United States Patent

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[33] **Germany**
[31] **P 18 05 534.0**

[54] **MULTISTAGE POTENTIOMETER**
10 Claims, 6 Drawing Figs.

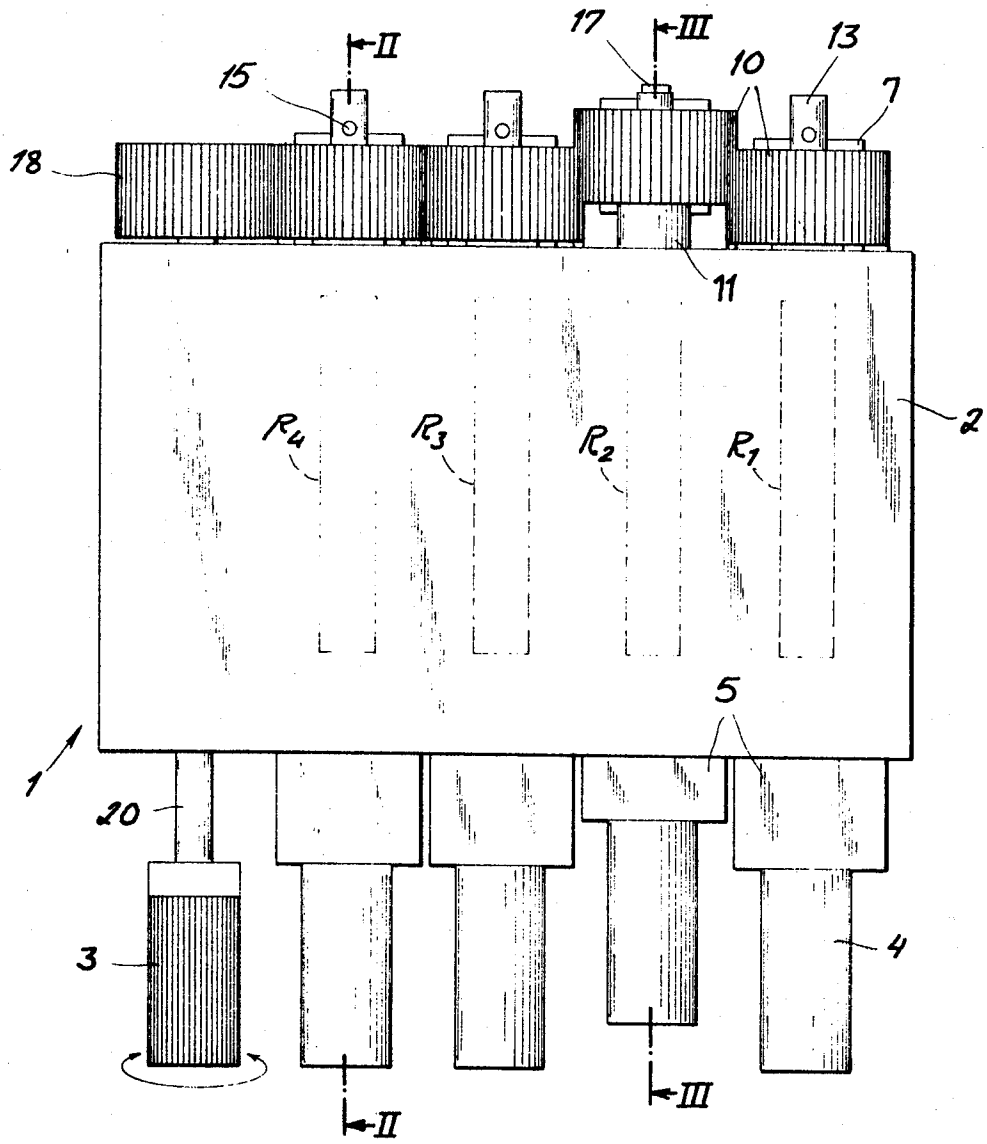
[52] **U.S. Cl.** **338/131,** 338/133
[51] **Int. Cl.** **H01c 1/16**
[50] **Field of Search** 338/128, 129, 130, 131, 132, 133

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ABSTRACT: Several resistance strips carried alongside one another on the underside of a potentiometer plate are engageable by respective sliders driven by individual leadscrews which are normally decoupled from a driving gear train and can be selectively coupled thereto by pusher bars and brackets straddling the corresponding gears to shift them into an engaged position. The brackets are loosely mounted on their pusher bars and, like the latter, are provided with pairs of confronting lugs enveloped by the turns of a coil spring resiliently linking each bracket to its bar.



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SHEET 1 OF 2

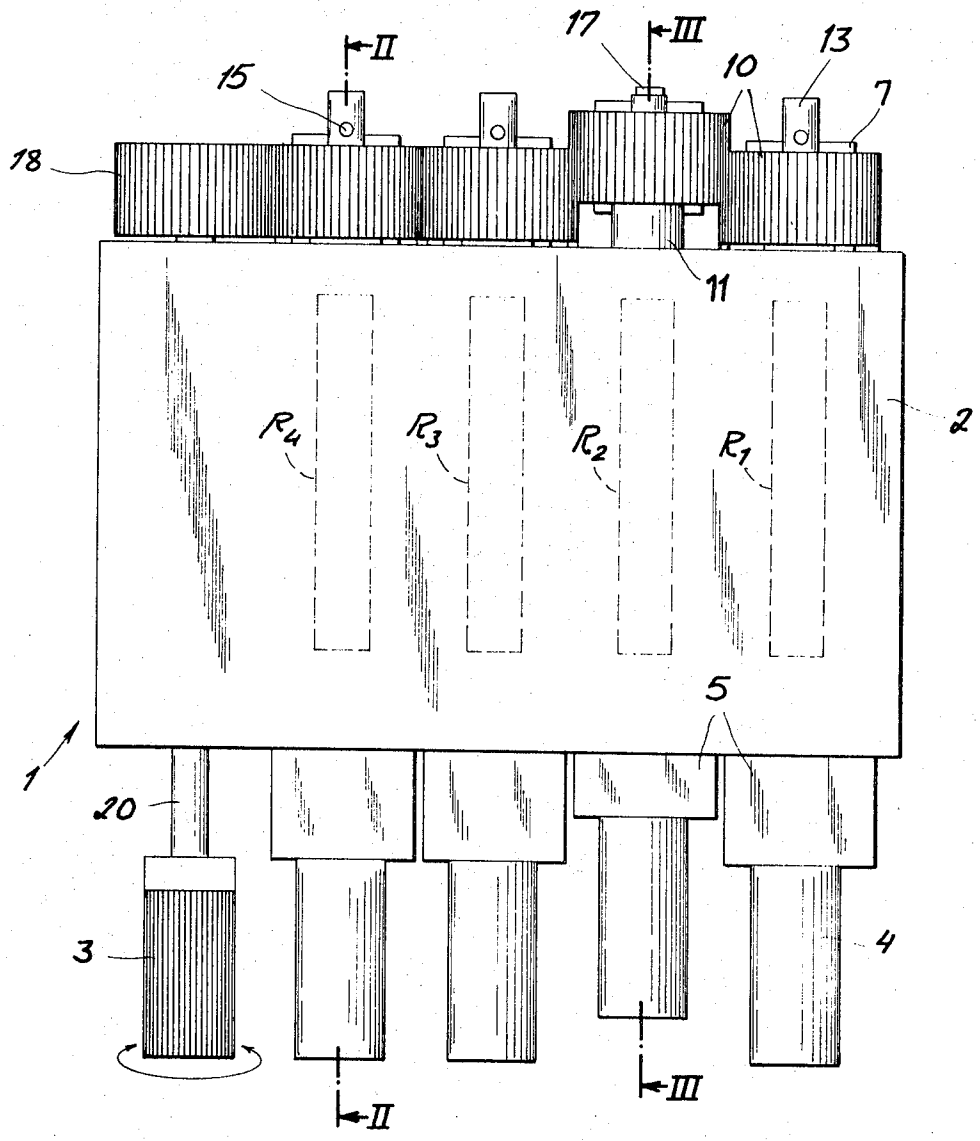


FIG. 1

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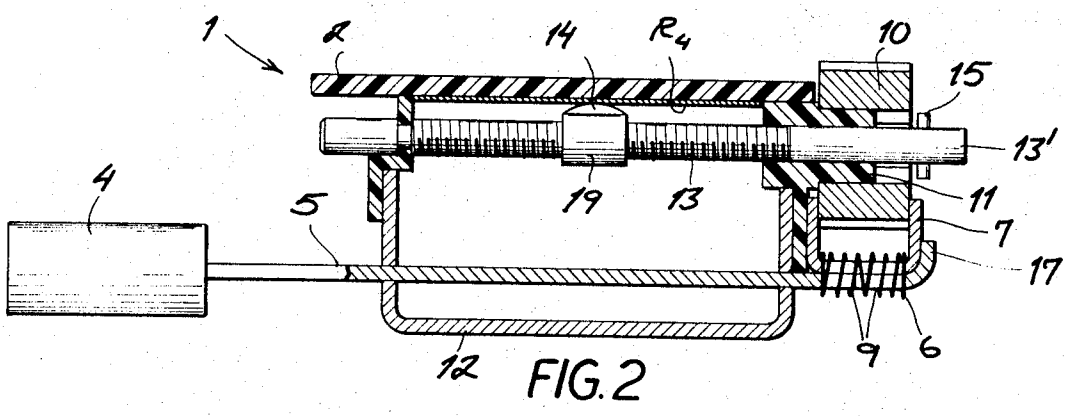


FIG. 2

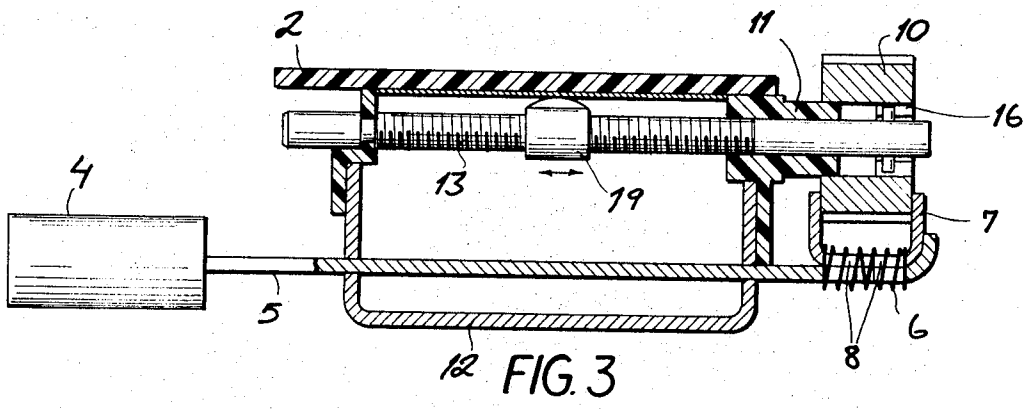


FIG. 3

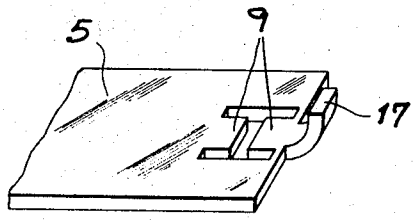


FIG. 5

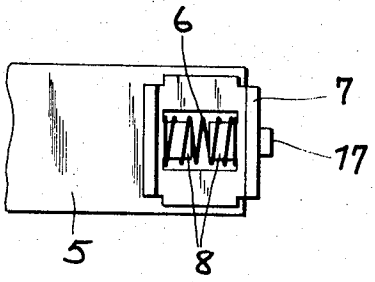


FIG. 4

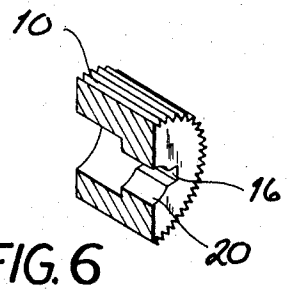


FIG. 6

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MULTISTAGE POTENTIOMETER

My present invention relates to a multistage potentiometer of the type wherein several strips of resistance material are carried alongside one another on the surface of an insulating plate for engagement with sliders that can be individually displaced by respective leadscrews. The resistance strips of such a potentiometer may form part of respective stages of a voltage selector and may be so interrelated, e.g. decadically, that a specific resistance value can be selected by the individual displacement of one or more sliders. For this purpose it is desirable to provide a common driving element, such as a manually rotatable knob, which can be selectively coupled with any of the associated leadscrews to transmit its motion thereto.

The general object of this invention is to provide a device of this kind in which a simple, compact and inexpensive mechanism is used for such selective coupling.

A more specific object of my invention is to provide a coupling mechanism for the purpose set forth which does not exert an excessive drag upon the driving element and which separates the decoupled leadscrews from the driving power attained to prevent any, however slight, unintentional entrainment of the slider in any stage.

These objects are realized, pursuant to my present invention, by the provision of a train of individually axially shiftable gears in mesh with one another and in axial alignment with the respective leadscrews, these gears being normally disconnected from their leadscrews and being selectively engageable therewith upon an axial shifting into an off-normal position in which they still maintain their meshing relationship with the remainder of the gear train to transmit a driving torque to the engaged leadscrew for the displacement of its slider.

For the purpose of such selective engagement I provide individual shifters for the several gears, these shifters advantageously including axially displaceable pusher members which are resiliently linked with respective entraining means engaging the associated gears. Thus, since the rotative coupling of any gear with its leadscrew generally involves the interengagement of a pair of complementary formations such as a pin and a slot, the resilient linkage between the pusher member and the entraining means delays the axial shift of the gear until the coupling formations have been properly aligned. For simplicity of assembly, I prefer to design each pusher member as a flat bar and to use a generally U-shaped bracket, straddling the gear, as the entraining means; the bracket and the bar are advantageously formed with respective pairs of confronting lugs enveloped by the turns of a coil spring which represents the resilient linkage therebetween and also constitutes the only means for attaching the bracket to the bar.

According to another important feature of my invention, a hub rigid with the potentiometer plate is provided for each gear and is axially penetrated by the respective leadscrew to guide the latter while normally holding it out of contact with the gear. A pin or the like on a projecting extremity of the leadscrew fits into a slot on an inner annular shoulder of the gear when the latter is axially shifted in a direction partly removing it from its hub; this partial removal, which leaves only a small portion of the inner gear periphery supported on the stationary hub, reduces the frictional resistance to be overcome by the driving element when any leadscrew is engaged

The invention will be described in greater detail with reference to the accompanying drawing in which:

FIG. 1 is a top plan view of a multistage potentiometer embodying my invention;

FIG. 2 is a cross-sectional view taken on the line II–II of FIG. 1, showing a decoupled stage;

FIG. 3 is a cross-sectional view taken on the line III–III of FIG. 1, showing a coupled stage;

FIG. 4 is a fragmentary plan view, drawn to a larger scale, of part of a pusher bar and an associated gear-entraining bracket seen in FIGS. 2 and 3;

FIG. 5 is a perspective view of the pusher-bar portion shown in FIG. 4; and

FIG. 6 is a perspective view of a gear forming part of the potentiometer, shown partly broken away.

The potentiometer 1 shown in the drawing comprises, by way of example, four stages including respective strips R_1, R_2, R_3, R_4, carried on the underside of an insulating plate 2 which forms a lid on an upwardly open housing 12. Rotatably journaled in this housing are a set of four leadscrews 13 whose extremities 13' pass through respective sleeves 11, preferably of synthetic resin, rigid with housing 12. Each leadscrew 13 is engaged by a respective nut 19 carrying a slider 14 in contact with the corresponding resistance strip along which this slider is displaceable upon rotation of this screw.

A common driving element for the several leadscrews is represented by a rotatable knob 3 on a shaft 21 whose other end carries a driving gear 18 in mesh with a train of four driven gears 10 forming a continuous part of a continuous train. These gears are rotatably mounted on hubs constituted by the sleeves 11 and are axially shiftable, as illustrated in FIG. 1 for the gear of the No. 2 stage, from a normal position coplanar with gear 18 into an off-normal position in which a displaced gear partly projects beyond its undisplaced neighbor or neighbors while still remaining operatively coupled therewith. Such axial shifting is brought about, as more fully described hereinafter, by the selective operation of associated pushbuttons 4 integral with respective pusher bars 5 which are slidably supported in the lower part of housing 12.

Each gear 10 is provided with a respective bracket (FIGS. which, as seen in FIGS. 2 and 3, is substantially U-shaped and straddles the lower part of the gear with its upstanding arms. If the gear is metallic, the bracket 7 preferably consists of insulating material. As best seen in FIG. 5, the bar 5 has a pair of confronting lugs 9 separated by a small gap; two similar lugs 8, FIG. 4, are formed on the bight portion of bracket 7 and are juxtaposed with the lugs 9, the four lugs being enveloped by a coil spring 6 which tends to maintain the bracket in a limiting position FIGS. 2 and 4) in which the bracket abuts a stop 17 constituted by a bent up tip of bar 5. With the bracket 7 sitting loosely on the free end of bar 5, these two parts can be assembled in a simple manner by a squeezing of the compressed spring 6 into the aligned gaps of their lugs 8 and 9 whereupon the spring reexpands to bear upon the ends of the H-shaped slots defining the two pairs of lugs.

Each gear 10 is formed with an inner shoulder 20 having at least one pair of diametrical opposite notches 16 designed to receive a transverse coupling pin 15 on the extremity 13' of the corresponding leadscrew 13; the width of shoulder 20 is shown to be a small fraction of the overall width of the gear. At least the smooth extremities 13' of the leadscrews should consist of insulating material if the gears are made of metal, thereby preventing any short-circuiting of the several potentiometer stages.

In the normal decoupled position, shown in FIG. 2 for stage No. 4, the gear 10 rides on its hub 11 which may consist of a low-friction material such as Teflon; the shoulder 20 of the gear 10 advantageously surrounds the leadscrew extremity with some clearance so as not to transmit any torque to the leadscrew in this position. When the pushbutton 4 is depressed (as shown in FIG. 3 for stage No. 2); gear 10 usually remains in or close to its normal axial position for a shot time, i.e. until its internal notches or slots 16 have aligned themselves with the pin 15 of screw 13. At that point the spring 6, previously compressed by the displacement of pusher bar 5, expands to move the gear 10 into its alternate position illustrated in FIG. 3. In the latter position, in which the ends of the pin or some other part of leadscrew 13 may provide additional support for the gear, the driving torque of knob 3 and gear 18 is transmitted to the leadscrew 13 so that slider 14 is displaced in one direction or the other depending on the sense of rotation of the knob. Upon subsequent retraction of pushbutton 4, stop 17 and spring 6 restore the gear 10 to its normal position.

It should be noted that the spring 6 normally exerts no pressure upon the gear 10 through the bracket 7 which, by its resilient linkage with pusher bar 5, is held substantially centered with reference to the gear.

The individual potentiometer stages represented by resistance strips R_1—R_4 and the associated sliders **14** may be cascaded by suitable leads, not shown, to enable the selection of a desired magnitude in terms of respective denominational orders, e.g. decades. Thus, the slider of the No. **1** stage may select unit values of 0—9 ohms on strip R_1, the slider of the No. **2** stage may similarly select 10's of ohms on strip R_2, and so forth. A dial or other indicator may be coupled with knob **3** to show the magnitude of the resistance selected within each decade. Naturally, the manual rotation of knob **3** may also be replaced by an automatic drive.

I claim:

1. A multistage potentiometer comprising a plate with a plurality of parallel resistance strips; a plurality of leadscrews respectively extending along said strips, each of said leadscrew being provided with a nut carrying a slider in contact with the respective strip; a train of individually axially shiftable gears in mesh with one another and in respective axial alignment with said leadscrews, said gears being normally disconnected from said leadscrews and being selectively engageable therewith upon an axial shifting into an off-normal position while maintaining their meshing relationship with the remainder of the gear train; a plurality of shifters, one for each gear, individually operable to couple the respective leadscrew to said gear train; and drive means for reversibly rotating said gear train.

2. A potentiometer as defined in claim **1** wherein each of said shifters comprises an axially displaceable pusher member, entraining means engaging the corresponding gear, and resilient means linking said entraining means with said member.

3. A potentiometer as defined in claim **2** wherein said entraining means comprises a generally U-shaped bracket straddling said corresponding gear, said member being a flat bar slidably supporting said bracket.

4. A potentiometer as defined in claim **3** wherein said bar is provided with stop means engageable with said bracket in a normal position of said bar.

5. A potentiometer as defined in claim **3** wherein said bracket and said bar are provided with respective pairs of confronting lugs lying alongside each other, said resilient means comprising a coil spring with turns enveloping the juxtaposed lugs of said pairs.

6. A potentiometer as defined in claim **1**, further comprising a plurality of hubs fixed relatively to said plate, said gears being axially slidable on said hubs.

7. A potentiometer as defined in claim **6** wherein said leadscrews axially traverse said hubs in coaxial relationship with said gears and are provided with extremities projecting beyond said hubs, said extremities and said gears being provided with coacting formations interengageable upon a partial removal of a gear from its hub.

8. A potentiometer as defined in claim **7** wherein said coating formations include a slotted inner annular shoulder on each gear and at least one radial projection on the corresponding leadscrew extremity.

9. A potentiometer as defined in claim **8** wherein said shoulder surrounds said leadscrew extremity with clearance.

10. A potentiometer as defined in claim **1** wherein said drive means comprises a further gear in permanent mesh with one of said axially shiftable gears.