

AUSTRALIA

PATENTS ACT 1990

PATENT REQUEST: STANDARD PATENT

666263

We, ESSELTE METO INTERNATIONAL GmbH, being the person identified below as the Applicant, request the grant of a patent to the person identified below as the Nominated Person, for an invention described in the accompanying standard complete specification.

Full application details follow.

Applicant: ESSELTE METO INTERNATIONAL GmbH

Address: Westerwaldstrasse 3-13, D-64646 Heppenheim, Germany

Nominated Person: As above

Address: As above

Invention Title: "INDUCTIVELY CHARGED TAG"

Names of actual inventors: Chris ESCRITT and Magnus HELLQUIST

BASIC CONVENTION APPLICATION DETAILS:

Application Number: 9309246.8

Country: United Kingdom

Country Code: GB

Date of Application: 5th May, 1993

Basic Applicant: Esselte Meto International GmbH

Drawing number recommended to accompany the abstract: Figure 1

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DATED this 2nd Day of May, 1994
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by

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 of SHELSTON WATERS

To: The Commissioner of Patents
WODEN ACT 2606

File: 17437
Fee: \$283.00

AUSTRALIA

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NOTICE OF ENTITLEMENT

We, ESSELTE METO INTERNATIONAL GmbH, of Westerwaldstrasse 3-13, D-64646 Heppenheim, Germany, being the applicant and nominated person in respect of Application No. 61825/94, state the following:-

1. The person nominated for the grant of the patent has entitlement from the actual inventors as follows:

If a patent were granted to the actual inventors in respect of the invention the nominated person would be entitled to have the patent assigned to it.

2. The person nominated for the grant of the patent is the applicant of the basic application listed on the patent request form.

3. The basic application listed on the patent request form is the first application made in a Convention country in respect of the invention.

For and on behalf of

ESSELTE METO INTERNATIONAL GmbH



(Signature)

20th November, 1995

(Date)

Name: Peter R. Heathcote

Title: Patent Attorney

File: 17437



AU9461825

(12) PATENT ABRIDGMENT (11) Document No. AU-B-61825/94
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 666263

(54) Title
INDUCTIVELY CHARGED TAG

International Patent Classification(s)
(51) G09F 019/00 G06F 015/21

(21) Application No. : 61825/94

(22) Application Date : 02.05.94

(30) Priority Data

(31) Number (32) Date (33) Country
9309246 05.05.93 GB UNITED KINGDOM

(43) Publication Date : 10.11.94

(44) Publication Date of Accepted Application : 01.02.96

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(56) Prior Art Documents
US 4962466
US 4500880
GB 2247760

(57) Claim

1. Electronic shelf price display system, with a computer, a control transmitter linked thereto, as well as electronic display units attached to the edges of the shelves, wherein

- at least one shelf equipped with display units is or are provided with electrically conductive transmission elements, which are supplied with an alternating current by means of the control transmitter and which radiate electromagnetic power.

- the control transmitter via the transmission elements transmits data packets, which contain the display data and are separated periodically therefrom by means of intervals, to the display units, and

- in the display units at least one element is provided for the reception of the power radiated by the transmission elements, the element feeds a rechargeable power source with a charging current, the rechargeable power source supplies at least a part of the operating power of the display units, characterised in that, the transmission elements are attached adjacent to the display units on the edges of the shelves, and in that the component elements of the display units inductively receive the power radiated from the transmission elements and in that the control transmitter furnishes the transmission elements with an alternating current in the intervals between the data packets and charges the power sources of the display units.

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AUSTRALIA

PATENTS ACT 1990

C O M P L E T E S P E C I F I C A T I O N

FOR A STANDARD PATENT

O R I G I N A L

Name of Applicant: ESSELTE METO INTERNATIONAL GmbH

Actual Inventors: Chris ESCRITT and Magnus HELLQUIST

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Invention Title: "INDUCTIVELY CHARGED TAG"

The following statement is a full description of this invention,
including the best method of performing it known to us:-

INDUCTIVELY CHARGED TAG

The system relates to an electronic shelf price display system, with a computer, a control transmitter connected thereto affixed to the edges of the shelves, together with
5 electronic display units, wherein at least one shelf with display units attached to it is equipped with electrically conducting transmitting elements, which are fed with an alternating current by the control transmitter and radiate electromagnetic energy; the control transmitter transfers data
10 packets containing the display data to the display units through the transmitting elements, and which are separated from one another by temporal intervals, and in the display units a component element for the reception of the energy radiated by the transmitting elements is located, which feeds
15 a charging current to a chargeable power supply to furnish at least part of the operating current of the display unit.

In modern retailing practice, bar codes are increasingly being employed to identify the type and the price of merchandise. These have resulted in a reduction in the use of individual
20 price tags or stickers on each article of merchandise; rather, price indication is now made by means of a tag or label which is applied to the shelf on which the article for sale is located. However, there is no guarantee that the price shown on the label is in agreement with that in the store computer
25 used for billing at the checkout, and this can lead to customer complaints, and possible legal action against the store owners. Furthermore, up-dating such shelf-edge labels is relatively labour-intensive, as each label has to be produced and replaced manually.

Hence electronic price display tags have been developed for use instead of conventional stickers, which attache to the shelf edges to visibly display price and other information relating to the articles of merchandise. As the display units are connected with the store computer, it is ensured that the price displayed on the tag agrees with that charged at the checkout. Moreover, it is a simple matter to update the information on any particular display unit from the central computer. This is effected by means of a transmission incorporating a specific address code unique to each display unit or group of display units, and price data relating to the merchandise associated with the display unit or group of display units. In this way price changes, for example promotional discounts, may be readily effected, at minimum cost.

Patent No. US-A-4,500,880 discloses electronic display systems which are physically connected to the store computer and a power supply by means of conductive wires. These systems have the disadvantage that the hard-wiring connection is a very time-wasting process if the display units are to be frequently moved. The connecting contacts between the display units and the connecting wires are subject to wear and tear and breakage, which results in unreliable data and/or power transmission to the display units.

Another system of similar type is that disclosed in Patent DE 37 31 852 A1: So that hard-wiring the display units may be dispensed with, these are powered by internal batteries. Information to be transferred is transmitted from the store computer by means of radio transmission via wires located above the shelves. Data are transmitted to the display units to be updated in packets with intervals between them, in which no reflected rays occur. As an alternative to batteries, electrical power supplied to the display units may be achieved by means of accumulators or capacitors of adequate capacity, which may be charged during transmission of data packets by

means of electromagnetic energy being received. Furthermore, it is recommended that the display units be exposed to and charged with electromagnetic energy from a separate transmitter outside of trading hours.

- 5 Also disadvantageous in this case is, primarily the relatively inefficient energy transmission to the display units is noteworthy. As the wires serving as transmission elements are located above the shelves and in addition to this are screened by them, it has come to be considered as essential that a
- 10 sufficiently high field strength of the power supply for charging and for error-free data transmission to the - relatively widely-spaced out - display units, to use a correspondingly high transmission power, such entailing on the one hand the need for higher technical cost and energy drain
- 15 and on the other hand, electronic apparatus installed nearby (such as scales or checkout machines) are affected by induced currents. What is more, charging is only possible during transmission of data packets, which is why the field strength for transmission is further increased. Also the staff and
- 20 clients are exposed to relatively intense electromagnetic fields. In a charging operation carried out outside of trading hours large and expensive accumulators or capacitors of high load capacity are required, however, in order that the operational capability of the display units throughout the
- 25 hours of trading be guaranteed.

Emanating from the prior art, the invention embraces the problem of creating a functionally secure system for an electronic price display on shelves, which by means of error-free and efficient energy and data transmission marks the

30 prices on the display units. It is the intention to put into practice a system, which exhibits not only the flexibility of wireless communication between the computer and the display units, but also the dependability of display units supplied with power by hard-wired connections.

The problem is solved by means of this invention, in that the transmitter elements are mounted on the shelf edges in the proximity of the display units, that the built-in elements of the display units receive the inductive energy from the
 5 transmitter element, and in that the control transmitter loads the transmission elements in the intervals between the data packets with an alternating current and charges the power supplies of the display units.

The central idea consists of, on the one hand, locating the
 10 transmitting elements fed by the control transmitter in immediate proximity to the display units to be mounted on the shelf-edges, such that an efficient - and by the use of low-cost small antennas tuned to the transmitting frequency - inductive power transfer is possible, and on the other hand,
 15 taking advantage of the intervals between the data packets to charge the power sources of the display units. As the control transmitter which (by analogy with the known hard-wire connection) loads the transmitting element mounted on the fronts of the shelves in the intervals between the data
 20 packets with an alternating current, a voltage is induced, due to the surrounding transmitting elements, as a function of the time-varying magnetic field according to Faraday's in the built-in element of the display unit for receiving the energy radiated (as a rule, a coil), which is rectified and serves to
 25 charge the power source. The latter supplies the display unit is provided with the necessary operating current to power the displays themselves and the built-in elements as well.

The advantages of the invention are that, the display units may be mounted in any desired position independently of the
 30 data to be displayed on them, without the time-consuming process of a voltaic connection with the store computer which would otherwise prove to be necessary; furthermore, the periodical exchange of the internal batteries of the conventional non hard-wired systems is avoided; maintenance
 35 costs, in contrast to the prior art systems, are reduced. It

is decisive however, that due to the small spacing between the transmitting element and the display unit, inductive power transfer as well as the use of data intervals to charge the power supply, by contrast with the prior art systems operated by electromagnetic waves appreciably lower transmission power only is required, in order that the charge condition of the power supply be sustained and the display units be provided with electric power. No disadvantageous influence of the environment on the transmitting element by electromagnetic waves is to be feared, consequently, on account of the significantly improved efficiency of power transfer. Also the control transmitter may, on account of the low transmission power be the significantly smaller and cheaper choice. Finally the possibility exists, to make use of, possibly already to hand, conventional wiring to the display units as transmitting elements, such that a simple exchange of the display units is required.

As a rule also the data packets from the central store computer via the control transmitter and the transmission elements on the basis of the optimal transfer security - interference or screening are not to be feared - are transferred inductively to a coil contained in the display unit, although in principle electromagnetic or capacitative data transfer could also be conceivable.

Accumulators and/or capacitors compatible with high capacity requirements may be brought into use as rechargeable power sources of the display units. These may also be advantageously designed such that also, the charge of the display units is maintained for at least several days also after the control transmitter is switched off or a breakdown occurs.

Within the scope of the notion of the invention various possibilities for charging the power units during the data transfer phase may be planned, for instance:

On the one hand it is suggested that inductive energy radiated by the transmitting elements also be captured during the data transfer inductively for use in charging the power sources, to augment the efficiency of power transfer.

- 5 On the other hand, it is recommended that the control transmitter be switched alternating between a phase of data transfer and a charging phase, such that impairment of error-free functioning - essential for the operation of the system - by the alternating current used for charging in the
- 10 transmitting elements is not to be feared. The display units detect the respective continuous phases by means of the voltages induced and internally switch between them accordingly.

- In actuality then, the alternating current flowing through the
- 15 transmitting elements in the intervals between the data packets as well as during the charging phase, is of constant frequency and amplitude. The result is, that the detection of the charging phase is facilitated to the display unit elements, and that due to the constant parameters of the
- 20 induced power efficient, low-loss dimensioning and regulation of the charging voltages is readily achieved. Further, it would also be conceivable to vary the amplitude or the frequency of the alternating current (or the duration of the charge phase) commensurate with the charge level, if the
- 25 display units were to transmit a return message to the control transmitter relating to their operational voltage. Likewise variation of the duration of the charge phase commensurate with the charge level of the display units would be possible.

- In order to make inductive transfer possible to the display
- 30 units according to Faraday's Law, it has been found to be appropriate to super-pose the data packets via the control transmitter onto a constant frequency and amplitude alternating current serving as a carrier. In this respect, frequency modulation is preferred to amplitude modulation due

to its significantly decreased sensitivity to external interference. In principle it is further conceivable, to superimpose the data onto an alternating current.

To discriminate between the data transfer phase and the charging of the power sources in the display units it is recommended that the control transmitter transmit to the transmission elements alternately (commensurate with the respective phase) with alternating current of different amplitudes and/or frequencies. In the display units discrimination between both phases occurs without any problems on the basis of the frequency or the amplitude of the induced voltages. The advantage lies - especially in the case of differentiation in terms of frequency - in that interference with the data transfer by the charge phase is not to be feared.

Furthermore, the display units may, on receipt of data packets addressed to them, themselves send confirmation back to the computer. A commensurate data packet is converted by means of an inductance contained in the display unit into a time-variable magnetic field, which induces a voltage in the adjacent transmitting element, which is transferred from the control transmitter to the computer. Obviously, in the confirmation phase neither charging of the power source nor data transfer from the control transmitter to the display unit can take place, as error-free reception of the - relatively weak - confirmation signal would not be possible.

Also, in practice various possibilities exist for the design of the built-in elements of the display units acting as receivers. So as to reduce production costs and space requirements it is recommended in one design, that the display units be equipped with only one built-in element (i.e. a coil), which serves to receive both the data and the charge current. In another design, the possibility also exists, to divide the tasks amongst two separate built-in elements, which

are made to conform to their own specific tasks without any problems occurring.

As a suitable built-in element for the reception of the power radiated by the transmission elements a flat coil wound in
5 layers may be a preferred option.

Also relative to the transmitting elements within the scope of the idea of the invention various embodiments are conceivable. They can, for example take the form of single-or multiple-core cables or flat ribbon cables.

10 So as to protect the transmitting elements from damage and to facilitate their installation, the opportunity presents itself to mould them in the form of a section to fit the edge of the shelf.

The magnetic field-strength in the display units may be
15 increased considerably where at least one of the transmitting elements adjacent to the display units are laid in loop-form. The advantageous result is an increase in the voltage induced and a significant improvement in the reliability of data transfer.

20 The data for transmission to, and visual display on, the shelf-edge display units may be held at a central computer located for example, at the head office of a retailing chain, and may be transmitted over the telephone or other suitable means to the individual store computers. The head office
25 computer may, however be omitted, and the data held in the individual store computers. It is to be understood that, within the framework of the invention, the term "computer" is intended to cover any electronic data storage and processing device, inclusive, for example, of price data controllers
30 ("EFTPOS", Electronic Funds Transfer at Point of Sale) etc.

Data are transmitted to the display units from any combination

of the above-mentioned computer systems via one or more control transmitter. These last-named may in practice be hard-wired to the transmission elements. Alternatively, the data may be transmitted from the computer to the control

5 transmitter and/or from the control transmitter feeding into the transmission elements by means of a wireless link which may consist of low frequency-, high frequency- or optical-magnetic radiation to and from an intermediate repeater unit.

To prevent reduction of the life of the power sources during

10 charging, the display units are cut off from the charge current radiation, as soon as their voltage exceeds a pre-determined threshold value.

In the event that one or more display units are to be removed from the shelves for a time longer than the discharge time of

15 the internal power source, the display units may be stored in a separate loading station, in which they are be exposed to an alternating magnetic field serving to charge their internal power sources.

Various embodiments of the invention will be further clarified

20 by reference to the following drawings, which depict, in schematic representation:

Figure 1: view of an electronic price display system,

Figure 2: a sectional view across a shelf with a display unit,

Figure 3: view of a shelf with a display unit,

25 Figure 4: interior view of a display unit,

Figure 5: wiring circuit for differentiation of the charge transmission from the data packets,

Figure 6: the temporal characteristics of the alternating current frequencies.

The electronic price display system depicted in Figure 1 may for example be installed in a sales establishment. The shelves arrayed in adjoining tiers (1) are laden with merchandise (5), whose sales prices are reproduced by electronic display units (4). The data supplied to the latter are stored in a central computer (2) and are transmitted via a control transmitter (3) and transmitting elements (6) located on the shelf-edges (1) inductively to the display units (4) which are fastened immediately adjacent to them. The control transmitter (3) and the transmission elements (6) are linked together by leads (7). Although not able to be depicted on the drawing, the control transmitter (3) sends an alternating current through the transmitting elements (6) during the intervals between individual data packets which induces a voltage for the purpose of charging the power supplies of the display units (4).

As is evident from Figure 2 the display unit (4) is located inside a protective section (8) affixed to the shelf edge (1). An upwardly bevelled leg (9) of the section (8) butts against the lower edge of the display unit (4), whilst its upper edge rests against a second downwardly bevelled leg (10) of the section (8). The upper leg (10) improves the readability of the display, as it is shaded from overhead light falling on it. The display unit (4) (if the occasion arises, in accordance with one solution of a mounting arrangement) is moveable along the axis of the section (8) and may be removed from it. Two transmission elements (6) in the form of wires run behind the rear side of the display unit (4) on the surface of the web portion of the section (8) adjacent to it. They are affixed parallel to the axis thereof, and in one embodiment, attached to the profile (8) by welding.

In Figure 3 a frontal view of the profile (8) with a display unit (4) is shown. There, can be seen a smaller set of figures (11) which, for example may hold product information, i.e. the merchandise code number and the larger figures (12) show the price. Instead of figures (11, 12) use may also be made of alphanumerical displays. It is to be noted that the possibility exists to charge one only of the transmitting elements (6) with a voltage, and the second may be set up to be used as a backup, in case of failure. Should however, both transmission elements (6) be driven, rectified or alternating current may flow through them.

Figure 4 shows the internal construction of a display unit (4). Inside the housing (17) the electronic components are attached to a conductive board (18). The built-in elements (13) for the inductive reception of the applied charge radiated by the transmission elements (6) is an azimuthal coil forming the shape of a frame around the inner wall of the housing (17), which is linked with the rectification circuit (16). The resultant current from the induced voltage serves to charge a power source (15), which in the embodiment shown, supplies the microprocessor (14) and the readout displays (11, 12) themselves. The microprocessor (14) updates the figures to be relayed (or the characters), when it receives a specific data packet for the display unit (4). In the embodiment illustrated two transmission elements (6) are spaced above and below the display unit (4).

Figure 5 represents a rectification and charging circuit, such as can be put into the unit shown in Figure 4. The alternating current induced in the built-in element for reception (13), a coil, is rectified by means of a diode (19) and reduced by a zener diode (20) to the desired operating voltage. A Schottky diode (19') connected with the power source (15) (capacitor) by the cathode of the zener diode (20) reduces the unwanted reverse-leakage current of the zener diode (20) and applies a charge to the capacitor at the operating voltage. The resistor

(21) and the antiparallel switched diodes (22) limit the induced voltage (23) to a voltage suitable for the input level of the microprocessor (14). This switching thus makes it possible both for data packets to be received and the power
5 supplies (15) to be charged using only one built-in element (13).

Finally, Figure 6 shows the temporal alternation of the frequency of the current flowing through the transmission elements (6). In the data packets transmission phase (25) a
10 relatively low frequency is frequency-modulated over a fraction (say, about a fifth) of its total, whereas the frequency in the intervals (26) lying between them is approximately doubled and remains constant. The display units
15 (4) can thus discriminate between both phases without difficulty due to the frequencies of the induced voltages.

In consequence a shelf edge price indication system has been developed, which excels in terms of operational security and low downtime.

THE CLAIMS DEFINING THE INVENTION ARE AS FOLLOWS:-

1. Electronic shelf price display system, with a computer, a control transmitter linked thereto, as well as electronic display units attached to the edges of the shelves, wherein
-at least one shelf equipped with display units is or are provided with electrically
5 conductive transmission elements, which are supplied with an alternating current by means of the control transmitter and which radiate electromagnetic power.

- the control transmitter via the transmission elements transmits data packets, which contain the display data and are separated periodically therefrom by means of intervals, to the display units, and

10 - in the display units at least one element is provided for the reception of the power radiated by the transmission elements, the element feeds a rechargeable power source with a charging current, the rechargeable power source supplies at least a part of the operating power of the display units, characterised in that, the transmission elements are attached adjacent to the display units on the edges of the shelves, and in that the
15 component elements of the display units inductively receive the power radiated from the transmission elements and in that the control transmitter furnishes the transmission elements with an alternating current in the intervals between the data packets and charges the power sources of the display units.

2. System in accordance with Claim 1, characterised in that, the display units receive
20 the data packets inductively.

3. System in accordance with Claims 1 or 2, characterised in that, the power source is a capacitor and/or an accumulator.

4. System in accordance with any of the Claims 1 to 3, characterised in that, the power sources of the display units are also charged during the transmission of the data
25 packets.

5. System in accordance with any of the Claims 1 to 4, characterised in that, the display units due to the induced current, switch between the charging phase in which the charging of the power sources takes place, and the phase of the transmission of data packets.

6. System in accordance with any of the Claims 1 to 5, characterised in that, the alternating current in the intervals between the data packets is of constant frequency and/or amplitude.

7. System in accordance with any of the Claims 1 to 6, characterised in that, the control transmitter over-modulates and/or superimposes the data packets on an alternating current of constant frequency and amplitude by amplitude and/or frequency modulation.

8. System in accordance with Claim 7, characterised in that, the frequency and/or amplitude of the alternating currents during the transmission of the data packets differ from the frequency and/or amplitude in the intervals.

9. System in accordance with any of the Claims 1 to 8, characterised in that, the display units after the reception of data packets issues in its turn a data packet, which is inductively coupled to the adjacent transmission element and transmitted from the latter via the control transmitter to the computer.

10. System in accordance with any of the Claims 1 to 9, characterised in that, the display units have a component element serving for the transfer of both power and data.

11. System in accordance with any of the Claims 1 to 10, characterised in that, the display units are equipped with two separate component elements, one of which serves as a power transmitter, the other as a data transmitter.

12. System in accordance with any of the Claims 1 to 11, characterised in that, the component element is a flat-wound coil.

13. System in accordance with any of the Claims 1 to 12, characterised in that, the transmission elements are single- or multiple-cored cables.

14. System in accordance with any of the Claims 1 to 5 13, characterised in that, the transmission elements are flat ribbon cables.

15. System in accordance with any of the Claims 1 to 14, characterised in that, the transmission elements are uniform with a section moulded to the shelf edge.

10 16. System in accordance with any of the Claims 1 to 15, characterised in that, at least one component of the transmission element adjacent to the display unit is laid in loop form.

17. System in accordance with any of the Claims 1 to 15 16, characterised in that, the control transmitter is wired to the transmission elements.

18. System in accordance with any of the Claims 1 to 17, characterised by a wireless link between the computer and the control transmitter and/or between the control transmitter and the transmission elements.

19. System in accordance with any of the Claims 1 to 18, characterised in that, the display elements limits the charging current of their power supplies as soon as its voltage exceeds a pre-determined threshold value.

20 20. System in accordance with any of the Claims 1 to 19, characterised by a charging station for charging display units removed from the shelves, separately.

21. An electronic shelf price display system substantially as herein described with reference to the accompanying drawings.

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DATED this 2nd Day of May, 1994

ESSELTE METO INTERNATIONAL GmbH

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of SHELSTON WATERS

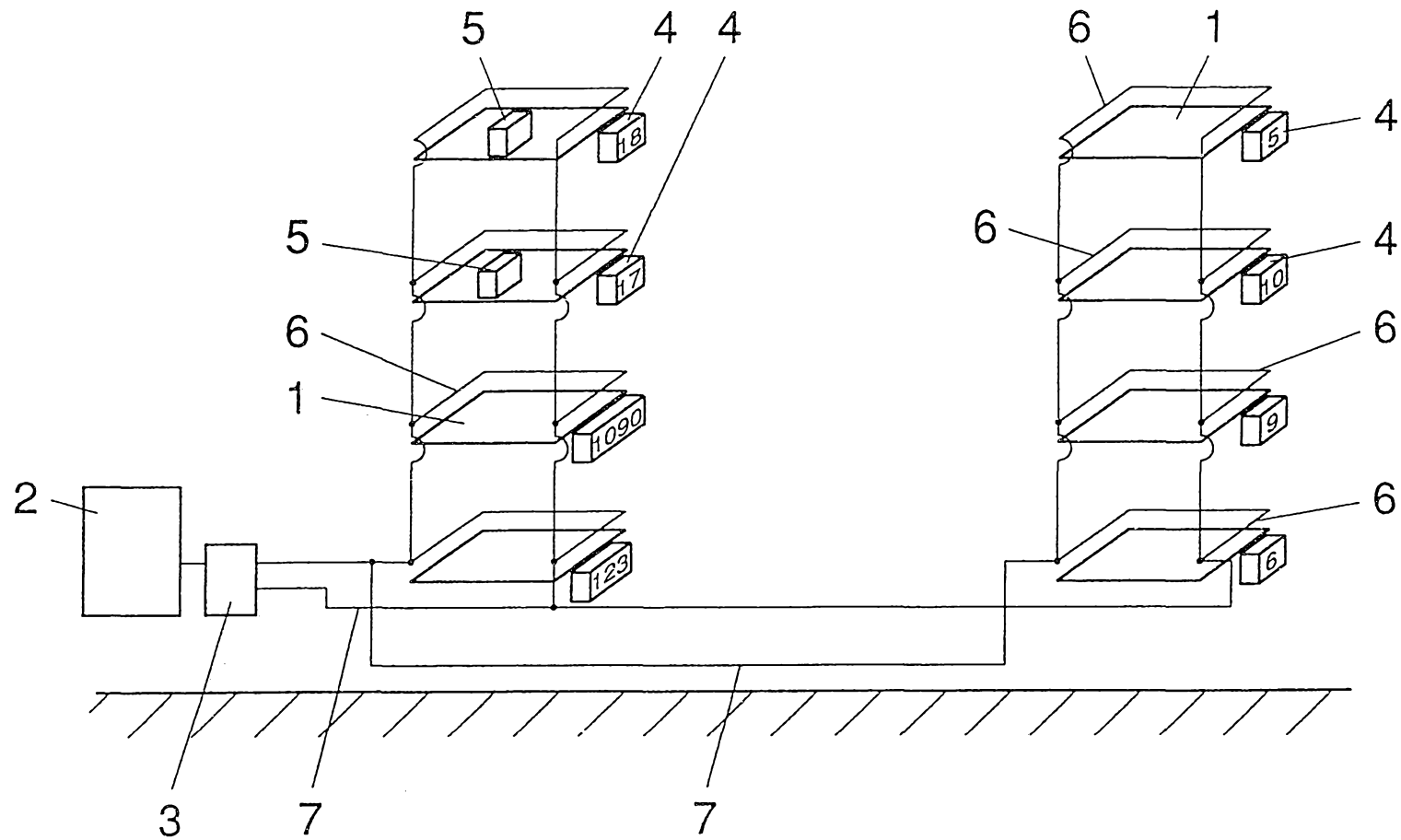
Abstract

The invention is concerned with an electronic shelf price display system (1).

To achieve enhancement of operational security and reduction
5 in transmission field strength it is proposed that the
transmission elements (6) be affixed to the edges of the
shelves (1) adjacent to the display units (4), that the built-
in elements (13) of the display units (4) which inductively
10 receive the power radiated by the transmission elements (6),
and that the control transmitter (3) loads the transmission
elements (6) with an alternating current in the intervals (26)
between the data packets (25) and charges the power sources
(15) of the display units (4).

-Figure 1-

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Fig. 1

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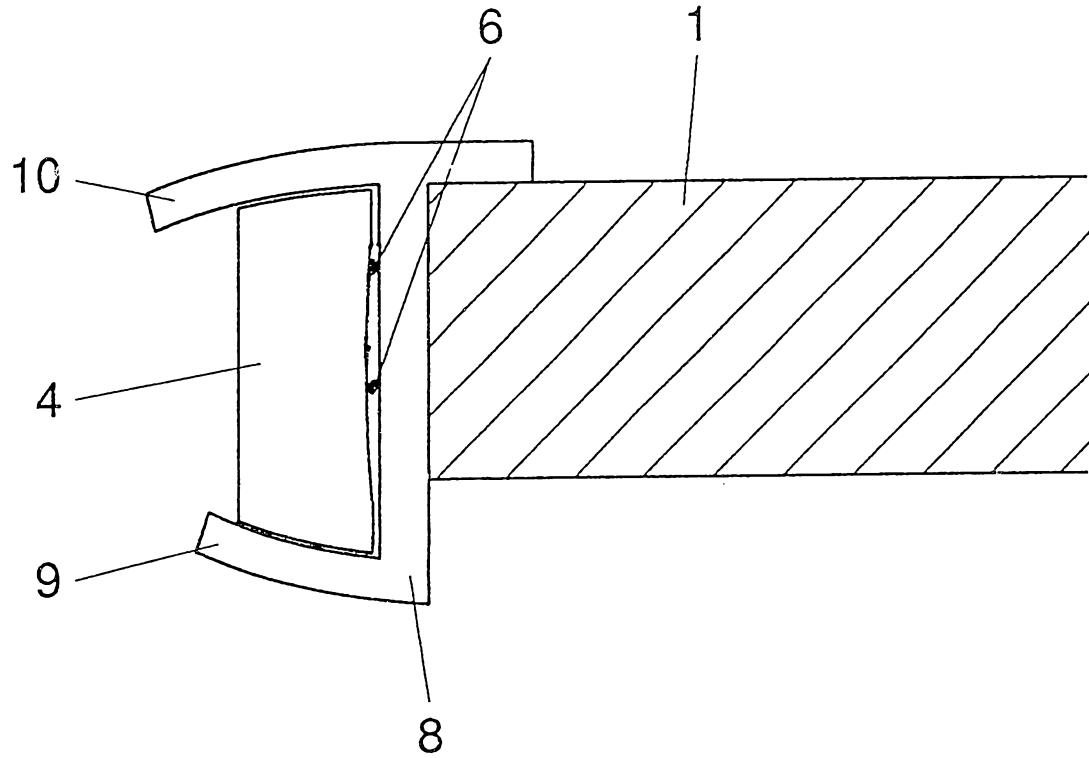
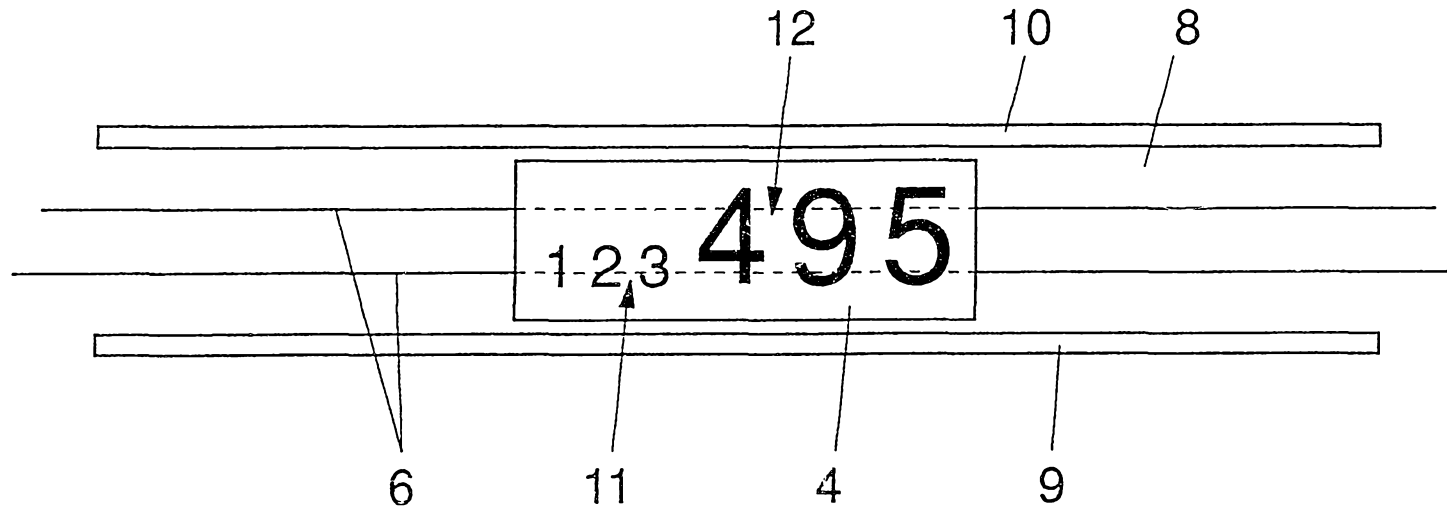


Fig. 2

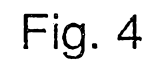
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Fig. 3

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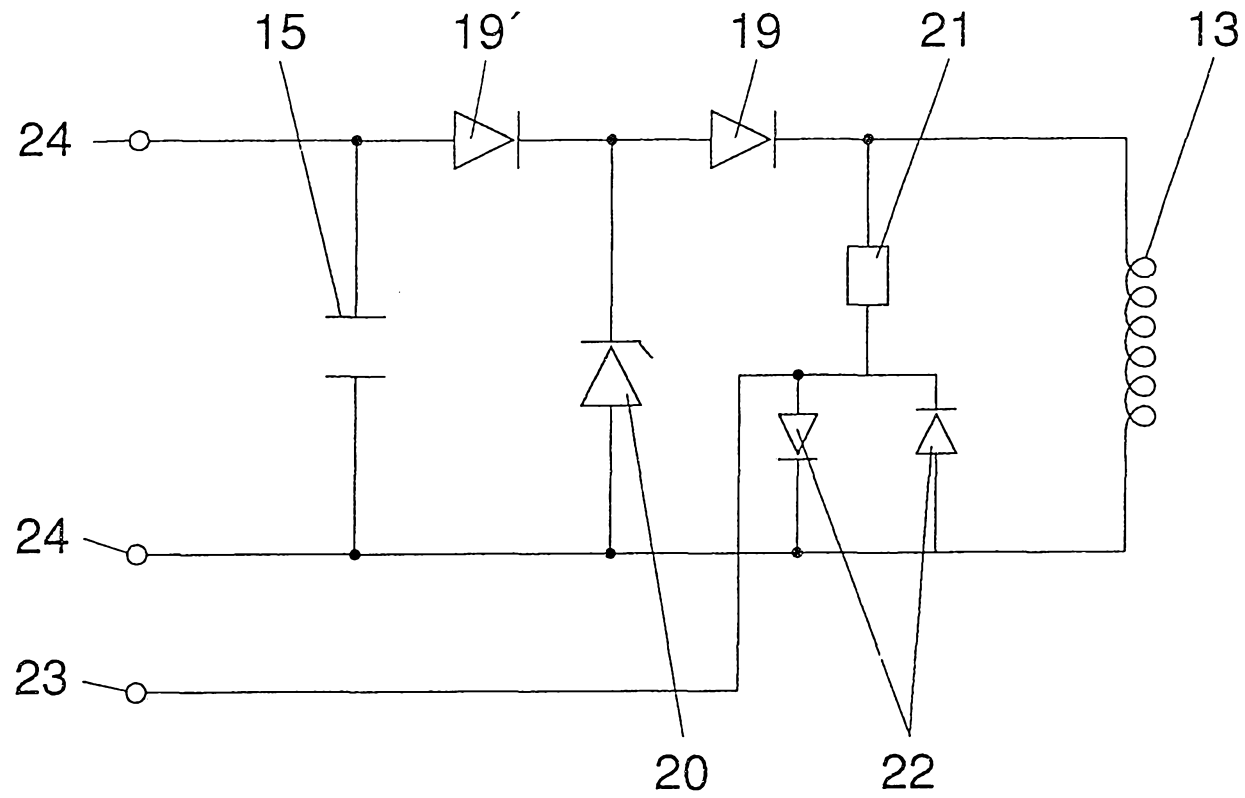
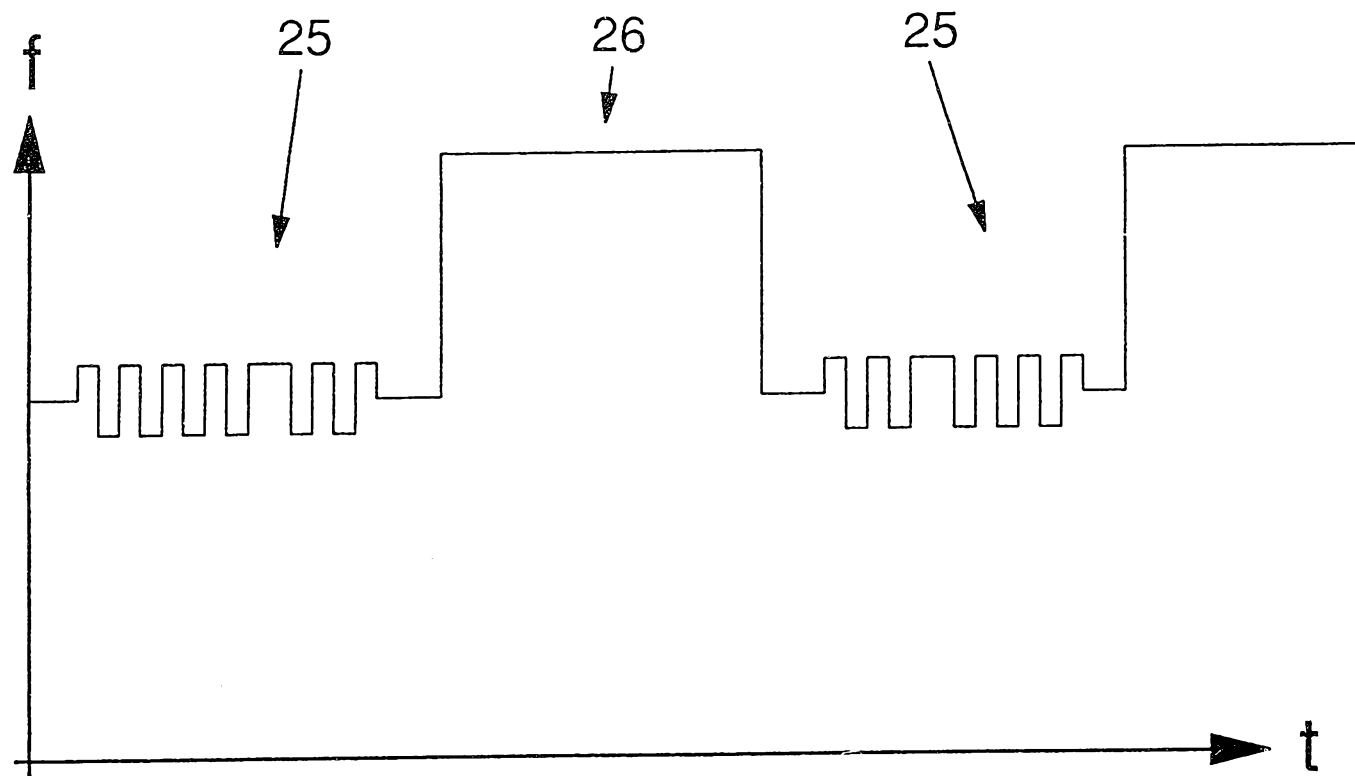


Fig. 5

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Fig. 6