"DISK UNIT WITH ROTATABLE INFORMATION DISK"

The invention relates to a disk unit for use with an information-recording and/or - reading apparatus, the disk unit comprising an information disk which is constructed for rotation in use and which is housed in an enclosure having two major walls disposed on opposite sides of and parallel to the information disk, and having side wallsat the edges of the major walls, at least one of the two major walls having a slot to give access to the disk to an information-recording and/or - reading head of an information-recording and/or - reading apparatus, which slot extends radially or substantially radially relative to the axis of rotation of the information disk in an area of said one of the major walls which is located between said axis and an edge of said one of the major walls, which edge extends perpendicularly to the longitudinal axis of the slot, and a device being provided for closing said slot, which device comprises a sliding plate which is translatable relative to the enclosure between an open position and a closed position, an actuating member which is connected to the sliding plate, and which is accessible from the exterior of the enclosure so as to be movable by means on said apparatus from a rest position to an operating position to move the sliding plate from the closed position during insertion of the disk unit into the apparatus,and resilient means for urging the sliding plate and actuating member to the closed and rest positions respectively.

Such a disk unit is known from, for example, the United States patent specification 3,529,301. In this known disk unit the information disk is accommodated in a flat enclosure of square shape. The slot-closing device comprises a sliding plate which is secured to a sliding rod which is movable along one of the walls of the enclosure. In the space between the circular information disk and a corner of the square enclosure there is arranged a tension spring, which resiliently loads the slot-closing device in such a way that the sliding plate is pulled towards the closed position by the tension spring. An information-recording and/or - reading apparatus comprises a push pin which via an opening in a side wall of the enclosure can

penetrate into said space between the information disk and the corner of the enclosure in order to push the actuating member from its rest position to its operating position against the force of the tension spring. Thus, the sliding plate is moved from the closed position to the open position. Connected to the sliding rod is a clamping mechanism for retaining the information disk against stops in the enclosure. When the actuating member is moved to the operating position the clamping device is released at the same time. The disk unit can be slid into an associated information-recording and/or - reading apparatus, the sliding movement permitting said pin on the apparatus to enter the enclosure of the disk unit through the opening. Thus, the disk unit is especially suitable for co-operation with apparatus which is constructed so that the slot in the enclosure of the disk unit is disposed transversely of the direction in which said unit is slid into the apparatus. The said space between the information disk and the corner of the enclosure should be available for the entry of the pin of the apparatus and for accommodating parts of the slot-closing device.

It is an object of the invention to provide a disk unit having an enclosure with a slot which extends in the direction in which the disk unit is slid into an information-recording and/or - reading apparatus. The invention further aims to provide a construction which is suitable for a disk unit having an enclosure of substantially square shape but in which the space between the information disk and the corners of the enclosure cannot accommodate parts of the slot-closing device.

According to the present invention there is provided a disk unit for use with an information-recording and/or - reading apparatus, the disk unit comprising an information disk which is constructed for rotation in use and which is housed in an enclosure having two major walls disposed on opposite sides of and parallel to the information disk, and having side walls at the edges of the major walls, at least one of the two major walls having a slot to give access to the disk to an information-recording and/or - reading

apparatus, which slot extends radially or substantially radially relative to the axis of rotation of the information disk in an area of said one of the major walls which is located between said axis and an edge of said one of the major walls of the housing, which edge extends perpendicularly to the longitudinal axis of the slot, and a device being provided for closing said slot, which device comprises a sliding plate which is translatable relative to the enclosure between an open position and a closed position, an actuating member which is connected to the sliding plate and which is accessible from the exterior of the enclosure so as to be movable by means on said apparatus from a rest position to an operating position to move the sliding plate from the closed position to the open position during insertion of the disk unit into the apparatus, and resilient means for urging the sliding plate and actuating member to the closed and rest positions respectively, wherein the actuating member comprises a lever which is pivotable relative to the enclosure between the rest position and the operating position about an axis parallel to the axis of rotation of the information disk, and which has a first end which, during insertion of the disk unit into said apparatus in a direction parallel to the longitudinal axis of the slot, co-operates with said means on said apparatus through an opening in a side wall of the enclosure which extends along said edge of said one of the major walls, and a second end which is pivotally connected to the sliding plate, the lever and the sliding plate being slidable on said one of the major walls, and the pivotal axis of the lever being situated nearer to the first end than to the second end of the lever, and the lever being arranged to move the sliding plate translationally between the closed and open positions in a direction substantially perpendicular to the longitudinal axis of the slot.

In a disk unit according to the invention, in which the slot extends in the direction in which the unit is inserted into an information-recording and/or - reading apparatus, the distance between the slot and the opening through which the relevant means

on the apparatus cooperate with the actuating member for moving the sliding plate to open the slot can be very much less than in the known disk units, in which the slot extends at right angles or an inclined angle to the direction of insertion of the unit. Consequently, less space is required in the enclosure for the actuating member. Further, as a result of the construction of the actuating member as a lever pivotally connected at one end to the sliding plate and pivotable about an axis which is situated nearer the other end of the lever, a relatively small movement of the latter end of the lever by the aforesaid means on the information -recording and/or - reading apparatus is required for producing the necessary translational opening movement of the sliding plate. Consequently, little space is needed inside the enclosure for the co-operation between the actuating member and said means on the apparatus.

In the slot-closing device of a disk unit in accordance with the invention the pivotal movement of the lever has to be converted into a substantially translational movement of the sliding plate. In order to prevent problems arising due to jamming of the sliding plate, which may have a length considerably greater than its width, an embodiment of the invention may be preferred wherein the sliding plate and the enclosure are provided with stop means which, when the sliding plate is in the closed position, co-operate with each other to determine the position which the sliding plate assumes relative to the enclosure under the influence of a load exerted by the resilient means, and wherein between the closed position and the open position the sliding plate is pivotable relative to the lever to a limited extent and unimpeded by the enclosure. This embodiment takes into account the fact that the orientation of the sliding plate is of importance especially in the closed position. During the movement between the closed position and the open position the orientation of the sliding plate is of less significance, whilst in principle this may also be the case for the orientation in the open position.

A flat and dust-tight slot-closing device is obtained with an

embodiment of the invention wherein the slot-closing device comprises a retaining plate which extends parallel to the major walls of the enclosure and which is secured to the major wall in which the slot is formed, the sliding plate, the lever and the resilient means being retained between the retaining plate and said major wall and the lever having a flat shape in a plane perpendicular to its pivotal axis and parallel to the retaining plate and the major walls of the enclosure, with a thickness which is smaller than its width in said plane. The lever may project through the opening in the side wall of the enclosure both in the operating position and in the rest position, and have a fit in the opening such that a more or less dust-tight sealing of said opening is constantly assured.

In order to minimize the required travel of the lever and the required translation of the sliding plate, the slot-closing device may comprise a second sliding plate similar to the first-mentioned sliding plate, the two plates being movable in opposite directions to their closed positions and to their open positions and each being arranged to close substantially one half of the slot, and a second lever which is similar to the first-mentioned lever and of which the second end is pivotally connected to the second sliding plate and the first end is arranged for co-operation through an opening in said side wall of the enclosure with means on said apparatus for moving the second lever from the rest position to the operating position, the second lever being arranged to move the second sliding plate translationally between the closed and open positions in a direction substantially perpendicular to the longitudinal axis of the slot, and the two sliding plates being constructed partly to overlap each other in their closed positions. Now each of the sliding plates need only perform a sliding movement which is slightly greater than half the width of the slot in the major wall of the enclosure. The overlapping construction provides a satisfactory dust-tight seal.

When the disk unit is placed in an information-recording and/or reading apparatus it may be important to ensure that if the disk

unit is not fully in position or is not correctly positioned, or if it is defective in some way, the information disk cannot be approached by an information-recording and/or - reading head of the apparatus if it is uncertain that the slot is actually fully open. Some protection in this respect is afforded in an embodiment of the invention wherein a window or windows is or are provided in the major wall of the enclosure in which the slot is formed, to permit optical detection of the position or positions of the sliding plate or plates of the slot-closing device, the window or windows being so arranged that a particular part or parts of the slot-closing device is or are optically detectable through the window or windows only when the sliding plate or each sliding plate is in a pre-determined one of its two positions.

An embodiment of the invention will now be described in more detail with reference to the accompanying drawings, in which:

Fig. 1 is a perspective view of an embodiment of a disk unit in accordance with the invention,

Fig. 2 is a plan view, on an enlarged scale, of part of the lower half of the enclosure of the disk unit of Fig. 1, showing the slot-closing device,

Fig. 3 is a sectional view taken on the line III-III in Fig. 2, and

Fig. 4 is a sectional view taken on the line IV-IV of Fig. 2.

The disk unit 1 shown in Fig.1 comprises a single optical disk 2 which may be of the type described in United States Patent Specification No: 4,074,282, and which at its centre has a centering element 3. The optical disk 2 rotates in use about its central axis 4. The disk is housed in an enclosure of substantially square shape with rounded corners. The enclosure has two major walls 5 and 6 disposed on opposite sides of and parallel to the optical disk 2. The major walls are thus perpendicular to the axis of rotation 4 of the disk. The enclosure also has side walls at the peripheries of the disc, these side walls being formed partly by an upstanding wall 7 which extends continuously around the periphery of the major wall 5, and partly by a similar wall 8

which extends around the periphery of the major wall 6. The major wall 5, together with the peripheral wall 7, constitutes an upper cover of the enclosure, and the major wall 6, together with the peripheral wall 8, constitutes a lower cover. The two covers are movable relative to each other over a limited distance in the axial direction, i.e. in the direction of the axis of rotation 4, so that they can be separated to give the disk 2 the necessary freedom to rotate inside the enclosure when the disk unit is in use. The two covers are connected together by four connecting devices 9 which are situated at the four corners of the enclosure and which are constructed to permit the separation of the two covers whilst constantly urging the covers resiliently towards each other. The construction of the connecting devices is irrelevant to the present invention. The upper major wall 5 has a slot 10, which extends radially or substantially radially relative to the axis of rotation 4 of the information disk 2, to give access to the disk to an information-recording and/or - reading head (not shown) of the information-recording and/or - reading apparatus. The lower major wall 6 is formed with a similar slot 11 (Fig 2) in a position diametrically opposite the slot 10 with respect to the axis of rotation 4. Each slot is situated in an area of the respective major wall which is located between the axis 4 and one of the side wall of the housing and the slot extends perpendicularly to this side wall, as can be seen in Fig. 2. The disk unit is inserted into an information recording and/or - reading apparatus in a direction parallel to the longitudinal axes of the slots.

Each of the slots 10 and 11 can be closed by means of an associated slot-closing device. In the following description only the device for closing the slot 11 will be described, the device for closing the slot 10 being identical.

As shown in Figs. 2 to 4, the device for closing the slot 11 comprises two sliding plates 12a and 12b which are each translatable, i.e., capable of translational movement, relative to the enclosure between an open position and a closed position. For

the sake of clarity the sliding plate 12a is shown in the open position and the sliding plate 12b in the closed position. Two actuating members 13a and 13b each movable between a rest position and an operating position are coupled to the sliding plates 12a and b . The actuating members are provided for moving the sliding plates between the closed and open positions. The actuating member 13a is shown in the operating position and the actuating member 13b in the rest position, which positions correspond to the open position of the sliding plate 12a and the closed position of the sliding plate 12b respectively. Resilient means in the form of leaf springs 14a and 14b secured to the major wall 6 of the enclosure act on the actuating members 13a and b to move these members back from their operating positions to their rest positions and thereby return the sliding plates from their open positions to their closed positions.

The actuating members 13a and 13b comprise two levers which are pivotable relative to the enclosure about axes parallel to the axis of rotation 4 of the optical disk 2. The levers each have a first end 15a, b respectively which is arranged for cooperation with means (not shown) on the information-recording and/or -reading apparatus for moving the levers from the rest position to the operating position, and a second end 16a, b which is coupled to the sliding plate 12a, b respectively. The two levers and the two sliding plates are movable slidably on the major wall 6 of the enclosure in which the slot 11 is formed. The levers are journalled on two pivot pins 17a and 17b which are integral with the enclosure wall 6. These pins are so arranged relative to the first and the second ends of the levers that the pivotal axis of each lever is situated nearer to the first than to the second end of the lever, so that a transmission ratio greater than unity is obtained between the two ends.

Each of the sliding plates 12a and 12b is pivotally connected to the second end 16a, b of the associated lever 13a, b by means of a pivot pin 18a, b respectively. The arrangement of the levers is such that, as can be seen in Fig. 2, each sliding plate is

movable translationally between the closed and open positions by means of the associated lever in a direction substantially perpendicular to the longitudinal axis of the slot 11. The sliding plates 12a and 12b and the major wall 6 of the enclosure are provided with co-operable stop means which in the closed positions of the sliding plates define the position which the plates assume relative to the enclosure under the influence of the leaf springs 14a and 14b. These stop means comprise stop pins 19a and 19b on the enclosure wall 6 and ridges 20a and 20b on the sliding plates 12a and 12b. In Fig. 2, the ridge 20b of the closed sliding plate 12b is shown urged against the associated stop pins 19b under the influence of the load exerted by the leaf spring 14b. The position of each sliding plate 12a, b when closed is determined by the position of the respective pivot pin 18a, b and by the respective stop pins 19a, b, so that the position of the sliding plate is determined by these points. In addition the sliding plates are formed with ridges 21a and 21b which cooperate with the stop pins 19a and 19b to define the positions which the sliding plates assume when open, as shown for the sliding plate 12a in Fig 2. Between the closed position and the open position, each sliding plate is pivotally movable to a limited extent relative to the associated lever 13a, b and to the enclosure wall 6 due to the freedom of movement which exists between the stop pins 19a, b and the respective sliding plate 12a, b in the space between the ridges 20a, b and 21a, b, within which space the pins 19a, b are accommodated. Thus, the sliding plates can be moved substantially unimpeded from the closed position to the open position or vice versa, so that during this movement only very small frictional forces obtain and no jamming of the sliding plates occurs.

Each slot-closing device also comprises a retaining plate 22 which is spaced from the lower enclosure wall 6 and extends parallel thereto and which is formed with a slot corresponding to the slot 11 in the wall 6. For the sake of clarity Fig 2 shows this plate partly cut away. The plate is secure by means of pins

23 on the enclosure wall 6. The sliding plates 12a and b, the levers 13a and b and the leaf springs 14a and b are retained between the enclosure wall 6 and the retaining plate 22. The levers 13a and b have a flat shape in a plane perpendicular to their pivotal axes, with a thickness which is several times smaller than their width, and the levers are arranged to pivot in this plane, parallel to the retaining plate 22 and to the enclosure wall 6. This reduces the space required for the slot-closing device. The peripheral wall 8 of the lower cover of the enclosure is formed with elongate openings 24 adjoining the major wall 6 of the enclosure, for the actuation of the levers 13a and 13b by the aforesaid means on the information-recording and/or - reading apparatus for moving the levers. These means may comprise, for example, a simple ridge for engagement with the ends 15a, b of the levers 13a, b. The ridge may be coated with an elastomeric material in order to avoid overloading of the levers, since in their open positions the sliding plates 12a, b bear against the stop pins 19a, b and cannot move any further.

In the closed position the two sliding plates 12a and 12b partly overlap each other. For this purpose the sliding plate 12a is provided with a projecting lip 25a and the sliding plate 12b with a complementary lip 25b, which lips engage with and overlap each other in the closed positions of the sliding plates.

In the major wall 6 of the enclosure two windows 26a and 26b are formed, consisting of transparent plastics disks glued in holes in the major wall 6. These windows permit an optical detection of the positions of the sliding plates 12a and 12b, since they are so arranged that in the open position of the sliding plates the plates themselves extend over the windows whilst in the closed position of the sliding plates the levers 13a and b associated with the plates extend over the windows. By giving the levers and the sliding plates different light-reflecting properties, detection of the open position of the sliding plates is possible with the aid of a light source and a photo-electric cell. Detection is effected at sufficient distance from the slot

11 for the detection means not to be affected by the moving information-recording and/or - reading head. When using a reflecting optical information disk it is alternatively possible to make the sliding plates 12a and 12b the retaining plate 22 transparent, so that the reflecting surface of the optical disk can be used for the detection of the open position of the sliding plates.

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CLAIMS:

1 . A disk unit for use with an information-recording and/or - reading apparatus, the disk unit comprising an information disk which is contructed for rotation in use and which is housed in an enclosure having two major walls disposed on opposite sides of and parallel to the information disk, and having side walls at the edges of the major walls, at least one of the two major walls having a slot to give access to the disk to an information-recording and/or - reading head of an information-recording and/or - reading apparatus, which slot extends radially or substantially radially relative to the axis of rotation of the information disk in an area of said one of the major walls which is located between said axis and an edge of said one of the major walls, which edge extends perpendicularly to the longitudinal axis of the slot, and a device being provided for closing said slot, which device comprises a sliding plate which is translatable relative to the enclosure between an open position and a closed position, an actuating member which connected to the sliding plate and which is accessible from the exterior of the enclosure so as to be movable by means on said apparatus from a rest position to an operating position to move the sliding plate from the closed position to the open position during insertion of the disk unit into the apparatus, and resilient means for urging the sliding plate and actuating member to the closed and rest positions respectively, wherein the actuating member comprises a lever which is pivotable relative to the enclosure between the rest position and the operating position about an axis parallel to the axis of rotation of the information disk, and which has a first end which, during insertion of the disk unit into said apparatus in a direction parallel to the longitudinal axis of the slot, cooperates with said means on said apparatus through an opening in a side wall of the enclosure which extends along said edge of said one of the major walls, and a second end which is pivotally connected to the sliding plate, the lever and sliding plate being slidable on said one of the major walls, and the pivotal axis of the lever

being situated nearer to the first end than to the second end of the lever, and the lever being arranged to move the sliding plate translationally between the closed and open positions in a direction substantially perpendicular to the longitudinal axis of the slot.

2. A disk unit as claimed in Claim 1, wherein the sliding plate and the enclosure are provided with stop means which, when the sliding plate is in the closed position, co-operate with each other to determine the position which the sliding plate assumes relative to the enclosure under the influence of a load exerted by the resilient means, and wherein between the closed position and the open position the sliding plate is pivotable relative to the lever to a limited extent and unimpeded by the enclosure.

3. A disk unit as claimed in Claim 1, wherein the slot-closing device comprises a retaining plate which extends parallel to the major walls of the enclosure and which is secured to the major wall in which the slot is formed, the sliding plate, the lever and the resilient means being retained between the retaining plate and said major wall, and the lever having a flat shape in a plane perpendicular to its pivotal axis and parallel to the retaining plate and the major walls of the enclosure, with a thickness which is smaller than its width in said plane.

4. A disk unit as claimed in Claim 1, 2 or 3, wherein the slot-closing device comprises a second sliding plate similar to the first-mentioned sliding plate, the two plates being movable in opposite directions to their closed positions and to their open positions and each being arranged to close substantially one half of the slot, and a second lever which is similar to the first-mentioned lever and of which the second end is pivotally connected to the second sliding plate and the first end is arranged for co-operation through an opening in said side wall of the enclosure with means on said apparatus for moving the second lever from the rest position to the operating position, the second lever being arranged to move the second sliding plate translationally between the closed and open positions in a direction substantially perpendicular to the longitudinal axis of the slot, and the two sliding plates being constructed partly to overlap each other in

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their closed positions.

5. A disk unit as claimed in any of Claims 1 to 4, wherein a window or windows is or are provided in the major wall of the enclosure in which the slot is formed, to permit optical detection of the position or positions of the sliding plate or plates of the slot-closing device, the window or windows being so arranged that a particular part or parts of the slot-closing device is or are optically detectable through the window or windows only when the sliding plate or each sliding plate is in a predetermined one of its two positions.

6. A disk unit for use with an information-recording and/or - reading apparatus, substantially as herein described with reference to the accompanying drawings.