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DESCRIPTION

DISK SUBSTRATE HOLDER AND TRANSPORTATION CASE

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Technical Field

The present invention relates to a disk substrate holder that holds disk substrates by the inner circumferential portions of center holes thereof during transportation and to a transportation case thereof.

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Background Art

There are disk-type recording mediums including optical disks, magnetic optical disks and magnetic disks for use with disk cartridges, and some of which are produced from hard disk substrates made of synthetic resins, such as plastic. The hard disk substrates have a drawback of getting easily damaged during transportation, as they are made of synthetic resins, such as polycarbonate and amorphous polyolefin.

For example, a plurality of hard disk substrates may be held by a holder with their outer circumferential portions clamped on the occasion of transporting the hard disk substrates. In such a case, the hard disk substrates tend to become radially deformed during transportation.

In order to avoid such deformation of the hard disk substrates, the hard disk substrates may be held by the holder with their outer circumferential portions supported loosely in such a manner as to allow the hard disk substrates to swing with vibrations. In this case, however, the outer circumferential portions of the hard disk substrates come into collision with a housing case in which the hard disk substrates are held by the holder owing to vibrations caused during transportation. Thus,

the outer circumferential portions of the hard disk substrates tend to get damaged.

Hence, there is provided a holder (a holding unit) 110 as shown in FIG. 24 for transporting plastic hard disk substrates without damages. This holder 110 includes first and second (hereinafter just referred to as "a pair of") holding members 111 and 112 for holding a plurality of hard disk substrates 101, and supporting portions 113 and 114 for supporting opposite ends of the pair of holding members 111 and 112.

The pair of holding members 111 and 112 is in the form of substantially linear rods so as to be inserted into center holes 102 of the hard disk substrates 101. A plurality of engagement grooves 115 and 116 are formed in the pair of holding members 111 and 112 to be engaged with the inner circumferential portions of the center holes 102 (i.e., the inner edges) of the hard disk substrates 101.

The engagement grooves 115 and 116 are formed in the holding members 111 and 112 from ends to ends at predetermined intervals and at the same depth. The pair of holding members 111 and 112 is inserted into the center holes 102 of the hard disk substrates 101 while being arranged adjacently to each other.

As shown in FIG. 25, the pair of holding members 111 and 112 is held at the opposite ends thereof by means of the supporting portions 113 and 114 in a housing case 103.

When the holding members 111 and 112 are moved away from each other in directions indicated by arrows X by means of the supporting portions 113 and 114 in the housing case 103, the engagement grooves 115 and 116 are

brought into engagement with the inner circumferential portions of the center holes 102 of the hard disk substrates 101. By this, the plurality of hard disk substrates 101 are held by the pair of holding members 111 and 112, i.e., by the holder 110 with their disk surfaces kept in parallel with one another. Then, the plurality of hard disk substrates 101 are subjected to transportation and the like while being held by the holder 110 and installed in the housing case 103.

10 The holder 110 provides the advantage that the hard disk substrates 101 can be prevented from getting radially damaged and transported safely by holding the hard disk substrates 101 by the inner circumferential portions of the center holes 102 thereof, in contrast to
15 the holder that holds the hard disk substrates by their outer circumferential portions.

By the way, the above-described conventional holder 110 has the following drawbacks.

(1) The pair of holding members 111 and 112 can hold
20 the plurality of hard disk substrates 101 only after installed in the housing case 103 with the supporting portions 113 and 114 of the housing case 103 being interposed between the holding members 111 and 112. In other words, the pair of holding members 111 and 112
25 cannot hold the plurality of hard disk substrates 101 before installed in the housing case 103.

(2) The holding members 111 and 112 are moved away from each other in the directions indicated by arrows X of FIG. 24 with the opposite ends thereof being stressed.
30 Thus, the holding members 111 and 112 become warped in such a manner as to allow midsections thereof to bend inwardly as shown in FIG. 25. This causes the engagement

grooves 115 and 116 to be separated from the inner circumferential portions of the center holes 102 of the hard disk substrates 101, thereby decreasing the holding powers to hold the hard disk substrates 101 at the
5 midsections of the holding members 111 and 112. As a result, the hard disk substrates 101 move during transportation and may get damaged by collisions with the adjacent hard disk substrates 101.

It is therefore an object of the present invention
10 to provide a hard disk substrate holder that can hold hard disk substrates by the inner circumferential portions of center holes thereof even when the holder is not yet installed in a housing case.

It is also an object of the present invention to
15 provide a hard disk substrate holder that can prevent holding members from becoming bent and a transportation case thereof.

Disclosure of the Invention

According to the subject matter of Claim 1, there
20 is provided a disk substrate holder wherein first and second disk holding members each having, in an outer surface thereof, a plurality of engagement grooves for engagement with inner circumferential portions of center
25 holes of disk substrates are inserted into the center holes of the disk substrates and then urged to increase a space between inner surfaces of the first and second disk holding members to engage the engagement grooves with the inner circumferential portions of the center
30 substrates by the inner circumferential portions of the center holes of the disk substrates, a third disk holding member is interposed between the inner surfaces of the

first and second disk holding members so as to be movable relative to the first and second disk holding members, and a movement of the third disk holding member relative to the first and second disk holding members causes the
5 first and second disk holding members to be pressed by press portions of the third disk holding member against the inner circumferential portions of the center holes of the disk substrates, whereby the disk substrate holder can hold the disk substrates assuredly in such a manner
10 as to prevent the disk substrates from moving while the third disk holding member is kept held between the first and second disk holding members in reaction to the force pressing the first and second disk holding members against the inner circumferential portions of the center
15 holes of the disk substrates.

According to the subject matter of Claim 2, the press portions are formed on opposite sides of the third disk holding member as substantially arc-shaped protrusions, and the first and second disk holding
20 members are joined together so as to be inserted into the center holes of the disk substrates by engaging the protrusions into holes of the first and second disk holding members. Thus, the first and second disk holding members, in the state of being combined by the third disk
25 holding member, can be inserted into the center holes of the disk substrates. Further, as the press portions on the opposite sides of the third disk holding is arc-shaped, the third disk holding member can be moved smoothly between the first and second disk holding members and the
30 first and second disk holding members can be pressed against the inner circumferential portions of the center holes of the disk substrates by means of the ends of the

arc-shaped press portions assuredly.

According to the subject matter of Claim 3, the first and second disk holding members have disk holding pieces for holding the inner circumferential portions of the center holes of the disk substrates engaged with the engagement grooves. The disk substrate holder can thus hold the plurality of disk substrates by the inner circumferential portions of the center holes thereof more assuredly by means of both the engagement grooves and the disk holding pieces of the first and second disk holding members.

According to the subject matter of Claim 4, there is provided a transportation case for disk substrate, comprising: a disk substrate holder wherein first and second disk holding members each having, in an outer surface thereof, a plurality of engagement grooves for engagement with inner circumferential portions of center holes of disk substrates are inserted into the center holes of the disk substrates and then urged to increase a space between inner surfaces of the first and second disk holding members to engage the engagement grooves with the inner circumferential portions of the center holes of the disk substrates, thereby holding the disk substrates by the inner circumferential portions of the center holes of the disk substrates; a case body for installing therein the plurality of disk substrates held by the disk substrate holder; and a lid attachable to the case body, the transportation case being characterized by that the disk substrate holder comprises a third disk holding member to be interposed between the inner surfaces of the first and second disk holding members so as to be movable relative to the first and second disk

holding members, the third disk holding member having press portions for pressing the first and second disk holding members against the inner circumferential portions of the center holes of the disk substrates upon
5 a movement of the third disk holding member relative to the first and second disk holding members, and that the case body has holder supporting portions for supporting opposite ends of the disk substrate holder, whereby the transportation case can protect the disk substrates from
10 impacts given from inside and outside the transportation case effectively while supporting the opposite ends of the disk substrate holder.

Brief Description of Drawings

FIG. 1 is an exploded perspective view of a
15 transportation case according to one embodiment of the present invention.

FIG. 2 is an exploded perspective view of a disk substrate holder according to one embodiment of the present invention.

20 FIG. 3A is an inner side view of a first or second disk holding member, and FIG. 3B is an outer side view of the first or second disk holding member.

FIG. 4 is a side view of a substantial portion of the holder.

25 FIG. 5 is a front view of the holder in a state where protrusions of a third disk holding member are engaged in holes of the first and second disk holding members.

FIG. 6 is a sectional plan view of the holder in a state where the first and second disk holding members
30 are being pushed with the protrusions of the third disk holding member.

FIG. 7 is a front view of the holder in a state where

the first and second disk holding members are being pushed with the protrusions of the third disk holding member.

FIG. 8 is a sectional plan view of the holder in a state where it is inserted into and got caught in center
5 holes of a plurality of hard disk substrates.

FIG. 9 is a sectional view when taken along a line A-A of FIG. 8.

FIG. 10 is a sectional plan view of the holder in a state where the first and second disk holding members
10 are held away from each other.

FIG. 11 is a sectional view when taken along a line B-B of FIG. 10.

FIG. 12 is a sectional plan view of the holder where the third disk holding member has been moved.

15 FIG. 13 is a sectional view when taken along a line C-C of FIG. 12.

FIG. 14 is a schematic view showing assembling process by the use of an assembly machine.

FIG. 15 is a schematic view showing the assembling
20 process by the use of the assembly machine.

FIG. 16 is a schematic view showing the assembling process by the use of the assembly machine.

FIG. 17 is a schematic view showing the assembling process by the use of the assembly machine.

25 FIG. 18 is a schematic view showing the assembling process by the use of the assembly machine.

FIG. 19 is a schematic view showing the assembling process by the use of the assembly machine.

FIG. 20 is a perspective view of a substantial
30 portion of the assembly machine.

FIG. 21 is a perspective view of a substantial portion in a state where the hard disk substrates are held

by the holder.

FIG. 22 is an elevational view of a modification of the disk holding member.

FIG. 23 is a perspective view for showing the external appearance of the transportation case.

FIG. 24 is a plan view of a conventional example.

FIG. 25 is a plan view for illustrating a condition of the conventional example in use.

Best Mode for Carrying Out the Invention

Hereinafter, a hard disk substrate holder and a transportation case to which the hard disk substrate holder is applied according to one embodiment of the present invention will be described with reference to the drawings.

As shown in FIG. 1, the transportation case is for transporting plastic hard disk substrates 1 used as substrates of disk-type recording mediums, such as optical disks, magnetic optical disks and magnetic disks. Each hard disk substrate 1 is formed with a center hole 2 at a center thereof so as to be engageable with a disk rotating mechanism or a hub. Further, each hard disk substrate 1 has a signal recording layer, such as a magnetic layer or an optical magnetic layer, and a protective layer formed on the signal recording layer for protection of the signal recording layer. The center hole 2 of the hard disk substrate 1 is engaged with the centering portion of the disk rotating mechanism of a recording and/or reproducing device or the hub for rotating the disk-type recording medium.

The transport case 3, which functions as a transportation unit for transporting the above-mentioned plurality of hard disk substrates 1 used as the substrates

of the disk-type recording mediums, includes a hard disk substrate holder 4 to be inserted into the center holes 2 of the hard disk substrates for holding the plurality of hard disk substrates 1 by the inner circumferential portions of the center holes 2 thereof, a case body 5 for housing therein the plurality of hard disk substrates 1 in a state of being held by the holder 4, and a lid 6 to be attached to the case body 5.

The holder 4 has first and second disk holding members 11 and 12 adapted to be engaged with the inner circumferential portions of the center holes 2 of the hard disk substrates 1, and a third disk holding member 13 adapted to be interposed between the first and second disk holding members 11 and 12 so as to join the first and second disk holding members 11 and 12 together in such a manner as to be inserted into the center holes 2 of the plurality of hard disk substrates 1.

As shown in FIG. 2, each of the first and second disk holding members 11 and 12 is in the form of a substantially linear rod and made of a synthetic resin that is less deformable and has rigidity, such as polyacetal, polypropylene or ABS resin.

Each of the first and second disk holding members 11 and 12 has a plurality of first to twenty-fifth engagement grooves 14a to 14y formed in an outer surface thereof to be engageable with the inner circumferential portions of the center holes 2 of the hard disk substrates 1. The first to twenty-fifth engagement grooves 14a to 14y are formed so as to extend in directions perpendicular to longitudinal directions of the first and second disk holding members 11 and 12 and have a predetermined spacing (by which any adjacent hard disk substrates 1 are

prevented from contacting with each other when being engaged in the first and twenty-fifth engagement grooves 14a to 14y).

Each of the first and second disk holding members 11 and 12 has arc-shaped disk holding pieces 15 extending from the ends of the first and twenty-fifth engagement grooves 14a and 14y.

The disk holding pieces 15 are formed integrally with the body portions of the first and second disk holding members 11 and 12 to be thin and flexible, and thus adapted to be pressed against the inner circumferential portions of the center holes 2 of the hard disk substrates 1 when being engaged in the engagement grooves 14a to 14y. Each of the first and second disk holding members 11 and 12 also has a slot 16 formed in its inner surface so as to extend in the longitudinal direction thereof.

FIG. 3A is an inner side view of the first or second disk holding member 11 or 12, and FIG. 3B is an outer side view of the first or second disk holding member 11 or 12. As shown in FIG. 3A, a plurality of insertion holes 18...18 are formed in the bottom of the slot 16 so as to be engageable with a plurality of press portions 17...17 of a third disk holding member 13 (described below).

The insertion holes 18...18 are formed by making holes in the central portions of the bottoms of the even-numbered engagement grooves 14b, 14d ... among the first to twenty-fifth engagement grooves 14a to 14y and in the end sides of the first and twenty-fifth engagement grooves 14a and 14y, while leaving the central portions of the bottoms of the odd-numbered engagement grooves 14a, 14c, 14e ... as beams 14a', 14c', 14e'.... The insertion

holes 18...18 and the beams 14a', 14c', 14e'... are configured as shown in FIG. 3B, when viewed from the outside.

As shown in FIG. 2, the plurality of press portions
5 17...17 are formed as arc-shaped protrusions in opposed positions on both sides of the third disk holding member 13 so as to be engaged in the insertion holes 18...18 of the first and second disk holding members 11 and 12.

Then, as shown in FIG. 4, the first, second and third
10 disk holding members 11, 12 and 13 are assembled by engaging the press portions 17...17 formed on the opposite sides of the third disk holding member 13 in the insertion holes 18...18 formed in the first and second disk holding members 11 and 12.

15 In the state where the hard disk substrate holder 4 is assembled from the first, second and third disk holding members 11, 12 and 13, the width D1 of the hard disk substrate holder 4 is set to be smaller than the diameter D2 of the center hole 2 of the hard disk substrate
20 1 as shown in FIG. 5. Further, the width D3 between the bottoms of the engagement grooves of the first and second disk holding members 11 and 12 is set to substantially the same value as the diameter D2 of the center hole 2 of the hard disk substrate 1 as shown in FIG. 7, in the
25 state where the press portions 17...17 of the third disk holding member 13 have come out of the insertion holes 18...18 of the first and second disk holding members 11 and 12 and press the beams 14a', 14c', 14e'... left on the central portions of the bottoms of the engagement
30 grooves 14a, 14c, 14e... as shown in FIG. 6.

The hard disk substrate holder 4 is structured as above. Accordingly, the first, second and third disk

holding members 11, 12 and 13 are first assembled and inserted into the center holes 2 of the plurality of hard disk substrates 1...1, as shown in FIGS. 8 and 9, and then, 25 sheets of hard disk substrates 1 are positioned so as to correspond to the first to twenty-fifth engagement grooves 14a to 14y of the first and second disk holding members 11 and 12, respectively. The first and second disk holding members 11 and 12 are moved away from each other, whereby the inner circumferential portions of the center holes 2 of the hard disk substrates 1 are engaged in the first to twenty-fifth engagement grooves 14a to 14y of the first and second disk holding members 11 and 12 as shown in FIGS. 10 and 11.

Then, the third disk holding member 13 is moved relative to the first and second disk holding members 11 and 12. By this, the beams 14a', 14c', 14e'... left on the central portions of the bottoms of the odd-numbered engagement grooves 14a, 14c, 14e... are pushed with the ends of the press portions 17...17 formed on the opposite sides of the third disk holding member 13, thereby pressing the bottoms of the odd-numbered engagement grooves 14a, 14c, 14e... against the inner circumferential portions of the center holes 102 of the hard disk substrates 1, as shown in FIGS. 12 and 13. Thus, the plurality of hard disk substrates 1 are held from inside of the center holes 2 by means of the first and second disk holding members 11 and 12. Further, the third disk holding member 13 is kept held between the first and second disk holding members 11 and 12 in reaction to the force pushing the press portions 17...17 toward the inner circumferential portions of the center holes 2 of the hard disk substrates 1.

FIGS. 14 to 20 shows an assembly machine 21 for allowing the hard disk substrate holder 4 to hold a plurality of hard disk substrates with ease.

The assembly machine 21 has a working case 22 for
5 holding the plurality of hard disk substrates 1 by the outer circumferential portions thereof, a holder supporting unit 23 for supporting the first and second disk holding members 11 and 12 so as to allow them to be arranged adjacently to each other, a press member 24 for
10 moving the third disk holding member 13 relative to the first and second disk holding members 11 and 12, and a base plate 25 on which the working case 22, the holder supporting unit 23, the press member 24 and the like are mounted.

15 The working case 22 retains the plurality of hard disk substrates 1 by their outer circumferential portions so as to allow substantially the same spacing as that of the first to twenty-fifth engagement grooves 14a to 14y of the first and second disk holding members 11 and 12,
20 and is movably mounted on the base plate 25.

The holder supporting unit 23 includes a short stand 31 for supporting one end of each of the first and second disk holding members 11 and 12, and a long stand 32 for supporting the other end of each of the first and
25 second disk holding members 11 and 12.

The short stand 31 has a first stand portion 33 for supporting the one end of the first disk holding member 11, and a second stand portion 34 for supporting the one end of the second disk holding member 12.

30 The first and second stand portions 33 and 34 are provided with positioning pins 35 and 36 with which the ends of the first and second disk holding members 11 and

12 are brought into contact, respectively. Further, the first and second stand portions 33 and 34 are movable toward and away from each other.

5 The long stand 32 has a third stand portion 37 for supporting the other end of the first disk holding member 11, and a fourth stand portion 38 for supporting the other end of the second disk holding member 12.

10 The third and fourth stand portions 37 and 38 are provided with positioning pins 39 and 40 with which the other ends of the first and second disk holding members 11 and 12 are brought into contact, respectively. The third and fourth stand portions 37 and 38 are movable toward and away from each other in synchronism with the first and second stand portions 33 and 34.

15 The press member 24 is disposed near the short stand 31, and is adapted to be inserted between the first and second stand portions 33 and 34 so as to press the end of the third disk holding member 13 after the first and second stand portions 33 and 34 as well as the third and fourth stand portions 37 and 38 are moved away from each other. Herein, the positioning pins 35 and 36 provided on the first and second stand portions 33 and 34, side walls 41 and 42 provided between the positioning pins 35 and 36, the positioning pins 39 and 40 provided on the third and fourth stand portions 37 and 38 and side walls 43 and 44 provided between the positioning pins 39 and 40 are formed at such heights as not to interfere with the press portions 17...17 of the third disk holding member 13 when the third disk holding member 13 is moved, as shown in FIG. 20. Further, chamfers 45 are formed on both sides of the bottoms of the third and fourth stand portions 37 and 38, so as to insert the hard disk substrate

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holder 4 into the center holes 2 of the hard disk substrates 1 easily.

Next, the operations of the assembly machine 21 will be explained.

5 Firstly, the working case 22 retaining therein the plurality of hard disk substrates 1 is mounted on the base plate 25 as shown in FIG. 14.

Then, the working case 22 is moved to the long stand 32 as shown in FIG. 15.

10 As shown in FIG. 16, the hard disk substrate holder 4 in which the first, second and third disk holding members 11, 12 and 13 are assembled is set between the short stand 31 and the long stand 32.

As shown in FIG. 17, the working case 22 is moved
15 to the hard disk substrate holder 4 supported between the short stand 31 and the long stand 32, and the plurality of hard disk substrates 1 retained by the working case 22 are positioned so as to correspond to the first to twenty-fifth engagement grooves 14a to 14y of the first
20 and second disk holding members 11 and 12.

Then, as shown in FIG. 18, the first to twenty-fifth engagement grooves 14a to 14y are brought into engagement with the inner circumferential portions of the center holes 2 of the plurality of hard disk substrates 1 by
25 moving the first and second stand portions 33 and 34 away from each other and moving the third and fourth stand portions 37 and 38 away from each other.

Subsequently, one end of the third disk holding member 13 is pushed with the press member 24 as shown in
30 FIG. 19. Then, the third disk holding member 13 is moved relative to the first and second disk holding members 11 and 12 so as to push the press portions 17...17 formed

on the opposite sides of the third disk holding member 13 to the beams 14a', 14c', 14e'... left on the central portions of the bottoms of the odd-numbered engagement grooves 14a, 14c, 14e..., thereby pressing the bottoms
5 of the odd-numbered engagement grooves 14a, 14c, 14e... against the inner circumferential portions of the center holes 2 of the hard disk substrates 1. The plurality of hard disk substrates 1 are thus held from inside of the center holes 2 by means of the first and
10 second disk holding members 11 and 12 within the working case 22. In this state, the third disk holding member 13 is kept held between the first and second disk holding members 11, 12 in reaction to the force pressing the ends of the press portions 17 against the beams 14a', 14c',
15 14e'.... When the working case 22 is removed, the plurality of hard disk substrates 1 are held by the hard disk substrate holder 4 from inside of the inner holes 2 of the hard disk substrates 1 as shown in FIG. 21. Meanwhile, in the assembly machine 21 of the
20 above-described embodiment, the third disk holding member 13 is moved after the first to twenty-fifth engagement grooves 14a to 14y are brought into engagement with the inner circumferential portions of the center holes 102 of the plurality of hard disk substrates 1 by
25 moving the first and second disk holding members 11 and 12 away from each other. However, the third disk holding member 13 may be moved so as to move the first and second disk holding members 11 and 12 away from each other, thereby bringing the first to twenty-fifth engagement
30 grooves 14a to 14y into engagement with the inner circumferential portions of the center holes 2 of the plurality of hard disk substrates 1, and at the same time,

to press the press portions 17 against the first and second disk holding members 11 and 12. In this case, the third disk holding member 13 can be moved smoothly when the press portions 17 on the opposite sides of the third disk holding member 13 are formed into gentle arcs (or waveform) as shown in FIG. 22. Further, the above-described embodiment is configured so that the bottoms of the odd-numbered engagement grooves 14a, 14c, 14e... are pressed against the inner circumferential portions of the center holes 2 of the hard disk substrates 1 among the first to twenty-fifth engagement grooves 14a to 14y. However, the hard disk substrate holder 4 may be structured so that the bottoms of the even-numbered engagement grooves 14b, 14d, 14f... or every few engagement grooves, e.g., every two or three engagement grooves are pressed against the inner circumferential portions of the center holes 2 of the hard disk substrates 1. In addition, the number of hard disk substrates held by the hard disk substrate holder 4 is not limited to twenty-five, and may be any number.

Next, the transportation case to which the hard disk substrate holder 4 is applied will be described below.

The transportation case 3 has the hard disk substrate holder 4, the case body 5 for housing therein the plurality of hard disk substrates 1 held by the hard disk substrate holder 4, and the lid 6 put on the case body 5, as shown in FIG. 1.

The case body 5 has a pair of holder supporting portions 51 and 52 for supporting opposite ends of the hard disk substrate holder 4. As shown in FIG. 21, the width W1 of each of the holder supporting portions 51 and

52 is set to substantially the same value as the spacing W2 between the first and second disk holding members 11 and 12 in the state of holding the plurality of hard disk substrates 1. The pair of holder supporting portions 51 and 52 is adapted to be interposed between the first and second disk holding members 11 and 12 so as to support the opposite ends of the hard disk substrate holder 4.

Each of the case body 5 and the lid 6 is produced from a film made of plastic, such as polyester or polypropylene, and having a thickness of 0.4 to 1.2 mm. By putting the lid 6 on the case body 5, the lid 6 is detachably fit on the case body 5 with a case attached portion 6a formed on the lower rim of the lid 6 and a lid attached portion 5a formed on the upper rim of the case body 5 attached to each other as shown in FIG. 23. Both the case body 5 and the lid 6 are adapted to be kept from contact with the outer circumferential portions of the hard disk substrates 1...1 installed in the case body 5 and the lid 6.

Industrial Applicability

The present invention is widely applicable to hard disk substrates for not only magnetic disks, such as a compact disk, but also magnetic optical disks, optical disks, digital video disks (DVDs) and the like.

CLAIMS

1. A disk substrate holder wherein first and second disk holding members each having, in an outer surface thereof, a plurality of engagement grooves for engagement with inner circumferential portions of center holes of disk substrates are inserted into the center holes of the disk substrates and then urged to increase a space between inner surfaces of the first and second disk holding members to engage the engagement grooves with the inner circumferential portions of the center holes of the disk substrates, thereby holding the disk substrates by the inner circumferential portions of the center holes of the disk substrates,
- the disk substrate holder being characterized in that a third disk holding member is interposed between the inner surfaces of the first and second disk holding members so as to be movable relative to the first and second disk holding members, and a movement of the third disk holding member relative to the first and second disk holding members causes the first and second disk holding members to be pressed by press portions of the third disk holding member against the inner circumferential portions of the center holes of the disk substrates.
2. A disk substrate holder according to Claim 1, characterized in that the press portions are formed on opposite sides of the third disk holding member as substantially arc-shaped protrusions, and the first and second disk holding members are joined together so as to be inserted into the center holes of the disk substrates by engaging the protrusions into holes of the first and

second disk holding members.

3. A disk substrate holder according to Claim 1,
characterized in that each of the first and second disk
5 holding members have disk holding pieces for holding the
inner circumferential portions of the center holes of the
disk substrates engaged with the engagement grooves.

4. A transportation case for disk substrate,
10 comprising:

a disk substrate holder wherein first and second
disk holding members each having, in an outer surface
thereof, a plurality of engagement grooves for engagement
with inner circumferential portions of center holes of
15 disk substrates are inserted into the center holes of the
disk substrates and then urged to increase a space between
inner surfaces of the first and second disk holding
members to engage the engagement grooves with the inner
circumferential portions of the center holes of the disk
20 substrates, thereby holding the disk substrates by the
inner circumferential portions of the center holes of the
disk substrates;

a case body for installing therein the plurality
of disk substrates held by the disk substrate holder; and

25 a lid attachable to the case body,

the transportation case being characterized by
that the disk substrate holder comprises a third disk
holding member to be interposed between the inner
surfaces of the first and second disk holding members so
30 as to be movable relative to the first and second disk
holding members, the third disk holding member having
press portions for pressing the first and second disk

holding members against the inner circumferential portions of the center holes of the disk substrates upon a movement of the third disk holding member relative to the first and second disk holding members, and that the
5 case body has holder supporting portions for supporting opposite ends of the disk substrate holder.