

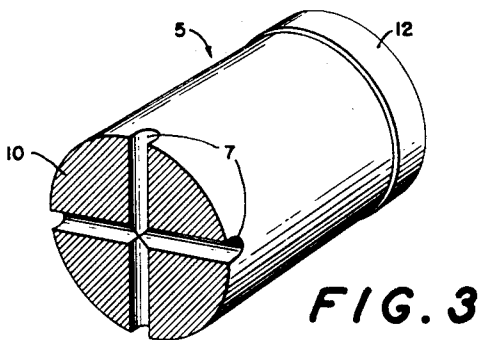
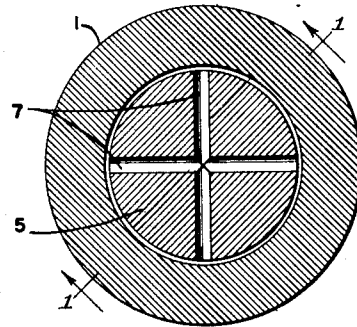
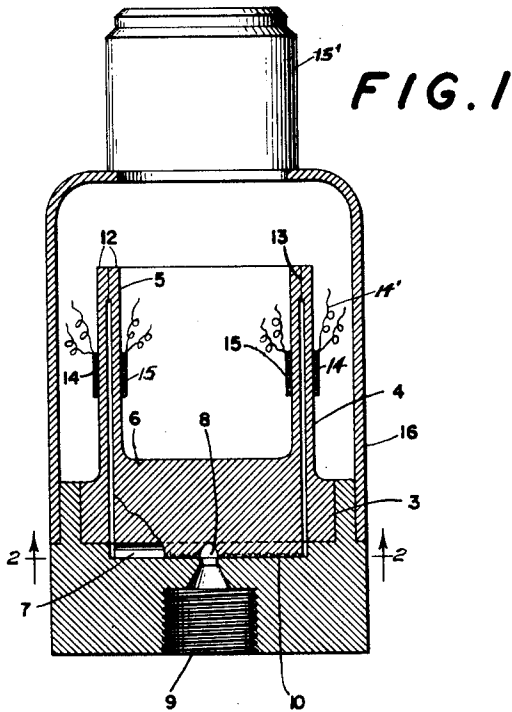
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PRESSURE CELL

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2,942,219

PRESSURE CELL

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3 Claims. (Cl. 338—5)

This invention relates to fluid pressure transducers (sometimes called cells) of the electrical strain responsive type.

One type of such cell as heretofore proposed employs inner and outer walls forming an annular space for fluid whose pressure is to be measured by electrical impedance strain gages mounted upon the walls, the strain gages responding to pressure-induced radial deformation of the walls. Such device is functionally deficient in its electrical output, frequency response, linear relation between strain and electrical output, and hysteresis characteristics.

It is an object of my invention to provide an improved annular type fluid pressure transducer having high frequency response and electrical output, together with good linearity and low hysteresis.

Other objects and advantages will be more apparent to those skilled in the art from the following description of the accompanying drawings in which:

Fig. 1 is a vertical sectional view of my improved transducer taken on the line 1—1 of Fig. 2;

Fig. 2 is a horizontal section taken substantially on the line 2—2 of Fig. 1; and

Fig. 3 is a perspective of the inner circular wall member of the transducer.

As shown in Fig. 1 my improved fluid pressure transducer includes a base 1 having a recess 3 in which the enlarged end of an outer tubular member 4 is brazed, welded, or otherwise suitably hermetically secured in position. An inner tube 5, of preferably circular cross section and preferably concentric to the outer tube, is provided with a relatively heavy base 6 which has cross passages 7 therein for communication with a central opening 8 of a threaded inlet 9. This base is welded, brazed, or otherwise suitably rigidly secured to the base 1 as indicated diagrammatically by the dotted connecting area 10. The inner and outer tubes have upper ends provided with tightly mating flanges 12 which are brazed, welded, or otherwise suitably hermetically connected along the line 13. Bonded filament type strain gages 14 and 15 such for example as the type shown in United States Patent No. 2,292,549 are mounted on the exposed surfaces of the tubes 4 and 5. These gages are responsive to the circumferential deformation of the tubular walls in response to fluid pressure admitted to the annular space between the inner and outer tubes. This circumferential response is preferably obtained by having the strain responsive resistance filaments extend in a circumferential direction around the walls 4 and 5. The gages may be of any desired effective length. As is well understood the gage filaments are connected by lead wires 14' to any suitable conductor extending through a well-known connector 15' which is mounted upon an outer protective shell 16 secured to a base 1.

In the operation of my improved transducer fluid pressure admitted to the annular space will cause the outer tube 4 to expand radially outward and the inner tube 5 to contract radially inward thereby putting the gages on tube 4 in circumferential tension and the gages on tube

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5 in circumferential compression. I accomplish my desired object of high frequency response and electrical output with good linearity and low hysteresis by reason of the inner tube 5 being securely anchored at its lower end to base 1 thereby minimizing axial stresses of the tubes so that the pressure has its maximum effectiveness in radially deforming the tubes. As a result of my improved cell I obtain an electrical output which is increased appreciably more than 15% as compared to an arrangement where the inner tube is not anchored at its lower end. This is because there are two principal stresses acting on the walls of a pressure cell of this general type, one being axial and the other circumferential. If the axial stress can be decreased the circumferential strain can be increased. In prior tubular cells where the inner tube is not anchored at its lower end of the axial force is equal to the pressure acting over the entire projected inside area of the cell thereby resulting in this force placing the outside tube under axial tension and the inside tube under axial compression. This appreciably decreases the circumferential strain by reason of the operation of Poisson's ratio. In my improved cell, with the base of the inner tube 5 secured to the base 1, the area over which pressure can act is reduced to the projected area of the small annular space between the inner and outer tubes. While pressure acting on this small annular area can develop a force tending to stretch the inside and outside tubes, yet this is counteracted in my improved cell. For instance, the axial tension stress developed in the outside tube tends to neck it inwardly, which would slightly reduce its circumferential expansion and thus slightly reduce the tension on the outside gages; this effect being balanced by the axial tension stress in the inside tube which tends to neck it inwardly and thereby effect a circumferential contraction of the inner tube and thus increase the compression on the inside gage. This balancing effect is reflected in an increased electrical output of the inside and outside sets of strain gages which are connected in a suitable well-known bridge to combine the outputs from both the circumferential strains in compression and tension. In addition to this improved electrical output for a given pressure I also have increased the frequency response of the prior annular type of cell as well as providing better linearity and minimizing hysteresis effects.

It will, of course, be understood that various changes in details of construction and arrangement of parts may be made by those skilled in the art without departing from the spirit of the invention as set forth in the appended claims.

I claim:

1. A fluid pressure device comprising, in combination, a base, inner and outer tubular members having an annular fluid pressure space therebetween, one end of each tubular member being directly secured to said base and the other ends being hermetically connected together, whereby the inner and outer walls of the annular space are each subjected to tension which is induced by fluid pressure acting on the hermetically sealed end of the annular space and the inner wall being subjected to a circumferential compression strain while the outer wall is subjected to a circumferential tension strain upon application of fluid pressure to said annular space, fluid passage means for supplying pressure to said annular space, and electrical impedance strain responsive means mounted on said inner and outer tubular walls so as to be subjected to compression and tension circumferential strains therein.

2. The combination set forth in claim 1 further characterized in that the end of the inner tube which is secured to the base is relatively heavy so that pressure-induced forces are not transmitted to the inner tube end,

3. The combination set forth in claim 1 further characterized in that the end of the inner tube which is secured to the base is relatively heavy so that pressure-induced forces are not transmitted to the inner tube end, and the fluid passage means comprising radially extending passages in the heavy end of the inner tubular member.

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