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(54) **COIL SPRING DRIVE SYSTEM AND WINDOW COVER**

(76) Inventor: **Andrew J. Toti**, 311 W. River Rd., Modesto, CA (US) 95351

(*) Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/989,148**

(22) Filed: **Dec. 11, 1997**

Related U.S. Application Data

(63) Continuation-in-part of application No. 08/963,775, filed on Nov. 4, 1997.

(51) **Int. Cl.**[7] **E06B 9/30**
(52) **U.S. Cl.** ..... **160/168.1 R**; 160/170 R; 185/39
(58) **Field of Search** ..... 160/170 R, 168.1 P, 160/84.02, 84.04, 84.05, 190, 191, 192, 189, 313, 315, 318; 185/39

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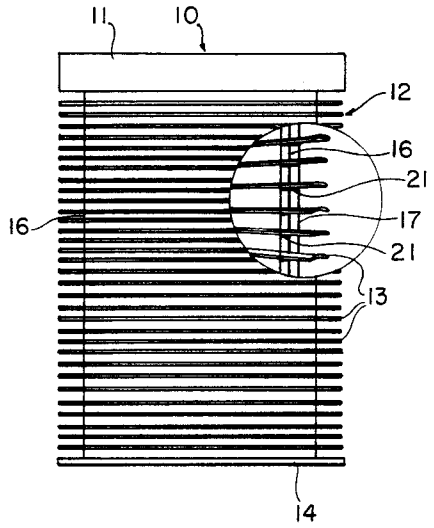
(57) **ABSTRACT**

A coil spring drive unit for window covers is disclosed, which comprises a coil spring drive and the combination whose elements are selected from (1) a band shift transmission which provides varying ratio power transfer as the cover is opened and closed; (2) gear means comprising various gear sets which provide frictional holding force and fixed power transfer ratios; and (3) a gear transmission which provides fixed ratio power transfer as the cover is opened or closed. The combination permits the coil spring drive torque to be tailored to the weight characteristics of the window cover such as a horizontal slat or pleated or box blind as the blind is opened and closed, and permits the length of the blind and the distance between the open and closed positions of the blind to be altered for a given rotational distance of the coil spring.

5 Claims, 3 Drawing Sheets



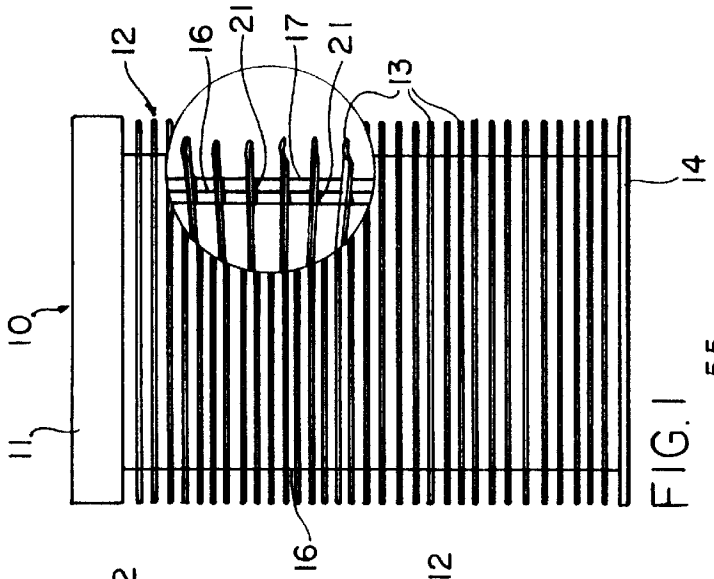


FIG. 1

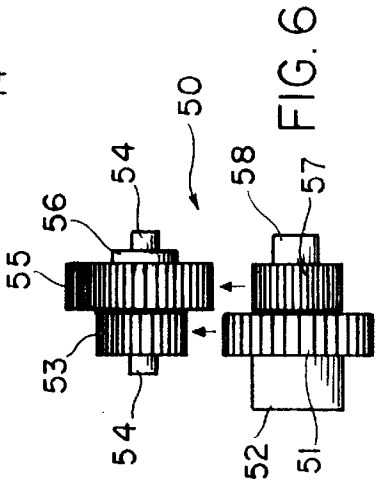


FIG. 6

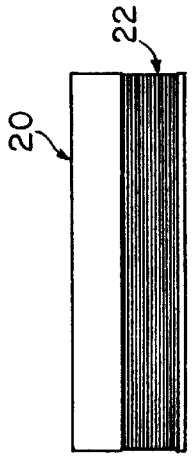


FIG. 4

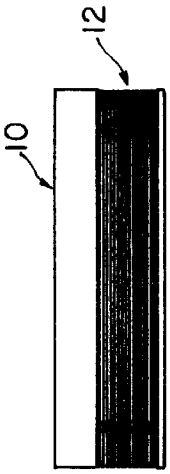


FIG. 2

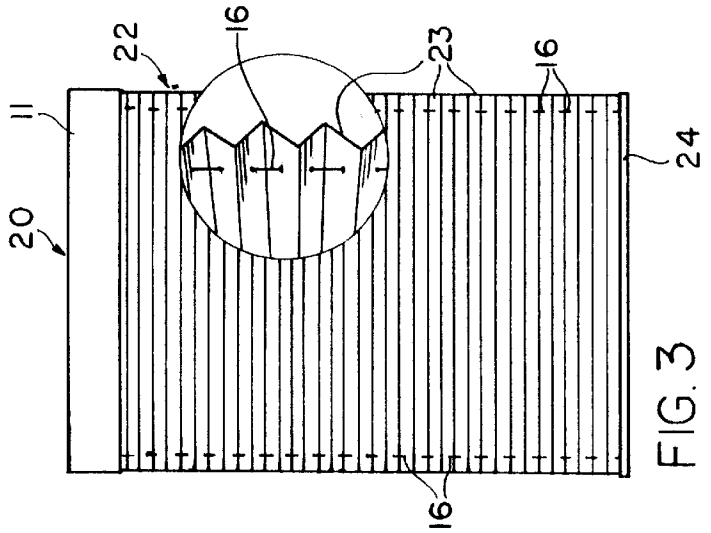


FIG. 3

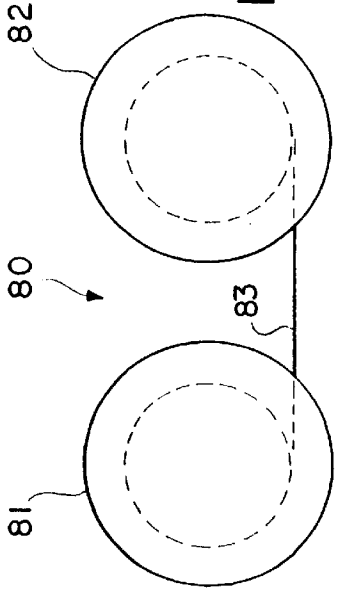


FIG. 8

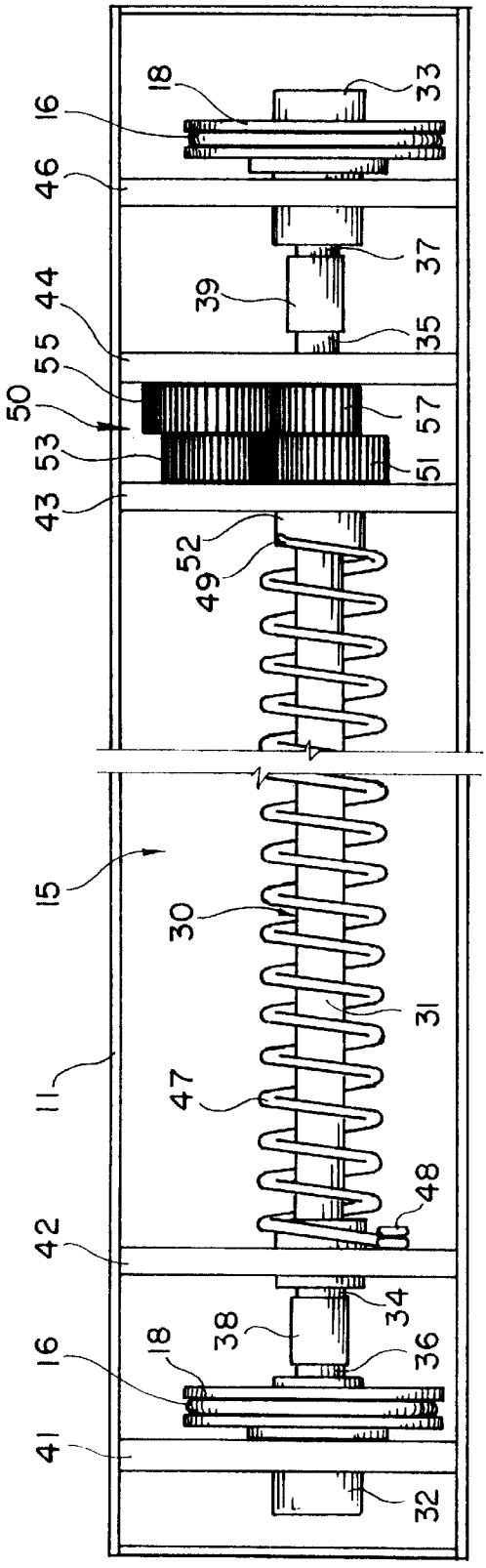


FIG. 5

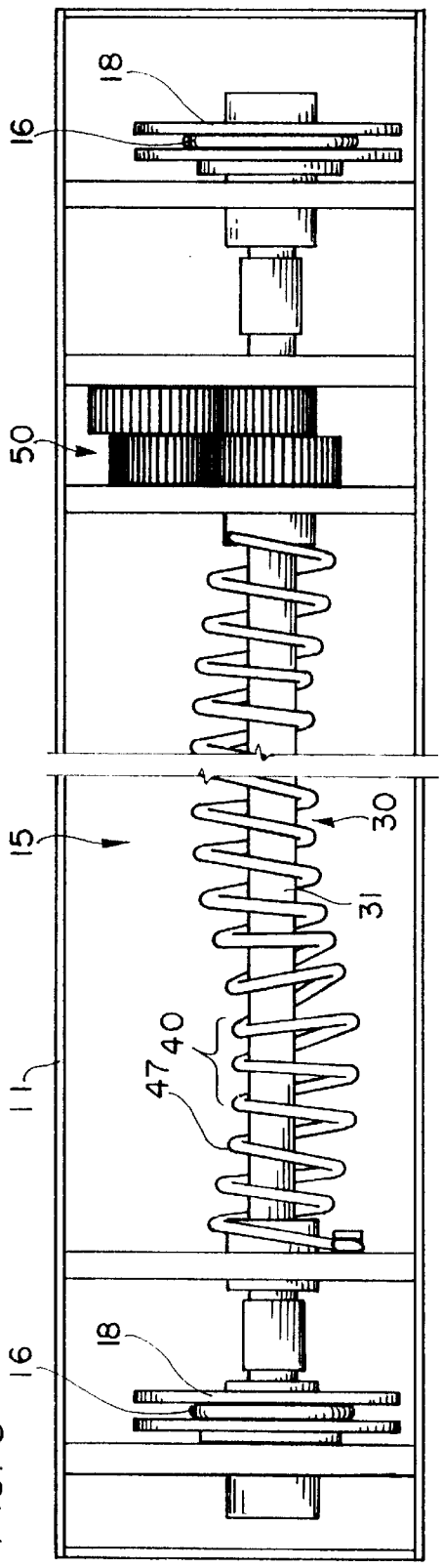


FIG. 10

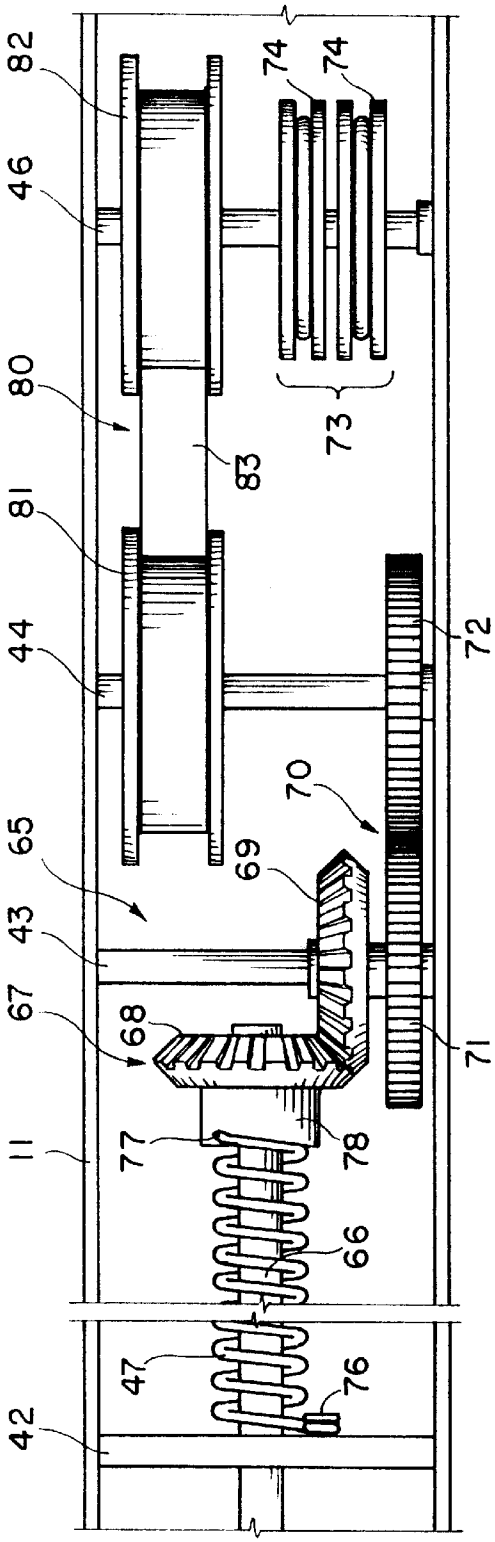


FIG. 7

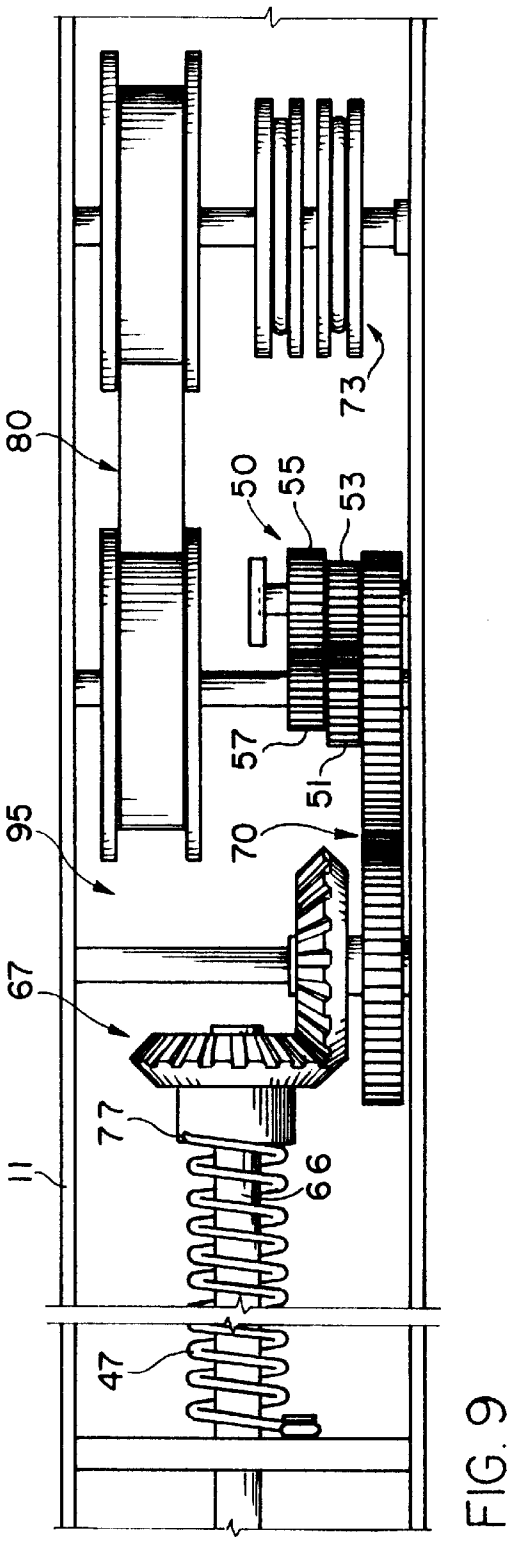


FIG. 9

COIL SPRING DRIVE SYSTEM AND WINDOW COVER

This is a continuation-in-part of application Ser. No. 08/963,775, titled COIL SPRING DRIVE SYSTEM FOR WINDOW COVER, filed Nov. 4, 1997, inventor Andrew J. Toti.

1. BACKGROUND OF THE INVENTION

a. Field of the Invention

The present invention relates generally to coil spring drives or motors, which are useful in numerous applications and, in particular, to the application of such coil spring drives in window cover systems.

b. Definitions and Applicability

Typically, as used here, "cover" refers to expandable or extendible structures. These include slat structures such as so-called venetian or slat blinds and so-called mini-blinds. These structures also include pleated folding structures such as single and plural pleat structures and box, hollow and cellular structures. "Cover" also refers to flat, sheet-type covers such as roller blinds. In this document, "cover" and "blind" are frequently used interchangeably. As applied to such covers, "operate" refers to the process of closing and opening the covers, typically (for horizontal covers) to lowering and raising the cover.

As used here, "horizontal" window cover refers to horizontally oriented covers such as horizontal slat blinds, horizontal folded pleat blinds and horizontal cellular blinds. The present invention is applicable generally to horizontal window cover systems and to flat window cover systems. It is understood that "window," as used for example in "window cover," includes windows, doorways, openings in general and even non-opening areas or regions to which "window" covers are applied for decoration, display, etc.

c. Current State of the Relevant Field

Typically a horizontal cover or blind is mounted above a window or space which is to be covered, and is operated using lift cords to extend the cover and lower it across the area, stopping at a selected position at which the blind partially or fully covers the area. For typical horizontal slat blinds, the lift cords are attached to a bottom rail and the individual slats are supported by the cross members or "rungs" of a separate cord ladder. When the blind is fully lowered, each slat is supported by a rung of the cord ladder and relatively little weight is supported by the lift cords. However, as the blind is raised, the slats are "collected" on the bottom rail, and the support of the slats is thus increasingly transferred from the cord ladder to the bottom rail and the weight supported by the rail and the lift cords increases.

Typical pleated, cellular, box, etc., blinds are formed of resilient material having inherent spring-like characteristics. As the resilient blind is raised toward the fully open position, the blind material is increasingly compressed, and requires increasingly greater force to overcome the compression force and move the blind and hold the blind in position. Effectively, then, both the slat blind and the pleated blind require increasingly greater force to open the blind and to maintain the blind open than is required to close the blind and maintain the blind closed.

So-called coil spring drives have operating characteristics which make it difficult to assist the opening and closing operation of blinds such as horizontal and flat blinds. As applied to downward-closing embodiments of such blinds, coil spring drives typically are mounted at the top of the blind, and are operatively connected or coupled to the shaft about which the blind lift cord is wound. As described above, as the blind is lowered, the slat weight supported by the lift cords decreases and the compression force of the pleats decreases. However, as the blind is lowered, the spring is wound and the energy stored in the spring increases, such that the increasing torque or force of the spring may then raise the blind in fast, uncontrolled fashion. Also, it may be difficult to keep the blind at a selected position. Furthermore, if the blind is heavy, and requires a strong spring to maintain the blind open, the blind is particularly susceptible to instability and uncontrolled raising operation when partially or fully extended or closed. Conversely, when the blind is at or near the upper limit of its travel (i.e., is open), the slat weight supported by the lift cords and the pleat compression is at or near maximum, while the spring torque is at or near minimum. In this position, then, unless the spring is strong (perhaps causing uncontrolled operation), the spring torque may be insufficient to keep the blind open.

Frequently, prior art coil spring drives use latching mechanisms in an attempt to hold the blind or cover in position.

2. SUMMARY OF THE INVENTION

In one aspect, the present invention is embodied in a spring drive unit comprising a shaft; a coil spring mounted around a shaft and having a fixed end and a rotatable end; and a gear transmission of fixed drive ratio, operatively connected at one end to the rotatable spring end and operatively connected at the opposite end to the shaft. As a result of this arrangement, the transmission applies holding friction to the shaft and applies the fixed drive ratio between the coil spring and the shaft, determining the ratio of the shaft rotational distance to the spring winding distance and thereby controlling the force applied to the shaft by the spring. In another related aspect, the spring drive unit further comprises a band transmission of continuously varying drive ratio, which is itself operatively connected at one end to the rotatable spring end and operatively connected at the opposite end to the shaft, for applying the continuously varying drive ratio between the coil spring and the shaft to continuously vary the force applied to the shaft by the spring and to continuously vary the ratio of the shaft rotational distance and the spring winding distance.

In another aspect, the present invention is embodied in a spring drive unit comprising a shaft; a coil spring mounted around the shaft and having a fixed end and a rotatable end; and a band transmission of continuously varying drive ratio, operatively connected at one end to the rotatable spring end and operatively connected at the opposite end to the shaft. As a result of this arrangement, the band transmission applies said continuously varying drive ratio between the coil spring and the shaft to continuously vary the force applied to the shaft by the spring and to continuously vary the ratio of the shaft rotational distance and the spring winding distance. In another related aspect, the spring drive unit further comprises a gear transmission of given drive ratio, which itself is operatively connected at one end to the rotatable spring end and is operatively connected at the opposite end to the shaft, for applying the given drive ratio to the shaft to fixedly alter the force applied to the shaft by the spring and to fixedly alter the ratio of the shaft rotational distance to the spring winding distance, and for applying inherent holding friction to the shaft.

In another aspect, the present invention is embodied in a window cover system comprising an extendible window

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