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BACKLASH COMPARATOR

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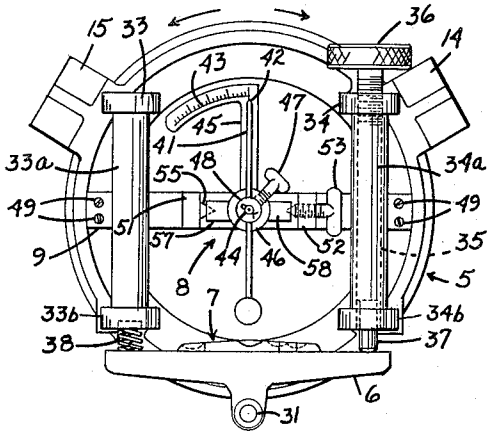


Fig. 1

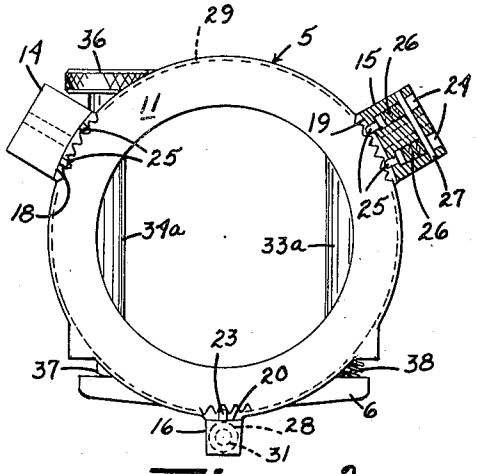


Fig. 2

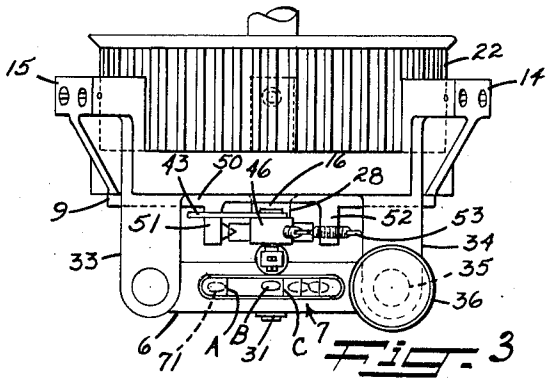


Fig. 3

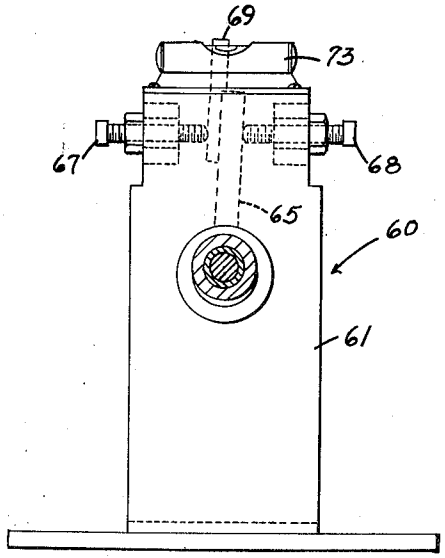
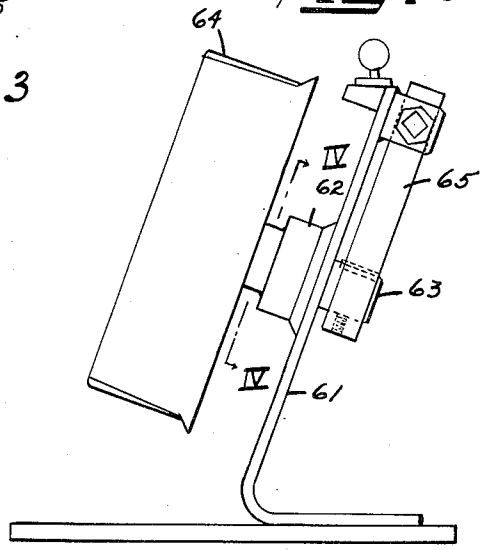


Fig. 4

Fig. 5



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BACKLASH COMPARATOR

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3 Claims. (Cl. 33—174)

This invention relates to the measurement of backlash in a drive system and particularly to an apparatus for ascertaining the amount of slack or play in a system comprising rotary elements connected in series relationship, such as those used for driving the godets of a spinning machine. The term "godet" refers to any roller having a periphery adapted to support a strand and conventionally used in the spinning of strands of artificial filaments.

In the conventional viscose rayon spinning machine, the freshly spun yarn is forwarded, as it emerges from a spinning bath, to a collecting device or additional treatment stations by at least one godet and usually a pair of godets. When two godets are provided, the one which handles the yarn last is driven at a peripheral rate greater than the godet which first receives the yarn, so as to continuously stretch the yarn as it advances from one godet to the other.

Slackness in the drive transmission for the godets may result in "backlash," a well-known behavior of loose mechanical driving systems wherein, when the torque load is light, the speed of rotation of a driven member may repeatedly accelerate above and then decelerate below the relatively uniform speed of a driving member. This condition, although it always exists to some degree in a godet driving system, may be of such magnitude as to affect the quality of the yarn.

The undesirable effects of backlash are multiplied in the two-godet yarn-forwarding system since the godet that is disposed rearwardly with respect to the movement of the yarn may be decelerated at the instant the forward godet is accelerated. In this situation, the section of the yarn extending between the godets is stretched substantially more than a section extending between the godets at another instant when the rear godet is accelerated and the forward godet is decelerated. Such behavior of the godet system is most likely to occur when spinning fine yarns since the torque load imposed by the yarn on the godets is very light and not sufficient to maintain constant driving contact of elements, such as intermeshing gears, of a driving system thereof.

It is an object of the present invention to provide apparatus for measuring the backlash in driving systems comprising rotary members and particularly in equipment for supporting filamentary material when such equipment comprises rotary members for advancing a strand product thereof. It is another object to provide apparatus for measuring backlash which may be readily attached to or detached from a yarn godet. Another object is to provide a device in accordance with the foregoing objects in the form of a single unit which may be used independently of the exterior reference aids. Still another object is to provide an auxiliary apparatus for calibrating the backlash-measuring device so as to facilitate the carrying out of the other named objects in an accurate manner. Another object is to improve the quality of multiple-filament strand, particularly those manufactured from regenerated cellulose, by providing apparatus for measuring backlash of spinning machine godets whereby excessive backlash may be discovered and the drive system for such godets corrected to maintain the backlash below a predetermined limit. Other objects, features, and advantages will become apparent from the following description of the invention and the drawing relating thereto in which

Fig. 1 is a front view of a backlash-measuring device constructed in accordance with the present invention;

Fig. 2 is a rear view of the apparatus shown in Fig. 1;

Fig. 3 is a view showing the device illustrated in Figs. 1 and 2 attached to a godet, the view being taken normal to the godet axis;

Fig. 4 is a front elevation partially in section of auxiliary apparatus for calibrating the device shown in Figs. 1 to 3; and

Fig. 5 is a side elevation of the apparatus shown in Fig. 4.

In brief, the invention resides in a device, hereinafter called a backlash comparator, having a frame member adapted to be attached to the periphery of a spinning machine godet or other rotor, a gravity-controlled level-indicating mechanism, and a support for the mechanism mounted pivotally on the frame member to enable an indicia-bearing element carried on the mechanism to be adjusted relative to a gravity-controlled medium. Ancillary to the present invention is apparatus onto which the device may be placed for rapid calibration. It comprises a rotor having peripheral contour features similar to those of the rotors on which the comparator is to be used, a spindle for supporting the rotor, and a support or a stand for rotatably supporting the spindle, the spindle having attached thereto an arm, and a stop means disposed radially from the spindle axis to limit the rotation of the arm to a predetermined angle.

Figs. 1 to 3 illustrate a backlash measuring device or comparator comprising a base or frame **5**, a beam **6** supported pivotably by the frame, a spirit-level gauge **7** mounted on the beam, and a gravitation-level mechanism **8** supported pivotably on the frame **5** by a bracket **9**.

The frame **5** comprises a ring portion having a flat radially-extending rearwardly-facing surface **11** for engaging the end surface of a godet or other rotor. Attached to the ring portion are extensions **14**, **15**, and **16** which project radially from the outer circumference of the ring portion and in an axial direction rearwardly of the surface **11**. The extensions **14**, **15**, and **16** have radially inwardly facing surfaces **18**, **19** and **20** which are adapted to overlap the peripheral surface of a rotor, such as the godet **22**, in the manner shown in Fig. 3 when the surface **11** of the frame engages the end surface of the godet. The extension **16** has a pin **23** fixed rigidly thereto and extending radially inwardly from its surface **20**.

The extensions **14** and **15** support the pins **25** and have passageways **24** which extend radially from the surfaces **18** and **19**. Portions of the passageways **24** are occupied as shown by portions of the pins **25**. The pins project outside the passageways to resiliently engage the periphery of the godet **22**. These pins have enlarged head portions disposed inwardly of the passageway which seat against the shoulder formed therein by the counterbore construction of the passageways. Springs **26** are held in the larger portions of the passageways by a pin **27** extending through each extension transversely through respective passageways **24**. Thus, the pins **25** may move inwardly of their passageways in accordance with the diameter of the rotor periphery over which the extensions **14**, **15**, and **16** are forced. The periphery of the godet **22** is defined in Fig. 2 by axially extending flutes indicated schematically by the generally circular lines **29**, comprising solid zig-zag sections adjacent the extensions **14**, **15**, and **16**, and dotted line sections connecting the zig-zag sections. The radially inner extremities of the pins, i. e., the surfaces thereof which en-

gage the periphery of the godet, are preferably rounded or tapered so that the pins may be constructed and angularly disposed with respect to the godet axis to engage to a slight extent the end surface of the godet as they enter respective valleys between the flutes of the godet periphery. However, the arrangement of pins **23** and **25** is admirably suited for engaging a smooth cylindrical peripheral surface of similar diameter of any rotor. The frame **5** is readily adapted for application to a rotor having a concentric radially inwardly-facing surface when constructed with extensions such as **14**, **15**, and **16** extending from the inner diameter of its ring portion with the direction of the pins **23** and **25** reversed from that shown in Fig. 2.

Extension **16** has a portion **28** projecting from the front face of the frame **5** which is bored to receive a pin **31** on which the beam is pivotably mounted. The beam is thus spaced from the face of the frame to bring the ends thereof directly under the end portions of the handles **33** and **34**. The handles have cylindrical shaped surfaces **33***a* and **34***a*, and their end portions are anchored in the ring portion of the frame **5**. The end portions of the handles extend as shown in the drawing from opposite ends of the cylindrical surfaces **33***a* and **34***a* in a direction generally parallel to the axis of the beam **6**. The end portions **33***b* and **34***b* serve as detents in an opposing relation with the end portions of the beam **6**. The surfaces **33***a* and **34***a* provide surfaces adapted to be gripped by the hands of the operator and extend generally parallel with the face of the frame. The portion of the handle **34** enclosed by the surface **34***a* is hollow and interiorly threaded to receive an adjusting screw **35** having a head **36** and an end portion **37** of reduced diameter which engages the beam **6**. The handle **33** is recessed in the end portion thereof adjacent the beam **6** to receive a spring **38** which is compressed between the handle and the beam to urge the beam against the screw **35**.

Thus, when the device is placed on a rotor as shown in Fig. 3 with the axis of the rotor being at some alignment varying from horizontal to steeply inclined, the inclination of the beam **6** may be changed by turning the screw **35** until the bubble of the liquid within the transparent tube of the spirit-level gauge **7** is placed in registry with some mark or index on the tube. This adjustment should be made when the rotor with the device mounted thereon has been rotated to one extremity of the range of rotation permitted by the backlash or play in the system for driving the rotor. The rotor and the device are then rotated through the range of play and the new position of the bubble with respect to the indicia of the gauge is noted.

The backlash comparator now being described is provided with another mechanism for obtaining measurements of the backlash which may be compared and checked against those obtained by the spirit-level system just described. The mechanism now to be described is essentially a weight-operated indicator **41** supported by the device in pivotable relationship with a gauge element **45** having a scale **43**. The scale **43** moves relative to the point or tip **42** of the indicator when the device is rotated, for example, when the device is placed upon a godet and rotated through the range of backlash. The magnitude of backlash may be measured by the portion of the scale **43** which moves past the point **42** of the indicator while the latter is held to fixed orientation by its weighted portion.

The indicator **41** is rotatably supported on an axle element **44** fixed to the gauge **45**. The element **44** has an enlarged portion which extends through a pivotably adjustable support member **46**. A set screw **47** extends radially through the bearing portion of the member **46** and may be screwed against the outer surface of the element **44** to secure the gauge **45** in any desired angular position with respect to the member **46**. The indicator **41** is mounted for free rotation on a diametrically smaller portion of the axle **44**. Means such as a cotter-pin **48** are used to retain the indicator on the axle. The member **46** with the indicator **41** and the gauge **45** attached thereto

is supported in a bracket **9** attached by screws **49** to the ring portion of the frame **5**. The bracket has a pair of spaced parallel extensions **51** and **52**, the latter extension having extending through it in threaded relationship therewith a set screw **53**. The extension **51** has a conical boss **55**. The set screw and the boss engage recessed end surfaces of the spindle portions **57** and **58** of the member **46**. The bracket **9** is attached to the frame **5** to dispose the axis of the indicator **41** and the gauge **45** along the axis of the rotor which supports the comparator when the latter axis is aligned horizontally. When the axis of the rotor is inclined from the horizontal, the set screw **53** may be loosened to allow the indicator and the gauge to seek a vertical orientation. The set screw may be again tightened to improve the stability of the device during use which may involve making a large number of observations on different godets having approximately the same axial inclination. The set screw **47** is loosened whenever necessary to bring the point **42** of the indicator into registry with a desired reference point of the indicia **43**. In using the comparator, it is desirable to compare the results of the weight-operated mechanism with those obtained on the spirit level gauge **7**. If desired, observations may be made on the basis of either mechanism used alone. The construction of a comparator may be limited, if desired, to either one of the two gravity-controlled mechanisms described.

For calibrating a spirit-level mechanism of the comparator, a calibrating device **60** is provided, as shown in Figs. 4 and 5, which comprises a stand **61**, a bearing **62** fixed to the stand, a rotatable spindle **63** extending through the bearing, a rotor such as the godet **64** shown mounted concentrically on the spindle, an arm **65** fixed to the spindle, and a pair of set screws **67** and **68** in threaded relationship with extensions of the stand **61** for limiting the movement of the arm **65**.

To calibrate the spirit level gauge **7**, the comparator is placed on the rotor **64** in the relationship shown in Fig. 3 with respect to the godet **22**. The set screws **67** and **68** are separated sufficiently to receive a thickness gauge **69** between the end of one of the screws and the arm **65**. The thickness of gauge **69** may represent the allowable backlash to be tolerated in the drive system to be examined. With the gauge **69** in place, as shown in Fig. 4, the screw **35** is adjusted to bring the bubble **71** into registry with a mark on the transparent tube of the spirit gauge, for example, line A. The thickness gauge **69** is then withdrawn and the rotor **64** with the comparator placed thereon is rotated to bring the arm **65** in contact with the screw **67**. The position of the bubble then shifts to that drawn at B in Fig. 3. Line C may then be scribed on the tube to indicate the position of the bubble at B. Thereafter, in measuring the backlash of godets, the spirit level is adjusted at each godet by turning the screw **35** to bring the bubble adjacent the line A before the range of backlash is measured. If the line C represents the greatest allowable backlash and the bubble shifts to a position beyond that established as hereinbefore described at line C when the comparator and the godet are rotated through the backlash range the drive system for the godet is indicated to need repairing. Coinciding with the establishment of the zero mark at line A of the spirit gauge, the gauge **41** of the device **8** may be adjusted relative to the indicator point **42** to bring the point **42** into registry with a desired point of the scale **43**.

While preferred embodiments of the invention have been shown and described, it is to be understood that changes and variations may be made without departing from the spirit and scope of the invention as defined in the appended claims.

I claim:

1. A device for measuring backlash between two rotatable members, one of the members having a generally cylindrical surface concentrically disposed about its axis

of rotation, the device comprising a circular frame having means extending from a circumference thereof in a direction parallel to its axis of rotation adapted to engage said cylindrical surfaces whereby the device is disposed generally over an end of the member, said frame having a concentric radially extending surface for engaging the end of the member, a pair of parallel handles extending parallel to the plane of said radially extending frame surface in spaced relationship with the side of the frame opposite said surface, a beam at least as long as the distance between the handles, means for pivotally supporting the beam on an axis passing transversely to a plane containing the lengthwise axes of the handles, each end of the beam being spaced adjacent the end of each handle, a set-screw extending in a direction parallel to the axis of the handle and in threaded relationship therewith through one of said handles into engagement with the beam, a spring extending in an axial direction being compressibly supported between the handle and the adjacent end of the beam, and a spirit gauge mounted on the beam with its lengthwise direction coinciding with that of the beam.

2. A device for measuring the backlash of a spinning godet within a drive system therefor, the godet having a periphery comprising axially-extending serrations disposed concentrically with respect to the axis of rotation of the godet, the device comprising a circular frame having an axially-facing surface adapted to engage an end surface of the godet, the frame having at least three axially-extending extensions which overlap the godet surface in an axial direction when said frame is placed in generally concentric relation with the godet, each extension being angularly spaced about the axis of the frame from an adjacent extension less than 180 degrees and having a pin extending radially toward the godet periphery, said pin being relatively angularly spaced to enter valleys between the serrations to engage said periphery, said extensions being annularly spaced to trap the peripheries of the godet within the grip of said pins, a pair of parallel handles extending parallel to the plane of said frame surface, the handles being supported in spaced relationship with the side of the frame opposite said frame surface, a beam at least as long as the distance between the handles, means for pivotally supporting the beam on an axis extending transversely to a plane containing the lengthwise axes of the handles, said beam being pivotable to engage an end of either handle, a set screw extending in

threaded relation through one of the handles into engagement with the beam, a spring compressibly supported between the other handle and an adjacent opposing surface of the beam, and a spirit-gauge mounted on the beam with its lengthwise direction coinciding with that of the beam.

3. A device for measuring backlash between two rotatable members, one of the members having a generally cylindrical surface concentrically disposed about its axis of rotation, the device comprising a circular frame having means extending from a circumference thereof in a direction parallel to its axis adapted to engage said cylindrical surface whereby the device is disposed generally over an end of the member, the frame having a concentric radially-extending surface for engaging an end surface of the member, said frame comprising a pair of spaced detents extending in a direction generally lengthwise of the axis of the frame, a beam at least as long as the distance between the detents, said beam being pivotally supported by the frame to dispose a surface thereof in opposing spaced relation with surfaces of the detents which face in the same direction, a set screw extending through one of the detent means in threaded relation therewith into engagement with said surface of the beam, a spring extending from the other detent means into engagement with said surface of the beam, and a spirit-gauge mounted on the beam with its lengthwise direction coinciding with that of the beam.

References Cited in the file of this patent

UNITED STATES PATENTS

1,377,720	Neff	May 10, 1921
1,477,257	Fritz	Dec. 11, 1923
2,170,824	Lichtenwalner	Aug. 29, 1939
2,285,965	Halstead	June 9, 1942
2,325,362	Black	July 27, 1943
2,438,229	Price	Mar. 23, 1948
2,495,765	Rauscher	Jan. 31, 1950
2,541,641	Dodson	Feb. 13, 1951
2,581,630	Carrigan	Jan. 8, 1952

FOREIGN PATENTS

25,439	Great Britain	1912
60,156	Switzerland	May 24, 1912
18,932	Denmark	June 23, 1914
827,831	France	May 4, 1938