LINEAR PRESSURE SENSOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to sensors, in particular pressure sensors.

2. Description of the Related Art

Pressure sensors have many practical applications and may be used to detect that a person is sitting in a car seat or to detect an obstacle in the path of a mechanical moving part. For example, a motorized garage or lift door may be equipped with a pressure sensor on the leading edge. When an obstacle is detected, an input signal may be provided to the motor control from the sensor, which in turn may trigger the motor control to reverse the direction of motion of the moving door to prevent damage to the door and/or the obstacle. Applications may be safety-critical.

Different types of pressure sensor are suitable for such an application. These include pneumatic based sensors that utilise a tube and an air pressure sensor arranged to detect a change in the internal tube pressure. Wire based sensors utilise conductive strips located within a soft component and are arranged to detect contact between the strips. Optical based sensors utilise a hollow, flexible soft component, light transmission and a receiver arranged to detect light occlusion. Field based sensors utilise an antenna to establish an electrical field along the leading edge, arranged to detect the presence of a conductive object. Another type of sensor utilises a flexible surface incorporating push-button control switches, formed from layered conductive plastic or foil. A common problem with these types of sensors is that they display unsatisfactory durability. Applications for the above types of sensor are restricted by the limited ability of pneumatic, wire, optical and push-button switch based sensors to accommodate bends or curves around tight radii, and the difficulty of operating a field based sensor in a changing environment.

BRIEF SUMMARY OF THE INVENTION

According to a first aspect of the present invention there is provided a linear sensor comprising electrically conductive textile fibres and electrically insulating textile fibres, wherein said sensor further comprises at least two conductive elements formed from said electrically conductive fibres, and said insulating textile fibres are spaced apart to allow electrical conduction between two conductive elements under the application of pressure.

In one embodiment, the sensor comprises a first conductive element, a second conductive element and a third conductive element, said first conductive element disposed between and electrically insulated from said second and third conductive elements, said sensor configured to allow electrical connection between said first conductive element and one of said second and third conductive elements.

In a preferred embodiment the sensor said at least two conductive elements comprise a first conductive element having electrically conductive textile fibres extending along at least a portion of the length of said sensor; and a second conductive element having electrically conductive textile fibres extending along at least said portion of the length of said sensor, and said sensor further comprises a third conductive element extending along at least said portion of the length of said sensor, wherein said third conductive element is electrically insulated from said first and second conductive elements over said portion of the length of said sensor, and said third conductive element is electrically connected at one end to only one of said first conductive element and said second conductive element.

According to a second aspect of the present invention there is provided a linear sensor comprising electrically conductive textile fibres and electrically insulating textile fibres: said sensor comprising a first conductive element having electrically conductive textile fibres extending along the length of said sensor; a second conductive element having electrically conductive textile fibres extending along the length of said sensor and surrounding said first conductive element; and electrically insulating textile fibres configured to (i) separate said two electrically conductive elements when no pressure is applied to said sensor and (ii) allow electrical conduction between said two conductive elements under the application of pressure.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

FIG. **1** shows an end of a sensor **101** having a construction utilising textile fibre;

FIG. **2** shows a cross-section of a second linear sensor **201**;

FIG. **3** shows an electrical arrangement for linear sensor **201** of FIG. **2**; and

FIGS. **4** and **5** illustrate an application of a linear sensor.

BEST MODE FOR CARRYING OUT THE INVENTION

FIG. **1**

The present invention provides a linear sensor having a construction utilising textile fibre. The sensor is suitable for use in linear position sensing applications.

Many textile structures may be used to produce a strip or braid on which to base the sensor. Such textile structures may be produced substantially in one operation, using conventional textile manufacturing techniques, such as weaving, knitting or braiding. The incorporation of elastic fibres, such as Lycra™ or Elastane™ into the textile structure assists the structure to return substantially to its original shape after the application of pressure.

FIG. **1** illustrates a construction of textile structure **101**. The structure **101** comprises a first conductive element **102**, which extends substantially centrally along and through the length of the structure **101**. In this example, conductive element **102** is fabricated from a bundle of carbon impregnated nylon conductive textile fibres **103**, such as F901, available from Shakespeare Inc. A second conductive element, **104** is braided around the central conductive element **102**. The second conductive element comprises similar carbon impregnated nylon conductive textile fibres **105** and insulating fibres **106**. The diameter of the insulating fibres **106** is greater than the diameter of the conductive fibres **105**, such that, in the no pressure applied condition, the second conductive element **104** does not make electrical contact with the central conductive element **102**. However, within the structure of the braided conductive element **104** the fibres are sufficiently spaced to allow electrical contact between the second conductive element **104** and the central conductive element **102** when pressure is applied to the textile structure **101**. Using conductive fibres and insulating fibres having different diameters is only one way to achieve this functionality.

The structure **101** further comprises a flexible, insulating, soft foam sheath **107** or sleeve surrounding the second conductive element **104**. The sheath **107** serves to provide pro-