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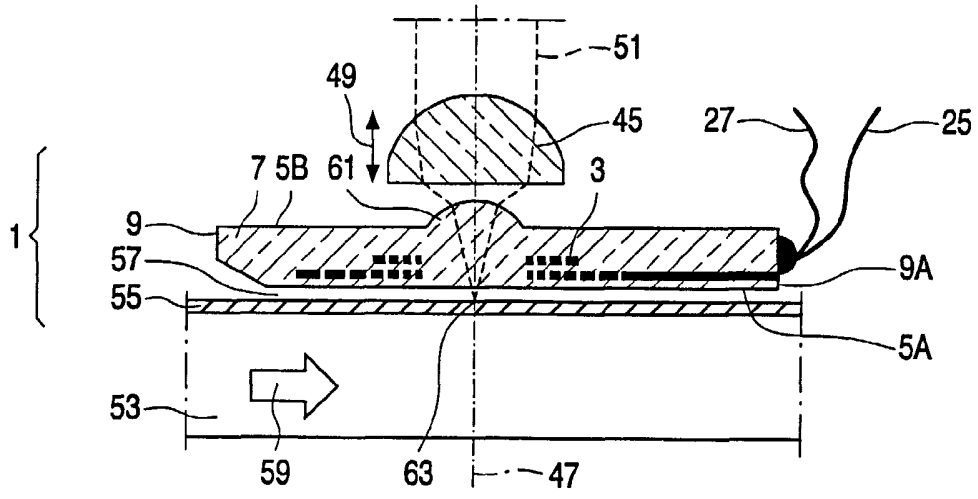
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(54) Title: METHOD OF MANUFACTURING A DIGITAL MAGNETO-OPTICAL SIGNAL WRITE/READ HEAD AND WRITE/READ HEAD MANUFACTURED ACCORDING TO THE METHOD



(57) Abstract: A method of manufacturing a digital magneto-optical signal write/read head (1) including a thin-film in-plane magnetic coil (3) disposed on an outwardly directed surface (5A) of a coil substrate (7). Coil lead in and coil lead out sections (11,15) of the coil (3) are extended to an interconnection part (9A) of the side surface (9) of the coil substrate (7) and first and second spaced interconnecting conductors (21,23) are deposited on the side surface (9) of the coil substrate (7) in electrical connection with the lead in and lead out sections (11,15) of the magnetic coil (3) for contacting the external lead in and lead out lines (25,29). Alternatively first and second contacting conductors (29,31) may additionally be deposited on a top surface (5B) of the coil substrate (7) in electrical connection with the first and second interconnecting conductors (21,23) on the side surface (9A) of the coil substrate (7) for contacting the said external lead in and lead out lines (25,27).

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Method of manufacturing a digital magneto-optical signal write/read head and write/read head manufactured according to the method

The invention relates to a method of manufacturing a magneto-optical write/read head of the type defined in the preamble of independent claims 1 and 2 and to a write/read head of the type defined in the preamble of independent claims 8 and 9.

A method and a write/read head of the above type are known from Reference [1] which is herewith incorporated into the present specification by reference. Further details relating to magneto-optical heads of the kind referred to above may be found in references [2] and [3] which herewith are also both incorporated into the present specification by incorporation and which were not yet published at the priority date of the present application.

The magneto-optical write/read head described in reference [1] comprises a sliding head with integrated focussing lens and magnetic field modulating coil which has been designed and manufactured by the authors of the reference. The sliding head is intended for use with high data rate, first surface magneto-optical recording. A coil is integrated into the air bearing surface of the slider to maintain a head-disk distance of around 1 micron.

A dual layer coil is described made in a thin film process on a glass coil substrate by growing galvanic Cu between photoresist walls. Insulation between the two coil layers is achieved by a thin oxide layer. Because in this embodiment the completed coil faces the rotating disk, the coil is also covered with a few microns of oxide in order to protect it from damage by incidental mechanical contact with the disk.

A problem in the manufacture of write/read heads of this kind or write/read heads as defined in the preambles of independent claims 1 and 2, is the provision of means for contacting the thin film magnetic coil by electrically connecting the coil lead in and lead out sections to external lead in and lead out lines which are needed for connecting the coil to the external electronic circuitry needed for sending signals to and receiving signals from the coil. The coil is located on the outwardly directed surface of the coil substrate while the lead in and the lead out lines need to be connected at the opposite side of the coil substrate to terminals spaced from the coil substrate. The very small air gap present between a thin film in-plane magnetic coil of this kind and a rotating magneto-optical disc is too small (in the order of 1 micron) to accommodate the external lead in and lead out lines.

It is an object of the invention to provide a method of the kind described which overcomes the above indicated problems, is excellently suitable for the manufacture of digital magneto-optical signal write/read heads and does not require cumbersome manufacturing steps such as making deep via holes through the coil substrate and is characterized by the characterizing parts of independent claims 1 and 2 respectively.

Extending the coil lead in and lead out sections of the magnetic coil on the outwardly directed surface of the coil substrate to an interconnection part of the side surface of the coil substrate can easily be effected concurrently with the deposition of the coil itself on the coil substrate. For the deposition of the interconnecting conductors on the side surface of the coil substrate and contacting conductors on the top surface of the coil substrate deposition techniques may be used which are well known in the art of replication techniques and do not require the making of via holes through the substrate. In this way digital magneto-optical signal write/read heads may be produced at low cost which are suitable for use with magneto-optical discs and which demonstrate a very small head-disc distance while the magnetic coil may be brought into contact with the external lead in and lead out lines by suitable contacting means such as bonding, welding or soldering at the lead in and lead out sections respectively provided on the side surface of the coil substrate or with first and second contacting conductors respectively on the top surface of the coil substrate.

Preferred embodiments of the methods according to independent claims 1 and 2 respectively are defined in depending claim 3 and depending claim 4 respectively. These preferred embodiments involve the use of an auxiliary substrate to facilitate the handling of the delicate write/read heads of the invention and to facilitate the deposition of conducting material on the coil substrate in such a way that the interconnecting conductors on the side surface of the coil substrate are deposited such as to be in electrical contact with the coil lead in and lead out sections of the magnetic coil.

According to claim 5 the coil substrate may be detachably arranged on the supporting surface of the auxiliary substrate by adhesive means provided between the outwardly directed surface of the coil substrate and the supporting surface of the auxiliary substrate.

An advantageous embodiment of the latter method according to the invention in which an auxiliary substrate is used is defined in claim 6. This embodiment is important in view of the ease of handling a number of write/read heads simultaneously during the steps of providing a mask over a part of the coil substrate and depositing conducting material on the coil substrate.

A highly interesting embodiment of the invention for use in a method of manufacturing a digital magneto-optical signal write/read head according to the invention provided with first and second contacting conductors on the top surface of the coil substrate is defined in claim 7. In this way an optical lens part of an optical pick-up may be provided on the top surface of the coil substrate between the lead in and lead out conductors of the coil while any light focussed through the lens may pass through the coil substrate unobstructed by the lead in and lead out conductors. This embodiment provides extended freedom of design compared to the write/read head known from reference [1] in that the said optical lens part may be located eccentrically in relation to the central axis of the electromagnetic coil.

Independent claims 8 and 9 and claim 10 relate to digital magneto-optical write/read heads according to the invention, preferably manufactured by the method according to the invention.

The invention will now be described in more detail by way of non-limiting examples with reference to the drawings in which:

FIG. 1 is a schematic cross sectional view of a sliding disc digital magneto-optical signal write/read head according to the invention co-operating with an optical disc;

FIG. 2 is a plan view of the outwardly directed surface of the coil substrate of the write/read head of FIG. 1;

FIG. 3 is an elevational view along the arrow P in FIG. 2 of the interconnecting part of the side surface of the substrate of FIG. 2;

FIG. 4 is a plan view of the top surface of the coil substrate of FIG. 2;

FIG. 5 is a side elevational view along the arrow Q in FIG. 3 of the coil substrate of FIG. 2;

FIG. 6 is an elevational view similar to the elevational view of FIG. 4 but with a different position of a lens part of an optical pick-up;

FIG. 7 is a partial perspective view of an auxiliary substrate strip with a number of coil substrates arranged on a supporting surface during a manufacturing step of the digital magneto-optical signal write/read head according to the invention;

FIG. 8 is a partial perspective view according to FIG. 8 showing the position of a mask provided over the auxiliary substrate and a plurality of coil substrates during a further manufacturing step; and

FIG. 9 is a partial perspective view similar to FIG. 7 and 8 in which the mask has been removed and metal interconnecting conductors and contacting conductors have been deposited on the coil substrates.

The figures in the drawing have been drawn to an arbitrary scale while certain dimensions have been exaggerated for the purposes of illustration. The same reference numbers have been used in the figures to designate the same or similar parts in the different figures.

FIG. 1 schematically shows a digital magneto-optical signal write/read head 1 according to the invention. In the embodiment shown in FIG. 1 the magneto-optical signal write/read head 1 comprises an optical lens part 45 having a central axis 47. The lens part 45 may be moved up and down along the central axis 47, as symbolized by the double pointed arrow 49, by a focussing actuator (not shown in the drawing) used for focussing a laser beam 51 emitted from a suitable laser source. Focussing actuators suitable for this purpose are well-known by the person skilled in the art of optical and magneto-optical recording so that the focussing actuator, not forming part of the invention itself, will not be described in detail.

The magneto-optical signal write/read head 1 further comprises a coil substrate 7, having substantially parallel main surfaces 5A, 5B interconnected by a joining side surface 9. In the embodiment shown in FIG. 1 the coil substrate 7 is a light transparent slider of the kind described in reference [1] in combination with a magneto-optical disc 53 provided with a suitable magneto-optical storage layer 55. The coil substrate 7 is separated from the magneto-optical storage layer 55 by an air gap 57 which is dynamically generated by rotation of the magneto-optical disc 53 in the direction of the arrow 59, such that during operation a head-disc distance in the gap 57 is maintained of the order of 1 micron.

A thin film magnetic coil 3 is deposited on the outwardly directed surface 5A of the coil substrate 7, comprising a continuous electrical conductor pattern with a coil lead in section 11, a coil winding section 13 and a coil lead out section 15 (see also FIG. 2). Information about the method of manufacturing the thin film magnetic coil 3 and the lead in and lead out sections 11 and 15 may be found in reference [2] and will not be described here. The dimensions of the coil 3 are drawn to arbitrary scale. As shown in FIG. 1 the coil may consist of two layers on top of each other. The coil substrate 7 provided with the coil 3 in the embodiment shown in the FIGs. 1 to 5 and also in the embodiment shown in FIG. 6 is made of glass and is transparent to the laser beam 51. On the top surface 5B of the coil substrate 7 a second lens part 61 of the optical signal write/read head has been provided, the central axis of which substantially coincides with the central axis 47 of the lens part 45. The two lens parts 45 and 61 co-operate to focus the laser beam 51 into a focussing spot 63 on the surface of the magneto-optical storage layer 55 of the magneto-optical storage disc 53.

The whole digital magneto-optical signal write/read head 1 is suspended in a suitable unit that is very similar to a rotating or translating optical pick-up unit known from the prior art, provided with suitable suspension means for suspending the floating coil substrate 7 such as known per se for example from magnetic hard disc drive technology. Alternatively the coil substrate 7 could have a configuration different from that of a slider, for example for use with a stationary or slowly moving magneto-optical storage element instead of the magneto-optical storage disc 53. With such an embodiment no air film in the air gap 57 can be maintained and the coil substrate 7 could be actuated to move in the direction symbolized by the double pointed arrow 49 along the central axis 47 by a suitable actuator, for example an electromagnetic actuator of the kind well known from the prior art of electromagnetic actuators for optical and magneto-optical disc drives.

In the embodiment shown in FIG. 1 the laser beam 51 is focussed through a transparent coil substrate 7 through the centre of the coil 3. Alternatively the coil substrate 7 could be opaque and provided with a central opening at the centre of the thin film coil 3 for letting through the laser beam 51.

A description will now be given of the means for contacting the thin film magnetic coil 3 by electrically connecting the coil lead in and lead out sections 11, 15 to external lead in and lead out lines 25, 27 to and from the coil.

The coil lead in and lead out sections 11, 15 of the magnetic coil 3 on the outwardly directed surface 5A have been extended to an interconnection part 9A of the side surface 9 of the coil substrate 7. A pattern of respective first and second interconnecting conductors 21 and 23 has been provided by deposition on the interconnection part 9A of the side surface 9 of the coil substrate 7, in such a way that an electrical connection is provided to the lead in and lead out sections 11, 15 respectively of the magnetic coil 3. In the embodiment of the invention shown in FIGs. 1, 2 and 3, these interconnecting conductors have been used for contacting the external lead in and lead out lines 25, 27 respectively by suitable contacting means such as bonding, welding or soldering. In this way a lead in conductor is formed on the coil substrate 7 comprising the first interconnecting conductor 21 and the lead in section 11 respectively of the magnetic coil 3 and a lead out conductor is formed comprising the second interconnecting conductor 23 and the lead out section 15 respectively of the magnetic coil.

In the embodiment according to FIGs. 4 and 5 an additional pattern of respective spaced first and second contacting conductors 29, 31 is provided on a contacting part 5C of the top surface 5B of the coil substrate 7 in electrical connection with the first and

second interconnecting conductors 23, 24 respectively on the side surface 9 of the coil substrate 7 for contacting the said external lead in and lead out lines 25, 27 respectively by suitable contacting means such as bonding, welding or soldering. In this way a lead in conductor is formed comprising the first contacting conductor 29, the first interconnecting conductor 21 and the lead in section 11 respectively of the magnetic coil and a lead conductor is formed comprising the second contacting conductor 31, the second interconnecting conductor 23 and lead out section 15 respectively of the magnetic coil 3. With the embodiments of FIGs. 4 and 5 the lead in and lead out conductors 25, 27 respectively may be connected from the top instead of from the side as in FIGs. 1, 2 and 3. This may have advantages in certain embodiments.

FIG. 6 is a plan view of a sliding disc digital single write/read head, very similar to the one shown in FIG. 4, comprising a light transparent coil substrate 7. An optical lens part 41 is provided on the top surface 5B of the coil substrate 7 in a position between the lead in and lead out conductors 29, 21, 11 and 31, 23, 15 respectively in a substantially eccentric position relative to the centre of the thin film magnetic coil 3. The lens part 41 has been positioned such and the lead in and lead out conductors 29, 21, 11 and 31, 23, 15 respectively have been provided on the coil substrate 7 such that any light focussed through the lens part 41 passes through the coil substrate unobstructed by the lead in and lead out conductors 29, 21, 11 and 31, 23, 15 respectively.

The method of manufacturing the digital magneto-optical signal write/read head and more particularly the manufacture of the lead in and lead out conductors on the coil substrate thereof will now be described in more detail with reference more particularly to FIGs. 7, 8 and 9 of the drawings.

An auxiliary substrate 33, which in FIGs. 7, 8 and 9 is formed as a strip shaped auxiliary substrate, is provided having a supporting surface 35 and a joining auxiliary side surface 37. After depositing the thin film magnetic coil 3 on the outwardly directed surface 5A of the coil substrate 7 but prior to the steps of depositing the interconnecting conductors 21, 23 on the interconnection part 9A of the side surface of the coil substrate 7, the coil substrate 7 is detachably arranged on the supporting surface 35 of the auxiliary substrate 23, in a position in which the thin film magnetic coil 3 is directed to the supporting surface 35 and the interconnection part 9A of the side surface 9 of the coil substrate 7 is flush with the auxiliary side surface 37 of the auxiliary substrate 33. The coil substrate 7 may for example be detachably arranged on the supporting surface 35 of the auxiliary substrate 33 by a thin

layer of removable adhesive means (not shown) disposed between the outwardly directed surface 5A of the coil substrate 7 and the supporting surface 35 of the auxiliary substrate 33.

Subsequently, see FIG. 8, a mask 39 is provided over a part of the interconnection part 9A of the side surface 9 and the adjoining part of the side surface 37 of the auxiliary substrate 33, such that the areas for disposing the interconnecting conductors 21, 23 remain exposed areas. In the embodiment of the method shown in FIGs. 8 and 9 the mask 39 is not only provided over a part of the interconnection part 9A of the side surface 9 but also over a part of the top surface 5B of the coil substrate 7 so that the areas for disposing the interconnecting conductors 31 and 23 as well as the areas for disposing the contacting conductors 29, 31 remain exposed areas. The embodiment shown in FIGs. 8 and 9 therefore is suitable for an embodiment of the coil substrate 7 in accordance with FIGs. 4 and 5.

The provision of the mask 39 may be effected by means of a manufacturing step well known in the prior art for providing conducting areas or stripes on substrates and will therefore not be described in detail. The material used for providing the mask 39 may also be entirely conventional and could consist of for example a suitable photoresist.

As a further manufacturing step a layer of conducting material is deposited over at least a part of the mask 39 and over the said exposed areas. Suitable processes for depositing a layer of conductive material are known from the prior art, such as galvanic processes or sputtering processes. Subsequently the mask 39 and any conducting material deposited thereon is removed (see FIG. 9) so that the pattern of spaced interconnecting conductors 21, 23 and contacting conductors 29, 31 remains on the interconnecting part 9A of the side surface 9 and the contacting part 5C of the top surface 5B respectively of the coil substrate 7.

As a last step the individual coil substrates 7 are removed from the auxiliary substrates 31, for example by melting or dissolving an adhesive layer provided between the detachably connected surfaces of the auxiliary substrate 33 and the individual coil substrates 7.

The individual coil substrates may have very small dimensions, for example length and width dimensions of the order of one or a few millimetres and a thickness of the order of 0.6 millimetres. Components having such small dimensions which need to be provided with thin film coils and deposited electrical conductors may be manufactured using manufacturing technology that is very similar to the prior art manufacturing technology used to manufacture for example thin film magnetic heads or chips. For example a wafer substrate of suitable shape could be provided, such as a glass substrate, on which a plurality of thin-

film in-plane magnetic coils 3 may be deposited using suitable stepper replication techniques to produce a plurality of individual thin-film in-plane magnetic coils 3 each disposed on a corresponding coil substrate 7 provided in the wafer substrate.

An auxiliary substrate having dimensions in accordance with the wafer substrate could be disposed over the wafer substrate and over the thin-film in-plane magnetic coils. Subsequently, in a first dicing step, the wafer substrate may be diced in a first direction into individual wafer substrate strips comprising rows of coil substrates having thin-film in-plane magnetic coils deposited thereon while leaving the auxiliary substrate intact. In a second dicing step the auxiliary substrate and the said individual wafer substrate parts disposed thereover may be diced in a second direction different from the first direction into strip shaped auxiliary substrates 33 each supporting a plurality of diced individual wafer substrate parts comprising a coil substrate 7 and a thin-film in-plane magnetic coil 3 deposited thereon, the coil lead in and lead out sections 11,15 of each individual magnetic coil being formed such and the dicing steps being executed such that after the second dicing step a cross section of the lead in and lead out sections 11,15 is exposed at an edge of the interconnecting part 9A of a side surface 9 of the coil substrates 7.

In FIGs. 7 to 9 the strip shaped auxiliary substrates 33 show shallow grooves 65 which are present between the individual coil substrates 7 and which remain after the first dicing operation.

The manufacturing method which has been discussed with reference to FIGs. 7, 8 and 9 comprises the interesting feature that the coil lead in section 11 and the coil lead out section 15 are exposed at the edge of the interconnection part 9A of the side surface 9 after the second dicing operation. Providing the interconnecting conductors 21 and 23 on the side surface 9A of the coil substrate 7, which side surface 9A is flush with the side surface 37 of the auxiliary substrate 33, therefore automatically provides an electrical connection between the coil lead in section and coil lead out section and the first and second interconnecting conductors 21, 23 respectively.

Although the invention has been described in relation to a limited number of embodiments of the invention, it should be appreciated that the invention is by no means limited to the embodiments described but instead is limited only by the scope of the independent claims 1,2,8 and 9. Interesting embodiments are described in the respective depending claims.

References

[1] Japanese Journal of Applied Physics, Vol. 40 (2001), pp. 1775-1777, Part 1, No. 3B, March 2001

[2] European Patent Application Filing No. 00201412.4 (= PHNL000221)

[3] European Patent Application Filing No. 01200477.6 (= PHNL 010093)

CLAIMS:

1. Method of manufacturing a magneto-optical write and/or read head (1) including a thin-film in-plane magnetic coil (3) disposed on an outwardly directed surface (5A) of a coil substrate (7), the method comprising the steps of:

- providing an electrically isolating coil substrate (7) having substantially parallel main surfaces (5A, 5B) comprising the outwardly directed surface (5A) and an opposed top surface (5B), interconnected by an adjoining side surface (9),

- depositing a thin film magnetic coil (3) on the outwardly directed surface (5A) of the coil substrate (7) comprising a continuous electrical conductor pattern with a coil lead in section (11), a coil winding section (13) and a coil lead out section (15) and

- providing means for contacting the thin film magnetic coil (3) by electrically connecting the coil lead in and lead out sections (13,15) to external lead in and lead out lines (25,27) ,

characterized in that the method comprises a plurality of further manufacturing steps including :

- extending the coil lead in and coil lead out sections (11,15) of the magnetic coil (3) on the outwardly directed surface (5A) of the coil substrate (7) to an interconnection part (9A) of the side surface (9) of the coil substrate (7), and

- depositing a pattern of respective first and second spaced interconnecting conductors (21,23) on the interconnection part (9A) of the side surface (9) of the coil substrate (7) in electrical connection with the lead in and lead out sections (11,15) respectively of the magnetic coil (3) for contacting the said external lead in and lead out lines (25,29) respectively by suitable contacting means such as bonding, welding or soldering,

such that a lead in conductor is formed comprising the first interconnecting conductor (21) and the lead in section (11) of the magnetic coil respectively and a lead out conductor is formed comprising the second interconnecting conductor (23) and the lead out section (15,19) of the magnetic coil, respectively.

2. Method of manufacturing a digital magneto-optical write and/or read head (1) including a thin-film in-plane magnetic coil (3) disposed on an outwardly directed surface (5A) of a coil substrate (7), the method comprising the steps of:

- providing an electrically isolating substrate (7) having substantially parallel main surfaces (5A, 5B) comprising the outwardly directed surface (5A) and an opposed top surface(5B), interconnected by an adjoining side surface (9),

- depositing a thin film magnetic coil (3) on the outwardly directed surface (5A) of the coil substrate (7) comprising a continuous electrical conductor pattern with a coil lead in section(11), a coil winding section (13) and a coil lead out section (15), and

- providing means for contacting the thin film magnetic coil (3) by electrically connecting the coil lead in and lead out sections (11,15) to external lead in and lead out lines (25,27),

characterized in that the method comprises a plurality of further manufacturing steps including:

- extending the coil lead in and coil lead out sections (11,15) of the magnetic coil (3) on the outwardly directed surface (9A) of the coil substrate (7) to an interconnection part (9A) of the side surface (9) of the coil substrate (7),

- depositing a pattern of respective first and second spaced interconnecting conductors (21,23) on the interconnection part (9A) of the side surface (9) of the coil substrate (7) in electrical connection with the lead in and lead out sections (11,15) of the magnetic coil (3) respectively and

- depositing a pattern of respective spaced first and second contacting conductors (29,31) on a contacting part (5C) of the top surface (5B) of the coil substrate (7) in electrical connection with the first and second interconnecting conductors (21,23) respectively on the side surface (9A) of the coil substrate (7) for contacting the said external lead in and lead out lines (25,27) respectively by suitable contacting means such as bonding, welding or soldering,

such that a lead in conductor is formed comprising the first contacting conductor (29), the first interconnecting conductor (21) and the lead in section (11) of the magnetic coil respectively and a lead out conductor is formed comprising the second contacting conductor (31), the second interconnecting conductor (23) and the lead out section (15) of the magnetic coil (3) respectively.

3. Method according to claim 1, characterized in that the method comprises a plurality of further manufacturing steps including :

- providing an auxiliary substrate (33) having a supporting surface (35) and an adjoining auxiliary side surface (37),

- after depositing the thin film magnetic coil (3) on the outwardly directed surface (5A) of the coil substrate (7) but prior to the steps of depositing the interconnecting conductors (21,23) on the interconnection part (9A) of the side surface of the coil substrate (35), detachably arranging the coil substrate (7) on the supporting surface (35) of the auxiliary substrate (33) in a position such that the thin film magnetic coil (3) is directed to the supporting surface (35) and the interconnection part (9A) of the side surface (9) of the coil substrate (7) is flush with the auxiliary side surface (37) of the auxiliary substrate (33),

- providing a mask (39) over at least a part of the interconnection part (9A) of the side surface (9) such that the areas for disposing the interconnecting conductors (21,23) remain exposed areas,

- depositing a layer of conducting material over at least a part of the mask (39) and over the said exposed areas,

- removing the mask (39) and any conducting material deposited thereon so that the pattern of spaced interconnecting conductors (21,23) remains on the interconnecting part (9A) of the side surface (9) of the coil substrate (7), and

- detaching the coil substrate (7) from the auxiliary substrate(33).

4. Method according to claim 2, characterized in that the method comprises a plurality of further manufacturing steps including :

- providing an auxiliary substrate (33) having a flat supporting surface (35) and an adjoining auxiliary side surface (37),

- after depositing the thin film magnetic coil (3) on the outwardly directed surface (5A) of the coil substrate (7) but prior to the steps of depositing the interconnecting conductors (21,23) on the interconnection part (9A) of the side surface (9) of the coil substrate (7) and depositing the contacting conductors (29,31) on the contacting part (5C) of the top surface (5B) of the coil substrate (7), detachably arranging the coil substrate (7) on the supporting surface (35) of the auxiliary substrate (33) in a position such that the thin film magnetic coil (3) is directed to the supporting surface (35) and the interconnection part (9A) of the side surface (9) of the coil substrate (7) is flush with the auxiliary side surface (37) of the auxiliary substrate(33),

- providing a mask (39) over at least a part of the interconnection part (9A) of the side surface (9) and a part of the top surface (5B) of the coil substrate (7) such that the areas for disposing the interconnecting conductors (29,31) and contacting conductors (29,31) remain exposed areas,

- depositing a layer of conducting material over at least a part of the mask (39) and over the said exposed areas,

- removing the mask (39) and any conducting material deposited thereon so that the pattern of spaced interconnecting conductors (21,23) and contacting conductors (29,31) remains on the interconnecting part (9A) of the side surface (9) and the contacting part (5C) of the top surface (5B) respectively of the coil substrate (7) and

- detaching the coil substrate (7) from the auxiliary substrate(33).

5. Method according to claim 3 or 4, characterized in that the coil substrate (7) is detachably arranged on the supporting surface (35) of the auxiliary substrate (33) by adhesive means disposed between the outwardly directed surface (5A) of the coil substrate (7) and the supporting surface (35) of the auxiliary substrate(33).

6. Method according to claim 3, 4 or 5, characterized in that the method comprises a plurality of further manufacturing steps including:

- providing a wafer substrate,

- depositing a plurality of thin-film in-plane magnetic coils (3) on the wafer substrate using suitable stepper replication techniques to produce a plurality of individual thin-film in-plane magnetic coils (3) each disposed on a corresponding coil substrate (7) provided in the wafer substrate,

- disposing an auxiliary substrate (33) over the wafer substrate,

- in a first dicing step dicing the wafer substrate in a first direction into individual wafer substrate strips comprising rows of coil substrates (7) having thin-film in-plane magnetic coils (3) deposited thereon while leaving the auxiliary substrate intact, and

- in a second dicing step dicing the auxiliary substrate and the said individual wafer substrate strips disposed thereover in a second direction different from the first direction into strip shaped auxiliary substrates (33) each supporting a plurality of diced individual wafer substrate parts comprising a coil substrate (7) and a thin-film in-plane magnetic coil (3) deposited thereon,

the coil lead in and lead out sections (11,15) of each individual magnetic coil (3) being formed such and the dicing steps being executed such that after the second dicing step a cross section of the lead in and lead out sections (11,15) is exposed at an edge of the interconnecting part (9A) of a side surface (9) of the coil substrate (7).

7. Method according to claim 2 or 4, characterized in that

- the coil substrate (7) is transparent,

- an optical lens part (41) of an optical pick up is provided on the top surface (5B) of the coil substrate (7) in a position between the position of the lead in and lead out conductors (29,21,11;31,23,15), such that any light focussed through the lens part (41) passes through the finished coil substrate (7) unobstructed by the lead in and lead out conductors(29,21,11;31,23,15).

8. Magneto-optical write and/or read head having a thin-film in-plane magnetic coil (3) disposed on an outwardly directed surface (5A) of the head, comprising:

- an electrically isolating coil substrate (7) having substantially parallel main surfaces (5A, 5B) comprising the outwardly directed surface (5A) and an opposed top surface (5B), interconnected by an adjoining side surface(9),

- a thin film magnetic coil (3) deposited on the outwardly directed surface (5A) of the coil substrate (7) comprising a continuous electrical conductor pattern with a coil lead in section(11), a coil winding section (13) and a coil lead out section (15), and

- means for contacting the thin film magnetic coil (3) by electrically connecting the coil lead in and lead out sections (11,15) to external lead in and lead out lines(25,27),

characterized in that the head comprises:

- extended coil lead in and coil lead out sections (11,15) of the magnetic coil (3) on the outwardly directed surface (5A) extending to an interconnection part (9A) of the side surface (9) of the coil substrate (7), and

- a pattern of respective first and second spaced interconnecting conductors (21,23) deposited on the interconnection part (9A) of the side surface (9) of the coil substrate (7) in electrical connection with the lead in and lead out sections (11,15) respectively of the magnetic coil (3) for contacting the said external lead in and lead out lines (25,27) respectively by suitable contacting means such as bonding, welding or soldering,

such that a lead in conductor is formed comprising the first interconnecting conductor (21) and the lead in section (11) of the magnetic coil (3) respectively and a lead out conductor is formed comprising the second interconnecting conductor (23) and the lead out section (15) of the magnetic coil respectively.

9. Magneto-optical write and/or read head having a thin-film in-plane magnetic coil (3) disposed on an outwardly directed surface (5A) of the head, comprising:

- an electrically isolating coil substrate (7) having substantially parallel main surfaces (5A,5B) comprising the outwardly directed surface (5A) and an opposed top surface(5B), interconnected by an adjoining side surface(9),

- a thin film magnetic coil (3) deposited on the outwardly directed surface (5A) of the coil substrate (7) comprising a continuous electrical conductor pattern with a coil lead in section(11), a coil winding section (13) and a coil lead out section (15) and

- means for contacting the thin film magnetic coil (3) by electrically connecting the coil lead in and lead out sections (11,15) to external lead in and lead out lines(25,27),

characterized in that the head comprises:

- extended coil lead in and coil lead out sections (11,15) of the magnetic coil (3) on the outwardly directed surface (5A) extending to an interconnection part (9A) of the side surface (9) of the coil substrate (7),

- a pattern of respective first and second spaced interconnecting conductors (21,23) deposited on the interconnection part (9A) of the side surface (9) of the coil substrate (7) in electrical connection with the lead in and lead out sections (11,15) of the magnetic coil (3) respectively and

- a pattern of respective spaced first and second contacting conductors (29,31) deposited on a contacting part of the top surface (5B) of the coil substrate (7) in electrical connection with the first and second interconnecting conductors (21,23) respectively on the side surface (9) of the coil substrate (7) for contacting the said external lead in and lead out lines (25,27) respectively by suitable contacting means such as bonding, welding or soldering,

such that a lead in conductor is formed comprising the first contacting conductor (29), the first interconnecting conductor (21) and the lead in section (11) of the magnetic coil respectively and a lead out conductor is formed comprising the second

contacting conductor (31), the second interconnecting conductor (23) and the lead out section (15) of the magnetic coil (3) respectively.

10. Write/read head according to claim 9, characterized in that

- the coil substrate (7) is transparent,
- an optical lens part of an optical pick up is provided on the top surface (5B) of the coil substrate (7) in a position between the lead in and lead out conductors (29,21,11;31,23,15), such that any light focussed through the lens part passes through the coil substrate (7) unobstructed by the lead in and lead out conductors (29,21,11;31,23,15).

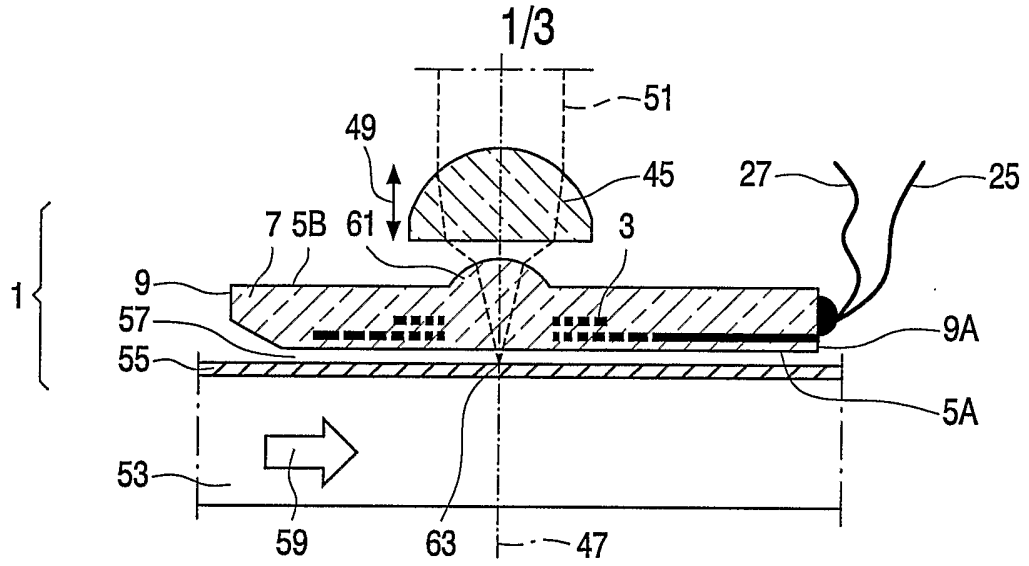


Fig.1

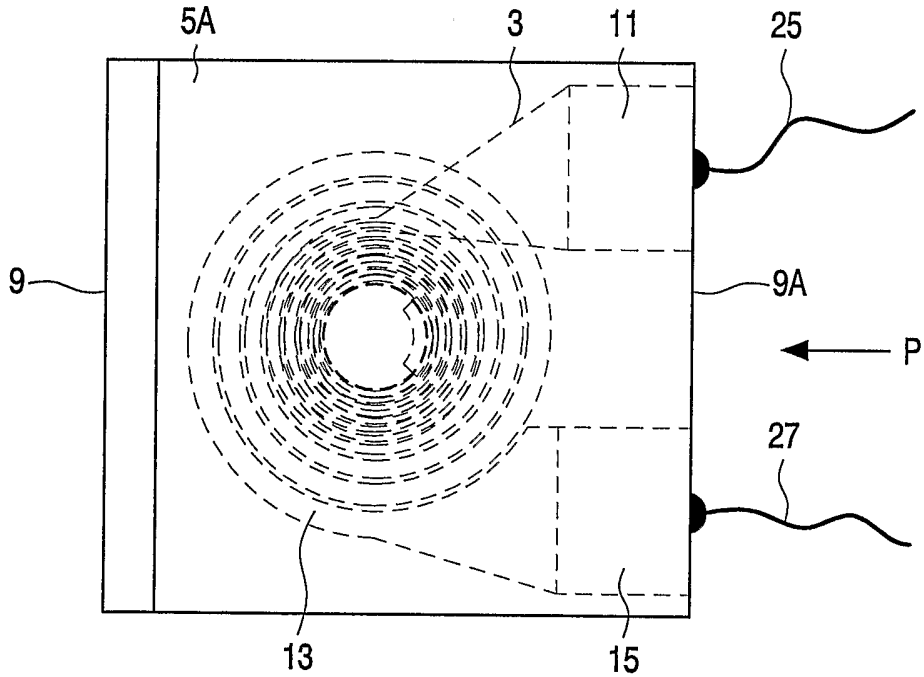


Fig.2

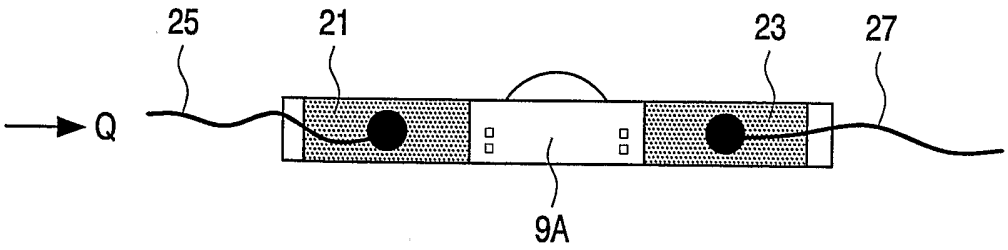


Fig.3

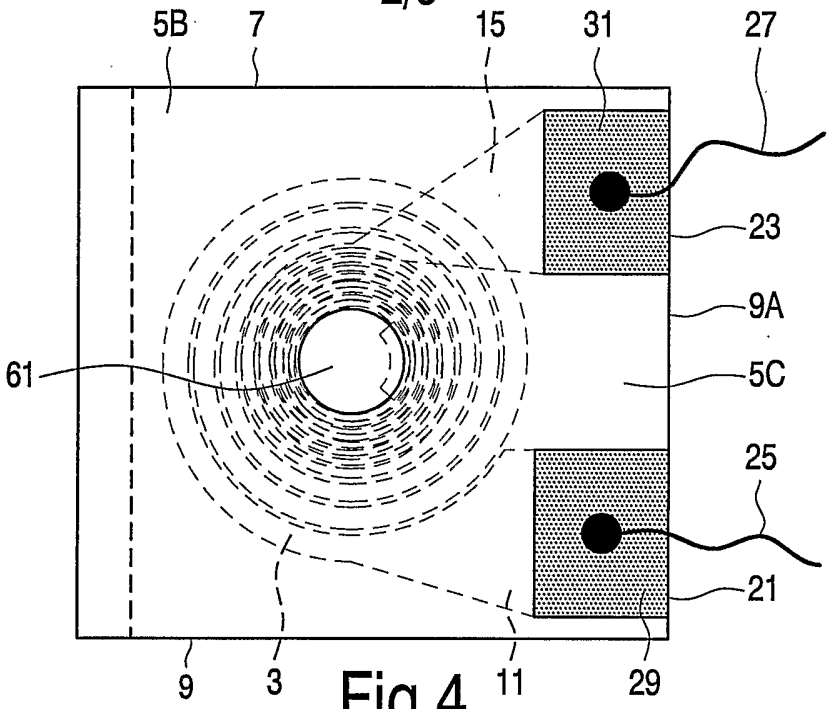


Fig.4

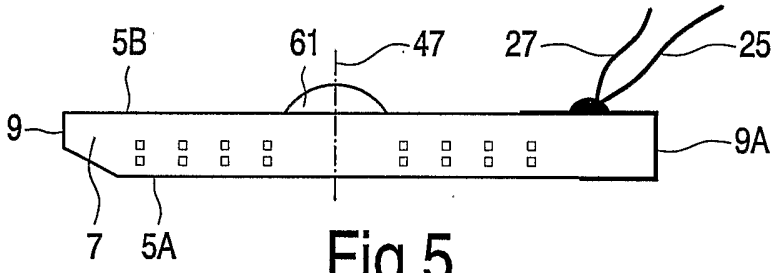


Fig.5

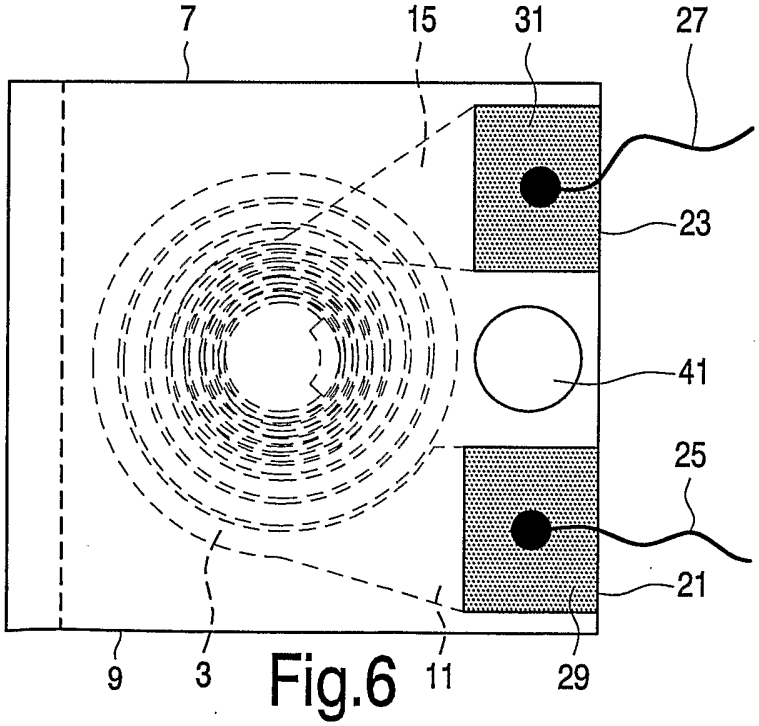


Fig.6

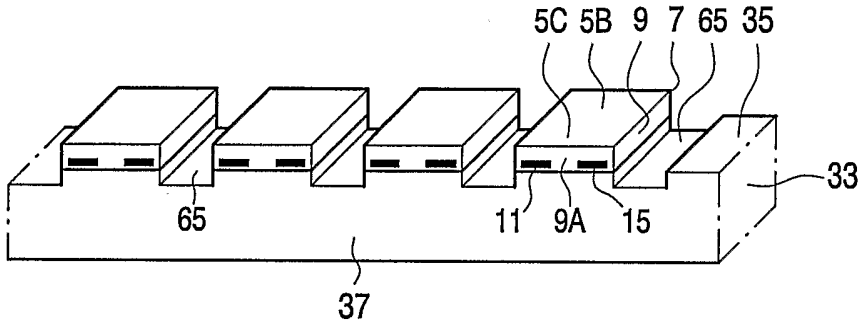


Fig.7

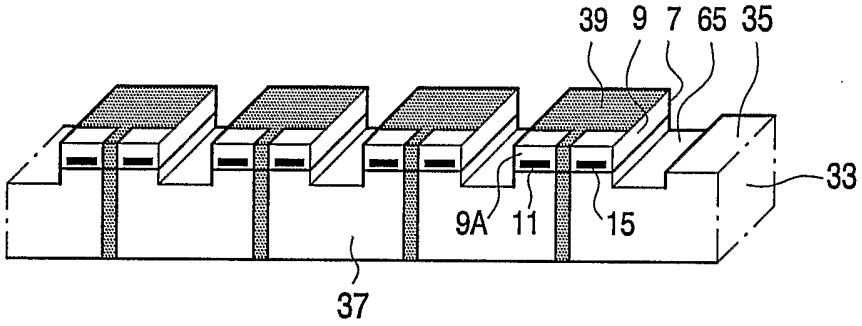


Fig.8

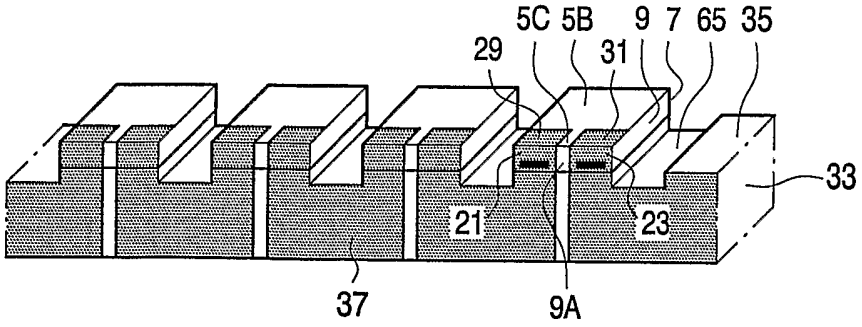


Fig.9