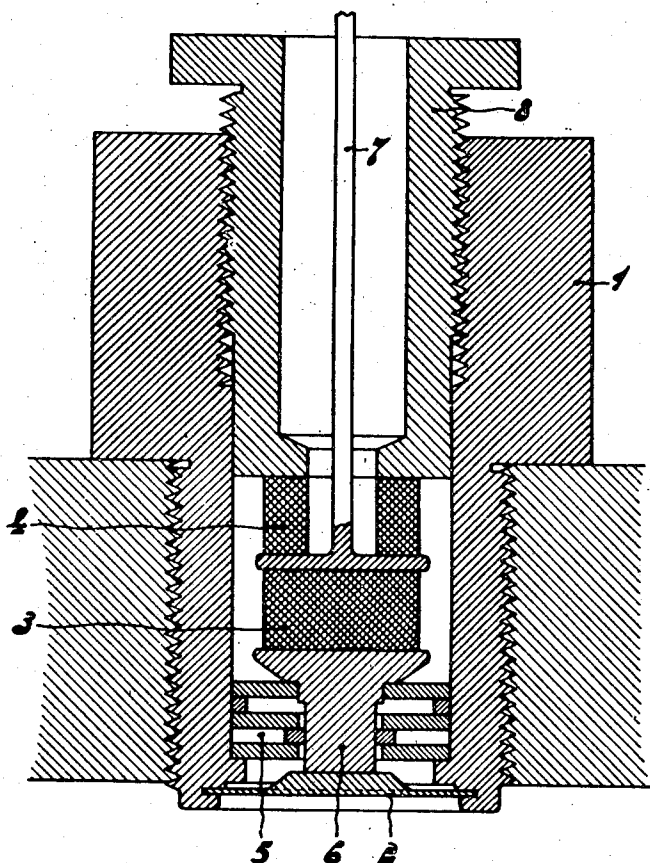


Nov. 16, 1948.

W. H. STIGTER
PIEZOELECTRIC DEVICE FOR CONVERTING PRESSURE
VARIATIONS INTO POTENTIAL VARIATIONS
Filed Jan. 19, 1943

2,454,264



WILLEM HENRIK STIGTER

INVENTOR

BY
E. F. Rindert
ATTORNEY

UNITED STATES PATENT OFFICE

2,454,264

PIEZOELECTRIC DEVICE FOR CONVERTING
PRESSURE VARIATIONS INTO POTENTIAL
VARIATIONS

Willem Hendrik Stigter, Eindhoven, Netherlands,
assignor to Hartford National Bank and Trust
Company, Hartford, Conn., as trustee

Application January 19, 1943, Serial No. 472,919
In the Netherlands August 31, 1940

Section 1, Public Law 690, August 8, 1946
Patent expires August 31, 1960

9 Claims. (Cl. 171—327)

1

For measuring pressure variations it is known to use piezo-electric members which convert pressure variations into electrical potential variations that can readily be read or registered from a distance. The transmission of the pressure to the said members is generally effected by means of a diaphragm which, either directly or by the intermediary of a mechanical transmission, engages the generally surface-ground piezo-crystals.

It has now been found that in the use of such devices a linear or substantially linear relation between pressure and electric voltage is only obtained if the said pressure is large. It is therefore desirable that a high preliminary pressure should be exercised on the crystals and that the pressure variations to be measured should be superimposed upon this preliminary pressure.

The invention has for its object to provide such a construction of a pressure indicator that the desired preliminary pressure can be obtained without the sensitiveness to pressure variations being lowered.

According to the invention, this object is achieved by the arrangement of a separate resilient member which receives the preliminary pressure. The diaphragm thus relieved of this preliminary pressure can be kept thin so that sufficient sensitiveness is ensured.

In order that the invention may be clearly understood and readily carried into effect it will now be described more fully with reference to the accompanying drawing, in which one form of construction of a pressure indicator according to the invention is shown.

The indicator comprises a metal bush 1 to the lower end of which a thin diaphragm 2 is secured.

The bush enclose two crystals 3 and 4, a resilient member 5, a head 6, an intermediate plate 7 with a leading-out wire and an adjusting nut 8. The resilient member 5, which comprises three small dish-springs, bears on a shoulder in the bush 1 and on the other side engages the head 6.

The crystals 3 and 4 with intermediate plate 7 are clamped, with the interposition of very thin copper plates, between the head 6 and the adjusting nut 8.

By means of this adjusting nut 8 the spring body 5 can be compressed to the extent of the required preliminary tension, for example 100 atm., existing on the crystals 3 and 4.

The length of the head 6 is chosen to be such that the diaphragm 2 will then bear on it without any appreciable preliminary tension.

2

In addition, the dimensions and materials should be such that the preliminary pressure on the crystals becomes substantially independent of the temperature. This is necessary since the crystals, for example when in use, assume a comparatively high temperature (300° C. and over), which may lead to erroneous indications.

What I claim is:

1. A piezo-electric pressure indicator comprising a piezo-electric element, a diaphragm member mechanically connected to the piezo-electric element for applying a variable pressure thereto, means for applying a preliminary pressure to the piezo-electric element, and resilient means interposed between the piezo-electric element and the diaphragm member to relieve the diaphragm member of the preliminary pressure applied to the piezo-electric element.

2. A piezo-electric pressure indicator comprising a housing provided with a bore, a piezo-electric element within said bore, a diaphragm member secured to said housing at one end of the bore and mechanically connected to the piezo-electric element, means within said bore for applying a preliminary pressure to the piezo-electric element, and an annular resilient member interposed between the piezo-electric element and the diaphragm member and peripherally supported within said bore to relieve the diaphragm member of the preliminary pressure applied to the piezo-electric element.

3. A piezo-electric pressure indicator comprising a housing provided with a bore, a piezo-electric element within said bore, a diaphragm member secured to said housing at one end of the bore and mechanically connected to the piezo-electric element, means within said bore for applying a preliminary and adjustable pressure to the piezo-electric element comprising a nut member threadingly engaging the bore of the housing and mechanically connected to the piezo-electric element, and an annular resilient member interposed between the piezo-electric element and the diaphragm member for relieving the diaphragm member of the preliminary pressure applied to the piezo-electric element, said annular resilient member having a side portion thereof mechanically connected to the piezo-electric element and the peripheral portion thereof supported within said bore.

4. A piezo-electric pressure indicator comprising a housing provided with a bore having a narrow annular shoulder at one end of the bore; a piezo-electric element supported within the bore; an adjustable fixed pressure head on one side

3

of the piezo element; a movable pressure head on the other side of the piezo element; resilient pressure biasing means to exert an initial pressure on the movable pressure head, said means being braced against the shoulder; and a diaphragm closing the bore of the housing at the other side of the annular shoulder and positioned to engage the movable pressure head and to transmit to said pressure head any external pressure imposed upon the diaphragm, while at the same time relieving the biasing pressure force of the resilient pressure means on the movable pressure head.

5. A piezo-electric pressure indicator comprising a piezo-electric element; means for impressing an initial compression stress on the piezo-electric element, said means consisting of an adjustably movable member presenting a compression surface to the piezo element and a stationary member presenting a reaction surface to the piezo element, means holding the movable member and the stationary member in selected adjusted position; and a pressure-responsive member disposed to engage the piezo element from the reaction surface side in such manner as to add to the initial compression stress, an external pressure as received by the pressure-responsive member, and that is to be measured by the indicator.

6. A piezo-electric pressure indicator as set forth in claim 5 in which the member that is responsive to the external pressure to be measured consists of a diaphragm peripherally seated and with its center free to move in response to an external pressure and operative to transfer that pressure against the piezo element.

7. A piezo-electric pressure indicator as in claim 5, in which the member that is responsive to the external pressure to be measured consists of a diaphragm peripherally seated on a part of the holding means spaced farther from the piezo element than the reaction surface; the center of the diaphragm being so mechanically coupled to the piezo element that any external pressure force received by the diaphragm is transmitted to the

4

piezo element in addition to the reaction pressure.

8. A piezo-electric pressure indicator as in claim 5, in which the holding means is substantially a hollow-cylinder having one end externally threaded to permit the indicator to be threaded as a plug into a wall of a pressure container; and in which the member to be responsive to the external pressure is a closure element for the inner end of the plug consisting of a diaphragm peripherally sealed in the plug wall with the center of the diaphragm free to move and normally directly mechanically coupled to the piezo element to transmit to that element any pressure impressed upon the diaphragm.

9. A piezo-electric pressure indicator as in claim 5, including a floating pressure element engaging the reaction pressure side of the piezo element; an annular pressure-biasing element disposed between the floating pressure element and the stationary reaction-surface member, the floating pressure element having a central surface to receive a pressure force other than the force from the annular pressure-biasing element; and in which the member that is to be responsive to the external pressure is supported to just engage the central surface of the floating pressure element, so any external pressure will be transmitted to the floating member in addition to the biasing stress from the pressure-biasing member.

WILLEM HENDRIK STIGTER.

REFERENCES CITED

The following references are of record in the file of this patent:

UNITED STATES PATENTS

Number	Name	Date
1,980,888	Thomas	Nov. 13, 1934
2,096,826	Schrader	Oct. 26, 1937
2,096,827	Schrader	Oct. 26, 1937
2,164,638	Brolze et al.	July 4, 1939
2,248,574	Knight	July 8, 1941