

(19)



(11)

EP 2 811 494 B1

(12)

EUROPEAN PATENT SPECIFICATION

(45) Date of publication and mention of the grant of the patent:
14.08.2019 Bulletin 2019/33

(51) Int Cl.:
H01F 27/29 (2006.01) **H01F 5/04** (2006.01)
H01F 27/06 (2006.01) **G09G 3/34** (2006.01)
G09G 3/36 (2006.01)

(21) Application number: **14152739.0**

(22) Date of filing: **27.01.2014**

(54) Inductor and display apparatus including the same

Induktor und Anzeigevorrichtung damit

Inducteur et appareil d'affichage en disposant

(84) Designated Contracting States:
**AL AT BE BG CH CY CZ DE DK EE ES FI FR GB
 GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO
 PL PT RO RS SE SI SK SM TR**

(30) Priority: **03.06.2013 KR 20130063455**

(43) Date of publication of application:
10.12.2014 Bulletin 2014/50

(73) Proprietor: **Samsung Electronics Co., Ltd.
 Gyeonggi-do 443-742 (KR)**

(72) Inventor: **Kang, Jeong-il
 Gyeonggi-do (KR)**

(74) Representative: **Appleyard Lees IP LLP
 15 Clare Road
 Halifax HX1 2HY (GB)**

(56) References cited:
**EP-A1- 0 422 609 EP-A1- 2 317 218
 CN-A- 1 229 516 US-A1- 2003 137 818
 US-A1- 2006 197 459 US-A1- 2008 106 505
 US-A1- 2008 106 898 US-A1- 2012 262 895
 US-A1- 2012 313 542**

EP 2 811 494 B1

Note: Within nine months of the publication of the mention of the grant of the European patent in the European Patent Bulletin, any person may give notice to the European Patent Office of opposition to that patent, in accordance with the Implementing Regulations. Notice of opposition shall not be deemed to have been filed until the opposition fee has been paid. (Art. 99(1) European Patent Convention).

Description

BACKGROUND

Field

[0001] The present invention relates to an inductor and a display apparatus including the same, and more particularly, to an inductor and a display apparatus including the same, in which an inductor core is improved in shape to stand on a printed circuit board.

[0002] EP 0422609 A1 and US 2006/0197459 A1 show a linearity coil and a layout configuration of a flat display device respectively.

Description of the Related Art

[0003] A display apparatus may include a display panel for displaying an image. The display panel may display an image based on a broadcasting signal and/or video signals having various formats. If a liquid crystal panel that cannot emit light by itself is used as the display panel, a backlight unit may be needed to illuminate the display panel. Taking into account environmental contamination, response speed, energy conservation, etc., a light emitting diode (LED) may be employed as a light source of the backlight unit. Further, the display apparatus may include a driving circuit in order to drive the light source.

[0004] In the case where the LED is used as the light source, a high-efficiency switching type direct current to direct current (DC-DC) converter has been generally employed as the driving circuit. A backlight unit of a small display apparatus equal to or smaller than 32" (81.28cm) may employ an inductor 1a to which a lead type drum core 2a is applied as shown in FIG. 1. The drum core 2a used in the inductor 1a may be fixed to a nonconductive base 4 by a bond or the like, and wound with a coil 3 to have desired electric characteristics. Both ends of the coil 3 may be wound around conductive pins 5 fixed to the base 4 and soldered, thereby completing the inductor 1a. The base 4 serves to form a sturdy electrode by fixing a body of the drum core 2a, and electrically insulating the drum core 2a from a wiring on a printed circuit board to which the inductor 1a is mounted.

[0005] Also, if the printed circuit board has a cross-section where the wiring is formed on only the rear of the printed circuit board, the inductor may be manufactured as shown in FIG. 3 by directly inserting and fixing a plurality of pins 5 in and to the drum core 2b instead of using the base, thereby reducing costs.

[0006] Referring to FIG. 4, a drum core type inductor 1b without using a base is applicable to only the printed circuit board that has the wiring on either of a first surface 6a to which the inductor 1b is mounted or a second surface 6b opposite to the first surface 6a.

[0007] The inductor 1b is manufactured by winding the coil 3 around the drum core 2b, winding both ends of the coil 3 around the conductive pins 5, and soldering both

ends of the coil 3 to the conductive pins 5. In the case of the inductor 1b manufactured as above, as shown in FIG. 4, when the inductor 1b is mounted to the printed circuit board 6, the inductor 1b is unbalanced and inclined by a finished portion 3a of the coil 3, thereby possibly causing contact failure, quality degradation, life-shortening, etc.

SUMMARY

[0008] The embodiments are conceived with a drum core comprised in the inductor without using a base, to provide an inductor and a display apparatus including the inductor, in which the inductor stands and remains horizontal on a printed circuit board so that mounting quality of an inductor may be improved.

[0009] According to the present invention, there is provided an inductor and a printed circuit board. The inductor includes a drum core including a cylindrical body and first and second flanges extending from opposite ends of the cylindrical body, a coil wound around the cylindrical body, a plurality of pins on which opposite ends of the coil are wound, wherein each of the plurality of pins has one end fixed to the second flange and another end configured to be fixed to the printed circuit board, and three projections which protrude from the second flange are configured to support the inductor to stand vertically on the printed circuit board.

[0010] A height of the projection is greater than a height of finished portions formed by winding the opposite ends of the coil around the pins.

[0011] The projection may be integrated with the second flange.

[0012] The printed circuit board includes wiring on at least a first surface facing the inductor and a second surface opposite the first surface.

[0013] According to an embodiment, there is provided a display apparatus including a video processor configured to process a video signal, a display that includes a backlight unit configured to emit light, wherein the display is configured to display an image with the emitted light based on the processed video signal, a driving circuit configured to drive the backlight unit, wherein the driving circuit includes a printed circuit board and an inductor mounted on the printed circuit board. The inductor is allowed to stand vertically on the printed circuit board.

[0014] The backlight unit may include at least one light emitting diode (LED) configured to emits the light.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015] The above and/or other aspects will be more apparent and more readily appreciated from the following description, taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a front view schematically showing a drum core type inductor with a base;

FIG. 2 is a perspective view schematically showing

a base of a drum core type inductor;
 FIG. 3 is a front view schematically showing a drum core type inductor without a base;
 FIG. 4 is a side view schematically showing that a drum core type inductor without a base being mounted on a printed circuit board;
 FIG. 5 is a front view schematically showing a drum core comprised in an inductor according to the present invention;
 FIG. 6 is a bottom view schematically showing a drum core of an inductor according to the present invention;
 FIG. 7 is a front view schematically showing a drum core of an inductor according to the present invention;
 FIG. 8 is a side view schematically showing an inductor mounted on a printed circuit board useful for understanding the present invention; and
 FIG. 9 is a block diagram schematically showing elements of a display apparatus.

DETAILED DESCRIPTION OF EXEMPLARY EMBODIMENTS

[0016] The following description is provided to assist the reader in gaining a comprehensive understanding of the methods, apparatuses, and/or systems described herein. Accordingly, various changes, modifications, and equivalents of the methods, apparatuses, and/or systems described herein will be suggested to those of ordinary skill in the art. Also, descriptions of well-known functions and constructions may be omitted for increased clarity and conciseness.

[0017] Throughout the drawings and the detailed description, unless otherwise described, the same drawing reference numerals will be understood to refer to the same elements, features, and structures. The relative size and depiction of these elements may be exaggerated for clarity, illustration, and convenience.

[0018] An inductor and a display apparatus including the inductor will be described in detail with reference to accompanying drawings.

[0019] As shown in FIG. 7, an inductor 10 includes a coil 30 through which electric current flows, a drum core 20 around which the coil 30 is wound, a plurality of pins 50 fixed to a lower surface of the drum core 20, and a projection 24 formed protruding from the lower surface of the drum core 20.

[0020] The coil 30 is provided as a wire having good conductivity to achieve inductance of the inductor 10. The wire is coated with an insulating material, and used as being wound cylindrically or spirally.

[0021] Referring to FIG. 5, the drum core 20 includes a cylindrical body 21 around which a coil is wound, a first flange 22 extended from a top of the body 21, and a second flange 23 extended from a bottom of the body 21. The second flange 23 is formed with a plurality of projections 24.

[0022] The cylindrical body 21 is designed to have a diameter and a length corresponding to desired inductance, and is wound around with the coil.

[0023] Further, the drum core 20 may be made of ferrite.

[0024] As shown in FIG. 7, the plurality of pins 50 are provided in the form of cylindrical bars, each of which has one side inserted in and fixed to a hole 25 (refer to FIG. 6) formed in the second flange 23 and the other side inserted in and fixed to a hole 63 (refer to FIG. 8) formed in the printed circuit board. With this, the drum core 20 is fixed without being separated from the printed circuit board. In this example useful for understanding the present invention, two pins 50 are provided.

[0025] Further, the pins 50 are made of a conductor such as copper or the like. Both ends 31 and 32 of the coil 30 are fixed to the second flange 23, wound around the cylindrical body 21, and are wound around and fixed to the pins 50. At this time, both ends 31 and 32 of the coil 30 may be soldered and electrically connected to the pins 50.

[0026] Also, the pins 50 inserted in the printed circuit board may be soldered to the printed circuit board so as to be electrically connected and fixed to the wiring provided on the printed circuit board.

[0027] As shown in FIG. 5, the drum core 20 includes the cylindrical body 21 standing with respect to FIG. 6, and the first and second flanges 22 and 23 extended from the top and bottom ends of the body 21. Here, the second flange 23 is a mounting surface facing the printed circuit board.

[0028] As shown in FIG. 6, the second flange 23 includes two holes 25 where the plurality of pins are inserted and fixed, and three projections 24 allowing the drum core 20 to stand while keeping horizontal on the printed circuit board.

[0029] The projections 24 are higher than a height of finished portions formed by winding both ends 31 and 32 of the coil 30 around the pins 50. With this structure as shown in FIG. 8, the drum core 20 can be placed and fixed such that the drum core 20 can maintain a horizontal position on the printed circuit board 60 regardless of the finished portions of the coil 32.

[0030] Here, three projections 24 are provided and the projections may have any shape as long as they can keep the drum core horizontal in relation to the printed circuit board.

[0031] Also, the projection 24 may be integrated with the second flange 23 in consideration of productivity and production costs, but not limited thereto. Alternatively, the projection 24 may be separately manufactured and then coupled to the second flange 23.

[0032] Referring to FIG. 8, the inductor 10 includes the projections 24 on the second flange 23 of the drum core 20, and is thus spaced apart at a predetermined distance and electrically insulated from the printed circuit board 60 where the inductor 10 is mounted. Therefore, the inductor 10 is applicable for the wiring being provided on

either or both of the top 61 and the bottom 62 of the printed circuit board 60.

[0033] The inductor 10 may be used in the display apparatus 100 according to an embodiment.

[0034] FIG. 9 is a block diagram schematically showing the elements of a display apparatus.

[0035] As shown in FIG. 9, the display apparatus 100 may include a communicator 200 configured to receive a video signal or a user's command signal from the exterior, a video processor 300 configured to process the received video signal, a controller 400 configured to control operations of the display apparatus 100 in response to a command received through the communicator 200, a storage 500 configured to store information and programs needed for operating the display apparatus 100, and a display 600 configured to display an image based on the video signal processed by the video processor 300.

[0036] The display 600 includes a display panel 610 such as a liquid crystal panel or the like to receive light, a backlight unit 620 to emit light to the display panel 610, and a driving circuit 630 to drive the backlight unit 620.

[0037] The backlight unit 620 is provided behind, at top/bottom sides and/or at left/right sides of the display panel 610, and emits light to the display panel 610. As a light source for emitting light, at least one light emitting diode (LED) may be included in the backlight unit 620. Alternatively, various methods such as cold cathode fluorescent lamp, etc. may be used as long as it can emit light.

[0038] The driving circuit 630 includes a DC-DC converter that is a buck circuit or a boost circuit based on a high efficiency switching method.

[0039] The inductor 10 may be used for storing energy of an input voltage in a filter of the driving circuit 630 that converts a level of the input voltage and outputs an output voltage.

[0040] For example, the buck circuit may include one inductor and two switches for controlling the inductor, and may connect the inductor with power, thereby alternating between an operation of storing energy in the inductor and an operation of discharging electricity regarding the inductor as load. Here, the inductor 10 according to an exemplary embodiment is used.

[0041] According to an embodiment, there are provided an inductor and a display apparatus including the inductor, in which the inductor is mounted keeping horizontal on the printed circuit board, thereby having an effect on improving a mounting quality of the inductor.

[0042] Thereby, the inductor may be prevented from inclination, thereby having effects on minimizing soldering failure and preventing contact failure.

[0043] The inductor may not movable but stationary on the printed circuit board, thereby maybe having an effect on preventing damage due to bending in a contact portion or fatigue stress.

[0044] The number of parts may be reduced when the inductor is manufactured, thereby may be having effects

on increasing productivity and reducing production costs.

Claims

1. An inductor (10) and a printed circuit board, the inductor mounted on a first surface of the printed circuit board and comprising:

a ferrite drum core (20) comprising a cylindrical body (21) and first (22) and second (23) flanges extending from opposite ends of the cylindrical body;

a coil (30) wound around the cylindrical body (21);

a plurality of pins (50) on which opposite ends (31, 32) of the coil (30) are wound, wherein each of the plurality of pins (50) has one end fixed to the second flange (23) and another end configured to be fixed to the printed circuit board; and three projections (24) equidistantly spaced relative to each other, the three projections directly protrude from an outer peripheral region of the second flange (23) and are configured to electrically insulate the drum core from the PCB and to support the inductor (10) to stand vertically on the first surface of the printed circuit board, the three projections (24) having a shape to keep the drum core horizontal in relation to the first surface of the printed circuit board without using a base; wherein

a height of the projections (24) is greater than a height of a finished portions formed by winding the opposite ends of the coil (30) around the pins; and

wherein the printed circuit board comprises wiring on at least the first surface facing the inductor (10) and a second surface opposite the first surface.

2. The inductor (10) and the printed circuit board according to claim 1, wherein the projections (24) are integrated with the second flange (23).

3. A display apparatus including the inductor (10) and the printed circuit board according to one of claims 1 to 2, the display apparatus comprising:

a video processor configured to process a video signal;

a display that comprises a backlight unit configured to emit light, wherein the display is configured to display an image with the emitted light based on the processed video signal; and

a driving circuit configured to drive the backlight unit, wherein the driving circuit comprises the printed circuit board and the inductor (10) is mounted on the printed circuit board.

4. The display apparatus according to claim 3, wherein the backlight unit comprises at least one light emitting diode (LED) configured to emit the light.

Patentansprüche

1. Induktor (10) und Leiterplatte, wobei der Induktor auf einer ersten Oberfläche der Leiterplatte montiert ist, umfassend:

einen Ferrittrommelkern (20) umfassend einen zylindrischen Körper (21) und einen ersten (22) und einen zweiten (23) Flansch, die sich von gegenüberliegenden Enden des zylindrischen Körpers erstrecken;

eine Spule (30), die um den zylindrischen Körper (21) gewickelt ist;

mehrere Stifte (50), auf welche gegenüberliegende Enden (31, 32) der Spule (30) gewickelt sind, wobei jeder der mehreren Stifte (50) ein Ende aufweist, das am zweiten Flansch (23) befestigt ist, und ein anderes Ende, das zum Befestigen an der Leiterplatte ausgelegt ist; und drei Vorsprünge (24), die gleich weit voneinander beabstandet sind, wobei die drei Vorsprünge direkt aus einem äußeren Umfangsbereich des zweiten Flansches (23) herausragen und zum elektrischen Isolieren des Trommelkerns von der Leiterplatte und zum Stützen des Induktors (10) zum vertikalen Stehen auf der ersten Oberfläche der Leiterplatte ausgelegt sind, wobei die drei Vorsprünge (24) eine Form aufweisen, um den Trommelkern in Bezug auf die erste Oberfläche der Leiterplatte ohne Verwendung einer Basis horizontal zu halten, wobei eine Höhe der Vorsprünge (24) größer ist als eine Höhe eines fertigen Abschnitts, der durch Wickeln der gegenüberliegenden Enden der Spule (30) um die Stifte gebildet wird; und wobei die Leiterplatte eine Verdrahtung auf mindestens der ersten Oberfläche, die dem Induktor (10) zugewandt ist, und einer zweiten der ersten Oberfläche gegenüberliegenden Oberfläche umfasst.

2. Induktor (10) und Leiterplatte nach Anspruch 1, wobei die Vorsprünge (24) in den zweiten Flansch (23) integriert sind.

3. Anzeigevorrichtung mit dem Induktor (10) und der Leiterplatte nach einem der Ansprüche 1 bis 2, wobei die Anzeigevorrichtung umfasst:

einen Videoprozessor, der zum Verarbeiten eines Videosignals ausgelegt ist;

eine Anzeige, die eine Hintergrundbeleuchtungseinheit umfasst, die zum Emittieren von

Licht ausgelegt ist, wobei die Anzeige zum Anzeigen eines Bildes mit dem emittierten Licht basierend auf dem verarbeiteten Videosignal ausgelegt ist; und

eine Ansteuerschaltung, die zum Ansteuern der Hintergrundbeleuchtungseinheit ausgelegt ist, wobei die Ansteuerschaltung die Leiterplatte umfasst, und der Induktor (10) auf der Leiterplatte montiert ist.

4. Anzeigevorrichtung nach Anspruch 3, wobei die Hintergrundbeleuchtungseinheit mindestens eine lichtemittierende Diode (LED) umfasst, die zum Emittieren des Lichts ausgelegt ist.

Revendications

1. Une inductance (10) et une carte de circuit imprimé, l'inductance étant montée sur une première surface de la carte de circuit imprimé et comprenant :

un noyau de cylindre en ferrite (20) comprenant un corps cylindrique (21) et des premier (22) et deuxième (23) flasques s'étendant depuis des extrémités opposées du corps cylindrique ;
une bobine (30) enroulée autour du corps cylindrique (21) ;

une pluralité de broches (50) sur lesquelles des extrémités opposées (31, 32) de la bobine (30) sont enroulées, chacune de la pluralité de broches (50) ayant une extrémité fixée au deuxième flasque (23) et une autre extrémité configurée pour être fixée à la carte de circuit imprimé ; et trois saillies (24) équidistantes les unes des autres, les trois saillies faisant directement saillie depuis une région périphérique externe du deuxième flasque (23) et sont configurées pour isoler électriquement le noyau de cylindre de la PCB et pour supporter l'inductance (10) pour qu'elle repose verticalement sur la première surface de la carte de circuit imprimé, les trois saillies (24) ayant une forme permettant de maintenir le noyau de cylindre horizontal par rapport à la première surface de la carte de circuit imprimé sans utiliser de socle ;

une hauteur des saillies (24) étant supérieure à une hauteur d'une partie finie formée en enroulant les extrémités opposées de la bobine (30) autour des broches ; et

la carte de circuit imprimé comprenant un câblage au moins sur la première surface faisant face à l'inductance (10) et une deuxième surface à l'opposé de la première surface.

2. L'inductance (10) et la carte de circuit imprimé selon la revendication 1, les saillies (24) étant intégrées avec le deuxième flasque (23).

3. Appareil d'affichage comportant l'inductance (10) et la carte de circuit imprimé selon une des revendications 1 à 2, l'appareil d'affichage comprenant :

un processeur vidéo configuré pour traiter un signal vidéo ; 5
un écran qui comprend une unité de rétroéclairage configurée pour émettre de la lumière, l'écran étant configuré pour afficher une image avec la lumière émise sur la base du signal vidéo traité ; et 10
un circuit de commande configuré pour commander l'unité de rétroéclairage, le circuit de commande comprenant la carte de circuit imprimé et l'inductance (10) étant montée sur la carte de circuit imprimé. 15

4. Appareil d'affichage selon la revendication 3, dans lequel l'unité de rétroéclairage comprend au moins une diode électroluminescente (DEL) configurée pour émettre la lumière. 20

25

30

35

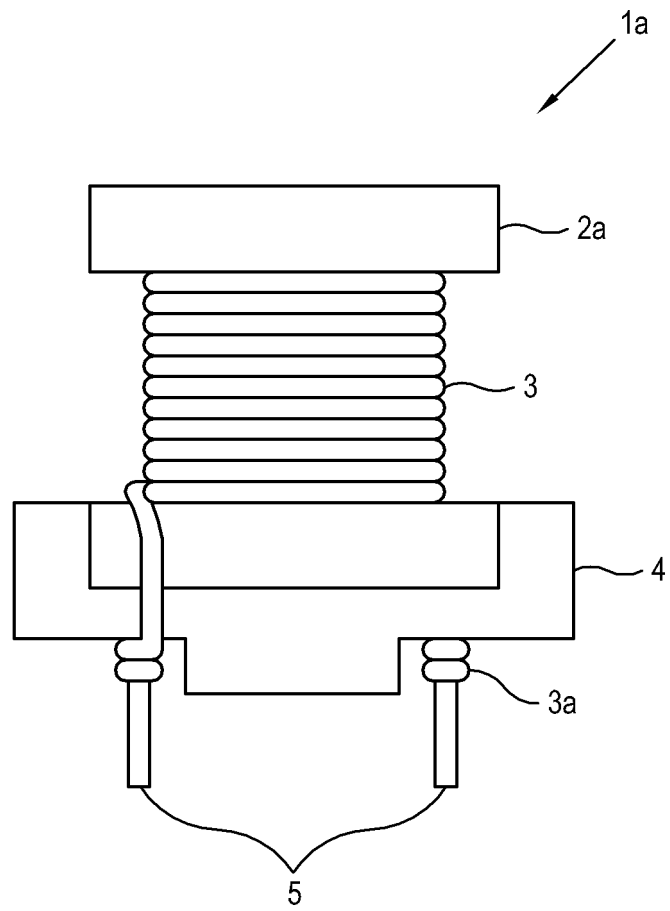
40

45

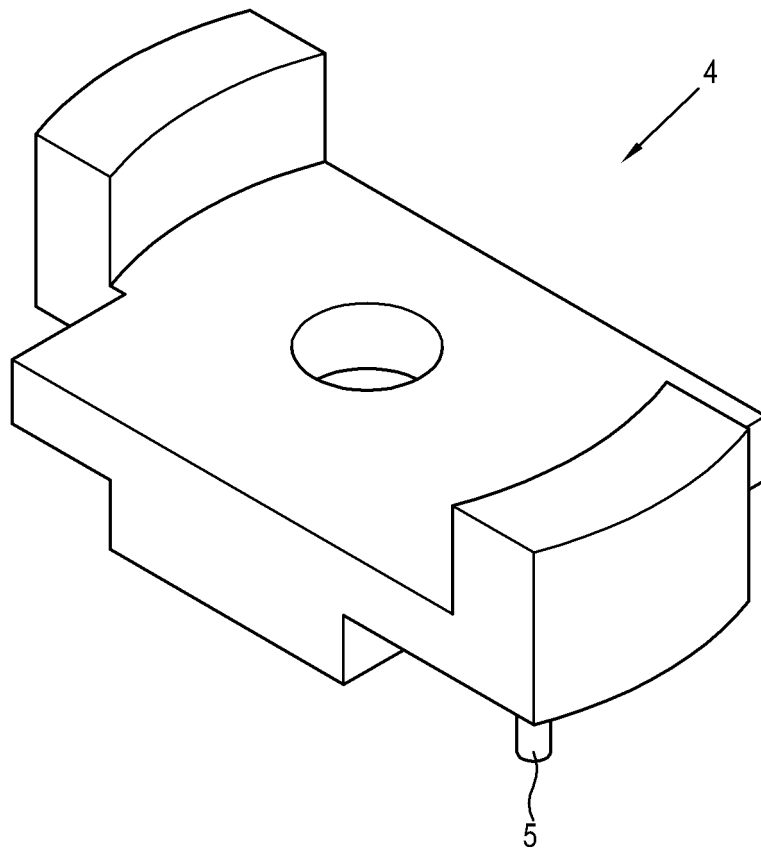
50

55

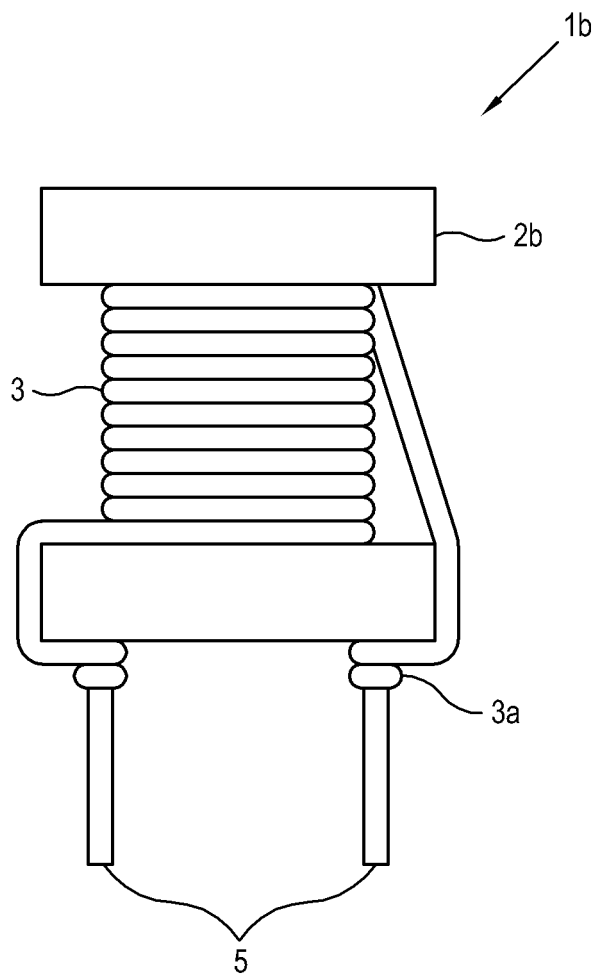
RELATED ART
FIG. 1



RELATED ART
FIG. 2



RELATED ART
FIG. 3



RELATED ART
FIG. 4

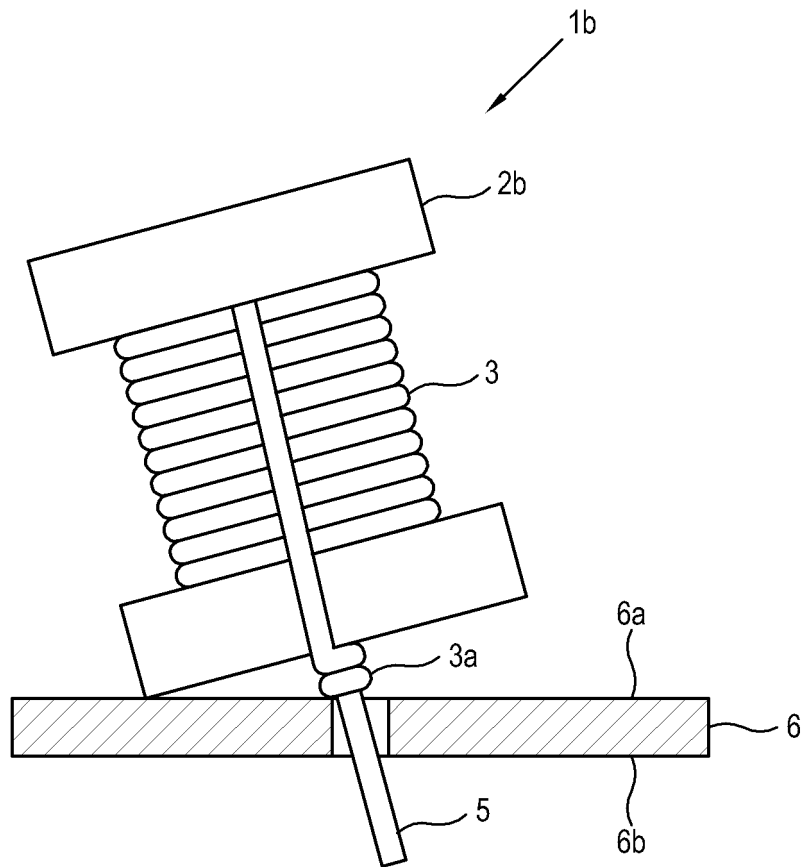


FIG. 5

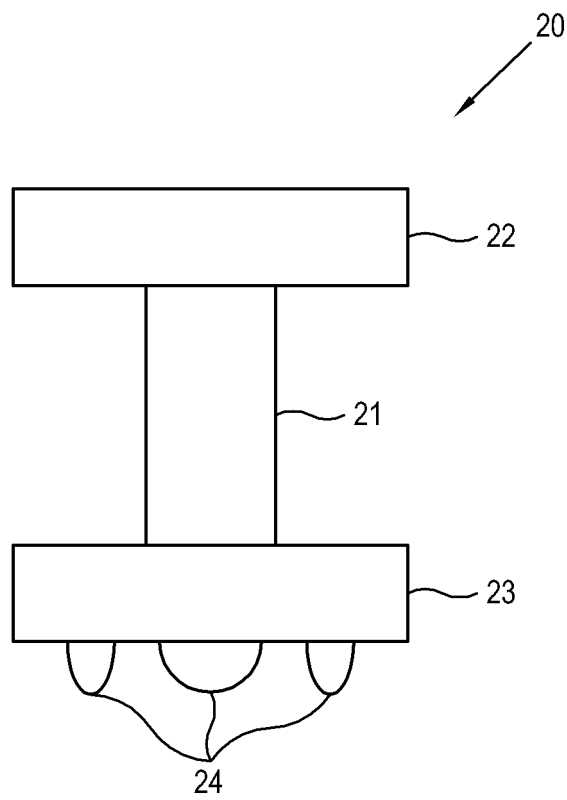


FIG. 6

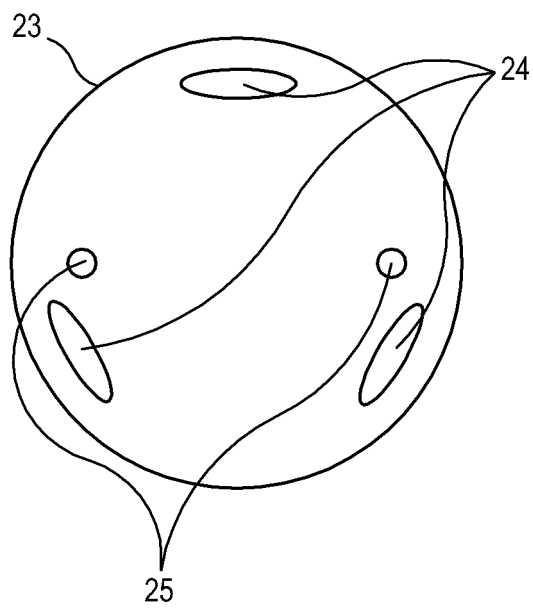


FIG. 7

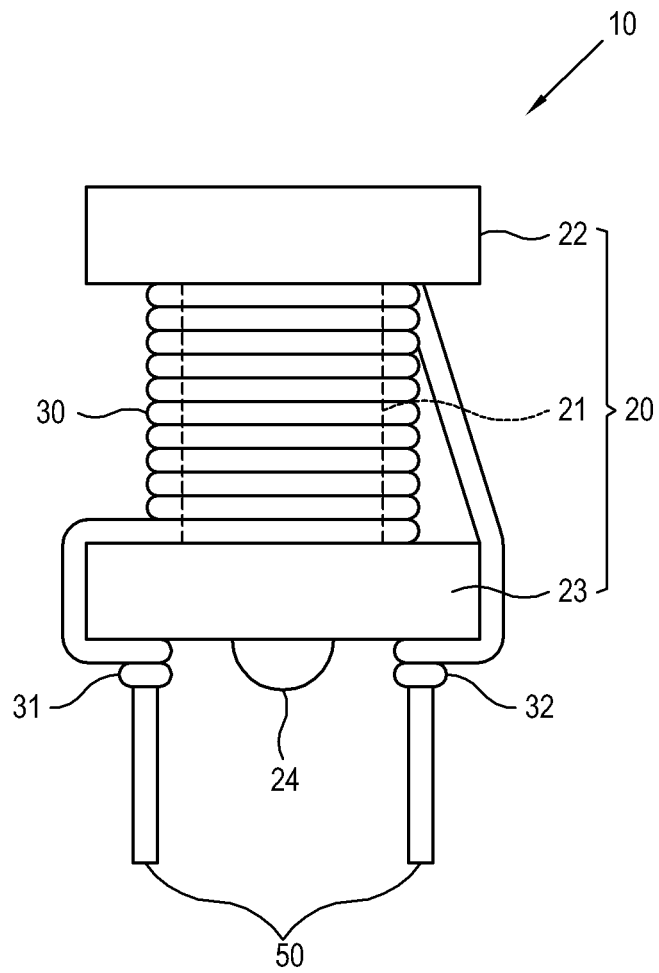


FIG. 8

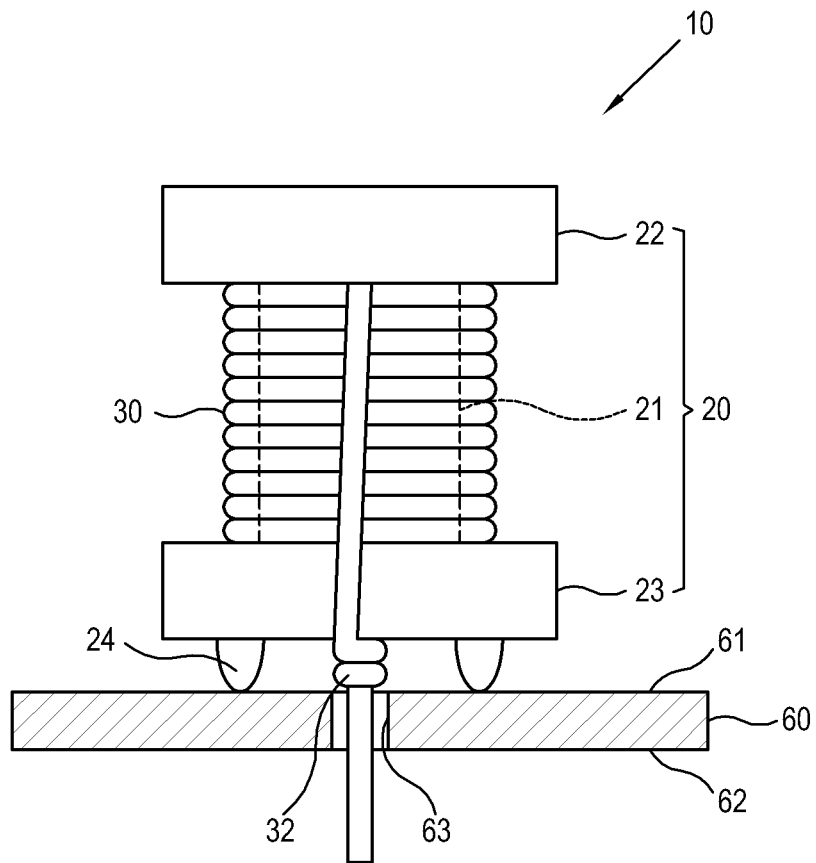
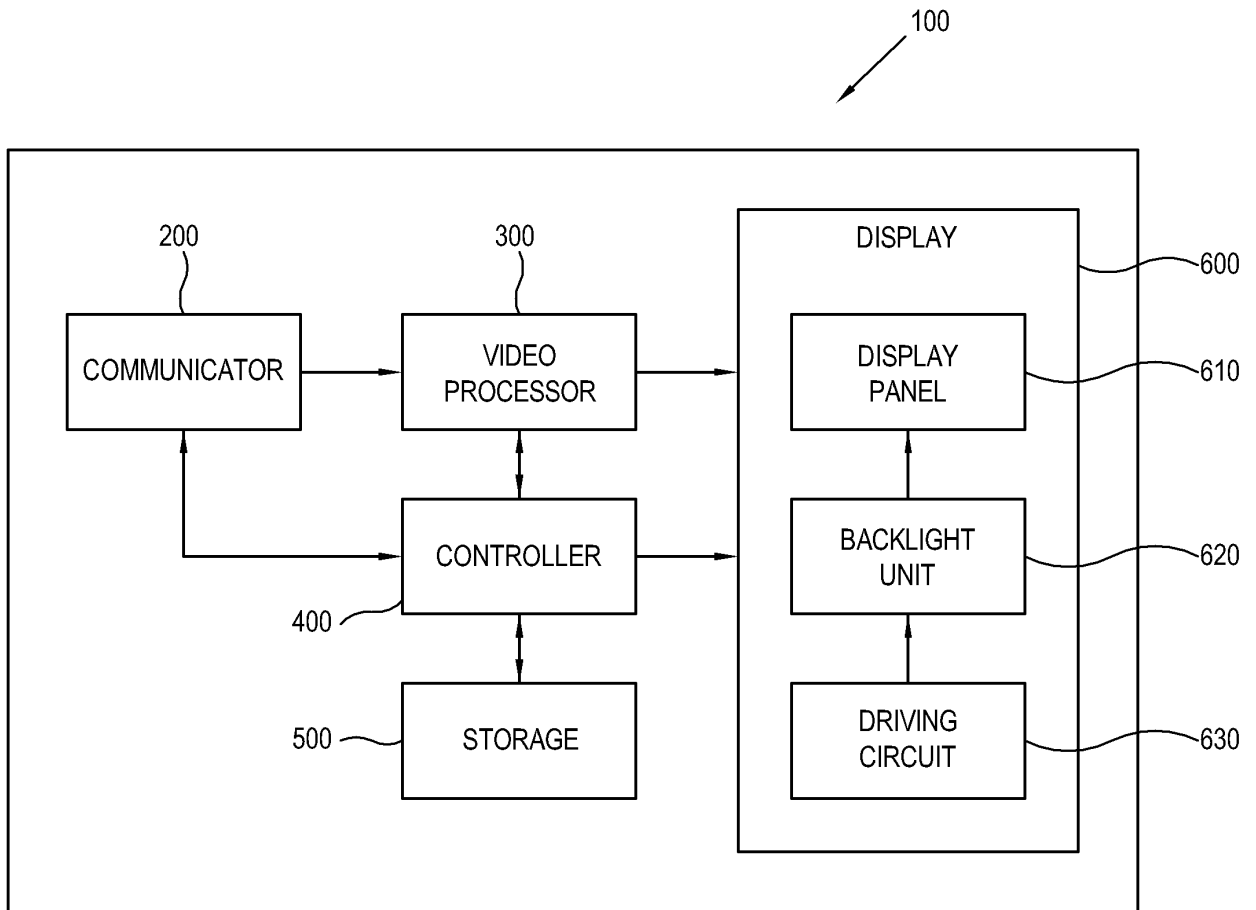


FIG. 9



REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- EP 0422609 A1 [0002]
- US 20060197459 A1 [0002]