

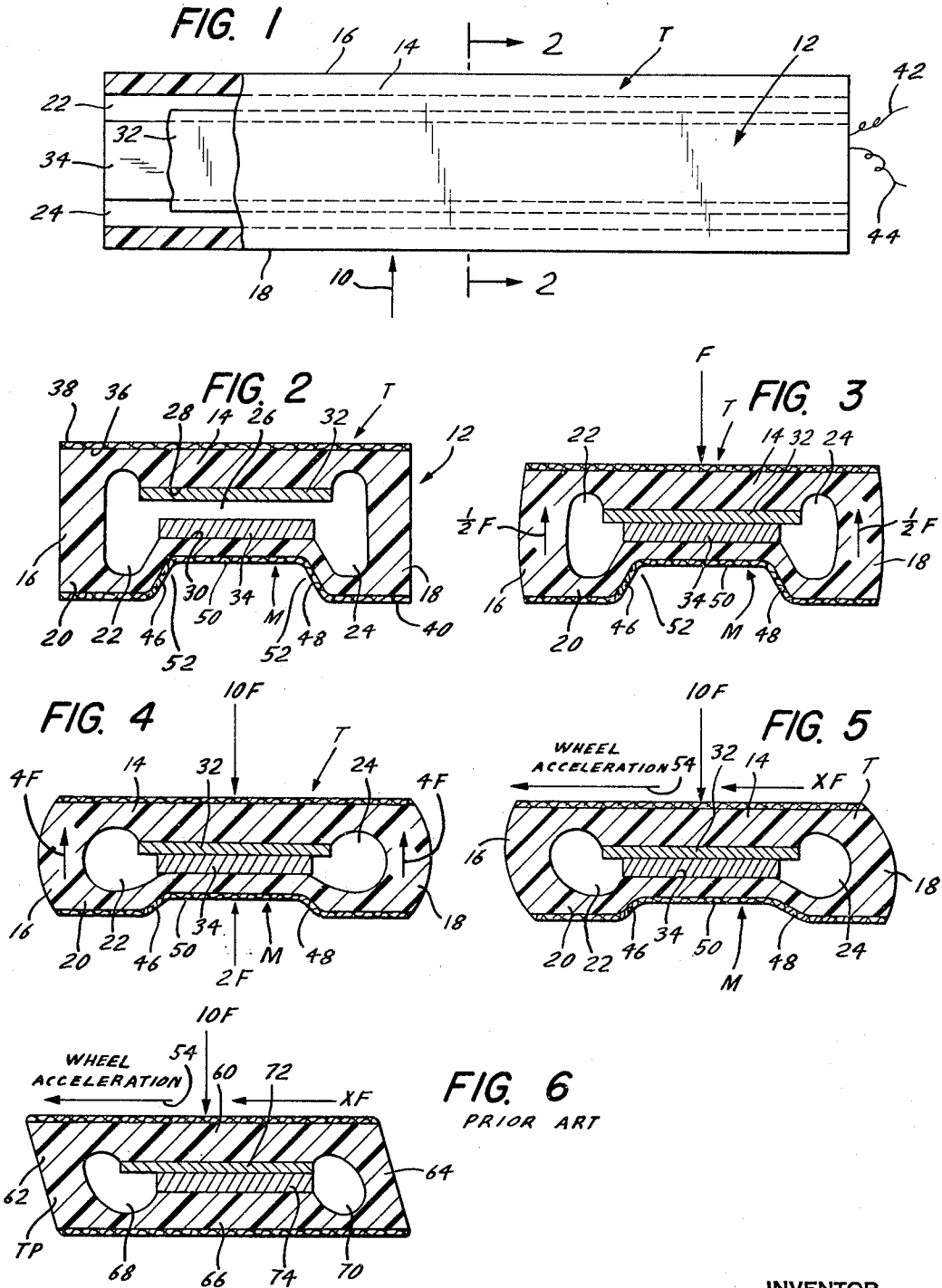
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TREADLE SWITCH UNIT FOR VEHICULAR TRAFFIC

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TREADLE SWITCH UNIT FOR VEHICULAR TRAFFIC

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ABSTRACT OF THE DISCLOSURE

A treadle switch unit for vehicular traffic of the type in which spaced upper and lower contact strips are bonded interiorly to an elastomeric envelope, constructed so that the lower contact strip is floatingly supported in the base of the envelope to allow the lower contact strip to move horizontally when in contact with the upper contact strip, responsive to a horizontal force component applied to the switch unit, so as to avoid or minimize frictional abrasion between the contact strips.

Thus invention relates to a treadle switch unit for vehicular traffic.

Known treadle switch units comprise an elastomeric envelope, the interior of which is provided with spaced contact strips interiorly bonded to the unit which are normally separated and which are arranged to electrically engage each other to actuate a circuit upon pressure being exerted on the treadle top, or on the top of an elastomer shell in which a number of such switch units are mounted, by the passage of a vehicle thereover. Such known treadle switch units comprise structurally an elastomeric envelope having an upper treadle portion, side walls and a base portion, the interior of the envelope being formed with transversely spaced air recesses separated by a space, both running longitudinally of the envelope, said space being defined by an upper interior surface in the treadle portion and a lower interior surface of the base portion, a first contact strip being bonded to said upper interior surface of the treadle portion and a second contact strip being bonded to said lower interior surface of the base portion. Apart from the air recesses, both the treadle portion and the base portion of such elastomeric envelopes are solid in structure.

Such treadle switch units work on the principle of causing the elastomeric envelope to be compressed and close the contact strips responsive to the pressure exerted on the envelope by the weight of a passing vehicle. When the wheels of the vehicle are in a rolling motion only, the treadle switch unit being acted upon only by a vertical force properly follows this principle. When, however, the vehicle is decelerating, due to an application of the vehicle brakes, or is accelerating, as when it leaves the toll station, horizontal force components are also created, which acting on the treadle causes a distortion of the envelope in the direction of the applied horizontal forces. This distortion is transmitted mainly to the upper contact strip, namely the strip which is bonded to the treadle portion of the envelope, causing it to move horizontally (in the direction of the applied horizontal force components) relative to the lower contact strip, bonded as the latter is to a base of solid structure or formation.

As a result of this relative movement of the upper contact strip relative to the lower contact strip, particularly because it takes place under pressure, the meal of the strips is subjected to substantial wear due to frictional abrasion therebetween, resulting in the formation of separated metal particles, which latter are found to short circuit the contact strips, reducing the workable life of

the switch unit or rendering the same ineffectual or inoperative.

The object of my present invention is to eliminate this source of trouble by so reconstructing the treadle switch unit as to allow the lower contact strip a freedom of movement so responsive to an applied horizontal force component as to cause it to move with and in the same direction with the upper contact strip, thereby effectively avoiding this relative movement and the resulting frictional abrasion between the engaging contact strips. The way I produce this action is to provide a mounting for the base bonded lower contact strip which will not exhibit the rigidity due to solid structured bases but which will allow the lower contact strip instead to float in relation to the top treadle section and to move with the upper contact strip when the switch unit responds to a horizontal force component, thereby avoiding or minimizing frictional abrasion between the contact strips.

To the accomplishment of the foregoing objects and such other objects as may hereinafter appear, this invention relates to a treadle switch unit for vehicular traffic as best defined in the accompanying claims considered together with the following specification and the appended drawings, in which:

FIG. 1 is a plan view with a part broken away of a treadle switch unit embodying the structure and principles of the present invention;

FIG. 2 is a view thereof on an enlarged scale taken in cross-section in the plane of the line 2—2 of FIG. 1 and showing a preferred embodiment of the treadle switch unit of the present invention, the unit being depicted in its non-compressed or relaxed condition;

FIG. 3 is a view similar to FIG. 2 and depicting the said treadle switch unit depressed under compression exerted by a vertical force F ;

FIG. 4 is a similar view thereof and depicting the said treadle switch unit depressed under a compression exerted by a larger vertical force indicated as $10F$;

FIG. 5 is a view thereof and depicting the said treadle switch unit depressed and distorted when under a compressive force, the equivalent to that shown in FIG. 4 but having a horizontal distorting component represented by the force XF ; and

FIG. 6 is a cross-sectional view of a known structure of a treadle switch unit depressed and distorted under a compressive force and a horizontal component force similar to that as shown applied in FIG. 5, FIG. 6 illustrating by contrast to that of FIG. 5 the different action and results that take place as between the structure of the present invention and that of the prior art

Referring now more in detail to the drawings and having reference first to FIGS. 1 and 2, the treadle switch unit of the present invention comprises a treadle switch device generally designated as T designed for vehicular traffic, which unit is mounted transversely on a roadway, the path of travel of the vehicle being indicated in FIG. 1 by the arrow 10 . Such treadle units may be designed and used as single units but are normally employed for vehicle treadles by assembling a plurality of such units in an elastomeric shell, such units being spaced in the direction of vehicular movement as disclosed in my Patent No. 3,351,724, patented Nov. 7, 1967, as well as in the Cooper et al. Patent No. 2,761,928, patented Sept. 4, 1956.

The treadle switch unit of the present invention is shown particularly in the cross-sectional view thereof of FIG. 2 of the drawings and comprises an elastomeric, such as a rubber envelope generally designated as 12 having an upper treadle portion 14 and opposite side walls 16 and 18 and a base portion 20 , the interior of the envelope being formed with transversely spaced air recesses 22 and 24 bridged by a space 26 , both running longitudinally of the envelope (as best indicated in FIG.

1 of the drawings), the said space being defined by an upper interior surface 28 in the treadle portion 14 and a lower interior surface 30 in the base portion 20. A first contact strip 32 is bonded according to known practice to said upper interior surface 28 of the treadle portion and a second contact strip 34 is bonded to said lower interior surface 30 of the base portion. Said contact strips 32 and 34 are normally separated as depicted in FIG. 2 and are arranged to electrically engage each other upon pressure being exerted on the treadle top 36 of the envelope by the weight of a passing vehicle. To the top of the treadle unit a protective fabric strip 38 may be cemented and similarly to the bottom of the treadle unit a protective fabric strip 40 may be applied.

In known treadle switch units of this type, apart from the air recesses and the space bridging the same, both the treadle portion and the base portion of the elastomeric envelope are solid in structure or formation. Such treadle switch units work on the principle of causing the elastomeric envelope to be compressed and to close the contact strips 32 and 34 responsive to the pressure exerted on the envelope by the weight of a passing vehicle, this resulting in the closing of an operated circuit connected by the leads or wires 42 and 44 (FIG. 1). When the wheels of the vehicle are in a rolling motion only, such a treadle switch unit being acted upon only by a vertical force properly follows this principle. When, however, the vehicle is decelerating due to an application of the vehicle brakes or is accelerating, as when it leaves a toll station, horizontal force components are also created which acting on the treadle causes a distortion of the envelope in the direction of the applied forces. This distortion is transmitted mainly to the upper contact strip causing it to move horizontally (in the direction of the applied horizontal force component) relative to the lower contact strip as a result of this relative movement of the contact strips, as will be further illustrated below in connection with a description of FIG. 6 of the drawings, the metal of the strips is subjected to frictional abrasion therebetween, resulting in the production of detached or separated metal particles, which latter are found to short circuit the contact strips, reducing the workable or useful life of the switch unit or rendering the same ineffectual or inoperative.

To eliminate this source of trouble the treadle switch unit of my present invention is so reconstructed as to allow the lower contact strip 34 a freedom of movement so responsive to an applied horizontal force component as to cause it to move with and in the same direction as the upper contact strip 32, thereby effectively avoiding the relative movement therebetween and inhibiting the resulting frictional abrasion between the engaging contact strips. This modified action of the treadle unit is produced by providing a mounting generally designated as M for the base bonded lower contact strip 34 which will not exhibit the rigidity due to solid structure bases of the prior art but which will allow the lower contact strip to float instead in relation to the top treadle section of the unit and to move with the upper contact strip 32 when the switch unit responds to a horizontal force component, thereby avoiding or minimizing frictional abrasion between the contact strips.

This structure of the floating mounting M for the base section 20 of the treadle unit is made to comprise laterally flexible parts 46 and 48 spaced transversely in the treadle unit and bridged by a basic part 50, as best shown in FIG. 2, these spaced parts 46 and 48 being formed at the bottoms of the air recesses 22 and 24, the said parts running longitudinally of the envelope. The spaced air recesses 22 and 24 preferably are given the cross-sectional configuration best shown in FIG. 2 of the drawings. As a result of this construction these laterally flexible parts 46 and 48 define supporting legs for the base bridging piece 50 and the second contact strip 34 bonded to this bridging strip. The said supporting leg parts 46 and 48

are disposed as shown at oppositely directed acute angles with reference to the treadle top of the envelope. These supporting leg parts 46 and 48 are thus defined on the outside treadle by an undercut cavity 52 formed longitudinally in said base portion 20 and on the inside of the treadle by the bottoms of the air recesses.

In FIGS. 3, 4 and 5 I illustrate the action and functioning of this modified treadle switch unit responsive to the various pressure and pressure directions to which the treadle switch is subjected by the passage of a vehicle thereover.

FIG. 3 illustrates the depression of the treadle switch until that takes place as a result of a vertical compressive force F which may be just sufficient to make electrical contact of the contact strips 32 and 34. As a result the effect of this force F is uniformly distributed; and the side walls 16 and 18 effectively carry the full load such that each side wall sustains, as indicated in FIG. 3, one-half of the force F represented by $\frac{1}{2}F$.

In FIG. 4 of the drawings I illustrate the function of the treadle switch unit when acted upon by a large vertical force illustrated by a force designated as 10F. Under the application of such a compressive force the lower contact strip 34 moves downwardly due to the same being mounted on a relatively thin bridging wall piece 50. The load is thus transferred to the side walls 16 and 18 in addition to being sustained by the base 20; and the relative distribution of the forces may for general analytical purposes be said to be as illustrated in FIG. 4, namely that each side wall 16 and 18 sustains a force corresponding to that represented as 4F while the bottom 20 and particularly the bridge piece 50 sustains a force corresponding to that represented as 2F.

In FIG. 5 of the drawings I illustrate the functioning of the treadle switch unit when compressed and distorted by a vertical force such as 10F which has a horizontal component represented by the force XF, this component force XF being the result of the acceleration represented by the arrow 54 of a vehicle moving over the treadle unit. (As will be understood, should the vehicle be moving with a deceleration, the horizontal component force as well as the distortion of the treadle unit will be in a direction opposite to that shown in FIG. 5.) Acting under these forces and due to the provision of the leg supports 46 and 48 and the relatively thin or narrow bridging strip 50, the mounting M for the lower contact strip 34 now has a floating characteristic which readily allows the horizontal displacement of the lower contact strip 34 so that when contacted by the upper contact strip 32 it moves with the upper contact strip. This is illustrated in FIG. 5 which depicts the substantial lack of displacement between the contact strips 32 and 34 under the depressing and distorting forces involved. FIG. 5 also illustrates the movements that take place of the supporting ledges 46 and 48 and the changes in configuration of the air recesses 22 and 24 under the operating conditions described.

In FIG. 6 I illustrate the contrasting functioning and action that take place in a treadle switch unit TP of the prior art. Such a unit comprises an upper treadle portion 60, side walls 62 and 64 and a base portion 66. Such a switch unit is also made with air recesses such as 68 and 70, and upper and lower contact strips 72 and 74. In such a unit the base 66 is a solid rubber support for the lower contact strip 74. As a result when the treadle unit is subjected to a vertical force 10F having a horizontal or transverse component XF in the direction indicated due to a vehicle acceleration in the direction of the arrow 54, the upper contact 72 will be displaced and will move relatively to the lower contact 74, as illustrated in FIG. 6 of the drawings; and this relative movement between the contact strips results, as explained above, in the production of metal particles due to the frictional abrasion between the strips, which metal particles have the effect of short circuiting the contact strips and producing the failures described.

The structure and operation of the treadle switch unit of my present invention and the improvement thereof over known treadle switch units of the type disclosed will it is believed be fully apparent from the above detailed description. It will be further apparent that changes may be made in the detail structure of the improved treadle unit of the invention without departing from the spirit of the invention defined in the following claims.

I claim:

1. A treadle switch unit for vehicular traffic mountable transversely on a roadway comprising an elastomeric envelope having an upper treadle portion, side walls and a base portion, the interior of the envelope being formed with transversely spaced air recesses separated by a space, both running longitudinally of the envelope, said space defined by an upper interior surface in the treadle portion and a lower interior surface in the base portion, a first contact strip bonded to said upper interior surface of the treadle portion and a second contact strip bonded to said lower interior surface of the base portion, said contact strips being normally separated and being arranged to electrically engage each other upon pressure being exerted on the treadle top of the envelope, characterized by the provision of means on said base portion to floatingly mount said bonded lower contact strip to allow the lower contact strip to float in relation to the top treadle section and to move with the upper contact strip when the switch unit

responds to a horizontal force component in addition to a vertical force component.

2. The treadle switch unit of claim 1 in which the floating mounting for the base bonded lower contact strip comprises laterally flexible transversely spaced parts formed in said base portion at the bottoms of said air recesses and running longitudinally of the envelope, said laterally flexible parts defining supporting legs for the base bonded second contact strip.

3. The treadle switch unit of claim 2 in which said transversely spaced laterally flexible supporting leg parts are disposed at oppositely directed acute angles with reference to the treadle top of the envelope.

4. The treadle switch unit of claim 2 in which the said laterally flexible supporting leg parts are each defined on the treadle outside by an undercut cavity formed longitudinally in said base and on the treadle inside by the bottom of an air recess.

References Cited

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