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ADJUSTABLE SHEAVE

Filed July 21, 1944

Fig. 1.

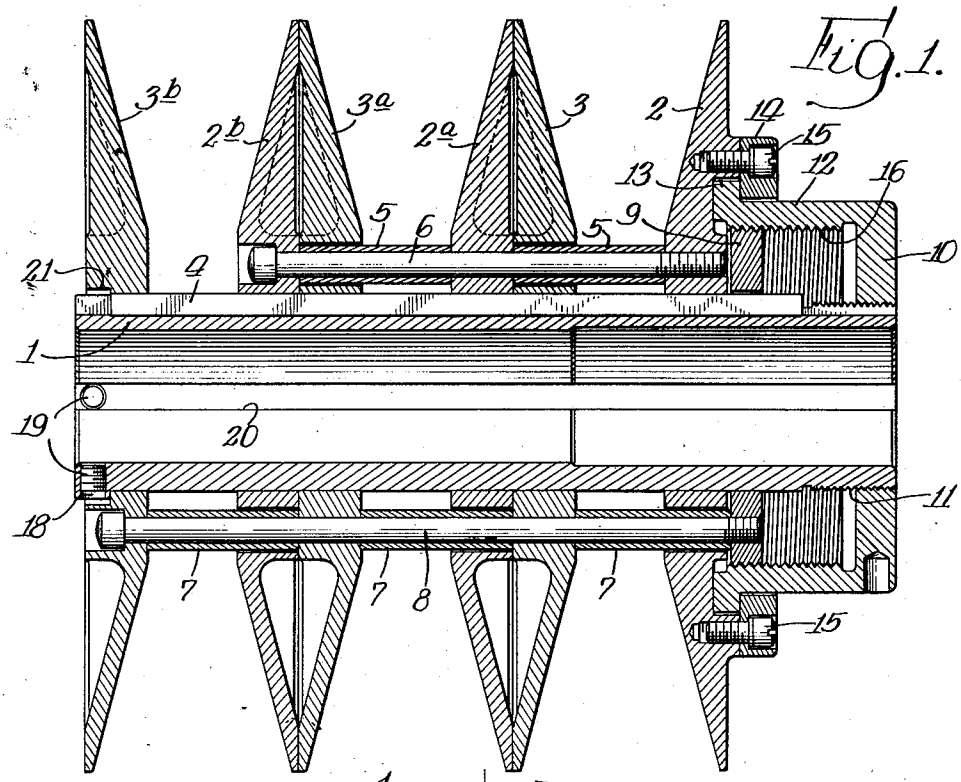
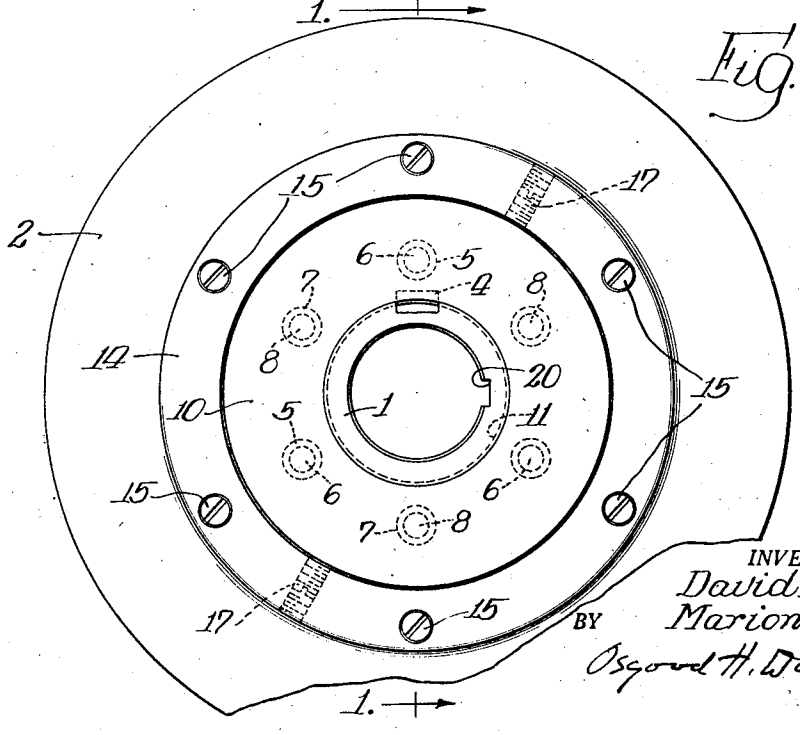


Fig. 2.



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2,400,294

ADJUSTABLE SHEAVE

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8 Claims. (Cl. 74—230.17)

This invention aims to provide an improved variable pitch sheave of the type in which adjustment is controlled by an adjusting nut coaxial with the sheave. An example of the type of sheave referred to is disclosed in the Nylan Patent No. 2,254,045, of August 26, 1941. The present invention seeks to obtain the advantages of the Nylan device in a simpler structure giving additional advantages.

The invention will be best understood by reference to an illustrated embodiment thereof shown in the accompanying drawing, in which:

Fig. 1 is a longitudinal section of the illustrative sheave taken on the line 1—1 of Fig. 2, and

Fig. 2 is an end view looking at the right hand end of Fig. 1 and indicating in dotted lines the several sets of spacers and tie bolts associated with the two axially shiftable groups of sheave discs.

The illustrative sheave comprises a hub 1 and annular discs mounted thereon, said discs having conical faces and arranged with alternate discs facing the others, thereby providing a plurality of V-grooves for the belts of a multiple V-belt drive. Corresponding side walls of the several belt grooves are provided by the group of discs 2, 2^a and 2^b, and the opposite side walls of said belt grooves are provided by the group of discs 3, 3^a and 3^b arranged in alternation with and confronting the others. The discs are slidably fitted on the hub but held from rotation relative thereto by the spline 4. The discs of each group are rigidly connected in spaced relation, and the two groups of discs are relatively shiftable axially for adjusting the pitch diameter of the sheave. As shown, the discs 2, 2^a and 2^b are spaced by tubular spacers 5, and these discs and spacers are connected by tie bolts 6 shown as long screws screwed into the disc 2 and having heads countersunk in the disc 2^b. The discs 3, 3^a and 3^b and a threaded ring 9 coaxial therewith are spaced by tubular spacers 7, and these elements are connected by tie bolts 8 shown as long screws screwed into the ring 9 and having heads countersunk in the disc 3^b. For each of the two groups of discs there are several suitably angularly spaced sets of spacers and tie bolts, as indicated in dotted lines in Fig. 2. The spacers 5 of the group of discs 2, 2^a and 2^b are slidable through the intervening discs of the other group, and likewise the spacers 7 of said other group are slidable through said discs 2, 2^a and 2^b. Thus the adjustable sheave structure comprises two relatively axially shiftable units, each comprising a group of discs rigidly connected in spaced relation and arranged in alternation with and confronting the discs of the other unit, the belt grooves being provided each by a pair of confronting discs. The construction as thus far described is substantially identical to that of the Nylan patent except that the unit comprising the group of discs 2, 2^a and 2^b is free of any additional annular element such as the ring 11 of the Nylan patent.

Adjustment of the sheave is controlled by a mechanism now to be described including an adjusting nut 10 screwed on the threaded extension 11 of the hub, said nut being at the other side of the end sheave disc 2 and having a tubular extension 12 enclosing the ring 9.

Said adjusting nut 10 is swivel-coupled to the group of sheave discs 2, 2^a, 2^b for moving said group axially with the nut in either direction, or in other words is so swivel-coupled thereto as to hold said group of discs in fixed axial relation to the nut while permitting relative rotation of the latter. As shown, the tubular nut extension 12 has an end flange 13, and the flanged end of the nut fits in a circular recess in the outer side of said disc 2 and is held against said disc or in fixed axial relation thereto by a collar or annular member 14 cooperating with said flange, said collar 14 being rigidly fastened to said disc by screws 15. Thus the nut is swivel-coupled to said group of discs 2, 2^a, 2^b by a direct swiveling of the nut to said end disc 2.

The adjusting nut is screw-coupled to the other group of sheave discs 3, 3^a, 3^b by threaded engagement of said nut with the ring 9. As shown, the tubular nut extension 12 has a relatively coarse internal screw thread 16 engaging a corresponding screw thread on said ring 9, the relation of these threads to those connecting the nut and hub being such that upon rotation of the nut the ring 9 and discs connected thereto move axially relative to the hub for the same distance as the nut in the opposite direction to that in which the nut moves axially. This is accomplished by interengaging screw threads of the nut and ring 9 of a pitch twice as great as the pitch of the interengaging screw threads of the nut and screw 11, all screw threads progressing in the same direction or being of the same hand, i. e. either right handed or left handed as preferred. Ordinary right handed screw threads are shown. For example, assuming the convolutions of the interengaging coarse screw threads of the nut and ring 9 to be ten per inch, those of the interengaging fine screw threads of the nut and hub screw 11 will be twenty per inch.

Thus the adjusting nut 10 is swivel-coupled

to the one sheave unit or group of discs 2, 2a, 2b for moving it axially with the nut in either direction, and screw-coupled to the complemental unit or group of discs 3, 3a, 3b for moving it axially an equal distance in the opposite direction. The control mechanism though relatively simple in principle gives the same advantageous result as that of the Nylan patent, in that, by rotation of an adjusting nut screwed on the sheave hub, the two groups of sheave discs are shifted axially equal distances in opposite directions, thus adjusting the pitch diameter of the sheave without shifting the belt-groove centers and hence without disturbing the alignment of the belt grooves of the driving and driven sheaves in a drive or power transmission mechanism utilizing the invention. However, with the simpler control mechanism of the present invention there is gained the further advantage that the relative movement of the two groups of sheave discs is twice as great as the axial movement of the nut. Thus a relatively large range of adjustment is obtainable with a comparatively short travel of the adjusting nut, which is a factor contributing to compactness or lessening the room required for the control mechanism.

In Fig. 1 the sheave is shown with its two groups of discs in the relationship assumed at one limit of adjustment, namely when the confronting discs 2 and 3, 2a and 3a and 2b and 3b are spread apart as far as possible. Assuming for example that in the condition of the structure shown the central hub portions of said confronting discs are 1¼" apart, or in other words that the range of adjustment or relative axial movement of the two groups of discs is 1¼", then rotation of the adjusting nut 10 to feed axially only $\frac{9}{16}$" to the left from the position shown will contract the sheave to its opposite limit of adjustment, bringing the confronting sheave discs into contact or as closely together as possible. For a range of adjustment of a half inch (which would be ample in many cases), the nut would need to feed only a quarter of an inch.

The feature of swivel-coupling the adjusting nut to the one group of discs 2, 2a, 2b by swiveling the nut directly to the end disc 2 is one of important advantage, as it permits utilizing a substantially shorter adjusting nut than would be required if the nut were swiveled to an extra ring connected to said discs and arranged at the outer side of the ring 9, besides eliminating the complexity of such an indirect coupling.

Another incidental advantage of the control mechanism of the illustrated sheave is that it can be secured in any given adjustment by very simple means represented in Fig. 2 by radial set screws 17 carried by and in threaded engagement with the collar 14 and adapted to be screwed against the tubular extension 12 of the adjusting nut.

The illustrative sheave is excellently adapted for manufacture on a mass production basis, being of comparatively simple construction and relatively easy to assemble. In the specific construction shown, the hub 1 has at its tail end a flange 18 and radial set screws 19 one of which is to bear directly against the shaft on which the hub is mounted and the other of which is to bear against a shaft key (not shown) fitted in the keyway 20. The sheave disc 3b is rabbeted at 21 so that in the expanded state of the sheave said disc 3b encloses the flange 18, thus reducing the essential length of the hub. With this construction, the sheave discs with the spacers and tie bolts associated with the respective groups of discs must be assembled on the hub before assembling the control mechanism therewith. After such assembly on the hub of said discs, spacers and tie bolts, and while the spline 4 and tie bolts 8 are in partially retracted positions, the control mechanism may be assembled by first screwing the ring 9 into the adjusting nut 10 to the position therein shown, then screwing said nut on the hub to the position shown, then forcing spline 4 forwardly to the position shown in which it engages in a notch or keyway in said ring 9, then screwing the tie bolts 8 into the ring 9, and then attaching the collar 14; thus completing the assembly with the several parts in the relationship shown in the drawing. The sheave can then be adjusted to bring its two units or groups of discs 2, 2a, 2b and 3, 3a, 3b to any desired relation within the permissible range of adjustment, and secured in desired adjustment by tightening the set screws 17 to bear against its adjusting nut.

While a preferred form of embodiment of the invention has been described, other forms of embodiment may be adopted within the scope of the invention as defined in the appended claims. Subject-matter of the invention is applicable both to single grooved and multiple grooved sheaves. The hub 1 of the illustrative sheave typifies a "rotatable central support," which term may be construed as applying either to the sheave hub or shaft or to the hub and shaft combined. A "sheave" may be one having a disc-carrying hub member for application to a shaft as in the case of the illustrative sheave, or one in which the sheave discs are carried directly by the shaft in driving connection therewith.

We claim:

1. An adjustable sheave comprising two oppositely axially shiftable rigid annular units cooperating to form a belt groove, a rotatable central support carrying said units in driving connection therewith, and an adjusting nut screwed on said support and swivel-coupled to one of said units for moving it axially with the nut in either direction and screw-coupled to the other unit for moving it axially in the opposite direction to that in which the nut moves.

2. An adjustable sheave comprising two interarranged and oppositely axially shiftable units each comprising a plurality of rigidly connected spaced discs alternating and cooperating with those of the other to provide belt grooves, a rotatable central support carrying said units in driving connection therewith, and an adjusting nut screwed on said support and swivel-coupled to one of said units for moving it axially with the nut in either direction and screw-coupled to the other unit for moving it axially in the opposite direction to that in which the nut moves.

3. An adjustable sheave comprising two interarranged and oppositely axially shiftable groups of discs cooperating to form belt grooves, the discs of each group being rigidly connected in spaced relation and arranged in alternation with and confronting those of the other group, a rotatable central support carrying said groups of discs in driving connection therewith, an adjusting nut screwed on said support and swivel-coupled to one of said groups of discs for moving it axially with the nut in either direction, and an annular screw rigidly connected to and movable axially with the other group of discs and in threaded engagement with said nut, the interengaging threads of said nut and screw progressing in the

same direction as and being of a pitch twice as great as that of the interengaging threads of said nut and support.

4. An adjustable sheave comprising two interarranged and oppositely axially shiftable groups of discs cooperating to form belt grooves, the discs of each group being rigidly connected in spaced relation and arranged in alternation with and confronting those of the other group, a rotatable central support carrying said groups of discs in driving connection therewith, an adjusting nut screwed on said support and swivel-coupled directly to the adjacent disc for moving the group including it axially with the nut in either direction, and an annular screw in threaded engagement with and operable by the nut for moving the other group of discs axially in the opposite direction to that in which the nut moves, said screw being rigidly connected to said other group of discs and arranged between the nut and the disc to which it is swivel-coupled and said disc being between the nut and all of the other discs.

5. An adjustable sheave comprising two interarranged and oppositely axially shiftable groups of discs cooperating to form belt grooves, the discs of each group being rigidly connected in spaced relation and arranged in alternation with and confronting those of the other group, a rotatable central support carrying said groups of discs in driving connection therewith, an adjusting nut screwed on said support and swivel-coupled directly to the adjacent disc for moving the group including it axially with the nut in either direction, said nut having an interiorly threaded extension abutting the back of said disc to which it is so coupled and the latter being between it and all the other discs, and an axially movable annular member non-rotatable relative to said support rigidly connected to the other group of discs and enclosed by and in screw-threaded engagement with said nut, the interengaging threads of said nut and member progressing in the same direction as and being of a pitch twice as great as that of the interengaging threads of said nut and support.

6. An adjustable sheave comprising a rotatable central support, a pair of confronting annular discs mounted thereon in driving connection therewith and cooperating to form a belt groove, said discs being axially shiftable toward and away from each other, and an adjusting nut screwed on said support and swivel-coupled directly to the adjacent disc for moving it axially with the nut in either direction and screw-coupled with the other disc for moving it axially in the opposite direction to that in which the nut moves.

7. An adjustable sheave comprising a rotatable central support, a pair of confronting annular discs mounted thereon in driving connection therewith and cooperating to form a belt groove, said discs being axially shiftable toward and away from each other, an adjusting nut screwed on said support and swivel-coupled directly to the adjacent disc for moving it axially with the nut in either direction, and an axially movable annular member non-rotatable relative to said support rigidly connected to the other disc and in screw-threaded engagement with said nut, the interengaging threads of said nut and member progressing in the same direction as and being of a pitch twice as great as that of the interengaging threads of said nut and support.

8. An adjustable sheave comprising complemental groove-forming components movable axially toward and away from each other, a screw coaxial with said components and in fixed relation to the sheave axis, one of said components being between said screw and the other of said components, a second axially movable screw coaxial with said components and rigid with said other of the components, and an adjusting nut in threaded engagement with both screws and swivel-coupled to said one of the components for moving it axially with the nut in either direction, the interengaging threads of said nut and second screw progressing in the same direction as and being of a pitch twice as great as that of the interengaging threads of said nut and first mentioned screw.

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