United States Patent [19]

Franzen

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[45] **June 26, 1973**

[54] **BELT DRIVE APPARATUS HAVING IMPROVED TAKE-UP**

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[73] Assignee: **Palitex Project Company GmbH,** Krefeld, Germany

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May 3, 1971 Germany ..... P 21 21 685.3

[52] **U.S. Cl.** **74/242.9**

[51] **Int. Cl.** **F16h 7/08**

[58] **Field of Search** ..... 74/242.9, 242.15 R

[56] **References Cited**

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2,935,869	5/1960	Shipley	73/136
3,413,865	12/1968	Nimtz et al.	74/242.9

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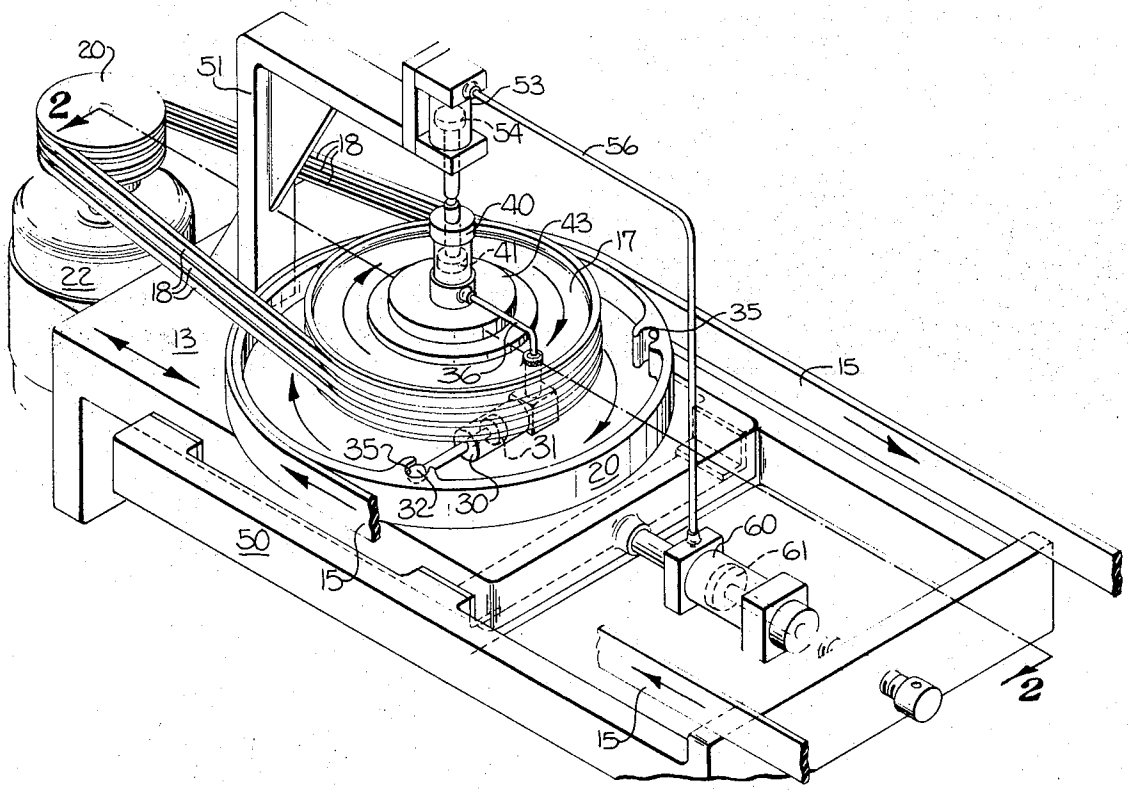
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Primary Examiner—Leonard H. Gerin
Attorney—Samuel G. Layton, Jr. et al.

[57] **ABSTRACT**

A belt drive apparatus having a take-up for varying the tension in the belt including a driven rotatable member, belt engaging means which includes a pulley for receiving and driving a belt and which is driven through a first cylinder-piston which is in fluid communication with a second cylinder-piston operatively connected with displaceable belt engaging means for displacing the belt in conformity with the relative movement of the members of the first cylinder-piston relative to each other to vary the tension on the endless belt in accordance with the amount of torque on the belt driving pulley. The second cylinder-piston is secured coaxially to the driven rotatable member for rotation therewith and with the first cylinder-piston to eliminate problems in fluid communication between the first and second cylinder-piston devices.

6 Claims, 4 Drawing Figures

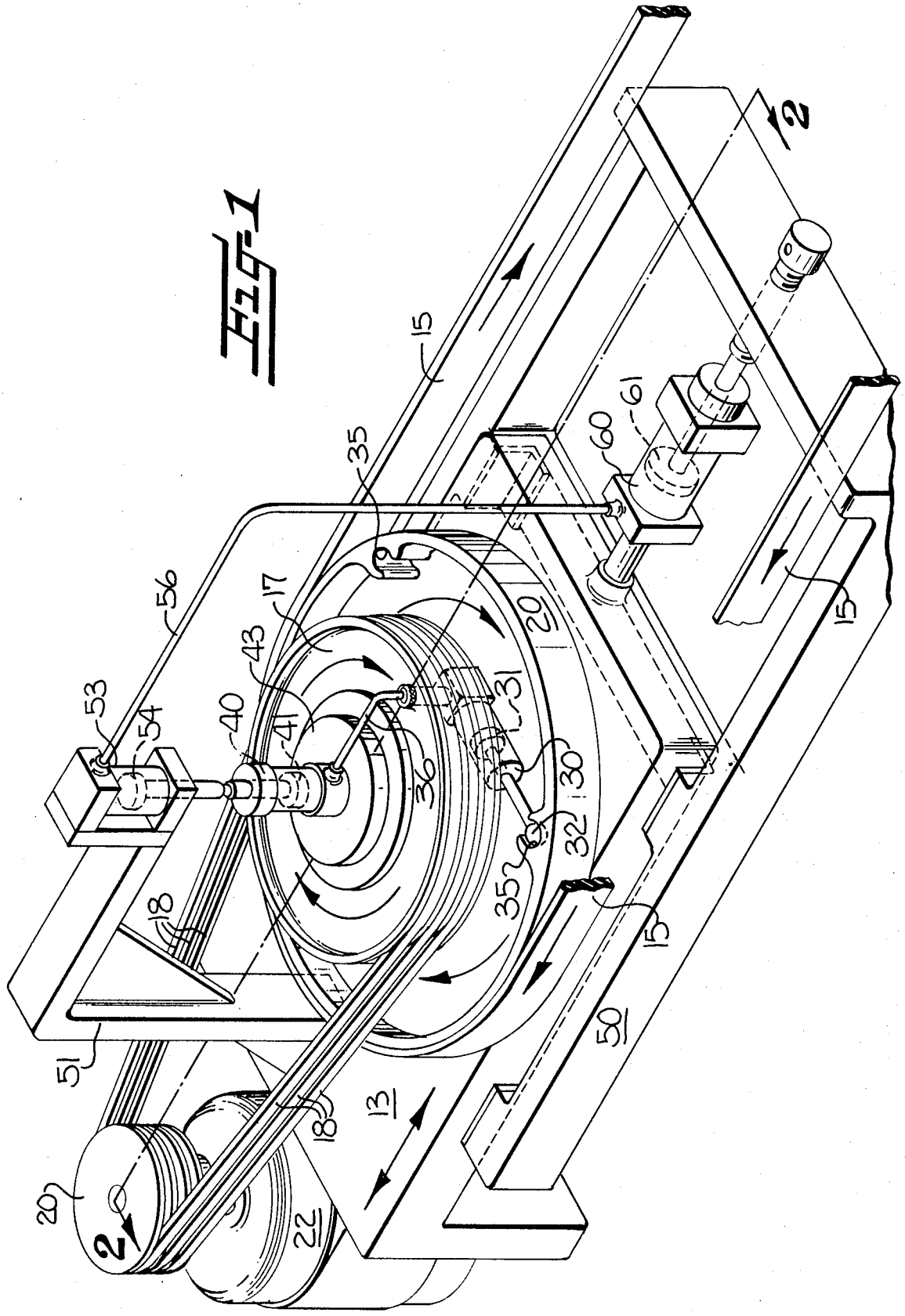


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Fig. 1



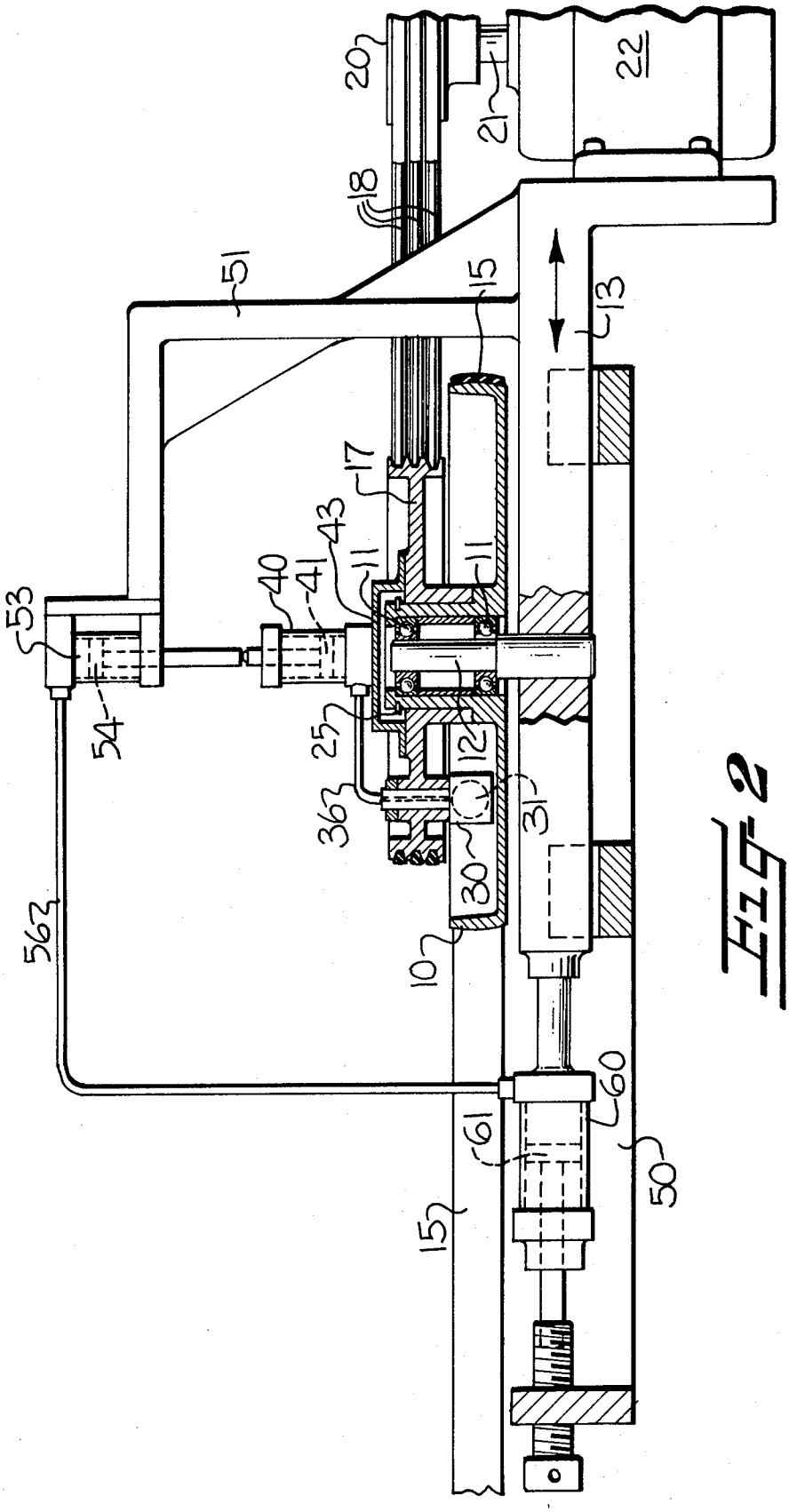

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FIG 2

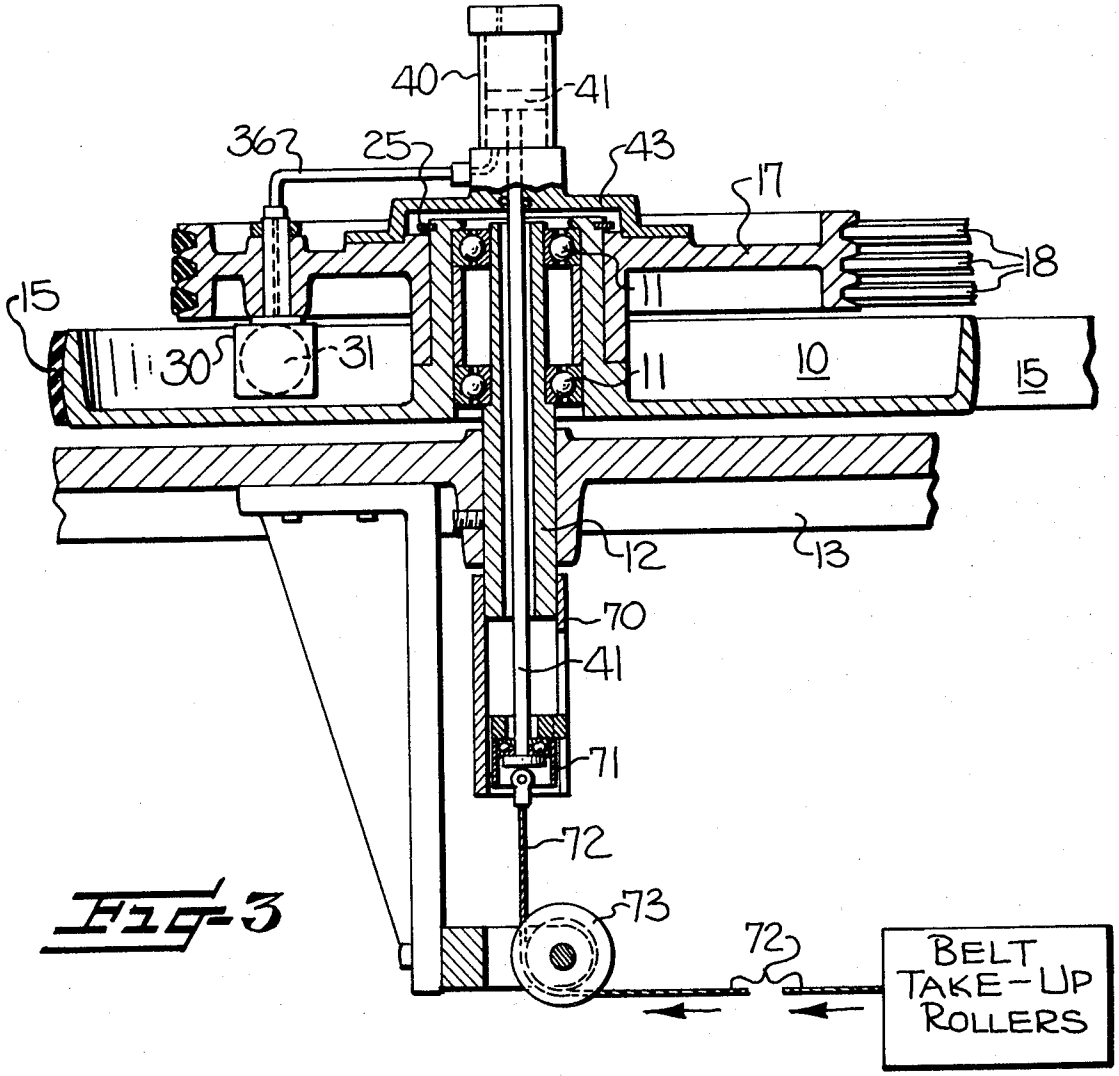

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BELT TAKE-UP ROLLERS

Fig-3

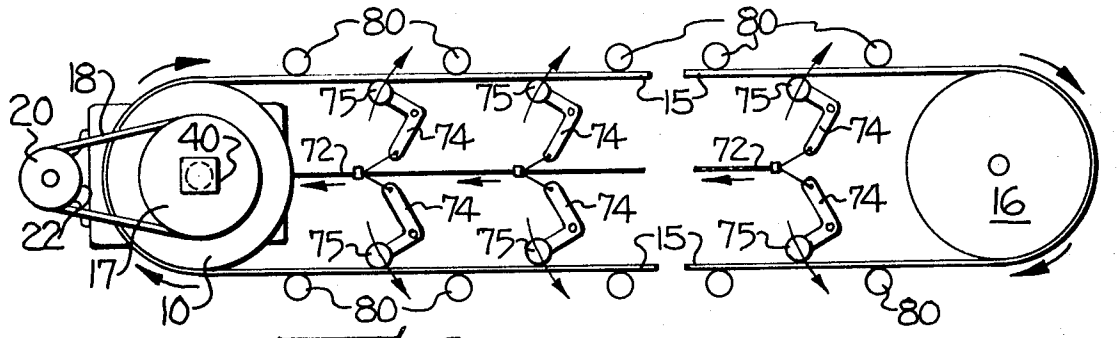

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Fig-4

BELT DRIVE APPARATUS HAVING IMPROVED TAKE-UP

The present invention relates to a belt drive apparatus having an improved take-up means for varying the tension in the belt.

In previously utilized belt drives for various machines including textile yarn processing machines, such as twisters, spinning frames or the like, various types of take-up mechanisms have been utilized for varying the tension on and tautness of the drive belt in accordance with the operating conditions of the machine. U.S. Pat. No. 3,413,865, issued Dec. 3, 1968, assigned to the assignee of the present application, disclosed a belt drive with a take-up mechanism which was far superior to previous take-up devices. The previous take-up devices were controlled, for example, in dependence on the driving speed or motor speed of the belt drive. In textile yarn processing machines, for example, where the driving belt is utilized for driving yarn processing spindles, the spindle mass and the air resistance vary constantly with constant circumferential belt speed because of the winding of the bobbins, so that the belt tension must undergo corresponding variations. The torque to be extended by the belt driving pulley, whose value remains unconsidered in a belt tension which depends only on motor speed, thus varies in one or the other directions.

In the belt take-up mechanism described in the aforementioned U.S. Pat. No. 3,413,865, an arrangement was provided which operated on torque-dependent control of the belt tension. This belt drive and take-up device included a driven rotatable member, an endless belt, belt engaging devices including a pulley for receiving and driving the belt which was coaxially arranged with and rotatable relative to the rotatable member, and devices displaceable with respect to the belt to vary the tension on and tautness of the belt. A first fluid operable cylinder-piston device was interposed between and drivingly connected the rotatable member and the pulley and comprised a first and a second member movable relative to each other. The first member was pivotally connected to a portion of the pulley eccentrically located with regard to the axis of rotation of the pulley and the second member was pivotally connected to and carried by a part of the rotatable member which was eccentrically located with regard to the axis of rotation of the pulley. Second fluid operable cylinder-piston means were operatively connected with the displaceable belt engaging means and were in fluid communication with the first cylinder-piston means for displacing the belt means in conformity with the movement of the first and second members of the first cylinder-piston means relative to each other to vary the tension of the endless belt in accordance with the amount of torque on the belt driving pulley.

In the specific arrangements disclosed in the prior U.S. Pat. No. 3,413,865, the first cylinder-piston device rotated with the rotatable member of the belt drive and the second cylinder-piston device was non-rotating. The fluid communication between the first and second cylinder-piston devices was by means of relatively movable conduits joined at a rotating joint. This arrangement has produced problems in sealing and packing of the relatively movable parts of the connecting joint.

Accordingly, it is the object of this invention to overcome the above problems in the belt drive apparatus and take-up mechanisms of the prior patent of the assignee of this invention and to provide a belt drive apparatus having improved take-up means.

By this invention, it has been found that these problems may be overcome by mounting the second fluid operable cylinder-piston device coaxially to the driven rotatable member for rotation therewith and with the first fluid operable cylinder-piston means. Additionally, positively operating mechanisms are controlled by the second cylinder-piston device for operating the displaceable belt engaging means for varying the tension on the belt.

Some of the objects and advantages of this invention having been stated, other objects and advantages will appear as the description proceeds when taken in conjunction with the accompanying drawings, in which:

FIG. 1 is a perspective view of one form of a belt driving apparatus having take-up means in accordance with this invention;

FIG. 2 is a sectional view taken generally along the line 2—2 of FIG. 1;

FIG. 3 is a vertical sectional view through another embodiment of a belt drive apparatus having a take-up means in accordance with this invention; and

FIG. 4 is a schematic plan view of the belt drive apparatus having take-up means in accordance with FIG. 3 and illustrating how this mechanism operates with belt take-up rollers.

Referring now to the drawings, FIGS. 1 and 2 illustrate a first emboidment of a belt drive mechanism with take-up devices in accordance with this invention and FIGS. 3 and 4 illustrate a second embodiment of a belt drive mechanism with take-up devices in accordance with this invention. Many of the basic features of this embodiment of FIGS. 1 and 2 and the embodiment of FIGS. 3 and 4 are the same and will be given like reference numerals for like parts.

Referring first to the basic features common to both the embodiment of FIGS. 1 and 2 and the embodiment of FIGS. 3 and 4, the belt drive mechanism with take-up devices includes a belt driving pulley **10** which is rotatably mounted by means of roller bearings **11** on a journal **12** which is mounted on a frame **13**. An endless belt **15** is received around the belt driving pulley **10** and may also pass around an idler pulley **16** (shown only in FIG. 4) at the other end of the endless belt **10** for providing an endless belt drive.

A rotatable member in the form of a V-belt pulley **17** is rotatably mounted on the hub of belt driving pulley **10** for relative rotation with respect thereto. The V-belt pulley **17** receives a plurality of V-belts **18** which also pass around a pulley **20** secured to the end of a shaft **21** leading from a motor or other suitable driving means **22**. Thus, the V-belt pulley **17** is rotatably driven by the V-belts **18** and driving means **20, 21** and **22**. The V-belt pulley **17** is secured against axial displacement by a snap ring **25** secured to the hub of the belt driving pulley **10**.

Drivingly connecting the rotatable member **17** and the belt driving pulley **10** is a fluid operable cylinder-piston which comprises a cylinder **30** and piston **31**. The end of the piston **31** which is in the form of a ball **32** is pivotally connected to the inside of the belt driving pulley **10** eccentrically with respect to the axis of rotation of the pulley **10** by being received within a ball socket **35**. The other end of the cylinder **30** includes a fluid conducting conduit **36** which passes through an aperture in the rotatable member or V-belt pulley **17**

so that the cylinder **30** is pivotally connected to the rotatable member **17** at a position eccentrically located with regard to the axis of rotation of the rotatable member **17** and the belt driving pulley **10.** The distance between the pivotal connection of the piston **31** and the belt driving pulley **10** from the axis of rotation of the pulley **10** is greater than the distance between the pivotal connection of the cylinder **30** and feed pipe **36** with the rotatable member or V-belt pulley **17** from the axis of rotation of the pulley **10.**

Thus, as the rotatable member **17** is rotated by the above-described driving mechanisms, the cylinder **30** and piston **31** will be rotated therewith and the piston **31** will cause rotation of the belt engaging pulley **10.** However, due to the resistance of the belt engaging pulley **10** to rotate, the piston **31** and cylinder **30** will move relative to each other forcing fluid out of the cylinder **30** and through the conduit **36.** The conduit **36** leads to a further fluid operable cylinder piston comprising a cylinder **40** and piston **41** which are mounted coaxially to the driven rotatable member **17** and the belt engaging pulley **10.** The cylinder **40** is secured to a disc **43** which is mounted on the rotatable member **17** for rotation therewith so that the cylinder **40** and piston **41** rotate with the rotatable member **17.**

Thus, as fluid is forced from the cylinder-piston device **30, 31** through conduit **36,** the fluid will be received by the cylinder **40** forcing the piston **41** outwardly therefrom. The piston **41** is operatively connected with control mechanisms for belt engaging devices for engaging the belt **40** to increase the tension or tautness therein. These belt engaging devices will be described more fully below in connection with the two embodiments of this invention illustrated in the drawings. As the belt **15** is continuously rotated by the above-described belt driving mechanisms, the amount of torque on the belt driving pulley **10** may decrease allowing a reversal of the above-described action to decrease the amount of tension or tautness on the belt **15.**

Referring now to the specific embodiment illustrated in FIGS. **1** and **2,** the frame portion **13** carrying the journal **12,** rotatable member **17** and belt driving pulley **10,** comprises a movable frame portion which is mounted for linear movement in a fixed frame portion **50.** Thus, the movable frame portion **13** and fixed frame portion **50** form a carriage for allowing linear movement of all of the aobve-described belt driving mechanisms.

Mounted on the movable frame portion **13** is an upright L-shaped arm member **51** which carries a fluid operable cylinder-piston device comprising a cylinder **53** and piston **54.** The cylinder-piston device **53, 54** is mounted in axially alignment with the cylinder-piston device **40, 41** so that as the piston **41** moves upwardly from the cylinder **40,** as described above, it will contact the piston **54** and cause it to move upwardly within the cylinder **53.** This forces fluid out of the cylinder **53** which passes through a fluid conducting conduit **56** and into a further cylinder-piston device comprising a cylinder **60** and piston **61.** The cylinder **60** is secured to the front of movable frame portion **13** and the piston **61** is secured to a portion of the fixed frame **50.**

Accordingly, as fluid is forced into the cylinder **60** from the line **56,** the piston **61** will be forced outwardly causing the movable frame **13,** belt driving pulley **10,** etc. to move linearly with respect to the fixed frame **50** or to the left as viewed in FIG. **1.** This increases the distance between the belt driving pulley **10** and the idler pulley on the other end of the belt **15,** thus increasing the tension or tautness in the belt **15.** In this embodiment of FIGS. **1** and **2,** the means displaceable with respect to the belt to vary the tension and tautness on the belt comprises, inter alia, the belt driving pulley and does not require the use of additional tension rollers or the like.

Referring now to the embodiment of FIGS. **3** and **4,** the piston **41** extends downwardly through a bore in the journal **12** and into an enclosed cylindrical housing and is attached at its lower end to a coupling member **71** carrying one end of a control cable **72** which passes out of the housing **70** and around an idler pulley **73** mounted on an extension of the frame portion **13,** which in this embodiment is stationary.

The cable **72** leads to and is connected with the ends of lever mechanisms **74** which are pivotally mounted on any stationary frame portion of the machine and carry on the other ends thereof tension rollers **75** which are positioned for movement toward and away from the drive belt **15** for increasing or decreasing the tension or tautness on the drive belt **15.**

Thus, as fluid is forced into the cylinder **40,** the piston **41** will move upwardly causing movement of the cable **72** from right to left, as viewed in FIGS. **3** and **4** and thus cause movement of the tension rollers **75** into tighter engagement with the belt **15** to increase the tension or tautness of the belt. Stationary guide rollers **80** may be suitably positioned on the outside of the belt **15** to cooperate with the tension rollers **75.** Accordingly, in this embodiment of FIGS. **3** and **4,** the means displaceable with respect to the belt comprise tension rollers **75.**

As may be clearly seen from the above descriptions of the embodiments of FIGS. **1,2** and **3,4,** the problems present with the prior take-up device of the above-described U.S. patent have been overcome inasmuch as no fluid conduits between cylinder-piston devices utilize rotary joints or connections and the control devices for the take-up means utilized with the belt driving mechanism have been simplified and made more direct.

In the drawings and specification, there have been set forth preferred embodiments of this invention and, although specific terms are employed, they are used in a generic and descriptive sense only and not for purposes of limitation.

What is claimed is:

1. In a belt drive apparatus having a take-up means for varying the tension in the belt including a driven rotatable member, endless belt means, belt engaging means including a pulley for receiving and driving said belt means which is coaxially arranged with and rotatable relative to said rotatable member and means displaceable with respect to said belt means to vary the tension on and tautness of said belt means, first fluid operable cylinder-piston means interposed between and drivingly connecting said rotatable member and said pulley and comprising a first and a second member movable relative to each other, said first member being pivotally connected to a portion of said pulley eccentrically located with regard to the axis of rotation of said pulley, said second member being pivotally connected to and carried by a part of said rotatable member which is eccentrically located with regard to the axis of rotation of said pulley, and second fluid operable cylinder-

piston means in fluid communication with said first cylinder-piston means and operatively connected with said displaceable belt engaging means for displacing said belt means in conformity with the movement of said first and second members of said first cylinder-piston means relative to each other to vary the tension of said endless belt means in accordance with the amount of torque on said belt driving pulley; the improvement of:

said second fluid operable cylinder-piston means being secured coaxially to said driven rotatable member for rotation therewith and with said first fluid operable cylinder-piston means to eliminate problems in fluid communication between said first and second cylinder-piston means.

2. In a belt drive apparatus having a take-up means, as set forth in claim **1**, in which the distance between the pivotal connection of said first member of said first cylinder-piston means from the axis of rotation of said pulley is greater than the distance between the pivotal connection of said second member from the axis of rotation of said pulley.

3. In a belt drive apparatus having a take-up means, as set forth in claim **1**, in which said means displaceable with respect to said belt means for varying the tension on and tautness of said belt means comprises said belt engaging and belt driving pulley.

4. In a belt drive apparatus having a take-up means, as set forth in claim **1**, in which said means displaceable with respect to said belt means to vary the tension on and tautness of said belt means comprises tension roller means positioned along said belt for displaceable movement with respect to said belt.

5. In a belt drive apparatus, as set forth in claim **1**, in which said apparatus further comprises movable frame means carrying said rotatable member, said pulley and said first and second cylinder-piston means, a fixed frame means carrying said movable frame means for allowing linear movement of said movable frame means and said components carried thereby, and third fluid operable cylinder-piston means comprising a first and second member movable relative to each other in which said first member is connected with said movable frame means and said second member is connected with said fixed frame means, said third cylinder-piston means being in fluid communication with said second cylinder-piston so that said first and second members of said third cylinder-piston means will move relative to each other upon reception of fluid from said second cylinder-piston means to move said movable frame and said pulley for varying the tension and tautness in said belt means.

6. In a belt drive apparatus having a take-up means, as set forth in claim **1**, in which said second fluid operable cylinder-piston means comprises a first and second member movable relative to each other, said means displaceable with respect to said belt means to vary the tension on and tautness of said belt means comprises tension roller means positioned along said belt means for movement into and out of engagement with said belt means for varying the tension thereon, said second cylinder-piston means being operatively connected to said tension roller means to move said tension roller means into and out of engagement with said belt means for varying the tension of said belt means in accordance with the relative movement between said first and second members of said second cylinder-piston means.

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