

617421

FORM 1

SPRUSON & FERGUSON

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

APPLICATION FOR A STANDARD PATENT

NEC Corporation, incorporated in Japan, of 33-1, Shiba 5-chome, Minato-ku, Tokyo 108, JAPAN, hereby apply for the grant of a standard patent for an invention entitled:

Small-Sized Equipment With a Liquid Crystal Display

which is described in the accompanying complete specification.

Details of basic application(s):-

<u>Basic Applic. No:</u>	<u>Country:</u>	<u>Application Date:</u>
63-31884	JP	16 February 1988

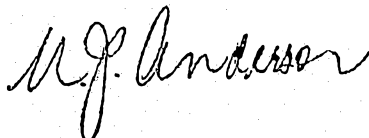
The address for service is:-

Spruson & Ferguson
Patent Attorneys
Level 33 St Martins Tower
31 Market Street
Sydney New South Wales Australia

DATED this FIFTEENTH day of FEBRUARY 1989

NEC Corporation

By:



Registered Patent Attorney

TO: THE COMMISSIONER OF PATENTS
OUR REF: 86350
S&F CODE: 56179

REPRINT OF RECEIPT

8005488 15/02/89

DECLARATION IN SUPPORT OF A
CONVENTION APPLICATION FOR A PATENTIn support of the Convention Application made for a
patent for an invention entitled:

Title of Invention

"SMALL-SIZED EQUIPMENT WITH A LIQUID CRYSTAL DISPLAY"

Full name(s) and
address(es) of
Declarant(s)I/~~We~~ Susumu Uchihara~~of~~ c/o NEC Corporation of 33-1, Shiba 5-chome,
Minato-ku, Tokyo, Japan

do solemnly and sincerely declare as follows:—

Full name(s) of
Applicant(s)~~1. I am/We are the applicant(s) for the patent~~*(or, in the case of an application by a body corporate)*1. I am/~~We are~~ authorised by NEC Corporationthe applicant(s) for the patent to make this declaration on
its/~~their~~ behalf.2. The basic application(s) as defined by Section 141 of the
Act was/~~were~~ made

Basic Country(ies)

in Japan

Priority Date(s)

on the 16th February, 1988

Basic Applicant(s)

by NEC Corporation

Full name(s) and
address(es) of
inventor(s)~~3. I am/We are the actual inventor(s) of the invention referred
to in the basic application(s)~~*(or where a person other than the inventor is the applicant)*

3. Kazuaki IGUCHI

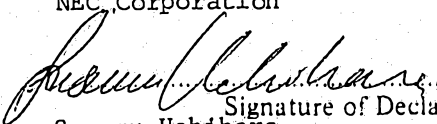
~~of~~ c/o NEC Corporation of 33-1, Shiba 5-chome,
Minato-ku, Tokyo, Japan*(respectively)*is/~~are~~ the actual inventor(s) of the invention and the facts upon
which the applicant(s) is/~~are~~ entitled to make the application are
as follows:

The said applicant is the assignee of the actual inventor.

Set out how Applicant(s)
derive title from actual
inventor(s) e.g. The
Applicant(s) is/are the
assignee(s) of the
invention from the
inventor(s)4. The basic application(s) referred to in paragraph 2 of this
Declaration was/~~were~~ the first application(s) made in a Convention
country in respect of the invention ~~is~~ the subject of the application.

Declared at Tokyo, Japan this 31st day of January, 1989.

NEC Corporation


 Signature of Declarant(s)
 Susumu Uchihara
 General Manager, Patents Division

(12) PATENT ABRIDGMENT (11) Document No. AU-B-29943/89
(19) AUSTRALIAN PATENT OFFICE (10) Acceptance No. 617421

(54) Title
ADJUSTING VISUAL ANGLE LCD BY CHANGING THE DRIVE VOLTAGE

International Patent Classification(s)
(51)⁴ **G09G 003/36 H04M 001/03**

(21) Application No. : **29943/89**

(22) Application Date : **15.02.89**

(30) Priority Data

(31) Number	(32) Date	(33) Country
63-31884	16.02.88	JP JAPAN

(43) Publication Date : **17.08.89**

(44) Publication Date of Accepted Application : **28.11.91**

(71) Applicant(s)
NEC CORPORATION

(72) Inventor(s)
KAZUAKI IGUCHI

(74) Attorney or Agent
SPRUSON & FERGUSON, GPO Box 3898, SYDNEY NSW 2001

(57) Claim

1. Small-sized equipment having a liquid crystal display (LCD), comprising:

a hand-held portable unit on which said LCD is mounted;
support means for holding said portable unit when said portable unit is mounted on said support means;

sensor means built in at least one of said portable unit and said support means for determining whether or not said portable unit is mounted on said support means and producing a sense signal; and

control means provided in said portable unit for varying a visual angle of said LCD in response to the sense signal from said sensor means wherein the visual angle of said liquid crystal display is alterable by adjusting a drive voltage of said liquid crystal display.

4. Equipment as claimed in claim 1, wherein said control means comprises:

a driver for driving said LCD;
a power source for feeding power to said driver; and
a controller for controlling said power source such that a first said drive voltage associated with a first visual angle is fed to said driver when the sense signal from said sensor is representative of presence of said portable unit on said support means, and a second said drive voltage associated with a second visual angle is fed to said driver when the sense signal is representative of absence of said portable unit on said support means.

S & F Ref: 86350

FORM 10

COMMONWEALTH OF AUSTRALIA

PATENTS ACT 1952

COMPLETE SPECIFICATION

6 1 7 4 2 1

(ORIGINAL)

FOR OFFICE USE:

Class Int Class

Complete Specification Lodged:
Accepted:
Published:

Priority:

Related Art:

Name and Address
of Applicant:

NEC Corporation
33-1, Shiba 5-chome
Minato-ku
Tokyo 108
JAPAN

Address for Service: Spruson & Ferguson, Patent Attorneys
Level 33 St Martins Tower, 31 Market Street
Sydney, New South Wales, 2000, Australia

Complete Specification for the invention entitled:

Small-Sized Equipment With a Liquid Crystal Display

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

ABSTRACT OF THE DISCLOSURE

A vehicle-mounted telephone or similar small-sized equipment having a handset with a liquid crystal display (LCD) and a cradle for holding the handset in place. Sensor is built in
5 at least one of the handset and cradle to determine whether or not the handset is present on the cradle. In response to a sense output of the sensor, a controller varies drive voltage which is applied to an LCD driver and thereby varies the visual angle of the LCD automatically. The drive voltage selectively has a first
10 value associated with a first visual angle which occurs when the handset is mounted on the cradle and a second value associated with a second visual angle which occurs when the handset is removed from the cradle. The controller further controls the drive voltage in such a manner as to selectively apply drive
15 voltage associated with any of a desired number of visual angles to the LCD driver. An implementation is provided for allowing a person to manually change the drive voltage in a stepless or analog fashion as desired.

SMALL-SIZED EQUIPMENT WITH A LIQUID CRYSTAL DISPLAY

BACKGROUND OF THE INVENTION

5 The present invention relates to small-sized equipment having a liquid crystal display (LCD) such as a radio telephone mounted on a motor vehicle and, more particularly, to small-sized equipment capable of switching over the visual angle of its LCD automatically.

10 An LCD has various advantages as well known in the art and are extensively used in a variety of fields today. Concerning the display surface of an LCD, the visual field angle remains substantially constant even when the visual angle to the display surface is changed. The visual angle, however, varies with the voltage which is applied to the LCD for driving it. When the small-sized equipment with an LCD is implemented as a desk-top portable word processor or similar apparatus, the visual angle of the LCD is not so critical. On the other hand, when it comes to a vehicle-mounted telephone or similar miniature equipment which is made up of a handset with an LCD and a cradle for mounting the handset thereon, the visual angle has to be considered with respect to at least two different conditions: a
20 condition in which the handset is mounted on the cradle and a

condition in which the handset is removed from the cradle by hand.
Heretofore, this kind of consideration has not been reported at all. In
fact, it has been customary to provide even the equipment of the type
which a person is incapable of seeing in one direction at all times with
5 only a single most effective visual angle which is expected under
particular conditions of use.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide
small-sized equipment having a capability of automatically switching over
10 the visual angle of its LCD depending upon the condition in which a
handset of the equipment is used.

It is another object of the present invention to provide generally
improved small-sized equipment with an LCD.

According to one aspect of the present invention there is disclosed
15 small-sized equipment having a liquid crystal display (LCD), comprising:

a hand-held portable unit on which said LCD is mounted;

support means for holding said portable unit when said portable
unit is mounted on said support means;

sensor means built in at least one of said portable unit and said
20 support means for determining whether or not said portable unit is
mounted on said support means and producing a sense signal; and

control means provided in said portable unit for varying a visual
angle of said LCD in response to the sense signal from said sensor means
wherein the visual angle of said liquid crystal display is alterable by
25 adjusting a drive voltage of said liquid crystal display.

30

35

HRF/0560y



BRIEF DESCRIPTION OF THE DRAWINGS

The above and other objects, features and advantages of the present invention will become more apparent from the following detailed description taken with the accompanying drawings:

5 Figs. 1 and 2 are views useful for understanding a relationship between visual angle and visual field angle of an LCD;

Fig. 3 is a plot representative of a relationship between visual angle and LCD drive voltage;

10 Figs. 4 and 5 are views of small-sized equipment embodying the present invention in the form of a vehicle-mounted telephone and each showing a handset of the telephone in a different position relative to a cradle;

15 Fig. 6 is a view showing a more specific construction of the handset and that of the cradle which are included in the embodiment of Figs. 4 and 5;

20 Figs. 7 and 8 are views showing the handset and cradle of the illustrative embodiment which are mounted in the passenger compartment of a motor vehicle, and different directions in which the operator of the vehicle may look at the display surface of the handset;

Figs. 9 and 10 are views showing an alternative embodiment of the present invention; and

25 Fig. 11 is a view showing a specific construction of a handset and that of a cradle of the embodiment shown in Figs. 9 and 10.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to Figs. 1 and 2 of the drawings, an LCD 10 having a display surface 10a is shown. Concerning the display surface 10a, the visual field angle for a visual angle of θ_1 by way of example is ϕ_1 . When the visual angle θ_1 is changed to θ_2 ($\theta_2 > \theta_1$), the bisector of the visual field angle ϕ_1 changes to the bisector of the angle ϕ_2 . However, the visual field angle ϕ_2 is substantially the same as the visual field angle ϕ_1 , i.e., the visual field angle substantially remains the same despite the change of visual angle. On the other hand, as shown in Fig. 3, the visual angle θ varies with the voltage which is applied to the LCD 10 for driving it.

Considering the fact stated above, the present invention provides a technique for allowing the visual angle of an LCD to be automatically switched over as needed. Preferred embodiments of the present invention which implement such an automatic visual angle switching capability will be described in detail hereinafter.

First Embodiment

A first and comparatively fundamental embodiment of the present invention will be described first, assuming that the small-sized equipment comprises a vehicle-mounted telephone. As shown in Figs. 4 and 5, the telephone is made up of a handset 12 and a cradle 14 for mounting the handset 12. The handset 12 has an LCD 16, a speaker 18 associated with a

receiver, a microphone 20 associated with a transmitter, a keypad 22 including numeral keys and function keys, and a drive control section which will be described. The cradle 14 has a sensor in the form of a hook switch 24 for determining whether or not the handset 12 is mounted on the cradle 14, and an extension cable 26 connected to the main unit 36 of the telephone (Fig. 6). The hook switch 24 is connected to the drive control section of the handset 12 by a curl cord 28. Fig. 6 shows a more specific construction of the handset 12 and that of the cradle 14. In Fig. 6, the handset 12 has an LCD driver 30 for driving the LCD 16, a power source 32 for applying voltage to the LCD driver 30, and a controller 34 for controlling the voltage of the power source 32. The hook switch or handset sensor 24 of the cradle 14 is connected to the controller 34. The speaker 18 and microphone 20 are connected to the telephone main unit 36 by the curl cord 28 and extension cable 26.

In operation, assume that when the handset 12 is mounted on the cradle 14 as shown in Fig. 4, the handset sensor 24 delivers a signal SR representative of such an on-hook condition to the controller 34 (the hook switch constituting the sensor 24 is assumed to be closed then). In response, the controller 34 controls the power supply 32 such that the drive voltage being applied to the LCD driver 30 has a particular value (e. g. V_1) which is associated with the visual angle θ_1 shown in Fig. 4. On the other hand, when the handset 12 is removed from the

cradle 14 by hand as shown in Fig. 5, the sensor 24 delivers a signal representative of such an off-hook condition to the controller 34 (at this instant, the hook switch is open). Then, the controller 34 controls the power source 32 such that the drive voltage being applied to the driver 30 has another particular value (e. g. V_2) which is associated with the visual angle θ_2 shown in Fig. 5. In this manner, the visual angle is automatically switched over depending upon the position of the handset 12, i. e., whether it is mounted on the cradle 14 or held by hand off the cradle 14.

The relationship between the visual angles θ_1 and θ_2 shown in Figs. 4 and 5 and the drive voltages V_1 and V_2 will be discussed more specifically.

Figs. 7 and 8 show a telephone disposed in the passenger compartment of a motor vehicle and the change of direction in which the operator 38 of the vehicle looks at the LCD 16. As shown, while the handset 12 is mounted on the cradle 14 fixed to the dashboard 41 of the motor vehicle (Fig. 7), the operator will look at the LCD 16 in a direction 40. This direction 40 is different from a direction 42 in which the operator will look at the LCD 16 when he or she holds the handset 12 by hand off the cradle 40 (Fig. 4). Such a difference is ascribable to the distance between the LCD 16 and the operator's eyes as well as to the position of the handset 12. In the illustrative embodiment, the drive voltage V_1 is applied to the LCD driver 30 when the

handset 12 is placed on the cradle 14 so as to set up the visual angle θ_1 ; the drive voltage V_2 is applied to the LCD driver 30 when the handset 12 is removed from the cradle 14 so as to set up the visual angle θ_2 . Here, V_1 is greater than V_2 and θ_1 is greater than θ_2 . The visual angles θ_1 and θ_2 are of course determined on the basis of the positional relationship between the operator 38 and the LCD 16. Usually, the handset 2 is left in a substantially vertical position (Fig. 7) while mounted on the cradle 14 and in a substantially horizontal position when removed from the cradle 14 (Fig. 8). The visual angle θ_2 therefore should preferably be determined such that the handset 12 is easy to see when held in a substantially horizontal position.

As stated above, the drive voltages V_1 and V_2 are selectively applied to the LCD driver 30 so that the visual angle θ_1 shown in Fig. 4 and the direction 40 shown in Fig. 7 and the visual angle θ_2 shown in Fig. 5 and the direction 42 shown in Fig. 8 may individually substantially coincide with each other.

While the sensor responsive to the presence/absence of the handset 12 on the cradle 14 has been shown and described as being implemented by the hook switch 24 which is built in the cradle 14, the hook switch 24 may be replaced with any other type of sensor having a similar function. Further, this sensor may even be built in the handset 12, if desired.

Second Embodiment

An alternative embodiment of the present invention which is also implemented as a vehicle-mounted telephone by way of example will be described with reference to Figs. 9 to 11. In the figures, the same or similar structural elements as those of the first embodiment are designated by like reference numerals.

As shown in Figs. 9 and 10, the handset 12A has the LCD 16, speaker 18, microphone 20, keypad 22 including numeral keys and function keys, and drive control section which will be described. The cradle 14A is provided with the extension cable 26 and curl cord 28 which are connected to the telephone main unit 36 (Fig. 11). In this particular embodiment, the handset sensor is constituted by a reed switch 44 and a magnet 46 which are built in the handset 12A and the cradle 14A, respectively.

Fig. 11 shows a more specific construction of the handset 12A and that of the cradle 14A. The handset 12A is provided with a drive control section for controllably driving the LCD 16. Specifically, the drive control section is made up of the LCD driver 30, an analog switch 48, and the controller 34. Implemented by an 8-channel multiplexer, for example, the analog switch 48 adequately selects one of a plurality of source voltages Vdd to apply a desired drive voltage Vlcd to the LCD driver 30. The controller 34 in the form of a CPU, for example, receives an output signal SR of the reed switch or handset sensor 44 and in response delivers multiplexer selection signals SEL0,

SEL1 and SEL2 to the analog multiplexer or switch 48. The LCD driver 30 feeds segment signals S_0 to S_n and common signals COM_0 to COM_m to the LCD 16 for driving it. The keypad 22 is provided with numeral keys 22a and function keys 22b and connected to the controller 34. More specifically, the multiplexer 48 includes voltage dividing resistors r_0 to r_7 , which are connected to terminals i_0 to i_7 , as illustrated, so that the source voltage V_{dd} may be divided to preset the drive voltage V_{lcd} , i. e., visual angle at any of seven consecutive steps. More specifically, the source voltage V_{dd} is divided by the resistors r_0 to r_7 and the resulting voltage is fed from the analog switch 48 in the form of the drive voltage V_{lcd} . Table 1 shown below indicates how the drive voltage V_{lcd} is changed depending upon the logical states of the multiplexer selection signals SEL2, SEL1 and SEL0.

Table 1

SEL2	SEL1	SEL0	PATH IN ANALOG SWITCH 48
0	0	0	$i_0 \rightarrow V_{lcd} \text{ OUT}$
0	0	1	$i_1 \rightarrow V_{lcd} \text{ OUT}$
0	1	0	$i_2 \rightarrow V_{lcd} \text{ OUT}$
0	1	1	$i_3 \rightarrow V_{lcd} \text{ OUT}$
1	0	0	$i_4 \rightarrow V_{lcd} \text{ OUT}$
1	0	1	$i_5 \rightarrow V_{lcd} \text{ OUT}$
1	1	0	$i_6 \rightarrow V_{lcd} \text{ OUT}$
1	1	1	$i_7 \rightarrow V_{lcd} \text{ OUT}$

As shown in Table 1, the source voltage V_{dd} is divided by any of the voltage dividing resistors r_0 to r_7 and terminals i_0 to i_7 depending upon the logical states of the multiplexer selection signals SEL0, SEL1 and SEL2. In this embodiment, therefore, the drive voltage V_{lcd} is variable over seven consecutive steps. Stated another way, this embodiment not only allows two different visual angles θ_1 and θ_2 (see Figs. 9 and 10) to be selectively and automatically set up but also allows a person to change desired independent visual angles each over seven steps by manipulating the keypad 22 which is connected to the controller 34. The preset visual angles are stored in the controller 34 and therefore does not need any further setting operations.

As shown in Fig. 11, a variable resistor 50 is connected to the terminal i_7 of the analog switch 48 so that the drive voltage V_{lcd} fed to the LCD driver 30 may be adjusted and, especially, finely adjusted by hand. Specifically, as a person operates a knob 50a (Figs. 9 and 10) of the variable resistor or volume 50, the drive voltage V_{lcd} is varied in a stepless or analog fashion to set up a desired visual angle.

In Fig. 11, a speaker amplifier 18a is connected to the speaker 18 and, by the curl cord 28 and extension cable 26, connected to the telephone main unit 36. Likewise, a microphone amplifier 20a is connected to the microphone 20 and, by the curl cord 28 and extension cable 26, connected to

the telephone main unit 36. Further, a control bus 52 is connected between the controller 34 and the telephone main unit 36 by the curl cord 28 and extension cable 26.

5 It should be born in mind that the embodiments shown and described are applicable not only to a vehicle-mounted telephone but also to any other kind of small-sized equipment having a handset with an LCD and a cradle for holding the handset.

10 In summary, it will be seen that the present invention provides small-sized equipment having an LCD the visual angle of which is variable to display clear-cut information with no regard to the position of the equipment. In addition, the equipment facilitates effective use of display such as in a real-time display mode.

15 Various modifications will become possible for those skilled in the art after receiving the teachings of the present disclosure without departing from the scope thereof.

The claims defining the invention are as follows:

1. Small-sized equipment having a liquid crystal display (LCD), comprising:

a hand-held portable unit on which said LCD is mounted;

5 support means for holding said portable unit when said portable unit is mounted on said support means;

sensor means built in at least one of said portable unit and said support means for determining whether or not said portable unit is mounted on said support means and producing a sense signal; and

10 control means provided in said portable unit for varying a visual angle of said LCD in response to the sense signal from said sensor means wherein the visual angle of said liquid crystal display is alterable by adjusting a drive voltage of said liquid crystal display.

2. Equipment as claimed in claim 1, wherein said sensor means
15 comprises a hook switch built in said support means.

3. Equipment as claimed in claim 1, wherein said sensor means comprises one of a reed switch and a magnet is built in said support means while the other is built in said portable unit.

4. Equipment as claimed in claim 1, wherein said control means
20 comprises:

a driver for driving said LCD;

a power source for feeding power to said driver; and

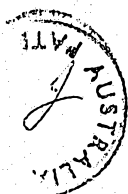
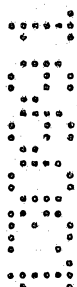
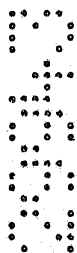
a controller for controlling said power source such that a first said drive voltage associated with a first visual angle is fed to said
25 driver when the sense signal from said sensor is representative of presence of said portable unit on said support means, and a second said drive voltage associated with a second visual angle is fed to said driver when the sense signal is representative of absence of said portable unit on said support means.

30 5. Equipment as claimed in claim 1, wherein said control means comprises:

a driver for driving said LCD;

an analog switch for producing a plurality of said drive voltages which are selectively applied to said driver; and

35 a controller for controlling said analog switch such that one of the drive voltages which is associated with a desired visual angle is selected and outputted by said analog switch in response to the sense signal from said sensor means.



6. Equipment as claimed in claim 5, wherein said analog switch comprises a multi-channel multiplexer.

7. Equipment as claimed in claim 6, wherein said control comprises a central processing unit.

5 8. Equipment as claimed in claim 5, wherein said control means further comprises manual drive voltage varying means accessible for manually varying the drive voltage fed to said driver in an analog fashion.

9. Small-sized equipment having a liquid crystal display, said
10 equipment substantially as described with reference to Figs. 4-8 or Figs. 9-11 of the accompanying drawings.

DATED this TWELFTH day of SEPTEMBER 1991

NEC Corporation

15

Patent Attorneys for the Applicant

SPRUSON & FERGUSON

20

25

30

35



FIG. 1

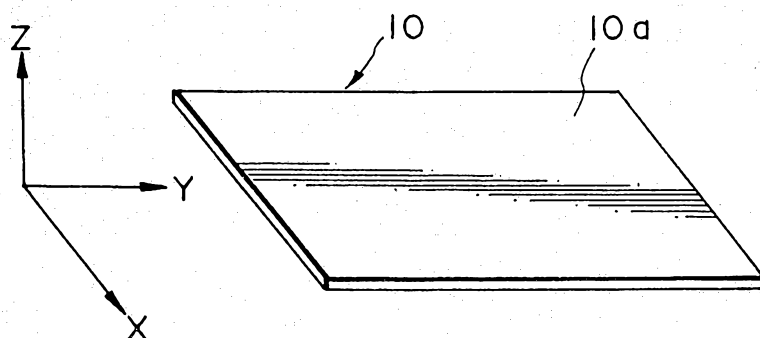


FIG. 2

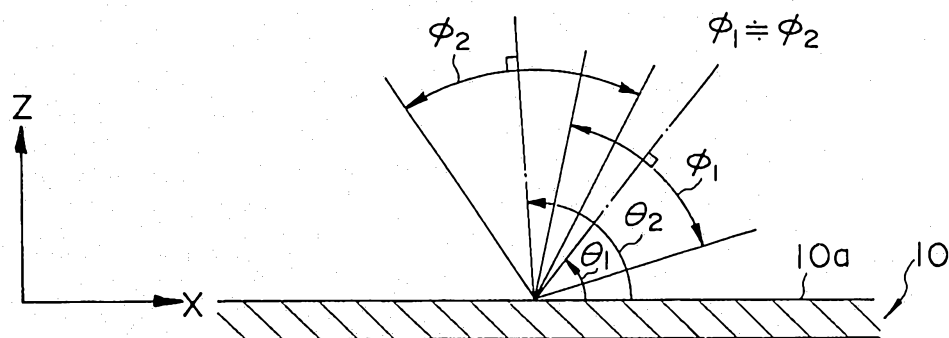


FIG. 3

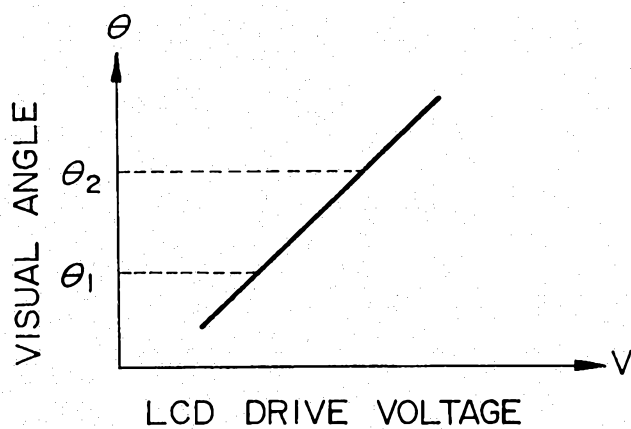


FIG. 4

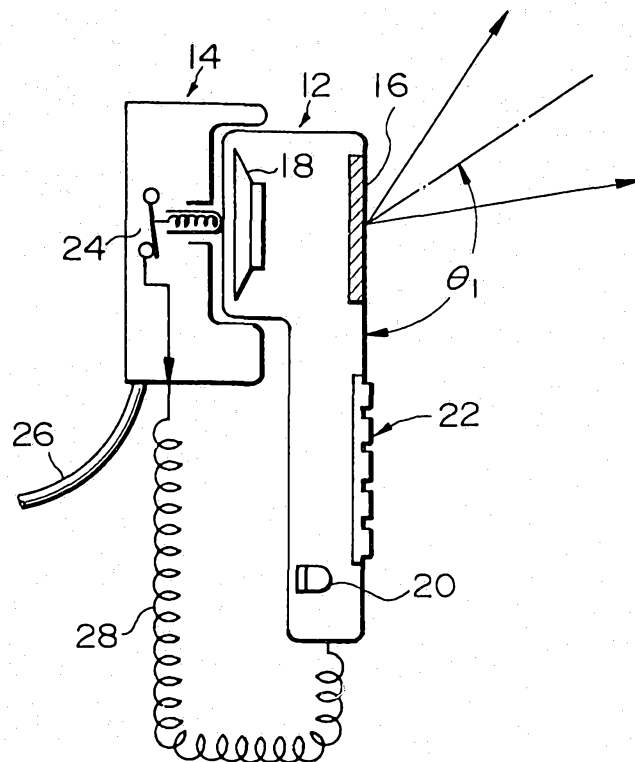


FIG. 5

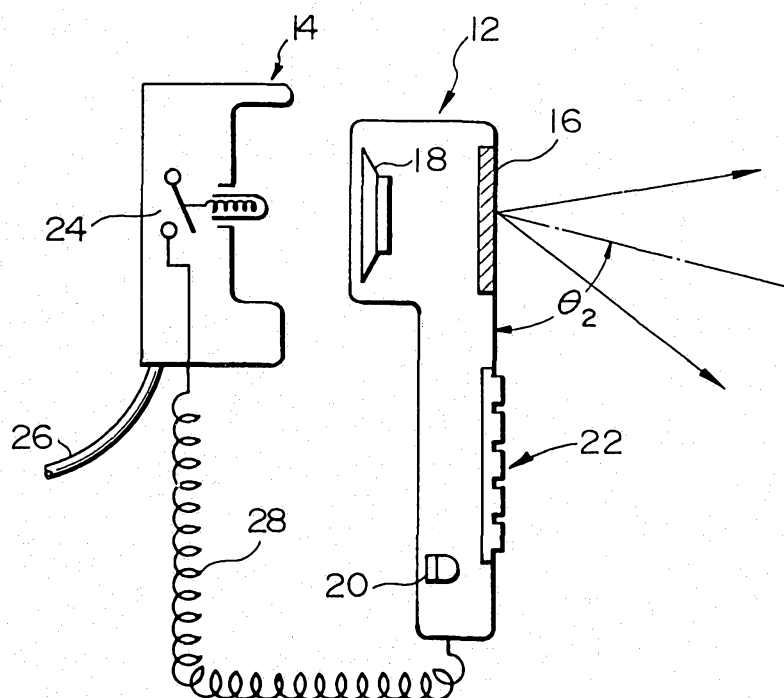
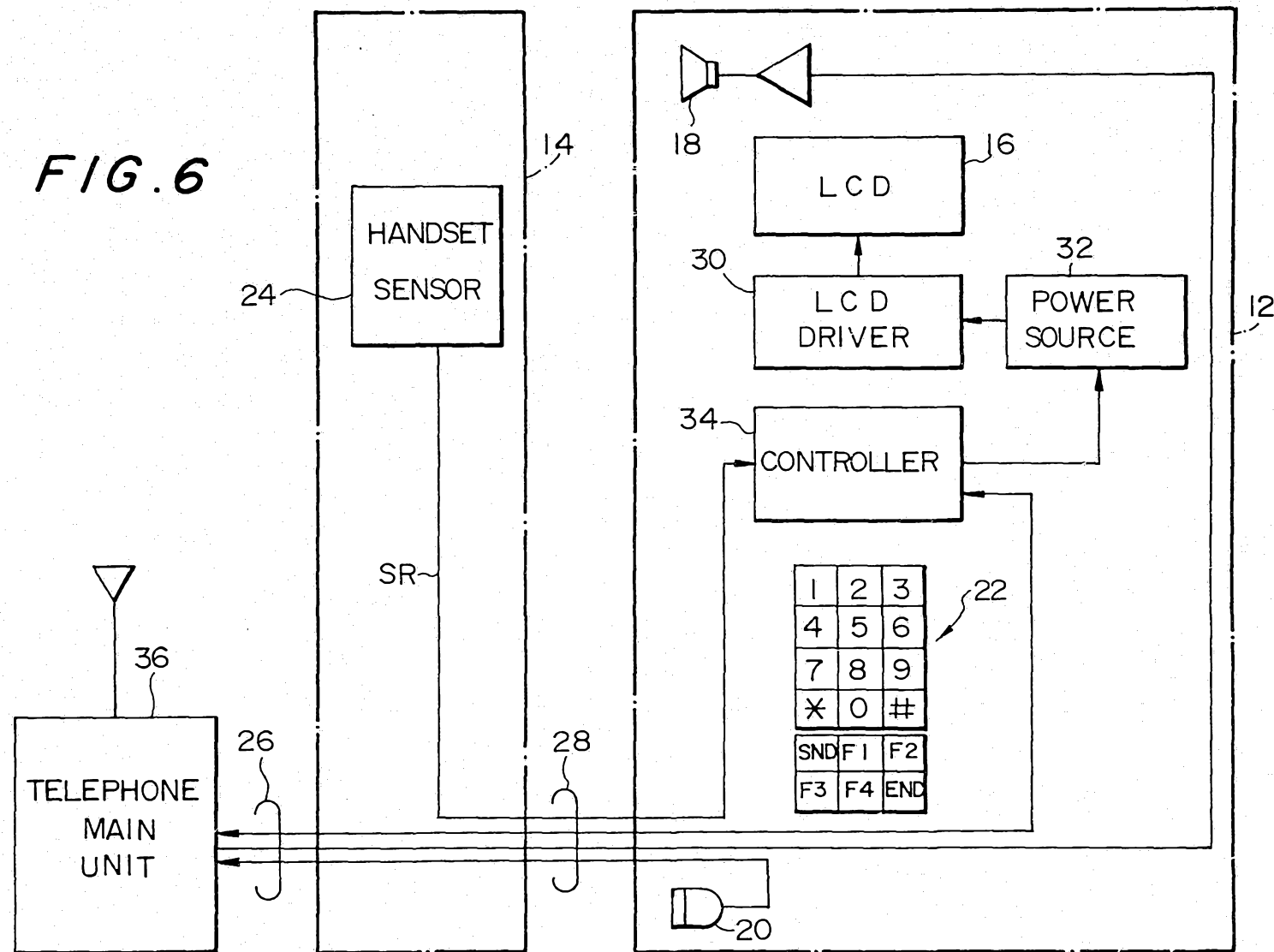


FIG. 6



29943/89

FIG. 7

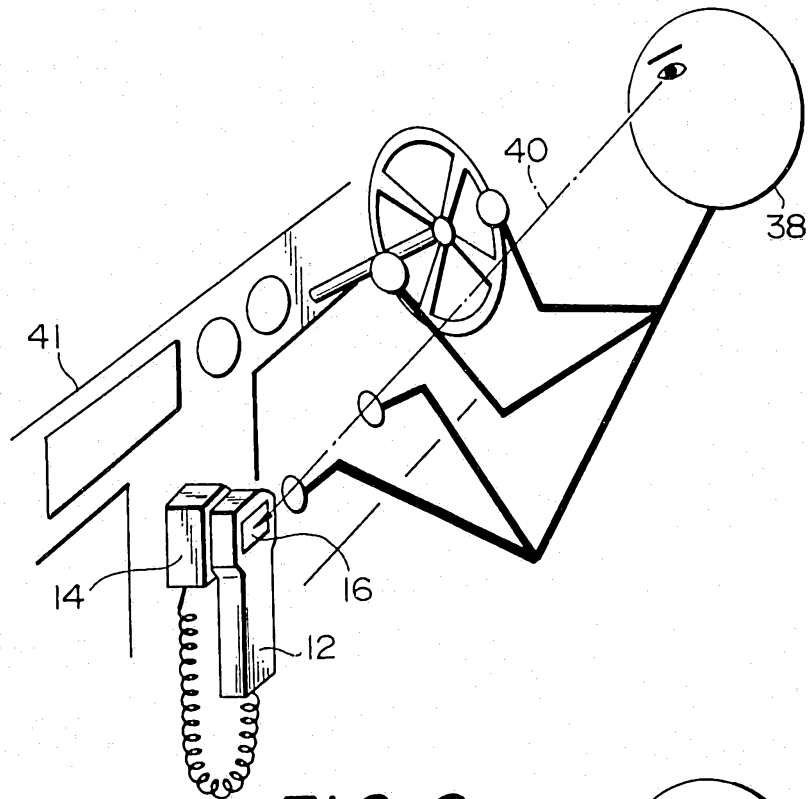


FIG. 8

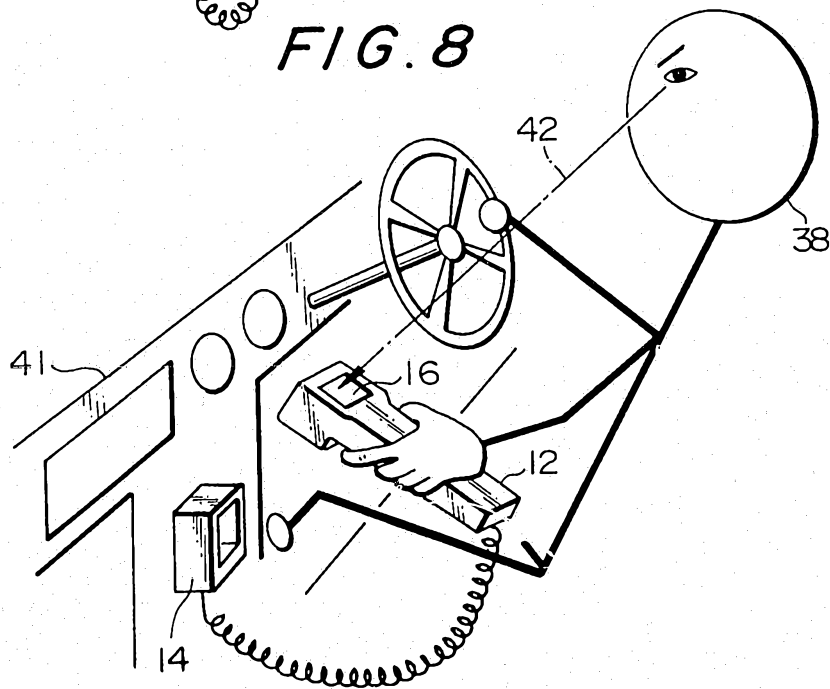


FIG. 9

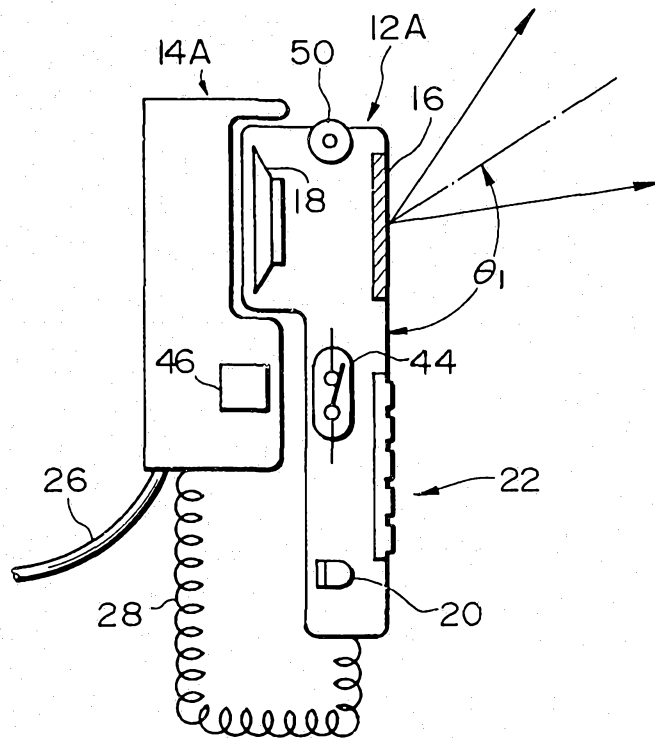


FIG. 10

