

DISK APPARATUS

BACKGROUND OF THE INVENTION

1. Field of the Invention

5 The present invention relates to a disk apparatus having a disk tray, and more specifically to a disk apparatus in which a disk is placed on a recess of a disk tray and retained by slidable holding members that are operatively interconnected by a link mechanism, said disk tray for loading into a main unit of the disk apparatus. The present invention may be incorporated in, for example, optical disk players such CD players and
10 DVD players as well as disk drives such as CD-ROM drives and DVD-ROM drives.

2. Description of the Related Art

 Conventionally, in known types of disk apparatus, particularly optical disk drives such as CD drives and DVD drives, an optical disk on which information is recorded is typically placed on a recess of a substantially-horizontal disk tray so as to be loaded on a
15 main unit. In such a disk drive, an optical disk needs simply to be placed on the disk tray before being withdrawn into the main unit for loading. Furthermore, such conventional disk apparatus allows disks of different diameters, such as 8 cm and 12 cm, to be placed on the disk tray; and thus a single disk apparatus may be made compatible with disks varying in diameter.

20 A disk apparatus of the above-described type may, in certain situations, be used in a vertical position in which the disk tray is rendered vertical as well as in a horizontal position in which the disk tray is rendered horizontal.

 When a disk apparatus is used in a vertical position, an optical disk would not be properly held by being simply placed on a recess of the disk tray. Japanese Unexamined
25 Patent Application Publication Nos. 6-333311 and 8-17118 each propose a disk apparatus having a disk tray provided with holding members for holding an outwardly-

facing surface of an optical disk in a loosely-fitting manner. The holding members described in such Publications are constructed as movable holding members which can be moved toward and away from the recess on which an optical disk is placed. When the disk apparatus is used in a horizontal position, the optical disk is held on the disk tray surface while the holding members are held back so as not to project across the circumference of the recess. When the disk apparatus is used in a vertical position, on the other hand, two holding members are projected across the circumference of the recess so that the optical disk will be held in between the holding members and the disk tray surface.

However, the problem is that these holding members, when the disk apparatus is used in a vertical position, do not properly hold an optical disk on the disk tray surface with only one of the holding members projected, thus requiring a somewhat cumbersome work of projecting at least two movable holding members individually.

SUMMARY OF THE INVENTION

Accordingly, it is an object of the present invention to provide a disk apparatus in which movable holding members can be moved toward and away from a recess of a disk tray in a simplified and efficient manner.

To this end, a disk apparatus according to the present invention includes a disk tray on a recess of which a disk for recording and/or playback is placed so as to be then loaded on the main unit. The disk tray is provided with a plurality of movable holding members for holding the outwardly-facing surface of the disk at a peripheral end region and a link mechanism for operatively interconnecting the plurality of movable holding members with one another.

The link mechanism allows moving the plurality of movable holding members towards and away from the recess of the disk tray in a simplified manner; in response to

the movement of one movable holding member, the other movable holding member(s) also moves in synchronization.

The plurality of movable holding members may be constructed to be rotatable over the disk tray. Such rotatable holding members serve to achieve a simple link mechanism structure; for example, the holding members have one of their respective
5 ends engaged with a linkage bar movable in one particular direction of the disk tray, so that in response to the movement of the bar the holding members rotate in synchronization with one another so as to be projected over a recess of the disk tray.

Alternatively, the plurality of movable holding members may be constructed to
10 be merely slidable over the disk tray. Such slidable holding members, which can be moved in synchronization with one another in one particular direction over the disk tray surface, serve to localize the holding members and the link mechanism on one side of the disk tray, achieving a more compact structure of those components and thereby saving space.

15 The plurality of movable holding members are preferably movable to allow holding disks varying in diameter. For example, a disk apparatus on which disks are to be loaded preferably includes a plurality of holding members whose movable range is compatible with the two commonly available disk diameters, i.e., 12 cm and 8 cm respectively. The plurality of holding members having such a movable range allow
20 holding the disks, even when the disk apparatus is used in a vertical position, by moving in synchronization with one another via the link mechanism. The link mechanism is also preferably provided with a stopper for retaining the plurality of movable holding members at predetermined positions.

BRIEF DESCRIPTION OF THE DRAWINGS

25 Fig. 1 is a perspective view of a disk apparatus according to a first embodiment of the present invention;

Fig. 2 is a cross-sectional view showing the internal structure of the disk apparatus according to the first embodiment;

Fig. 3 is a plan view showing the top face of a disk tray in the first embodiment;

Fig. 4 is a plan view showing the bottom face of the disk tray in the first
5 embodiment;

Fig. 5 is another plan view showing the bottom face of the disk tray in the first embodiment;

Fig. 6 is a cross-sectional view showing the mechanism for supporting holding members in the first embodiment;

10 Fig. 7 is a plan view showing the top face of a disk tray in a second embodiment of the present invention;

Fig. 8 is a plan view showing the bottom face of the disk tray in the second embodiment; and

Fig. 9 is another plan view showing the bottom face of the disk tray in the second
15 embodiment.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The following describes preferred embodiments of the present invention with reference to the attached drawings.

Fig. 1 shows a disk apparatus 1 according to a first embodiment of the present
20 invention. The disk apparatus 1, which plays back an optical disk 2 which may be, for example, a CD-ROM or a DVD-ROM, includes: a main unit 10 in which an optical pickup unit (see Fig. 2) is contained; and a disk tray 20 for loading the main unit 10 with the optical disk 2.

The main unit 10, as shown in cross section in Fig. 2, is provided with: a housing
25 11 having a slot 11A through which the disk tray 20 is inserted and ejected; a spindle motor unit 12 and a chucking pulley 13 for spinning the optical disk 2 placed on the disk

tray 20; and an optical pickup unit 14 for reading information recorded on the optical disk 2. The spindle motor unit 12 includes: a rotor case 12A containing a motor; and a disk table 12B for supporting the optical disk 2, which is attached on a spindle (not numbered) projecting from the rotor case 12A. The spindle motor unit 12 and the optical pickup unit 14 are provided on a base member 16 pivotably supported on a support 15 in the rear interior of the main unit 10. The spindle motor unit 12 and the optical pickup unit 14 are thus moved towards and away from the disk tray 20 in response to the pivotal move of the base member 16. The chucking pulley 13 is disposed so as to oppose the spindle motor unit 12 and the optical pickup unit 14 across the disk tray 20, and is revolvably held by a pulley holder 17 formed on one inner face of the housing 11. In the interior of the main unit 10, though not shown in Fig. 2, there is also provided a driving mechanism for inserting and ejecting the disk tray 20 through the slot 11A and for pivotally moving the base member 16 on the support 15.

Referring to Fig. 3, the disk tray 20 on its surface has circular recesses 21 and 22 for receiving optical disks 2 of different sizes. The recess 21 accepts optical disks 12 cm in diameter while the recess 22 accepts optical disks 8 cm in diameter. It will be understood that a disk tray having recesses of other diameters may be used to accommodate disks having diameters other than the commonly used 12 cm and 8 cm. The disk tray 20 also has a middle opening 23 in which the optical pickup unit 14 is moved when the disk tray 20 is withdrawn into the main unit 10. The disk tray 20 is typically a plastic product made of materials with high wear resistance such as POM (polyoxymethylene, polyacetal).

The disk tray 20 is further provided with, on the downside as viewed in Fig. 3, movable holding members 24 and 25 which can be moved back and forth so as to hold the peripheral end of an 12-cm optical disk 2 at an outwardly-facing surface of the disk. The holding members 24 and 25 are disposed so as to approach each other across an arc

of the recess 21 as viewed in the direction of insertion/ejection of the disk tray 20. While not specifically shown, such holding members 24 and 25 may also be dimensioned to extend over the recess 22 for holding the peripheral end of an 8-cm disk.

As shown in Fig. 4 and Fig. 5, an elongated linkage bar 26 is disposed behind the disk tray 20. One of the holding members 24 is linked to one end of the elongated bar 26, while the other holding member 25 is linked to the other end of the bar 26. The bar 26, to be more particular, has two cranked cut-outs 26A disposed on either end, and between the two cut-outs 26A two insertion holes 26B slotted to extend in the longitudinal direction of the bar 26. In the proximity of one end of the bar 26 remoter from the main unit 10 (to the left as viewed in Fig. 4), there is provided a slider switch 26C projecting on the top face of the disk tray 20. The bar 26 is supported on, but not fixed to, the disk tray 20 with screws 26D received in the insertion holes 26B. Thus, when the slider switch 26C is manipulated to move along the insert/eject direction of the disk tray 20, the linkage bar 26 in response slides along the insert/eject direction relative to the disk tray 20 (i.e., relative to the screws 26D). The movable range of the bar 26 is defined by the length of the slotted insertion holes 26B.

The holding members 24 and 25, as shown in Fig. 6, are linked to the cutouts 26A of the bar 26 via planar-L-shaped arm members 27 with screws or the like. To be more specific, the holding members 24 and 25 are attached to the upper faces of the arm members 27 with screws or the like, and the projections 27A formed on the bottom faces of the arm members 27 are slidably fitted into the cut-outs 26A. Accordingly, in response to the slide of the bar 26, the arm members 27 slide along the cut-outs 26A, so that the holding members 24 and 25 in turn slide over the surface of the disk tray 20 so as to move, relative to the recess 21, to and from positions above the plane of the recess 21.

The two cutouts 26A formed in both ends of the bar 26 are preferably identical in shape, width, direction etc. Thus, when the bar 26 is made to slide, the holding members

24 and 25 linked to both ends of the bar 26 move in synchronization with each other, i.e., substantially in the same timing and in the same direction. The bar 26 thus constitutes a link mechanism which operatively interconnects the two holding members 24 and 25.

On the other end of the bar 26 closer to the main unit 10, there is provided a stopper 29 for retaining the holding members 24 and 25 at particular positions. The stopper 29 is a coiled spring in planar U-shape with one end retained by a shaft 28 formed on the disk tray 20 and the other end acting on the associated edge of the bar 26. The stopper 29 is elastically deformed and is movable to pivot clockwise about the end retained by the shaft 28 so that the other end always biases the associated edge of the bar 26.

Accordingly, as shown in Fig. 5, when the bar 26 is made to slide so that the holding members 24 and 25 are projected over the recess 21, or over the recess 22 if the holding members are appropriately dimensioned, the bar 26 is stopped at a particular point by the stopper 29, thereby retaining the holding members 24 and 25 at predetermined positions. Thus, the bar 26 is prohibited from arbitrary sliding so that the holding members 24 and 25 would not accidentally release holding during the loading operation.

In operation, the above-described disk apparatus 1, when in a vertical position, is typically used in the following manner. First, when an eject button (not shown) provided on the front panel of the main unit 10 is properly operated, the base member 16 inside the main unit 10 moves pivotally so as to move the spindle motor unit 12 and the optical pickup unit 14 away from the disk tray 20, so that the disk tray 20 is ejected. While the disk tray 20 is in eject position, the slider switch 26C is manipulated in order to slide the bar 26, so that the holding members 24 and 25 are moved to be projected over the recess 21. To be more specific, in Fig. 4 the slider switch 26C is manipulated so as to slide the bar 26 away from the main unit 10; thus in Fig. 5 the projections 27A are moved along

the cut-outs 26A, and in response to the slide of the arm members 27 on which the projections 27A are formed, the holding members 24 and 25 attached on the arm members 27 are moved to be projected over the recess 21. Then, a desired optical disk 2 is placed on the recess 21 and held in a vertical orientation by holding members 24 and 25. When the eject button is operated again or the disk tray 20 is appropriately pushed inward, the disk tray 20 is withdrawn by the driving mechanism within the main unit 10, and then the base member 16 moves pivotally so as to move the spindle motor unit 12 and the optical pickup 14 towards the disk tray 20. As the spindle motor unit 12 is moved nearer to the disk tray 20, the disk table 12B of the spindle motor unit 12 pushes up the optical disk 2 placed on the recess 21, so that the center hole of the optical disk 2 is brought into engagement with the chucking pulley 13. When the optical disk 2 has been chucked by the chucking pulley 13, the spindle motor unit 12 spins the optical disk 2, so that the information recorded on the optical disk 2 is read by the optical pickup unit 14.

15 The first embodiment as described above provides the following advantages.

The sliding motion of the bar 26 provided on the disk tray 20 allows moving the two holding members 24 and 25 back and forth in synchronization with each other, thereby simplifying the handling of the two holding members 24 and 25 for back-and-forth movement thereof relative to the recess 21 of the disk tray 20, or the recess 22 if the holding members 24 and 25 are appropriately dimensioned. The slidable holding members 24 and 25 also serve to localize the two holding members 24 and 25 and the bar 26 on one side of the disk tray 20, achieving a more compact structure of those components and thereby saving space. In addition, the stopper 29 provided on the bar 26 serves to retain the holding members 24 and 25 projected over the recess at certain predetermined positions, thereby further facilitating the manipulation of the holding members 24 and 25.

Fig. 7 shows a disk tray 20 in a second embodiment of the present invention.

In the following description of the second embodiment, identical or equivalent components as in the above-described first embodiment are designated by the like reference characters and their description is omitted or simplified as appropriate.

5 The second embodiment replaces the holding members 24 and 25 of the first embodiment with rotatable holding members 41 and 42. The disk tray 20 is provided with, on the downside or backside as viewed in Fig. 7, movable holding members 41 and 42 which can be moved back and forth so as to hold the peripheral end of an optical disk 2 at an outwardly-facing surface thereof. The two holding members 41 and 42 are
10 arranged in the insert/eject direction of the disk tray 20. One of the holding members 41 is disposed on one side of the recess 21 on which a 12-cm optical disk is to be placed, while the other holding member 42 is disposed on the other side of the same recess 21.

As shown in Fig. 8 and Fig. 9, an elongated bar 43 provided behind the disk tray 20 extends along the insert/eject direction. The holding members 41 and 42 are attached
15 to adjacent ends of the bar 43. The bar 43 is provided with three notches 43A formed in series on a longitudinal edge of one end closer to the main unit 10 (to the right as viewed in Fig. 8 and Fig. 9) and an elongated throughhole 43B on the other end remoter from the main unit 10, which is adjusted to overlap an arcuate aperture 44 formed on the disk tray 20. Between the notches 43A and the throughhole 43B, there are formed two insertion
20 slots or holes 43C formed along the longitudinal direction of the bar 43. On the end of the bar 43 remoter from the main unit 10, there is provided a slider switch 43D projecting on the top face of the disk tray 20.

The bar 43 is supported by, but not fixed to, the disk tray 20 via the screws 43E received in the insertion holes 43C. Thus, when the slider switch 43D is manipulated to
25 move along the insert/eject direction of the disk tray 20, the bar 43 in response slides along the insert/eject direction relative to the disk tray 20 (i.e., relative to the screws

43E), with the movable range of the bar 43 is defined by the length of the slotted insertion holes 43C.

Holding member 41 has its one end supported by the bar 43. On the bottom face of the holding member 41, a pin 41A is formed in the middle, which is received in the throughhole 43B via the aperture 44. Thus, the holding member 41 is rotatable on the supported end along the aperture 44. Holding member 42, disposed closer to the main unit 10, is supported by the bar 43 on its middle, with one end engaged with the bar 43, thus being rotatable on the middle.

The holding members 41 and 42 rotate in association with each other in response to the slide of the bar 43, and have sufficient lengths to provide such a movable range thereof which allows holding two sizes of optical disk, i.e., 12 cm and 8 cm in diameter, respectively. Bar 43 is also provided with, on the side closer to the main unit 10, a stopper 45 having a protrusion 45A constituted by a leaf spring. When the bar 43 is made to slide, the protrusion 45A is fitted into one of the three notches 43A. Accordingly, the holding members 41 and 42 rotate and are retained in one of the following positions; held back outside the circumference of the recess 21 (as at A in Fig. 7); projected over the recess 21 so as to hold a 12-cm optical disk (as at B in Fig. 7); and projected over the recess 22 so as to hold an 8-cm optical disk (as at C in Fig. 7).

To be more specific, when the holding members 41 and 42 are retained at position A in Fig. 7, the slider switch 43D is moved leftwards so that the protrusion 45A fits into the middle one of the three notches 43A. Accordingly, the holding member 41 rotates counterclockwise on the supported end along the aperture 44 while the holding member 42 rotates clockwise on the middle, so that the holding members 41 and 42 are projected over the recess 21 (as at location B in Fig. 7). When the slider switch 43D is moved further leftwards, the protrusion 45A fits into one of the three notches 43A remotest from the main unit 10. Accordingly, the holding member 41 rotates

counterclockwise further on the supported end along the aperture 44 while the holding member 42 rotates clockwise further on the middle, so that the holding members 41 and 42 are projected over the recess 22 (as at location C in Fig. 7).

The second embodiment as described above provides the following advantages in addition to the advantages of the first embodiment. The rotatable holding members 41 and 42 achieve a simple link mechanism structure in the form of the bar 43; the holding members 41 and 42 have one of their respective ends engaged on the associated ends of the bar 43, so that in response to the slide of the bar 43 the holding members 41 and 42 rotate in synchronization with each other so as to be projected over desired one of the recesses 21 and 22 of the disk tray 20. Further, the two holding members 41 and 42 have a movable range compatible with multiple sizes of optical disks, such as 8 cm and 12 cm in diameter respectively, thus allowing either size of optical disk to be held properly, even when the disk apparatus is used in a vertical position.

It is to be appreciated that the present invention is not limited to the described embodiments but includes other types of construction, including but not limited to the modifications given below, which essentially accomplish the same objectives.

The stopper employed in the embodiments may, for example, be replaced with other types of mechanism or structure capable of retaining the holding members at predetermined positions. The holding members need not always have such a movable range which allows holding optical disks of different diameters. Alternatively, for example, two types of holding members may be provided separately for optical disks 8 cm and 12 cm in diameter. The holding members may also be constructed, as preferred in particular embodiments, in any type including extendable and foldable as well as slidable and rotatable in order to be movable back and forth relative to a recess of a disk tray.

Further, although the described embodiments are particularly concerned with playback-only apparatus for playing back optical disks, the present invention is equally advantageous when applied to a disk apparatus capable of recording on optical disks alternatively or in addition to playback of optical disks. Still further, although the

5 described embodiments are concerned with a disk apparatus of the type which reads information recorded on an optical disk by means of an optical pickup unit, the present invention may be implemented in other types of disk apparatus employing other playback and/or recording techniques. That is, the present invention is applicable to any type of disk apparatus in which a disk is held on a disk tray for loading.

10 The specific structure, shape etc. in the embodiments may be altered without departing from the spirit and scope of the present invention.

WHAT IS CLAIMED IS:

1. A disk apparatus having a disk tray with at least one recess on which a disk is placed so as to be then loaded in a main unit, wherein said disk tray comprises:
 - a) a plurality of movable holding members for holding an outwardly-facing surface of a disk placed on said disk tray at a peripheral end region thereof, said plurality of movable holding members being further adapted for holding said disk in the vertical orientation; and
 - b) a link mechanism for operatively interconnecting said plurality of movable holding members with one another.
2. A disk apparatus according to claim 1, wherein said plurality of movable holding members are rotatable over said disk tray.
3. A disk apparatus according to claim 1, wherein said plurality of movable holding members are slidable over said disk tray.
4. A disk apparatus according to claim 1, wherein said plurality of movable holding members are adapted to hold a disk of more than one diameter.
5. A disk apparatus according to claim 1, wherein said link mechanism is adapted to retain said plurality of movable holding members at predetermined positions.
6. A disk apparatus according to claim 3, wherein said plurality of holding members slide toward each other.



7. A disk apparatus according to claim 6, wherein said plurality of holding members are slidable along parallel planes.

8. A disk apparatus according to claim 7, wherein said plurality of holding members are slidable along parallel planes that are perpendicular to the link mechanism.

9. A disk tray for use with a disk apparatus, said disk tray comprising

- a) at least one recess on which a disk is placed,
- b) a plurality of movable holding members for holding an outwardly-facing surface of a disk placed on said disk tray at a peripheral end region thereof,
- c) said plurality of movable holding members being further adapted for holding said disk in the vertical orientation; and
- d) a link mechanism for operatively interconnecting said plurality of movable holding members with one another.

10. A disk tray according to claim 9, wherein said plurality of movable holding members are slidably movable toward each other.

11. A disk tray according to claim 9, wherein said plurality of movable holding members are movable from a first position, where said plurality of movable holding members fail to hold a disk placed on said disk tray, to a second position, where said plurality of movable holding members are adapted to hold a disk of a first diameter placed on said disk tray, to a third position, where said plurality of movable holding members are adapted to hold a disk of a second diameter placed on said disk tray.



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12. A disk tray according to claim 9, further comprising at least two recesses, wherein said plurality of movable holding members are movable from a first position where said plurality of movable holding members are not positioned over any recess, to a second position where said plurality of movable holding members are positioned over a first recess for holding a disk placed in said first recess, to a third position where said plurality of movable holding members are positioned over a second recess for holding a disk placed in said second recess.

13. A disk tray according to claim 12, wherein when said plurality of movable holding members are movable to said third position, said plurality of movable holding members are positioned over said first and said second recesses.

14. A disk tray according to claim 9, further comprising a wherein said plurality of holding members are slidable along parallel planes.

15. A disk tray according to claim 9, wherein at least one of said plurality of holding members are slidable along a "Z"-shaped slot in said link mechanism.

16. A disk tray according to claim 9, wherein at least one of said plurality of holding members are slidable along an arcuate slot in said link mechanism.

17. A disk tray for use with a disk apparatus, said disk tray comprising

- a) a front surface having at least one recess on which a disk is placed, and a rear surface,
- b) a plurality of movable holding members for holding an outwardly-facing surface of a disk placed on said disk tray, and



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- c) a link mechanism for operatively interconnecting said plurality of movable holding members with one another,
- d) wherein said plurality of movable holding members are collectively movable in response to the movement of only one of said plurality.

18. A disk tray according to claim 17, wherein said plurality of movable holding members are slidably movable across said front surface and are connected to said link mechanism, which is positioned adjacent said rear surface.

19. A disk tray according to claim 17, further comprising a stopper member for retaining said plurality of holding members at predetermined positions.

20. A disk tray according to claim 19, wherein said stopper member is a spring connected between the rear surface of the disk tray and the link mechanism.

