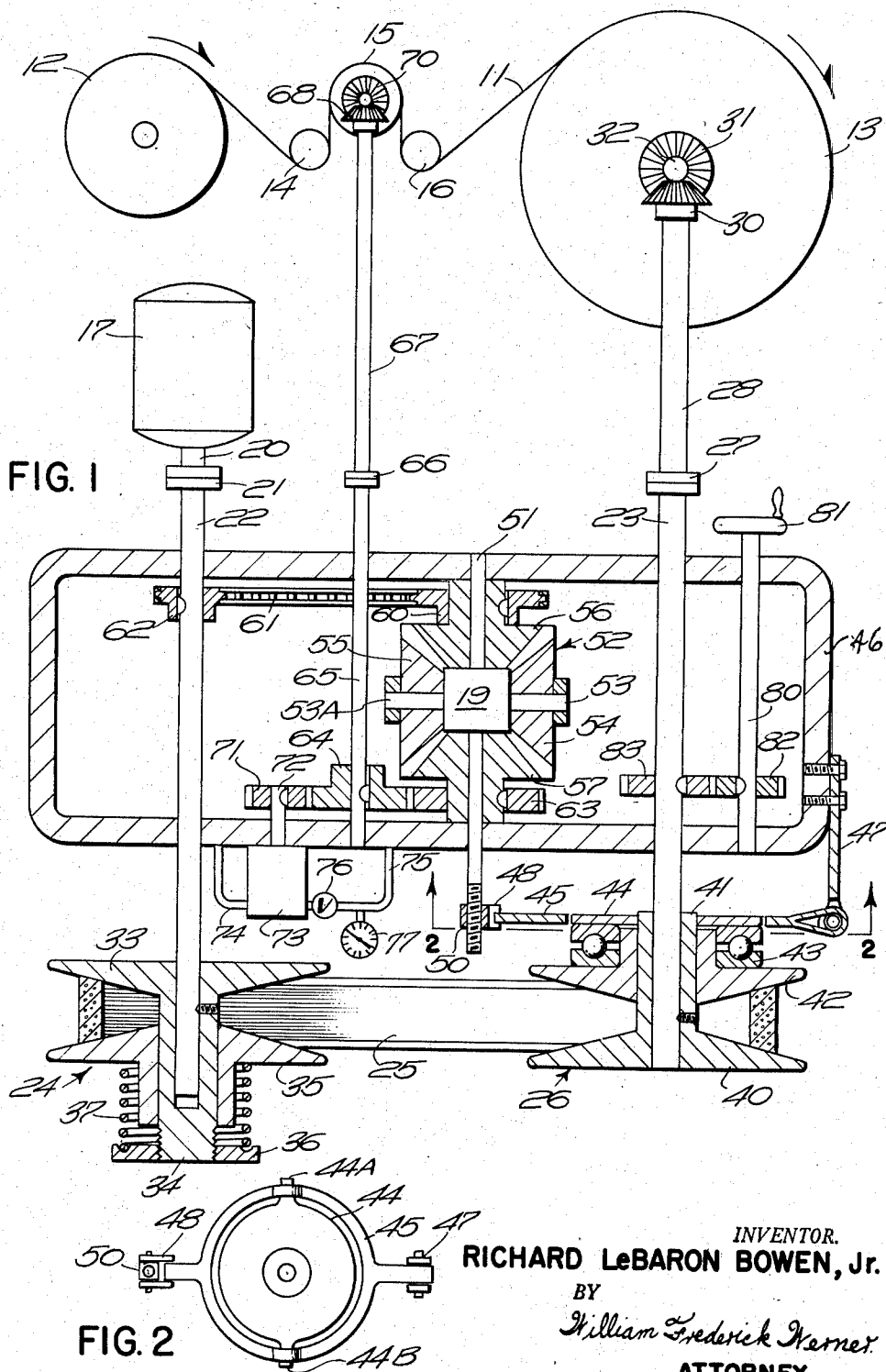


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CONSTANT SPEED WEB WINDUP

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CONSTANT SPEED WEB WINDUP

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5 Claims. (Cl. 242—75.5)

This invention relates to a mechanism for winding web material into rolls, and more particularly to a mechanism which will wind the web material at a constant linear speed.

An object of the present invention is to provide a mechanism which will wind a roll of web material at a constant linear speed.

Another object of the present invention is to provide a mechanism which will wind a roll of web material from a starting position to a very high constant linear speed, quickly and automatically.

Other objects of the present invention will be pointed out in part and will become apparent in part, in the following specification and claims.

In the past mechanisms which rewound web material from one roll to another for the purpose of straightening the roll, changing the density of the package, inspecting the material, fixed the winding roll to a shaft which was driven at a constant speed. As the winding roll increased in diameter due to the accumulating web, the peripheral speed increased in proportion to the increasing diameter. This speed increase was reflected in the linear speed of the web passing from one roll to another. To prevent too great an increase in speed, it was common practice to run the first part of the roll slower than was necessary.

The present invention obviates this undesirable condition by fixing the roll to be driven to a shaft which automatically slows down as the roll increases in diameter, without resorting to devices which press against the web material on the roll being wound. Said devices undesirably tend to mar the web material.

In the accompanying drawing wherein like reference characters refer to like parts:

Figure 1 is a diagrammatic plan view, partly in section, showing the new and improved constant speed web windup.

Figure 2 is a side elevational view of a detailed part of the mechanism taken on line 2—2 of Figure 1.

According to the invention in its general aspects, the winding roll is driven from a constant speed power source through a variable speed mechanism. An idler roller driven by the web material serves as a speed detecting device, driving one element of a differential gear train, another element of which is driven at a constant speed. Errors in the speed of the web are corrected by the third element of the differential gear train which changes the speed of the variable speed mechanism.

Referring to the drawing, web 11 is being unwound from storage roll 12 and wound into finished roll 13. In passing from storage roll 12 to finish roll 13, web 11 passes first under idler roller 14, then over speed detecting roller 15, then under a second idler roller 16. Rollers 14, 15, 16 can be located on any type of machine wherein web material is processed, the web passing from a storage roll to the processing mechanism and then to the take-up or finished roll.

A differential gear train 52 is provided, consisting of

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a casing 46, which provides journals for an input shaft 22, an output shaft 23 and an idler shaft 51. Bevel gears 56 and 57 provided with extended hubs are rotatively mounted for independent rotation on idler shaft 51. Bevel gears 54 and 55 which are in engagement with bevel gears 56 and 57, are journaled to a carrier 19 through stub axles 53, 53A. Carrier 19 is fixed to idler shaft 51.

Input shaft 22 is connected to the shaft 20 of an electric motor 17 through a coupling 21. A sprocket 62 fixed to input shaft 22 is operatively connected through a chain 61 to a sprocket 60 fixed to the extended hub of bevel gear 56.

A speed detecting shaft 65 journaled in casing 46 has a spur gear 64 fixed to it. A spur gear 63 fixed to the extended hub of bevel gear 57 meshes with spur gear 64. A shaft extension 67 connected by means of coupling 66 to speed detecting shaft 65 has a bevel pinion gear 68 in engagement with a bevel gear 70 secured to the shaft to which speed detecting roller 15 is fixed.

A hydraulic pump 73 may be secured to casing 46 with the spindle 72 of said pump journaled in said casing. A spur gear 71 fixed to spindle 72 meshes with spur gear 64. Casing 46 acts as a reservoir for the storage of hydraulic fluid. A suction line 74 connects hydraulic pump 73 with the reservoir. A discharge line 75 provided with a throttle valve 76 and a fluid pressure gage 77 connects hydraulic pump 73 with the reservoir.

Output shaft 23 is connected to output shaft extension 28 by means of coupling 27. A bevel pinion gear 30 secured to the end of output shaft extension 28 engages bevel gear 31 secured to shaft 32, which has finish roll 13 secured to it.

An auxiliary spindle 80 journaled in casing 46 is provided with a hand wheel 81 and a spur gear 82, both of which are fixed to it. A spur gear 83 fixed to output shaft 23 meshes with spur gear 82.

An expansible V-pulley generally indicated by reference character 26, consists of a coned disk 40 having an elongated hub 41 fixed to output shaft 23. A mating coned disk 42 is slidably mounted on elongated hub 41. A ball thrust bearing 43 which is secured to the hub of coned disk 42 abuts disk 42 and thrust ring 44 which has two projecting arms 44A and 44B. See Figure 2. Thrust ring 44 is pivotally mounted on lever 45 which in turn is pivotally mounted to bracket 47. Bracket 47 is fixed to casing 46. A yoke 48 formed in one end of lever 45 has a threaded block 50 pivotally mounted in said yoke. Idler shaft 51 is provided with threads on one end which engage the threads in block 50.

A resiliently expansible V-pulley generally indicated by reference character 24 consists of a coned disk 33 having an elongated hub 34 fixed to input shaft 22. A mating coned disk 35 is slidably mounted on elongated hub 34. A stop washer 36 secured to the end of elongated hub 34 provides an abutment for one end of a coil spring 37 which encompasses the hub of coned disk 35. The opposite end of coil spring 37 abuts coned disk 35, tending to constantly force coned disks 33, 35 together.

Resiliently expansible V-pulley 24 is connected to expansible V-pulley 26 by means of edge-active V-belt 25. In operation, electric motor 17 drives input shaft 22, resiliently expansible V-pulley 24 and through edge active V-belt 25, expansible V-pulley 26; which in turn drives output shaft 23, output shaft extension 28, bevel pinion 30, bevel gear 31, shaft 32 and finish roll 13.

Motor 17 driving input shaft 22 also drives sprocket 62, chain 61, sprocket 60 and bevel gear 56.

Web 11 being drawn off storage roll 12 by the action of finish roll 13 passes under idler roller 14, speed detecting roller 15 and idler roller 16, driving them. Speed

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detecting roller 15 through its shaft and bevel gear 70, drives bevel pinion 68, shaft extension 67, speed detecting shaft 65, spur gear 64, spur gear 63 and bevel gear 57.

Bevel gear 70, bevel pinion 68, spur gears 63 and 64 are so designed, that when web 11 is traveling at the desired speed, bevel gear 56 and bevel gear 57 are traveling at the same speed in relation to each other. When bevel gears 56 and 57 travel at the same speed, idler shaft 51 is motionless.

Assume that finish roll 13 is revolving at an arbitrary speed. As additional web material winds on finish roll 13 it increases in diameter and its peripheral speed increases, increasing the speed in which web 11 is drawn off storage roll 12. Thus the speed of speed detecting roller 15 increases and through speed detecting shaft 65, spur gears 64, 63, bevel gear 57 changes its speed relative to bevel gear 56 causing idler shaft 51 to rotate through bevel gears 54 and 55. Rotation of idler shaft 51 moves threaded block 50 away from casing 46, thus forcing coned disk 42 closer to coned disk 40, increasing the pitch diameter of expansible V-pulley 26 and simultaneously decreasing the pitch diameter of resiliently expansible V-pulley 24 as edge active V-belt 25 forces coned disk 35 away from coned disk 33.

In actual operation, the movement of idler shaft 51 is hardly perceptible. Therefore the reduction in speed of output shaft 23 is steplessly accomplished.

When the web material 11 on storage roll 12 becomes exhausted, the mechanism has shifted so that output shaft 23 is travelling at its minimum speed. Replenishment of storage roll 12 and the attachment of web 11 to a new core for finish roll 13 finds the initial speed of output shaft 23 at the minimum and not at a maximum. The differential gear train 52 is unbalanced. Speed detecting roller 15 will detect this slow speed and accordingly will very rapidly bring the speed of speed detecting shaft 65 in harmony with input shaft 22. Thus when high web velocities are used, the mechanism starts slowly but automatically brings the speed of output shaft 23 to its maximum.

If it is desired to start a finish roll 13 at maximum speed, handwheel 81 is manually rotated, causing spur gear 82 and spur gear 83 to rotate output shaft 23 and cone disk 40 to change the pitch diameters of expansible V-pulleys 26 and 24, so that the pitch diameter of 24 is greater than 26.

In the description of the mechanism so far, tension is applied to web 11 between storage roll 12 and finish roll 13 by the friction of the mechanism and the inertia of storage roll 12. If this tension is insufficient a braking force may be applied to speed detecting roller 15, thereby applying tension between storage roll 12 and finish roll 13. Throttle valve 76 is adjusted. Speed detecting shaft 65 through spur gears 64, 71 and spindle 72 will use part of its speed and energy to pump hydraulic fluid through the medium of hydraulic pump 73. A pressure gage 77 may be installed in line 75 so that the amount of tension applied to web 11 through speed detecting roller 15 can be observed visually. The amount of tension is proportional to the pressure set by throttle valve 76.

Having illustrated and described a preferred embodiment of the present invention, by way of example, but realizing that structural changes could be made and other

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examples given without departing from either the spirit or scope of this invention what I claim is:

1. In a constant speed winding mechanism, an input shaft rotatable at a constant speed, an output shaft, means connecting said output shaft to a load means, a third shaft providing a variable rotary power source, a variable speed transmission connecting said input and output shafts, and having a speed changing mechanism, a differential gear train having a first rotary member connected to said input shaft, a second rotary member connected to said third shaft, and a third rotary member responsive to variation in the speed between said input shaft and third shaft connected to said speed changing mechanism for varying the speed of said output shaft, and means for loading said third shaft to provide a predetermined opposing force to the rotation thereof by said differential.

2. A constant speed winding mechanism according to claim 1 wherein said means loading said third shaft is a pump.

3. A constant speed winding mechanism according to claim 1 wherein said third shaft is rotated by a roller engaged by a web traveling to said load means.

4. A constant speed winding mechanism according to claim 1 wherein said speed changing mechanism is threadedly connected to the said third rotary member.

5. In a constant speed winding mechanism, a variable speed transmission having an input shaft, an output shaft, and a speed changing mechanism, a take-up beam connected to be driven by said output shaft, a supply roll from which a web is traveled to said take-up beam, power means for rotating said input shaft at a constant speed, a roller engaged by said web during the travel thereof and rotated thereby, means independent of the supply roll for applying a predetermined drag on said roller, a differential train of gears having a first rotatable power transmitting member, a second rotatable power transmitting member, and a third rotatable power transmitting member rotatable in response to variation in the speed of rotation between the said first and second rotatable members, means connecting the first said rotatable member to said power means for rotation thereby, means connecting the said second rotatable member with said roller for rotation thereby, and means connecting the said third rotatable member to said speed changing mechanism for decreasing the velocity of said output shaft in response to increase in the velocity of the travel web.

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