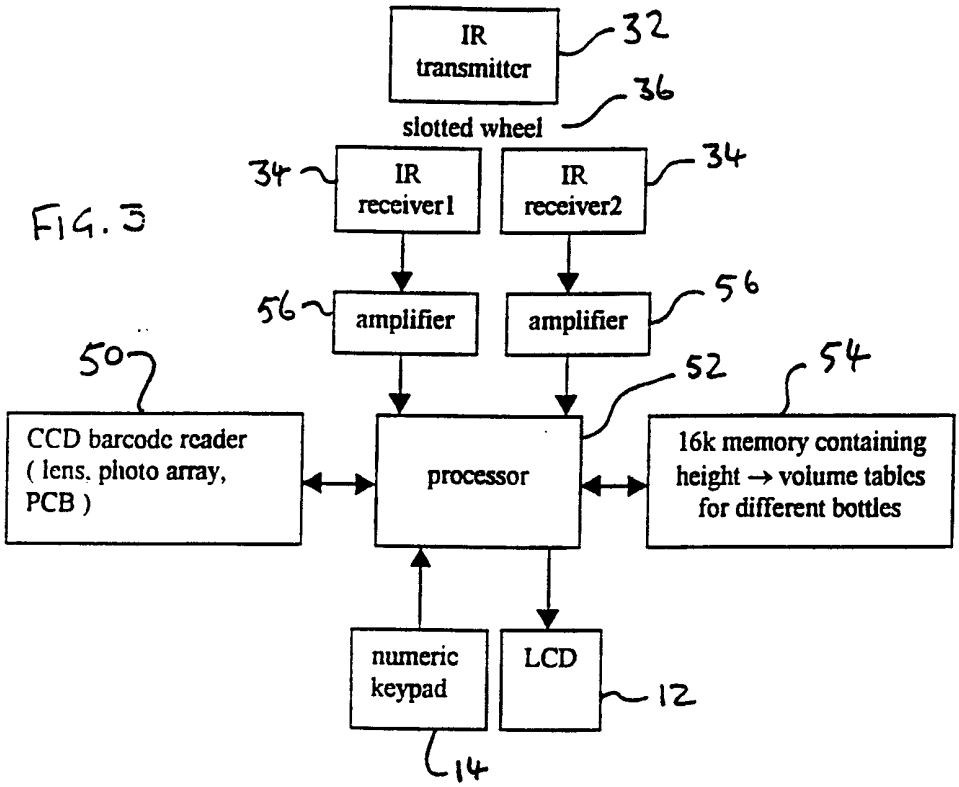


FIG. 4a

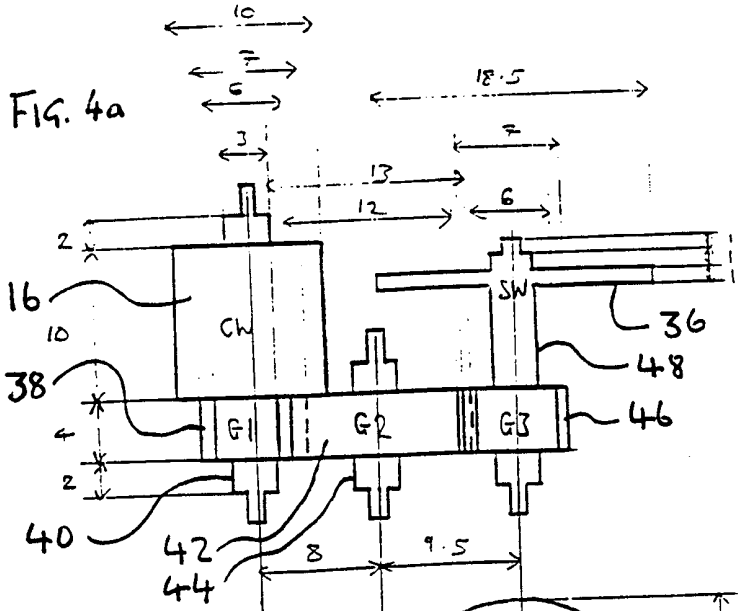
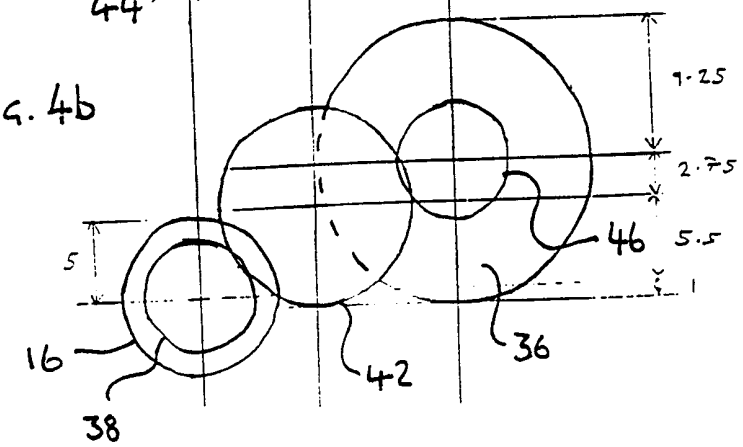


FIG. 4b



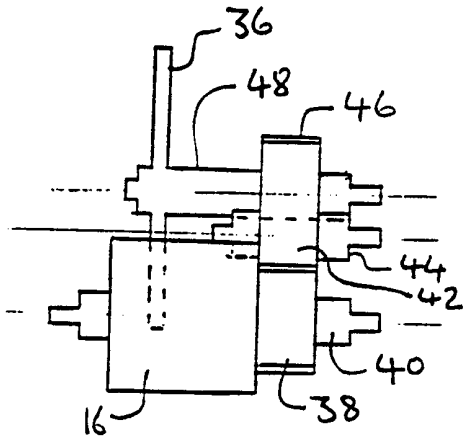


FIG. 4c

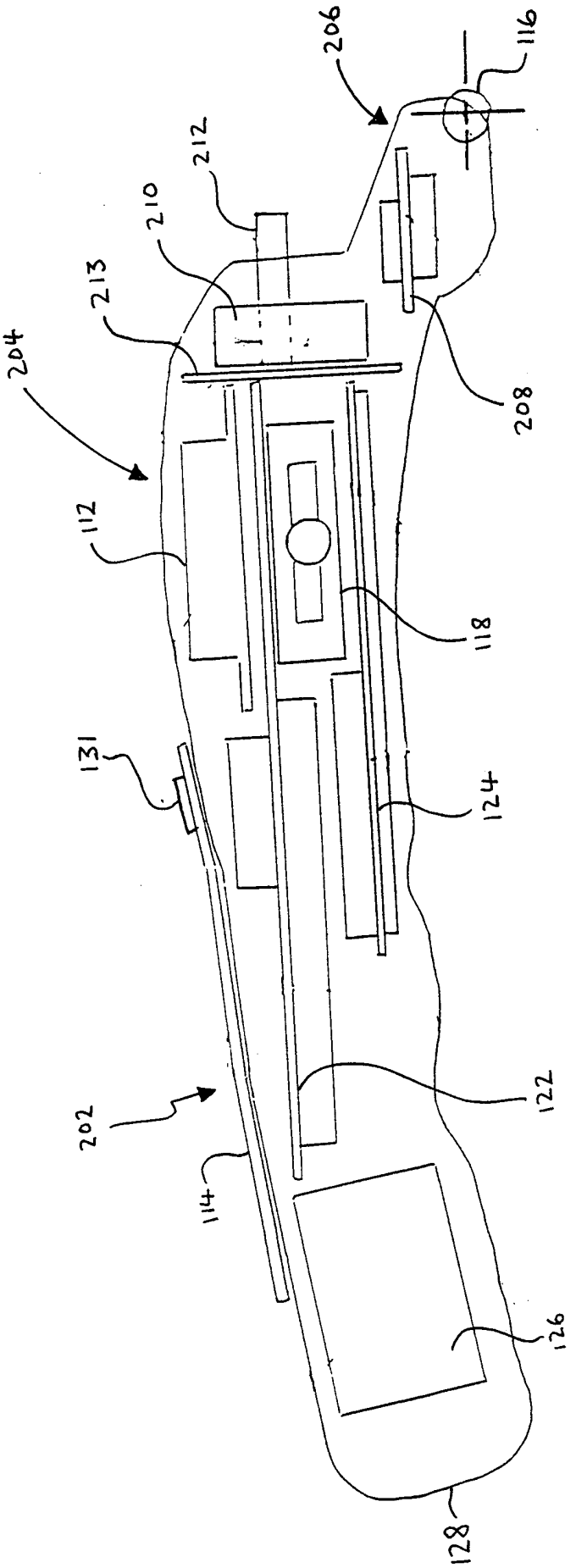


FIG. 5

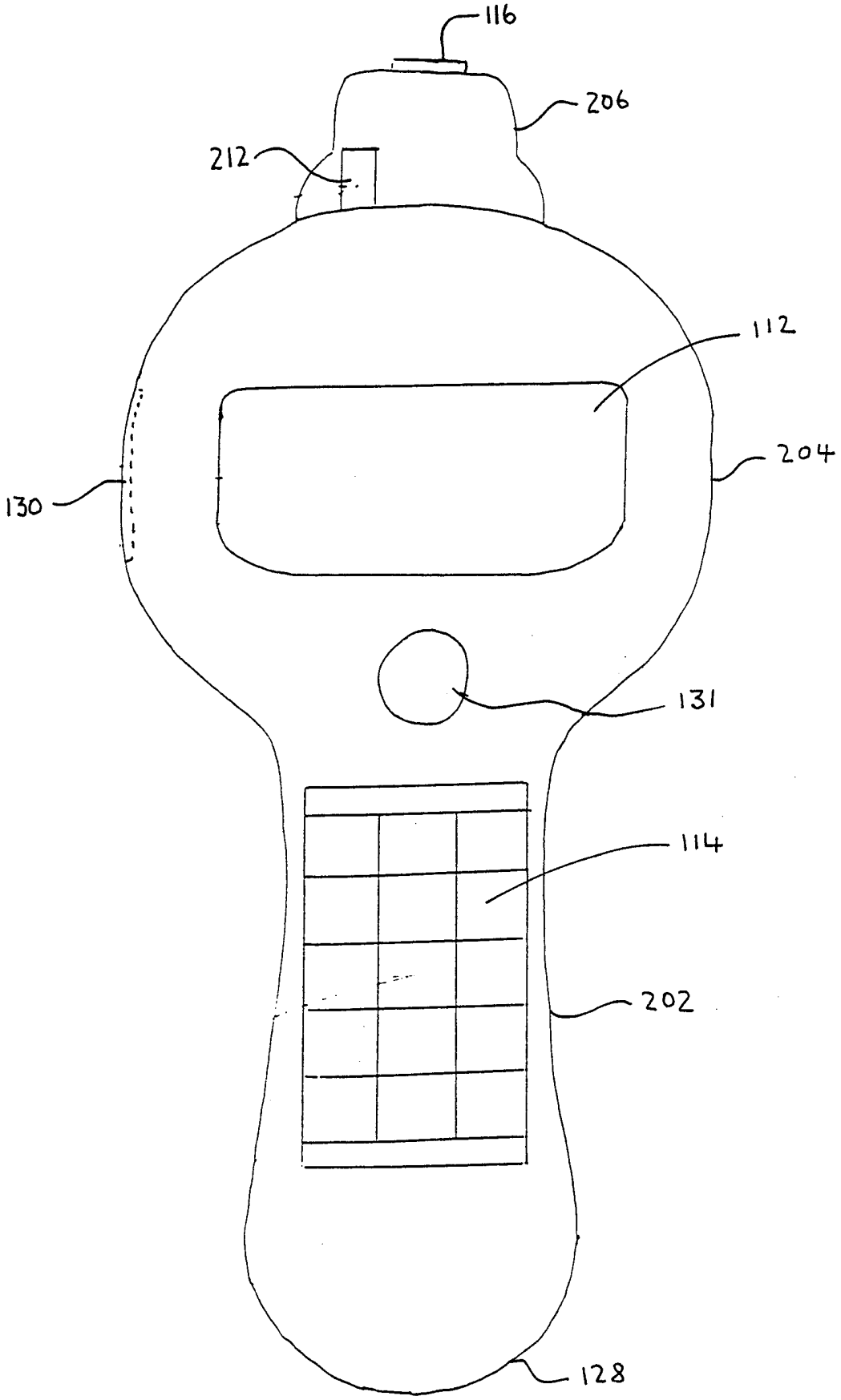
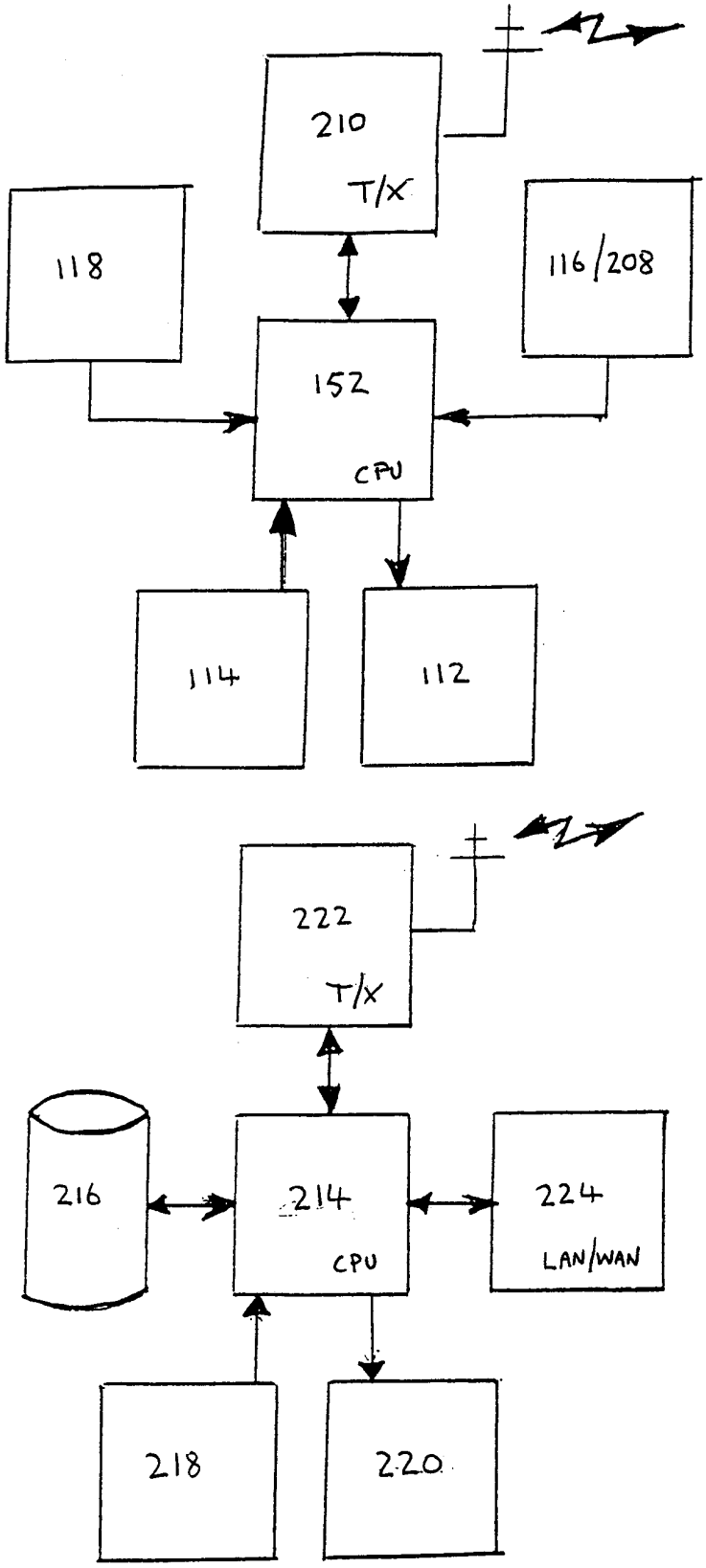


FIG. 6

Fig.7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INTERNATIONAL SEARCH REPORT

Int tional Application No
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A. CLASSIFICATION OF SUBJECT MATTER
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According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
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Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category °	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5 755 918 A (CHRISTOPHER AMY S ET AL) 26 May 1998 (1998-05-26) column 2, line 26 - line 49 column 3, line 9 - line 41 column 4, line 37 - line 50 column 6, line 55 - line 67 figures 1-7	1-3,6-8
Y	---	4,5,9-12
Y	EP 0 770 859 A (ENDRESS HAUSER GMBH CO) 2 May 1997 (1997-05-02) column 3, line 55 -column 4, line 34 figure 1	4,5,9-12

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