The present invention relates to a CD disc changer device according to the preamble of claim 1.

A CD changer device with which as desired various CD discs can be played, preferably contains a playing part with drive, scanner and signal processing circuits and a magazine in which is arranged a plurality of CD discs in a stack. Means are provided between the playing part and the magazine, with which as required one of the CD discs contained in the magazine can be removed from the magazine and brought into the playing position within the playing part. In order to select various CD discs a relative movement is necessary between the playing part and the magazine. Due to this movement the playing part is brought as compared to the magazine into a position in which a desired CD disc can be removed from the magazine. Thus it is necessary to determine exactly and control the relative position between the playing part and the magazine.

Document JP-A- 59/135661 discloses a CD disc changer device with a playing part and a magazine. The magazine has magazine compartments which contain disc supports, on which discs are mounted. In order to take various disc supports out the playing part and the magazine are displaceable in their height position with respect to each other, in which for their positioning relative to each other optical scanning of the disc supports is provided.

The object underlying the invention is to achieve positioning of the playing part relative to the magazine for such a changer device, which is particularly simple and operates with essentially contactless determination of the position.

This object is achieved by the invention described in claim 1. Advantageous modifications of the invention are described in the dependent claims.

Fig. 1 shows in general the mode of operation of optical scanning with playing part and magazine moved relative to each other

Fig. 2 shows a magazine with lateral scanning of the discs,

Fig. 3,4,5 show embodiments of the optical conductors in Fig. 2,

Fig. 6 shows characteristics of scanning for large and small CDs,

Fig. 7 shows a container part for a disc compartment, making up a magazine

Fig. 8 shows a modification of the magazine with an additional reflection point for each compartment,

Fig. 9 shows a reflection component

Fig. 10 shows a magazine with displaceable disc container,

Fig. 11 shows a plan view on to a magazine compartment with inner container,

Fig. 12 shows measurements.

In Fig. 1 the playing part 1 with the platter 2 is arranged so as to be displaceable relative to the fixed magazine 4 in the directions 3, so as to be able to remove as desired various CD discs 5 from the individual

compartments 6. In each case a CD disc 5 is removed or transported from the magazine 4 by means not shown in greater detail, for example a slider controlled with the aid of a Bowden cable and supplied in direction 7 to the platter 2. It is also possible to fix the disc player 1 and move the magazine.

The playing part 1 contains a light source 8 which throws the light beam 9 in a direction towards the left wall of the magazine 4. Furthermore, in the playing part 1 there are provided a photo element 10, a control circuit 11, a drive 12 and a control stage 13 for removing a disc 5 in direction 7 (or for triggering transportation for this disc).

If the playing part 1 is moved in direction 3 in order to remove a particular disc 5 from the magazine 4, the light beam initially hits the dark front wall 14 of the magazine 4 for example, as shown by the light beam 9a. The light beam 9a is not or only weakly reflected on the black or non-reflecting front wall 14 . Thus no light or only a little light reaches the photo element 10. As a result the control circuit 11 is controlled so that the drive 12 remains switched on for the movement of the playing part 1 in direction 3 and the control stage 13 is not switched on or not effective for removing a disc 5 in direction 7. For selecting a particular CD disc 5 the playing part 1 may move further (or the magazine 4 may), for example in direction 3.

If the playing part 1 has reached a relative position suited to removal of a disc 5 relative to the magazine, then the light beam 9 hits a CD disc 5. As a result the reflected light beam 9b arises and reaches the photo element 10. As a result the control circuit 11 is controlled so that the drive 12 is switched for the

movement in direction 3 and the control stage 13 is switched on for the removal of a disc 5. The reflection of the light beam 9 on a CD disc 5 is therefore utilised as a criterion for the fact that the playing part 1 has taken up a position relative to the magazine 4 which is suited to the removal of a CD disc 5. If the light beam 9 is directed to the chamber 6d containing disc 5 then there is not sufficient reflection either. The control stage 13 is not then triggered for the removal of a disc 5.

Fig. 2 shows the embodiment in accordance with the invention of the arrangement shown in outline only in Fig. 1 with a magazine 4, to whose individual compartments 6 optical conductors 30 are assigned. These optical conductors 30 are formed so that they lead a light beam 9 supplied by a light source 8 from outside into the inside of the compartment 6 and direct a beam 9c on to the side surface of the disc 5 in the region of the disc 5. For this purpose the optical conductor may be provided with one or a plurality of reflection points or may be bent towards the side surface of the disc 5 so that the light outlet surface is the light inlet surface at the same time. The beam reflected by the side surface of the disc 5 is collected by the optical conductor 30 again and passed to the photo element 10. For up and down movement of the optical support 31 which supports the light source 8 and the photo element 10 this optical support 31 is preferably firmly connected to the playing device (1 in Fig. 1). The position of the optical conductors 30 and of the optical support 31 are matched to each other so that when a predetermined position is reached the playing device is adjusted to the disc 5 just reached. An aperture 32 is associated with the light source 8 and is sufficient for the required fine adjustment. Another possibility of fine adjustment is the plate 33 which is

* translator's note: wording of original German contains an error

provided in Fig. 2 and moved or rotated by the optical support 31 during its up and down movement, said plate operating with a scanner 34 as an incremental sensor. The number of rotations of the plate 33 is a measure of the height position of the optical support 31.

Fig. 3 shows an optical conductor 30 with a reflection point 35 at its end having a disc 5 lying thereunder. The light beam 9 is deflected and reflected there at the end of the optical conductor 30 downwards to the side surface 35 of the disc 5. If the side surface 35 is made sufficiently reflecting the reflected light beam 9d reaches the photoelement 10 (Fig. 1) through the optical conductor 30. The disc 5 is equipped with reflecting, and non- or poor-reflecting, side surfaces so that only with a correctly inserted disc 5 is the stop process triggered for the up and down movement of the playing device.

Fig. 4 shows an optical conductor 30 with several reflection points.

Figs. 5a and 5b show an optical conductor 30 with a limb 36 with reflection point 37 which reaches into the region of small discs 5 and with a reflection point 38 which detects only large discs 5. The reflection points are arranged to be so offset that from the magnitude of the measured, reflected light it is possible to deduce whether one or all reflection points have received reflected light. With such an optical conductor it is possible to distinguish correctly positioned large discs 5, correctly positioned small discs 5, incorrectly positioned discs and empty compartments 6 from each other.

Fig. 6 shows curves for test results with an optical conductor 30 according to Fig. 5, in which a light beam

9 is fed into the optical conductor 30 by a search device 8, so that it hits both reflection points 37, 38. The light which is reflected in some cases is measured at a plurality of photo elements 10 (receivers) associated with the individual reflection points. The receiver 10a only receives reflected light from the limb part 38, the receiver 10b only from limb 36. If a small disc 5 is in the compartment only receiver 10b receives reflected light, on the other hand if a large disc 5 is in the compartment both receivers 10a, 10b receive light, because reflecting disc material is located under both reflection points. The measurement curves 40a, 40b in Fig. 7 correspond to the measured light for a small disc which therefore receives only reflected light from the long limb 36. Thus the receiver 10a also receives little light. Curves 41a, b show the test result for light reflected by large discs by the reflection points 37 and 38. Curve 41b is therefore larger than curve 40a, because both refletion points 37, 38 produce reflected light from large discs. It is recognised by the signal from the receiver 10b whether thee is a disc inserted at all. Then the correct positioning takes place too. The differences of the curves 40a, 41a, 41b are insignificant and rely on component properties. According to the threshold value the up and down movement may therefore be adjusted correctly to the compartments 6 filled by discs 5. By using a plurality of light beams 9 or a plurality of photo elements 10 the test result may be refined further. The reflected light may also be utilised too to indicate whether the disc has been brought into the compartment 6 properly again after playing.

Fig. 7 shows a container part 40 in snap-in technology which can be used for the construction of a magazine 4 with an almost optional number of compartments 6.

Fig. 8 shows the outside of a magazine 4 with optical conductors 30 for gaining the control signal for the up and down movement of the parts 1 and/or 4, in which in addition fixed reflection points 41 are provided for the light beam 9. The fixed reflection points 41 are a measure of the number of compartments 6 available. Without these reflection points empty compartments 6 could not be recognised. If for example in Fig. 1 of four successive compartments 6 only the first, second and fourth compartment 6 is equipped with a disc 5 but the third compartment 6 is not then the disc 5 in the fourth compartment would be interpreted as disc 5 in the third compartment. In order to achieve correct details for empty compartments light reflections are evaluated for each compartment. The reflection point 41 may be a flat mirror in some circumstances, for example a reflecting foil. An optical support 44 which can be moved upand down having a light source 8 and light reeivers 10 is associated with the visible optical conductors 30 which emanate from the individual compartments 6 and with the reflection points 41. The optical support 44 may be firmly connected to the playing device 1 and may be movable together therewith. Since however the light source 8 and the light receiver 10 are arranged and dimensioned for the optical conductors 30, in some circumstances with a flat mirror the light beam 9 would not safely reach the receiver 10 on reflection at the point 41.

Fig. 9 shows a reflection component 42 with a reflection surface 43 which is optimised for this application. It is achieved due to the shape of the reflection surface 43 that the light beam reaches the receiver 10 from the transmitter 8.

In Fig. 10 the plan view of the compartment 6 of a magazine 4 is shown, in which in the compartment 6 a

displaceable container 45 is arranged. The optical conductor or conductors 30 is / are arranged on this container 45 and cooperate with the optical support 44. The container 45 is moved together with the disc 5 out of the compartment 6 into the playing position and thus takes the optical conductor 30 with it. This optical conductor 30 therefore travels out of the radiation region of the optical support 44. If after the end of the playing process the container 45 is again pushed into the compartment 6, then reaching the horizontal end position of the optical support 44 may be ascertained and used. The moving in and out of the container 45 is caused by a toothed rod 47 and a gear wheel 46.

Fig. 11 shows the embodiment of compartment 6 and inner container 45 in side view. A window 48 in the walls of the magazine 4 is decisive for the radiation contact of optical support 44 and optical conductor 30. A guide strip ~~((flap/tongue))~~ 49 is arranged in the magazine 4 or compartment 6 for the respective container 45.

Figs. 12a to 12d show in four stages of measurement the test results with an offset optical conductor 30 and a reflector 42, associated with which is a light transmitter 8 not shown and two light receivers 10. In Fig. 12a the light beam passed from the transmitter 8 not shown to the disc 5k (small), that is a disc 5 of small diameter of e.g. 7.6 cm, and reflected there reaches the receiver 10b. In Figs. 12a -12d there are indicated below the optical conductor 30 the receivers 10a, 10b and thereunder in the two receivers the produced voltages in yes (1)or no (0) form. In Fig. 12a only the receiver 10b emits a voltage. In Fig. 12b the disc 5g is a disc of large diameter. Both receivers 10a, 10b emit a voltage. In Fig. 12c no disc 5 is provided and thus neither receiver 10a, 10b emits a voltage. The reflector 42 in Fig. 12d causes a

voltage at the receiver 10a, but not in the receiver 10b and therefore may be distinguished from the signals of the optical conductor 30, since there a signal is always to be expected from the receiver 10b with a large and with a small disc.

Patent Claims

1. A CD disc changer device with a playing part (1) and a magazine (4), which has magazine compartments (6) for accommodating discs (5), in which the playing part (1) and the magazine (4) are displaceable in their height position with respect to each other for removing various discs (5), and in which optical scanning of the discs (5) is provided for their positioning relative to each other, characterised in that into each of the magazine compartments optical conductors (30) project, and that the optical conductors (2) are provided with at least two light outlet points in the magazine compartment (6), one of which is arranged in the region of the centre of the disc and the other is arranged in the region of the edge of the disc.

2. A changer device according to claim 1, characterised in that each optical conductor (30) directs the light from a light source (8) on to a side surface of the disc (5), collects the light reflected by the discs and supplies (it) to a photo element (10) or the like.

3. A changer device according to claim or 2, characterised in that the optical conductors (30) are inserted into the surface supporting the disc (5) and are provided at the light outlet points with light-deflecting mirror surfaces.

4. A changer device according to claim 1, 2 or 3, characterised in that the magazine (4) has walls (14) which face the playing part (1) and that these walls (14) are non-light- reflecting.

5. A changer device according to claim 2, 3 or 4, characterised in that the photo element (10) is connected to a control circuit (11) for positioning playing part (1) and/or magazine (4) for the purpose of relative positioning of playing part (1) and magazine (4).