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CIRCUIT CONTROLLING MEANS

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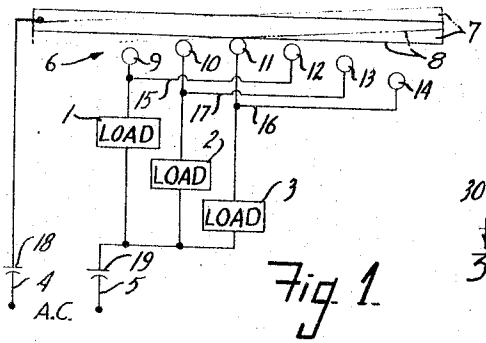


Fig. 1.

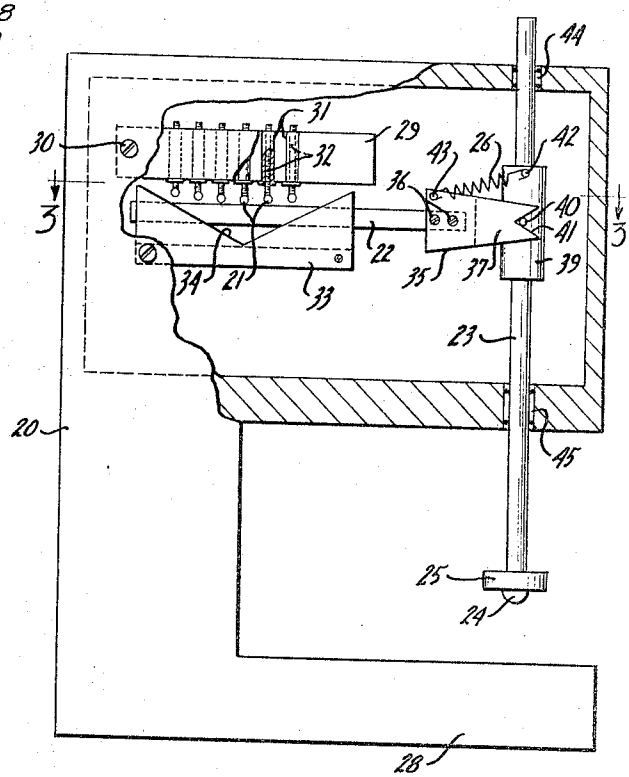


Fig. 2.

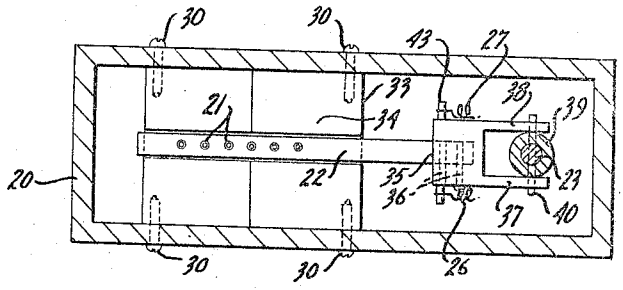
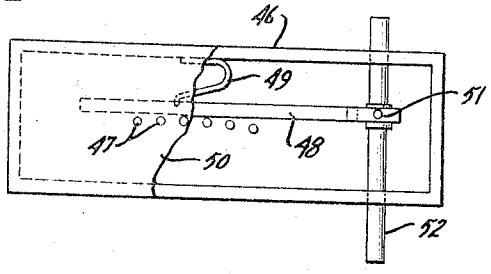


Fig. 3.

Fig. 4.



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CIRCUIT CONTROLLING MEANS

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This invention relates to a circuit controlling means and particularly to a means for making and breaking a circuit.

In signalling and control circuits, means for making and breaking one or more electrical circuits in response to a relatively small movement or the like may be desirable. Although various switching devices have been proposed, a highly sensitive switching circuit particularly for simultaneously making and breaking of different circuits without essentially any time difference has not heretofore been provided.

The present invention is particularly directed to an improved circuit controlling means including means for making and breaking of a circuit in response to very minute movements and particularly to controlling load circuits in sequence.

Generally, in accordance with the present invention, a floating member is provided with a flat and preferably polished contact surface. The member is mounted with the contact surface in opposed relation to a plurality of spaced contacts which are arranged in a generally convex surface beneath the contact surface. The contact member constitutes a common terminal power connection to one side of a power source and the several individual contacts provide separate load connections to the opposite side of a power source. The member rests on the contacts and can engage any two of the contacts at the very most and when engaged therewith provides completion of power to both of the engaged contacts. Very slight or minute pivotal movement of the member with respect to an engaged contact however causes it to engage the adjacent contact and provide energization of only one circuit. The member then pivots about the single engaged contact. The amount of movement required for making and breaking the circuit to any given contact can be made extremely small such that as a practical matter only one circuit will be energized at any given time. The positioning of the member can be determined by a positioning control means connected thereto to pivot the bar successively about the several contacts.

In a preferred construction, the several contacts are formed with generally spherical or round contact surfaces which engage the flat contact surface. The surface is formed as a flat and hardened surface on one face of a bar which is mounted in floating aligned relation with the contacts. The spherical contacts provide an essentially point engagement and the rounded contacts provide a similar line engagement between the bar and the contacts. Consequently, only the slightest movement is required to make and break the circuit therebetween.

Due to the relatively small contact area, however, the circuit arrangement should be selected to create a relatively low voltage and minimal current across the contact area. For example, the power source may be a conventional alternating current power source having voltage limiting capacitors connected in the respective leads.

The present invention thus provides a relatively simple and inexpensive arrangement for making and breaking of circuits in response to small movements and further provides a highly improved means to sequentially actuate a plurality of circuits in accordance with the positioning of any suitable position sensitive input.

The drawing furnished herewith illustrates preferred constructions of the present invention in which the above

advantages and features are clearly illustrated as well as others which will be clear from the following description.

In the drawing:

FIG. 1 is a diagrammatic view of the present invention incorporated to sequentially operate three circuits;

FIG. 2 is a side elevational view of a measuring or gauge device constructed in accordance with the present invention;

FIG. 3 is a view of a portion of FIG. 2 showing the mounting details of a part of the present invention; and

FIG. 4 is a side view, partly in section, of another measuring device which may be used as a depth gauge or the like.

Referring to the drawing and particularly to FIG. 1, the illustrated embodiment of the invention includes three alternating current loads **1**, **2** and **3** adapted to be connected to power lines **4** and **5** from an incoming power supply such as the conventional 110 volt alternating current employed in the United States. The circuits to loads **1**, **2** and **3** are completed in sequence by a circuit controlling means **6** which is the subject matter of the present invention.

The diagrammatically illustrated embodiment of the invention includes a contact bar **7** which is preferably formed of a suitable hardened steel or the like and includes a lower flat and highly polished contact face or surface **8**. The bar **7** is disposed in floating arrangement above individual contacts **9–14** which are selectively connected to the several loads **1–3**, as presently described. The number of contacts can of course be varied in accordance with the outputs desired as more fully appears from the operational description.

The contacts **9–14** are supported in any suitable manner in generally circumferentially spaced relation to define a convex array immediately below and in alignment with the flat and polished contact surface **8** of the contact bar **7**. The convex array opens downwardly from the contact surface **8** with the bar **7** resting on one or two contacts as hereinafter described. The contacts **9–14** are preferably formed as spheres as shown or at least with a spherical contact surface to present a point engagement with the flat contact surface **8** of bar **7**.

In the illustrated embodiment of the invention, the contacts **9–14** are paired, with the outer end contact **9** connected by a jumper lead **15** to contact **12** and end contact **14** connected by a similar jumper lead **16** to the contact **11**. The intermediate contacts **10** and **13** to each side of the array are interconnected by a similar lead **17** to parallel contacts. The several loads **1**, **2** and **3** are connected between the paralleled circuits and the power lead **5**, as shown.

The bar **7** rests on the aligned contact or contacts and is adapted to be pivoted about an engaging contact. When the contact bar is engaging a single contact; for example, the contact **11** as shown in FIG. 1, the corresponding load **3** is energized. If the bar **7** is pivoted in either direction, it moves about the engaged contact **11** as a pivot point toward the immediately adjacent contact **10** or **12** depending upon the direction of pivot. If the illustrated contact bar **7** is pivoted counterclockwise, it pivots about the contact **11** toward the contact **10** and, in the limiting position shown in phantom, spans and engages both of the contacts **10** and **11**. Consequently both of the loads **2** and **3** will be energized. Slight further counterclockwise movement beyond the phantom line position results in the contact bar **7** and particularly contact surface **8** moving from the original pivot contact **11** to pivot engagement solely about the intermediate contact **10**.

The movement required to make and break the point contact engagement can be made relatively infinitesimal and consequently the device provides a very reliable and simple means for detecting the position of the contact

bar 7 with respect to the spatially distributed contacts 9–14 which in turn can be made to provide a reference control or the like. Generally, when employing device in connection with its most sophisticated form and with spherically shaped contacts, the voltage and current supplied to the small point contact area between the contact bar and the several contacts should be limited to prevent damaging of the surfaces by arcing and the like. Generally, in such sensitive circuit constructions, when the voltage and the current are so limited, amplification will be required. A high impedance circuit such as a vacuum tube or the like would generally be employed, as the input part of each load 1–3.

In the illustrated embodiment of the invention, capacitors 18 and 19 are connected in each of the lines 4 and 5 to reduce the voltage and the current to minimum; for example, to the order of 2 or 3 volts and 5 milliamps or less. The precise current and voltage characteristics employed will be limited generally by the work function of the contact bar and the contacts and by the desired life of the device.

In certain practical applications, useful tools can be made at a sufficiently low cost to permit replacement of the bar and/or contacts and the power limitations can be substantially increased as a practical matter.

Referring particularly to FIGS. 2 and 3, the present invention is shown in simplified form as incorporated in a gauge or measuring device.

Referring particularly to FIG. 2, a housing 20 is provided within which spherical or base contacts 21 are mounted in a generally convex array which opens upwardly. A contact bar 22, similar to that shown in FIG. 1, is disposed in floating generally horizontal arrangement below the spherical contacts 21 and is connected at one end to a gauge measuring rod 23 which is slidably supported for vertical movement at an angle substantially perpendicular to the normal horizontal position of the contact bar 22, with a spherical work engaging member 24 secured to the lower end of the rod 23 by a suitable support 25. Springs 26 and 27 act between bar 22 and rod 23 to hold the bar in engagement with a contact 21. The lower end member 24 of the rod 23 is positioned with respect to a reference base 28 constructed to define a predetermined spacing with the contact bar 22 in a horizontal position. If the rod 23 is moved to either side of this reference position, it correspondingly pivots the contact bar 22 to engage a different contact 21 and establish a signal circuit or the like, not shown, in FIGS. 2 and 3 for clarity and simplicity of explanation.

More particularly in the embodiment of FIG. 2, the contacts 21 are held in a two-piece support block 29 which is physically secured within the housing 20 as by mounting bolts 30. The block 29 includes cylindrical openings, one for each of the contacts 21 and within which a stainless steel or other suitable threaded insert 31 is suitably secured; for example, by clamping between the two parts of block 29. Each of the spherical contacts 21 is suitably fixed to the upper end of a related threaded rod 32 for adjustment within the corresponding tapped insert 31. This permits accurate positioning of the several contacts 21 with respect to one another to define the convex array, and particularly the necessary pivotal movement of the contact bar 22 on one contact before it engages an adjacent contact.

The contact bar 22 is generally formed as in FIG. 1 and is mounted in a generally floating arrangement within a suitable U-shaped guide member 33 which is also suitably secured within housing 20 and opens upwardly in alignment with the contacts 21. The upper edges of the side arms of member 33 are concave as at 34 to accommodate the convex arrangement of the contacts 21.

The outer end of the contact bar 22 is pivotally secured to the shaft or rod 23 in any suitable manner. In the illustrated embodiment of the invention, a forked member 35 is fixed to the outer end of the pivot bar 22 as by pins 36.

Members 35 includes spaced arms 37 and 38 projecting to opposite sides of a bushing 39 which is fixed to the rod 23 as by a pin 40. The outer ends of the arms 37 and 38 are provided with similar V-shaped recesses 41 mating with the opposite ends of the pin 40 which projects in opposite directions from the shaft and the bushing 39. The springs 26 and 27 are small coil springs secured to opposite sides of the forked member 35. One end of each spring is pinned to the bushing 39 above the pin 40, as by a pin 42, and the opposite end is similarly secured to the fork 35 as by pin 43. The coil springs 26 and 27 hold the pin 40 with the recesses 41 and resiliently urge the bar 22 upwardly into engagement with the contacts 21.

The measuring rod 23 is slidably mounted within the housing 20 for vertical reciprocation with the upper and lower portions disposed within suitable bearings 44 and 45 which preferably provide a close sliding fit permitting relatively free vertical movement while essentially preventing any lateral or pivotal movement of the measuring rod 23.

The base 28 is provided with a hardened, flattened surface which defines a reference plane from which all measurements are taken by detecting the position of the lower end of the rod 23 with respect thereto.

The contacts 21 can be connected in any suitable load circuit, for example, as shown in FIG. 1, to provide an electrical output signal.

In a gauge device similar to that shown in FIGS. 2 and 3, the contacts 21 were interconnected to energize small neon lamps which required only a minimal voltage and current. In more sophisticated and expensive controls, the circuit might be connected to a vacuum tube control circuit, as previously discussed.

The present invention as applied to a gauge measuring device has been found to provide a very simple and inexpensive means for measuring and gauging work pieces. For example, if it is desired to measure the tolerance of shafts or the like, the contacts 21 are set to have the contact bar engage a given intermediate contact 21 with the rod 23 spaced from the base 28 by that distance. The engaged contact 21 constitutes the initial pivot point for a proper shaft. The shafts to be measured may be rolled between the lower end of the measuring rod 23 and the base 28 and would rapidly cause the contact bar 22 to pivot successively about the contacts 22 and permit rapid positioning in engagement with the contact 21 with the diameter aligned with the end of rod 23. This would indicate the diameter of the shaft and by appropriate lighting of a lamp or the like indicate whether or not it was within a selected tolerance. The contacts 21 are positioned within the contact block 29 such that the required pivotal movement to move from the reference or proper contact 21 as a pivot point to an out of tolerance contact 21 is related to the actual measurement or the difference in vertical position of the rod 23 from the base diameter position.

FIG. 4 illustrates a further simplified application of the present invention in a depth gauge or measuring device which has been employed for measuring the depth of the tread of a tire. Generally, the invention includes a small block-like support 46 formed of a suitable plastic or the like. A plurality of contact pins 47 are embedded in one side of the contact support 46 and project laterally therefrom. The contact pins 47 are disposed in a suitable convex array, in accordance with the previous discussion. A contact bar 48 is disposed in alignment with the convex array and biased toward the contacts 47 by a U-shaped spring 49 secured at one end generally centrally of the contact bar 48 and at the opposite end to a suitable portion of the contact block 46. The pins 47 and bar 48 can be connected in a suitable signalling circuit, for example, with each pin connected to energize a separate related neon lamp or the like, not shown.

A suitable cover **50** is secured to the support **46** overlying the contact pins **47** and forming a guide for the bar **48** to prevent undue lateral movement thereof. The contact bar **48** projects outwardly through a side slot **51** in the cover **50**. The outer end **48** is pivotally secured as by a pin **52** to a small gauge shaft or rod **43**. The rod is free to move rectilinearly into the tire tread or other recess, the depth of which it is desired to measure. The movement of the rod **53** into the recess causes the contact bar **48** to pivot about the successive contact pins **47** and terminate in engagement with one contact pin **47** related to the degree of movement. This in turn provides an indication of the movement with respect to the reference contact pin **47**, in the illustrated embodiment shown as a right-hand-most pin.

The present invention thus provides a very simple and inexpensive means for accurately measuring a movement or a distance and more particularly a position with respect to any desired reference position.

Various modes of carrying out the invention are contemplated as being within the scope of the following claims particularly pointing out and distinctly claiming the subject matter which is regarded as the invention.

I claim:

1. In a circuit controlling means,
a plurality of contacts mounted in a generally convex array, and
a contact member having a contact surface aligned with the convex array and mounted to successively engage the several contacts and pivot about an engaged contact into engagement with an immediately adjacent contact.

2. The circuit controlling means of claim **1** wherein generally circular contacts are employed to minimize the contact area between the contacts and the contact member.

3. The circuit controlling means of claim **2** wherein the contact member includes a flat contact surface engaging said contacts.

4. The circuit controlling means of claim **1** wherein the contacts are spherical members presenting an essentially point contact to the contact member.

5. The circuit controlling means of claim **4** wherein the contact member includes a flat contact surface engaging said contacts.

6. The circuit controlling means of claim **3** wherein the contact member and contacts are connected in a low voltage and current circuit to minimize arcing and damaging of the contact member and contacts.

7. In a circuit controlling means,
a plurality of contact rods terminating in generally spherically shaped contacts on one end of the rods,

a support having a plurality of laterally spaced and aligned openings, one for each of said rods,
adjustable means supporting the rods within the openings for longitudinal movement therein for arranging of the contacts in a convex array,
a contact bar having a flat contact edge surface,
guide means aligned with the contacts, said contact bar mounted in the guide means for movement toward and away from said contacts,
means urging the bar toward the contacts, and
positioning means secured to an end portion of the bar to pivot the bar on said contacts.

8. In a circuit controlling means,
a support having a reference surface means,
a contact block secured to the support,
a plurality of laterally spaced rod members adjustably mounted in the contact block for longitudinal movement with respect to the reference surface means,
spherical contacts secured to corresponding ends of the rod members and positioned in a predetermined convex array,
a contact bar disposed in alignment with the contacts, said bar having a flat and polished contact surface opposing said contacts,
a guide means on the support with the contact bar disposed within the guide means to permit free movement toward and away from the contacts while preventing lateral movement thereof,
a position sensing rod slidably mounted in the support along a line substantially normal to the contact bar, and
means to pivotally attach the contact bar to the sensing rod to pivot the contact bar on said contacts in response to movement of the rod.

9. In a circuit controlling means,
a contact block,
a plurality of contact pins embedded in the block and projecting outwardly from a common side thereof, said contact pins disposed in a convex array,
a floating contact bar aligned with the contact pins and having a flat and polished surface opposing said contact pins,
resilient means secured to the contact bar and urging the bar into engagement with the contact pins, and
a measurement rod pivotally secured to one end of the contact bar and mounted for rectilinear movement for pivoting contact bar about an engaged contact pin into pivoting engagement with an adjacent pin.

No references cited.

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