

Dec. 22, 1942.

O. J. LA BELL

2,305,717

CIRCUIT CONTROLLING MEANS

Filed Oct. 23, 1939

Fig. 1.

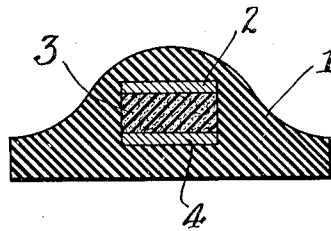


Fig. 2.

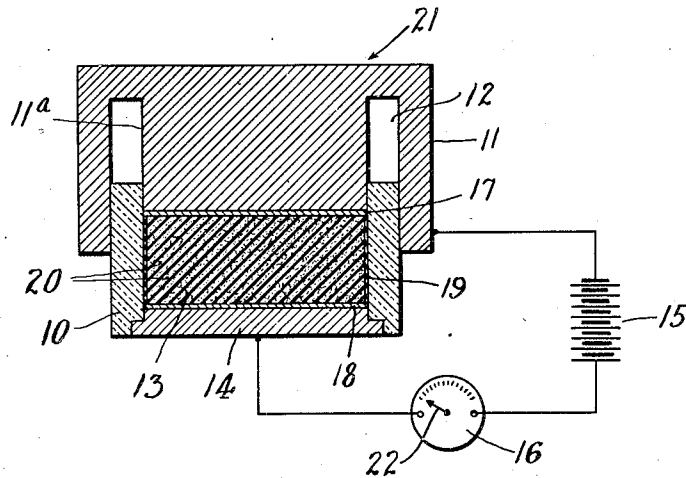
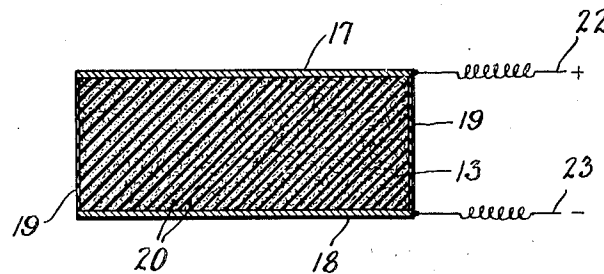


Fig. 3.



Inventor

Oldric J. LaBell

By Bacon + Thomas

Attorneys

UNITED STATES PATENT OFFICE

2,305,717

CIRCUIT CONTROLLING MEANS

Oldric Joseph La Bell, Washington, D. C.

Application October 23, 1939, Serial No. 300,870

10 Claims. (Cl. 201—50)

The principal object of my invention is to provide a circuit controlling means adapted to be actuated by static or impact loads.

Another object of the invention is to provide a device for measuring or indicating the magnitude of static or impact loads.

My invention relates more particularly to a pressure-responsive circuit controlling means and provides an elastic cellular, or porous and non-conductive medium which is made into a conductor of variable conductivity by filling the cells or pores with a powdered conductive material. Thus to accomplish this result I have taken a fine grade of highly porous sponge rubber and filled the voids or cells therein with powdered carbon. These materials are by no means the only ones that lend themselves to this end but they are everyday materials easily obtainable to demonstrate the invention.

Sponge rubber is, of course, a highly elastic material and also a good insulator. Its pores can accommodate a high percentage, by volume, of powdered carbon. The grains of carbon are also sufficiently elastic and are excellent conductors.

In making this carbon pad, I take a disc or body of sponge rubber and pour into slits of the side wall and into the top and bottom faces, finely ground powdered carbon. When the proper amount of carbon has been incorporated within the cells and uniformly distributed therein, I seal the side walls with an elastic cement and attach to the top and bottom faces of the pad, metal plates or discs. These discs serve as the positive and negative conductors.

The elastic carbon pad, it can hardly be called a pile, is then ready to act as an insulator or as a conductor depending entirely upon the amount of pressure to which it is subjected. This, of course, depends upon the amount of carbon present and the voltage applied. However a small pad two inches in diameter and a half inch thick when submitted to a potential of 45 volts D. C. will pass no current if free from outside pressure. As the pressure is increased the flow of current begins and varies with the intensity of pressure. To illustrate the actual working of this principle, I have attached hereto several drawings of different applications or uses.

Figure 1 is a cross-sectional view through a strip of circuit controlling material constructed in accordance with the principles of the present invention;

Figure 2 is a diagrammatic cross-sectional view of a device adapted to indicate the magnitude

of static or impact loads and embodying the principles of the present invention; and

Figure 3 is a cross-sectional view through a sealed circuit controlling unit such as employed in the device shown in Figure 2, but with conductor wires connected to the plates of the unit so that it can be used, if desired, without the piston and cylinder shown in Figure 2.

In Figure 1, I have shown in cross section a simple embodiment that can serve as a circuit controlling means associated with a roadway, etc., designed to be actuated by a vehicle wheel passing over it or by a person stepping upon it. In Figure 1, number 1, is a rubber casing or housing which protects the circuit controlling element from wear and tear and weather. The circuit controlling element consists of the two conductors 2 and 4 separated by the continuous strip of sponge rubber, 3, impregnated with carbon as previously described. A vehicle wheel passing over the device would compress the sponge rubber, 3, and the incorporated carbon granules permitting a current to flow from conductor 2 through 3 and into 4. This current may then be used to actuate diverse types of electrical mechanisms.

In Figure 2, I make use, in a very simple manner, of that property of the pad that permits the current flowing through it to vary with the pressure exerted upon the two parallel faces of the pad. Thus 10, is a cylinder made of a nonconductive material preferably hard rubber or Bakelite. Number 11 is a metal piston including a portion 11^a designed to slide vertically within the cylindrical walls of cylinder 10 and serve as the first of a pair of conductors. The piston 11 has an annular recess 12 to receive the side wall of the cylinder 10. Number 13 is a disc shaped carbon pad and number 14 is the metal bottom of the cylinder and the second of the pair of conductors. Conductors 11 and 14 are placed in series with a simple electrical direct current circuit including a battery 15 and an ammeter 16. Plates 17 and 18 are suitably attached to the opposite sides of the pad 13 and the periphery or side wall of said pad is sealed by a suitable elastic cement 19 to retain the carbon particles 20 within said pad. From previous tests with known weights and known pressures applied to the weigh platform portion 21, the relation between amperes and pounds is determined for the particular pad in question and the dial of the ammeter is preferably calibrated in pounds weight to give a direct reading.

Thus when an unknown weight is applied to

the platform portion 21, the piston, 11, moves downward compressing the carbon pad, 13, and decreasing its internal resistance and thereby increasing the reading on the ammeter scale, 16. The needle 22 of the ammeter 16 is moved according to the load applied and the ammeter scale is read when said needle comes to rest and this reading will be the weight in pounds.

Figure 3 shows a circuit controlling pad or unit of the type used in the device shown in Figure 2 but with conductor wires 23 and 24 secured directly to the plates 17 and 18, respectively.

It is to be realized, of course, that what I have shown here is the very simplest type of an electrical scale. For special operations such as weighing the load on axles of vehicles, it may be necessary to use an entire battery of these "pressure cells" in conjunction with more complicated control apparatus.

Due to the inherent structure of this pad it is especially adapted to the measuring of rapid and momentary applications of force without the danger of damaging the pad itself. Thus, the impact of moving wheel loads can be determined as can also the value of static wheel loads.

While I have described the pad as being essentially a disc, this is not an essential part of the invention. An oblong pad or one of irregular outline can be made to serve equally well.

The sponge-rubber carbon-impregnated pad of my invention can also be made as follows: the disc or body to be impregnated is placed in the bottom outlet neck of a tank (not shown) into which is placed, under pressure, a mixture of powdered carbon and water. This mixture is continually agitated so that the carbon particles are suspended throughout the liquid in a state approximating a colloidal suspension. This mixture is then filtered through the sponge pad where the particles of carbon tend to accumulate in the cells, or pores, of the pad. After a certain period the predetermined amount of carbon has been deposited in the pad the flow is stopped and the pad is removed and allowed to dry. To the dry pad are attached the top and bottom conductors. The carbon pad is then tested and calibrated after which it is ready for use.

On the basis of the disclosures in the foregoing specifications, I claim as my invention the following:

1. Circuit controlling means comprising two substantially flat current conducting elements; a flat, resilient, integral body of cellular non-conducting material attached to said conducting elements and separating said conducting elements, the area of the adjacent contacting surfaces of said flat conducting elements and said body being substantially equal; a finely divided conducting material substantially completely filling the cells of said flat body, said attached plates serving as sealing means to retain said material in said cellular body; and housing means enclosing said flat conducting elements and said flat body.

2. A circuit controlling unit comprising two thin, disc-shaped conductor elements; a homogeneous relatively thick circular body of cellular elastic sponge rubber separating said conductor elements and constituting the sole means for maintaining said conductor elements in spaced apart relation, said conductor elements and said body being of substantially the same diameter; a powdered conducting material substantially completely permeating the cells of said body; and elastic means adhering to and sealing the

peripheral surface of said cellular body to retain said powdered conducting material therein, said disc-shaped conductor elements being attached to said cellular body to further retain said powdered material therein.

3. Means for use in an electrical circuit comprising a resilient body of porous non-conducting material; a powdered conducting material substantially completely permeating the pores of said body; and means adhering to and sealing the peripheral surface of said porous body to retain said powdered material therein.

4. Means for use in an electrical circuit comprising a body of sponge rubber of substantial thickness; particles of finely divided carbon substantially uniformly distributed throughout the voids of said body; and an elastic medium adhering to and sealing the side walls of said body to retain said powdered carbon therein.

5. Circuit controlling means comprising, two current conducting elements; a body of resilient, cellular non-conducting material separating said conducting elements; a powdered conducting material substantially completely permeating the cells of said body; and means adhering to and sealing the peripheral surface of said cellular body to retain said powdered material therein.

6. Circuit controlling means comprising two current conducting plates, a yieldable body of porous non-conducting material interposed between said plates; a powdered conducting material substantially completely permeating the cells of said body; means attaching said plates to the top and bottom surfaces of said body; and means sealing the side surface of said porous body to retain said powdered material therein.

7. A circuit controlling device comprising a hollow member; a current conducting element carried by one end of said hollow member; a second current conducting element being arranged for unrestrained movement in opposite directions in said hollow member; and a body of elastic porous non-conducting material in said hollow member interposed between said current conducting elements and being adapted to be compressed in accordance with the force acting upon said second current conducting element and to return to its initial uncompressed state upon withdrawal of said force, said body having the pores thereof substantially completely permeated with a finely divided conducting material and means for sealing the peripheral surface of said porous elastic body to retain said conducting material therein.

8. A circuit controlling device comprising a hollow member of insulating material; a current conducting element carried by one end of said hollow member; a second current conducting element adapted to have a force act thereon, said second current conducting element being arranged for unrestrained movement in opposite directions relative to said first current conducting element; a body of yieldable cellular non-conducting material interposed between said current conducting elements and being adapted to be compressed in accordance with the force acting upon said second current conducting element and to return to its uncompressed state upon withdrawal of said force, said body having the cells thereof substantially completely permeated with grains of a current conducting material; a metal plate disposed between said body and each of said current conducting elements; and elastic means adhering to and sealing the peripheral surface of said body, said plates being attached

to said body and serving to prevent escape of said current-conducting material therefrom.

9. Circuit controlling means comprising a hollow member; a current conducting element adjacent to one end of said hollow member; a second current conducting element adapted to have a force act thereon, said second current conducting element having a portion telescoping said hollow member and being arranged for movement relative to said hollow member and to said first current conducting element; and a body of resilient cellular non-conducting material interposed between said current conducting elements and being adapted to be compressed in accordance with the force acting upon said second current conducting element, said body having the cells thereof substantially completely permeated with a powdered current conducting material.

10. Circuit controlling means comprising a hollow member; a current conducting element adjacent to one end of said hollow member; a sec-

ond current conducting element arranged for movement relative to said first current conducting element and being adapted to have a force act thereon; a body of non-fibrous resilient cellular non-conducting material in said hollow member interposed between said current conducting elements and being adapted to be compressed in accordance with the force acting upon said second current conducting element and to return to its initial uncompressed state upon withdrawal of said force, said body having the cells thereof substantially completely permeated with a finely divided current conducting material; and means cooperable with one of said current conducting elements and in telescoping engagement with the other of said current conducting elements for maintaining said current conducting elements in substantial parallelism at all times.

OLDRIC JOSEPH LA BELL.