shown in **FIG. 1** is also, as already indicated above, suitable for determining the density or viscosity of a medium in a container. Container and medium are not shown in **FIG. 1**. While, in the case of fill level determination, the oscillatable unit **2** only reaches into, or leaves, the medium being measured upon arrival of the detected limit fill level, it must be continuously in contact with the medium up to a predetermined immersion depth for the monitoring, or determining, of density or viscosity. As regards the container, it can, of course, also be a pipe containing the medium flowing therein.

[0028] The sensor has a housing, which is sealed at its end region protruding into the container by the membrane **5**. Membrane **5** is held at the area of its edge in the housing. The oscillatable unit **2** extending into the container is secured to the membrane **5**. In the illustrated case, the oscillatable unit **2** is provided in the form of a tuning fork, thus comprising two mutually separated oscillation tines **3**, **4** secured to the membrane **5** and extending into the container.

[0029] The membrane **5** is caused by the driver/receiver unit **6** to oscillate at a predetermined excitation frequency. The driver/receiver unit **6** is e.g. a stack drive or a bimorph drive. Both kinds of piezoelectric drives are sufficiently known in the state of the art, that a description of them does not need to be given here. Due to the oscillations of the membrane **5**, also the oscillatable element **2** executes oscillations, with the oscillation frequency being different, depending on whether the oscillatable unit **2** is in contact with the medium being measured, in which case the mass of the adhering medium must follow with the oscillations, as compared with when the oscillatable unit is able to oscillate freely and without contact with the medium.

[0030] Piezoelectric elements change their dimensions (thickness, diameter), depending on a voltage difference applied in the direction of polarization. If an alternating voltage is applied, then the thickness oscillates: When the thickness increases, the diameter of the piezoelectric element decreases; when, on the other hand, the thickness decreases, then the diameter of the piezoelectric element correspondingly increases.

[0031] Because of this oscillatory behavior of the piezoelectric element, the voltage difference effects a flexing of the membrane **5** held in the housing. The oscillation tines of the oscillatable unit **2** arranged on the membrane **5** are caused by the oscillations of the membrane **5** to execute oscillations of opposite sense about their longitudinal axes. Oscillations of opposite sense have the advantage that the alternating forces exerted by each oscillation tine **3**, **4** cancel one another. In this way, the mechanical loading of the membrane securement is minimized, so that essentially no oscillation energy is transferred to the housing.

[0032] The mechanical oscillation system formed of driver/receiver unit **6**, membrane **5** and oscillatable unit **2** is a part of the oscillation circuit **7**. In addition to the mechanical oscillation system, the oscillation circuit **7** also has an electrical component, which, for the most part, is embodied by the feedback electronics **9**. The feedback electronics **9** can be constructed, for example, in the manner of the feedback electronics in the LIQUIPHANT M switch available from the assignee. The feedback electronics **9** provides periodic signals, especially rectangular signals, which are fed via the booster (amplifier circuit) to the driver/receiver unit **6** and, from there, transferred onto the membrane **5**. This causes the membrane with the mounted, oscillatable unit **2**, to oscillate with the predetermined frequency.

[0033] Also integrated into the oscillation circuit **7** is the microprocessor **8**. This microprocessor **8** corrects, as an 'intelligent' member, the phase of the rectangular signals as a function of frequency. The phase correction value for each measured frequency value is stored in the memory unit **10**. The phase correction value can still be influenced by other parameters, for example temperature. Therefore, a temperature sensor **13** is additionally provided, which delivers information concerning temperature at the measurement location, or in the region of the feedback electronics.

[0034] The input signal (In) fed to the microprocessor **8** is not converted A/D and subsequently filtered in the frequency domain, but, instead, is processed in the time domain. To this end, the microprocessor **8** executes the following steps:

[0035] In a first step, the rising edges of the rectangular input signal are used to determine the frequency of the oscillation circuit; in a second step, the phase correction value belonging to the determined frequency is ascertained; in a third step, an output signal is generated, which exhibits the corrected phase determined in the second step. This phase-corrected signal is amplified in the booster **12** and triggers the driver/receiver unit **6**.

[0036] Potentially, the microprocessor also effects an amplitude correction, in addition to the phase correction. In this way, a weighting of the frequency occurs for the purpose of further 'intelligent' influencing of the signal. Additionally, it is provided that the (analog) feedback electronics **9** delivers to the microprocessor **8** a signal, which is amplitude-proportional to the input signal (In).

[0037] **FIG. 2** shows graphically the behavior of phase and corrected phase as a function of frequency. The continuous curve with dots in it gives the phase as a function of frequency without phase correction by the microprocessor **8**. The continuous curve with the x's characterizes the phase as a function of frequency in the case of phase adjustment by the microprocessor **8**. In the illustrated case, the phase correction effects that the oscillations have a constant phase-frequency characteristic over the entire working range. In the illustrated case, a phase correction to 0° occurs.

[0038] Additionally, the microprocessor **8** effects an amplification of the output signals, with the amplification in the illustrated case likewise being controlled to a constant value in the working range.

[0039] The correction values for the phases as a function of frequency are, in an advantageous further development of the apparatus of the invention, available in the memory unit **10** in the form of a table or in the form of a function. Instead of the stored phase correction values, also an online determining of the optimal phase correction values matched to the actually existing conditions at the measurement location can occur. This is illustrated in **FIG. 1** by the label (Ref.) and the dashed line. On the basis of a comparison of the phase of the input signal (In) and the phase of the output signal of the feedback electronics **9**, it is possible to determine the present and, thus, optimal phase correction value. In this way, the reliability and accuracy of the apparatus of the invention can be increased still further.