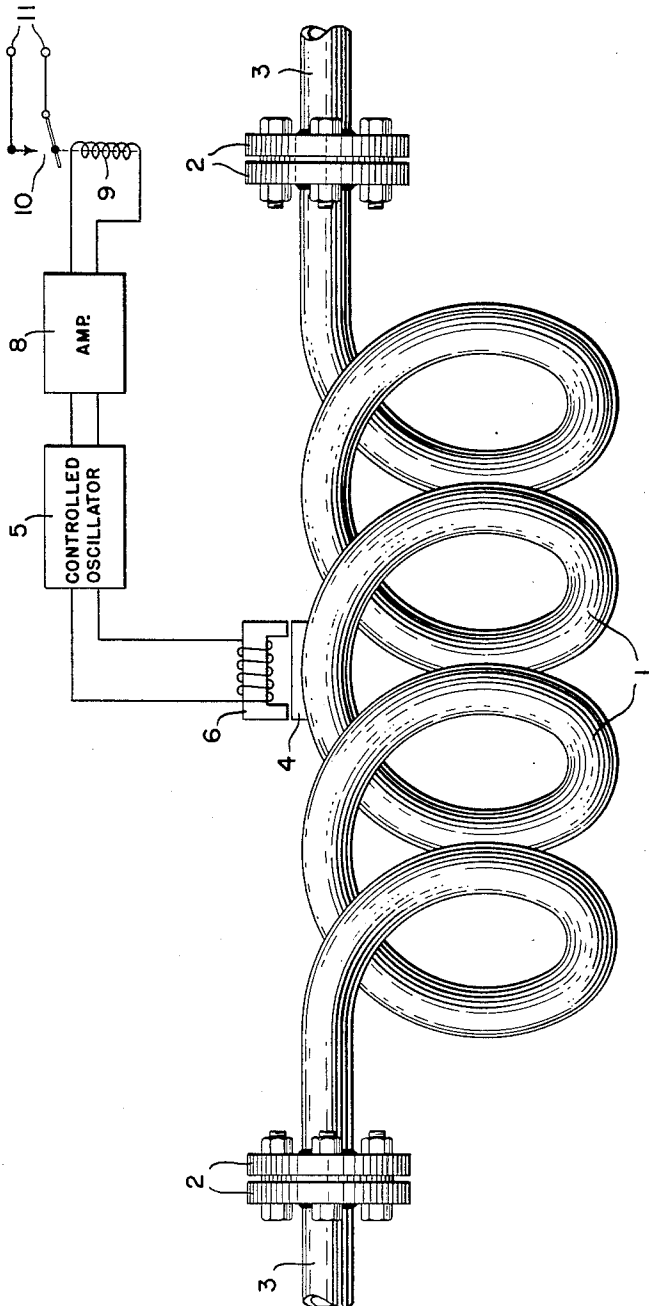


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ELECTRICAL APPARATUS
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ELECTRICAL APPARATUS

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This invention relates to electrical transducers. More specifically, the present invention relates to a fluid pressure transducer.

An object of the present invention is to provide an improved fluid pressure transducer for indicating a change in fluid pressure within a fluid conduit.

Prior art pressure transducers have had a serious deficiency in an ability to maintain the strength of the fluid conduit structure. Such prior art devices as Bourdon tubes, bellows, diaphragms, etc. are inherently the weakest point in the conduit structure by virtue of their design or attachment to the fluid conduit. Thus, in every case, the pressure transducer is the limiting factor in the design of the fluid conduit and, unless expensively ruggedized for the expected fluid pressures, is the conduit element most subject to mechanical failure.

Another object of the present invention is to provide an improved pressure transducer for sensing a fluid pressure within a fluid conduit without weakening the conduit structure.

A further object of the present invention is to provide an improved pressure transducer for sensing an increase or a decrease in a fluid pressure without interfering with the flow of the fluid.

A still further object of the present invention is to provide an improved pressure transducer, as set forth, characterized by a simplicity of operation and construction.

In accomplishing these and other objects, there has been provided, in accordance with the present invention, a fluid pressure transducer comprising a pre-formed helical conduit element for insertion in a fluid conduit. The helical element is used to bridge a gap in the fluid conduit to allow the conducted fluid to flow therethrough. A ferrite element is firmly attached to an outside surface of the helical conduit element. A ferrite-position detecting means is arranged to sense the spatial displacement of the helical conduit element and the attached ferrite element as the helical conduit element responds to the fluid pressure of the conducted fluid.

A better understanding of the present invention may be had from the following detailed description when read in connection with the accompanying drawing which drawing is a pictorial representation of a fluid pressure transducer embodying the present invention.

Referring to the drawing, there is shown a fluid pressure transducer having a helical conduit element 1. The helical conduit element 1 includes suitable fixed conduit connectors 2 at both ends for connection to a fluid conduit 3. Further the helical conduit element 1 is formed from a size of conduit which is similar to the fluid conduit 3 to maintain the pipeline strength of the fluid conduit 3 with respect to the pressure of the fluid therein. In other words, the design of the helical conduit element 1, by means of factors such as helical radius conduit size and connectors, is arranged to not impair the pressure capabilities of the fluid conduit 3. A ferrite element 4 is attached to the helical conduit element 1 at a point approximately midway between the conduit connectors 2.

A controlled oscillator 5 is used to detect the motion of the ferrite element 4 by means of an oscillator coil and core 6. The controlled oscillator 5 may be a device as shown in Patent No. 2,847,625 granted to William J. Popowsky. As shown therein, particularly in FIGS. 4

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and 5, the ferrite element is used to control the impedance of the inductive control section of the oscillator. The effect of varying the magnetic coupling by the ferrite element is to change the amplitude of the oscillations of the oscillator. This change in amplitude is detected as a change in the direct current power drain on a power supply or as a change in the amplitude of the alternating-current oscillations. FIG. 5 of that patent shows a detection of the direct current variation, and FIG. 4 shows a detection of the variation in the alternating-current amplitude.

As shown in the instant application, an amplifier 8 is used to amplify the detected variation in the operation of the controlled oscillator 5. Further the amplifier 8 is effective to produce a direct-current signal representative of this variation. The direct-current signal from the amplifier 8 is applied to a relay coil 9 to operate a relay-controlled contact 10. The contacts 10 are connected to a pair of output terminals 11 to control associated equipment; e.g., a pressure alarm device.

In operation, the helical conduit element 1 is inserted in the fluid conduit line 3. The fluid carried by the fluid conduit line 3 is allowed to flow through the helical conduit element 1 and to exert a fluid pressure therein. The helical conduit element 1 is affected by this fluid pressure to produce a limited circular motion of the helix coils. This motion is the result of a torsional twisting of the conduit material produced by the force applied to the helical conduit walls by the angular acceleration of the fluid passing therethrough. This angular motion is proportional to the pressure up to the limit of elasticity of the helical conduit material. Further, the helical conduit element is able to return to an initial position after an increase or decrease in pressure has been corrected if the elastic limit were not exceeded. Thus, the conduit connectors 2 are rigid connectors, and the pressure transducer of the present invention does not use any rotating joints.

The pressure-induced motion of the helical conduit element 1 is effective to move the attached ferrite element 1 through a small arc to an initial spatial position corresponding to the fluid pressure. The coil and core 6 of the controlled oscillator 5 are positioned with respect to the ferrite element 4 in this initial spatial position to produce a suitable output signal from the oscillator 5.

The oscillator of the previously discussed Popowsky patent is arranged to have a low amplitude output signal when the ferrite element is in close proximity to the inductive control section and vice versa. The oscillator 6 output signal may be arranged to be of an amplitude that the amplifier 8 will, in turn, produce a corresponding output signal of insufficient magnitude to energize the relay coil 9 whereby to close the relay contacts 10; i.e., the coil and core 6 is close to the ferrite element 4. As previously mentioned, the relay contacts 10 are effective to control associated equipment through the output terminals 11 to indicate and/or control the fluid pressure.

Assume the relay contacts 10 are open when the fluid pressure in the helical conduit element 1 is at a desired level; i.e., the coil and core 6 is arranged to produce a minimum amplitude of the output signal from the oscillator 5. If the fluid pressure were to increase or decrease, the helical conduit element 1 would be subjected to a further rotation or a relaxation, respectively. In either case, the ferrite element 4 would be spatially displaced from its initial position, and the coil and core 6 of the oscillator 5 would detect this change in position. This displacement would increase the separation of the ferrite element 4 from the coil and core 6 and would be effective to ultimately increase the signal supplied to the relay coil 9. The energization of the relay coil 9 is effective to close

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the contacts 10 to affect the alarm device connected to the output terminals 11. Upon a resumption of the desired fluid pressure, the ferrite 4 would return to the initial spatial position to effect a reopening of the contacts 10 by a reversal of the operation described above.

Thus, it may be seen that there has been provided, in accordance with the present invention, a fluid pressure transducer for sensing an increase or a decrease in a fluid pressure which transducer is characterized by the ability to maintain the strength of a fluid conduit structure.

What is claimed is:

1. A pressure transducer comprising a helical fluid-conduit element, connecting means for inserting said element to bridge a gap in a fluid conduit to provide a continuous fluid path with said fluid conduit, a ferrite element means fastened to the outer surface of said conduit element and means for detecting a spatial motion of said ferrite element means relative to said means for detecting whereby to indicate a change in the fluid pressure of the fluid within said helical fluid conduit element.

2. A pressure transducer comprising a helical fluid-conduit element, connecting means at both ends of said element for inserting said element in a fluid conduit in a fluid conducting relationship to provide a continuous fluid path with said fluid conduit, said element comprising a segment of conduit having conduit dimensions similar to said fluid conduit, a ferrite element means attached to the outer surface of said conduit element, said ferrite element means spatially moving with said conduit element in response to variations in the fluid pressure of the fluid conducted therethrough, and means for detecting the spatial motion of said ferrite element means relative to said means for detecting whereby to indicate a change in the fluid pressure of the fluid within said helical fluid conduit element.

3. A pressure transducer comprising a helical fluid-conduit element, connecting means for inserting said ele-

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ment to bridge a gap in a fluid conduit to provide a continuous fluid path with said fluid conduit, a ferrite element means attached to the outer surface of said conduit element at a point substantially midway between the ends of said conduit element, said ferrite element means spatially moving with said conduit element in response to variations in the fluid pressure of the fluid conducted therethrough, and means for detecting the spatial motion of said ferrite element means relative to said means for detecting whereby to indicate a change in the fluid pressure of the fluid within said helical fluid conduit element.

4. A pressure transducer comprising a helical fluid-conduit element, connecting means for inserting said element to bridge a gap in a fluid conduit to provide a continuous fluid path with said fluid conduit, a ferrite element means attached to the outer surface of said conduit element at a point substantially midway between the ends of said conduit element, said ferrite element means spatially moving with said conduit element in response to variations in the fluid pressure of the fluid conducted therethrough and oscillator detecting means for detecting a spatial motion of said ferrite element means, said oscillator detecting means including an inductive control circuit responsive to the relative position of the ferrite element means thereto whereby to indicate a change in the fluid pressure of the fluid within said helical fluid-conduit element.

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