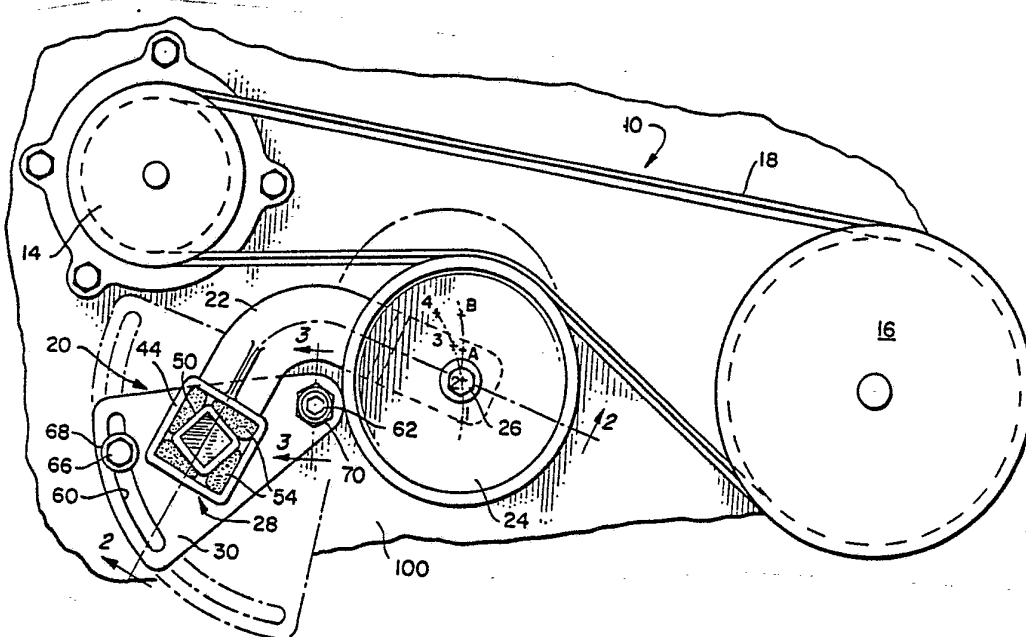




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(54) Title: IDLER MECHANISM



(57) Abstract

An idler mechanism (20) for maintaining tension on a drive belt (18) in a drive belt system comprising an idler arm (22), a pulley (24) mounted on the arm for rotation about a rotational axis (26), a pivotally adjustable mounting plate (30), means (28) pivotally mounting the arm to the mounting plate eccentrically with respect to the pivot axis of the plate, and resilient means (54) operatively associated with the pivotal mounting means for resiliently biasing the pulley (24) into tensioning engagement with the drive belt (18). Application of a predetermined input torque to the pivot axis of the adjustable plate imparts a substantially constant tension to the drive belt substantially independent of belt length within predetermined tolerances.

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DescriptionIdler MechanismTechnical Field

5 The present invention relates to drive belt
tensioning systems and, more particularly, to an
idler mechanism for use in a belt drive tensioning
system.

Background Art

10 Belt drive systems are widely and conventionally
used in various applications to transmit power be-
tween a power source and a device to be driven.
Typical of such a use is the conventional belt drive
system employed on engines of various types to trans-
mit power between an engine operated accessory drive
15 and a driven accessory, such as a water pump, etc..
Belt drive systems generally include a driving pulley,
associated with the accessory drive, and at least
one driven pulley, associated with the accessory,
connected by an endless belt that transmits the rota-
20 tion of the driving pulley to the driven pulley.
To operate most efficiently and with minimum belt
wear the tension of the belt must be periodically
adjusted to an optimum tension range sufficiently
high to efficiently transmit power without excessively
25 stretching and wearing the belt. To accomplish this
belt tensioning it has become common to utilize idler
mechanisms comprising an idler pulley positioned
between the driving and driven pulleys to engage
and apply tension to the drive belt. The more sophis-
30 ticated idler mechanisms employ a tensioning idler
pulley which is resiliently biased into tensioning



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engagement with the drive belt. By resiliently biasing the idler pulley many shortcomings associated with rigidly mounted idler mechanisms are overcome and the mechanism is better able to compensate for
5 many operational variations which affect belt tension, such as variations in load and belt wear.

U.S. Patent No. 4,144,772 to Brackin et al discloses an arm supported idler pulley wherein the arm is pivotable on and resiliently connected to,
10 using a block of elastomeric material, a rigidly secured and fixedly positioned mounting assembly therefor. Notwithstanding the resilient mounting, it has been found that the tension imparted to the drive belt by the idler pulley is directly related
15 to drive belt length and, to achieve optimum drive belt tensioning by repositioning the idler pulley requires monitoring of belt tension.

U.S. Patent No. 3,071,980 to Brewer exemplifies an idler pulley which is non-resiliently mounted
20 on an arm rotatably supported on a pivotable base. The pulley is repositionable to impart a desired tension to the drive belt by rotation of the mounting arm and pivotal shifting of the base. However, the idler mechanism arrangement disclosed in this patent
25 has the dual disadvantages that it requires a multi-step procedure to accurately reposition the idler pulley to retension the drive belt and, due to varying drive belt lengths, such repositioning requires monitoring of the drive belt tension to know when the
30 pulley is in optimum position.

Therefore, at least one very significant disadvantage of known idler mechanisms is that the idler mechanism adjustment necessary to optimally tension or retension drive belts varies widely with drive



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belt length. As is well known, even new drive belts vary in length within certain tolerances and, in use, drive belts stretch with an attendant drop in belt tension. Therefore, using known idler mechanisms, 5 each time a belt requires tensioning it becomes necessary to monitor the actual tension in the belt as the idler mechanism is adjusted to know when the optimum tension is reached. Such a requirement is unrealistic and impactical and rather than actually 10 monitor belt tension each time, known idler mechanisms are adjusted in a manner which insures at least a minimum acceptable tension in the belts. The practical effect of this practice is to consistently over-tension drive belts. This is very undesirable 15 since unnecessarily high belt tension requires the use of heavy duty bearings in the accessory drive and increases wear on and thus shortens the useful life of the drive belt. Therefore, to avoid this over-tensioning practice a need exists for an idler 20 mechanism which is capable of establishing substantially optimum tension in the drive belt without need to monitor belt tension during idler pulley repositioning.

Disclosure of the Invention

25 In one aspect of the present invention this is accomplished by providing, in a belt drive system, an idler mechanism capable of tensioning a drive belt to a substantially optimum tension range without monitoring belt tension by application of a constant 30 input torque.

In another aspect of the invention an idler mechanism capable of tensioning a drive belt to a substantially optimum tension range is provided which



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includes an idler pulley resiliently biased into tensioning engagement with the drive belt and a pivotable support arm for the pulley mounted on a pivotally adjustable plate, the pivot axis of the support arm being offset from the pivot axis of the plate to eccentrically mount the arm with respect to the pivot axis of the plate.

In a particularly preferred form of the invention the idler mechanism of the present invention comprises an idler arm, a pulley mounted on the arm for rotation about a rotational axis, a pivotally adjustable mounting plate, means pivotally mounting the arm to the mounting plate eccentrically with respect to the pivot axis of the plate, and resilient means operatively associated with the pivotal mounting means for resiliently biasing the pulley into tensioning engagement with the drive belt, whereby application of a predetermined input torque to the pivot axis of the adjustable plate imparts a substantially constant tension to the drive belt substantially independent of belt length within predetermined tolerances.

Brief Description of the Drawings

FIGURE 1 is a top plan view of a typical belt drive system showing the idler mechanism of the present invention in tensioning engagement with the drive belt.

FIGURE 2 is a sectional view taken substantially along line 2-2 in FIGURE 1.

FIGURE 3 is a sectional view taken substantially along line 3-3 in FIGURE 1.

FIGURE 4 is a perspective view of a specific embodiment of the idler mechanism of the present



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invention.

FIGURE 5 is a graphical representation showing the relationship between drive belt tension and idler pulley position or drive belt length for the idler mechanism of the present invention.

Best Mode For Carrying Out the Invention

Referring to the drawings, FIGURE 1 illustrates an engine accessory drive, designated generally as 10, that incorporates the idler mechanism of the present invention. It should be understood that although the idler mechanism of the present invention is disclosed herein in connection with accessory drive 10, the idler mechanism has equal applicability in other belt drive systems.

An engine accessory, herein illustrated as water pump 12, is driven by a belt drive system that includes driven pulley 14 operatively attached to the water pump drive shaft to impart rotational motion thereto. The belt drive system also includes a driving power source which is connected via power take off means (not shown) to the engine. Power is transmitted from driving pulley 16 of the driving power source to driven pulley 14 by an endless drive belt 18. Endless belt 18 is conventional in all respects and exhibits good frictional characteristics and adequate resiliency. As in all belt drive systems, to achieve efficient power transmission from driving pulley 16 to driven pulley 14, endless belt 18 must be maintained under suitable tension. In conventional manner the endless belt 18 is tensioned by an idler mechanism 20 comprising an idler arm 22 having an idler pulley 24 mounted thereon for rotation about a rotational axis 26. Mounting means



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28, described more fully hereinafter, pivotally
mounts arm 22 on a pivotally adjustable mounting
plate 30 which is itself mounted to the engine housing
100. Pulley 24 is resiliently biased into contact
5 with belt 18 to provide the desired tension therein
in a manner to be described more fully hereinafter.

The structure of the idler mechanism 20 of the
present invention can be seen in greater detail from
a consideration of FIGURES 2-4 in conjunction with
10 FIGURE 1. Pulley 24 includes a pair of pulley halves
32 and 34 that are secured back-to-back to define
a generally concave annular groove 36 in which belt
18 is received. Pulley halves 32 and 34 may be
fastened together in any convenient fashion such
15 as by welding or riveting. In the embodiment shown,
a bearing member 38 is centrally captivated in pulley
24 between the halves by stud member 40 which extends
through centrally aligned apertures in pulley halves
32 and 34 and bearing member 38 and is threadedly
20 received within aperture 42 in arm 22 for mounting
pulley 24 thereon.

Arm 22, in the embodiment shown, comprises an
end portion 22a affixed to mounting means 28 and
an offset end portion 22b having a boss 22c on which
25 pulley 24 is mounted. Offset end portion 22b and
boss 22c extend generally axially inward of and are
substantially housed within the recessed outer sur-
face of pulley half 34. Mounting means 28 includes
a tubular socket member 44 which is preferably square
30 in cross-section, as shown in FIGURE 1, defining
preferably square tubular passageway 46, and to which
arm end portion 22a is affixed. The central axis
48 of passageway 46 is the pivotal axis of arm 22
and is aligned generally parallel to the rotational



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axis 26 of pulley 24. Axially received within square tubular passage 46 is a generally square tubular sleeve member 50 which is rigidly affixed at one end, as by welding, to adjustable mounting plate 5 . 30 with the sleeve central axis substantially normal to plate 30. The outer surface of sleeve member 50 defines with the inner surface of passageway 46 an annular space 52 in which is received a plurality, preferably four, of generally elongated rod shaped 10 sections of resilient elastomeric material 54 which may, for example, be any suitably resilient natural or synthetic rubber. Rods 54 are inserted within annular space 52 in the axially extending spaces defined between the opposite side walls of socket 15 member 44 and sleeve member 50. Rods 54 have cross sectional dimensions before insertion somewhat greater than the dimensions of the spaces such that rods 54 are held within annular space 52 in a tight compressive engagement. As can be seen in FIGURE 1, with 20 rods 54 installed, sleeve member 50 is arranged substantially coaxially within socket member 44 and the members 50, 44 are relatively rotatable with respect to each other.

Mounting plate 30 is generally triangular having 25 a top surface 56 and a bottom surface 58 and is pivotally supported along bottom surface 58 for adjustable pivotal movement on engine housing 100. Plate 30 is provided with an arcuate slot 60 disposed generally along one side of mounting plate 30. Slot 60 preferably 30 corresponds to a circular arc having its radius extending from the pivotal axis 62 of plate 30, defined by pivot pin 64. An externally threaded bolt 66 projects outwardly from engine housing 100 and is received within arcuate slot 60. The head



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68 of bolt 66 rigidly secures mounting plate 30 to engine housing 100 when the bolt 66 is tightened. Mounting plate 30 is pivotally adjustable about pivot pin 64 located in the apex angle of plate 30 generally opposite slot 60. Pivot pin 64 extends through integral upstanding torque collar 70 surrounding aperture 72 on mounting plate 30 and is threadedly received in coaxially aligned reduced diameter aperture 74 in engine housing 100. Pivot pin 64 includes a head portion 76, having a tool receiving recess 78 in the upper surface thereof, an axially extending intermediate shank portion 80 and an externally threaded reduced diameter end shank portion 82. Pivot pin 64 is received within collar 70 and apertures 72 and 74 with the annular shoulder 84 defined between head 76 and intermediate shank portion 80 facing the upper surfaces of collar 70, with intermediate shank portion 80 received within collar 70 and aperture 72 and with the annular shoulder 86 defined between intermediate and end shank portion 80,82 facing the annular shelf 88 defined between apertures 72 and 74. It will be appreciated that the axial lengths of end shank portion 82 and intermediate shank portion 80 may be selected to cause pivot pin 64 to function only as a pivot axis for mounting plate 30 or also to rigidly secure mounting plate 30 to engine housing 100. Thus, if the shank length between shoulders 84 and 86 is greater than the height of collar 70 above engine housing 100, pivot pin 64 serves only a pivoting function since shoulder 86 will seat upon shelf 88 before shoulder 84 can seat upon and firmly grip the upper surfaces of collar 70 to rigidly fix mounting plate 30 in place. On the other hand, if the shank length between shoulders 84 and



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86 is less than the height of collar 70 above engine housing 100, then shoulder 84 will seat on the upper surfaces of collar 70 to rigidly fix mounting plate 30 in place before shoulder 86 seats on shelf 88.

5 Industrial Applicability

The idler mechanism 20 of the present invention has wide applicability in various type belt drive systems and is particularly advantageous because the tension it imparts to a drive belt for a given
10 torque input is substantially constant notwithstanding small variations in belt length. The manner in which this is accomplished with the idler mechanism of the present invention will appear more clearly from the following brief description of its manner
15 of operation.

In operation, the drive belt system is configured as in FIGURE 1 with pulley 24 adjusted to engage belt 18 and apply a tensioning force thereto. To adjust the tension in belt 18, bolt 66 and pivot
20 pin 64 are loosened to permit pivotally adjustable movement of mounting plate 30 relative to engine housing 100. A suitable tool, such as a torque wrench, is utilized to grasp torque collar 70 and to apply thereto a predetermined input torque. Mounting plate
25 30 rotates about its pivotal axis 62 with bolt 66 sliding within arcuate slot 60 to a pivotal position resulting from the applied torque. Bolt 66 and pivot pin 64 are then retightened to fix mounting plate 30 in its new position. The applied input torque
30 is transmitted via plate 30 through sleeve member 50, resilient rods 54 and socket member 44 to cause a pivotal repositioning of the pivot axis of arm



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22 and pulley 24 relative to drive belt 18 which results in an increased tension in belt 18. The pivotal repositioning of arm 22 caused by pivotal repositioning of plate 30 with pulley 24 in tensioning engagement with drive belt 18 is accomplished by
5 relative rotation of sleeve member 50 and socket member 44 causing deformation of resilient rods 54. The resiliency, i.e., elastic memory of rods 54, tends to bias arm 22 back to its pre-retensioned position and, in this manner, rods 54 function as
10 an elastomeric spring in applying a tensioning force to pulley 46.

It has been found that the idler mechanism of the present invention advantageously improves over prior art resiliently biased idler mechanisms by
15 virtue of the dual pivot arrangement whereby the initial tension in drive belt 18 is achieved during retensioning using eccentric pivot axis 62 whereas, following retensioning with mounting plate 30 fixed in position, pulley 46 is resiliently biased into
20 tensioning engagement with drive belt 18 using pivot axis 48. This use of an eccentric pivot for retensioning allows attainment of a substantially constant initial belt tension substantially independent of belt length within predetermined tolerances, by
25 application of a constant input torque. This feature is most important since it obviates the need to monitor belt tension during retensioning and eliminates any need for the practice of overtensioning to assure application of at least a minimum acceptable belt
30 tension.

The advantages of the eccentric pivot, resiliently biased idler mechanism of the present invention will become more apparent, particularly when compared



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to prior art fixed pivot resiliently biased idler mechanisms, from the following illustrative example.

A drive belt system, as shown generally to scale in FIGURE 1, was assembled utilizing a water pump
5 driven pulley diameter of about 9.65 centimeters, a driving pulley diameter of about 17.78 centimeters, an idler pulley diameter of about 12.70 centimeters, an offset distance of about 6.85 centimeters inches
10 between arm pivotal axis 48 and mounting plate pivotal axis 62 and a distance of about 15.24 centimeters between arm pivotal axis 48 and pulley rotational axis 26. The pivot axes of the various elements were positioned relative to one another as illustrated in FIGURE 1. For this system, the optimum initial belt tension is 31.75
15 KG. As the belt stretches during operation, the belt tension drops off until a minimum allowable tension of 18.14 KG. is reached at which point the belt is retensioned to a tension as close as possible to the optimum initial belt tension by application of a
20 constant input torque, determined to be 29.15 nt-m. in the case of the illustrated system, at the eccentric pivot axis 62. This retensioning causes the idler pulley rotational axis to move along path 1-2-3-4, depending upon belt length, and can be repeated each
25 time the belt stretches until the belt is worn beyond retensioning.

FIGURE 5 illustrates on the solid line curve the relationship between initial belt tension and belt length (also shown as idler pulley rotational axis
30 position on FIGURE 1) for the eccentric pivot idler mechanism of the present invention when a constant input torque of 29.15 nt-m is applied. It is noteworthy that the eccentric pivot idler mechanism maintains a substantially constant initial belt



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tension ranging between about 31.29 - 39.00 KG. for belt lengths varying from about 132.18 to 136.34 centimeters. This initial belt tension is always substantially greater than the minimum allowable belt tension and, therefore, assures a relatively long useful operational period for the drive belt system between retensionings. This was compared with a conventional fixed pivot resiliently biased idler mechanism having substantially the same dimension except, of course, that the constant input torque of 29.15 nt-m. was applied directly at the fixed arm pivot to cause idler pulley rotational axis 26 to move along path 1-2-A-B, depending upon belt length, and there is no eccentric pivot. The dashed line curve in FIGURE 5 illustrates the relationship between drive belt tension and belt length for the fixed pivot idler mechanism of the prior art. It is noteworthy that the initial belt tension constantly decreases with increasing belt length and is almost always less than the initial belt tension achieved by the eccentric pivot idler mechanism. Moreover, the difference between the initial belt tension achieved by the fixed pivot idler mechanism and the minimum allowable belt tension becomes quite small with increasing belt length. Therefore, the fixed pivot idler mechanism does not provide a substantially constant initial belt tension substantially independent of belt length and a system utilizing a fixed pivot idler mechanism would have to be retensioned many more times during the life of a belt than would a system utilizing the eccentric pivot idler mechanism.



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Claims

1. An idler mechanism for maintaining tension on a drive belt in a belt drive system which includes at least one driving pulley and one driven pulley operatively interconnected by a drive belt, comprising:

5 (a) pulley means for applying a belt tensioning force to said drive belt;

(b) an idler arm supporting said pulley means for rotation about a rotational axis;

10 (c) resilient means for applying a biasing force to said idler arm for biasing said pulley means into tensioning engagement with said drive belt;

(d) pivot axis forming means supporting said idler arm for rotation about a first pivot axis, said first pivot axis being positionable and the
15 belt tensioning force applied by said pulley means changing with the position of said first pivot axis; and

(e) positioning means for adjusting the position of said first pivot axis in response to a given
20 input torque to cause the resulting belt tension to be substantially constant and independent of belt length, within tolerances.

2. An idler mechanism, as claimed in claim 1, wherein said positioning means includes base means pivotally
25 adjustable about a second pivot axis.

3. An idler mechanism, as claimed in claim 2, wherein said first pivot axis is arranged eccentrically with respect to said second pivot axis.



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4. An idler mechanism, as claimed in claim 3, wherein said positioning means includes means for receiving the given input torque, said base means pivotally rotating about said second pivot axis in response to said given input torque for adjusting the position of said first pivot axis.

5. An idler mechanism, as claimed in claim 4, wherein said first and second pivot axes are substantially parallel.

6. An idler mechanism, as claimed in claim 5, wherein said pivot axis forming means is supported on said base means with said first pivot axis extending substantially normal to said base means.

7. An idler mechanism, as claimed in claim 6, wherein said pivot axis forming means comprises an elongated tubular socket member, said idler arm is secured to said socket member, and said first pivot axis comprises the central axis of said socket member.

8. An idler mechanism, as claimed in claim 7, wherein said positioning means further includes an elongated sleeve member secured to said base means with its central axis substantially normal to said base means, said sleeve member being received substantially coaxially within said socket member for relative rotation therebetween about said first pivot axis.

9. An idler mechanism, as claimed in claim 8, wherein said sleeve member and socket member define an axially extending annular space therebetween and said resilient means is disposed in said annular space.



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10. An idler mechanism, as claimed in claim 9,
wherein said resilient means comprises an elastomeric
spring.

5 11. An idler mechanism, as claimed in claim 9,
wherein said resilient means comprises a plurality
of elastomeric rods.

12. An idler mechanism, as claimed in claim 11,
wherein said sleeve and socket members are substan-
tially square in cross section and said elastomeric
10 rods are arranged in the axially extending spaces
defined between opposite walls of said socket and
sleeve members.

13. An idler mechanism, as claimed in claim 12,
wherein said rods have cross-sectional dimensions
15 greater than said spaces between said walls and said
rods are maintained in compressive engagement with
said walls within said annular space.

14. An idler mechanism, as claimed in claim 13,
wherein said base means comprises plate means having
20 a generally circular arcuate slot adapted for slidably
receiving fastening means therein, an aperture formed
in said plate having a center corresponding to said
second pivotal axis, said aperture adapted for receiv-
ing fulcrum defining means therein and arranged
25 relative to said slot for guided pivotal adjustment
of said plate means about said fulcrum defining means
with said fastening means guidingly slidable in said
slot.



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15. An idler mechanism for maintaining tension on a drive belt in a drive belt system comprising:

5 (a) an idler arm mounted for rotation about an arm pivot axis, said arm pivot axis being position-
able;

(b) an idler pulley mounted on said arm for rotation about a rotational axis, said idler pulley applying a belt tensioning force to said drive belt, said belt tensioning force changing with the position
10 of said arm pivot axis;

(c) resilient means for applying a biasing force to said idler arm for biasing said idler pulley into tensioning engagement with said drive belt;

(d) a mounting plate pivotally adjustable
15 around a plate pivot axis in response to a given input torque applied to said plate;

(e) means pivotally mounting said arm to said mounting plate for rotation about said arm pivot axis, said arm pivot axis being arranged eccentrically with respect to said plate pivot axis, whereby
20 adjustable pivoting of said plate about said plate pivot axis causes relative repositioning of said arm pivot axis and changes said belt tensioning force, the resulting belt tension being substantially
25 constant and independent of belt length within tolerances for a given input torque.

16. An idler mechanism, as claimed in claim 15, wherein said means pivotally mounting said arm to said mounting plate comprises:

30. an elongated tubular socket member, said arm being affixed to said socket member and extending substantially normal therefrom, said arm pivot axis comprising the central axis of said socket member;



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an elongated sleeve member secured to said mounting plate with the central axis of said sleeve member substantially normal to said plate, said sleeve member received substantially coaxially within said
5 socket member for relative rotation therebetween about said arm pivot axis, said sleeve member and said socket member defining an axially extending annular space therebetween; and

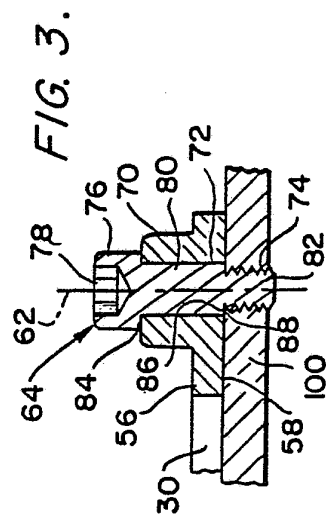
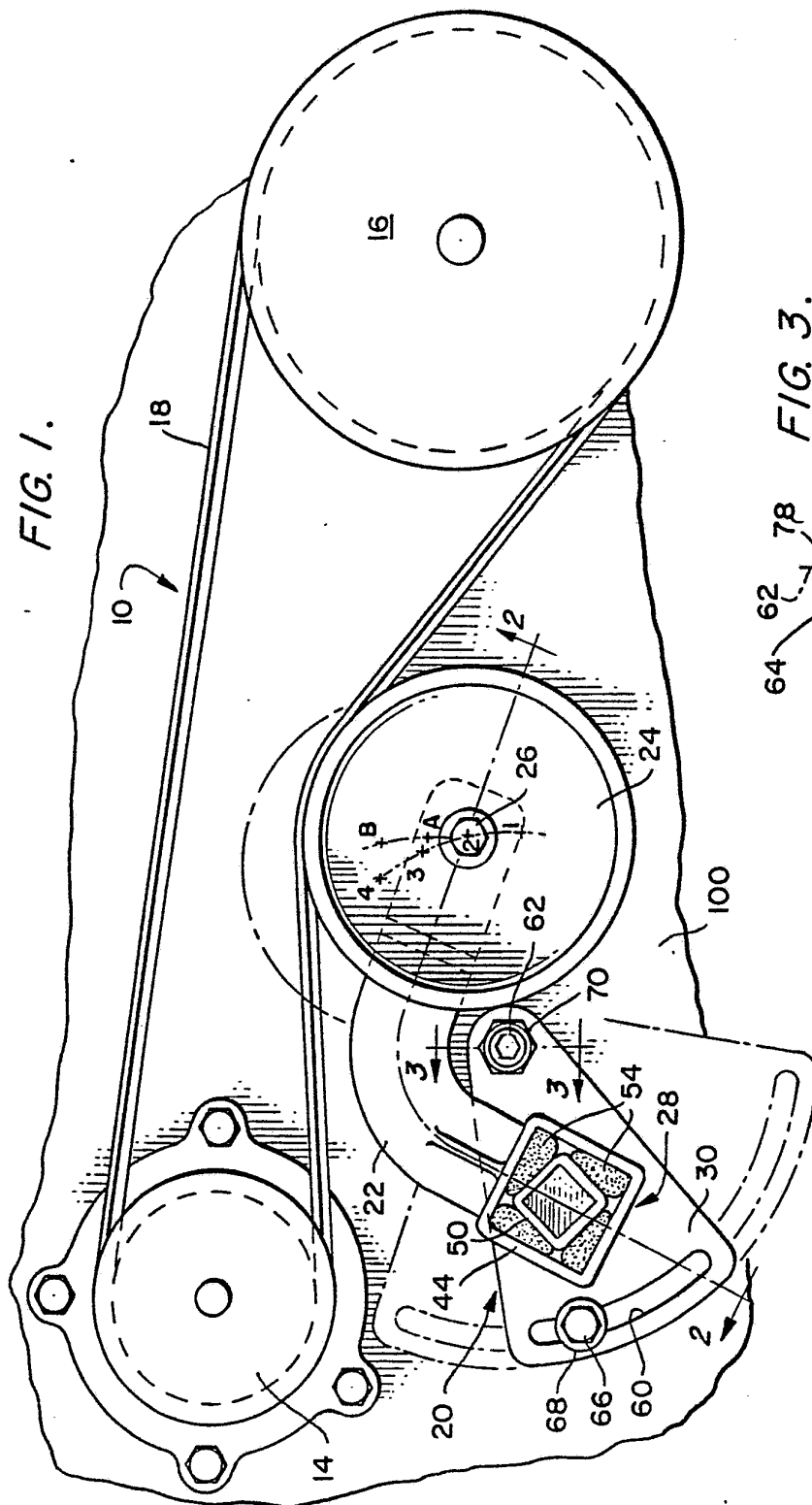
resilient means, comprising a plurality of elastomeric rods, arranged in said annular space in compressive engagement with said sleeve and socket members.

17. An idler mechanism, as claimed in claim 16, wherein said plate includes a generally circular
15 arcuate slot adapted for slidably receiving fastening means therein, an aperture having a center corresponding to said plate pivot axis adapted for receiving fulcrum defining means therein, said aperture arranged relative to said slot for guided pivotal
20 rotation of said plate about said fulcrum defining means with said fastening means guidingly slidable in said slot.

18. An idler mechanism, as claimed in claim 17, wherein said sleeve and socket members are substantially square in cross section and said elastomeric
25 rods are arranged in the axially extending spaces defined between opposite walls of said socket and sleeve members and said mounting plate is substantially triangular, said slot being arranged substantially
30 along one side of said triangle and said aperture being formed in said plate in the apex of the angle opposite said slot.



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SUBSTITUTE SHEET



2/2

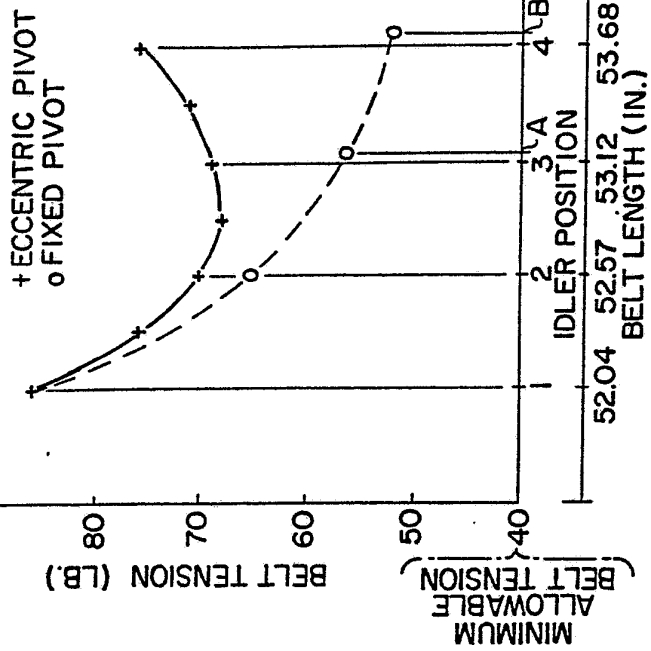
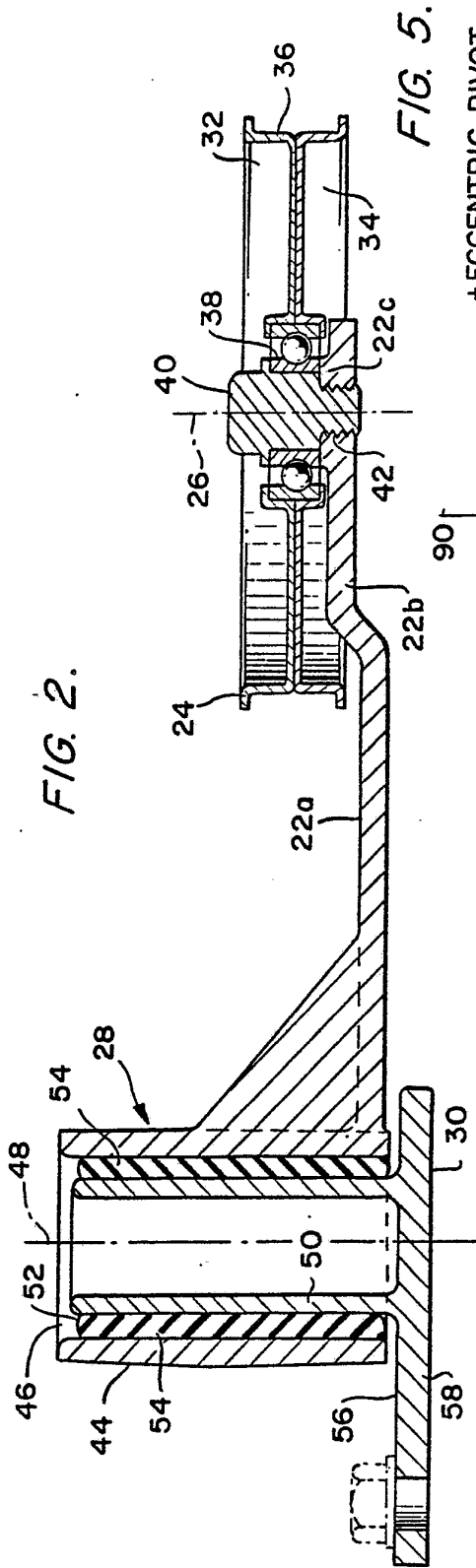
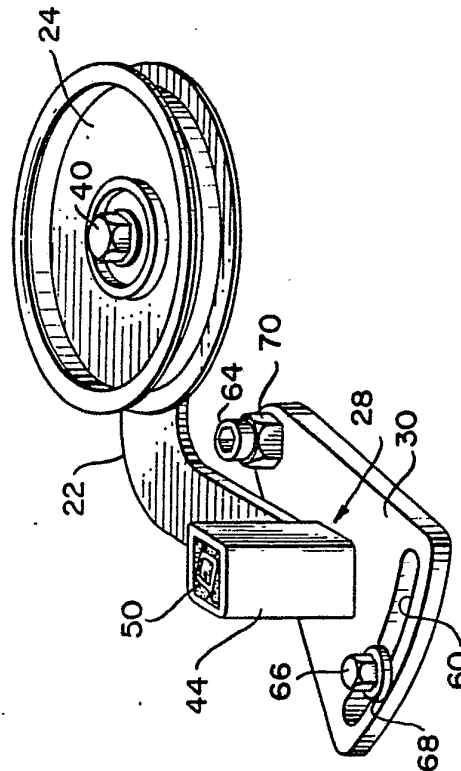
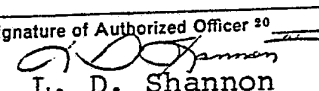


FIG. 4.



INTERNATIONAL SEARCH REPORT

International Application No PCT/US82/01825

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ³		
According to International Patent Classification (IPC) or to both National Classification and IPC		
INT. CL. 3	F16H 7/12	
U.S. CL.	474/135	
II. FIELDS SEARCHED		
Minimum Documentation Searched ⁴		
Classification System	Classification Symbols	
U.S.	474/111, 112, 113, 117, 133, 135	
Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in the Fields Searched ⁵		
III. DOCUMENTS CONSIDERED TO BE RELEVANT ¹⁴		
Category *	Citation of Document, ¹⁶ with indication, where appropriate, of the relevant passages ¹⁷	Relevant to Claim No. ¹⁸
X	US, A, 660,570 published 30 October 1900 Green	1-18
Y	US, A, 4,144,772 published 20 March 1979 Brackin	11-14,16-18
A	US, A, 3,071,980 published 8 January 1963 Brewer	1-18
A	US, A, 3,358,521 published 19 December 1967 Brownin, Jr.	1-18
A	US, A, 3,950,046 published 13 April 1976 Lubbersmeyer	1-10
A	US, E, Re. 30,842 published 5 January 1982 Speer	1-18
A	DE, A, 2,902,182 published 24 July 1980 Brenner	1-18
<div style="display: flex; justify-content: space-between;"> <div style="width: 48%;"> <p>* Special categories of cited documents: ¹⁵</p> <p>"A" document defining the general state of the art which is not considered to be of particular relevance</p> <p>"E" earlier document but published on or after the international filing date</p> <p>"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>"O" document referring to an oral disclosure, use, exhibition or other means</p> <p>"P" document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 48%;"> <p>"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.</p> <p>"&" document member of the same patent family</p> </div> </div>		
IV. CERTIFICATION		
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International Searching Authority ¹	Signature of Authorized Officer ²⁰	
ISA/US	 L. D. Shannon	