Description

The invention relates to an optical scanning unit for scanning recording tracks of a reflecting optical record carrier, said unit comprising: a tubular part having a first and a second end and a lateral opening formed therein, a radiation source arranged near said first end for emitting an unmodulated primary radiation beam towards said second end along a beam axis, a lens system having an optical axis and arranged near said second end for concentrating said radiation beam into a radiation spot so that when the tracks are scanned by said spot, the radiation is modulated by the recording tracks and the modulated radiation is reflected back through said lens system and along said optical axis, a double prism arranged in said tubular part adjacent said lateral opening, said double prism having a first and second prism attached to each other and a splitting surface disposed at an angle of 45° to said optical axis for deflecting the reflected radiation beam in a lateral direction through said lateral opening in said tubular part, a radiation-sensitive means arranged externally of said tubular part in the path of the reflected radiation beam for converting the modulated, reflected radiation into a corresponding electrical signal, and means for supporting said double prism and said radiation source in said tubular part.

Such a scanning unit, intended for a socalled optical audio disk player, is described in the article "PCM-Schallplatte für achtziger Jahre", Radio Mentor, Jahrgang 45, (1979), No. 4, pages 138 and 139. The radiation source comprises a semiconductor laser arranged on the optical axis of the lens system, so that the beam axis of the primary, unmodulated radiation beam coincides with the optical axis of the lens system, so that the beam axis of the primary, unmodulated radiation beam coincides with the optical axis of the lens system. The reflected radiation beam, which has been modulated by the information contained in the information tracks of the optical audio disk, is partly reflected to an electronic output device of the radiation sensitive means by the splitting surface of the double prism *via* the lateral opening in the tubular part of the housing, which means convert the radiation beam modulation into an electrical signal which is applied to suitable electronic circuitry.

The location and orientation of the double prism in the optical scanning unit are critical. The unmodulated primary radiation beam should be concentrated correctly to form an optimally round read spot with an optimally uniform radiation-intensity distribution on the recording surface on the audio disk. For the incident primary beam the behaviour of the double prism should therefore approximate as closely as possible that of a plane-parallel optical body, that is, one which causes minimal distortion of the primary radiation beam. Correct imaging of the tracks on the electronic output device is possible when the optical pathlength for the primary radiation beam is accurately equal to the optical path-length for the reflected, secondary radiation beam. This means that the double prism and the electronic output device should be positioned accurately relative to each other and that the distance covered by the primary radiation beam from the point where it enters the double prism until it reaches said splitting surface should be exactly equal to the distance traversed by the reflected radiation beam from the point where it is incident on the splitting surface until its reaches the location where it emerges from the double prism. Moreover, the distance from the semiconductor diode laser to the splitting surface of the double-prism should be equal, within narrow tolerances, to the distance from the radiation-sensitive means of the electronic output device to the splitting surface. In view of the use of the known optical scanning unit, namely its use in an optical audio disk player suitable for mass-production and for large-scale domestic use, it is necessary that the optical scanning unit can be manufactured at a low cost price. Moreover, it should permit fast and efficient maintenance and replacement routines.

It is an object of the invention to provide an optical scanning unit of the type mentioned in the opening paragraph, which is simple construction, which comprises fewer parts and which can be manufactured with the required precision at comparatively low cost, so that the scanning unit is eminently suitable for use in consumer equipment. The invention is characterized in that said supporting means includes a metal support on which said double prism and said radiation source are mounted so that the beam axis is aligned with said optical axis and said source is spaced axially by a predetermined distance from a point (Q) on said splitting surface at which said beam axis intersects said splitting surface, said support being rotatable and axially movable relative to said tubular part so as to enable the position of said splitting surface to be adjusted during assembly such that said reflected radiation beam is converged by said lens system into a desired spot on said radiation-sensitive means, said support being fixed relative to said tubular part at the position at which said reflected radiation beam is converged into said desired spot.

The metal support of the prism of the optical scanning unit in accordance with the invention has several functions. Firstly, the support functions as a so called "heat-sink" for the diode laser, that is, it forms a part having a high thermal conductivity which is capable of carrying off heat developed by the semiconductor laser rapidly and with a small temperature gradient. Secondly, the support functions as a stable and robust mount to which the beam splitter prism can be firmly secured. The support can be manufactured with the required accuracy using the customary machining operations, alignment and mounting of the splitter prism on the support being effected with a suitable alignment tool which aligns and positions the splitter prism with the required

accuracy relative to the support. Thirdly, the support forms a component which during assembly of the optical scanning unit can be manipulated in order to adjust the prism arrangement relative to the tubular part of the housing in such a way that the reflected portion of the secondary radiation beam is accurately incident on the radiation-sensitive means at the desired location. For this purpose the output device is initially mounted on the exterior of the tubular part and then the support is axially shifted and rotated relative to the tubular part of the housing until the correct position of the support is indicated by measuring equipment. In this position, the support is subsequently fixed relative to the tubular housing. In essence, the problems of correctly aligning and positioning the optical radiation-sensitive parts of the optical scanning unit in accordance with the invention are thus reduced to the accurate manufacture of a metal support, mounting of the double prism in the correct position and orientation by means of suitable alignment tools, mounting of the support and empirically determining the correct position of the support relative to the tubular part of the housing in the correct position thus found.

It is noted that GB—A—2.064.848, discloses the mounting of a double prism in a support, which can be set within a tubular part of an optical scanning unit, can be adjusted by rotation and axial movement relative to said tubular part and fixed to said tubular part. As this support mounts only the prism and not other elements as the radiation source, separate adjustment and fixing of the support and the radiation source is necessary.

An embodiment of the invention which eases the mounting of the double prism on the support is characterized in that: at a free end facing the radiation source the support is bevelled at an angle of 45° relative to the beam axis of the radiation source; the bevelled portion of the support is formed with a slot parallel to a plane which is defined by the beam axis and a normal to the bevelled portion which intersects the beam axis, so that on each side of the slot a bevelled surface is formed; the first prism of the double prism extends across the slot and is attached to the two bevelled surfaces; and the second prism engages in the slot and is attached to the first prism. This embodiment has some substantial advantages. Forming a surface on the support which encloses an angle of 45° with the axis of the support is possible in a comparatively simple manner within the required tolerances by machining operations. This surface is used as a reference surface when mounting the double prism. Each of the prisms can then be adjusted to the desired position independently of the other prism using an alignment tool. Only the first prism is attached to the support. The second prism is attached to the first prism, but not to the support. This fixing method has the additional advantage that the reflecting surface of the double prism is not subject to stresses occurring during operation, mainly thermal stresses which may occur as a result of the support being heated by the semiconductor diode laser.

In a further embodiment of the invention the support has an additional function. This embodiment is characterized in that the tubular part is provided with an internal locating cam which engages said slot with clearance in order to obtain coarse rotational adjustment of the support relative to the tubular part. The advantage of this embodiment mainly resides in the fact that before the support is adjusted relative to the housing it can be fitted in a substantially correct position, which may provide a substantial gain of time during the previously described adjustment of the support relative to the housing.

For securing the two prisms to the support it is advantageous to use an embodiment which is characterized in that the first prism is attached both to the two bevelled surfaces of the support and to the second prism by means of a layer of a transparent cement which is applied over the entire width of the first prism. Only one of the two prisms needs to be provided with a layer of cement, which may greatly reduce problems presented by the use of a cement in mass production. Suitable types of cement for use in accordance with the invention are for example the known ultraviolet-curing cements, which are commercially available for bonding optical components to each other. These types of cement are clear and cure very rapidly when exposed to ultraviolet light.

In the optical scanning unit described in the aforementioned article the reflected secondary radiation beam is split into two sub-beams be a beam-splitting optical element, which sub-beams each co-operate with two radiation-sensitive diodes of the output device. This beam-splitting optical element is arranged on that side face of the double prism where the reflected secondary radiation beam leaves the double prism. An embodiment of the invention in which a beam-splitting optical element is arranged at the said location is characterized in that said optical element entirely consists of a cured transparent cement. This embodiment of the invention has some substantial advantages. In comparison with said known optical scanning unit, in which the beam-splitting element is integral with the first prism of the double prism, a first prism of simpler shape may be used. A separately manufactured beam-splitting optical element would have very small dimensions and would be very fragile. Manufacture, handling and aligning with the required accuracy relative to the first prism would present great problems. All these problems are precluded by the use of this embodiment of the invention. The optical element is formed by applying a drop of cement on the side face of the prism arrangement, then pressing a die of suitable shape into the drop of cement in the correct position relative to the support and finally allowing the cement to cure. Again, it is advantageous to utilize a cement which cures under the influence of ultraviolet light. Apart from the pre-

viously mentioned advantages, this embodiment has another major advantage. Owing to the accurate alignment and positioning of the die, which can be achieved by means of an adjustment tool, the correct orientation and correct position of the refractive edge of the beam-splitting optical element relative to the central axis of the prism support and thus the optical axis are always accurately defined, regardless of the orientation of the side face of the first prism on which the beam-splitting element is formed. This is because the space between said side face and the die is entirely filled with the transparent cement.

An embodiment of an optical scanning unit in accordance with the invention will now be described in more detail, by way of example, with reference to the drawings, in which:

Figure 1 is a longitudinal section, about three times actual size, of a scanning unit and a part of an optical disk,

Figure 2 is a plan view, approximately twice actual size, of the optical scanning unit of Figure 1,

Figure 3 is an exploded view of the prism arrangement and some other parts of the optical scanning unit at substantially the same scale as Figure 1,

Figure 4 is a perspective view, a greatly enlarged scale, of the first prism provided with a beam-splitting optical element, and

Figure 5 is a plan view of the prism of Figure 4 during manufacture of the beam-splitting optical element.

The optical scanning unit shown in Figure 1 comprises a tubular part 1 having a first end 2 and a second end 3 and it is formed with a lateral opening 4. A radiation source 5 in the form of a commercially available semiconductor laser device 6 is arranged near the first end 2. Said device comprises a metal enclosure 7, a glass window 8, a brass support 9, a plurality of connecting pins 10, a light-sensitive diode 11 for intensity control, and a feed-through insulator 12. The laser 3 projects an unmodulated primary radiation beam 13 along a beam axis 14, which coincides with the axis of the tubular part 1. Near the second end 3 of the tubular part there is arranged a lens system which comprises two lenses 15 and 16 and a plurality of lenses, not shown, of an objective 17. The lenses 15 and 16 are mounted in a lens mount 18, which is pressed into the tubular part 1. Together they convert the divergent radiation beam from the laser 5 into a parallel beam. The objective 17 concentrates the radiation beam to form a radiation spot 19 on the information surface 20 of an optical disk 21. The information layer 20 is covered with a transparent coating 22 through which the radiation beam 13 is focused. In order to enable possible deviations in the position of the information layer 20 to be followed with the radiation spot 19, the objective 17 is movable to a limited extent in the direction of the optical axis which coincides with the beam axis 14. For this purpose the objective 17 is movably suspended in an objective unit 25 by means of two parallel leaf springs 23 and 24, the objective unit being slidable on the tubular part 1 by means of a cylindrical sleeve 26. A tubular permanently magnetic body 27 is arranged around and attached to the movable objective 17, which body is axially magnetized and comprises areas of magnetic polarity as indicated in the drawing. Around said magnetic body an annular coil 28 is arranged attached to the stationary part of unit 25, to which coil a control current can be applied for controlling the focusing position of the objective 17.

Between the laser 5 and the lens system a double prism 29 is arranged. Said prism comprises a first prism 29A and a second prism 29B, which are attached to each other with a beam splitting surface 30 at an angle of 45° to the beam axis 14. Said splitting surface serves for deflecting a secondary radiation beam 31, reflected by an optical disk 21 and modulated by the record tracks in the information surface 20, through the lateral opening 4 in the tubular part 1. The secondary radiation beam is concentrated on the radiation-sensitive means 32 belonging to an electronic output device 33 arranged externally of the tubular part. The radiation-sensitive means 32 convert the radiation-beam modulation into an electrical modulation.

A prism arrangement 34 is mounted in the first end 2 of the tubular part. Said arrangement comprises an aluminium support 35 on which both the double prism 29 and the laser device 6 are arranged, radially and axially aligned relative to each other within the required tolerances. The support 35 comprises a portion 36 of slightly greater diameter outside the tubular part 1, in which portion the laser device 6 is mounted. Between the portion 36 of the support and the second end 2 of the tubular part a gap "a" is formed. The prism arrangement 34 is axially movable relative to the tubular part 1, within a specific adjustment range, so that the dimension of the gap "a" depends on the displacement of the prism arrangement relative to the tubular part. The prism arrangement is also rotatable relative to the sleeve, at least to a limited extent. By shifting and rotating the prism arrangement 34 and the tube 1 relative to each other during assembly, it is possible to adjust the point where the reflected radiation beam 31 impinges on the radiation-sensitive means 32. Once the position has been found in which the reflected secondary radiation beam 31 impinges within a specific tolerance zone on the radiation-sensitive means 32 of the output device 33 *via* the lateral opening 4, the prism arrangement is fixed relative to the tubular part. During adjustment a measuring device in a special measuring arrangement can be connected to the radiation-sensitive means 32, to provide a direct reading of the electric signal produced by the reflected secondary radiation beam.

The open end of the support 35 of the prism arrangement 34 which faces the diode laser 5 is bevelled at an angle of 45° relative to the beam

axis 14. The bevelled portion 37 thus obtained is formed with a slot 38 which is parallel to a plane which is defined by the beam axis 14 and a normal to the bevelled portion which intersects the beam axis. On each side of the slot 38 a bevelled surface 37A and 37B respectively is disposed. The first prism 29A of the double prism extends across the slot 38 and is attached to the bevelled surfaces 37A and 37B. The second prism 29B engages in the slot 38 and is attached to the first prism 29A. The first prism 29A is fixed in place with an ultraviolet-curing transparent cement applied as a layer over the entire width of the splitting surface 30A. Said layer is not shown in the Figure. The layer of cement connects the first prism 29A to the two bevelled surfaces 37A and 37B and moreover connects the respective faces 30A and 30B (see Figure 3) of the first prism 29A and the second prism 29B to each other.

The first prism 29A has a side face 39 through which the reflected secondary radiation beam 31 emerges from the double prism *29*. On said side face a beam-splitting optical element 40 is arranged. Said element comprises two faces 41A and 41B (see Figure 4) which intersect each other in a straight line 42. Said line constitutes the refractive edge of the beam-splitting element and should be perfectly parallel to the optical axis 14 of the lens system. The entire optical element 40 is made of a cured transparent cement.

The support 9 of the laser device 6 is made of brass and has an annular portion 43. During manufacture of the laser device care has been taken to arrange the semiconductor laser 5 on the support in such a way that the beam axis 14 accurately coincides with the axis of the annular portion 43 of the support 9. Said annular portion is press-fitted into the prism arrangement to abut with the annular stop 44. This ensures accurate centring of the laser 5 relative to the prism arrangement. A critical dimension of the support 35 of the prism arrangement *34* is the distance between the annular stop 44 and point Q where the beam axis 14 intersects the plane of the bevelled portion 37. The is the only very accurate dimension of the support 35, which has a tolerance of 30 microns. The diameter of the cylindrical portion of the support to be slid into the tubular part 1 should be in conformity with the standard ISO h7 sliding fit. The support 35 is placed on the outer surface of the cylindrical portion of the support in a mounting jig, to abut with stops which accurately define the position. The first prism 29A, as already stated, is provided with a layer of a transparent ultraviolet-curing cement on the side of the beam splitting surface 30A. It is placed onto the bevelled surfaces 37A and 37B and is subsequently loaded in the direction of the arrow P1, P2 and P3 with accurate locating cams. The arrows P3 is represented as a double arrow to indicate that the front face 39 at the location of the arrow P3 bears against a fixed reference cam. Spring-pressure is applied in the direction of the arrows P1 and P2. As a result of this, the first prism 29A is aligned on the surfaces 37A and 37B in precisely the correct position, whilst moreover an accurate alignment is obtained along the line 45 joining the heads of the arrows P1 and P2. The second prism 29B is placed into the slot 38 underneath the first prism 29A and bears on two fixed stops of the adjusting tool at the heads of the double arrows P4 and P5, under the influence of a force exerted by a movable locating cam acting in the direction of the arrow P6. As a result of this, the reflecting surface 30B of the second prism 29B is pressed onto the reflecting surface 30A of the prism 29A. Moreover, an alignment is obtained relative to the axis 46 joining the heads of the arrows P4 and P5. The first prism 29A is attached to the bevelled portion 37 of the support 35 and the second prism 29B is simultaneously attached to the first prism by exposing the two prisms to ultraviolet light in the position just described.

For the formation of the beam-splitting element 40 a drop of a transparent cement which cures under the influence of ultraviolet light is applied to the side face 39 of the first prism 29A. A glass die 52 of the adjusting tool, see Figure 5, is positioned with the required high accuracy and the drop of transparent cement is allowed to cure by exposure to ultraviolet radiation *via* the glass die. After mounting two spacers 47 and 48 near the laser unit 6 the prism arrangement is ready for mounting in the tubular part 1.

A plastics holder 49 for the output device 33 is injection-moulded around the tubular part 1. Opposite the lateral opening 4 the tubular part 1 has a port through which an amount of material of the holder 49 can enter the tubular part. Said material is moulded to form a locating cam 50, which engages the slot 38 of the prism unit with clearance for coarse adjustment of the prism arrangement in the direction of rotation.

After manufacture of the prism arrangement it is inserted into the tubular part in such a way that the cam 50 engages the slot 38. The output device 33 is then connected to the electrical measuring equipment and the prism arrangement *34*, in a measuring set-up, is manually adjusted within the adjustment range in the axial direction and in the direction of rotation until the reflected secondary radiation beam impinges on the radiation-sensitive means 32 in the correct manner. Subsequently, at the location of a constricted portion 51 at the second end 2 of the tubular part, the tubular part is connected to the support *34* by laser-welding, so that it is fixed within the adjustment range in a position in which the reflected radiation beam 31 impinges on the radiation-sensitive means within a specified tolerance zone *via* the lateral opening 4.

Claims

1. An optical scanning unit for scanning recording tracks of a reflecting optical record carrier (21), said unit comprising: a tubular part (1) having a first and second end (2, 3) and a lateral opening (4) formed therein, a radiation source (5) arranged near said end (2) for emitting an unmodulated

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axis 14. The bevelled portion 37 thus obtained is formed with a slot 38 which is parallel to a plane which is defined by the beam axis 14 and a normal to the bevelled portion which intersects the beam axis. On each side of the slot 38 a bevelled surface 37A and 37B respectively is disposed. The first prism 29A of the double prism extends across the slot 38 and is attached to the bevelled surfaces 37A and 37B. The second prism 29B engages in the slot 38 and is attached to the first prism 29A. The first prism 29A is fixed in place with an ultraviolet-curing transparent cement applied as a layer over the entire width of the splitting surface 30A. Said layer is not shown in the Figure. The layer of cement connects the first prism 29A to the two bevelled surfaces 37A and 37B and moreover connects the respective faces 30A and 30B (see Figure 3) of the first prism 29A and the second prism 29B to each other.

The first prism 29A has a side face 39 through which the reflected secondary radiation beam 31 emerges from the double prism 29. On said side face a beam-splitting optical element 40 is arranged. Said element comprises two faces 41A and 41B (see Figure 4) which intersect each other in a straight line 42. Said line constitutes the refractive edge of the beam-splitting element and should be perfectly parallel to the optical axis 14 of the lens system. The entire optical element 40 is made of a cured transparent cement.

The support 9 of the laser device 6 is made of brass and has an annular portion 43. During manufacture of the laser device care has been taken to arrange the semiconductor laser 5 on the support in such a way that the beam axis 14 accurately coincides with the axis of the annular portion 43 of the support 9. Said annular portion is press-fitted into the prism arrangement to abut with the annular stop 44. This ensures accurate centring of the laser 5 relative to the prism arrangement. A critical dimension of the support 35 of the prism arrangement *34* is the distance between the annular stop 44 and point Q where the beam axis 14 intersects the plane of the bevelled portion 37. The is the only very accurate dimension of the support 35, which has a tolerance of 30 microns. The diameter of the cylindrical portion of the support to be slid into the tubular part 1 should be in conformity with the standard ISO h7 sliding fit. The support 35 is placed on the outer surface of the cylindrical portion of the support in a mounting jig, to abut with stops which accurately define the position. The first prism 29A, as already stated, is provided with a layer of a transparent ultraviolet-curing cement on the side of the beam splitting surface 30A. It is placed onto the bevelled surfaces 37A and 37B and is subsequently loaded in the direction of the arrow P1, P2 and P3 with accurate locating cams. The arrows P3 is represented as a double arrow to indicate that the front face 39 at the location of the arrow P3 bears against a fixed reference cam. Spring-pressure is applied in the direction of the arrows P1 and P2. As a result of this, the first prism 29A is aligned on the surfaces 37A and 37B in precisely the correct position, whilst moreover an accurate alignment is obtained along the line 45 joining the heads of the arrows P1 and P2. The second prism 29B is placed into the slot 38 underneath the first prism 29A and bears on two fixed stops of the adjusting tool at the heads of the double arrows P4 and P5, under the influence of a force exerted by a movable locating cam acting in the direction of the arrow P6. As a result of this, the reflecting surface 30B of the second prism 29B is pressed onto the reflecting surface 30A of the prism 29A. Moreover, an alignment is obtained relative to the axis 46 joining the heads of the arrows P4 and P5. The first prism 29A is attached to the bevelled portion 37 of the support 35 and the second prism 29B is simultaneously attached to the first prism by exposing the two prisms to ultraviolet light in the position just described.

For the formation of the beam-splitting element 40 a drop of a transparent cement which cures under the influence of ultraviolet light is applied to the side face 39 of the first prism 29A. A glass die 52 of the adjusting tool, see Figure 5, is positioned with the required high accuracy and the drop of transparent cement is allowed to cure by exposure to ultraviolet radiation *via* the glass die. After mounting two spacers 47 and 48 near the laser unit 6 the prism arrangement is ready for mounting in the tubular part 1.

A plastics holder 49 for the output device 33 is injection-moulded around the tubular part 1. Opposite the lateral opening 4 the tubular part 1 has a port through which an amount of material of the holder 49 can enter the tubular part. Said material is moulded to form a locating cam 50, which engages the slot 38 of the prism unit with clearance for coarse adjustment of the prism arrangement in the direction of rotation.

After manufacture of the prism arrangement it is inserted into the tubular part in such a way that the cam 50 engages the slot 38. The output device 33 is then connected to the electrical measuring equipment and the prism arrangement *34*, in a measuring set-up, is manually adjusted within the adjustment range in the axial direction and in the direction of rotation until the reflected secondary radiation beam impinges on the radiation-sensitive means 32 in the correct manner. Subsequently, at the location of a constricted portion 51 at the second end 2 of the tubular part, the tubular part is connected to the support *34* by laser-welding, so that it is fixed within the adjustment range in a position in which the reflected radiation beam 31 impinges on the radiation-sensitive means within a specified tolerance zone *via* the lateral opening 4.

Claims

1. An optical scanning unit for scanning recording tracks of a reflecting optical record carrier (21), said unit comprising: a tubular part (1) having a first and second end (2, 3) and a lateral opening (4) formed therein, a radiation source (5) arranged near said end (2) for emitting an unmodulated

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primary radiation beam (13) towards said second end (3) along a beam axis (14), a lens system (15, 16, 17) having an optical axis and arranged near said second end (3) for concentrating said radiation beam (13) into a radiation spot (19) so that when the tracks are scanned by said spot (19), the radiation is modulated by the recording tracks and the modulated radiation is reflected back through said lens system (15, 16, 17) and along said optical axis, a double prism (29) arranged in said tubular part (1) adjacent said lateral opening (4), said double prism (29) having a first and second prism (29A, 29B) attached to each other and a splitting surface (30) disposed at an angle of 45° to said optical axis for deflecting the reflected radiation beam (31) in a lateral direction through said lateral opening (4) in said tubular part (1), a radiation-sensitive means (32) arranged externally of said tubular part (1) in the path of the reflected radiation beam (31) for converting the modulated, reflected radiation into a corresponding electrical signal, and means (35) for supporting said double prism (29) and said radiation source (5) in said tubular part (1), characterized in that said supporting means includes a metal support (35) on which said double prism (29) and said radiation source (5) are mounted so that said beam axis (14) is aligned with said optical axis and said source (5) is spaced axially by a predetermined distance from a point (Q) on said splitting surface (30) at which said beam axis (14) intersects said splitting surface (30), said support (35) being rotatable and axially movable relative to said tubular part (1) so as to enable the position of said splitting surface (30) to be adjusted during assembly such that said reflected radiation beam (31) is converged by said lens system (15, 16, 17) into a desired spot on said radiation-sensitive means (32), said support (35) being fixed relative to said tubular part (1) at the position at which said reflected radiation beam (31) is converged into said desired spot.

2. An optical scanning unit as claimed in Claim 1, characterized in that at a free end facing the radiation source (59) the support (35) is bevelled at an angle of 45° relative to the beam axis (14) of the radiation source, the bevelled portion (37) of the support (35) is formed with a slot (38) parallel to a plane which is defined by the beam axis (14) and a normal to the bevelled portion which intersects the beam axis, so that on each side of the slot a bevelled surface (37A, B) is formed, the second prism (29B) engages in the slot (38)° and is attached to the first prism (29A).

3. An optical scanning unit as claimed in Claim 2, characterized in that the tubular part (1) is provided with an internal locating cam (50) that engages said slot (38) with clearance, in order to obtain coarse rotational adjustment of the support (35) relative to the tubular part.

4. An optical scanning unit as claimed in Claim 2 or Claim 3, characterized in that the first prism (29A) is attached both to the two bevelled surfaces (37A, B) of the support (35) and to the second prism (29B) by means of a layer of a transparent cement which is applied over the entire width of the first prism.

5. An optical scanning unit as claimed in any one of the preceding Claims, in which the double prism (29) carries a beam-splitting optical element (40) at that side face (39) where the reflected radiation beam (31) emerges from the double prism, for splitting the reflected radiation beam into two subbeams, characterized in that the said optical element (40) entirely consists of a cured transparent cement.

Patentansprüche

1. Optische Abtasteinheit zum Abtasten von Aufzeichnungsspuren eines reflektierenden optischen Aufzeichnungsträgers (21) wobei die genannte Einheit die folgenden Elemente aufweist: eine hülsenförmigen Teil (1) mit einem ersten und einem zweiten Ende (2, 3) und einer darin gebildeten Seitenöffnung (4), eine in der Nähe des genannten ersten Endes (2) vorgesehene Strahlungsquelle (5) zum Ausstrahlen eines unmodulierten primären Strahlungsbündels (13) in Richtung des genannten zweiten Endes (3) entsprechend einer Bündelachse (14) ein Linsensystem (15, 16, 17) mit einer optischen Achse, das in der Nähe des genannten zweiten Endes (3) vorgesehen ist zum Konzentrieren des Strahlungsbündels (13) zu einem Strahlungsflecken (19), so dass, wenn die Spuren von dem genannten Flecken (19) abgetastet werden, die Strahlung durch die Aufzeichnungsspuren moduliert wird und die modulierte Strahlung durch das genannte Linsensystem (15, 16, 17) und entsprechend der genannten optischen Achse reflektiert wird, ein Doppelprisma (29), das in dem genannten hülsenförmigen Teil (1) in der Nähe der genannten Seitenöffnung (4) vorgesehen ist, wobei das genannte Doppelprisma (29) ein erstes und ein zweites Prisma (29A, 29B) aufweist, die gegeneinander befestigt sind und mit einer Teilungsfläche (30) in einem Winkel von 45° gegenüber der genannten optischen Achse zum Ablenken des reflektierten Strahlungsbündels (31) in seitlicher Richtung durch die genannte Seitenöffnung (4) in dem genannten hülsenförmigen Teil (1), strahlungsempfindliche Mittel (32), die auf der Aussenseite des hülsenförmigen Teils (1) in der Strecke des reflektierten Strahlungsbündels (31) zum Konvergieren der modulierten reflektierten Strahlung zu einem entsprechenden elektrischen Signal vorgesehen sind und Mittel (35) zum Unterstützen des genannten Doppelprismas (29) und der genannten Strahlungsquelle (5) in dem genannten hülsenförmigen Teil (1), dadurch gekennzeichnet, dass die genannten Unterstützungsmittel einen Metallträger (35) aufweisen, auf dem das genannte Doppelprisma (29) und die genannte Strahlungsquelle (5) derart angeordnet sind, dass die genannte Bündelachse (14) zu der genannten optischen Achse fluchtend liegt und die genannte Quelle (5) durch einen vorbestimmten Abstand von einem Punkt (Q) auf der genannten Teilungsfläche (30), wo die genannte Bündelachse (14) die

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genannte Teilungsfläche (30) schneidet, axial entfernt ist, wobei die genannte Träger (35) drehbar und axial beweglich gegenüber dem genannten hülsenförmigen Teil (1) ist um zu ermöglichen, dass die Lage der genannten Teilungsfläche (30) beim Zusammenbauen derart eingestellt werden kann, dass das genannte reflektierte Strahlungsbündel (31) durch das genannte Linsensystem (15, 16, 17) zu einem gewünschten Flecken auf den genannten strahlungsempfindlichen Mitteln (32) konvergiert wird, wobei der genannte Träger (35) gegenüber dem genannten hülsenförmigen Teil (1) an einer Stelle, wo das genannte reflektierte Strahlungsbündel (31) zu dem genannten gewünschten Flecken konvergiert wird, befestigt ist.

2. Optische Abtasteinheit nach Anspruch 1, dadurch gekennzeichnet, dass an einem freien Ende, das der Strahlungsquelle (59) zugewandt ist, der Träger (35) in einem Winkel von 45° gegenüber der Bündelachse (14) der Strahlungsquelle abgeschrägt ist, wobei der abgeschrägte Teil (37) des Trägers (35) mit einem Schlitz (38) parallel zu einer Ebene gebildet ist, die durch die Bündelachse (14) und eine Normale gegenüber dem abgeschrägten Teil, welche die Bündelachse schneidet, definiert ist, so dass auf jeder Seite des Schlitzes eine abgeschrägte Fläche (37A, B) gebildet ist, wobei das zweite Prisma (29B) in den Schlitz (38) passt und an dem ersten Prisma (29A) befestigt ist.

3. Optische Abtasteinheit nach Anspruch 2, dadurch gekennzeichnet, dass der hülsenförmige Teil (1) mit einem inneren Einstellnocken (50) versehen ist, der mit Spielraum in den genannten Schlitz (38) passt um eine grobe Dreheinstellung des Trägers (65) gegenüber dem hülsenförmigen Teil zu erhalten.

4. Optische Abtasteinheit nach Anspruch 2 oder 3, dadurch gekennzeichnet, dass das erste Prisma (29A) an den zwei abgeschrägten Flächen (37A, B) des Trägers (35) sowie an dem zweiten Prisma (29B) mittels einer Schicht eines transparenten Klebemittels befestigt ist, wobei dieses Mittel über die ganze Breite des ersten Prismas angebracht wird.

5. Optische Abtasteinheit nach einem der vorstehenden Ansprüche, wobei das Doppelprisma (29) auf der Seitenfläche (39), wo das relektierte Strahlungsbündel (31) as Doppelprisma verlässt, ein bündelspaltender optischer Körper (40) trägt und zwar zum Spalten des reflektierten Strahlungsbündels in zwei Teilbündel, dadurch gekennzeichnet, dass der genannte optische Körper (40) völlig aus einem gehärteten transparenten Klebemittel besteht.

Revendications

1. Unité de balayage optique pour balayer des pistes d'enregistrement d'un support d'enregistrement optique réfléchissant (21), cette unité comprenant: un élément tubulaire (1) comportant une première et une seconde extrémité (2, 3) et une ouverture latérale (4) qui y est ménagée, une source de rayonnement (5) disposée près de la première extrémité (2) pour émettre un faisceau de rayons primaire non modulé (13) vers la seconde extrémité (3) suivant un axe (14) du faisceau, un système de lentilles (15, 16, 17) présentant un axe optique et disposé près de la seconde extrémité (3) pour concentrer le faisceau de rayons (13) en un spot de rayonnement (19) de telle sorte que, lorsque les pistes sont balayées par le spot (19), le rayonnement soit modulé par les pistes d'enregistrement et que le rayonnement modulé soit réfléchi à travers le système de lentilles (15, 16, 17) et le long de l'axe optique, un double prisme (29) disposé dans l'élément tubulaire (1) près de l'ouverture latérale (4), ce double prisme (29) comportant un premier et un second prisme (29A, 29B) fixés l'un à l'autre et une surface de division (30) disposée à 45° par rapport à l'axe optique pour dévier le faisceau de rayons réfléchis (31) dans un sens latéral par l'ouverture latérale (4) de l'élément tubulaire (1), un moyen sensible au rayonnement (32) disposé à l'extérieur de l'élément tubulaire (1) dans le trajet du faisceau de rayons réfléchi (31) pour convertir le rayonnement réfléchi modulé en un signal électrique correspondant, et un moyen (35) pour supporter le double prisme (29) et la source de rayonnement (5) dans l'élément tubulaire (1), caractérisée en ce que le moyen de support comprend un support en métal (35) sur lequel le double prisme (29) et la source de rayonnement (5) sont montés de telle sorte que l'axe (14) du faisceau soit aligné sur l'axe optique et que la source (5) soit espacée axialement d'une distance prédéterminée d'un point (Q) sur la surface de division où l'axe (14) du faisceau coupe la surface de division (30), le support (35) pouvant tourner et se déplacer axialement par rapport à l'élément tubulaire (1) de manière que la position de la surface de division (30) puisse être adjustée pendant l'assemblage pour que le faisceau de rayons réfléchi (31) converge à l'intervention dy système de lentilles (15, 16, 17) en un spot souhaité sur le moyen sensible au rayonnement (32), le support (35) étant fixé par rapport à l'élément tubulaire (1) à l'endroit où le faisceau de rayons réfléchi (31) converge pour former le spot souhaité.

2. Unité de balayage optique suivant la revendication 1, caractérisée en ce qu'au niveau d'une extrémité libre tournée vers la source de rayonnement (59), le support (35) est biseauté à 45° par rapport à l'axe (14) du faisceau de la source de rayons, la partie biseautée (37) du support (35) présente une fente (38) parallèle à un plan qui est défini par l'axe (14) du faisceau et une perpendiculaire à la partie biseautée qui coupe l'axe du faisceau, de sorte que de chaque côté de la fente, une surface biseautée (37A, B) est formée, le second prisme (29) s'engageant dans la fente (38) et étant fixé au premier prisme (29).

3. Unité de balayage optique suivant la revendication 2, caractérisée en ce que l'élément tubulaire (1) est pourvu d'une came de positionnement interne (50) qui s'engage dans la fente (38) avec aisance afin de permettre un ajustement de

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rotation grossier du support (35) par rapport à l'élément tubulaire.

4. Unité de balayage optique suivant la revendication 2 ou 3, caractérisée en ce que le premier prisme (29A) est fixé à la fois aux deux surfaces biseautées (37A, B) du support (35) et au second prisme (29B) au moyen d'une couche d'une colle transparente qui est appliquée sur toute la largeur du premier prisme.

5. Unité de balayage optique suivant l'une quelconque des revendications précédentes, dans laquelle le double prisme (*29*) porte un élément optique diviseur de faisceau (40) au niveau de la face latérale (39) par laquelle le faisceau de rayons réfléchi (31) sort du double prisme, pour diviser le faisceau de rayons réfléchi en deux sous-faisceaux, caractérisé en ce que l'élément optique (40) est fait entièrement d'une colle transparente durcie.

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