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Turn-table for disc-shaped information carriers

The present invention relates to a turn-table for disc-shaped information carriers and to the method for the manufacture thereof, wherein the turn-table has a centering piece which reaches through a central bore in the information carrier and an outer rim surface of the turn-table forms the support surface for the information carrier such as in a CD player for example.

Disc-shaped information carriers which are scanned or recorded upon while rotating on a turn-table for recording and reproducing items of information are generally known. While disc-shaped information carriers in the form of the well-known analogue gramophone record are, as a rule, laid flat on a turn-table and rotate at a relatively low rotational speed of 33 1/3 or 45 revolutions per minute, disc-shaped information carriers, such as the CD or MOD for example, in which the compact storage technique is utilised, are placed-on or clamped at a central region which does not carry any information and rotate at a substantially higher rotational speed in the region of 500 revolutions per minute for example. Due to the high rotational speed and the very small dimensions of the area that has to be scanned as well as to the central clamping of the information carrier, only very small deviations of the rotating information carrier from the envisaged scanning location can be permitted in the radial direction and in height so that large demands are made upon the precision of the fixing and the centering of the information carrier on the turn-table and upon the turn-table.

In addition to the centering, whose precision is affected by the centering piece reaching through the central boring in the information carrier, very close manufacturing tolerances have to be maintained due to the central clamping of the information carrier, in particular as regards the run out in the vertical direction of the turn-table, since a run out of the turn-table of, for example, just 0.05 mm, which represents a maximum permissible upper limit, causes a vertical run out of 0.2 mm at the outer edge of a CD which, in many cases, will no longer

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ensure the requisite reliability of scanning required for the information carrier.

A turn-table for disc-shaped information carriers, that has been used for many years in CD play-back equipment and which comprises a bearing bush made of brass that is pressed onto the drive spindle of a motor and onto which a flat metal disc forming a support surface for the information carrier and having an inner shoulder is riveted or slotted together with the bearing bush is known c.f. Fig. 3. Due to the tolerances of the riveting surface of the brass bush relative to the support surface of the information carrier, the maximum permissible run out is frequently not maintained and this leads to a high proportion of defective turn-tables or to a high number of reject items. In addition, the mating process involved in the riveting disadvantageously affects the precision of the turn-table and high pressing-forces, which lead to deformations that likewise contribute to the run out and the deviations from a centered position, are required for fixing the brass bushing on the motor spindle. In order to diminish the pressing-force or the supporting surface, grooves were provided in the brass bushing, whereby however, only a further deterioration in respect of the running properties of the turn-table was achieved.

For the purposes of centering the information carrier on the turn-table, there is provided a centering cone which can be displaced along the axis of the turn-table and is formed by a third part. The displaceability of the centering piece along the axis of the turn-table does, it is true, provide the advantage of adapting to the tolerances in the central borings of the information carrier, but, due to the play of the centering piece relative to the axis of the turn-table itself, this causes eccentricities or deviations in the position of the information carrier in a radial direction.

Although there is no longer any overriding significance to be attributed to the rotational mass or the flywheel effect due to the use of an electronic direct drive for the turn-table, it has

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to be mentioned nevertheless, that a high rotational mass or a large flywheel effect is desirable for improving the running properties. The metal parts, which substantially affect the rotational mass, are distributed relatively evenly over the whole region of the turn-table so that a substantially uniform distribution of the mass is present.

Furthermore, a turn-table for accommodating record-like information carriers which consists of a single piece of permanently magnetic, powdered material that is bound together by a synthetic material is known c.f. DE-GM 78 34 662 dated 22.11.1978. An expensive technological process, which affects the costs of the turn-table disadvantageously, is required for the manufacture of the permanently magnetic material that is bound together by a synthetic material. The connection of the turn-table to the motor spindle by a press-seating, which only requires a small effort, leads to stress cracks in the case of the suggested powdered material and hence, to the breakdown of the equipment. Moreover, the range of variations resulting from the manufacturing process used for one piece turn-tables consisting of materials that are bound together by a synthetic material does not satisfy the demands that are being made in respect of precision and dimensional stability. Attempts using designs that are completely of synthetic material have also resulted in the previously described level of precision not being able to be maintained over a long period of time due to the flowing properties of the synthetic material and the tolerances involved in the manufacturing process despite having a plurality of injection points.

Due to the homogeneity of the material, the turn-table does not exhibit any of the features which tend to assist the flywheel effect but rather, they are affected disadvantageously due to the very low weight of the one piece turn-table.

The centering piece does not have a very steep cone so that a relatively exact pre-positioning relative to the turn-table is required for centering the information carrier.

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In the context of a one piece turn-table, a centering piece, which is additionally placed on the one piece turn-table and is formed of synthetic material springs, is known c.f. Specification CDM 12.3 in N.V. Philips Industrial Activities, Rev. 1.0 dated 14 September 1992, Page 27, Fig. 10. Since the tolerances of the centering piece add to the tolerances, which the support surfaces of the turn-table have in relation to the drive spindle of the motor and which are already involved due to the manufacturing process, and, since synthetic material springs become fatigued after only a very short time, only a very small precision in respect of the centering process can be achieved.

Furthermore, a turn-table for disc-shaped information carriers is known, which consists of a flat metal disc that is shouldered in its inner region and comprises a body of synthetic material - by means of which the motor spindle is accommodated - in its inner region, c.f. Drive unit for compact disc player (KSM-210) in Sony Electronic Devices General Catalog '91, p 76. The outer annular edge of the metal disc serves as the support surface for the information carrier and the body of synthetic material is arranged on the inside of the metal disc at a distance from the inner edge of the surface provided as a support for the information carrier. The inner region of the metal disc has recesses in which the body of synthetic material engages in order to achieve a safeguard in respect of twisting distortion. A shouldered inner surface of the metal disc, which is spaced from the support surface of the information carrier, is used as a sealing surface in the injection moulding tool for inserting the body of synthetic material into the metal disc. Due to the use of a body of synthetic material in the inner region of the turn-table, only very low pressing-forces are required, especially in connection with the mounting of the turn-table on the motor spindle. However, due to the replacement of the brass bushing mentioned hereinabove by a body of synthetic material, no substantial improvements could be achieved as regards the run out of the turn-table, the precision of the centering or the appearance of radial errors and the rotational mass. Only a low precision of the centering could be achieved using an envisaged centering piece which can be displaced in sliding manner on a

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surface of the body of synthetic material in a direction along the axis of the motor, due to the tolerance chains between the motor spindle and the body of synthetic material as well as between the body of synthetic material and the centering piece and the backlash existing between the body of synthetic material and the centering piece.

Consequently, the object of the invention is to create a turn-table for disc-shaped information carriers which, at low cost, ensures low run out, high centering precision as well as an advantageous rotational mass, mainly by virtue of its construction and its method of manufacture.

In accordance with the invention, this object is achieved by the features indicated in claims 1 and 6 as well as the advantageous developments specified in the appendant claims.

In order to avoid the disadvantage occurring with known turn-tables, there is proposed a turn-table for disc-shaped information carriers which consists of an apertured disc that forms a support surface for the information carrier and comprises a shoulder, which bounds the inner edge of the support surface, in its inner region, wherein, in the inner region of the apertured disc, there is inserted a moulded part that accommodates the driving spindle of the turn-table and embeds the apertured disc in abutting manner up to the shoulder of the support surface of the information carrier. The moulded part is preferably injected as a synthetic material part into the apertured disc in an injection moulding tool, whereby the support surface of the apertured disc for the information carrier is simultaneously used as a reference surface in the injection moulding tool and the inner region of the apertured disc is embedded in the moulded part in abutting manner up to the inner edge of the support surface for the information carrier. The moulded part simultaneously accommodates the driving spindle of the turn-table so that chains of tolerances, which disadvantageously affect the precision of the manufacturing process as regards run out and centering, are avoided due to the construction of, and the method of

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manufacturing the turn-table. This is achieved, in particular, in that the surface of the apertured disc, which is envisaged later as the support surface for the information carrier, is used as a reference surface in the injection moulding tool. In advantageous manner, the shoulder between the shouldered surface and the support surface for the information carrier serves as a sealing surface in the injection moulding tool. For the purposes of centering the information carrier on the turn-table, use is preferably made of a centering piece which forms a constructional unit with the moulded part that is injected into the inner region of the apertured disc or is simultaneously implemented with the moulded part being integrated therein. The centering piece integrated into the turn-table is formed by a cup-shaped boss which has a rounded shape over a large diametrical region in order to allow centering even in the event of an inexact pre-centering of the information carrier. Since the centering piece is manufactured simultaneously with the moulded part, neither chains of tolerances nor backlash which could disadvantageously affect the precision of the centering occur. It has been discovered that the deviations occurring as a result of the differing diameters of the information carriers or the undersize of the centering piece can be selected to be smaller than the tolerances occurring in the case of the centering piece which is displaceable along the axis of the motor. However, a combination of the proposed turn-table with a displaceable centering piece likewise leads to turn-tables having a very low run out.

As regards the rotational mass or the flywheel effect, it should be noted that the preferably metallic apertured disc exhibits a comparatively greater thickness and that a large flywheel effect or advantageous running properties are achieved, in particular, due to the concentration of the mass elements in the support region of the information carrier.

The turn-table and the said measures enable, at low cost, the manufacture of turn-tables which exhibit a very low run out and a high centering precision, mainly due to the proposed construction and the proposed method of manufacture so that the

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proportion of turn-tables that are manufactured with defects is lowered and the reliability of the scanning of the information carriers, such as the compact disc or CD, which is also referred to as a digital gramophone record, a data bank CD-ROM, a CD-Video or Photo-CD for example, is increased.

The invention will be explained in more detail hereinafter by means of two embodiments in the drawings. Therein :

Fig. 1 shows a sectional illustration of a first turn-table in accordance with the invention,

Fig. 2 a view of the turn-table in accordance with Fig. 1 from below,

Fig. 3 the construction of a known turn-table and

Fig. 4 a basic sketch of a second turn-table in accordance with the invention as a semi-side-sectional view.

The turn-table illustrated in Fig. 1 consists of an apertured disc LS which has a shoulder S in its inner region and which is embedded in a moulded part F that abuts up to the shoulder S and simultaneously forms a centering piece Z as well as a bushing B for accommodating a driving spindle. The apertured disc LS, whose surface that is not embedded in the moulded part forms the support surface AF for the information carrier, is manufactured as a stamp punched part from a metal ring, in order to enable the information carrier to be clamped in known manner by means of a not-illustrated puck, which serves as a counter support, using magnetic means. Due to the stamping process, there is achieved a high degree of stability, dimensional stability and precision of the upper surface with respect to the apertured disc LS and, in particular, the support surface AF for the information carrier. To this end, especial significance has to be attributed to the planing of the support surface AF during the stamping process, just as in the case of known turn-tables, and the apertured disc has a greater thickness in comparison

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th the metal disc M of a known turn-table which is illustrated n Fig. 3.

The apertured disc LS of the turn-table illustrated in the Figs. 1, 2 and 4 is embedded internally in a moulded part F that abuts up to the said shoulder S, the moulded part being formed by a body of synthetic material which is injected into the apertured disc LS using an injection moulding tool. The moulded part F is designed in such a way that, in correspondence with Figs. 1 and 4, it is off-set vis a vis the support surface AF for the information carrier in a region extending from the shoulder S up to the centering piece Z and is shaped such as to slope down in a direction towards the centering piece in order to ensure that the placing or clamping of the information carrier occurs exclusively on the support surface AF of the apertured disc LS. None the less, the internally shouldered region of the apertured disc LS is embedded on both sides or completely in the moulded part F or the body of synthetic material that abuts up to the shoulder S of the apertured disc LS. The inner, shouldered region of the apertured disc LS is completely enclosed in the moulded part F or is completely enveloped by the moulded part F, whereby a firm and solid connection between the moulded part F and the apertured disc LS is produced. The connection between the moulded part F and the apertured disc LS is additionally assisted by means of webs or recesses provided internally of the apertured disc LS which are illustrated in Fig. 2 as invisible edges of the body. Furthermore, in correspondence with Fig. 2 and in order to increase the degree of stability and the dimensional stability, strengthening ribs V are provided on the under side of the moulded part F and supports a ring of the moulded part F which is arranged beneath the shouldered inner surface of the apertured disc LS and simultaneously forms an outer rim and an end point for the strengthening ribs V which point in a direction towards the centre of the turn-table. In order to ensure that the recesses in the inner region of the apertured disc LS formed between the support webs are reliably filled when injecting the moulded part F in the injection moulding tool, the strengthening ribs V are arranged in the vicinity of the recesses.

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This also formed a pre-requisite for being able to design the moulded part F to abut up to the shoulder S of the support surface AF in order to then be able to use, in advantageous manner, the surface of the apertured disc LS envisaged as the support surface AF for the information carrier as a reference surface in the injection moulding tool when injecting the moulded part F and to ensure nevertheless that there was an absolutely reliable safeguard in respect of twisting distortion between the moulded part F consisting of synthetic material and the metallic apertured disc LS. Due to the use of the surface AF of the apertured disc LS envisaged as the support surface AF for the information carrier as a reference surface in the injection moulding tool when injecting the moulded part F, tolerance chains between the support surface of the apertured disc LS and the bushing B for accommodating the drive spindle and in relation to the centering piece Z which is likewise formed by the moulded part as well as between one another are avoided so that a turn-table of this type exhibits very low run out as well as a high precision of centering, mainly by virtue of its special design and the technique used to manufacture it.

Due to the comparatively augmented arrangement of weighty masses in the edge region, the turn-table achieves a greater rotational mass or flywheel effect which has a further advantageous effect upon the running properties of the turn-table.

The advantage of the reduced run out can be used, in correspondence with a second embodiment in Fig. 4, in connection with a centering piece Z which is displaceable relative to the axis of rotation of the turn-table, this enabling adaptation or centering to occur even in the case of extremely large deviations between the, in principle, standardised diameters of the central bores in the information carriers. In agreement with the embodiment corresponding to Fig. 1, the turn-table consists of an internally shouldered apertured disc LS which is embedded in a moulded part F consisting of synthetic material that abuts internally up to the shoulder S which is formed by the inner edge of the support surface AF of the apertured disc LS for the

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information carrier. The support surface AF of the apertured disc LS for the information carrier is used, in a similarly advantageous manner, as a reference surface when injecting the moulded part F in the injection moulding tool so that turn-tables having a reduced run out are manufactured. The centering piece Z is implemented with locking lugs R that engage in recesses of the moulded part F and is also implemented such as to be displaceable in sliding manner directly on the driving spindle T as well as to be supported on the moulded part F via a spring E. Due to the direct guidance of the centering piece Z on the driving spindle T, tolerance chains are avoided and the precision of the centering is basically determined only by virtue of the backlash between the driving spindle T and the moulded part F. The guideway of the centering piece Z on the driving spindle T can be selected to be comparatively long so that there is only a very small amount of backlash whereby a high degree of precision for the centering process is achieved. Since the embodiments corresponding to Fig. 1 and Fig. 4 differ exclusively only in regard to the centering piece Z used internally of the turn-table, the said advantages concerning the rotational mass or flywheel effect are also applicable for this embodiment.

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Claims

1. Turn-table for disc-shaped information carriers, in which an outer edge surface of the turn-table forms a support surface (AF) for the information carrier which is internally bounded by a shoulder (S), and including a central centering piece (Z) which reaches through a central bore in the information carrier, characterised in that, the turn-table is formed by an apertured disc (LS) that has a shoulder (S) and is arranged so as to be embedded internally in a moulded part (F) which accommodates a driving spindle (T) of the turn-table and which abuts up to the shoulder (S) that forms an inner edge of a support surface (AF) of the turn-table for the information carrier.

2. Turn-table in accordance with Claim 1, characterised in that, a centering piece (Z) of the turn-table is integrated in the moulded part (F) and is implemented in one piece with the moulded part (F) as a cup-shaped boss.

3. Turn-table in accordance with Claim 1, characterised in that, a centering piece (Z), which is displaceable on the driving spindle (T) of the turn-table, is arranged to engage in recesses of the moulded part (F) by means of locking lugs (R) and to be supported on the moulded part (F) via a spring (E).

4. Turn-table in accordance with any of the Claims 1 to 3, characterised in that, the apertured disc (LS) is a stamp punched part which is produced from a metal ring and in which there is provided at least one recess in which the moulded part (F) is arranged to engage for the purpose of providing a safeguard in respect of twisting distortion vis a vis the moulded part (F).

5. Turn-table in accordance with any of the Claims 1 to 4, characterised in that, the apertured disc (LS) is formed by a ferro-magnetic metal ring and the moulded part (F) accommodating the apertured disc (LS) and the axis of rotation is a part of synthetic material.

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6. Method of manufacturing a turn-table in accordance with any of the Claims 1 to 5, characterised in that, the turn-table is manufactured from an apertured disc (LS) which has a shoulder (S) and which is inserted into an injection moulding tool using a reference surface that is envisaged as the support surface (AF) for the information carrier and from a moulded part (F) which is formed so as to embed the apertured disc up to the shoulder (S) of the turn-table bounding the inner part of the support surface (AF) for the information carrier as well as the inner region of the apertured disc (LS) and to contain a boring (B) that is provided for accommodating a driving spindle (T) of the turn-table.

7. Method in accordance with Claim 6, characterised in that, a centering piece (Z) is manufactured in one piece with the part of synthetic material as a cup-shaped boss of the turn-table in an injection moulding tool.

8. Method in accordance with Claim 6, characterised in that, there is used a centering piece (Z) which is specially manufactured and slides on the driving spindle (T), engages in recesses of the turn-table by means of locking lugs (R) and is supported on the turn-table via a spring (E).

9. Method in accordance with any one of the Claims 6 to 8, characterised in that, there are used, as a reference surface in an injection moulding tool, a surface provided as the support surface (AF) of the turn-table for the information carrier and, as a sealing surface in an injection moulding tool, a shoulder (S) which bounds the inner edge of the support surface (AF) for the information carrier.

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