

Description

Device for displaying alphanumeric symbols and/or graphic symbols

The present invention relates to a device for displaying alphanumeric symbols and/or graphic symbols according to the precharacterizing clause of Claim 1.

A variety of devices for displaying alphanumeric symbols and/or graphic symbols have been described in the literature and also used in practice. Such devices are, for example, displays of various sizes with light-emitting diodes (LED's) arranged in rows and columns in the form of a matrix.

A display device of the generic type is disclosed, for example, in the international patent application PCT/RO95/00013. In this, a line of LED's or LED groups is arranged in a vertical orientation on an appropriately designed support which rotates at a constant rotational speed of more than 1200 rpm about the vertical axis of a drive motor. The block diagram includes, inter alia, a sequence generator for generating code sequences for the series of symbols and pictures and a synchronizing circuit for detecting the exact angular position of the rotating LED support, from which the actual rotational speed of the LED support is determined and regulated.

The rotating LED arrangement is located in the interior of a rotationally symmetrical housing made of acrylic glass or a similar material pervious to light. To the viewer, a stationary picture or a readable series of symbols and/or pictures which is stationary or moves in the manner of moving display is projected onto the surface of the housing and is visible to the viewer from an angular range of more than 270°.

In order to generate a series of symbols and/or pictures which are easily readable by the viewer, correct control of the LED's is crucially important, particularly in respect of the rotational speed of the LED arrangement.

The object of the present invention is to provide a device of the type mentioned at the beginning which is able to effect the energy transmission to the rotating elements or the rotating arrangement using an arrangement which is technically simple and in particular free from wear.

This object is achieved by the features of Claim 1. Advantageous refinements and developments of the invention are the subject matter of the subclaims.

The measures according to the invention for contactless energy transmission provide an arrangement which is free from any wear, with the result that on the one hand freedom from maintenance can be ensured and on the other hand the quality of the entire display device is improved, despite the smaller number of components and simplified design.

In an advantageous embodiment of this method of solution, inductive energy transmission is proposed as the contactless energy transmission. In this case, there may be provided in a first alternative a rotor, the coil ends or winding ends of which are electrically fixedly connected to the circuit board or electric or electronic components. Around this rotor is arranged a stator formed of half-shells. The rotor has at least one coil winding. As a result of the rotation of the rotor together with the drive shaft, the outer magnetic half-shells generate a current in the coil which is delivered to the rotating electronic subassembly (circuit board).

Preferably, the stator or the half-shells of the stator is or are designed as a permanent magnet. It is also advantageous to provide the rotor with six coil assemblies, the coil longitudinal

axes of which are radially oriented, in order to obtain a three-phase system more favourable in terms of efficiency and smoothing of the alternating voltage.

In a second alternative, annular coils are located opposite with a small spacing on the circuit board and stationarily on the motor output side, these annular coils serving for the induction and transmission of electric energy on rotation of the circuit board.

In a development of the invention, the device is equipped with a PC interface and/or an infrared interface for the purpose of data transmission for control and programming. The infrared interface makes it possible to input a desired series of symbols and/or pictures by means of a remote control.

Various exemplary embodiments of the invention are described in more detail below with reference to the drawing, in which:

Figure 1 shows the display device in its basic construction in section along the axis of rotation of the arrangement;

Figure 2 shows a detail of the contactless energy transmission in an enlarged representation in accordance with the circle II of Figure 1;

Figure 3 shows a sectional representation of the exemplary embodiment of Figure 3 [sic] in accordance with the line IV-IV in Figure 3 [sic];

Figure 4 shows an alternative of the exemplary embodiment depicted in Figure 3, in a sectional representation analogously to the line IV-IV in Figure 3 [sic]; and

Figure 5 shows a further exemplary embodiment of the contactless energy transmission in a simplified sectional representation.

Fig. 1 depicts a preferred exemplary embodiment of the LED display device according to the invention in section along the axis of rotation 21 of the arrangement. Mounted on a base, stand or similar mounting or supporting means 1 is an electric motor 2, which is designed for a suitable motor rotational speed, for example of approximately 1000 to 3000 rpm, preferably approximately 2000 to 3000 rpm. The electric motor 2 customarily used is a synchronous motor. It is of course also possible to employ other drive motors provided that they are suitable for the intended purpose.

For coupling a circuit board 4 to the electric motor 2 for the intended rotary drive, a coupling piece 3 is fastened to the drive shaft 20 of the electric motor 2. Mounted on this coupling piece 3 or on the output side of the coupling piece 3 is the circuit board 4, which is oriented at an angle of approximately 90° to the axis of rotation 21 of the drive shaft 20. The circuit board 4 contains the entire electronic circuits for controlling the display device. Essentially these are the control of the light-emitting diodes (LED's) 6 or the LED groups 6 via regulated constant-current sources, non-volatile storage of the alphanumeric symbols and/or graphic symbols and a symbol generator for converting the series of symbols and/or pictures into the corresponding LED control.

The electronic circuit board 4 at the same time serves as a mechanical mount for a support 5 which is preferably arranged approximately at right angles to the circuit board 4, i.e. approximately parallel to the axis of rotation 21. At least one preferably vertical line of LED's or LED groups 6 is attached to the support 5, these being oriented radially outwards, i.e. substantially perpendicular to the drive shaft 20 or axis of rotation 21.

The LED's 6 on the support 5 are coloured light-emitting diodes of predeterminable colour and in a colour sequence. Both light-emitting diodes with continuously changing colours and light-

emitting diodes of the same colour may be employed. The choice of colour essentially depends on the intended display. Furthermore, the application is of course not limited to the single LED line of sixteen LED's 6 used in this exemplary embodiment. In particular, the line may have more or fewer LED's 6 depending on the specific application.

The control on the circuit board 4 ensures that the LED's 6 in each case desired light up in a temporally predetermined manner in accordance with a stored input (program, computer program). In general, the font (bold, italic, etc.) and the speed of movement of the series of symbols and/or pictures are fixedly preset, and the user can only choose and input a desired series of symbols and/or pictures. A more elaborate, flexible programming tool will of course also allow the user to freely select the font, speed of movement or other parameters of the series of symbols and/or pictures to be displayed.

In addition to controlling the device via a computer 28 with IR control 27, the above-described device may alternatively be directly controlled by means of an infrared remote control 29. The infrared sensor 30 is mounted, for associated movement, on a rotating part, such as for example on the support 5 or the circuit board 4. The advantage obtained on attaching the infrared sensor 30 to a rotating part is that data can be transmitted to the so-called spherical display from all directions using the remote control.

The frequency range for the data transmission by remote control 29 is, in principle, not limited to the infrared range, but this is the obvious choice on account of the use in commercially available remote controls.

Since the remote control 29, unlike the computer 28, generally does not have a screen or other display elements in order to check the input data, in the case of data transmission by means of remote control 29 the display device itself by way of its

LED's 6 functions as a display for checking the data input.

The high rotational speed at the drive shaft 20 of the electric motor 2 of, for example, approximately 3000 rpm generates, for the viewer of the display device, a "stationary" image at a frame rate of approximately 50 Hz. This image may be a stationary or moving character image composed of alphanumeric symbols or else a picture, depending on the preset and programmed storage contents. Combinations of such symbols and pictures are of course also possible.

In order to achieve a greater reading angle for the viewer of the display device, the LED heads 6 may be sloped, the sloping preferably being in the vertical. Alternatively, SMD LED's 6 may also be used.

A flexible (elastically deflectable) spring steel bar 7 is fastened to that side of the circuit board 4 which is located opposite the LED support 5. Located, optionally, at the free front end of the spring steel bar 7 is a weight 8 which, in a particularly advantageous manner, is displaceable in the longitudinal direction on the spring steel bar. This enables an optimal weight counterbalance adapted to the structural as well as operational conditions.

Instead of the spring steel bar 7 a bar made of another material having comparable properties is also usable, with the elastic deformability being considered an essential material property. It is also conceivable to choose, instead of the spring steel bar 7, a bar with the capability of singly or plurally folding down or dying out [sic] or a telescopic bar, said bar automatically folding up or extending to its operational length owing to the centrifugal force produced upon rotation.

When the arrangement starts to rotate about the axis of rotation 21, the spring steel bar 7 or the equivalent bar element orients itself into the horizontal or virtually horizontal position or

a position to be seen as an extension of the circuit board 4 owing to the increasing centrifugal force and thus stabilizes and counterbalances the weight of the device in the operating state. The counterweight 8 attached to the end of the spring steel bar 7 in this case compensates for the weight of the LED arrangement 5, 6 employed. The entire display device thus stands firmly, without the need for special, additional fastenings to a base.

The use of a flexible, foldable or telescopic counterbalancing element 7 instead of a rigid mechanical counterbalancing body has the advantage of simpler mounting, in particular when the complete device is mounted in housing 31 with small receiving openings.

The entire above-described arrangement with its components is customarily mounted in a closed housing 31. The housing 31 is essentially a spherical, cylindrical or other rotationally symmetrically shaped housing. The spherical body 31 consists of a material pervious to light, for example acrylic glass, plastic, glass or the like. Preference is given to employing a spherical body 31 which has a diameter of approximately 30 cm and a receiving opening substantially smaller than that, through which the above-described arrangement is introduced into the housing 31. During this procedure, the housing 31 is supported by the base or stand 1 on which the electric motor 2 is mounted.

In principle, the circuit board 4 could also be attached outside the housing 31. In this case, the electric controls are fed directly to the LED's 6 by electric connections 32. However, the arrangement of the circuit board 4 inside the housing 31 is a preferred design, since all the elements are accommodated entirely in the housing 31 and the LED display device thus forms a self-contained constructional unit. Moreover, the housing 31 also provides the circuit board 4 with protection from dirt and other harmful environmental influences.

The electric motor 2 is connected to the mains via a supply cable

10 through an appropriate duct passing through the base 1, with the result that the electric motor 2 is supplied with the necessary electric energy when the system is switched on.

For the contactless transmission of electric energy to the circuit board 4, the law of induction is implemented in accordance with Figs. 2 to 6. In this implementation, use is made of the fact that an electric potential is generated (induced) in an electric conductor when the magnetic flux through an area enclosed by this electric conductor changes with time. As a result, when the circuit is closed a current flows without a supply point being present in the circuit. The electric potential is generated under specific law-governed preconditions:

- when the electric conductor is moved in a magnetic field such that it cuts the magnetic lines of force;
- when the electric conductor is fixed and the magnet is moved;
- when the electric conductor and the magnet [lacuna] fixed, but the magnetic field is varied;
- when the electric conductor and the magnet are stationary and with a fixed magnetic field a substance with a different relative permeability is brought into the magnetic field; or
- when the electric conductor is bent.

In all the cases outlined above, the electric potential is thus induced by a change of the magnetic flux with time.

Fig. 2 schematically depicts an exemplary embodiment for the contactless energy transmission. The electric motor 2 is connected to an energy source by the supply cable 10 and, via the drive shaft 20, drives the circuit board 4 with the LED's or LED groups 6. Simultaneously, a rotor 14 with a coil winding 15 is set in rotation by the electric motor 2. Located around the rotor 14 is a stationarily mounted stator 16 formed of two half-shells 17, as can be seen more clearly from the section of Fig. 3. The

stator 16 can be connected to direct current or alternating current, or alternatively can be a permanent magnet. The two half-shells 17 of the stator 16 are arranged with their free front ends 18 at a distance 19 from one another, thus resulting in an air gap between them. The winding ends 13 of the coil 12 indicate an electric connection to the circuit board 4, which is set in rotation by the drive shaft 20. The coil 12 may be provided with an iron core or soft-iron core (not shown). In order to protect the coil 12 from atmospheric influences, at least part of it may be arranged in a casting compound.

Instead of two half-shells 17, it is also possible to arrange several shells in the shape of an annulus around the rotor 14. The number of shells 17, which is even in each case, is calculated according to the relation $n \cdot \frac{1}{2}$, where n is an even number.

The stationarily arranged stator 16 in this case consists of a permanent magnet 34 surrounded by an iron shell 35. The rotor 14, which rotates together with the drive shaft 20 of the electric motor 2, has six coil formers 32 arranged in the shape of ring, the coil longitudinal axes of which are radially oriented so that the front faces of the coil formers 32 are each located approximately parallel to and opposite the permanent magnet 34. To intensify the inductive action, the six coil formers 32 are each provided with an iron core or soft-iron core 33, which advantageously has an anchor-shaped cross-section depicted in Fig. 4. The winding ends of the coil formers 32 are electrically connected to the circuit board 4 or to electronic components on the circuit board 4, as with the exemplary embodiments described above.

Fig. 5, lastly, shows in a further alternative the electric motor 2 again, which is supplied with electric energy via the supply cable 10 and, by means of the drive shaft 20, drives the circuit board 4 for a rotational movement. A primary coil 23 with a magnetic core or coil core 24 (iron core, soft-iron core) is

arranged beneath the circuit board 4 with a small air gap 22 of up to approximately two millimetres, the coil longitudinal axis being oriented approximately at right angles to the circuit board 4. Located opposite and directly assigned to this primary coil 23, beneath the circuit board, is a secondary coil 25, the two front sides of the coils 23 and 25 being located approximately parallel to and opposite one another. This secondary coil 25 may be let into the underside of the circuit board 4 together with a coil core 26. The secondary coil 25 may, however, also be mounted on the underside of the circuit board 4 or applied by the substrate technique.

The inductive energy transmission according to this alternative outlined is effected by the primary circuit (primary coil) being supplied with electric energy and passing it on to the secondary coil.

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Claims

1. Device for displaying alphanumeric symbols and/or graphic symbols, with a housing (31) in which an electric motor (2) drives a support (5) on which at least one line of light-emitting diodes or light-emitting diode groups (6) is arranged, the light-emitting diodes (6) being oriented substantially perpendicular to the drive shaft (20), and with a circuit board (4) with a control circuit for the light-emitting diodes (6),

characterized by

a contactless transmission of electric energy and/or data to the circuit board (4) or corresponding elements to be supplied with electric energy.



2. Device according to Claim 1,

characterized

in that the contactless transmission of the electric energy is effected, by generator and/or transformer, by electromagnetic induction.

3. Device according to Claim 2,

characterized

in that the electric motor (2), which is operatively connected to the circuit board (4), drives a rotor (14) provided with at least one coil (15, 32), the coil ends (13) of which are electrically connected to the circuit board (4) or corresponding elements, and

in that a stationary stator (16,33) is arranged with spacing around the rotor (15).

4. Device according to Claim 3,

characterized

in that the stator (16) is formed of at least two half-shells (17).

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5. Device according to Claim 3,
characterized

in that the stator (33) is formed of a permanent magnet.

6. Device according to one of Claims 3 to 5,
characterized

in that the rotor (14) is provided with at least four, preferably six, coil formers (32), the coil axes of which are radially oriented.

7. Device according to Claim 2,
characterized

in that a secondary coil (25) provided on the circuit board (4) is located opposite, with a small spacing with an air gap (22), a primary coil (23) arranged on the motor output side and supplied with electric energy.

8. Device according to Claim 7,
characterized

in that the secondary coil (25) is applied to the circuit board (4) by the substrate technique or as a film.

9. Device according to Claim 7,
characterized

in that the secondary coil (25) is set into the surface of the circuit board (4).

10. Device according to one of the aforementioned claims,
characterized

in that the coil(s) (12, 15, 23, 25, 32) has or have an iron core.

11. Device according to one of the aforementioned claims,
characterized

in that the coil(s) (12, 15, 23, 25, 32) is or are embedded in a casting body.



12. Device according to Claim 1,
characterized

in that the contactless transmission of the electric energy is effected capacitively.

13. Device according to one of the aforementioned claims,
characterized

in that, for the input of the alphanumeric symbols and/or graphic symbols to be displayed, at least one PC interface (27) and/or an infrared or radio interface (30) is provided between the input medium and display device.