The invention relates to a scanning device including two holding devices which are attached at one end to two opposite sides of the scanning device or of a part of the scanning device and the other end of which is attached to a fixed holding means, wherein each holding device is constructed from two end parts, two intermediate parts and at least one central part which are connected to one another by hinge means, wherein the parallel axes of rotation of the two outer hinge means, which link the end parts to the intermediate parts, are perpendicular to the parallel axes of rotation of the two inner hinge means which link the central part to the intermediate parts, wherein the end parts and the intermediate parts extend in parallel to one another, wherein each end part is connected to the intermediate part by means of at least one hinge means, wherein two central parts extending in parallel with one another are each connected at their ends to the intermediate parts via a hinge means.

Scanning devices of this type are employed in e.g. CD players for reading the items of data on a compact disc by means of a light beam.

The construction and method of operation of an optical scanning device, a so-called optical pick-up, are described in "Electronic Components & Applications", Vol. 6, No 4, 1984 on pages 209 - 215.

The light beam emitted by a laser diode is focused by means of an objective lens onto the compact disc and reflected from there onto a photodetector. The items of data stored on the compact disc and the instantaneous values for the focusing and for the tracking control loop are obtained from the output signal of the photo-detector. In the said document, the deviation of the instantaneous value from the reference value for the focusing control loop is referred to as the "focusing error" while the expression "radial tracking error" is selected for the deviation of the instantaneous value from the reference value of the tracking control loop.

Coils, by means of whose magnetic fields an objective lens can be moved along the optical axis, serve as control members for the focusing control loop. The focusing control loop then causes the light beam emitted by the laser diode to always be focused on the compact disc by displacing the objective lens. The optical scanning device is displaceable in a radial direction with reference to the compact disc by means of the tracking control loop which is often referred to as a radial drive. The light beam thereby follows the spirally shaped data tracks of the compact disc.

In some devices, the radial drive is constructed from a so-called coarse and a so-called fine driving means. The coarse driving means is implemented for example as a screw by means of which the whole optical scanning device consisting of the laser diode, the lenses, the prismatic beam splitter and the

photo-detector is radially displaceable. The light beam can also be displaced in the radial direction by the fine driving means for which coils and magnets are likewise provided as the control members. Consequently, the light beam can be moved a small distance - about 1 mm - along a radius of the compact disc by means of the fine driving means.

In addition to the need to precisely focus the light beam onto the disc, a precise guidance along the data tracks of the disc is also required in order to achieve a perfect reproduction of the data, be this now e.g. picture and sound in a video disc player or merely the sound from a CD player or the data on a magneto-optic disc.

Consequently, the objective lens or the whole optical scanning device has to be moveable both perpendicularly relative to the surface of the disc and also in a radial direction in order for the coils serving as control members to be able to displace the objective lens or the optical scanning device in both directions. The movement along the optical axis serves for the purpose of focusing while the movement parallel to the surface of the disc serves for track following.

The mounting means for the objective lens or the optical scanning device should, on the one hand, function smoothly so that very small forces will suffice for moving the objective lens or the optical scanning device. On the other

hand however, the arrangement should not be prone to oscillations. Moreover, the objective lens or the optical scanning device should be capable of being guided as precisely as possible in a direction parallel to the perpendicular to the plane of the disc and as precisely as possible in a direction parallel to the plane of the disc.

A scanning device in which two long, parallel-extending arms are attached at their one end to a retaining block, is known from the EP-A 0 296 458. Two short arms are mounted on each long arm at the other end of the two long arms. The short arms extend towards the central plane of the two long arms. A lens holder is held centrally between the two long arms by the total of four short arms.

Figure 7 of the EP-A 0 178 077 shows an optical scanning device whose objective lens is mounted on a frame by means of four parallel leaf springs which can be deflected in the direction of the optical axis - perpendicular to the surface of the disc - and which are referred to as focusing springs. This frame is connected to a fixed portion of the housing by means of four further parallel leaf springs whose oscillatory plane is, however, perpendicular to the plane of oscillation of the four focusing springs. The oscillatory plane of these leaf springs, which are referred to as tracking springs, is parallel to the surface of the disc.

However, the optical scanning device illustrated in Figure 7 of the said EP-A 0 178 077 has some disadvantages.

The arrangement is easily inclined to oscillate because the objective lens is attached to the housing by means of leaf springs. Moreover, the leaf springs do not ensure the precise parallel guidance of the objective lens.

A substantial disadvantage consists in the whole arrangement being built up from many parts of different materials. The mounting of the objective lens by means of the leaf springs requires painstaking mechanical finishing operations during the production process which not only cost time but also increase the production costs.

Another optical scanning device having the following construction is known from the EP-A 0 326 246 which is only relevant in accordance with Art. 54(3) for DE, FR, GB, IT and NL.

Two holding devices are attached at one end to two opposite sides of the scanning device or of a part of the scanning device; their other end is attached to a fixed holding means. Each holding device is constructed from two end parts, two intermediate parts and at least one central part which are connected to each other by hinge means, The parallel axes of rotation of the two outer hinge means, which link the end parts to the intermediate parts, are perpendicular to the parallel axes of rotation of the two inner hinge means which link the central part to the intermediate parts. The end parts and the intermediate parts

extend in parallel to one another. Each end part is linked to the intermediate part by means of at least one hinge means. Two central parts, which extend in parallel with one another, are each connected at their ends to the intermediate parts via a hinge means.

The same applies for the EP-A- 0 376 531 which is only relevant in accordance with Art. 54(3) for DE, FR and GB.

Consequently, the object of the invention is to provide a scanning device which, despite its simple construction and very low production costs, is capable of being guided very precisely in a direction parallel to the optical axis and the plane of the disc and which is not prone to oscillations.

This object is achieved by the invention in that the scanning device or a part of the scanning device and the fixed holding means are attached to the inner sides of the holding device.

Figure 1 shows an embodiment of a holding device from a top view

Figure 2 the holding device in side view

Figure 3 an embodiment of the invention from a top view

Figure 4 the embodiment in side view.

Figure 4 the embodiment in side view.

The holding device will now be described and thereafter explained with the help of the Figures 1 and 2.

A holding device, which is constructed symmetrically, is illustrated as a side view in Figure 2. Following on from an end part E, there is an intermediate part Z which is followed by two parallel central parts M to which there are then attached an intermediate part Z and the other end part E. The individual parts are linked to one another by hinge means in the following manner.

The two end parts E are each connected by two hinge means K1 to the two intermediate parts Z. The two central parts M, which extend in parallel and are each connected by means of a hinge means K2 to the intermediate parts Z, are provided between the two intermediate parts Z. The rotational axis of the parallel hinge means K1 is perpendicular to the axis of rotation of the parallel hinge means K2. The holding device is fabricated from one piece of synthetic material. Notches are provided at the hinge points so that bending regions which serve as the hinge means K1 and K2 are formed. Borings B are provided in the end parts E for the mounting of the whole optical scanning device or one of its parts, e.g. the objective lens, at the one end and for mounting the whole of the arrangement on a holder H at the other end.

The holding device is illustrated as a top view in Figure 2.

An embodiment of the invention is depicted in Figure 3, in which two holding devices are attached by their one end parts E to two oppositely located sides of the holder L for an objective lens O. The other end parts E of the two holding devices are attached to a fixed holder H. The attachment may be effected for example by means of screws or pins which are inserted through the borings B. An indication as to how the objective lens can be displaced in a precise manner parallel to the surface of the disc is provided by the double-ended arrow. It is likewise apparent from Figure 3 how the hinge means K are formed at the bending regions.

Figure 4 shows the embodiment from Figure 3 as a side view. The double-ended arrow indicates that the objective lens can be precisely guided in a direction parallel to its optical axis. Furthermore, it can also be perceived from Figure 4 how the hinge means K2 are formed when the objective lens is moved parallel to its optical axis.

The objective lens O may be moved parallel relative to the optical axis and parallel relative to the surface of the disc by means of magnets and coils for example. The magnets may be arranged on or in the lens holder L for example, while the coils are provided to the right and left or to the front and rear of the lens holder L. For the sake of clarity, the coils and the magnets are not drawn-in in Figures 3 and 4.

Now one substantial advantage of the invention is that the holding device can be fabricated from one piece of synthetic material due to which the production costs turn out to be lower than in the case of the holding device for the optical scanning device from EP-A 0 178 077 mentioned hereinabove which is composed of a plurality of springs and rigid parts of different materials. In the case of the invention, there is achieved an improved parallel guidance of the objective lens or of the whole optical scanning device because, in the case of the holding device of the invention, springs are not provided as the connecting members as was the case in the known holding device. The optical scanning device in accordance with the invention is not prone to oscillations to the same extent as an optical scanning device which is equipped with springs. The resonant frequency and the degrees of motion can easily be varied by altering the dimensions of the end parts, the intermediate parts, the central parts and also the hinge means. Consequently, the resonant frequency can be shifted into a non-critical region without taking any additional measures. The lengths of the levers can also be varied for both directions by altering the length of the intermediate parts and the central parts.

In the case of the scanning device in accordance with the invention, the type of scanning used - mechanical or non-contact making - is of no importance. It is suitable in particular for optical scanning devices such as those that are encountered in CD players, video disc players, DRAW disc

players or magneto-optic recording and reproduction devices for example.

Claims

1. Scanning device including two holding devices which are attached at one end to two opposite sides of the scanning device or of a part of the scanning device and the other end of which is attached to a fixed holding means (H), characterised in that, each holding device is constructed from two end parts (E), two intermediate parts (Z) and at least one central part (M) which are connected to each other by hinge means (K1, K2), wherein the parallel axes of rotation of the two outer hinge means (K1), which link the end parts (E) to the intermediate parts (Z), are perpendicular to the parallel axes of rotation of the two inner hinge means (K2) which link the central part (M) to the intermediate parts (Z), wherein the end parts (E) and the intermediate parts (Z) extend in parallel to one another, wherein each end part (E) is connected to the intermediate part (Z) by means of at least one hinge means (K1), wherein two central parts (M) extending in parallel with one another are each connected at their ends to the intermediate parts (Z) via a hinge means (K2) and the scanning device or a part of the scanning device and the fixed holding means (H) are attached to the mutually opposite inner sides of the holding devices.

2. Scanning device in accordance with Claim 1, characterised in that, a one sided notch (K1, K2) is provided at the hinge areas so that a bending region is formed, and that the notches between the end parts (E) and the intermediate parts

* C L M S *

(Z) are arranged perpendicularly to the notches between the central parts (M) and the intermediate parts (Z).

3. Scanning device in accordance with Claim 1 or 2, characterised in that, the holding devices are fabricated from one piece of synthetic material.

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