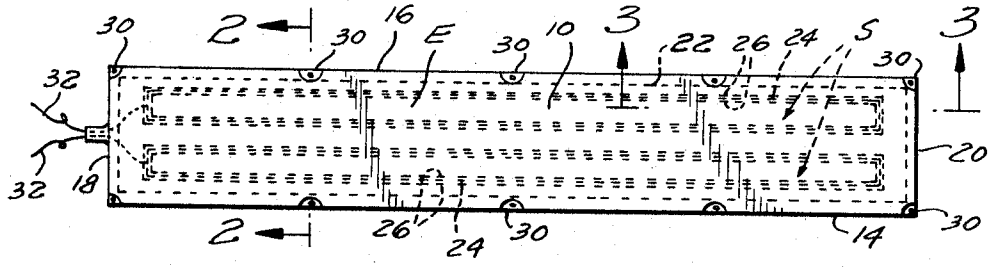
July 16, 1968 W. C. GOBLE 3,393,284

ROAD TREADLE SWITCH HAVING ENVELOPE OF A POURED AND CURED LIQUID POLYURETHANE

Filed June 28, 1966

FIG. 1



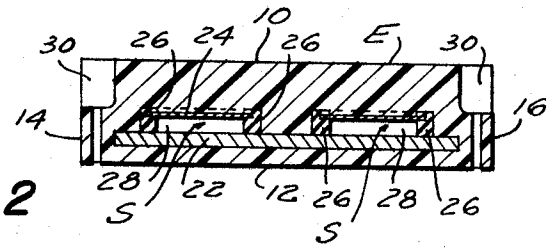
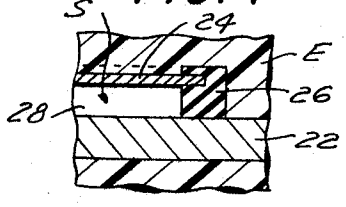


FIG. 2

FIG. 4



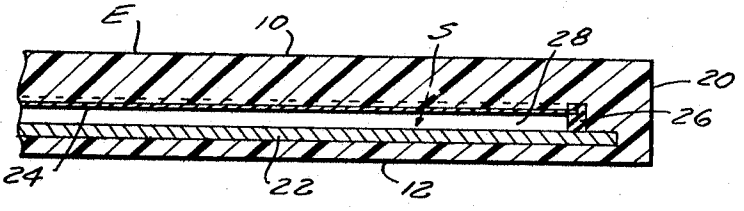


FIG. 3

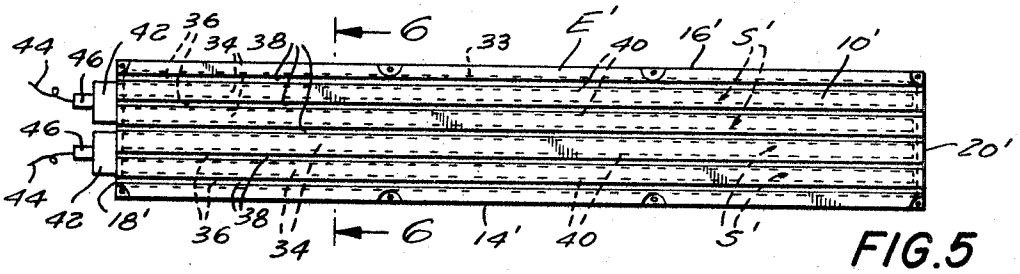


FIG. 5

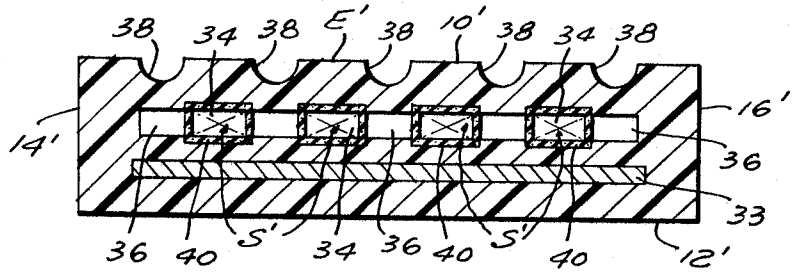


FIG. 6

INVENTOR
WILLIAM C. GOBLE
BY James S. Franklin
ATTORNEY

United States Patent Office

3,393,284

Patented July 16, 1968

3,393,284

ROAD TREADLE SWITCH HAVING ENVELOPE OF A POURED AND CURED LIQUID POLYURETHANE

William C. Goble, East Paterson, N.J., assignor to Raybestos-Manhattan, Inc., Passaic, N.J., a corporation of New Jersey

Filed June 28, 1966, Ser. No. 561,277
4 Claims. (Cl. 200—86)

ABSTRACT OF THE DISCLOSURE

A road treadle switch encasing switch members operable by a treadle depression, the switch members being encased by an envelope of a solid polyurethane elastomer which is the product of a poured and heat cured liquid polyurethane, poured to flow about and encase the switch members, the said elastomer having an inherent resilience and flexibility alone adequate to permit efficient operation of the switch members upon depression of the treadle.

This invention relates to a road treadle or detector switch.

The prime object of the present invention is directed to a road treadle or detector switch which (a) can be made with an ease of manufacture and at a lesser cost than can treadles of known manufacture and which (b) possesses to an improved extent the needed characteristics of road detectors or treadles of predetermined resilience, high abrasive resistance and oil and water resistance.

Road detectors or treadle switches of known manufacture are made from a rubber elastomer and comprise a rubber envelope which encases the contact elements of a number of assembled switch members. In one form of such road treadles, a metal base plate which is to define the lower contact element of the switch members is prepared, and forming bars (to form the shape of the cavities within the treadle) are placed thereon and beneath a plurality of spring steel plates (usually made of high carbon spring steel) which are to define the upper mating elements of the switch members. The spacing of the upper contact elements is critical, for it determines the operating pressures in the use of the treadle switch. In another form of such road treadles, a plurality of forming bars are spacedly mounted above a steel rigidifying plate for the treadle, the said bars functioning to form the shape of a plurality of cavities and spaces within the treadle, the cavities (after the bars are withdrawn) serving to receive switch members and the spaces (after the bars are withdrawn) functioning to impart to the treadle a required internal flexibility.

In both forms of such road treadles the rubber elastomer (such as neoprene or G.R.S. rubber) must be intially prepared to a convenient shape and size and placed over the assmebly of switch members in a heavy mold. This mold is then placed in a press, and by a combination of extreme pressure and high temperature, the elastomer is cured. All this time, the forming bars to control the shape of the cavities and the spaces must be in position. After the curing, these forming bars are withdrawn from the molded detector or treadle, leaving the cavities and spaces inside the detector of the same cross-section as the forming bars. This withdrawing operation of the forming bars leaves either the back end or the front end of the detector open to the ambient conditions, and thus another operation is required using a press, mold, high pressures and temperatures to seal the openings from which the forming bars were withdrawn; this latter makes a hermetic seal for the detector or treadle.

In the manufacture of the road treadle or detector

switch of the present invention the envelope or shell of the road treadle is made with a liquid urethane elastomer which, after a simplified form of switch members is assembled and set up in a receptacle, is poured into the receptacle, the liquid elastomer flowing about and encasing the switch members. In the above first mentioned form of treadle switch referred to, since the polyurethane elastomer only requires to be poured, it becomes only necessary to mount the upper contact elements, spacedly upon the lower contact plate, framed in a rubber or like sealing mount to prevent the liquid polyurethane from running into the cavities between the contact elements. The only operation necessary after the pouring of the polyurethane elastomer is to cure the whole assembly in a dry heat at a temperature of approximately 180° F. for a period of about one hour. Thus there is no need for employing the extremely high pressures used in making the conventional molded rubber detector or treadle switches. The spring steel plates which form the upper contact elements are sufficiently stiff to avoid being deformed by the slight liquid forces created during the pouring.

Also with the proper conducting lead wires already connected, just prior to the pouring (in the first form of the treadle above referred to), the complete detector or treadle may thus be made in a single operation.

The making of road treadle switches of the present invention is thus characterized by an extremely greater ease of manufacture, at a lesser cost, compared to the making of known rubber envelope treadles, not alone from the reduced production-labor required, but by its very essence, because the elimination of the need for expensive equipment, expensive molds, double operations, or the need of preparing the elastomer in the manufacturer's plant.

Imparting a desired predetermined resilience to a road treadle has been a major problem, such resilience being tied up with the correct or efficient operation of the switch members. In the second form of treadle above referred to, in addition to providing for the internal flexibility imparting spaces, the top wall of the treadle is formed with flex grooves running longitudinally of the treadle and spaced transversely thereof. These functional flex grooves are not without their disadvantages since they produce an irregular surface which wears down faster (than a smooth, flat surface), and the grooves also undesirably trap and hold road dirt, oils, and the like.

The making of the road treadle envelope with the polyurethane elastomer according to the present invention, is found to result in treadle or detector shell or envelope structures which possess a required predetermined resilience such that it becomes unnecessary to provide for the use of these top wall flex grooves (or the use of internal spaces referred to); and the shell or envelope may thus be so poured as to produce a flat top envelope wall. In addition to the fact that the polyurethane shell or envelope body also possesses improved abrasion resistance and resistance to water and oils (compared to the rubbers emplyoed in the manufacture of known treadles), the non-corrugated or flat top wall of these shells (in the first described form of treadle referred to above) avoids any entrapment of road dirt and oils. As a result the regular continuous surface of the top wall of the treadle of the present invention produces a cleaner and longer wearing detector than had been possible to be produced in known road treadles.

To the accomplishment of the foregoing objects, the present invention relates to an improved road treadle or detector switch as more specifically defined in the appended claims taken together with the disclosure of the following description and the accompanying drawings thereof in which:

FIG. 1 is a top plan view of a first form of a road treadle switch embodying the principles of the present invention;

FIG. 2 is a view thereof shown on an enlarged scale and taken in cross-section in the plane of the line **2—2** of FIG. 1;

FIG. 3 is a partial view of the road treadle also shown on an enlarged scale, this view being taken in cross-section in the plane of the line **3—3** of FIG. 1;

FIG. 4 is a view shown on a still further enlarged scale of a part of the treadle and is explanatory of the manner of mounting the contact elements of the switch members;

FIG. 5 is a plan view of a second form of the invention made according to the principles of the present invention; and

FIG. 6 is a view of FIG. 5 shown on an enlarged scale and taken in cross-section in the plane of the line **6—6** of FIG. 5.

Referring now more in detail to the drawings and having reference first to FIGS. 1 to 3 thereof, the road detector or treadle of the present invention comprises a shell or envelope E defined by a top wall **10**, a bottom wall **12**, opposite side walls **14** and **16** and opposite end walls **18** and **20** and the switch members S, two of which are shown in the drawings. Each of the switch members S comprises normally open contact elements movable to switch closing condition by the treadle depression of the top wall **10** of the envelope E, the said contact elements for each switch member comprising a metal base plate **22** as the lower contact element (serving for both switch members) and a spring steel plate **24** as the upper contact element, the upper contact elements **24, 24** being supportingly spaced from the lower contact element **22** by an encircling mount **26**.

The shell or envelope E comprises a solid polyurethane elastomer possessing a predetermined resilience referred to which is the product of a poured and heat cured liquid polyurethane. Polyurethanes comprise a group of synthetics with end products characterized as flexible and elastomeric rubber-like products of superior strength, good elasticity, extremely good abrasion resistance and hardness, and resistance to greases, oils, and solvents. Basically they are reaction products of polyols and isocyanates, the major contributing variable being the polymers or polyfunctional resins which can be alkyl, polyesters or polyethers. These resins are of a class based on polyhydric alcohols and organic or polybasic acids. Adipic acid and glycols of various types are the prime source of polyols used in the manufacture of polyurethanes. The polyurethane elastomer selected for the treadle of the present invention, to yield the desired solidity and the predetermined flexibility and resilience is a liquid polyurethane produced by the E. I. du Pont Company and sold as their "Adiprene L" liquid urethane elastomer; the preferred Adiprene product for use in the making of the treadle of the present invention being Du Pont's "Adriprene L–100" which yields a solidified product having a durometer hardness of 89–90 and "Adriprene L–420" which yield a solidified product having a durometer hardness of 80.

The road treadle of the form of the invention of FIGS. 1 to 3 is produced as follows:

The metal base plate **22** is suitably prepared and placed in a forming receptacle (not shown) whose diamensions conform to the desired final size of the treadle being manufactured. The treadle of FIGS. 1 to 3 is generally made having a length of from 8 feet to 10 feet and a width of 4 inches to 14 inches (nominally 10⅝ inches) and a height of 1 inch. The upper spring contact plates **24, 24** are mounted spacedly from the lower metal contact plate **22** by means of the mounts **26** which encircle the cavities **28, 28**, the upper contact spring plates being framed in the mounts **26**, which latter are made of rubber or a like material designed to seal the enclosure cavities **28, 28.**

With these parts of the switch members S, S assembled and with suitable fixtures or plugs being also set up in the receptacle for forming the road mounting orifices **30, 30**, the liquid polyurethane is then poured into the forming receptacle, the liquid polyurethane flowing about and encasing the switch members S, S. In the assembling step of the switch members the proper conducting lead wires **32, 32** (see FIG. 1) are connected to the contact elements **22, 24** of the switch members. The next operation is the curing of the thus completed assembly in a dry heat at a temperature of about 180° F. for the period of about one hour.

Thus, in the making of the treadle switch of the form shown in FIGS. 1 to 3, the assembling of the elements of the switch members S, S only requires the mounting of the upper contact elements **24, 24**, spacedly from the lower contact plate **22**, framed in a rubber or like sealing mount **26**, which latter serves not only to properly space the elements of the switch members but to prevent the liquid polyurethane which is next to be poured onto the assembly from running into the cavities **28, 28** between the contact elements. The next operation of merely pouring the liquid polyurethane elastomer into the forming receptacle in which the switch members are mounted, is a simple pouring step, thus eliminating the prior use of expensive molds or the need of preparing the elastomer (rubber) in the manufacturer's plant. Also since the lead wires **32, 32** are connected prior to the pouring step, the complete detector or treadle may thus be cured in a single operation.

The resulting treadle switch of the form shown in FIGS. 1 to 3 is found to have that predetermined resilience (and flexibility) which results in the correct operation of the switch members, namely the efficient depression of the spring contact elements **24, 24** for contacting the bottom contact element **22** for the switch operations. In this form of the invention the desired resilience and flexibility is obtained with a treadle having its top wall continuous and flat minus the need of flexing grooves, which latter yield the disadvantages hereinabove referred to.

The resulting treadle of the invention form of FIGS. 1 to 3 possesses the improved abrasion resistance and resistance to water and oils known as the desirable characteristics of these polyurethane products; and this together with the elimination of the flexing grooves or corrugations in the top walls of the shells or envelopes results in a detector or treadle having longer wear than has been possible in known rubber road treadles.

In FIGS. 5 and 6 of the drawings is shown a second form of the invention wherein features of treadle flexibility and resilience are obtained in the customary way employed with rubber treadles, with the use of such a structure, with the envelope being made of the polyurethane products described imparting thereto some of the improved characteristics of the first form of the invention shown in FIGS. 1 to 3 of the drawings.

In this form of the treadle the envelope E′ comprises a shell having a top wall **10′**, a bottom wall **12′**, side walls **14′** and **16′** and end walls **18′** and **20′** encasing switch members S′, S′, the contact elements of which (not independently shown) are indicated by the mark X. As before, the envelope E′ comprises a solid polyurethane elastomer possessing inherent resilience and high abrasive resistance, the same being the product of a poured and heat cured liquid polyurethane referred to.

In this form of the invention the customary means of imparting the required flexibility and resilience to the treadle are employed. In this form of treadle the liquid polyurethane is poured into a forming receptacle in which are assembled a steel supporting plate **33** functioning to rigidify the structure and a number of bars (four in number) enveloped by a rubber impregnated cloth, these bars serving to produce the cavities **34, 34** and a number of bars (five in number) serving to form the additional

spaces **36, 36**. In this form of the invention this assembly of the plate **33** and the referred to bars are arranged reversely to that shown in the drawings, suitable members being set in the bottom of the receptacle for forming the flex grooves **38, 38** in the top wall **10'** of the treadle.

With these parts thus assembled the liquid polyurethane is poured into the receptacle producing, after the heating step, the cast treadle portrayed in the drawings.

After these operations the bars which form the cavities **34** are withdrawn leaving in the cavities the rubber impregnated cloth **40** which now defines the walls for the cavities **34, 34**, the withdrawing of the remaining bars leaves or produces the spaces **36, 36** which function, as a supplement to the flexing grooves **38, 38**, for imparting needed flexibility to the treadle structure.

In this form of construction there is also produced at the bar withdrawing end of the treadle shell, integral so-called "boots" **42, 42** of the polyurethane product through which the previously attached lead wires **44, 44** extend, the bars being withdrawn through these extending boots, after which sealing corks **46, 46** are inserted to seal this end of the treadle E'.

In this second form of the treadle structure, while a treadle similar in general form to treadles of known rubber manufacture is made, many of the advantages secured in the making of the first form of treadle described are produced such as the greater ease of manufacture, and a lesser cost, compared to the making of known rubber envelope treadles, because of the reduced production-labor required and also because of the elimination of the need for expensive equipment, expensive molds and the need of preparing the elastomer (rubber) in the manufacturer's plant. Also the resulting product possesses more readily predetermined resilience characteristics and an envelope having greater abrasive resistance and resistance to water and oils.

The making of the road treadle or detector switch of the present invention, the physical characteristics of the resulting treadle switch and the many advantages thereof over the making of road treadle switches of prior makes will be apparent from the above detailed description of the method of manufacture and the resulting treadle product of the present invention.

It will be further apparent that many changes may be made without departing from the spirit of the invention defined in the following claims.

I claim:

1. A road treadle switch comprising an envelope defined by a top wall, a bottom wall, opposite side walls, and opposite end walls, switch members encased by said envelope, to said switch members comprising normally open contact elements movable to switch closing condition by the treadle depression of the top wall of said envelope, the said switch members comprising normally elastomer possessing inherent resilience and flexibility, the same being the product of a poured and heat cured liquid polyurethane, poured to flow about and encase the switch members, the said inherent resilience and flexibility being alone adequate to permit the efficient operation of the switch members upon the treadle depression of the top wall of the envelope.

2. The road treadle switch of claim **1** in which the polyurethane envelope has a durometer hardness of the order of 80 to 90.

3. The road treadle switch of claim **1** in which the top wall of the envelope has a continuously smooth surface.

4. The road treadle switch of claim **3** in which the encased contact elements of the switch members comprise a metal base plate as the lower contact element and a spring steel plate as the upper contact element, the upper contact element being supportingly spaced from the lower contact element by an encircling mount, the said mount defining a seal for the space between the contact elements sealing the same from the polyurethane envelope material.

References Cited

UNITED STATES PATENTS

3,056,005	9/1962	Larson	200—86
2,951,921	9/1960	Wikkerink	200—86
2,885,508	5/1959	Wilcox	200—86
2,583,813	1/1952	Burke	200—86

BERNARD A. GILHEANY, *Primary Examiner.*

GEORGE HARRIS, JR., *Examiner.*