~~Patent Claims~~

CLAIMS

1. Apparatus for determining ~~at least one process variable~~ fill level, density, viscosity, or pressure of a medium in a container or in a pipeline, comprising:

an essentially tubular sensor housing, wherein one of the two ends of the sensor housing is embodied as a membrane;

an oscillatable element placed on the outside of the membrane, which oscillatable element forms an oscillatable unit with the membrane;

a driving/receiving unit;

a nose, which is arranged as a contact piece between the driving/receiving unit and the membrane, and which contacts the membrane at the contact location;

a clamping apparatus, which presses the driving/receiving unit toward the membrane; and

a control/evaluation unit;

wherein the driving/receiving unit excites the oscillatable unit to mechanical oscillations, and

wherein the control/evaluation unit evaluates the amplitude, frequency, and/or phase of the oscillations of the oscillatable unit; and the nose and the membrane are embodied in such a manner that they form a thermocouple;

wherein the nose and the membrane ~~at least a first element (5) and a second element (4), which~~ are necessary components of the apparatus for determining the process variable and which contact at a contact location ~~(12)~~, which is exposed to a process temperature T_p,

~~characterized in that~~ wherein

the ~~first element~~ nose ~~(5)~~ comprises a first material ~~(M1)~~ and has a first connection line ~~(9)~~, which contacts the ~~first element~~ nose ~~(5)~~ with a first end region;

the ~~second element~~ membrane ~~(4)~~ comprises a second material ~~(M2)~~ and has a second connection line ~~(10)~~, which contacts the ~~second element~~ membrane ~~(4)~~ with a first end region;

a second end region of the first connection line ~~(9)~~ and a second end region of the second connection line ~~(10)~~ are led to a temperature determining unit ~~(11)~~, which is exposed to a reference temperature T_{ref};

the first material ~~(M1)~~ and the second material ~~(M2)~~ are selected and matched to one another in such a manner that at the contact location ~~(12)~~ between the first material ~~(M1)~~ and the second material ~~(M2)~~ a thermovoltage U_{th} dependent on the difference between the process temperature T_p and the reference temperature T_{ref} arises; and

the temperature determining unit ~~(11)~~ measures the thermovoltage U_{th} and determines the process temperature T_p therefrom.

~~2. Apparatus as claimed in claim 1,~~
~~characterized in that~~
~~the second material (M2) is stainless steel and the first material (M1) is essentially a nickel chromium compound.~~

~~3. Apparatus as claimed in claim 1 or 2,~~
~~characterized in that~~
~~the apparatus is a fill level measuring device (1) for determining and/or monitoring a limit fill level of a medium in~~

~~a container or a pipeline and and comprises: an essentially tubular sensor housing (2), wherein one of the two ends of the sensor housing (2) is embodied as a membrane (4); an oscillatable element (3) placed on the outside of the membrane (4), which oscillatable element (3) forms an oscillatable unit with the membrane (4); a driving/receiving unit (6); a nose (5), which is arranged as a contact piece between the driving/receiving unit (6) and the membrane (4), and which contacts the membrane (4) at the contact location (12); a clamping apparatus (7), which presses the driving/receiving unit (6) toward the membrane (4); and a control/evaluation unit (21), wherein the driving/receiving unit (6) excites the oscillatable unit to mechanical oscillations, and wherein the control/evaluation unit (21) evaluates the amplitude, frequency, and/or phase of the oscillations of the oscillatable unit, and the nose (5) and the membrane (4) are embodied in such a manner that they form a thermocouple.~~

~~4~~2. Apparatus as claimed in claim ~~3~~1, ~~characterized in that~~ wherein

the nose ~~(5)~~ and the first connection line ~~(9)~~ are manufactured from a first material ~~(M1)~~, which has a first Seebeck coefficient a1, and

the membrane ~~(4)~~ and the second connection line ~~(10)~~ are manufactured from a second material ~~(M2)~~, which has a second Seebeck coefficient a2, wherein a1 is different from a2.

3. Apparatus as claimed in claim 1 or 2, wherein

the second material is stainless steel and the first material is essentially a nickel chromium compound.

~~5~~4. Apparatus as claimed in ~~claim 3 or 4~~ claim 1, 2 or 3, ~~characterized in that~~ wherein

the temperature determining unit ~~(11)~~ is arranged on the side of the clamping apparatus ~~(7)~~ facing away from the driving/receiving unit ~~(6)~~.

~~6~~5. Apparatus as claimed in one of claims ~~3~~1 to ~~5~~4, ~~characterized in that~~ wherein

the temperature determining unit ~~(11)~~ is integrated into the control/evaluation unit ~~(21)~~.

~~7~~6. Apparatus as claimed in one of claims ~~3~~1 to ~~6~~5, ~~characterized in that~~ wherein

the driving/receiving unit ~~(6)~~ comprises piezoelectric elements, and, together with the contact lines ~~(8)~~ of the piezoelectric elements, the first connection line ~~(9)~~ is led through the clamping apparatus ~~(7)~~.

~~8~~7. Method for determining a process temperature T_p with a measuring device for determining ~~a process variable different from temperature~~ fill level, density, viscosity, or pressure in a container or a pipeline, which measuring device comprises

an essentially tubular sensor housing, wherein one of two ends of the sensor housing is embodied as a membrane;

an oscillatable element placed on the outside of the membrane, which oscillatable element forms with the membrane an oscillatable unit;

a driving/receiving unit;

a nose, which is arranged between the driving/receiving unit and the membrane as a contact piece, and contacts the membrane at the contact location;

a clamping apparatus, which presses the driving/receiving unit toward the membrane; and

a control/evaluation unit;

wherein the driving/receiving unit excites the oscillatable unit to execute mechanical oscillations, and

wherein the control/evaluation unit evaluates amplitude, frequency, and/or phase of the oscillations of the oscillatable unit, and a thermocouple is formed by the nose and the membrane;

wherein the nose and the membrane ~~at least a first element (5) and a second element (4), which~~ are necessary components of the measuring device for determining the process variable and which contact at a contact location ~~(12)~~, which is exposed to the process temperature T_p,

~~characterized in that~~ wherein

the ~~first element~~ nose ~~(5)~~ is manufactured from a first material M1 and the ~~second element~~ membrane ~~(4)~~ is manufactured from a second material ~~M2~~;

the ~~first element~~ nose ~~(5)~~ is contacted with a first connection line ~~(9)~~ and the ~~second element~~ membrane ~~(4)~~ is contacted with a second connection line ~~(10)~~;

the connection lines ~~(9, 10)~~ are led to a temperature determining unit ~~(11)~~, which is exposed to a reference temperature T_{ref};

the first material ~~(M1)~~ and the second material ~~(M2)~~ are selected and matched to one another in such a manner that a thermovoltage U_{th} forms between the ~~first element~~ nose ~~(5)~~ of the first material ~~(M1)~~ and the ~~second element~~ membrane ~~(4)~~ of the

second material ~~(M2)~~, which thermovoltage U_{th} is dependent on the difference between the process temperature T_p and the reference temperature T_{ref};

the thermovoltage U_{th} is measured in the temperature determining unit; and

the process temperature T_p is determined from the thermovoltage U_{th}.

~~9~~8. Method as claimed in claim ~~8~~7,
~~characterized in that~~ wherein

the first material ~~(M1)~~ and the second material ~~(M2)~~ are selected in such a manner that their Seebeck coefficients differ from one another.

~~10. Method as claimed in claim 8 or 9,~~
~~characterized in that~~
~~a vibronic fill level measuring device (1) is used for determining the process temperature T_p; wherein the vibronic fill level measuring device (1) comprises: an essentially tubular sensor housing (2), wherein one of two ends of the sensor housing (2) is embodied as a membrane (4); an oscillatable element (3) placed on the outside of the membrane (4), which oscillatable element (3) forms with the membrane (4) an oscillatable unit; a driving/receiving unit (6); a nose (5), which is arranged between the driving/receiving unit (6) and the membrane (4) as a contact piece, and contacts the membrane (4) at the contact location (12); a clamping apparatus (7), which presses the driving/receiving unit (6) toward the membrane (4); and a control/evaluation unit (21); wherein the driving/receiving unit (6) excites the oscillatable unit to~~

~~execute mechanical oscillations, and wherein the control/evaluation unit (21) evaluates amplitude, frequency, and/or phase of the oscillations of the oscillatable unit, and a thermocouple is formed by the nose (5) and the membrane (4).~~