

The invention relates to a circuit arrangement for the magnetic or magneto-optical recording of data on to a data carrier with a series connection consisting of an inductance and a current source.

Such circuit arrangements are e.g. used in magneto-optical recording and reproducing devices, in order to reverse the direction of magnetisation in the magnetic layer of a magneto-optical recording medium.

A known magneto-optical recording medium is the magneto-optical disc, in which behind a transparent layer is placed a magneto-optical layer, on which data can be recorded and from which the data can be read. It is first explained how the data are written onto a magneto-optical disc.

The magneto-optical layer is heated up to a temperature near the Curie-Temperature by means of a laser beam focused onto the disc. However, it is usually sufficient, to heat the magneto-optical layer only up to the compensation temperature, which is below the Curie-Temperature. Behind the focus on the disc there is arranged an electro-magnet, which magnetises the zone heated by the laser beam in one or the other magnetisation direction. Because the heated area cools down below the compensation temperature after switching off the laser beam, the magnetisation direction determined by the electro-magnet remains preserved. It is so to say frozen in. In this way the individual bits are stored in domains of different magnetisation direction. Here e.g. the one magnetisation direction of a domain corresponds to a logic one, while the opposed magnetisation direction represents a logic zero.

For reading the data the Kerr-effect is exploited. The plane of polarisation of a linearly polarised light beam is rotated upon reflection at a magnetised mirror by a measurable angle. Depending on the direction of magnetisation of the mirror,

the plane of polarisation of the reflected light beam is rotated to the right or to the left. Because the individual domains on the disc react like magnetised mirrors, however, the plane of polarisation of a scanning light beam is rotated about a measurable angle to the right or to the left according to the direction of magnetisation of the just scanned domain.

From the rotation of the plane of polarisation of the light beam reflected by the disc the optical scanning device recognises which bit is present, a logic one or a logic zero.

A known solution to magnetise the magneto-optical layer in one or the other direction provides a circuit arrangement acting like an electromagnet having a coil behind the magneto-optical disc. The coil must be so dimensioned that it is able to re-magnetise the entire region which the optical scanning device covers. This region depends on the type of recording and reproducing device e.g. a radial or circular arc-shaped strip, which extends from the rim to the centre of the disc. Because the field strength must reach a minimum value over the entire strip, in order to be able to reverse magnetise the strip, the cross-section and thus the inductance of the coil are relatively large.

In a further known solution the coil is attached to the optical scanning device. The coil can for instance be wound about the objective lens of the optical scanning device. Because with this solution the coil is guided together with the optical scanning device by means of a track control circuit along the data tracks on the magneto-optical disc, a reduced cross-section and thus a lower inductance are sufficient, in order to generate the same minimum field strength because in the magneto-optical layer there is re-magnetised not a radial or circular arc-shaped strip but only a small e.g. circular shaped region with a substantially punctiform laser dot as its centre.

In Leistungs-MOSFET-Praxis, Jens Per Stengl, Jenő Tihanyi, 1985 by Richard Pflaum Verlag KG, München a push-pull transducer is described.

The centre point of two centre-point-circuit-connected coils of a transformer is connected to a voltage supply. The other connection of each of the two coils is grounded by means of a switching transistor. The two switching transistors are operated in the push-pull mode.

It is therefore the object of the invention to provide a circuit arrangement with a coil in such a way, that a secure and rapid reversal of the magnetic field is achieved.

The invention solves this object in that a coil is constructed of two windings with opposed sense of winding in a centre-point-circuit, that the centre point of the two windings is connected via the series circuit consisting of the inductance and the current source to a supply voltage, that the free terminal of the one winding is connected via a first controllable switch and the free terminal of the other winding via a second controllable switch to reference potential and that the control input of the first controllable switch is connected with the first output and the control input of the second controllable switch with the second output of a control circuit.

The invention will now be described and explained with reference to the embodiment shown in the Figure.

A double wound coil S is constructed of two series-connected windings W1 and W2 having opposed sense of winding. The common connecting point of both windings W1 and W2 having opposed sense of winding is connected via a series circuit consisting of an inductance L and a current source Q to a supply voltage U. The free terminal B1 of the winding W1 is connected to reference potential by means of a controllable

switch S1, of which the control input is connected to the first output A1 of a control circuit AS. Similarly the free terminal B2 of the winding W2 is connected to reference potential by means of a controllable switch S2, the control input of which is connected to the second output A2 of the control circuit AS. The free terminal B1 of the winding W1 is connected to reference potential by means of a diode D1 and in series with diode D1 a parallel circuit consisting of a capacitor C and a Zener-diode Z. The free terminal B2 of the winding W2 is connected to the common terminal point of the diode D1 and the parallel circuit consisting of the capacitor C and the Zener-diode Z by means of a diode D2. The input E of the control circuit AS is supplied with the data signal DS, which is to be recorded.

In reading operation both controllable switches S1 and S2 are open. If, however, data are recorded on the magneto-optical disc, either the controllable switch S1 or the controllable switch S2 is closed by the control circuit AS depending on whether a logic one or a logic zero is to be stored on the magneto-optical disc.

If for instance a logic one is recorded, the control circuit AS closes the controllable switch S1. Now a current flows from the current source Q via the inductance L, the winding W1 and the controllable switch S1 to reference potential. No current can flow via the two diodes D1 and D2, because both diodes are oriented in blocking direction. If there is now to be recorded a logic zero, the control circuit AS opens the controllable switch S1, while closing the at the same moment the controllable switch S2. Because now with closed controllable switch S2 a current is flowing through the winding W2 to reference potential, while the winding W1 is without current, the direction of the magnetic field generated by the coil S is reversed.

Due to the self-inductance of both windings W1 and W2 the current in the two windings W1 and W2 changes only slowly if the two controllable switches S1 and S2 are switched in antiphase. Therefore the current through the inductance L is kept almost constant at the moment when the switches S1 and S2 are switched-over and the flow of current should change-over from the one winding W1 or W2 to the other winding W2 or W1, so that the current nears the zero value rapidly in the one winding, while at the same time the current in the other winding increases to its final value. In this way a rapid reversal of the magnetic field is realised.

Tests have shown that a rapid change of the current flow from one winding to the other can be achieved if the inductance of the coil L is chosen to be five- to fifty-times greater than that of the windings W1 and W2.

The high induction voltage arising in the winding W1 when opening the controllable switch S1 is limited to a predetermined value by the diode D1 and the parallel circuit consisting of the capacitor C and the Zener-diode Z.

If the controllable switch S1 is again closed by the control circuit AS and the controllable switch S2 is simultaneously opened, then the induction voltage arising in the winding W2 during this switching action is limited by the diode D2 and the parallel circuit consisting of the capacitor C and the Zener-diode Z also to a predetermined value.

The invention offers the advantage in magneto-optical recording and reproducing devices that data already recorded on the magneto-optical disc can readily be over-written.

In contrast, in known magneto-optical recording and reproducing devices, the old data are first erased, before new data are recorded. For this purpose the magneto-optical layer is heated up by the laser to the compensation

temperature at those locations where the new data are to be stored. In this way these locations are magnetised in one direction. The disc is being initialised, which is the technical term for this process. The direction of the magnetic field generated in the coil is then again reversed.

For recording of the new data the laser power is switched between a low and a high value depending on the bit to be stored. If at an erased position e.g. a logical zero is stored, then the laser operates low power so that the compensation temperature is not reached. On the contrary for recording of a logical one the laser heats up the location to be rewritten to the compensation temperature so that this location can be reversely magnetised by the coil. In this complicated way the data on the magneto-optical disc are first erased, before the new data subsequently recorded. According to the invention on the contrary, the old data are simply over-written by the new.

The invention is suitable for magneto-optical devices but also for other magnetic recording devices.

Claims

1. A circuit arrangement for magnetic or magneto-optical recording of data onto a data carrier with a series circuit of an inductance (L) and a current source (Q), characterised in that, a coil (S) is constructed as a centre point circuit of two windings (W1, W2) having opposed sense of winding, that the centre point of the two windings (W1, W2) is connected via the series circuit consisting of the inductance (L) and the current source (Q) to a supply voltage (U), that the free terminal (B1) of the one winding (W1) is connected via a first controllable switch (S1) and the free terminal (B2) of the other winding (W2) via a second controllable switch (S2) to reference potential and that the control input of the first controllable switch (S1) is connected to the first output (A1) and the control input of the second controllable switch (S2) with the second output (A2) of a control circuit (AS).
2. A circuit arrangement according to claim 1, characterised in that the free terminal (B1) of the one winding (W1) is connected to reference potential via a first diode (D1) and a parallel circuit connected in series therewith and consisting of a capacity (C) and a Zener-diode (Z) and that the free terminal (B2) of the other winding (W2) is connected to reference potential via a second diode (D2) and the parallel circuit consisting of the capacity (C) and the Zener-diode (Z).
3. A circuit arrangement according to claim 1 or 2, characterised in that the circuit arrangement serves for the reversal of the direction of magnetisation of the magnetic layer of a magnetic recording medium, that during recording of digital data the two controllable switches (S1, S2) are opened and closed with opposed phase by the control circuit (AS) in dependence on the bit to be recorded.



4. A circuit arrangement according to claim 3, characterised in that a magneto-optical disc is provided as magnetic recording medium.

5. A circuit arrangement according to claim 1, 2, 3 or 4, characterised in that the value of the inductance (L) is selected to be greater than the inductance of the two windings (W1, W2).



* C L N S *