United States Patent

[11] 3,585,563

[72] Inventor **Kenneth L. Hegle**
Temple City, Calif.

[21] Appl. No. **839,349**
[22] Filed **July 7, 1969**
[45] Patented **June 15, 1971**
[73] Assignee **Spectrol Electronics Corporation**
City of Industry, Calif.

[54] **VARIABLE RESISTOR CONSTRUCTION HAVING SPRING TERMINAL CLIPS SURROUNDED BY A POTTING AGENT**
5 Claims, 3 Drawing Figs.

[52] **U.S. Cl.** ..... **338/180,** 338/164, 338/183, 338/313, 339/218 C
[51] **Int. Cl.** **H01c 9/02**
[50] **Field of Search** ..... 338/118, 160, 176, 180, 183, 272, 313, 322, 329, 332, 164; 339/17 C, 17 LC, 217 R, 218 R, 218 C

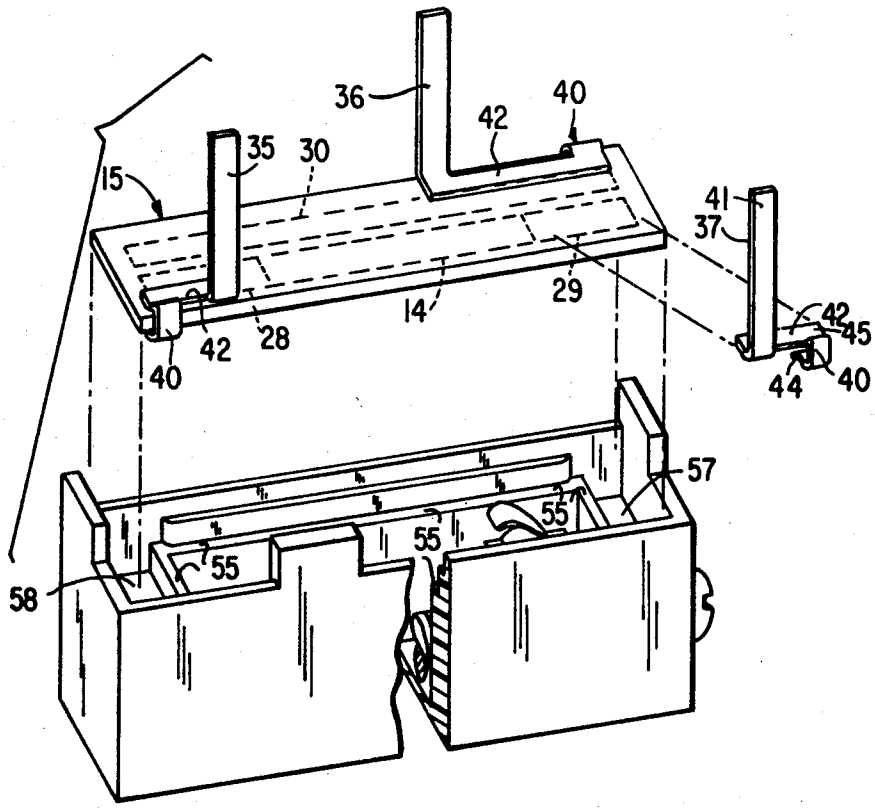
[56] **References Cited**

UNITED STATES PATENTS

3,400,355	9/1968	Van Benthuysen	338/183
3,488,618	1/1970	Yongblut	338/164

Primary Examiner—Laramie E Askin
Assistant Examiner—Gerald P. Tolin
Attorneys—Harry G. Martin, Jr. and J. Raymond Curtin

ABSTRACT: A potentiometer having a hollow housing containing a continuous recessed shoulder and a pair of axially spaced recessed cavities adjacent opposite ends thereof. A lead screw and associated wiper element are disposed within the housing. An axially extending resistance element and a parallel collector track are deposited on a substrate member. A plurality of electrical terminals having spring clip portions are clipped to the terminations of the resistance element and to the collector track to make electrical contact therewith. The resistance substrate is positioned in the housing so that it rests on the recessed shoulder with the spring clip portions of the terminals lying within the recessed cavities. A potting agent, such as epoxy resin, fills the recessed cavities and extends over the outer face of the substrate to completely seal the substrate to the housing and to encapsulate the terminals.



PATENTED JUN 15 1971

3,585,563

FIG. 1

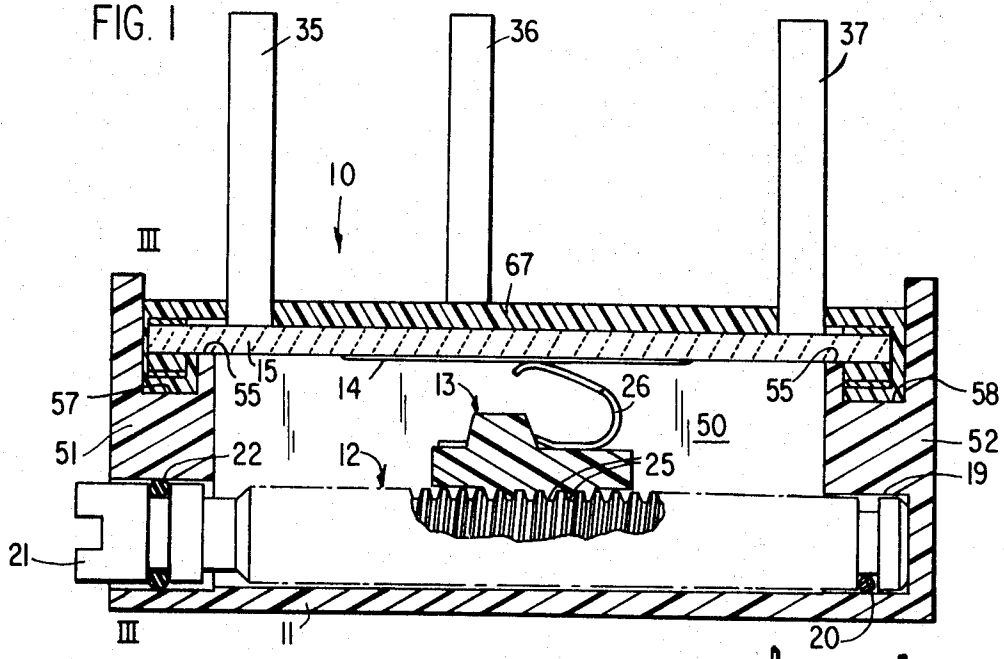


FIG. 3

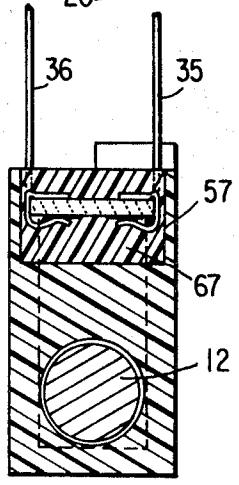
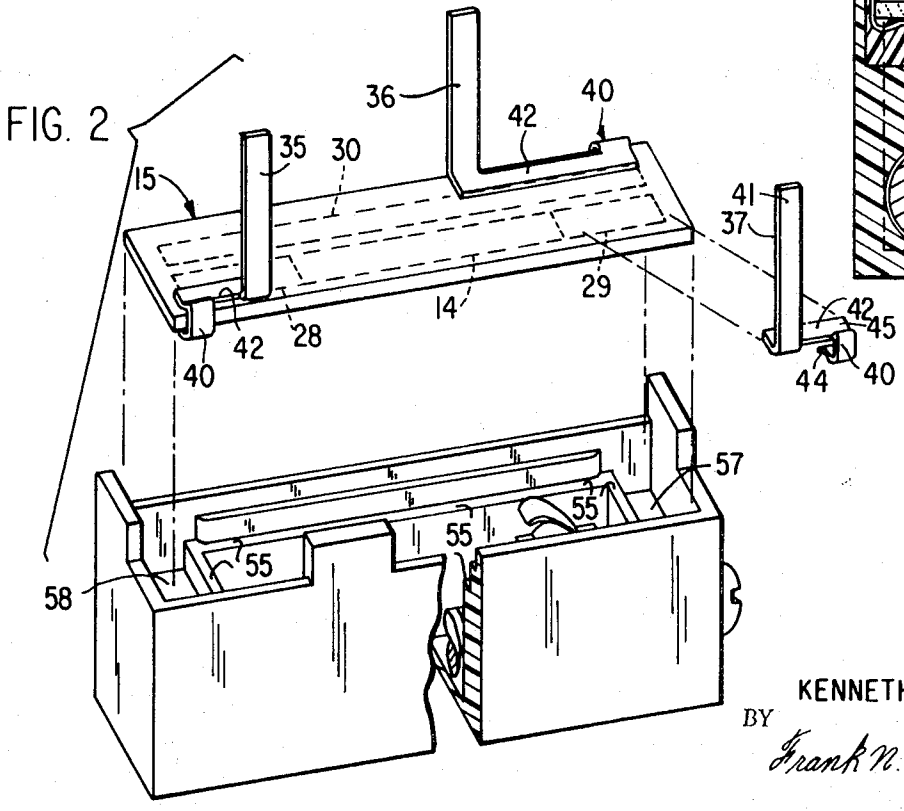


FIG. 2



INVENTOR.
KENNETH L. HEGLE.
BY
Frank N. Decker Jr.
ATTORNEY.

VARIABLE RESISTOR CONSTRUCTION HAVING SPRING TERMINAL CLIPS SURROUNDED BY A POTTING AGENT

BACKGROUND OF THE INVENTION

This invention relates to variable resistors and particularly to variable resistors of the type having a hollow housing sealed by a cover member.

Variable resistors of the type described usually employ some type of cover member which is cemented or otherwise secured in sealed relation with the housing to prevent the entrance of foreign matter therein. Prior arrangements have sometimes been unsatisfactory because of an imperfect seal either between the cover member and the housing or between the resistor terminations at the point of their emergence from the housing. Furthermore, the connection of the resistor terminals with the resistance element has been subject to failure and breaking of the electrical contact with the resistance element due to vibration of the resistor housing.

Accordingly, it is a principal feature of this invention to provide a variable resistor having a housing which employs a potting agent for mechanically retaining the resistor terminals in contact with the resistance element while at the same time sealing the resistance substrate to the housing and forming a cover member which is sealed to the resistor terminals.

SUMMARY OF THE INVENTION

A housing for variable resistors is provided having a resistance wiper element disposed in contact with a resistance element and movable from the exterior of the housing to provide a desired resistance setting. The housing is provided with a continuous recessed shoulder upon which a resistance substrate carrying the resistance element rests. The housing is further provided with one or more recessed cavities between the recessed shoulder and the peripheral edge of the housing. A plurality of resistance terminals having a spring clip portion is clipped into engagement with the terminations of the resistance element and is disposed therewith so that the spring clip portion lies within the recessed cavity in the housing. A suitable potting agent, such as epoxy resin, is flowed into the recessed cavity in the housing and covers the exterior face of the resistance substrate. When the potting agent solidifies, it completely seals the substrate to the recessed shoulder and mechanically retains the spring clip portion of the terminals in electrical and mechanical engagement with the resistance element terminations while at the same time the solidified potting agent forms a cover for the housing which also seals the points of emergence of the terminals therefrom.

BRIEF DESCRIPTION OF THE DRAWING

FIG. 1 is a cross-sectional view through a completed variable resistor in accordance with this invention;

FIG. 2 is an exploded view showing the resistor housing and the resistance substrate element with the terminals connected therewith; and

FIG. 3 is a cross-sectional view taken along line III–III of FIG. 1.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a variable resistor 10 which, in the illustrated embodiment, comprises a potentiometer. Variable resistor 10 includes a hollow housing 11 having a lead screw 12, a wiper element 13, a resistance element 14 and a resistance substrate 15 forming part of a cover member for the housing.

Lead screw 12 is axially disposed in housing 11 and provided with helical threads 25. The lead screw is journaled in a cylindrical recess 19 and retained therein by a transversely extending pin 20. The other end of the lead screw is provided with a head 21 with a suitable slot for manipulating the lead screw from the exterior of the housing and is sealed with the housing by means of an O-ring 22. Wiper element 13 comprises a half nut having helical threads formed thereon for engagement with the threads of lead screw 12. Wiper element 13 also includes a resilient electrically conducting metal contact element 26 which makes electrical contact with resistance element 14 and a parallel electrically conducting collector track 30, as shown in broken lines in FIG. 2. The inner face of substrate 15 is flat and has resistance element 14 deposited thereon which is provided with a pair of axial end terminations 28 and 29 for making electrical contact with the resistance element. Rotation of lead screw 12 moves wiper element 13 within housing 11 so as to position wiper element 13 at the desired electrical resistance location along the resistance element 14.

A plurality of resistor terminals 35, 36 and 37 are provided for making electrical contact from the exterior of housing 11 with the resistance element. Each of the terminals comprise a spring clip portion 40, a terminal pin portion 41 and an axially extending connecting portion 42. The terminals are made of a resilient electrically conducting metal. Spring clip portion 40 of the terminals comprises a channel-shaped portion having a pair of substantially parallel legs 44 and 45. The transverse distance between legs 44 and 45 is preferably initially less than the transverse dimension through the resistance substrate element so that the spring clip can be pushed into tight engagement with one of the terminations or with the collector track and make a good mechanical and electrical connection therewith. When assembled, the resiliency of the spring clip portion 40 urges leg 44 thereof into good electrical contact with a resistance termination or with the collector track, depending on the location of the terminal. In addition, the terminations may be solder coated and the shoulder may be heated to more firmly secure the terminals to the substrate after assembling the potentiometer thereon.

Housing 11 has a generally hollow interior 50 formed by axial end walls 51 and 52 of the housing and is outwardly open on one side thereof. Housing 11 also includes a continuous, substantially flat, recessed shoulder 55 extending completely around the interior of the housing for supporting resistance substrate 15 within the housing. Housing 11 also includes a pair of axially spaced, recessed cavities 57 and 58 which are located between recessed shoulder 55 and the peripheral edges of end walls 51 and 52 respectively of the housing.

Terminals 35, 36 and 37 are secured on substrate 15, as shown in FIG. 2, and the substrate is disposed within housing 11 so that it rests on recessed shoulder 55 as shown in FIG. 1. Substrate 15 has a lesser axial dimension than the distance between the outer walls of recessed cavities 57 and 58 so that some clearance exists between the substrate and the ends of recessed cavities 57, 58.

A suitable potting agent 67, such as epoxy resin, is poured in liquid form over substrate 15 which is clamped to the body 11 and flows into recessed cavities 57, 58. The potting agent is poured into the housing until it completely covers the outer face of substrate 15 and has filled recessed cavities 57 and 58. Thereafter, potting agent 67 is solidified, such as by curing it in an oven, so that it forms a hard permanent cover for housing 11.

The engagement of substrate 15 and recessed shoulder 55 prevents the potting agent from flowing into hollow space 50 within housing 11 and provides a location for the potting agent to completely seal the substrate to the recessed shoulder of the housing entirely around the interior of the housing. When the potting agent from flowing into hollow solidifies in recessed cavities 57 and 58, it completely surrounds the clip portions of the terminals 35, 36 and 37 to maintain them in secure electrical and mechanical engagement with the resistance element terminations and collector track. Similarly, the axial connecting portion 42 and the point of emergence of terminal pin portion 41 from the variable resistor is completely sealed with the potting agent to prevent the entrance of foreign particles into housing 11.

Accordingly, a variable resistor made in accordance with this invention is completely sealed against the entrance of foreign matter into the housing by the formation of a cover member which also serves to maintain the electrical contact of the terminals with the resistance element. Accordingly, the variable resistor is highly shock and vibration resistant in contrast to prior constructions wherein electrical contact between the terminals and resistance element was subject to breakage.

While a preferred embodiment of this invention has been described for purposes of illustration, the invention may be otherwise embodied within the scope of the following claims.

I claim:

1. A variable resistor comprising a hollow housing member enclosing a resistance substrate having a resistance element thereon, a wiper element, and means for adjusting the position of the wiper element on the resistance element from the exterior to said housing, wherein the improvement comprises:

A. said housing being hollow and having an open side thereof for reception of the resistance element and the wiper element, said housing having a continuous, recessed shoulder surrounding the hollow interior thereof, said recessed shoulder being disposed inwardly of the peripheral edges of said housing and facing outwardly from the open end thereof to support a resistance substrate element within said housing, said housing further having at least one recessed, outwardly open terminal receiving cavity opening outwardly from the open end of said housing, said terminal receiving cavity being disposed entirely between said recessed shoulder and the peripheral edge of said housing, said recessed cavity having an imperforate bottom wall recessed into said housing below said recessed shoulder, said recessed shoulder forming a continuous wall isolating said recessed cavity from the hollow interior of the housing, said substrate being disposed on said recessed shoulder and overlying a portion of said recessed cavity, and being disposed in inwardly spaced relation with the outer wall of said recessed cavity to provide a space for entrance of a potting agent into said cavity;

B. a resistance substrate element comprising a substantially nonelectrically conducting material, said substrate being shaped to form a cover member for the open side of said housing, said substrate being disposed in said housing and having a portion of the inner face thereof resting on and contacting said recessed shoulder about the entire circumference of the hollow interior of the housing to completely close the interior of the housing;

C. said electrical resistance element being disposed on the inner side of said substrate facing the interior of said housing, said wiper element being in electrical engagement with said resistance element;

D. a plurality of electrical terminals connected to said resistance element for making electrical connection therewith, each of said electrical terminals comprising an electrically conducting metal having a resilient, channel-shaped spring clip portion and an integral lug portion extending from said spring clip portion, said spring clip portion having a pair of spaced electrically conducting metal legs, the normal unstressed distance between said legs being less than the transverse thickness of said substrate, said substrate being disposed between the legs of said spring clip with one of said legs being urged by resiliency of said spring clip into electrical contact with said resistance element, said spring clip being positioned on the substrate with said one leg thereof disposed entirely on the inner side of said substrate between said recessed shoulder and the peripheral edge of said housing and lying in said recessed cavity, the other leg of said spring clip and said lug portion being disposed entirely on the outer side of said substrate with said lug portion extending away from said substrate and said housing; and

E. a solidified, electrically nonconducting potting agent disposed over the outer face of said substrate and filling said recessed cavity in said housing to form a sealed cover for said housing, said potting agent completely surrounding both legs of the spring clip portions of said terminals and said potting agent being disposed about both inner and outer faces of said substrate and covering the region of the electrical contact made by the spring clip portion of said terminals to retain the legs of said spring clips in solid electrical contact with the resistance element and to resist breaking of the electrical contact by vibration of said housing, said potting agent also surrounding the point of emergence of said terminal lugs from said housing to seal said housing from the entrance of foreign matter therein, and said potting agent further sealing said substrate to the inner walls of said housing to form a sealed cover member.

2. A variable resistor as defined in claim 1 wherein said housing includes a plurality of said recessed cavities spaced from each other, each of said recessed cavities containing one of said electrical terminals.

3. A variable resistor as defined in claim 1 wherein said housing is rectangular in cross section and includes a recessed cavity adjacent each axial end thereof, and wherein one of said plurality of electrical terminals is located in each of said recessed cavities.

4. A variable resistor as defined in claim 1 including a collector track of electrically conducting material disposed on the inner face of said substrate in parallel relation with said resistance element being linearly movable and, said collector element electrically contacting both said resistance element and said collector track, and one of said terminals contacting said collector track whereby electrical connection may be made to said resistance element at an adjustable location from the exterior of said housing.

5. A variable resistor as defined in claim 1 wherein said housing is rectangular in cross section, said housing having a recessed cavity adjacent opposite sides of said housing, at least one of said terminals being disposed on said substrate with the clip portion thereof disposed in one of each of said recessed cavities, said substrate being of greater axial dimension than the distance between the opposite edges of said recessed shoulder so that the substrate overlies a portion of both of said recessed cavities, said substrates being spaced from a wall of each of said recessed cavities to provide a path for the potting agent to flow into said recessed cavities about the clip portion of said terminals.

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,585,563 Dated June 15, 1971

Inventor(s) KENNETH L. HEGLE

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 3, line 17, cancel "to" and insert in place thereof --of--.

Column 4, Claim 4, line 42, cancel "being linearly movable and".

Column 4, Claim 4, line 43, after "element", insert --being linearly movable, and--.

Signed and sealed this 25th day of April 1972.

(SEAL)
Attest:

EDWARD M.FLETCHER,JR.
Attesting Officer

ROBERT GOTTSCHALK
Commissioner of Patents

FORM PO-1050 (10-69)

USCOMM-DC 60376-P69
* U.S. GOVERNMENT PRINTING OFFICE : 1969 O—366-334