

Description

This invention relates generally to improvements in video recorder-playback machines, and more specifically, to an improved spindle clamp assembly for securely positioning and accurately centering a video information disc on a rotatable drive spindle of a video recorder-playback machine.

Video recorder-playback machines in general are known in the art and include appropriate means for recording and/or playing back a video information signal utilizing a selected medium for storage of the signal. For example, in one type of machine, the video signal is recorded magnetically for storage and/or retrieval upon a length of so-called video tape. In another type of system, the video signal is recorded upon an information disc for retrieval by means of a stylus, in a manner analogous to that of sound reproduction from phonographic records. In still another type of system, the video signal is used to frequency modulate a beam of amplified light, such as a laser beam, with sufficient power for physically altering the surface characteristics of a light sensitive coating on a video information disc and thereby record the signal upon the disc. During playback, a lower power light beam is reflected from the disc and the resulting signal is demodulated to reproduce the recorded signal. In all of these types of systems, the video information signal can be combined with an appropriate audio signal for either recording or playback purposes to yield a composite audio-video signal of the type commonly used for television transmissions and the like. For convenience, however, the signal will be referred to herein as a video information signal.

Video recorder-playback machines utilizing light beams for recording and playback purposes offer significant advantages in that all physical contact of the recording and playback elements with the storage medium, namely, the information disc, is avoided. This prevents wear and deterioration of the machine elements and the disc, resulting in a high quality stored video signal which can be played back repeatedly over a long period of time with unimpaired video resolution.

In video recorder-playback machines using amplified light beams for signal recording and playback, the recording and playback optical beams are focused upon the video information disc by a focusing lens which traverses the span of the disc in a radial direction simultaneously with rotation of the disc. In this manner, a spiral pattern of closely spaced tracks is formed on the disc to represent the video information. For maximum storage capacity for each disc, together with maximum signal resolution, the information tracks are formed to have a narrow width such as on the order of about 0.5 microns, and the center-to-center spacing between radially adjacent tracks in the spiralling pattern is on the order of about 1.5 microns. Accordingly, to prevent cross talk between the tracks during recording and/or play-

back operation, it is imperative that the video information disc be rotatably driven about a precisely located and repeatably obtained axis of rotation to minimize radial eccentricities. In the prior art, this accurate positioning and centering has been obtained by precisely forming an axially centered opening in the video information disc for reception of the disc upon a correspondingly precisely formed rotating spindle.

In particular, US-A-3 609 722 discloses clamping means (Figure 10) generally referred to as a compressor which is receivable over the spindle and includes balls and groove for locking engagement between the clamping means and the spindle. A disc engaging means is provided for engaging the disc adjacent its opening and retaining the disc on the spindle. A biasing means, referred to as compression spring is carried by the clamping means for effecting a biased engagement between the disc engaging means. However, with this construction, the disc opening and spindle tolerances are crucial for accurate centering of the disc within the allowable range of radial error. This centering problem becomes increasingly apparent with prolonged use since the central disc opening tends to enlarge over time as a result of wear.

Further, US-A-3968972 describes a disc-clamping member for flexible recording discs which clamping member is disposed coaxial with a circular drum fixed upon a rotatable shaft. A self-centering hub comprises a plurality of segmental centering elements and is disposed coaxially with the circular drum in such a way that the centering elements abut against an angularly-bevelled, conical surface along the outer edge of an inner annular ridge. Thus, the centering elements are cammed diametrically outwards as the clamping member is increasingly moved toward the circular drum, with the centering elements being utilized to hold the disc in slightly resiliently-centered position. This arrangement of the prior art does not positively prevent free wandering of the disc-clamping member at high speeds of rotation, since it is solely supported by an overhead bridge portion. Therefore, the arrangement is not usable for a securely clamping of discs at high speed rotation.

It is an object of the invention to improve the spindle clamp assembly for a recorder-playback machine in order to accurately and repeatably center an information disc upon a rotatable drive spindle, and further to securely clamp the disc in position upon the spindle without excessive strain forces.

In accordance with the invention, a spindle clamp assembly for positioning a disc upon a rotatable drive member through an opening formed in the disc, comprises: disc engaging means for engaging the disc adjacent its opening, said disc engaging means comprising radially expandible means rotatable by said rotatable drive member and received within the opening formed in the disc, said expandible means presenting a tapered face for engaging with a

complementary shaped expansion element, clamping means acting on said expansion element for displacing said expansion element towards said expansible means and thereby substantially uniformly radially expanding said expansible means into bearing engagement with the disc for centering the disc with respect to the spindle, characterized in that said rotatable drive member includes a spindle having a shaft portion for reception through the opening in the disc, said clamping means is receivable over the spindle and includes locking means for locking engagement with the spindle; said radially expansible means and said expansion element are journaled about said spindle, and biasing means including said expansion element which is axially movable for applying clamping forces from said clamping means to said radially expansible means and creating said substantially uniformly radially expansion of said expansible means upon locking engagement of said clamping means with said spindle.

Further developments of the invention are subject of sub-claims.

Other features and advantages of the present invention will become apparent from the following detailed description, taken in conjunction with the accompanying drawings, which illustrate by way of example the principles of the invention.

The accompanying drawings illustrate the invention. In such drawings:

Fig. 1 is a fragmented perspective view illustrating, partially the exploded form, a video recorder-playback machine;

Fig. 2 is an enlarged fragmented perspective view of a portion of the machine illustrating, partially in exploded form, use of the spindle clamp assembly of this invention;

Fig. 3 is an enlarged fragmented vertical section of the spindle clamp assembly illustrating the invention in locking engagement with a rotatable drive spindle of the machine;

Fig. 4 is a top plan view of the spindle clamp assembly; and

Fig. 5 is an enlarged fragmented vertical section of a portion of the spindle clamp assembly taken substantially along the line 5—5 of Fig. 4.

As shown in the exemplary drawings, the present invention is embodied in a video recorder-playback machine 10 having suitable optical and electronic elements for recording and playback of video information from a video information disc 14. The information disc 14 is removably supported within the machine upon a spindle assembly 18 for controlled high speed rotation of the disc during the recording and playback operations. A clamp assembly 20 cooperates with the spindle assembly 18 to clamp the disc 14 in a precisely centered position for accurate, high speed rotation without radial substantial eccentricities or rotational slippage.

The machine 10, including the clamp assembly 20 of this invention, comprises an improvement over the prior art in that the clamp assembly 20 is designed to center the disc 14 accurately and

repeatedly with respect to the axis of rotation of the spindle assembly 18. The disc 14 is centered quickly and easily by placement of the clamp assembly 20 in locking engagement with the spindle assembly 18 and without requiring a precise or close tolerance between a disc central opening 15 and the spindle assembly 18. The invention provides additional improvements in that the clamp assembly 20 is adapted to secure upon the spindle assembly 18 any of a multiplicity of discs having a variety of different thicknesses with substantially uniform clamping forces whereby the machine can accommodate a variety of discs of different thickness without slippage during rotation.

As shown in Fig. 1, the video recorder-playback machine 10 includes a machine base 12 which provides support for a relatively high power laser generator unit 16, such as an argon ion laser, for use in recording a prescribed video information signal upon the disc 14. The high power laser generator unit 16 emits a highly amplified collimated beam of light for redirection by a suitable mirror assembly 22 to an electronically driven modulator 24. The modulator 24 is driven by a suitable frequency modulated electronic signal supplied via an input lead 26 wherein the electronic signal is representative of the desired video information. The modulator 24 responds to the electronic signal to interrupt appropriately the amplified beam of light to pass a corresponding modulated optical signal beam. This resultant optical signal beam is therefore representative of the prescribed video information. Conveniently, in many instances, the electronic signal comprises a composite audio-video signal of the type commonly used in television transmissions and which, when supplied to the modulator 24, yields an optical signal beam representative of the composite audio and video information. However, for sake of clarity and ease of description, all further reference herein will be to video information.

The modulated optical signal beam is incident upon a second mirror assembly 28 for redirection to a mobile optics carriage 30. This optics carriage 30 includes an angularly disposed dichroic mirror 32 for reflection of the optical signal beam in an upward direction for passage through a focusing assembly 34. The focusing assembly 34 carries an objective lens assembly 36 for focusing the optical signal beam to a precise spot on the underside of the video information disc 14.

The optics carriage 30 is movably positioned by a carriage drive assembly 38 along a path in a radial direction with respect to the disc 14. In this manner, the objective lens assembly 36 is movably positioned with respect to the disc 14 along a radius of the disc to control the point of focusing of the optical signal beam upon the disc. The carriage drive assembly 38 comprises a precision lead screw 48 supported for rotation by a bracket 50 which can be secured to a frame 40 and to the machine base 12 by a plurality of bolts 42. The lead screw 48 threadably receives a lead screw

nut 52 coupled via a nonrotational coupling indicated at 54 to a sleeve-type push block 46 received freely about the lead screw 48. As illustrated, the push block 46 is secured to an upright wall 44 of the optics carriage 30.

The lead screw 48 is oriented in a direction parallel with the required radial direction of movement of the optics carriage 30. A relatively slow speed motor 56 and a relatively high speed motor 58 are connected to the lead screw 48 through a selective clutch unit 60, and this clutch unit is operated to control driving of the lead screw 48 about its own axis either at a relatively slow or relatively fast speed of rotation.

As illustrated in Fig. 1, the optics carriage 30 is driven by the lead screw 48 in a radially outward direction with respect to the disc 14 whenever the lead screw 48 is rotated to cause the lead screw nut 52 to push against the push block 46. When the lead screw is rotated in an opposite direction, the lead screw nut 52 travels along the screw in an opposite direction. To assure that the optics carriage 30 follows in the opposite, or radially inward direction, the carriage 30 is secured by pins 62 to a linear track member 64 which is springably urged with respect to the disc 14 in the radially inward direction by a constant tension band spring 66 wound about a barrel 68 secured to the frame 40. The track member 64 is slidably mounted on a track guide 70 to accommodate movement linearly of the optics carriage 30 in both the radially inward and the radially outward directions.

The video information disc 14 is rotatably driven about a vertical axis by the spindle assembly 18 simultaneously with linear movement of the optics carriage 30. More specifically, the disc 14 is vertically supported upon a rotatable drive spindle 72 including an upwardly extending annular shoulder 74 for supporting the disc and an upper shaft portion 76 received through the disc central opening 15. The drive spindle 72 is carried within an upright spindle housing 78 which is secured to the machine base 12 and supports the spindle 72 for relatively high speed rotation, such as on the order of about 1800 rpm, about its vertical axis. A drive motor (not shown) is drivingly coupled to the spindle 72 for rotating the spindle at the relatively high speed of rotation.

In operation, the optical signal beam is focused upon the underside of the video information disc 14 by the radially traversing objective lens assembly 36 on the optics carriage 30 simultaneously with high speed rotation of the disc. By appropriately controlling the relationship between radial traversal and rotational speed, the optical signal beam is focused upon the disc along a spiraling pattern of closely spaced tracks. Importantly, the disc 14 includes a photosensitive coating, such as a layer of thin metal or a photoresist material, adapted to be physically altered by the high power optical signal beam whereby the optical signal beam is physically recorded upon the disc as a pattern of discontinuities

representative of the prescribed video information. In practice, the closely spaced tracks have a width on the order of about 0.5 microns and a center-to-center spacing of about 1.5 microns.

As illustrated in Fig. 1, a relatively low power laser generator unit 80, such as a helium-neon laser, is mounted directly upon the optics carriage 30 for use in retrieving or playing back the recorded video information from the disc 14. This low power laser generator unit 80 emits an amplified and collimated beam of light for reflection off the disc 14 whereby the reflected optical beam comprises a modulated playback beam which is alternately reflected and nonreflected in accordance with the recorded video information. This modulated playback beam is of sufficiently low power to avoid physical alteration of the photosensitive coating on the disc 14.

The amplified beam of light from the low power laser generator unit 80 is redirected by a suitable mirror assembly 82 on the optics carriage 30 for appropriate incidence upon an angularly oriented mirror 84 which reflects the beam upwardly through the dichroic mirror 32 for focusing upon the disc 14 by the objective lens assembly 36. The reflected modulated playback beam is returned through the lens assembly 36 and by the mirror 84 to appropriate optical and electronic components 86 for demodulating the playback beam to the form of an electronic signal representative of the prescribed video information. This electronic signal can be supplied to an appropriate video display device, such as a television receiver, for playback of the recorded video information. Importantly, playback can occur independently of the recording function or substantially simultaneously with the recording function to serve as a check of the recording resolution.

The clamp assembly 20 of this invention is provided for securely mounting the information disc 14 upon the spindle assembly 18 in a precise and repeatably obtained centered location so as to allow accurate positioning of the optical beams for precision recording and playback without cross talk between the closely spaced tracks. Moreover, the clamp assembly 20 is provided for securely clamping the disc 14 in position on the spindle assembly 18 so as to assure consistent and accurate rotation of the disc at the required relatively high rotational speeds. The clamping is obtained without undue strain on the disc so as to allow relatively fragile discs formed from polished glass or the like to be used, such as during a mastering process, and to allow the machine to accommodate discs having a variety of thicknesses.

The clamp assembly 20 of this invention is shown in more detail in Figs. 2—5 and comprises a shell-shaped, downwardly open housing 88 including locking means for locking engagement with the upper shaft portion 76 of the rotatable drive spindle 72, as will be described in more detail. Moreover, the clamp assembly 20 includes a radially expansible sleeve 90 and an annular wedge collet 92 mounted over the spindle

assembly shaft portion 76 for cooperating with each other and with the locking means for radially centering the disc on the rotatable drive spindle 72.

As best shown in Figs. 2 and 3, the rotatable drive spindle 72 includes a radially enlarged base 75 of relatively wide cross section from which the annular shoulder 74 extends upwardly. This base 75 merges with the upper shaft portion 76 of a relatively narrow cross section for reception within the central opening 15 of the video information disc 14. The upper shaft portion 76 is positioned in alignment with the vertical axis of the spindle assembly 18, whereby rotational driving of the spindle 72 within the spindle housing 78 rotates the upper shaft portion 76 about said vertical axis.

The spindle upper shaft portion 76 is sized for relatively loose reception of the radially expansible sleeve 90 which is in turn relatively loosely receivable within the central opening 15 of the disc 14. This radially expansible sleeve 90 is formed from a suitable plastic material such as Delrin or the like, and comprises an annular split sleeve which is retained relatively snugly about the shaft portion 76 by a resilient retaining ring 93, such as an O-ring, received in a peripheral sleeve groove 94. Conveniently, if desired, the sleeve 90 and the upper shaft portion 76 can include complementary shaped shoulders, as illustrated at 96, for preventing slippage of the sleeve 90 upwardly off the shaft portion 76. Importantly, as illustrated, the sleeve 90 includes an angularly upwardly and radially inwardly presented tapered conical face 98 for engagement with the wedge collet 92.

The wedge collet 92 is received about the upper shaft portion 76 above the expansible sleeve 90, and is formed from a relatively rigid, non-expansible material such as stainless steel or the like. The wedge collet 92 is vertically slidable with respect to the upper shaft portion 76 and includes an angularly downwardly and radially outwardly tapered conical face 100 for engagement with the conical face 98 of the sleeve 90.

The housing 88 of the clamp assembly 20 includes a compression spring 102 for biasing the wedge collet 92 downwardly into engagement with the sleeve 90 when the assembly 20 is lockingly received over the spindle 72. More specifically, the spring 102 is retained within an annular chamber 104 in the housing 88 and bears downwardly against an annular washer 106. This washer 106 is retained within the housing 88 by an annular plug 108 threadably secured into the housing and including a radially inwardly projecting annular stop 110 for limiting downward vertical motion of the washer 106. However, when the assembly 20 is received over the spindle 72, the washer 106 bears downwardly against the wedge collet 92 as illustrated in Fig. 3 for substantially uniform radial expansion of the split sleeve 90. In this manner, the sleeve 90 is expanded to bearingly engage the disc 14 within the central opening 15 with substantially uniform radial forces whereby the disc 14 is accurately centered on the spindle 72.

A locking stud 112 is threadably secured into the upper shaft portion 76 of the spindle and extends

upwardly therefrom along the vertical axis of the spindle 72. The locking stud 112 includes a radially outwardly presented recess 114 for receiving locking balls 116 for locking engagement with the clamp assembly 20. These locking balls 116 are carried within complementary-sized radial passages 118 formed near the lower end of a locking cylinder 120 which is received in a vertically extending passage 119 within the housing 88.

The locking cylinder 120 includes a downwardly open cylindrical chamber 122 receiving a cylindrical cap-shaped bushing 124 biased downwardly by a small compression spring 125 within the chamber 122. The cylinder 120 also carries a push pin projecting downwardly through the bushing 124 for bearing engagement with the top of the stud 112. When the clamp assembly 20 is lockingly received over the upper shaft portion 76 of the spindle 72, the bushing 124 bears against the top of the stud 112, and the head 127 of the push pin 126 is slightly spaced above the top of the stud, as illustrated in Fig. 3.

The upper end of the locking cylinder 120 is secured to a horizontally extending axle rod 128 which is carried for rotation within the opposite ends of a generally U-shaped lever arm 130. This lever arm 130 carries at its opposite ends a pair of cam rollers 132 in rolling engagement with the upper surface 131 of the housing 88. As illustrated in Fig. 5, the axis of rotation of the axle rod 128 is positioned above the axis of rotation of the rollers 132, whereby pivoting motion of the lever arm 130 with the rollers 132 in rolling engagement with the housing 88 serves to vertically shift the position of the locking cylinder 120 within the passage 119 with respect to the housing 88.

In use, rotation of the lever arm 132 in the direction of arrow 134 in Fig. 3 to the horizontal position illustrated in Figs. 3-5 serves to lift the locking cylinder 120 within the housing 88 to bring the locking balls 116 into registry with the stud locking recess 114. More specifically, the cylinder passage 119 in the housing 88 is sized to urge and retain the balls 116 radially inwardly within their radial passages 118 into the stud recess 114 to lock the clamp assembly 20 upon the stud 112 and to prevent upward movement of the locking cylinder 120 within the housing 88. Importantly, in this position, the annular washer 106 is in bearing engagement with the wedge collet 92 for appropriate radial expansion of the sleeve 90 and accurate centering of the disc 14.

When the lever arm 130 is rotated upwardly in the direction opposite to arrow 134 in Fig. 3, toward the generally vertical position illustrated in Fig. 2, the locking cylinder 120 is pushed by the rod 128 downwardly within the housing 88 to bring the head 127 of the push pin 126 into bearing engagement with the top of the stud 112. At this point, the locking cylinder 120 is itself locked against downward movement by the balls 116 in the stud recess 114 whereby the housing 88 lifts with respect to the locking cylinder 120. This lifting motion of the housing 88 brings an enlarged annular chamber 138 in the housing 88 into vertical alignment with

the radial ball passages 118 whereby the balls 116 are allowed to displace radially outwardly from the locking recess 114 of the stud 112. This allows the housing 88 and the locking cylinder 120 to be lifted simultaneously from the stud 112, whereupon the spring 125 urges the bushing 124 downwardly to close off the inner diameter of the ball passages 118 and thereby retain the balls 116 in the enlarged housing chamber 138. The head 127 of the push pin 126 limits downward movement of the bushing 124 out of the locking cylinder chamber 122.

The clamp assembly 20 is quickly and easily repositioned in locking engagement with the stud 112 by pressing the housing 88 over the stud and moving the lever arm 130 back to the horizontal position shown in Figs. 3—5. This causes the stud 112 to retract the bushing 124 upwardly within the chamber 122 against the force of the spring 125, and thereby allows radially inward movement of the balls 116 into the stud recess 114 when appropriate vertical alignment is obtained. The downward pivoting motion of the lever arm 130 shifts the locking cylinder 120 upwardly within the housing 88 to draw the balls 116 upwardly out of alignment with the enlarged housing chamber 138 and into the stud recess 114. At the same time, the washer 106 is moved into downward bearing engagement with the wedge collet 92.

Accordingly, the spindle clamp assembly 20 of this invention for a video recorder-playback machine 10 securely and accurately centers the information disc 14 upon a spindle assembly 18 in a precise and repeatable manner.

A variety of modifications and improvements to the spindle clamp assembly of this invention are believed to be apparent to one skilled in the art. Accordingly, no limitation on the invention is intended, except as set forth in the appended claims.

Claims

1. A spindle clamp assembly for positioning a disc upon a rotatable drive member through an opening formed in the disc, comprising:

— disc engaging means for engaging the disc adjacent its opening, said disc engaging means comprising radially expansible means (90) rotatable by said rotatable drive member and received within the opening in the disc;

— said expansible means (90) presenting a tapered face (98) for engaging with a complementary shaped expansion element (92);

— clamping means (20) acting on said expansion element (92) for displacing said expansion element (92) towards said expansible means (90) and thereby substantially uniformly radially expanding said expansible means (90) into bearing engagement with the disc for centering the disc with respect to the spindle;

characterized in that

— said rotatable drive member (72) includes a spindle (76) having a shaft portion for reception through the opening in the disc;

— said clamping means (20) is receivable over

the spindle (76) and includes locking means (114, 116, 120) for locking engagement with the spindle;
— said radially expansible means (90) and said expansion (92) are journaled about said spindle (76); and

— biasing means (92, 102, 106) including said expansion element (92) which is axially movable for applying clamping forces from said clamping means (20) to said radially expansible means (90) and creating said substantially uniformly radially expansion of said expansible means (90) upon locking engagement of said clamping means (20) with said spindle (76).

2. The spindle clamp assembly of Claim 1, characterized in that

— said expansion element is a collet (92) receivable about the spindle (76) between the radially expansible means (90) and the locking means (114, 116) for effecting a biased engagement between said expansible means (90) and the disc;

— said radially expansible means is a radially expansible sleeve (90) receivable about the spindle (76) and within the opening formed in the disc, said sleeve (90) and said collet (92) being configured with respect to each other such that displacement of said collet (92) toward said sleeve causes substantially uniform radial expansion of said sleeve (90) into bearing engagement with the disc for centering the disc with respect to the spindle; and

— said biasing means (92, 102, 106) includes a spring (102) arranged for engaging said collet (92) when said clamping means (20) is received over the spindle (76) for displacing said collet (92) towards said sleeve (90) for radial expansion of said sleeve (90).

3. The spindle clamp assembly of Claim 2, characterized in that

— the tapered annular face (98) of the sleeve (90) is presented radially inwardly and generally toward said collet, and wherein said collet includes a face (100) presented generally toward said sleeve for bearing engagement with said sleeve face.

4. The spindle clamp assembly of Claim 3, characterized in that

— said collet face (100) is a tapered annular face presented radially outwardly and generally toward said sleeve.

5. The spindle clamp assembly of Claim 2, characterized in that

— said sleeve (90) comprises a split collet.

6. The spindle assembly of Claim 5, characterized by

— retainer means (93) for normally biasing said split collet to a radially non-expanded configuration.

7. The spindle clamp assembly of Claim 6, characterized in that

— said sleeve has a radially outwardly presented groove (94) formed therein, said retainer means (93) comprising a resilient ring received in said groove.

8. The spindle clamp assembly of Claim 1, characterized in that

the radial ball passages 118 whereby the balls 116 are allowed to displace radially outwardly from the locking recess 114 of the stud 112. This allows the housing 88 and the locking cylinder 120 to be lifted simultaneously from the stud 112, whereupon the spring 125 urges the bushing 124 downwardly to close off the inner diameter of the ball passages 118 and thereby retain the balls 116 in the enlarged housing chamber 138. The head 127 of the push pin 126 limits downward movement of the bushing 124 out of the locking cylinder chamber 122.

The clamp assembly 20 is quickly and easily repositioned in locking engagement with the stud 112 by pressing the housing 88 over the stud and moving the lever arm 130 back to the horizontal position shown in Figs. 3—5. This causes the stud 112 to retract the bushing 124 upwardly within the chamber 122 against the force of the spring 125, and thereby allows radially inward movement of the balls 116 into the stud recess 114 when appropriate vertical alignment is obtained. The downward pivoting motion of the lever arm 130 shifts the locking cylinder 120 upwardly within the housing 88 to draw the balls 116 upwardly out of alignment with the enlarged housing chamber 138 and into the stud recess 114. At the same time, the washer 106 is moved into downward bearing engagement with the wedge collet 92.

Accordingly, the spindle clamp assembly 20 of this invention for a video recorder-playback machine 10 securely and accurately centers the information disc 14 upon a spindle assembly 18 in a precise and repeatable manner.

A variety of modifications and improvements to the spindle clamp assembly of this invention are believed to be apparent to one skilled in the art. Accordingly, no limitation on the invention is intended, except as set forth in the appended claims.

Claims

1. A spindle clamp assembly for positioning a disc upon a rotatable drive member through an opening formed in the disc, comprising:

— disc engaging means for engaging the disc adjacent its opening, said disc engaging means comprising radially expandable means (90) rotatable by said rotatable drive member and received within the opening in the disc;

— said expandable means (90) presenting a tapered face (98) for engaging with a complementary shaped expansion element (92);

— clamping means (20) acting on said expansion element (92) for displacing said expansion element (92) towards said expandable means (90) and thereby substantially uniformly radially expanding said expandable means (90) into bearing engagement with the disc for centering the disc with respect to the spindle;

characterized in that

— said rotatable drive member (72) includes a spindle (76) having a shaft portion for reception through the opening in the disc;

— said clamping means (20) is receivable over

the spindle (76) and includes locking means (114, 116, 120) for locking engagement with the spindle; — said radially expandable means (90) and said expansion (92) are journaled about said spindle (76); and

— biasing means (92, 102, 106) including said expansion element (92) which is axially movable for applying clamping forces from said clamping means (20) to said radially expandable means (90) and creating said substantially uniformly radially expansion of said expandable means (90) upon locking engagement of said clamping means (20) with said spindle (76).

2. The spindle clamp assembly of Claim 1, characterized in that

— said expansion element is a collet (92) receivable about the spindle (76) between the radially expandable means (90) and the locking means (114, 116) for effecting a biased engagement between said expandable means (90) and the disc;

— said radially expandable means is a radially expandable sleeve (90) receivable about the spindle (76) and within the opening formed in the disc, said sleeve (90) and said collet (92) being configured with respect to each other such that displacement of said collet (92) toward said sleeve causes substantially uniform radial expansion of said sleeve (90) into bearing engagement with the disc for centering the disc with respect to the spindle; and

— said biasing means (92, 102, 106) includes a spring (102) arranged for engaging said collet (92) when said clamping means (20) is received over the spindle (76) for displacing said collet (92) towards said sleeve (90) for radial expansion of said sleeve (90).

3. The spindle clamp assembly of Claim 2, characterized in that

— the tapered annular face (98) of the sleeve (90) is presented radially inwardly and generally toward said collet, and wherein said collet includes a face (100) presented generally toward said sleeve for bearing engagement with said sleeve face.

4. The spindle clamp assembly of Claim 3, characterized in that

— said collet face (100) is a tapered annular face presented radially outwardly and generally toward said sleeve.

5. The spindle clamp assembly of Claim 2, characterized in that

— said sleeve (90) comprises a split collet.

6. The spindle assembly of Claim 5, characterized by

— retainer means (93) for normally biasing said split collet to a radially non-expanded configuration.

7. The spindle clamp assembly of Claim 6, characterized in that

— said sleeve has a radially outwardly presented groove (94) formed therein, said retainer means (93) comprising a resilient ring received in said groove.

8. The spindle clamp assembly of Claim 1, characterized in that



— the locking means (114, 116, 120) includes means (114) forming a radially outwardly presented recess and a locking cylinder (120) movably carried in said clamping means (20) and having a plurality of radial passages (118) formed therein; locking balls (116) received in said passages; and means (126, 130) for moving said cylinder between a first position with said locking balls positioned partially within said recess for locking said clamping means on the spindle, and a second position with said locking balls in registry with a radially enlarged chamber (138) formed in said clamping means for allowing displacement of said balls from said recess formed in said spindle and removal of said clamping means from the spindle.

9. The spindle clamp assembly of Claim 8, characterized by

— means (124, 125) for preventing radially inward motion of said locking balls (116) when said clamping means is removed from the spindle.

10. The spindle clamp assembly of Claim 2, characterized in that

— said biasing means (92, 102, 106) comprises an annular washer (106) carried for movement with respect to said clamping means (20) for engagement with said collet (92) when said clamping means (20) is received over the spindle (76), the spring (102) reacting between said clamping means (20) and said washer (106) for urging said washer (106) into bearing engagement with said collet (92).

11. The spindle clamp assembly of Claim 10, characterized by

— stop means (110) for limiting displacement of said annular washer (106) with respect to said clamping means.

Patentansprüche

1. Eine Spindel-Klemmvorrichtung zur Positionierung einer Platte auf einem drehbaren Antriebselement durch eine in der Platte gebildete Öffnung, in der enthalten sind:

— Platteneingreiffvorrichtungen, die auf der Platte in der Nähe ihrer Öffnung eingreifen, wobei die genannten Platteneingreiffvorrichtungen radial ausdehnbare Vorrichtungen (90) enthalten, die von dem genannten drehbaren Antriebselement gedreht werden können und innerhalb der in der Platte gebildeten Öffnung aufgenommen werden;

— wobei die genannten ausdehnbaren Vorrichtungen (90) eine abgeschrägte Fläche (98) aufweisen, die mit einem komplementär geformten Ausdehnungselement (92) in Berührung gebracht werden;

— Klemmvorrichtung (20), die auf das genannte Ausdehnungselement (92) einwirken, um das genannte Ausdehnungselement (92) in Richtung auf die genannten ausdehnbaren Vorrichtungen zu verschieben und dadurch die genannte ausdehnbare Vorrichtung (19) im wesentlichen gleichförmig und in radialer Richtung erweitern, bis sie

die Platte berührt, um die Platte bezüglich der Spindel zu zentrieren;

dadurch gekennzeichnet, daß

— das genannte drehbare Antriebselement (72) eine Spindel (76) enthält, die einen Wellenteil aufweist, der von der Öffnung in der Platte aufgenommen wird;

— die genannte Klemmvorrichtung (20) auf der Spindel (76) aufgenommen werden kann und Verriegelungsvorrichtungen (114, 116, 120) aufweist, um eine Verriegelung mit der Spindel durchzuführen;

— die genannte in radialer Richtung ausdehnbare Vorrichtung (90) und das genannte Ausdehnungselement (92) sind um die genannte Spindel (76) herum gelagert sind; und

— Vorspannvorrichtungen (92, 102, 106) unter Einschluß des genannten Ausdehnungselements (92) vorgesehen sind, die in axialer Richtung verschiebbar sind, um Klemmkraft von den genannten Klemmvorrichtungen (20) auf die genannten in radialer Richtung ausdehnbaren Vorrichtungen (90) auszuüben und die genannte im wesentlichen gleichförmige radiale Ausdehnung der genannten ausdehnbaren Vorrichtungen (90) zu erzeugen, wenn die genannten Klemmvorrichtungen (20) mit der genannten Spindel verriegelt werden.

2. Die Spindel-Klemmvorrichtung nach Anspruch 1, dadurch gekennzeichnet, daß

— das genannte Ausdehnungselement ein Ring (92) ist, der auf die Spindel (76) zwischen den in radialer Richtung ausdehnbaren Vorrichtungen (90) und den Verriegelungsvorrichtungen (114, 116) aufgesteckt werden kann, um eine Vorspannung zwischen den genannten ausdehnbaren Vorrichtungen (90) und der Platte zu erzeugen;

— die genannte in radialer Richtung ausdehnbare Vorrichtung eine in radialer Richtung ausdehnbare Muffe (90) ist, die auf die Spindel (76) und innerhalb der in der Platte ausgebildeten Öffnung aufgesetzt werden kann, wobei die genannte Muffe (90) und der genannte Ring (92) im Bezug aufeinander so ausgebildet sind, daß eine Verschiebung des genannten Rings (92) in Richtung auf die genannte Muffe eine im wesentlichen gleichförmige radiale Ausdehnung der genannten Muffe (90) bis zur Berührung mit der Platte ergibt, um die Platte bezüglich der Spindel zu zentrieren; und

— die genannten Vorspannvorrichtungen (92, 102, 106) eine Feder (102) enthalten, die so angeordnet ist, daß sie den genannten Ring (92) berührt, wenn die genannte Klemmvorrichtung (20) auf die Spindel (76) aufgesetzt wird, um den genannten Ring (92) in Richtung auf die genannte Muffe (90) zu verschieben, damit sich die genannte Muffe (90) in radialer Richtung ausdehnt.

3. Die Spindel-Klemmvorrichtung von Anspruch 2, dadurch gekennzeichnet, daß

— die abgeschrägte ringförmige Fläche (98) der Muffe (90) in radialer Richtung nach innen und im allgemeinen auf den genannten Ring verläuft und wobei der genannte Ring eine Fläche (100) aufweist, die im allgemeinen auf die genannte Muffe



verläuft, um die genannte Fläche der Muffe zu berühren.

4. Die Spindel-Klemmvorrichtung von Anspruch 3, dadurch gekennzeichnet, daß

— die genannte Fläche (100) des Rings eine abgeschrägte ringförmige Fläche ist, die radial nach außen und im allgemeinen auf die genannte Muffe verläuft.

5. Die Spindel-Klemmvorrichtung von Anspruch 2, dadurch gekennzeichnet, daß

— die genannte Muffe (90) einen geschlitzten Ring enthält.

6. Die Spindel-Klemmvorrichtung von Anspruch 5, dadurch gekennzeichnet, daß

— Haltevorrichtungen (93) vorgesehen sind, um den genannten geschlitzten Ring im allgemeinen in einer Konfiguration vorzuspanssen, die in radialer Weise nicht ausgedehnt ist.

7. Die Spindel-Klemmvorrichtung von Anspruch 6, dadurch gekennzeichnet, daß

— die genannte Muffe eine radial nach außen weisende Kerbe (94) enthält und die genannten Haltevorrichtungen (93) einen elastischen Ring aufweisen, der in die genannte Kerbe eingelegt ist.

8. Die Spindel-Klemmvorrichtung von Anspruch 1, dadurch gekennzeichnet, daß

— die Verriegelungsvorrichtungen (114, 116, 120) Vorrichtungen (114) enthalten, die eine radial nach außen weisende Vertiefung ausbilden und einen Verriegelungszylinder (120), der in der genannten Klemmvorrichtung (20) beweglich gehalten ist und in dem eine Vielzahl von radialen Durchgängen (118) ausgebildet ist; Verriegelungskugeln (116) in den genannten Durchgängen aufgenommen sind; und Vorrichtungen (126, 130) vorgesehen sind zur Bewegung des genannten Zylinders zwischen einer ersten Position, bei der die genannten Verriegelungskugeln teilweise innerhalb der genannten Vertiefung angeordnet sind, um die genannte Klemmvorrichtung auf der Spindel zu verriegeln, und einer zweiten Position, in der die genannten Verriegelungskugeln mit einer in radialer Richtung vergrößerten Kammer ausgerichtet sind, die in der genannten Klemmvorrichtung ausgebildet ist, um eine Verschiebung der genannten Kugeln von der genannten Vertiefung in der genannten Spindel zu erlauben sowie die Entfernung der genannten Klemmvorrichtung von der Spindel.

9. Die Spindel-Klemmvorrichtung von Anspruch 8, gekennzeichnet durch

— Vorrichtungen (124, 125), die verhindern, daß sich die genannten Verriegelungskugeln (116) radial nach innen bewegen, wenn die genannte Klemmvorrichtung von der Spindel entfernt wird.

10. Die Spindel-Klemmvorrichtung von Anspruch 2, dadurch gekennzeichnet, daß

— die genannten Vorspannvorrichtungen (92, 102, 106) eine ringförmige Beilagscheibe (106) enthalten, die bezüglich der genannten Klemmvorrichtung (20) beweglich gehalten ist, um den genannten Ring (92) zu berühren, wenn die genannte Klemmvorrichtung (20) auf die Spindel

(76) aufgesetzt ist, wobei die Feder (102) zwischen der genannten Klemmvorrichtung (20) und der genannten Unterlagscheibe (106) wirkt, um die genannte Unterlagscheibe (106) in Berührung mit dem genannten Ring (92) zu bringen.

11. Die Spindel-Klemmvorrichtung von Anspruch 10, gekennzeichnet durch

— Anschlagvorrichtungen (110) zur Begrenzung der Verschiebung der genannten ringförmigen Beilagscheibe (106) bezüglich der genannten Klemmvorrichtung.

Revendications

1. Dispositif de serrage de broche pour placer un disque sur un organe rotatif d'entraînement à travers une ouverture formée dans le disque, comprenant:

un moyen d'engagement du disque pour engager le disque à proximité de son ouverture, ledit moyen d'engagement du disque comprenant un moyen radialement dilatable (90) pouvant être entraîné en rotation par ledit organe d'entraînement en rotation et reçu dans l'ouverture formée dans le disque;

ledit moyen dilatable (90) présentant une face effilée (98) pour engagement avec un élément de dilatation (92) de forme complémentaire;

un moyen de serrage (20) agissant sur ledit élément de dilatation (92) pour déplacer ledit élément de dilatation (92) vers ledit moyen dilatable (90) et ainsi dilater radialement sensiblement uniformément ledit moyen dilatable (90) en engagement d'appui avec le disque pour centrer le disque par rapport à la broche;

caractérisé en ce que

ledit organe d'entraînement en rotation (72) comprend une broche (76) ayant une partie de tige pour réception à travers l'ouverture du disque;

ledit moyen de serrage (20) peut être reçu sur la broche (76) et comprend un moyen de blocage (114, 116, 120) pour un engagement de blocage avec la broche;

ledit moyen radialement dilatable (90) et ledit élément de dilatation (92) sont tourbillonnés autour de ladite broche (76); et

un moyen de sollicitation (92, 102, 106) comprenant ledit élément de dilatation (92) qui est axialement mobile pour appliquer des forces de serrage dudit moyen de serrage (20) audit moyen radialement dilatable (90) et créer ladite dilatation radialement sensiblement uniforme dudit moyen dilatable (90) lors d'un engagement de blocage dudit moyen de serrage (20) avec ladite broche (76).

2. Dispositif de serrage de broche de la revendication 1 caractérisé en ce que

ledit élément de dilatation est une douille (92) pouvant être reçue autour de la broche (76) entre le moyen radialement dilatable (90) et le moyen de blocage (114, 116) pour effectuer un engagement sollicité entre ledit moyen dilatable (90) et le disque;

ledit moyen radialement dilatable est un man-



chon radialement dilatable (90) pouvant être reçu autour de la broche (76) et dans l'ouverture formée dans le disque, ledit manchon (90) et ladite douille (92) étant configurés relativement l'un à l'autre de façon qu'un déplacement de ladite douille (92) vers ledit manchon provoque une dilatation radiale sensiblement uniforme dudit manchon (90) en engagement d'appui avec le disque pour centrer le disque par rapport à la broche;

ledit moyen de sollicitation (92, 102, 106) comprend un ressort (102) agencé pour engager ladite douille (92) lorsque ledit moyen de serrage (20) est reçu sur la broche (76) pour déplacer ladite douille (92) vers ledit manchon (90) pour une dilatation radiale dudit manchon (90).

3. Dispositif de serrage de broche de la revendication 2 caractérisé en ce que

la face annulaire effilée (98) du manchon (90) est présentée radialement vers l'intérieur et généralement vers ladite douille, et où ladite douille comprend une face (100) présentée généralement vers ledit manchon pour un engagement d'appui avec ladite face du manchon.

4. Dispositif de serrage de broche de la revendication 3 caractérisé en ce que

ladite face (100) de la douille est une face annulaire effilée présentée radialement vers l'extérieur et généralement vers ledit manchon.

5. Dispositif de serrage de broche de la revendication 2 caractérisé en ce que

ledit manchon (90) comprend une douille fendue.

6. Dispositif de serrage de broche de la revendication 5 caractérisé par

un moyen de retenue (93) pour solliciter normalement ladite douille fendue à une configuration radialement non dilatée.

7. Dispositif de serrage de broche de la revendication 6 caractérisé en ce que

ledit manchon a une gorge présentée radialement vers l'extérieur (94) qui y est formée, ledit moyen de retenue (93) compre-

nant une bague élastique reçue dans ladite gorge.

8. Dispositif de serrage de broche de la revendication 1 caractérisé en ce que

le moyen de blocage (114, 116, 120) comprend un moyen (114) formant un évidement présenté radialement vers l'extérieur et un cylindre de blocage (120) porté de manière mobile dans ledit moyen de serrage (20) et ayant un certain nombre de passages radiaux (118) qui y sont formés; des billes de blocage (116) reçues dans lesdits passages; et un moyen (126, 130) pour déplacer ledit cylindre entre une première position avec lesdites billes de blocage placées partiellement dans ledit évidement pour bloquer ledit moyen de serrage sur la broche et une seconde position avec lesdites billes de blocage correspondant à une chambre radialement élargie (138) formée dans ledit moyen de serrage pour permettre le déplacement desdites billes dudit évidement formé dans ladite broche et l'enlèvement dudit moyen de serrage de ladite broche.

9. Dispositif de serrage de broche de la revendication 8 caractérisé par

un moyen (124, 125) pour empêcher un mouvement radialement vers l'intérieur desdites billes de blocage (116) lorsque ledit moyen de serrage est retiré de la broche.

10. Dispositif de serrage de broche de la revendication 2 caractérisé en ce que

ledit moyen de sollicitation (92, 102, 106) comprend une rondelle annulaire (106) portée pour un mouvement par rapport audit moyen de serrage (20) pour engagement avec ladite douille (92) lorsque ledit moyen de serrage (20) est reçu sur la broche (76), le ressort (102) réagissant entre ledit moyen de serrage (20) et ladite rondelle (106) pour solliciter ladite rondelle (106) en engagement d'appui avec ladite douille (92).

11. Dispositif de serrage de broche de la revendication 10 caractérisé par

un moyen d'arrêt (110) pour limiter le déplacement de ladite rondelle annulaire (106) par rapport audit moyen de serrage.



* C L M S *