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Gammill

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[54] **PHASE-LINKING ROTATING MECHANISM FOR PLURAL SWITCH ASSEMBLY**

[75] Inventor: **Lawrence A. Gammill,** Colorado Springs, Colo.

[73] Assignee: **Hewlett-Packard Company,** Palo Alto, Calif.

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[52] **U.S. Cl.** ..... **200/14,** 200/17 R, 200/18

[51] **Int. Cl.** **H01h 3/52**

[58] **Field of Search** ..... 200/14, 17 R, 18; 74/10 R, 10.15, 10.27, 10.41

[56] **References Cited**

UNITED STATES PATENTS

3,534,315	10/1970	De Nicola	200/14 X
2,811,594	10/1957	Popouschek	200/14
3,207,861	9/1965	White	200/14
3,214,531	10/1965	Dux	200/14 X
3,254,165	5/1966	Volkmann	200/14
3,621,158	11/1971	Swinstead	200/14
3,287,512	11/1966	Gertsch et al.	200/14

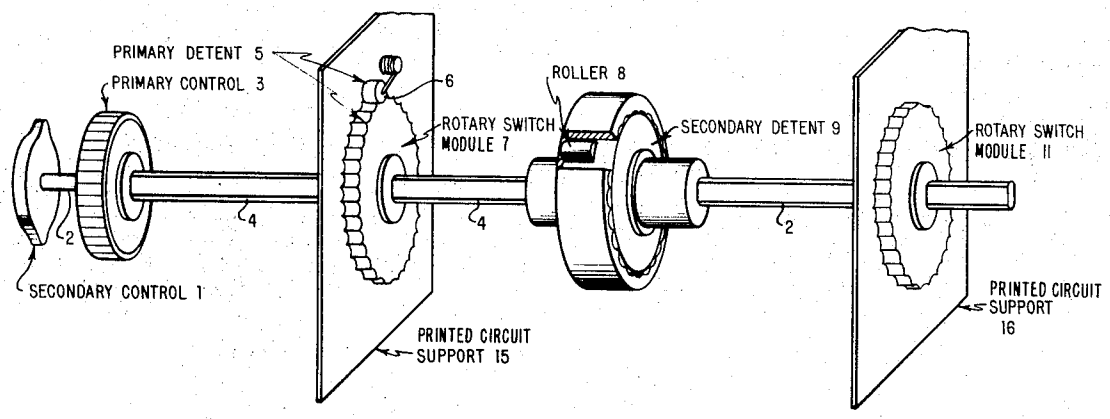
Primary Examiner—J. R. Scott

Attorney—Roland I. Griffin

[57] **ABSTRACT**

Two or more rotating elements are linked together so they can be rotated simultaneously by a primary control. The first element is detented from a support by a detent that requires a relatively large override torque. Each successive element is detented from the preceding element by a detent that requires less override torque. The primary control, connected to the first element, rotates all the elements simultaneously without changing the phase relationships between elements. A control to a later element rotates that element and the succeeding elements without rotating the preceding elements. Thus, the phase relationship between elements can be adjusted.

2 Claims, 2 Drawing Figures



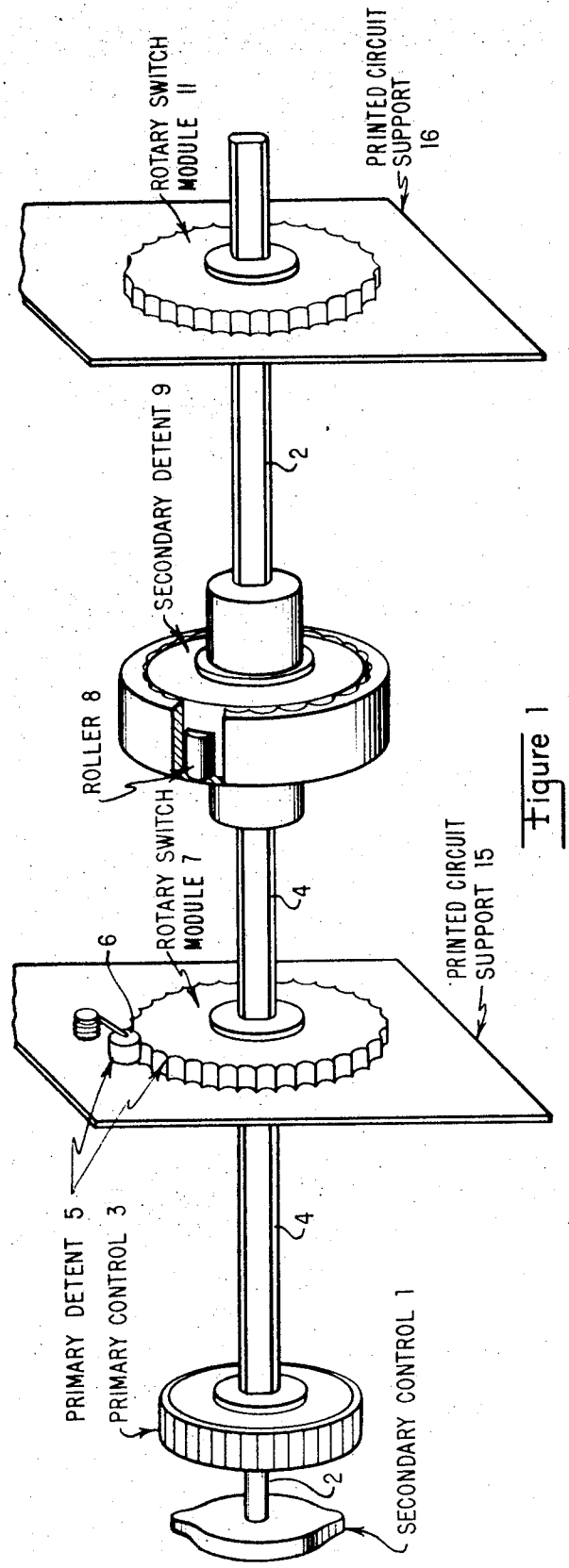


Figure 1

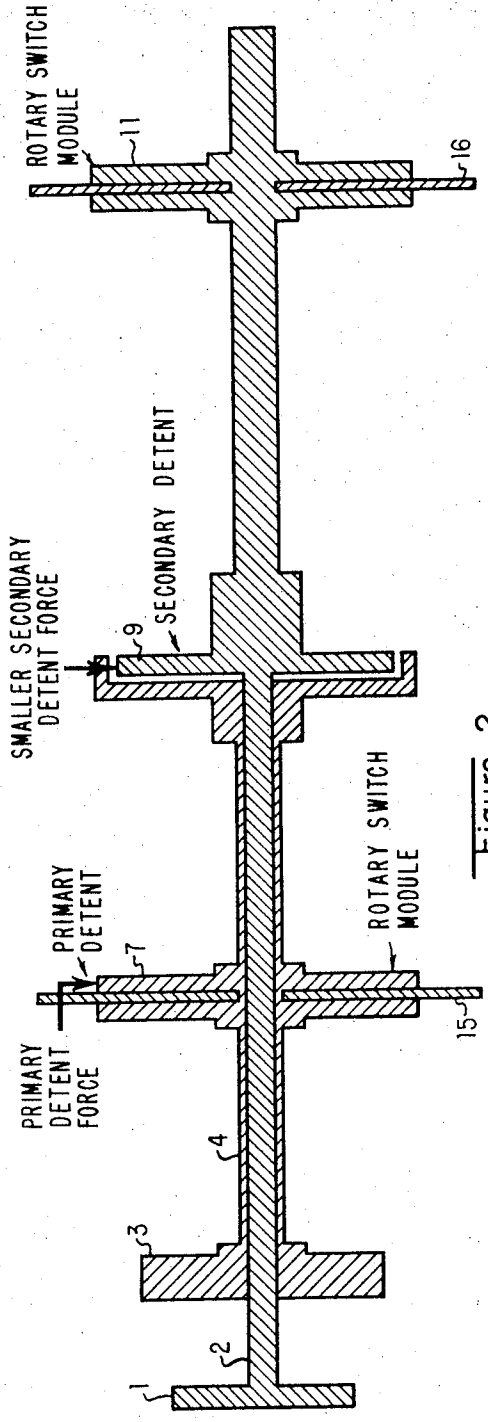


Figure 2

INVENTOR
LAWERENCE A. GAMMILL
BY Roland D. Griffin
ATTORNEY

PHASE-LINKING ROTATING MECHANISM FOR PLURAL SWITCH ASSEMBLY

BACKGROUND AND SUMMARY OF THE INVENTION

Mechanical devices sometimes require that two or more rotating elements be rotated simultaneously by the same control. This is usually accomplished by mounting the elements on the same shaft or by using a gear or sprocket assembly to link the elements together. Some devices, such as electrical rotating switches, impose the additional constraint that the phase relationship between the rotating elements be adjustable. This can be accomplished by gear or sprocket assemblies, but often such assemblies are too bulky and complex.

The present invention provides for both simultaneous rotation of two or more elements and convenient adjustment of the phase relationship between the elements. This is done by arranging the elements in series and detenting each element from the preceding element by a detent that requires less override torque than the preceding detent. For example, in a two element device, the first element is detented from a supported structure while the second element is detented from the first. The detent for the second element requires less override torque than the detent for the first, so the second element can be rotated without rotating the first. Thus, the phase relationship between the two elements can be adjusted. When enough torque is applied to overcome the detent for the first element, both elements will rotate simultaneously because the detent for the second element links the two elements together.

DESCRIPTION OF THE DRAWINGS

FIGS. 1 and 2 show perspective and cross-sectional views, respectively, of a rotational switch assembly constructed according to the preferred embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring now to FIGS. 1 and 2, two rotary switches 7, 11 are supported by printed circuit boards 15, 16. The switches make electrical contact with conducting surfaces on the printed circuit boards. Swtich 7 is connected to a primary control knob 3 by a hollow shaft 4, is restricted by a detent 5 mounted on circuit board 15, and is attached to one part of a second detent 9 by the hollow shaft. Each detent comprises a roller 6, 8 forced by a spring into a corresponding notch located in the opposing part. A secondary control knob 1 is attached to switch 11 by a second shaft 2 that passes through the hollow shaft. The second shaft is attached to another part of detent 9.

The detents are constructed so secondary detent 9 requires less override torque than primary detent 5. Thus, when secondary control knob 1 is turned with enough torque to override detent 9, switch 11 turns, but detent 5 prevents switch 7 from turning. In this manner, detent 9 acts as a disengaged clutch and the phase relationship between the two swtiches can be adjusted.

When primary control knob 3 is turned, both switches 7, 11 are turned simultaneously with the adjusted phase relationship kept intact. Since switch 7 is directly linked to knob 3 by shaft 4, it turns when knob 3 is turned with enough torque to override detent 5. Detent 9 now acts as an engaged clutch and links switch 11, via shaft 2, to shaft 4. Thus, when knob 3 is turned, causing shaft 4 to turn, switch 11 is turned.

This invention can be used to control any number of switches as long as each successive switch is detented from the preceding switch by a detent that requires less override torque. The phase relationship between the switches depends on the number and locations of the catches in the detents. If the detent works solely by the friction between its parts, an infinite number of positions is available and the phase relationship can be adjusted to any desired value. This invention also provides the advantage of adjustable separation between switches. Depending on the length of the connecting shafts, the switches can be as widely separated as desired.

I claim:

1. Apparatus for controlling the phase relationship between a plurality of rotatable elements, said apparatus comprising:

a first rotatable element;

a first detent mechanism coupled to the first rotatable element for providing it with a plurality of different detent positions and for requiring the application of a first override torque to rotate the first rotatable element from one of these detent positions to another;

a second rotatable element;

a second detent mechanism coupled to the second rotatable element for providing it with a plurality of different detent positions and for requiring the application of a second override torque smaller than the first override torque to rotate the second rotatable element from one of these detent positions to another;

a hollow first shaft coupled to the first rotatable element and to the second detent mechanism for simultaneously rotating the first and second rotatable elements together to maintain the phase relationship therebetween; and

a second shaft coaxially supported within the first shaft and coupled to the second rotatable element for rotating the second rotatable element relative to the first rotatable element to adjust the phase relationship therebetween.

2. Apparatus as in claim 1 wherein each rotatable element comprises a rotary switch element supported by a printed circuit board.

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