

SPECIFICATION

TITLE OF THE INVENTION

Optical pickup

BACKGROUND OF THE INVENTION

The present invention relates to an optical pickup used in a recording/reproducing apparatus using an optical disk.

In recent years, for miniaturization and cost reduction of optical disk apparatus, integration of the optical parts of the optical pickups has developed, and hologram laser units combining semiconductor lasers, receiving elements and optical elements have become popular.

In the following, an optical pickup of a prior art is explained referring to the drawings. Referring to Fig. 4, a conventional optical pickup comprises a hologram laser unit 21, a diffraction grating 22 attached thereto, mirror 23, objective lens 24, and disk 25. The laser unit 21 is packaged in a hexahedron having a pair of two opposing relatively large flat main surfaces, and a laser light is emitted from one of the large flat surfaces to pass into the grating 22 where it is diffracted. The package has, further, two pairs of opposing small side surfaces. The surfaces of one of the two pairs are flat while other two surfaces 28a and 28b are partially cylindrical. The flat side surfaces are arranged generally parallel with the disk. A light beam B with its two subbeams is reflected by the mirror 23, which is inclined 45° to the disk 25 to be projected

perpendicularly to the disk and focussed on the incidence point 27 on the disk by the objective lens 24.

The incidence point 27 of the beam runs along a track 26 on the disk 25 as it rotates, while subbeams project on the disk surface at incidence points 27a and 27b.

Referring to Fig. 5, a plan view of the apparatus shown in Fig. 4, the axis A of the light beam which proceeds from the hologram laser unit 21 to the mirror 23 becomes the tangent 29 at the incident point. Usually, in order to make the tracking sensitivity maximum the hologram laser unit is rotated and adjusted around the light beam axis A so as to have the θ between the tangent 29 and the line 27c which connects the subbeams 27a and 27b to be

$$\theta = \arcsin(P/2L)$$

where P is the track pitch and L is the subbeam pitch.

However, the hologram laser unit 21 with the diffraction grating 22 having its diffraction direction 30 parallel with the short side 31 of the laser unit package as shown in Fig. 6 must be rotated, as shown in Fig. 7, by angle α from a plane parallel with the disk to obtain the angle θ , resulting in a shortcoming of increase of the thickness of the optical pickup 33 by H corresponding to the projection of the unit 21 from the base 32.

Against the shortcoming, a method was proposed to incline previously the diffraction grating 22 from the package by an angle as shown in Fig. 8. However, variation of the value of L or

θ depending upon the specification of the objective lenses made the application of the idea difficult.

It is an object of the present invention to solve the above difficulties of the prior art and to provide a thin optical pickup.

SUMMARY OF THE INVENTION

To attain the above object, an optical pickup according to the present invention comprises: a hologram laser unit in a package of hexahedron having a pair of main surfaces and two pairs of side surfaces, the two side surfaces of one of the pairs being partially cylindrical; a diffraction grating attached to one of the main surfaces and having its direction of diffraction parallel with said two side surfaces which is partially cylindrical; a base supporting the hologram laser unit rotatably around the optical axis; a mirror fixed on the base and reflecting the light beam from the laser unit into the direction perpendicular to the disk surface, and an objective lens placed between the mirror and disk surface; wherein the hologram and the mirror are so fixed on the base that the angle between the projection of the light beam axis on the disk surface and the tangent to the track at the incident point of the axis of the main beam may have a prescribed value.

Further, the pickup has its hologram unit and the mirror so fixed on the base that the angle θ between the projection of the light beam axis on the disk surface and the tangent to the track

at the incident point of the axis may be;

$$\theta = \arcsin(P/2L)$$

where, P is the pitch of the track and L is the subbeam pitch.

The optical pickup of the present invention comprising a hologram laser unit with the light beam axis arranged parallel with the disk surface to make it possible to incline the straight line passing through the incidence points of the two subbeams from the track on the disk by a prescribed angle by the adjustment within a small range, to realize a thin optical pickup.

BRIEF DESCRIPTION OF THE DRAWINGS

Fig.1 shows a perspective view of the optical system of an optical pickup according to the present invention.

Fig.2 shows a plan view of the same optical system.

Fig.3 shows a side view of the same optical system.

Fig.4 shows a perspective view of the optical system of an optical pickup of prior art.

Fig.5 shows a plan view of the same optical system.

Fig.6 shows a front view of a hologram laser unit of a conventional technology.

Fig.7 shows a side view of an optical pickup of a prior art.

Fig.8 shows a front view of a hologram laser unit of a prior art.

DETAILED DESCRIPTION OF THE INVENTION

Referring to Figures 1, 2 and 3, an optical pickup 13 embodying the present invention comprises a hologram laser unit 1

having a lightemitting element and light receiving element therein and a diffraction grating 2 for generating a subbeam for the detection of the trucking.

The pickup further comprises a mirror 3 to reflect the light beam B with the axis 10 from the hologram laser unit 1 in the vertical direction, and an objective lens 4 to converge the light beam B. The converged light beam B strikes a disk 5 to form a truck 6 thereon, consisting of a main beam and two subbeams, the main beam 7 focuses on the disk 5 at point 7 and the two side beams pass the disk 5 at points 7a and 7b, to define a straight line 7c. The truck 6 has a tangent 11 at the point 7. The package of the hologram laser unit 1 is a hexahedron with a pair of two main surfaces and two pairs of side surfaces. The light is emitted from one of the main surfaces into the adjacent diffraction grating 2. The surfaces of one of the two pairs are flat, while the surfaces 9a and 9b parallel with the direction of diffraction of the grating are partially cylindrical to be used as adjusting guides when the optical pickup 13 is fixed on a base 12.

The axis 10 of the light beam of the hologram laser unit 1 going to the mirror 3 is parallel with the surface of the disk 5, and, as shown in Fig.2 viewed from the upper side, the angle θ formed by the projection 10a of the axis 10 and the tangent 11 of the truck 6 is;

$$\theta = \arcsin(P/2L)$$

where P is the truck pitch and L is subbeam pitch of subbeams 7a and 7b.

In the optical pickup constructed as above described, the light radiated by the hologram laser unit 1 parallel with the surface of the disk 5 is diffracted by the diffraction grating 2, reflected by the mirror 3 to the disk 5 and is converged by the objective lens 4 to focus on the disk surface; and the straight line 7c passing through the incidence points 7a and 7b of the subbeams and showing the direction of diffraction coincides with the projection 10a of the axis 10 of the light beam from the laser unit 1 to the mirror 3 on the disk surface, that is, the line 7c has angle θ against the tangent 11 to make the trucking detection sensibility maximum.

Thus, according to the present invention, the hologram laser unit 1 can be held parallel with the surface of the disk 5 with no projection from the base 12, although some small rotation the package of the laser unit 1 along the arcs 9a and 9b to adjust against the variation of the parts.

What is claimed is;

1. An optical pickup comprising:

a hologram laser unit in a package of hexahedron having a pair of main surfaces and two pairs of side surfaces, the two side surfaces of one of the pairs being partially cylindrical;

a diffraction grating attached to one of the main surfaces and having its direction of diffraction parallel with said two side surfaces which is partially cylindrical;

a base supporting said hologram laser unit rotatably around its optical axis;

a mirror fixed on said base and reflecting the light beam emitted from said hologram laser unit in the direction perpendicular to the disk; and

an objective lens placed between said mirror and the disk;

wherein said hologram laser unit and said mirror are so fixed on said base that the angle θ between the projection of the axis of the light beam which proceeds from said hologram laser unit to said mirror on the disk surface and the tangent to the track at the incident point of the axis of the main beam may have a prescribed value.

2. An optical laser unit according to Claim 1, wherein the angle θ is;

$$\theta = \arcsin(P/2L)$$

where, P is the track pitch and L is the subbeam pitch.

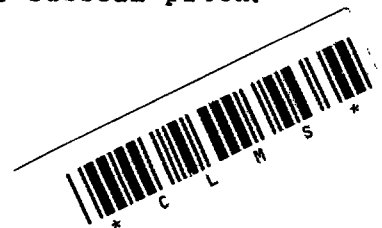


Fig. 1

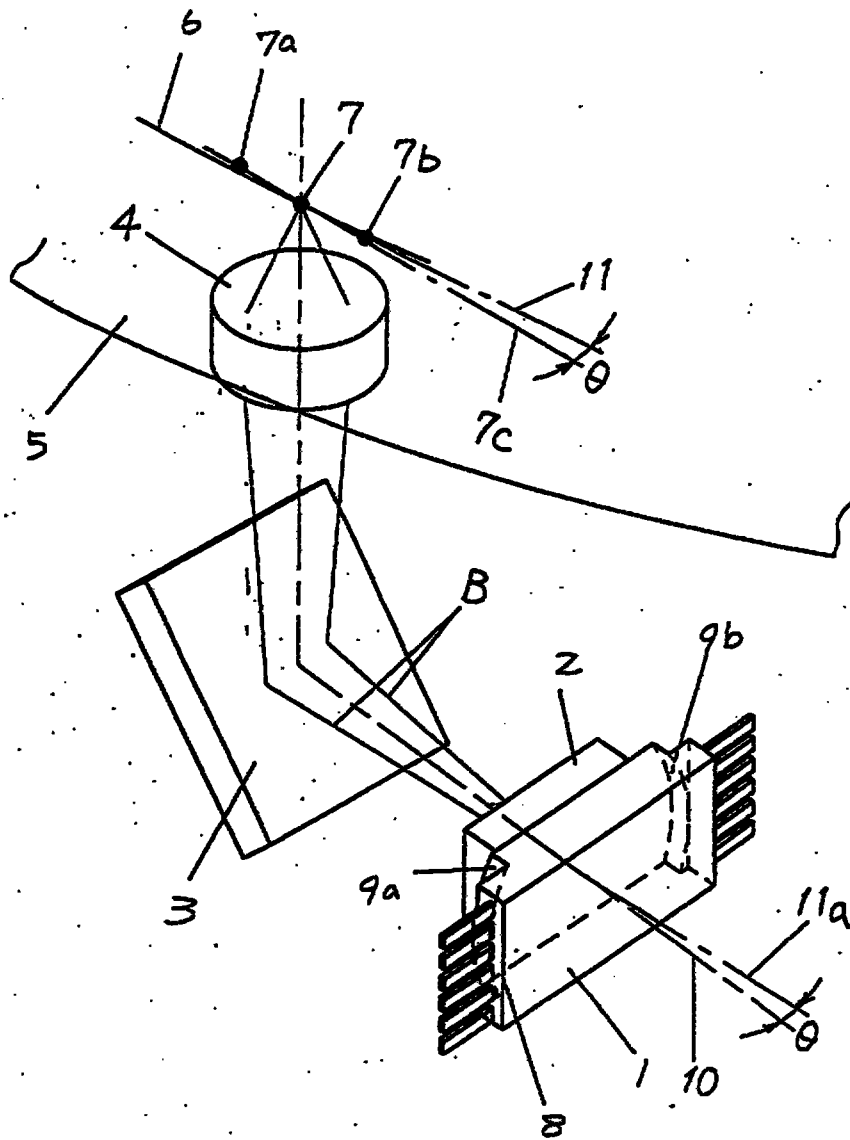


Fig. 2

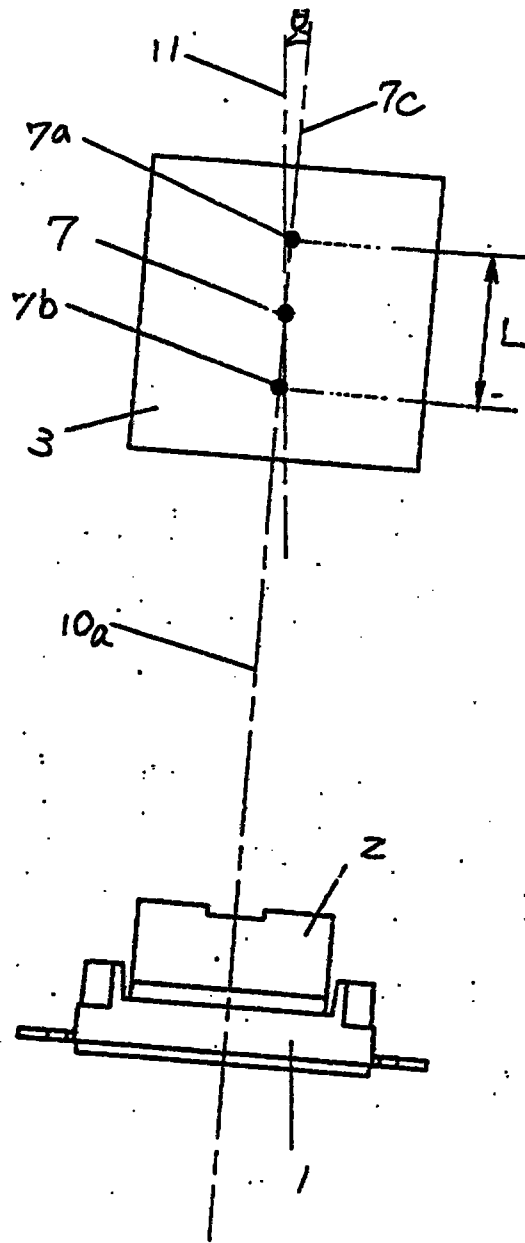


Fig. 3

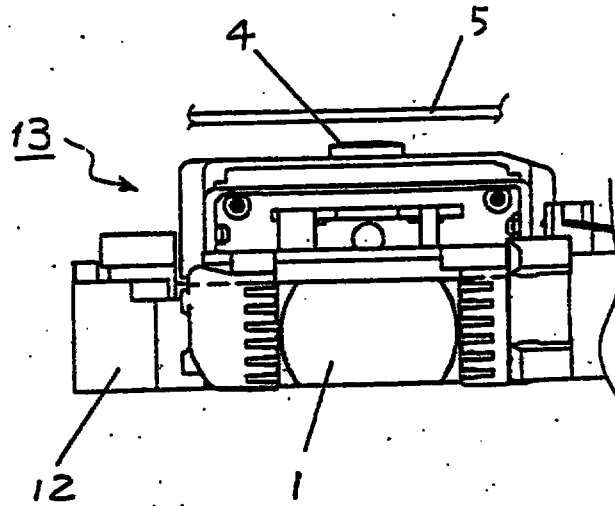


Fig.4

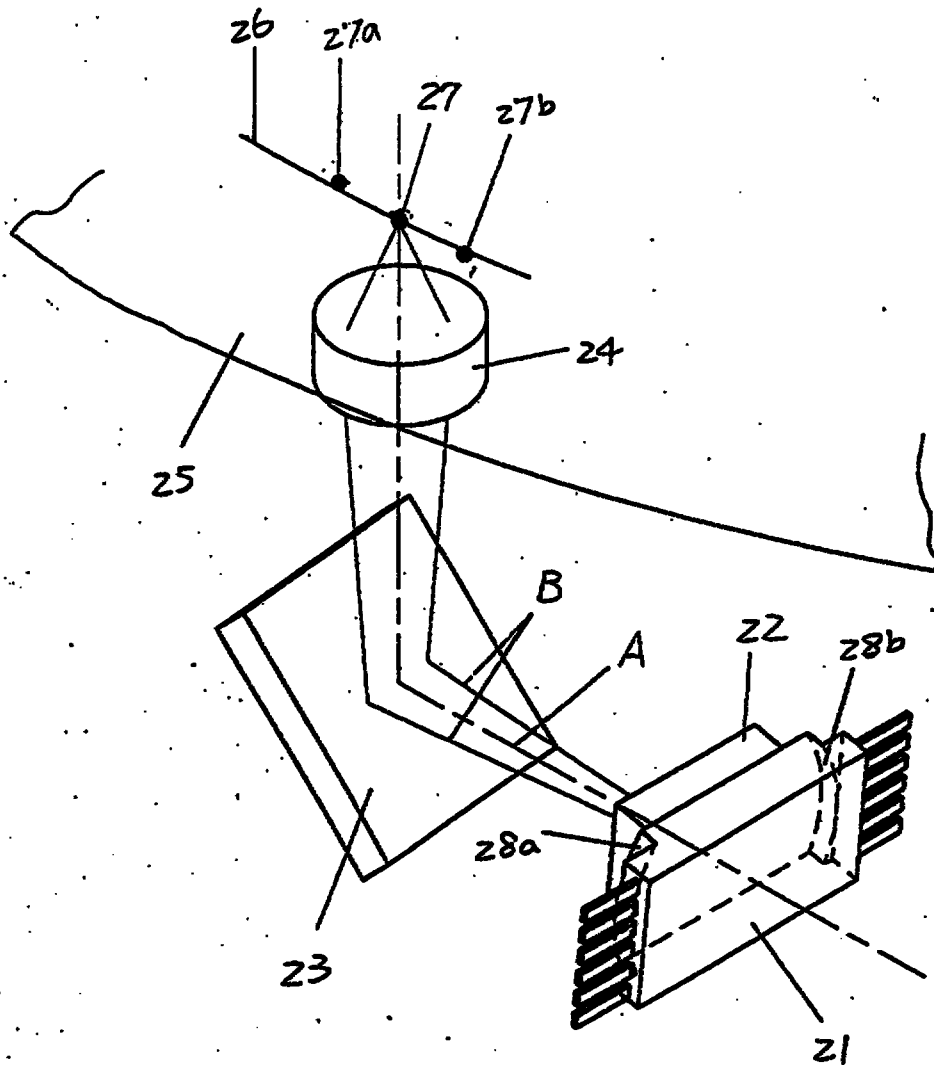


Fig. 5

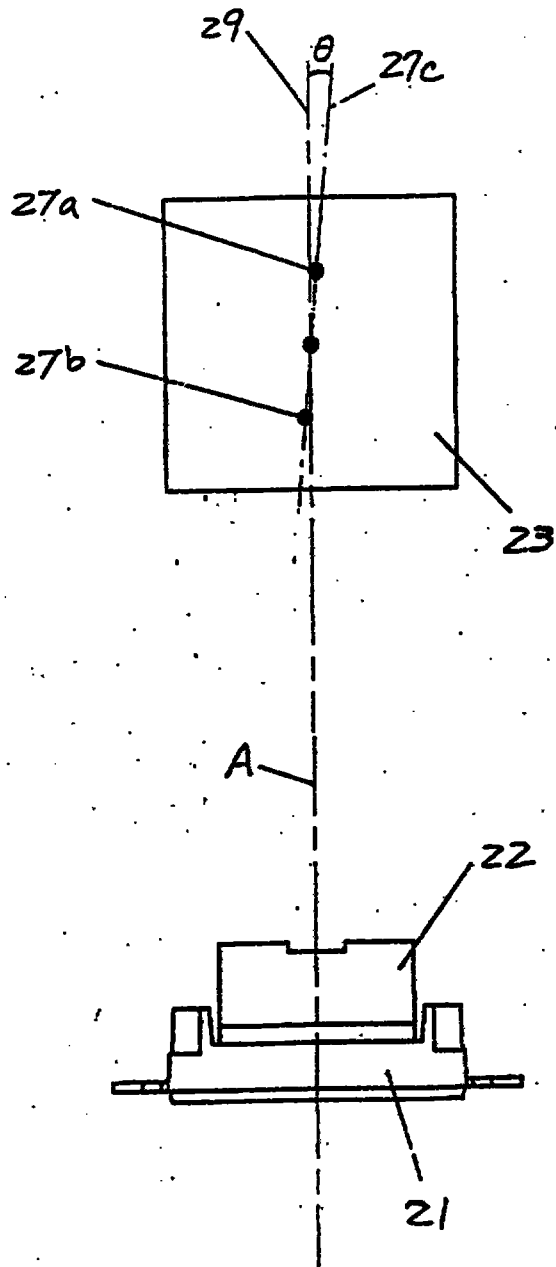


Fig. 6

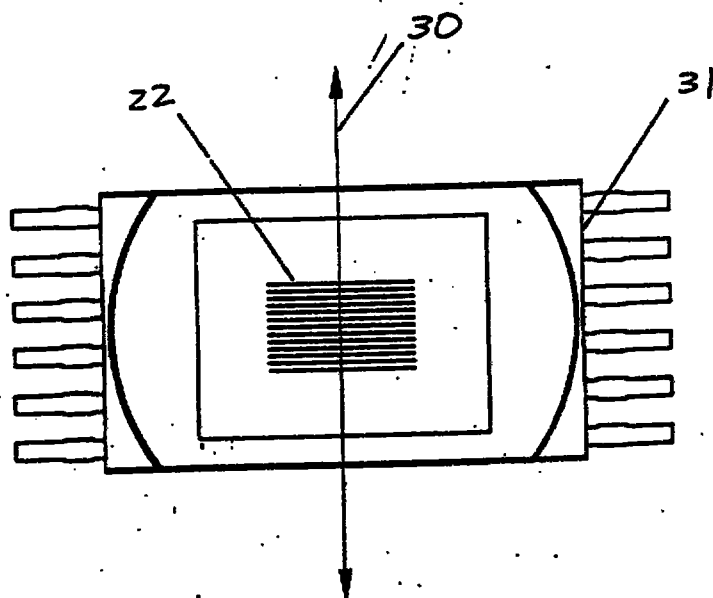


Fig. 7

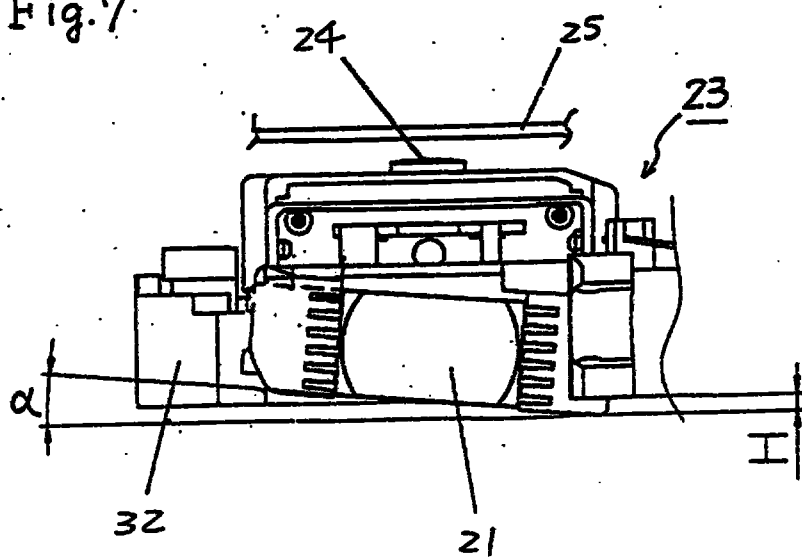
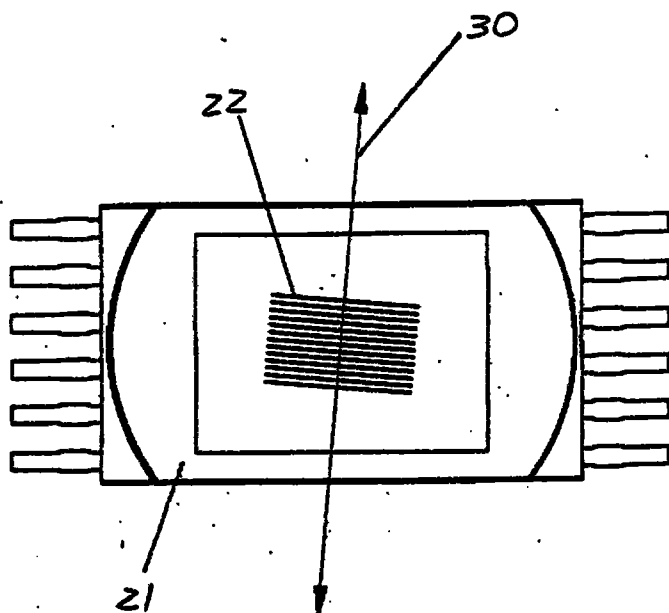


Fig. 8



ABSTRACT OF THE DISCLOSURE

TITLE OF INVENTION: OPTICAL PICKUP

To provide an optical pickup of thin form, an optical pickup comprises: a hologram laser unit in a package of hexahedron having a pair of main surfaces and two pairs of side surfaces, the two side surfaces of one of the pairs being partially cylindrical; a diffraction grating attached to one of the main surfaces and having its direction of diffraction parallel with said two side surfaces which is partially cylindrical; a base to support the unit 1 rotatable around the axis 10 of the light beam from the unit; a mirror 3 to reflect the beam to the disk 5; and an objective lens 4 placed between the mirror 3 and the disk 5 to focus the beam on the surface of the disk, wherein the projection 10a of the axis 10 of the beam onto the disk surface and the tangent 11 of the track 6 on the disk at the incidence point of the axis.

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