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(54) CLAMPING DEVICE FOR DISC RECORD

(71) We, N. V. PHILIPS' GLOEILAMPENFABRIEKEN, a limited liability company, organised and established under the laws of the Kingdom of the Netherlands, of Emmasingel 29, Eindhoven, the Netherlands, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement: —

The invention relates to a clamping device which is suitable for clamping a rotatable disc-shaped information-carrying record with a central record hole in position, and in particular for driving a video record which device comprises a drive spindle with a free end, which spindle is rotatable about an axis of rotation, record supporting means on the drive spindle, which means comprise a centring member which is coaxial with the drive spindle, which member has a centring surface whose transverse dimension varies in the axial direction from smaller than to greater than the diameter of the record hole, which surface, during operation, co-operates with the edge of the record hole, and record carrying means radially outside the centring member which carrying means are axially movable relative to the axis of rotation of the drive spindle and during operation frictionally co-operate with a record to be played with the aid of a positioning surface; and record loading means for pressing the edge of the record hole against the centring surface, which loading means during operation bear on a record to be played and are movable to a position opposite the centring member.

Such a clamping device is proposed in Patent Specification No. 1,538,568. This device comprises a record support which is fixed to the drive spindle, the centring member being rigidly connected to said support. The part of the centring surface which has a transverse dimension equal to the diameter of a record hole is situated at some axial distance from the other stationary parts of the record support, so that a record to be played is freely pivotable on the centring member to a limited extent. During operation the record loading means exert a resilient pressure on a record to be played, so that the edge of the record hole is resiliently pressed against the centring surface. In this previously proposed clamping device it is assumed that the record may be disposed slightly aslant on the centring member. As the record spindle gains speed centrifugal forces tilt the record into a plane of rotation which is essentially disposed at right angles to the axis of rotation of the drive spindle. In certain video players which are being developed in which the information is read from the record with the aid of a laser beam, the record is rotated with a speed of 1500 or 1800 revolutions per minute, depending on whether the main frequency is 50 or 60 Hz. For further general information pertaining to such video record players reference is made to a number of articles which have appeared in "Philips Technical Review", Vol. 33, 1973, No. 7, pp. 178-193. At a speed of 1500 or 1800 revolutions per minute rather substantial centrifugal forces are produced, so that despite the friction between the edge of the record hole and the centring member a fairly strong tilting effect is produced as a result of which the record will be positioned in said plane of rotation with comparatively high precision.

It may be desirable to use a clamping device of such a type that when the record is placed in position it is at once disposed in a plane perpendicular to the axis of rotation of the drive spindle within small tolerance limits. In the said previously proposed clamping device additional space is needed inside the video player to allow a video record to be positioned aslant.

The invention provides a clamping device suitable for clamping and driving a rotatable disk-shaped information-carrying record with a central record hole in a position on a drive spindle, which device comprises a drive spindle with a free end, which spindle is rotatable about an axis of rotation, record supporting means on the drive spindle

which means comprise a centring member which is coaxial with the drive spindle, which centring member has a centring surface whose radial dimension varies in the axial direction from smaller than to greater than the diameter of the record hole and which centring surface, during operation, co-operates with the edge of the record hole, record carrying means radially outside the centring member, which carrying means comprise a record carrying member which is coaxially movable relative to the centring member between a first position nearer the free end of the drive spindle and a second position which is more remote therefrom and during operation frictionally co-operates with the record with the aid of a positioning surface, and record loading means for ensuring contact between the centring surface and the edge of the record hole, which loading means during operation bear on the record and are movable to a position opposite the centring member, wherein parallel guidance means is provided for coaxially guiding the record carrying member relative to the centring member, wherein the positioning surface is rigidly connected to the record carrying member and is disposed in a plane which, regardless of the axial position of the record carrying member relative to the centring member, is perpendicular to the axis of rotation of the drive spindle, and wherein resilient means are provided for urging the record carrying member towards its first position.

The record carrying member functions as a means of bringing a record, when placed in position, in a plane which is essentially perpendicular to the axis of rotation of the drive spindle. When the record is put on and as the record loading means comes into position, the record carrying member together with the record is moved downwards along the drive spindle until the edge of the record hole is in contact with the centring surface. Should the record hole not be fully coaxial with the centring surface, the record may, at this stage of the positioning of the record relative to the axis of rotation, be slightly shifted over the record carrying member until the record hole co-operates with the centring surface in the desired manner. The distance over which the record carrying member is axially movable is selected so that the record carrying member can never act as an axial stop for a record to be played. The axial position of a record to be played is exclusively determined by the co-operation of the edge of the record hole with the centring surface of the centring member. Also the record loading means presses the edge of the record hole and the centring surface against each other during operation.

The record carrying member is resiliently pressed against the side of the record opposite to that which faces the record loading means and thus acts against the resilient action of the record loading means. The resilient means which serve for exerting pressure on the record carrying member and the record loading means may be proportioned to suit specific requirements. In this respect there are various possibilities, the most suitable choice for a specific case depending on practical conditions. It is for example possible to dimension the resilient means for the record carrying member so that by the mere weight of a record to be played the record carrying member is axially moved relative to the centring member over such a distance, that the edge of the record hole engages with the centring surface. If a record to be played is not centred correctly relative to the centring member, the record will be moved in a radial direction owing to the axial force which is exerted by the record loading means in the next phase of loading.

In such a case the tangentially directed frictional forces which provide the driving torque and which should accelerate and keep the record in rotation are mainly produced at the location of the edge of the record hole, namely by the centring member. The record carrying member only contributes slightly to the driving torque.

Another possibility is to dimension the resilient means of the record carrying member to be more powerful, yet not so powerful that they cancel the action of the record loading means. In the case of such a dimensioning the record carrying member could provide a grater share of the driving torque. However, a consequence is that radial movements of the record for centring the record hole relative to the centring member are counteracted by greater frictional forces between the record and the record loading means.

The centring member may consist of a cylindrical body mounted on the drive spindle and having a frustoconical end whose exterior surface serves as the centring surface. The record carrying member may consist of a cylindrical sleeve with a continuous internal bore and a flange at one end bearing the positioning surface. The parallel guidance means for the record carrying member may consist of the said cylindrical sleeve and the cylindrical body of the centring member which is a sliding fit within the internal bore of the sleeve. In such an embodiment the resilient means for urging the record carrying member towards its upper position may suitably comprise pre-loaded leaf springs which are rigidly connected to the centring surface, which springs bear on the record carrying member with free ends. The leaf springs may

exert a total force on the record carrying member which is only slightly less than the weight of a rigid 30 cm video record weighing 100 grammes.

An embodiment of the invention will now be described, by way of example, with reference to the accompanying drawings in which:

Figure 1 shows a perspective view of a video player with appertaining video record,

Figure 2 on an enlarged scale shows a part of the video player of Figure 1 near the clamping device,

Figure 3 shows a part of a cross-section of the video player of Figure 1 across the axis of rotation of the clamping device, and

Figure 4 is an elevation in accordance with the arrows IV-IV in Figure 3.

The video player *1* of Figure 1 comprises a housing 2 and a hinged cover 3. At the front of the housing a number of buttons 4 and 5 are provided for controlling the various apparatus functions. At a central location the record supporting means *6* are disposed, which will be discussed in further detail. A video record 7 having a central record hole 8, can be positioned on the record supporting means so as to be driven with the required speed of 1500 or 1800 revolutions per minute, depending on whether the mains frequency is 50 or 60 Hz. Beside these means a radially extending slot 9 is formed in the upper surface of the housing 2, in which slot a focussing device 10 is movable in a radial direction with the aid of means (not shown) which are accommodated in the housing. The focussing device is provided with an objective 11 with which a light beam from a laser source can be projected onto the underside of a record, when positioned on the clamping device, and reflected by the record back through the objective (11) to photoelectric information-detection meants (not shown).

The record supporting means *6*, see in particular Figure 3, comprise a centring member *13* which is coaxial with a drive spindle 12 of an electric motor 131, which member has a centring surface 14 whose transverse dimension varies, in the axial direction, from smaller than to greater than the diameter of the record hole 8 in the video record, which centring surface, during operation, co-operates with the edge 15 of the record hole 8. Furthermore, the record supporting means comprise a record carrying member 16. Relative to the axis of rotation 17 of the drive spindle this member is axially movable to a limited extent and frictionally co-operates with a video record to be played with the aid of a positioning surface 18.

During operation a record loading means 19 which is movable to a position opposite the centring member *13* bears on the video record. In the centring member *13* an annular axially magnetized permanent magnetic ring 20 is mounted (for example by glueing), which co-operates with a soft-iron annular disk 21 in the record loading means 19. The edge 15 of the record hole in the video record 7 is pressed against the centring surface 14 by the magnetic force which acts between the annular permanent magnetic ring 20 and the soft-iron disk 21. During operation the record loading means 19 does not come into contact with stationary parts of the video player. A flange 22 at the top of the cylindrical portion 23 rotates in and clear of the walls of a chamber 24 in the cover 3 during operation. When the cover is opened the record loading means is withdrawn from the video record in that three bolts 25 come into contact with the flange 22 and thus exert a tensile force on the record loading means *via* the cover 3. An internal bore 26 is a sliding fit on the free end of the drive spindle 12 and so aligns the record loading means 19 relative to the record supporting means 6.

The record carrying member 16 is movable, coaxially with the centring member 13, between an upper and a lower position. These two positions are disposed at such a distance from each other that, allowance being made for the tolerance in the diameter of the record hole and thus also in the axial position of a video record positioned on the centring surface 14, the friction surface 18 is always in contact with a record to be played.

The record carrying member *16* co-operates with the centring member *13* by means of an accurate parallel guidance. This guidance comprises a cylindrical bore in the record carrying member *16* in which a cylindrical portion 27 of the centring member *13* is an accurate sliding fit. The centring member thus consists of a cylindrical body 27 with a frustoconical end which is mounted on the drive spindle 12, whose outer surface constitutes the centring surface 14. The record carrying member *16* comprises a cylindrical sleeve 28 with the said bore and furthermore a flange 29.

The entire plane upper surface of the flange 29 functions as positioning surface 18 for the frictional co-operation with the video record 7 to be played. This positioning surface as a whole is disposed in a plane which, regardless of the axial position of the record carrying member *16* relative to the centring member *13*, is perpendicular to the axis of rotation *17* of the drive spindle 12.

For urging the record carrying member *16* to its upper position resilient means are provided in the form of three leaf springs 30 which are rigidly connected to the cen-

tring member *13*, see in particular Figure 4. With the aid of two pins 31 each of the three leaf springs 30 is connected to the centring member *13* in a central portion. The two free ends 32 press the record carrying member *16* upwards. Since the leaf springs 30 are mounted in slots in the centring member and in the record carrying member these two members are prevented from being rotated relative to each other.

The invention is not limited to the present embodiment. Alternative embodiments can be derived from the described embodiment. As an example, it is not necessary that the centring surface 14 consists of a continuous conical surface. It is for example possible to form grooves in this surface or, conversely, to form three or more ridges on this surface. The positioning surface 18 is in the present embodiment consists of a single surface. However, the same effect might also be achieved when on the flange 29 a plurality of local elevations, for example three, were formed, or if instead of the flange 29 a number of spoke-shaped projections were used. It is possible to provide the positioning surface 18, or as the case may be any further positioning surfaces, with a surface layer of a material which in co-operation with the material of a video record exhibits a high coefficient of friction, for example rubber.

WHAT WE CLAIM IS:—

1. A clamping device suitable for clamping and driving a rotatable disk-shaped information-carrying record with a central record hole in position on a drive spindle, which device comprises a drive spindle with a free end, which spindle is rotatable about an axis of rotation, record supporting means on the drive spindle which means comprise a centring member which is coaxial with the drive spindle, which centring member has a centring surface whose radial dimension varies in the axial direction from smaller than to greater than the diameter of the record hole and which centring surface, during operation, co-operates with the edge of the record hole, record carrying means radially outside the centring member, which carrying means comprise a record carrying member which is coaxially movable relative to the centring member between a first position nearer the free end of the drive spindle and a second position which is more remote therefrom and during operation frictionally co-operates with the record with the aid of a positioning surface, and record loading means for ensuring contact between the centring surface and the edge of the record hole, which loading means during operation bear on the record and are movable to a position opposite the centring member, wherein parallel guidance means is provided for coaxially guiding the record carrying member relative to the centring member, wherein the positioning surface is rigidly connected to the record carrying member and is disposed in a plane which, regardless of the axial position of the record-carrying member relative to the centring member, is perpendicular to the axis of rotation of the drive spindle, and wherein resilient means are provided for urging the record carrying member towards its first position.

2. A clamping device as claimed in Claim 1, wherein the centring member comprises a cylindrical body which is mounted on the drive spindle, which body has a frustoconical end whose exterior surface serves as the centring surface, wherein the record carrying member comprises a cylindrical sleeve with a continuous internal bore and a flange at one end, bearing said positioning surface, and wherein the parallel guidance means for the record carrying member consists of said cylindrical sleeve and the cylindrical body of the centring member which is a sliding fit within the internal bore of the sleeve.

3. A clamping device as claimed in Claim 2, wherein the resilient means for urging the record carrying member towards its first position comprise pre-loaded leaf springs rigidly connected to the centring member which springs bear on the record carrying member with free ends.

4. A clamping device substantially as described with reference to the accompanying drawings.

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1584812 COMPLETE SPECIFICATION

3 SHEETS *This drawing is a reproduction of the Original on a reduced scale*

Sheet 1

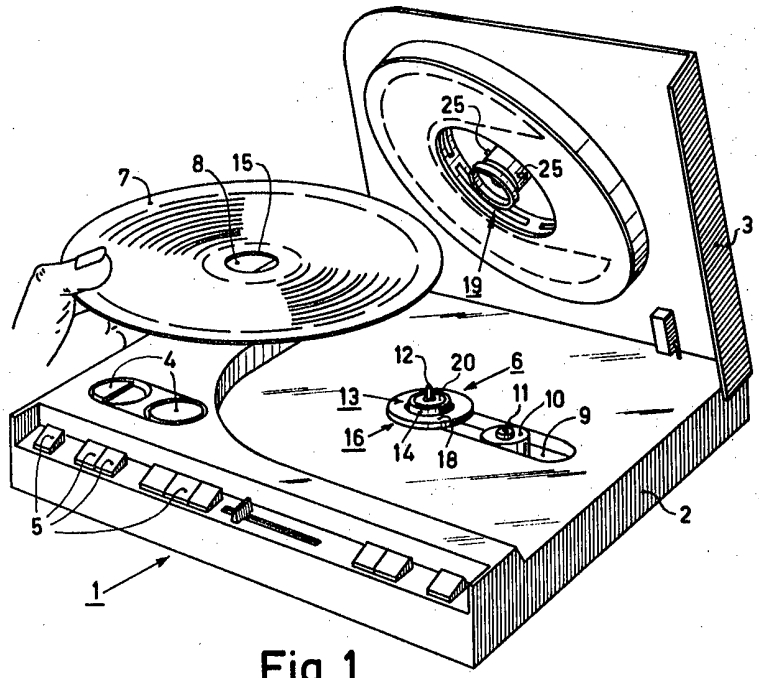

Fig. 1

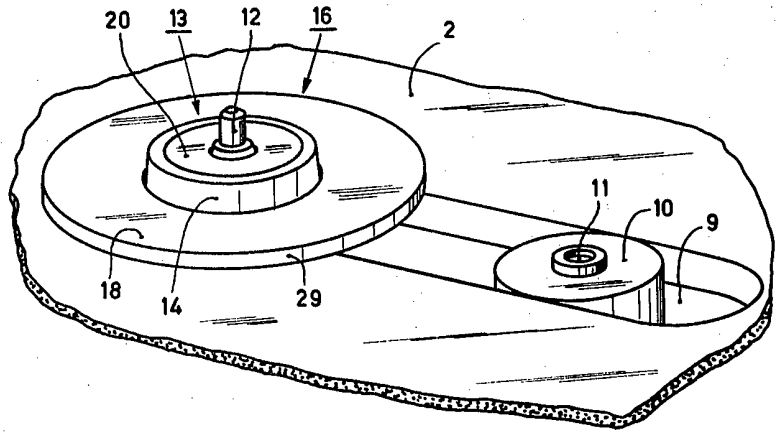

Fig. 2

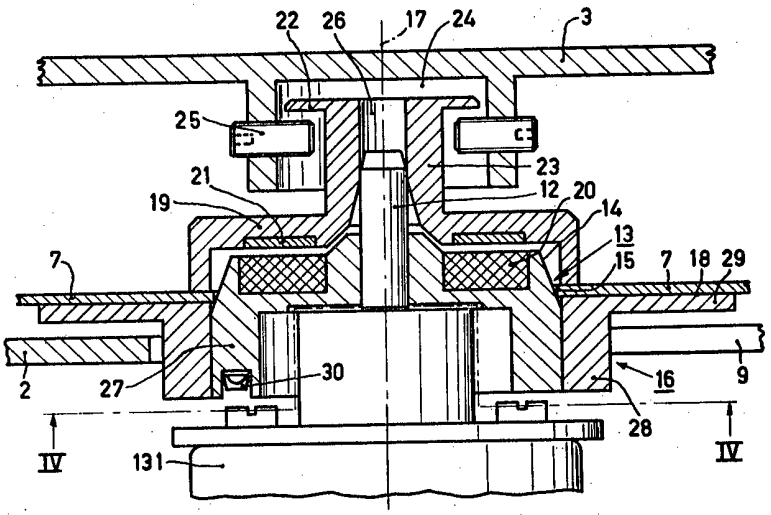
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Fig. 3

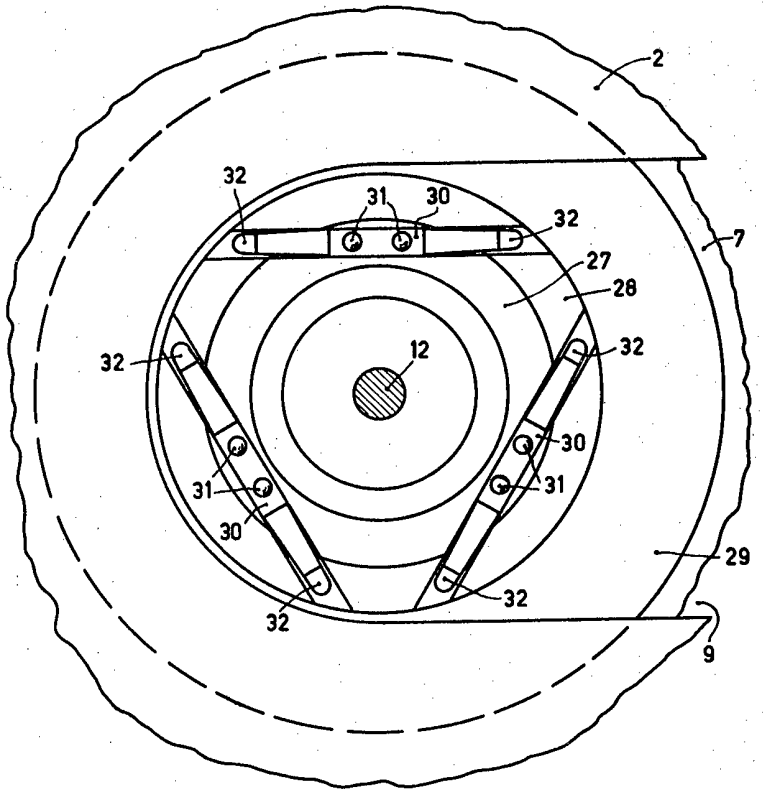

Fig. 4