

United States Patent

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[54] TRANSDUCER MEANS
12 Claims, 4 Drawing Figs.

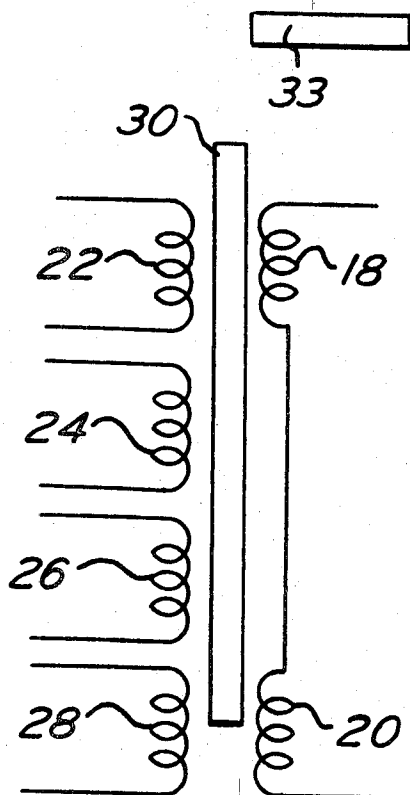
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323/48

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ABSTRACT: A transducer of the proximity type having a primary winding, a plurality of separate secondary windings, and a core. The secondary windings are positioned with respect to the primary winding so that each of the secondary windings has a different output signal created by the same input signal to the primary winding. The different output signals are also caused to change in amplitude differently when a metal member is moved toward and away from the core of the transducer.



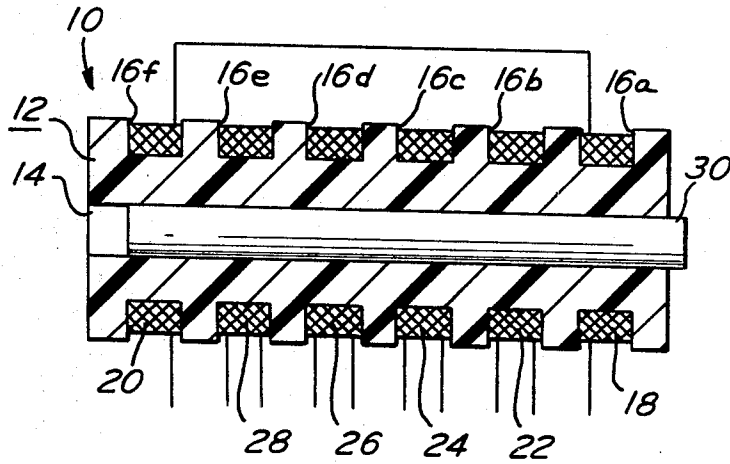


FIG. 1

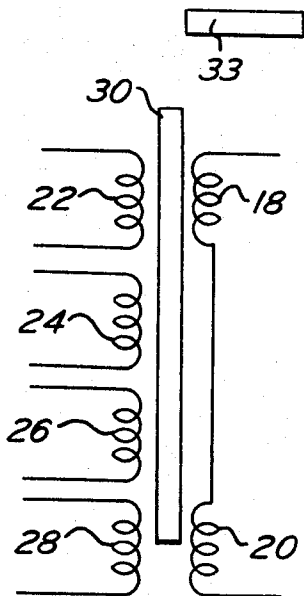
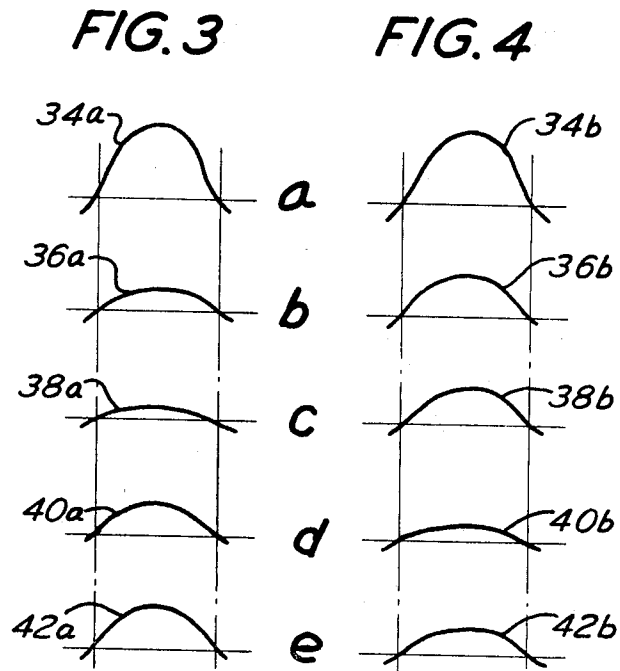


FIG. 2



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TRANSDUCER MEANS

The present invention relates to a novel transducer means, and more particularly to a proximity transducer having a plurality of individual secondary windings which provide different output signals.

Proximity transducers in general include a primary, a secondary and a core coupling the primary and secondary. An input signal applied to the primary produces an output signal from the secondary. When a metal member is moved toward an end of the core of the transducer, the output signal from the secondary changes even though the input signal to the primary is not changed. Thus the transducer can be used to control an electronic device by moving a metal member toward or away from the core of the transducer so as to change the output signal from the transducer to the electronic device.

It is an object of the present invention to provide a proximity transducer having a plurality of output signals produced from a single input signal.

It is another object of the present invention to provide a proximity transducer having a plurality of output signals produced from a single input signal with each output signal being different and which output signals change differently in amplitude when a metal member is moved towards and away from the core of the transducer.

These objects are achieved by a proximity transducer having a single primary, a plurality of secondaries and a core coupling the secondaries and the primary. The primary comprises a pair of spaced primary windings connected in series. The secondaries are separate windings which are arranged in different positions between the two primary windings.

For the purpose of illustrating the invention, there is shown in the drawings a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.

FIG. 1 is a longitudinal sectional view of the transducer of the present invention.

FIG. 2 is a circuit diagram of the transducer of the present invention.

FIG. 3 is a series of diagrams showing the input signal to the transducer and the output signals produced from the separate secondaries in one condition of operation of the transducer.

FIG. 4 is a circuit diagram similar to FIG. 3 but showing the output signals from the secondaries in another condition of operation of the transducer.

Referring to FIG. 1, the transducer of the present invention is generally designated as 10. The transducer 10 comprises a cylindrical bobbin 12 of an electrical insulating material, such as a ceramic or plastic. Bobbin 12 has a hole 14 extending longitudinally therethrough along the longitudinal axis thereof. Bobbin 12 also has a plurality of annular grooves 16a, 16b, 16c, 16d, 16e and 16f in its outer surface and spaced along the bobbin.

Separate wire windings 18 and 20 are provided in the end grooves 16a and 16f in the bobbin 12. As shown in FIG. 2, the windings 18 and 20 are connected in series-opposing relation and constitute the primary of the transducer 10. Separate wire windings 22, 24, 26 and 28 are provided in the other grooves 16b, 16c, 16d and 16e of the bobbin 12. As shown in FIG. 2, each of the windings 22, 24, 26 and 28 is a separate secondary of the transducer 10. Thus, as shown, the transducer 10 of the present invention has four separate secondaries. A core 30 of a magnetic metal is provided within the hole 14 in the bobbin 12, and is offset from one end of the bobbin 12.

In the core of the transducer 10, the primary windings 18 and 20 are connected across a source of AC current so as to provide an AC input signal across the primary. This input signal induces a separate output signal in each of the secondary windings 22, 24, 26 and 28. FIGS. 3 and 4 show these input and output signals. FIG. 3a is the input signal to the primary windings 18 and 20 and FIGS. 3b, 3c, 3d, and 3e are the output signals from the secondary windings 22, 24, 26 and 28 respec-

tively for one condition of operation of the transducer 10. As previously stated, in the operation of a proximity-type transducer, when a metal member such as the metal member 33 in FIG. 2, is moved closer to the end of the core of the transducer, the output signal of the transducer changes. In FIG. 3, the curves are the signals without a metal member in proximity with the core 30 of the transducer 10. In FIG. 4 the curves are the signals with a metal being in close proximity with the core 30.

As shown by the curves 34a and 34b in FIGS. 3a and 4a respectively, the AC input signal to the primary windings 18 and 20 remains uniform even when the metal is brought into proximity with the core 30. Curves 36a, 38a, 40a and 42a in FIGS. 3b, 3c, 3d and 3e respectively show the induced output signals of the secondary windings 22, 24, 26, and 28 respectively with the metal being away from the end of the core 30. As can be seen, the amplitude of the output signal of the secondary winding 22 is greater than that of secondary winding 24. However, the amplitude of the output signal of secondary winding 26 is greater than that of secondary winding 22, but is less than that of secondary winding 28. Thus, there is induced concurrent output signals from the secondary windings which are of different amplitude.

Curves 36b, 38b, 40b, and 42b in FIGS. 4b, 4c, 4d, and 4e respectively show the output signals of the secondary windings 22, 24, 26, and 28 respectively when a metal member is brought into proximity with the core 30. As can be seen, when the magnetic metal is moved in proximity to the core 30, the amplitudes of the output signals of the secondary winding 22 and 24 increase with the amplitude of the output signal of the secondary winding 22 being greater than that of the secondary winding 24. However, the movement of the magnetic metal to the core 30 causes the amplitude of the output signals of the secondary windings 26 and 28 to decrease with the amplitude of the output signal of the secondary winding 26 being less than that of the secondary winding 28. Thus, the movement of the metal into proximity with the core 30 causes the output signals of the secondary windings 22, 24, 26 and 28 to change in different amounts so that the resulting output signals of the secondary windings are all different. In addition, the output signals of some of the secondary windings decrease whereas the output signals of the other secondary windings increase.

Thus there is provided by the present invention a transducer which from a single input signal produces a plurality of separate output signals with each of the output signals being of a different amplitude. In addition, when a metal member is brought into proximity with the core of the transducer, the amplitude of each of the output signals changes. Also, the change in the amplitude of each of the output signals is different with some of the output signals decreasing in amplitude and the other of the output signals increasing in amplitude. Thus, the transducer of the present invention can be used to simultaneously provide control signals to a plurality of different electronic devices or to different functions of the same device. Also, because of the differences in the amplitudes of the output signals and the differences in the changes of the amplitudes of the output signals, the transducer of the present invention can be used as a logic function device.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

What I claim is:

1. A transducer means comprising a primary winding having spaced series-connected first and second windings receiving an alternating energizing signal, a plurality of independent secondary windings positioned between said first and second windings of said primary winding each providing respective output signals, said primary and secondary windings being about a core opening, and a core consisting of a rod of magnetic material fixed in said core opening and extending within and magnetically coupling said secondary windings with said

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primary winding and being asymmetrically positioned with respect to said primary winding and said secondary windings said secondary windings being positioned with respect to said primary winding to produce respective output signals from said secondary windings of different respective amplitudes during energization of said primary winding, and a movable metallic member positioned with respect to an end of said core.

2. Transducer means in accordance with claim 1 in which the secondary windings are positioned in spaced side-by-side relation between the pair of primary windings.

3. Transducer means in accordance with claim 2 including a cylindrical bobbin of electrical insulating material having a hole extending longitudinally therethrough providing said core opening, the primary and secondary windings being wound around said bobbin and the core being fixed within and extending along the hole in said bobbin.

4. A transducer in accordance with claim 3 in which the bobbin has a plurality of annular grooves in its outer surface and each of said windings is in a separate one of said grooves.

5. Transducer means in accordance with claim 1 in which at least one of said plurality of secondary windings is positioned with respect to said primary winding to provide an output signal having an amplitude which increases when a metallic material is moved toward said core while at least another one of said secondary windings is positioned with respect to said primary winding to provide an output signal having an amplitude which decreases when said metallic material is moved toward said core.

6. Transducer means in accordance with claim 5 in which the output signal of said secondary winding which has its amplitude increase when a metallic material is moved toward said core has its amplitude decrease when said material is moved away from said core.

7. Transducer means in accordance with claim 5 in which the output signal of said secondary winding which has its amplitude decrease when a metallic material is moved toward said core has its amplitude increase when said material is moved away from said core.

8. Transducer means in accordance with claim 2 in which at

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least one of said plurality of secondary windings is positioned with respect to the pair of spaced windings of said primary winding to provide an output signal having an amplitude which increases when a metallic material is moved away from said core while at least another one of said secondary windings is positioned with respect to the pair of spaced windings of said primary winding to provide an output signal having an amplitude which decreases when said metallic material is moved away from said core.

9. Transducer means in accordance with claim 8 in which the output signal of said secondary winding which has its amplitude increase when a metallic material is moved away from said core has its amplitude decrease when said metallic material is moved toward said core, and the output signal of said secondary winding which has its amplitude decrease when said metallic material is moved away from said core has its amplitude increase when said metallic material is moved toward said core.

10. Transducer means in accordance with claim 1 in which at least two of said plurality of secondary windings are positioned with respect to said primary winding to each provide an output signal having an amplitude which increases when a metallic material is moved toward said core, the amplitude of one of said output signals increasing to a greater extent than that of the other.

11. Transducer means in accordance with claim 2 in which at least two of said plurality of secondary windings are positioned with respect to the pair of spaced windings of said primary winding to each provide an output signal having an amplitude which decreases when a metallic material is moved away from said core, the amplitude of one of said output signals decreasing to a greater extent than that of the other.

12. Transducer means in accordance with claim 5 in which at least two of said plurality of secondary windings are positioned with respect to said primary winding to each provide an output signal having an amplitude which increases when a metallic material is moved toward said core, the amplitude of one of said output signals increasing to a greater extent than that of the other.

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