United States Patent

Adams

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[54] RE-WIND MECHANISM WITH PROFILED CAM-POTENTIOMETER

[72] Inventor: **Richard Calvin Adams,** West Barrington, R.I.

[73] Assignee: **G. T. Schjeldahl Company,** Northfield, Minn.

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[52] **U.S. Cl.** **242/67.5,** 242/75.45, 242/75.51

[51] **Int. Cl.**.....**B65h 25/04,** B65h 25/32

[58] **Field of Search**....242/75.5, 75.51, 75.52, 75.53, 242/67.5, 75.45, 75, 187

[56] **References Cited**

UNITED STATES PATENTS

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Primary Examiner—George F. Mautz
Assistant Examiner—Gregory A. Walters
Attorney—Orrin M. Haugen

[57] **ABSTRACT**

A system for re-winding an elongated moving treating web onto a winding core downstream from a web treating station, the system including web handling means for establishing and maintaining a slack segment in the web downstream from the treating station, and take-up roll means for re-winding the treated web onto the winding core at a substantially constant rate of speed, the rate substantially matching the rate of movement of the web through the treating station. Means are provided for applying tension to the web between the slack loop segment and the winding core. The take-up roll includes a motor means for rotating the winding core and control means for driving the motor means at a certain predetermined arcuate rate responsive to the immediate composite diameter of the core and its wound web. Sensing arm means are arranged for sensing the diameter of the core and its re-wound web portion, the arm means being provided with a profiled cam having its cam surface arranged to provide motion in a cam follower proportional to the reciprocal of the immediate composite diameter of the winding core and the re-wound web.

5 Claims, 4 Drawing Figures

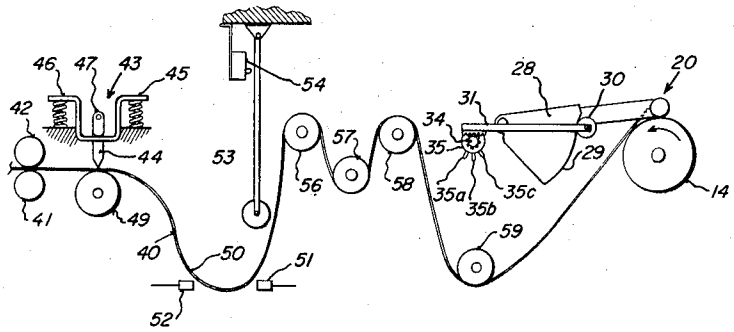


FIG. 1.

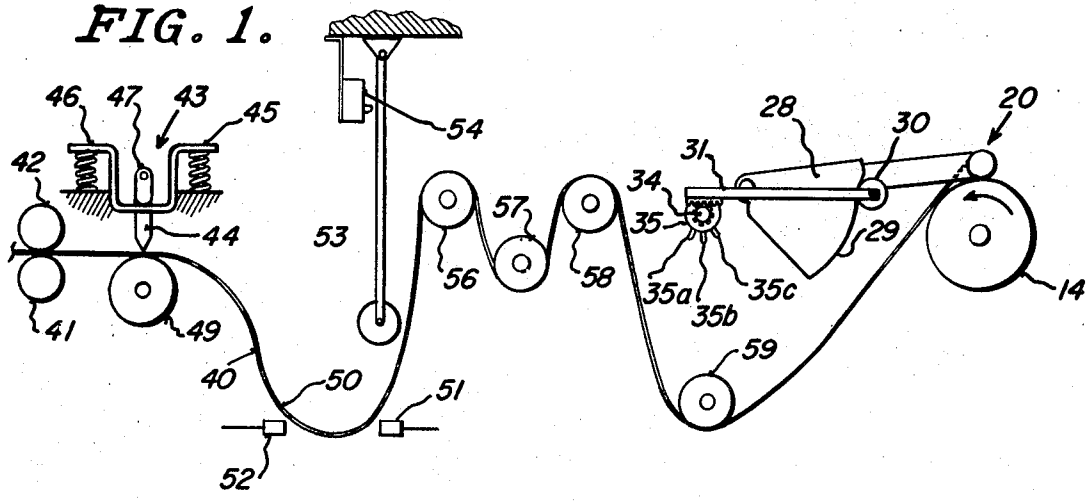
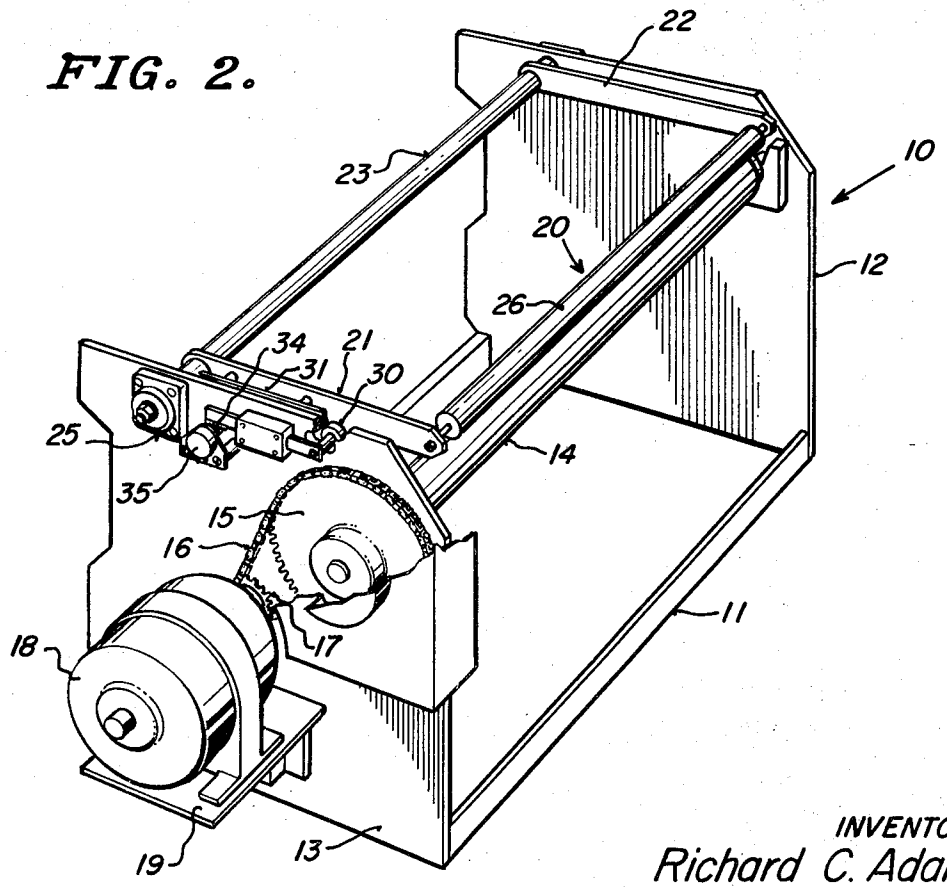


FIG. 2.



INVENTOR
Richard C. Adams
BY Orrin M. Haugen
ATTORNEY

FIG. 4.

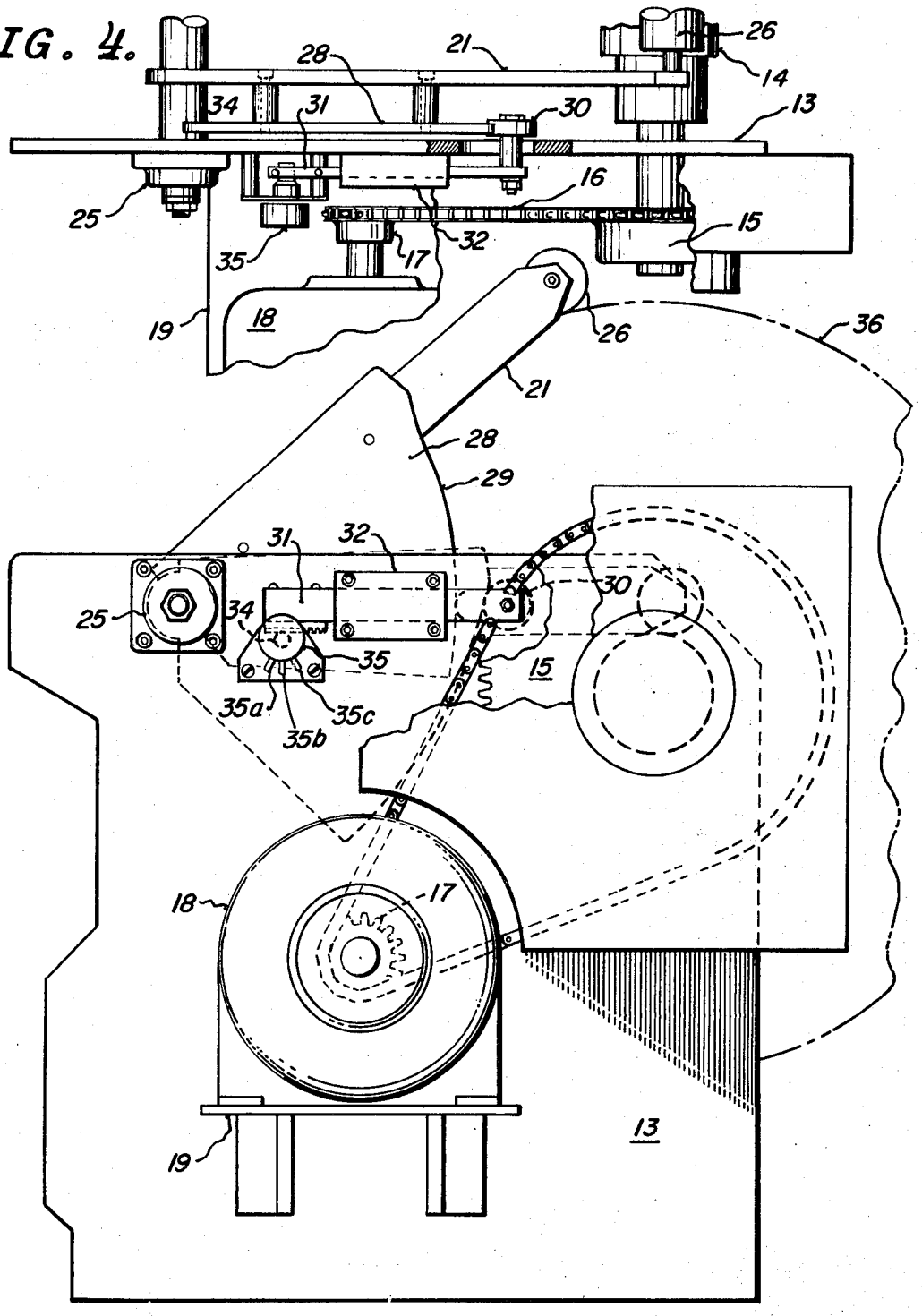


FIG. 3.

INVENTOR
Richard C. Adams
BY Orrin M. Haugen
ATTORNEY

RE-WIND MECHANISM WITH PROFILED CAM-POTENTIOMETER

BACKGROUND OF THE INVENTION

1. Field of the Invention:

The present invention relates generally to web handling apparatus, and more specifically to apparatus for treatment and re-winding of webs of thermoplastic film. A re-wind apparatus is utilized to maintain a substantially constant rate of lineal speed in the web so as to provide consistent conditions in the web during the treatment operations. The system of the present invention is particularly adapted to treatment of a thermoplastic film web which is periodically provided with a transverse hot seal, the system being adapted to maintain a slack section for protection of the hot seal area prior to cooling, along with a tension section adjacent thereto which controls and assists in maintaining tension in the re-wound web.

2. Description of the Prior Art:

In the past, various systems and devices have been employed to provide a continuous roll-to-roll operation on treated webs. In these systems, it is frequently suggested that the take-up roll be driven at a constant arcuate rate of rotation, with the lineal rate normally exceeding the normal lineal rate of the web. In order to properly compensate, it has been necessary to drive the re-wind rolls in these systems on an intermittent basis, with a slack loop being provided and controlled between certain predetermined upper and lower limits. In these systems, as the take-up roll is over-driven, the over-driving rate continues until the slack loop reaches a predetermined lower limit of magnitude or size. Upon sensing such a condition, means are normally employed to disengage or de-energize the means driving the take-up roll for a period sufficient to permit the continuously running web to form a slack loop of a predetermined upper limit of magnitude or size. When such an upper limit is reached, the re-wind roll is again energized and driven at an arcuate rate of rotation which provides a lineal rate of web travel greater than the machine speed. This condition then continues until the lower limit of slack is reached, at which time the take-up roll is again de-energized.

Such an arrangement provides for varying conditions in the take-up portion of the apparatus, and hence these conditions may be reflected in the characteristics of the web, and also of the uniformity of the re-wind. Variable slack loop sizes can be reflected in anomalous characteristics occurring in the welded portion of the web, and these characteristics will, of course, be reflected in the quality of the finished product.

SUMMARY OF THE INVENTION

The present invention provides means for controlling the rate of rotation of the take-up roll so as to provide a substantially constant rate of lineal motion on the web. Thus, as the diameter of the composite take-up roll core and web increases, the rate of rotation will decrease so as to provide a substantially constant lineal rate of travel. A slack loop is employed downstream from the treating station, and this slack loop is normally maintained at a substantially constant magnitude. Web tensioning means are provided adjacent the slack loop so as to control the tension in the re-wound web.

The apparatus includes a pivotally mounted sensing arm which has a tip end arranged to contact the outer periphery of the take-up roll, the sensing arm having secured thereto a profiled cam which moves arcuately with the sensing arm. The face of the cam is profiled so as to provide linear motion in a cam follower, with the linear motion being proportional to the reciprocal of the diameter of the take-up roll. The cam follower drives the wiper of a motor controlling potentiometer, with the immediate disposition of the cam follower determining the immediate rate of rotation for the take-up roll.

Therefore, it is a principal object of the present invention to provide an improved and simplified means for driving a take-up roll on a web treating apparatus at a rate which provides a substantially constant linear rate of draw, the linear rate of draw of the take-up roll substantially matching the rate of the draw of the web treating apparatus.

It is yet a further object of the present invention to provide an improved take-up roll apparatus which is utilized in combination with a web treating machine, the take-up roll being adapted to provide substantially constant web handling conditions immediately downstream from the ultimate web treating station.

Other and further objects of the present invention will become apparent to those skilled in the art upon a study of the following specification, appended claims and accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a schematic diagram of a typical web treating apparatus utilizing the re-wind mechanism and stand of the present invention, the view showing a welding station for web treatment;

FIG. **2** is a perspective view, partially broken away, of the re-wind stand of the present invention;

FIG. **3** is a side elevational view of the re-wind stand of the present invention and illustrating the disposition of the sensing arm along the surface of a partially filled take-up roll, and illustrating in phantom the disposition of the sensing arm along an empty take-up roll; and

FIG. **4** is a detail plan view, partially broken away, of the drive portion of the re-wind stand, with the take-up roll being shown substantially empty.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In accordance with the preferred embodiment of the present invention, the re-wind stand generally designated **10** is supported on base **11** and side panels **12** and **13**. A take-up roll shaft is shown at **14**, this shaft being suitably journaled for rotation with bearings in the side panels **12** and **13**. The shaft **14** has a drive sprocket **15** secured fast to one end thereof, the sprocket **15** having a chain **16** coupled to drive sprocket **17** which is secured to the end of the shaft of variable speed motor **18**. In order to obtain an appropriate rate of speed for driving sprocket **17**, a speed reduction assembly may be utilized in combination with variable speed motor **18**. The motor **18** is mounted on motor mount plate **19**, which is, in turn, secured to the apparatus along side panel **13**.

The sensing arm means of the present invention is shown generally at **20** and includes a pair of pivotally

mounted arms **21** and **22**. Arms **21** and **22** are each fastened or secured to shaft **23**, shaft **23** being, in turn, journaled for arcuate rotation within panels **12** and **13** by means of bearings, such as the bearing **25** in side panel **13**. The free end of arms **21** and **22** are secured to sensing shaft or roller **26**, roller **26** preferably being journaled for rotation in the free ends of arms **21** and **22**, and also being adapted to receive a wrap of the film web. As is illustrated in FIG. **3** of the drawings, a cam **28** is secured to the sensing arms, and has a cam surface **29** which controls the disposition of cam follower **30**. The term "cam follower" is used in its conventional and well-known sense, that is, the cam follower **30** is the peg or roller which follows the curvature of a cam and to which the motion of the cam is directly communicated. Cam follower **30** is coupled to one end of rack **31**, rack **31** being mounted for reciprocatory motion in a suitable guide **32**. Rack **31** has teeth in mesh with pinion **34**, this pinion being secured to the wiper shaft of potentiometer **35**.

With attention being directed to FIG. **3** of the drawings, the cam surface **29** is profiled so as to provide motion proportional to the reciprocal of the diameter of the roll being sensed. This cam profile is, of course, reflected in the immediate disposition of rack **31** and pinion **34**. The signal output of potentiometer **35** is coupled to the power supply to variable speed motor **18**, thus controlling its rotational velocity.

Attention is now directed to FIG. **1** of the drawings wherein a typical system is illustrated utilizing the re-wind stand of the present invention. In this system, a web **40** is shown as it emerges from the welding station of a web treating device. For example, the welding station may be of the type illustrated in U.S. Pat. No. 2,947,345. The apparatus is shown with a pair of draw rolls **41** and **42**, along with a welding bar assembly generally designated **43**. This welding bar assembly includes a heated bar **44** which is arranged for reciprocatory motion within guides **45** and **46**, with cam **47** being utilized to actuate the reciprocatory motion. A backup roll **49** is also employed. Web **40** is preferably a thermoplastic film material such as polyethylene or the like, with the welding bar **44** being employed to form a weld across the surface of the web at desired intervals. Inasmuch as fusion occurs during the welding cycle, a slack loop is formed in the web **40** as at **50**. It is important that the slack loop be present in a controlled magnitude, and the upper and lower limits of the loop are monitored by any suitable means, such as, for example, a photo-responsive cell or the like. In FIG. **1**, the lower limit of the slack loop is sensed by photo-responsive cell **51** positioned opposite source **52**, while the upper limit of the web is controlled by the pendulum sensor **53**. The output of cell **51** is preferably coupled to the power source for the draw rolls **41** and **42**, while the output from the pendulum sensor **53** is coupled to the power source of the re-wind stand, such as the motor **18**. In this fashion, if the slack loop becomes too large, the main drive source is interrupted for a period sufficient to permit the take-up roll to remove the unwanted portion of the slack loop. Conversely, if the slack loop becomes too small, motion in the pendulum sensor **53** may produce a signal in electrical switch member **54**, thus interrupting motion of the re-wind apparatus.

In order to provide appropriate tension in the traveling web, tension rollers **56**, **57**, **58** and **59** are provided, each tension roll having drag means coupled thereto for retarding or braking the rotation of the roll. Thus, appropriate tension may be established in traveling web **40**, with this tension being maintained in the web by virtue of its succeeding re-winding path including a wrap about roller **26**.

With attention being re-directed to FIG. **3** of the drawings, it will be noted that potentiometer **35** is provided with three points of contact, with contacts **35***a* and **35**b being across the main winding, while contact **35***c* is coupled to the wiper. Thus, the signal is obtained which is delivered to the speed control for variable speed motor **18**.

While the apparatus as illustrated is shown with a rack-and-pinion drive, it will, of course, be appreciated that other sensing means may be employed as well. The arrangement makes it possible to utilize conventionally wound potentiometers to obtain appropriate speed control.

I claim

1. Means for re-winding an elongated treated web onto a winding core from a treating station, and comprising:

a. web handling means for establishing and maintaining a slack segment in said elongated web downstream from said web treating station;

b. take-up roll means including frame means for mounting and driving means for rotating a winding core to re-wind said treated web onto said winding core; and

c. means for applying tension to said web between said slack loop segment and said winding core;

d. said take-up roll means including motor means for rotating said winding core, control means for driving said motor means at a certain predetermined arcuate rate responsive to the immediate diameter of said core, sensing arm means having one end mounted for pivotal arcuate rotation on said frame means and having the free end thereof adapted for running contact with that portion of said treated web forming the outer periphery of said web on the winding core to determine the immediate composite diameter thereof, and profiled cam means secured to said sensing arm means and having a cam face, and cam follower means arranged in contact with the cam face of said cam means, said cam face having a profile to provide linear motion in said cam follower means relative to said frame means with said linear motion being proportional to the reciprocal of the immediate composite diameter of said winding core and said re-wound web, means coupling said cam follower means to said control means, said control means being responsive to said linear motion to maintain said motor means at said predetermined arcuate rate.

2. The apparatus as defined in claim **1** being particularly characterized in that said web treating station forms a thermal weld in a web.

3. The apparatus as defined in claim **1** being particularly characterized in that said treating station provides intermittent motion for said web.

4. The apparatus as defined in claim **1** being particularly characterized in that said control means includes a

linear potentiometer having a wiper, and said cam follower being coupled to said wiper.

5. The apparatus as defined in claim 4 being particularly characterized in that said control means is provided with a linear potentiometer, whereby the energy output of said linear potentiometer is proportional to the reciprocal of the immediate composite diameter of the winding core and re-wound web.

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