

DESCRIPTION

END POSITION DETECTING APPARATUS OF A MOBILE ELEMENT, AND A DISK
APPARATUS USING THE SAME

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TECHNICAL FIELD

The present invention relates to an information recording and reproducing apparatus, and more particularly to a moving position detecting apparatus of a mobile element used in a disk apparatus of the like.

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BACKGROUND ART

In a conventional disk apparatus of magnetic disk or optical disk, a pickup device is moved to an innermost circumferential position or outermost circumferential position of a disk. A position detecting apparatus detects when the pickup apparatus is moved to a specified position. Thus, the specified operation of the pickup apparatus is done automatically.

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As the position detecting means, hitherto, a push type switch has been used. In this case, when the pickup apparatus is moved to an innermost circumferential position or outermost circumferential position of a disk, the pickup apparatus pushes this push type switch from its moving direction, thereby detecting that the pickup apparatus has

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reached the innermost circumferential position or outermost circumferential position.

In the push type switch, when a pressing work force larger than specified is applied to the pressing knob portion, 5 the pressing knob portion is moved by overcoming the elastic force (reaction force) of the spring in the switch. When the pressing knob portion moves more than a specific distance, an electric contact is opened or closed. When the pressing force of the pressing knob portion is eliminated, it is 10 restored to the initial state by the thrusting force of the spring.

Therefore, when the pressing work force and the reaction force are not mutually balanced, that is, when the reaction force by the push type switch and the pressing work force by 15 the pickup apparatus are not adjusted properly, if the pickup apparatus is sent to the innermost circumferential position or outermost circumferential position of the disk along the radial direction of the disk, the push type switch cannot be driven. Moreover, if the pickup apparatus is driven, the 20 pickup apparatus may be shifted from the specified position by the reaction force of the switch after driving.

SUMMARY OF THE INVENTION

A position detecting apparatus of the invention for 25 detecting the moving position of a mobile element comprises:

A mobile element moving reversibly along a specified running path,

a conductive electrode disposed along the running path,

a detecting electrode disposed on the mobile element, and

5 detecting means for detecting contact or non-contact between the conductive electrode and detecting electrode.

In which, the detecting electrode is disposed so as to contact with or not to contact with the conductive electrode by the move of the mobile element. The position of the
10 mobile element is detected by the detecting means.

Preferably, the position detecting apparatus further includes a guide shaft for guiding the move of the mobile element, and the conductive electrode is disposed on the surface of the guide shaft.

15 Preferably, the position detecting apparatus further includes a guide shaft for guiding the move of the mobile element, and the conductive electrode is disposed on the surface of the guide shaft, and the detecting electrode is disposed so as to may contact electrically with the
20 conductive electrode from the direction crossing with the moving direction of the detecting electrode.

Preferably, the position detecting apparatus further includes a guide shaft for guiding the move of the mobile element, and a drive shaft for moving the mobile element, and
25 the conductive electrode is disposed on the surface of the

drive shaft.

Preferably, the position detecting apparatus further includes a guide shaft for guiding the move of the mobile element, a drive shaft for moving the mobile element, and an
5 elastic member disposed between the drive shaft and the mobile element, and the conductive electrode is disposed on the surface of the drive shaft.

In this constitution, application of reaction to the mobile element is prevented. Moreover, move of the mobile
10 element from the specified position is lessened and eliminated.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig. 1 is an essential perspective view of a moving
15 position detecting apparatus of mobile element in an embodiment of the invention.

Fig. 2 is a partially cut-away perspective view of the moving position detecting apparatus of mobile element in the embodiment of the invention.

20 Fig. 3 (a) and Fig. 3 (b) are side views schematically showing the operating state of the moving position detecting apparatus of mobile element in the embodiment of the invention.

Fig. 4 is an essential perspective view of a moving
25 position detecting apparatus of mobile element in other

embodiment of the invention.

Fig. 5 is a partially cut-away sectional view of the moving position detecting apparatus of mobile element shown in Fig. 4.

5 Fig. 6 (a) and Fig. 6 (b) are side views schematically showing the operating state of the moving position detecting apparatus of mobile element shown in Fig. 4.

BEST MODE FOR CARRYING OUT THE INVENTION

10 A moving position detecting apparatus of a mobile element in an embodiment of the invention comprises:

a mobile element moving reversibly along a specified running path,

an electrode holder having a conductive electrode
15 partially at a specified position of the surface, and disposed along the running path,

a detecting electrode disposed on the mobile element so as to be connected electrically to the conductive electrode when the mobile element is positioned at a predetermined
20 moving position on the running path, by contacting from a direction crossing with the moving direction of the mobile element, and

detecting means for detecting presence or absence of electric contact between the conductive electrode and
25 detecting electrode.

In this constitution, the detecting electrode disposed on the mobile element contacts with the conductive electrode from the direction crossing with the moving direction of the mobile element. It hence prevents application of reaction to
5 the mobile element. Moreover, move of the mobile element from the specified position is lessened and eliminated.

Preferably, the electrode holder includes a mobile element guide shaft disposed along the running path so that the mobile element slides and moves, and the conductive
10 electrode is formed on the surface of the mobile element guide shaft.

In this constitution, the mobile element guide shaft necessary for the move of the mobile element and the electrode holder are commonly used, so that the structure is
15 simplified.

Preferably, a plurality of the detecting electrodes are disposed on the mobile element, and the detecting means is contacting with the conductive electrode together with each detecting element.

20 In this constitution, since there are a plurality of detecting means, more secure detection is realized.

Preferably, the mobile element guide shaft is disposed, penetrating through the through-hole formed in the mobile element, and the plurality of detecting electrodes are
25 disposed on the mobile element so as to contact with the

surface of the mobile element guide shaft in the through-hole individually.

In this constitution, the detecting electrodes can be disposed in the mobile element forming the through-hole
5 directly by driving or other means, and the structure is simplified.

A moving position detecting apparatus of a mobile element in other embodiment of the invention comprises:

10 a mobile element moving reversibly along a specified running path,

an electrode holder having a conductive electrode partially at a specified position of the surface, and disposed parallel along the running path,

15 a detecting electrode disposed on the mobile element so as to be connected electrically to the conductive electrode when the mobile element is positioned at a predetermined moving position, by contacting from a direction crossing with the moving direction of the mobile element, and

20 detecting means for detecting presence or absence of electric contact between the conductive electrode and detecting electrode.

In this constitution, the detecting electrode disposed on the mobile element contacts with the conductive electrode
25 from the direction crossing with the moving direction of the

mobile element. It hence prevents application of reaction to the mobile element. Moreover, move of the mobile element from the specified position is lessened and eliminated.

Preferably, the electrode holder is a drive shaft
5 disposed parallel to the running path for transmitting rotary motion from the motor, and the conductive electrode is formed on the surface of this drive shaft.

In this constitution, the drive shaft necessary for the move of the mobile element and the electrode holder are
10 commonly used, so that the structure is simplified.

Preferably, a plurality of the detecting electrodes are disposed on a motion converting device disposed between the drive shaft and the mobile element, for converting the rotary motion from the drive shaft into a motion for reversibly
15 moving the mobile element along the running path, and the detecting means detects when the detecting electrode contacts with the conductive electrode.

In this constitution, the motion converting device necessary for the move of the mobile element and the
20 detecting electrode are commonly used, so that the structure is simplified.

Preferably, the motion converting device is formed so as to hold the drive shaft and mobile element with a spring pressure, and the plurality of detecting electrodes are
25 disposed on the motion converting device so as to contact

with the surface of the electrode holder.

In this constitution, since the detecting means are provided in a plurality, and the drive shaft and mobile element contact with each other as being pressed by the spring, secure detection of position of the mobile element is realized.

Moreover, in a constitution in which a lubricant is provided for moving the mobile element smoothly, disturbance of electric conduction by the lubricant is prevented, and the position of the mobile element can be detected accurately.

Exemplary embodiments of the moving position detecting apparatus of mobile element of the invention are specifically described below.

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Exemplary Embodiment 1

As an exemplary embodiment of the moving position detecting apparatus of mobile element of the invention, a pickup device of a disk apparatus is described below.

20 Fig. 1 is a perspective view of essential parts of a moving position detecting apparatus of mobile element in an exemplary embodiment of the invention. Fig. 2 is a partial magnified view of the moving position detecting apparatus shown in Fig. 1.

25 In Fig. 1 and Fig. 2, the moving position detecting

apparatus comprises a pickup device 3 as mobile element, electrode holders 4a, 4b, 7 detecting electrodes 5, 6, detecting means 11a, 11b, and a drive shaft 10. The electrode holders 4a, 4b, 7 including mobile element guide shafts 4a, 4b, and a conductive electrode 7, and the mobile element guide shafts 4a, 4b have a first mobile element guide shaft 4a and a second mobile element guide element 4b. The conductive electrode 7 is disposed at a specified position of the surface of the mobile element guide shaft 4a. The detecting electrodes 5, 6 have a first detecting electrode 5 and a second detecting electrode 6. The detecting means 11a, 11b have first detecting means 11a and second detecting means 11b. The mobile element has a motion converting device (not shown) for converting the rotary motion of the drive shaft into a linear motion. The mobile element itself has a function of motion converting device. The mobile element moves along the guide shaft while being driven by the driving force of the drive shaft.

The pickup device 3 is made of a non-conductive material. The pickup device has a relatively light weight. The pickup device 3 has a pickup 8, and the disk (not shown) is mounted on a turntable 2. The disk has a function of information medium for recording and reproducing information. Two through-holes 9 are formed in the pickup device 3. Two guide shafts 4a, 4b are disposed parallel to each other by

penetrating through the respective through-holes 9. These guide shafts 4a, 4b at least have a surface composed of a non-conductive material. The pickup device 3 can slide and move along these guide shafts 4a, 4b.

5 A feed screw rod 10 as drive shaft is disposed parallel to these guide shafts 4a, 4b, and the feed screw rod 10 is reversibly rotated by a gear 1 coupled to a motor (not shown). The pickup device 3 is always engaged with the feed screw rod 10. The pickup device 3 is reversibly slidable along the
10 guide shafts 4a, 4b depending on the rotating direction of the feed screw rod 10.

On the surface at a specified position in the longitudinal direction of the first guide shaft 4a of the two guide shafts 4a, 4b, a conductive electrode 7 made of a
15 conductive material is disposed. In this embodiment, the conductive electrode 7 is disposed on the surface at the end in the longitudinal direction of the first guide shaft 4a. This conductive electrode 7 is grounded. Near the end of the through-hole 9 penetrating through the first guide shaft 4a,
20 the two detecting electrodes, that is, first detecting electrode 5 and second detecting electrode 6 are adjustably driven into the pickup device 3. Two detecting electrodes 5, 6 are disposed so that the leading ends of the two detecting electrodes 5, 6 may press the first guide shaft 4a to the
25 inner wall of the through-hole 9 while abutting against the

surface of the first guide shaft 4a, from mutually different directions. That is, the pickup device 3 moves while the leading ends of the first detecting electrode 5 and second detecting electrode 6 are contacting with the surface of the first guide shaft 4a from the direction crossing with the moving direction of the pickup device 3 in the through-hole 9. The direction crossing with the moving direction of the pickup device 3 is, for example, a right-angle direction. In such constitution, with the disk mounted on the turntable 2, the pickup device 3 moves to the innermost circumference and outermost circumference of the disk. When the pickup device 3 has reaches a specified position, it is detected by the position detecting apparatus. That is, the relative positions of the pickup 8 and disk are detected.

In this constitution, when the pickup device 3 moves and the first detecting electrode 5 and second detecting electrode 6 are moved to the position contacting with the conductive electrode 7 as shown in Fig. 3 (a), an electric conductivity takes place between the first detecting electrode 5 and conductive electrode 7, and between the second detecting electrode 6 and conductive electrode 7. This electric conduction is detected by the first detecting means 11a and second detecting means 11b to detect conduction between the first detecting electrode 5 and conductive electrode 7, or between the second detecting electrode 6 and

conductive electrode 7, or both. By this detection, it is confirmed that the pickup device 3 has moved to a specified position. As the first detecting means 11a and second detecting means 11b, ammeters or the like may be used.

5 Similarly, as shown in Fig. 3 (b), at the positions where these detecting electrodes 5, 6 are remote from the conductive electrode 7, electric conduction is not obtained between the detecting electrodes 5, 6 and conductive electrode 7. Accordingly, by detecting it may ammeters or
10 other detecting means 11a, 11b, it is confirmed that the pickup device 3 is not moved to the specified position.

The embodiment is constituted so as to obtain an electric conduction between the detecting electrodes 5, 6 and conductive electrode 7 when the pickup device has moved to
15 the specified position, but not limited to this constitution, to the contrary, it may be also effective to constitute so as to set in non-conducting state when reaching a specified position.

In the embodiment, the conductive electrode 7 is disposed
20 on the guide shaft 4a as electrode holder, and the conductive electrode 7 and electrode holder 4a are shared, but not limited to this constitution, the electrode holder 4a and the conductive electrode 7 may be independently disposed mutually.

Also in the embodiment, the conductive electrode 7 is
25 disposed on the first guide shaft 4a, but not limited to this

constitution, the conductive electrode 7 may be also disposed on the second guide shaft 4b.

Exemplary Embodiment 2

5 A moving position detecting apparatus of mobile element in other exemplary embodiment of the invention is described below while referring to the accompanying drawings. Same constituent elements as in the preceding embodiment are identified with same reference numerals, and the description
10 of the same constituent elements is omitted.

Fig. 4 is an essential perspective view of the moving position detecting apparatus of mobile element in exemplary embodiment 2 of the invention. Fig. 5, Fig. 6 (a), and Fig. 6 (b) are partial magnified views of the moving position
15 detecting apparatus shown in Fig. 4.

In Fig. 4 and Fig. 5, the moving position detecting apparatus comprises a pickup device 3 as mobile element, mobile element guide shafts 4a, 4b, a drive shaft 10, a conductive electrode 7, detecting electrodes 5, 6, and
20 detecting means 11a. The conductive electrode 7 is disposed at a specified position on the surface of the feed screw rod 10 as drive shaft. A rack 12 and a spring 13 are disposed between the pickup device 3 and feed screw rod 10. The rack 12 has a function as motion converting device. The rack 12
25 is always pressed and engaged with the pickup device 3 and

feed screw rod 10 by the spring 13 as an elastic member. The rack 12 has a function of converting the rotary motion of the feed screw rod 10 into a sliding motion of the pickup device 3.

5 On the surface at a specified position of the feed screw rod 10, a conductive electrode 7 of a conductive material is formed, and this conductive electrode is grounded. The conductive electrode is disposed, for example, on the surface at the end of the feed screw rod 10. As shown in Fig. 5, the
10 detecting electrodes 5, 6 are disposed in part of the rack 12. The feed screw rod 10 and detecting electrode 5 are pressed by the spring 13, and the detecting electrodes 5, 6 contact with the surface of the feed screw rod 10. The detecting electrode is composed of a plurality of electrodes of first
15 detecting electrode 5 and second detecting electrode 6.

The first guide shaft 4a and second guide shaft 4b are disposed parallel to each other. The pickup device 3 is held by the first guide shaft 4a and second guide shaft 4b, and is reversibly movable along the first guide shaft 4a and second
20 guide shaft 4b. A lubricant is applied on the surface of the guide shafts 4a, 4b, and this lubricant has a function of smoothing the move of the mobile element.

From the direction crossing with the moving direction of the pickup device 3, the pickup device 3 moves with the
25 detecting electrode 5 kept in contact with the surface of the

feed screw rod 10. The direction crossing with the moving direction of the pickup device 3 is, for example, a right-angle direction.

In this constitution, as the pickup device 3 moves, and, as shown in Fig. 6 (b), when the detecting electrode 5 is moved to the position contacting with the conductive electrode 7, an electric conduction between the detecting electrode 5 and conductive electrode 7 is obtained. This electric conduction is detected by the detecting means 11a, and it is confirmed that the pickup device 3 has moved to the specified position.

Similarly, as shown in Fig. 6 (b), in the state of the detecting electrode 5 departing from the conductive electrode 7, electric conduction is not obtained between the detecting electrode 5 and conductive electrode 7. Accordingly, by detecting it by the detecting means 11a, it is confirmed that the pickup device 3 is not moved to the specified position.

This embodiment is constituted so that the electric conduction between the detecting electrode 5 and conductive electrode 7 is obtained when the pickup device is moved to the specified position, but not limited to this constitution, to the contrary, it may be constituted so that the detecting electrode 5 and conductive electrode 7 do not conduct when the pickup device has reached the specified position.

In the embodiment, it is constituted to obtain electric

conduction between one detecting electrode 5 and conductive electrode 7, but not limited to this constitution, it may be also effective to constitute so as to obtain electric conduction between a plurality of detecting electrodes and
5 conductive electrode 7.

INDUSTRIAL APPLICABILITY

In the constitution of the moving position detecting apparatus of mobile element of the invention, the detecting
10 electrode disposed on the mobile element contacts with the conductive electrode from the direction of crossing with the moving direction of the mobile element. In this constitution, application of reaction to the mobile element is prevented, and the move of the mobile element from the specified
15 position is lessened and eliminated.

Since the mobile element guide shaft and electrode holder are shared, the structure of the moving position detecting apparatus is simplified.

As the feed screw shaft and mobile element are pressed to
20 contact by the spring pressure, the position of the mobile element is detected accurately.

In the constitution of the lubricant disposed on the surface of the guide shaft, disturbance of electric conduction by the lubricant is prevented, and the position of
25 the mobile element can be detected accurately.



CLAIMS

1. A position detecting apparatus for detecting a moving position of a mobile element, comprising:

5 a mobile element moving reversibly along a specified running path,

a conductive electrode disposed along said running path,

a detecting electrode disposed on said mobile element, said detecting electrode being disposed so as to contact and
10 not to contact with said conductive electrode by a move of said mobile element, and

detecting means for detecting contact and non-contact between said conductive electrode and said detecting electrode, the position of said mobile element being detected
15 by said detecting means.

2. The position detecting apparatus of claim 1, further comprising:

a guide shaft for guiding the move of said mobile
20 element,

wherein said conductive electrode is disposed on a first surface of a surfaces of said guide shaft.

3. The position detecting apparatus of claim 1, further
25 comprising:

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a guide shaft for guiding the move of said mobile element,

wherein said conductive electrode is disposed on a first surface of the surfaces of said guide shaft, and

5 said detecting electrode is disposed so as to contact electrically with said conductive electrode from a direction crossing with a moving direction of the detecting electrode when said mobile element is positioned at a predetermined moving position on said running path.

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4. The position detecting apparatus of claim 1,

wherein said detecting electrode has a first detecting electrode and a second detecting electrode, and

15 said detecting means has first detecting means for detecting electric conduction between said first detecting electrode and said conductive electrode, and second detecting means for detecting electric conduction between said second detecting electrode and said conductive electrode.

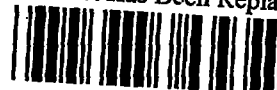
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5. The position detecting apparatus of claim 1, further comprising:

a guide shaft for guiding the move of the mobile element,

25 wherein said conductive electrode is disposed on a first surface of the surfaces of said guide shaft,

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said mobile element has a through-hole,
said guide shaft penetrates through said through-hole,
said conductive electrode may be movable in said
through-hole, and

5 said detecting electrode is disposed on said mobile
element so as to may contact with said conductive electrode
position in the said through-hole.

6. The position detecting apparatus of claim 5,
10 wherein said detecting electrode has a first detecting
electrode and a second detecting electrode,

 said detecting means has first detecting means for
detecting electric conduction between said first detecting
electrode and said conductive electrode, and second
15 detecting means for detecting electric conduction between
said second detecting electrode and said conductive
electrode,

 said first detecting electrode may contact with said
conductive electrode from a first direction orthogonal to
20 said moving direction of said mobile element, and

 said second electrode may contact with said conductive
electrode from the opposite direction of said first direction.

7. The position detecting apparatus of claim 3, further
25 comprising:

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a drive shaft for moving said mobile element,
wherein said mobile element moves along said guide shaft
while being driven by a driving force of said drive shaft.

5 8. The position detecting apparatus of claim 1, further
comprising:

an electrode holder disposed parallel to said running
path,

wherein said conductive electrode is disposed on a first
10 surface of the surfaces of said electrode holder, and

said detecting electrode may contact with said conductive
electrode when said mobile element is moved to a
predetermined moving position.

15 9. The position detecting apparatus of claim 8,

wherein said detecting electrode may contact with said
conductive electrode from a direction crossing with the
moving direction of said mobile element.

20 10. The position detecting apparatus of claim 8,

wherein said electrode holder has a drive shaft for
transmitting rotary motion, and

said conductive electrode is disposed on the surface of
said drive shaft.

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11. The position detecting apparatus of claim 1, further comprising:

a drive shaft for moving said mobile element, and

a motion converting device disposed between said drive
5 shaft and said mobile element,

wherein said conductive electrode is disposed on the surface of said drive shaft,

said motion converting device has a function of converting a rotary motion from said drive shaft into a
10 motion for moving reversibly said mobile element along said running path,

said detecting electrode is disposed in said motion converting device, and

said detecting electrode may contact with said conductive
15 electrode when said mobile element is moved to a predetermined moving position.

12. The position detecting apparatus of claim 11,

wherein said detecting electrode has a plurality of
20 detecting electrodes, and

said plurality of detecting electrodes may contact with said conductive electrode.

13. The position detecting apparatus of claim 1, further
25 comprising:

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a drive transmission shaft for moving said mobile element,
and

an elastic member disposed between said mobile element
and drive shaft,

5 wherein said conductive electrode is disposed on the
surface of said drive shaft,

said detecting electrode is disposed between said elastic
member and said drive shaft, and

said detecting electrode may contact with the surface of
10 said drive shaft and said conductive electrode while being
pressed by the pressing force of said elastic member.

14. The position detecting apparatus of claim 13,
wherein said detecting electrode has a plurality of
15 detecting electrodes, and

each one of said plurality of detecting electrodes may
contact with the surface of said drive shaft and said
conductive electrode while being pressed by the pressing
force of said elastic member.

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15. The position detecting apparatus of claim 1, further
comprising:

a guide shaft for guiding the move of said mobile element,
a drive shaft for moving said mobile element, and
25 a lubricant disposed on the surface of said guide shaft,

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wherein said conductive electrode is disposed on the surface of said drive shaft.

16. The position detecting apparatus of claim 1,

5 wherein said mobile element has a pickup device used in a disk apparatus for performing at least one of recording and reproduction of information.

17. A disk apparatus for recording and reproducing
10 information comprising:

a turntable for mounting a disk for recording information thereon, and

a position detecting apparatus for detecting a relative
positions of a mobile element and said disk mounted on said
15 turntable,

wherein said position detecting apparatus comprises:

said mobile element moving reversibly along a predetermined running path,

a conductive electrode disposed along said running path,

20 a detecting electrode disposed on said mobile element, said detecting electrode being disposed so as to contact and not to contact with said conductive electrode by the move of said mobile element, and

detecting means for detecting contact and non-contact
25 between said conductive electrode and said detecting

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electrode, a position of said mobile element being detected by said detecting means.

18. The disk apparatus of claim 17,
5 wherein said position detecting apparatus further comprises:

a guide shaft for guiding the move of said mobile element,
and

said conductive electrode is disposed on the surface of
10 said guide shaft.

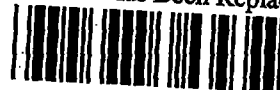
19. The disk apparatus of claim 17,
wherein said position detecting apparatus further
comprises a guide shaft for guiding the move of said mobile
15 element,

wherein said conductive electrode is disposed on the
surface of said guide shaft, and

said detecting electrode is disposed so as to contact
electrically with said conductive electrode from the
20 direction crossing with the moving direction of the detecting
electrode.

20. The disk apparatus of claim 17,
wherein said position detecting apparatus further
25 comprises:

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a guide shaft for guiding the move of said mobile element,
and

a drive shaft for moving said mobile element,

wherein said conductive electrode is disposed on the
5 surface of said guide shaft.

21. The disk apparatus of claim 17,

wherein said position detecting apparatus further
comprises:

10 a guide shaft for guiding the move of said mobile element,
wherein said conductive electrode is disposed on a first
surface of the surfaces of said guide shaft,

said mobile element has a through-hole,

said guide shaft is penetrating into said through-hole,

15 said conductive electrode is movable in said through-hole,
and

said detecting electrode is disposed on said mobile
element so as to may contact with said conductive electrode
positioned in a center of said through-hole.

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22. The disk apparatus of claim 17,

wherein said position detecting apparatus further
comprises:

a guide shaft for guiding the move of said mobile element,

25 and

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a drive shaft for moving said mobile element,
wherein said conductive electrode is disposed on the
surface of said drive shaft.

5 23. The disk apparatus of claim 17,
 wherein said position detecting apparatus further
 comprises:

 a guide shaft for moving said mobile element,
 wherein said conductive electrode is disposed on the
10 surface of said drive shaft,

 said detecting electrode is disposed between said mobile
 element and said drive shaft, and

 said detecting electrode may contact with the surface of
 said drive shaft and said conductive electrode.

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 24. The disk apparatus of claim 17,
 wherein said position detecting apparatus further
 comprises:

 a drive shaft for moving said mobile element, and
20 an elastic member disposed between said mobile element
 and drive shaft,

 wherein said conductive electrode is disposed on the
 surface of said drive shaft,

 said detecting electrode is disposed between said elastic
25 member and said drive shaft, and

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said detecting electrode may contact with the surface of said drive shaft and said conductive electrode while being pressed by the pressing force of said elastic member.

5 25. A moving position detecting apparatus of mobile element, comprising:

a mobile element moving reversibly along a predetermined running path,

an electrode holder disposed along said running path,

10 a conductive electrode disposed partially at a specified position of the surface of said electrode holder,

a detecting electrode disposed on said mobile element, said detecting electrode may contacting with said conductive electrode from a direction crossing with the moving direction
15 of said mobile element, and

detecting means for detecting presence and absence of electric connection between said conductive electrode and said detecting electrode when said mobile element is positioned at a predetermined moving position on said running
20 path.

26. The moving position detecting apparatus of mobile element of claim 25,

wherein said electrode holder includes a mobile element
25 guide shaft disposed along said running path so that said

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mobile element may slide and move, and

said conductive electrode is disposed on the surface of
said mobile element guide shaft.

5 27. The moving position detecting apparatus of mobile
element of claim 25,

wherein said detecting electrode has a plurality of
detecting electrodes,

said plurality of detecting electrodes are disposed on
10 said mobile element, and

said detecting means detects contact of each detecting
electrode of said plurality of detecting electrodes with said
conductive electrode.

15 28. The moving position detecting apparatus of mobile
element of claim 25,

wherein said mobile element has a through-hole,

said mobile element guide shaft is disposed by
penetrating through said through-hole, and

20 each one of said plurality of detecting electrodes may
contact with the surface of said mobile element guide shaft
in said through-hole.

25 29. The moving position detecting apparatus of mobile
element of claim 25,

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wherein said electrode holder is disposed parallel along said running path.

30. The moving position detecting apparatus of mobile
5 element of claim 25,

wherein said electrode holder is disposed parallel along said running path,

said electrode holder further has a drive shaft for transmitting rotary motion from the motor, and

10 said conductive electrode is disposed on the surface of said drive shaft.

31. The moving position detecting apparatus of mobile element of claim 30,

15 wherein said mobile element includes a motion converting device for converting the rotary motion from said drive shaft into a motion for moving said mobile element reversibly along said running path,

said detecting electrode has a plurality of detecting
20 electrodes,

said plurality of detecting electrodes are disposed between said drive shaft and said mobile element,

said plurality of detecting electrodes are disposed in said motion converting device, and

25 said detecting means detects when said detecting

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electrode contacts with said conductive electrode.

32. The moving position detecting apparatus of mobile element of claim 31, further comprising:

5 a spring disposed between said drive shaft and mobile element,

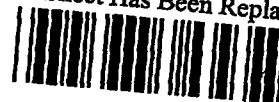
wherein said motion converting device is pressed to said drive shaft and mobile element by a spring force, and

said plurality of detecting electrodes are disposed in
10 said motion converting device so as to contact with the surface of said electrode holder



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