

[54] **DEVICE FOR CONTROLLING
SIMULTANEOUSLY A PLURALITY OF
VARIABLE RESISTORS**

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[58] Field of Search..... 338/128, 196;
74/471 XY; 33/25 B

[56]

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[57]

ABSTRACT

A display device for displaying the interrelation among the controlled resistances of a plurality of variable resistors is provided for a device for controlling simultaneously a plurality of variable resistors by a single operating or control shaft. The display device may clearly indicate the position of a point, for example, the lower end of the control shaft, which is displaced as the control shaft is shifted.

4 Claims, 4 Drawing Figures

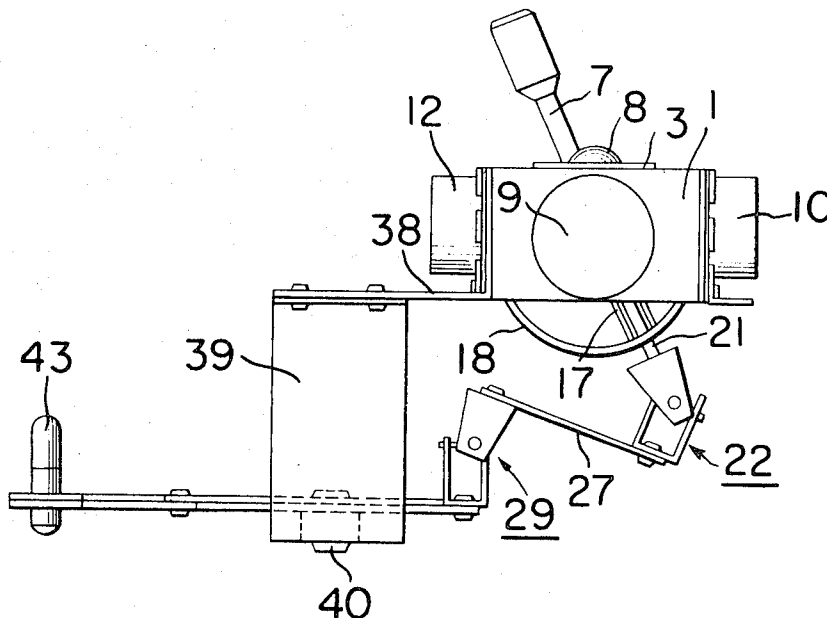


FIG. 1

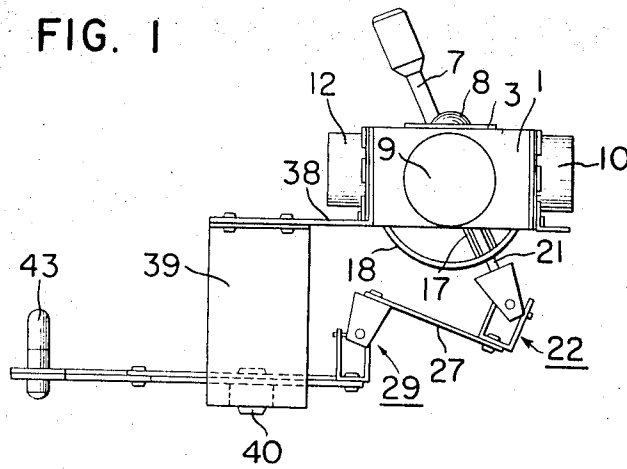


FIG. 2

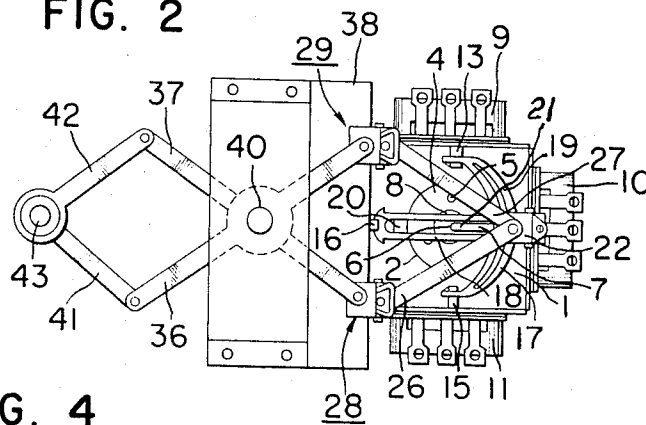


FIG. 4

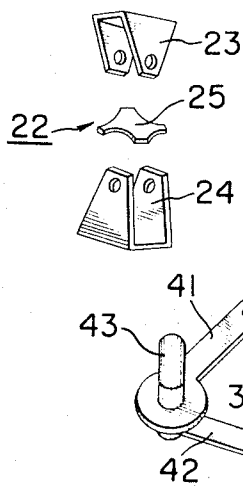
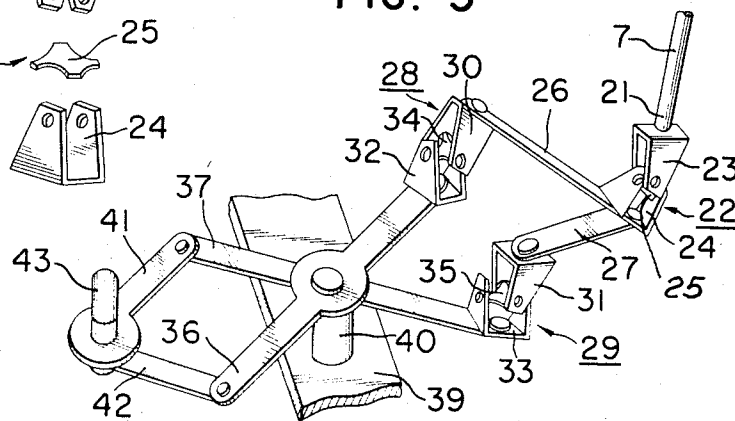


FIG. 3



DEVICE FOR CONTROLLING SIMULTANEOUSLY A PLURALITY OF VARIABLE RESISTORS

BACKGROUND OF THE INVENTION

The present invention relates to a device for controlling simultaneously a plurality of variable resistors by one control shaft.

In the device for controlling a plurality of variable resistors by one control shaft in order to simultaneously control the resistances of the variable resistors, it becomes extreme difficult to determine or to find out a predetermined or optimum interrelation among a plurality of variable resistors because of the large number of variable resistors which are simultaneously adjusted.

SUMMARY OF THE INVENTION

One of the objects of the present invention is, therefore, to provide a device for controlling simultaneously a plurality of variable resistor, which may display a predetermined or optimum interrelation among the variable resistors. (The predetermined or optimum interrelation among the variable resistors will be referred to as "balanced condition" in this specification.)

Another object of the present invention is to provide a device for controlling simultaneously a plurality of variable resistors, which may be made simple in construction and inexpensive to manufacture, but may display the balanced condition of the variable resistors in a highly reliable and dependable manner.

According to one embodiment of the present invention a display device may indicate a desired point of a control shaft which may control simultaneously a plurality of variable resistors. For this purpose, a sort of pantograph linkage one point of which is connected to the desired point of the control shaft through a universal joint is used so that a display device at another point of the pantograph linkage may indicate the displacement and position of the desired point of the control shaft. According to the present invention, the display of the desired point on the control shaft may be effected without modifying the conventional device for controlling simultaneously a plurality of variable resistors.

The above and other objects, features, and advantages of the present invention will become more apparent from the following description of one preferred embodiment thereof taken in conjunction with the accompanying drawing.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a front view of one preferred embodiment of a device for controlling simultaneously a plurality of variable resistors, said device incorporating a display device in accordance with the present invention;

FIG. 2 is a bottom view thereof;

FIG. 3 is a perspective view on enlarged scale illustrating the essential parts thereof; and

FIG. 4 is an exploded perspective view on enlarged scale illustrating a universal joint used in the control device of the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

A box-shaped casing 1 square in cross section has an opened bottom and a top surface having a center aperture 2. A pair of molded bearings 3 and 4 each having an inner semispherical bearing surface are fixed to the

top surface of the casing 1 with rivets 5 or the like in coaxial relation with the aperture 2. A spherical member 8 through the center of which extends an operating shaft 7 is rotatably fitted into the pair of bearings 3 and 4 in such a manner that the shaft 7 extends through a center aperture 6 of the bearing 4.

Four variable resistors 9, 10, 11, and 12 are mounted at the centers of the side walls of the casing 1 respectively. The variable resistors 9 - 12 may be fixed to the side wall by inserting the truck-out portions (not shown) of a shield plate or cover of the variable resistor into engaging openings (not shown) formed in the side wall of the casing 1 and thereafter bending the struck-out portions against the side wall. The rotary shafts 13, 14, 15, and 16 (the shaft 14 being not shown), which may be made of a metal or insulating material, extend through the side walls into the casing 1, and the pairs of the opposed rotary shafts 13 and 15; and 14 and 16 are interconnected with bow-shaped slotted yoke members 17 and 18 respectively made of resilient material. More particularly, the struck-out portions (not shown) at both ends of the yoke members 17 and 18 are snugly fitted the notches (not shown) so that the pairs of opposed rotary shafts may be firmly interconnected under the spring force of the yoke members 17 and 18. As best shown in FIG. 2, the pair of yoke members 17 and 18 are so arranged that they may cross each other but will not interfere the other when they are oscillated. The pair of yoke members 17 and 18 are provided with longitudinal elongated slots 19 and 20 and lower end portion 21 of the shaft 7 is extended through the slots 19 and 20 at the point of the intersection between the yoke members 17 and 18.

Next referring particularly FIG. 3, the lower end of the shaft 7 is fixed to the base of a U-shaped yoke member 23 which is joined to a U-shaped yoke member 24 through a spider 25. The pair of yoke members 23 and 24 and the spider 25 constitute a universal joint generally designated by 22.

A first pair of links 26 and 27 have their one ends rotatably fixed to the yoke member 24 and their other ends rotatably fixed to universal joints 28 and 29, respectively. The universal joints 28 and 29 are similar in construction to the universal joint 22, and each comprises a pair of U-shaped yoke members 30 and 32; 31 and 33, and a spider 34 and 35 respectively. A second pair of crossed links 36 and 37 are rotatably pivoted with a pivot pin 40 to the base of a U-shaped supporting member 39 which in turn is fixed to an extension 38 of the casing 1 (See FIG. 2). One ends of the second pair of crossed links 36 and 37 are rotatably fixed to the universal joints 28 and 29 respectively whereas the other ends are pivoted to one ends of a third pair of links 42 and 41, respectively. The other ends of the third pair of links 42 and 41 are rotatably joined together, and carry an indicating lamp or the like 43.

Next the mode of operation will be described. Since the spherical member 8 is rotatably fitted into the pair of bearings 3 and 4, the operating shaft 7 which extends through the spherical member 8 may attain any angular position so that the lower end portion 21 of the operating shaft 7 which is fitted into the elongated grooves 19 and 20 of the yoke members 17 and 18 causes the latter to rotate about the axes of the pairs of opposed rotary shafts 13 and 15; and 14 and 16, respectively. As a result, the rotary shafts 13, 15, 14, and 16, which are securely fixed to the yoke members 17 and 18, are caused

to rotate through angles equal to the angles of rotation of the yoke members 17 and 18 respectively. Thus the four variable resistors 9, 10, 11, and 12 may be simultaneously controlled to vary their resistances. When it is desired to vary only the resistances of the variable resistor 9 and 11 simultaneously without changing the resistances of the variable resistors 10 and 12, the operating shaft 7 is shifted in a plane which passes the center of the spherical member 8 and is in parallel with the paper in FIG. 1. When it is desired to vary only the resistances of the variable resistors 10 and 18, the operating shaft 7 is shifted in a plane which passes the center of the spherical member 8 and is perpendicular to the paper in FIG. 1. In these cases, the lower end portion 21 of the operating shaft 7 rotates the yoke member 17 or 18 while sliding through the elongated slots 20 or 19 of the yoke member 18 or 17 without rotating the latter so that the rotary shafts 13 and 15 or 14 and 16 or the pair of opposed variable resistors 9 and 11 or 12 and 14 may be rotated.

The first, second and third pairs of links 26 and 27, 36 and 37, and 41 and 42 form a sort of pantograph linkage so that the display device 43 is always located on the line connecting between the pivot 40 and the universal joint 22 as the latter which is joined to the lower end of the operating shaft 7 is displaced. When the first and third pairs of links 26 and 27, and 41 and 42 are equal in length and the second pair of links 36 and 37 are pivoted at their centers, the movement of the display device 43 is symmetrical about the pivot pin 40 with respect to the movement of the universal joint 22. In other words the locus of the indicating lamp 43 is symmetrical about the pivot pin 40 with respect to that of the universal joint 22, and the displacement of the indicating lamp 43 is equal to that of the universal joint 22 and hence of the lower end 21 of the operating shaft 7. Thus the displacement of the lower end 21 of the operating shaft 7 may be displayed by the indicating lamp 43.

In the instant embodiment, three universal joints 22, 28 and 29 are used in order to permit the indicating lamp 43 to move in a plane while the lower end of the operating shaft 7 makes the three-dimensional movement, but the universal joints 22, 28 and 29 may be eliminated when the movement of the indicating lamp 43 in a plane is not required. Instead of the mechanism for controlling a plurality of variable resistors by one operating shaft described above, any other suitable mechanism may be used in the present invention.

In summary, according to the present invention the movement of the operating shaft may be displayed by the indicating lamp or the like spaced apart from the operating shaft so that the relation among the resistances of the variable resistors may be immediately seen. Since the representation of the adjusted position may be enhanced by the indicating lamp or the like, the electronic equipment may have a novel design.

What is claimed is:

1. A device for simultaneously controlling a plurality of variable resistors comprising

- a. control means for simultaneously controlling with one operating or control shaft the rotary shafts of a plurality of variable resistors,
- b. a first pair of links whose one ends are rotatably fixed to said operating shaft,
- c. a pair of crossed links which are crossed each other at the centers thereof, pivoted rotatably at the centers thereof to a stationary member of said device, and have their one ends rotatably fixed to the other ends of said first pair of links and their other ends rotatably pivoted to one ends of a third pair of links respectively,
- d. said third pair of links having the other ends thereof rotatably pivoted to each other, and
- e. display means disposed at said pivoted joint between the other ends of said third pair of links.

2. A device as defined in claim 1 wherein said first pair of links are connected to the free end of said control shaft and to said second pair of links through universal joints respectively.

3. A device as defined in claim 1 wherein said control means comprises

- a. a casing having a top surface, side walls and an opened bottom,
- b. a pair of molded bearings fixed to said top surface of said casing in coaxial relation with a centered aperture formed through said top surface, said pair of molded bearings having an inner semispherical bearing surface,
- c. an operating shaft which extends through the center of a spherical member rotatably fitted into said pair of bearings and through said center aperture of said top surface,
- d. a plurality of variable resistors mounted on said outer side walls of said casing in such a manner that the rotary shafts thereof extend through said side walls into said casing,
- e. a plurality of resilient, bow-shaped and slotted yoke members each for interconnecting a pair of opposed rotary shafts of said variable resistors, said plurality of resilient bow-shaped slotted yoke members crossing one another in such a manner that they will not interfere the oscillations or rotations of the others, and

f. the lower end of said operating shaft extending through all of said slots of said plurality of yoke members and pivoted to said one ends of said first pair of links so that when said operating shaft is shifted each of said plurality of yoke members may rotate about the axis of said pair of opposed rotary shafts of said variable resistor and cause said pair of opposed rotary shafts to rotate through an angle equal to the angle of rotation of said each yoke member.

4. A device as defined in claim 3 wherein said first pair of links are connected to said free end of said operating shaft and to said one ends of said second pair of links through universal joints respectively.

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