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- (73) Patenthaver: **Diehl Metering GmbH, Industriestrasse 13, 91522 Ansbach, Tyskland**
- (72) Opfinder: **Buckl, Roland, Kematen 9 1/2, 91722 Arberg, Tyskland**
Meier, Marc-André, Dombühler Str. 21, 91567 Herrieden, Tyskland
Müller, Johannes, Südsteige 11, 91720 Absberg, Tyskland
Schuster, Reiner, Eisvogelweg 7, 91598 Colmberg, Tyskland
vom Schloß, Edgar, Hasensprung 64, 90574 Roßtal, Tyskland
Stefke, Frank, Raiffeisenstr. 8, 97258 Gollhofen, Tyskland
- (74) Fuldmægtig i Danmark: **RWS Group, Europa House, Chiltern Park, Chiltern Hill, Chalfont St Peter, Bucks SL9 9FG, Storbritannien**
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Description

The present invention relates to a flow meter for detecting the flow rate and/or the amount of heat of a flowing fluid for fitting into a feed line containing the fluid.

Technological Background

It is possible by means of flow meters to detect the consumption of a fluid, for example of water. A heat meter enables the energy supplied via the fluid as a transport medium, for example water or a fluid mixture based on water, to be detected in the form of an amount of heat and/or cold. Both flow meters and also heat meters or cold meters (both referred to hereinafter as "energy meters") are subject to obligatory calibration. To be able to detect the flow rate or the amount of heat or the amount of cold exactly, it is necessary for the flow meter or energy meter to be fitted correctly in the feed line. Flow meters and energy meters have a marking of the meter throughflow direction, which is usually applied to the attachment housing of the flow meter, so that the installer can install the flow meter in accordance with the meter throughflow direction. Energy meters are typically installed in the so-called return line, since they are subjected there to a lower temperature than in the feed line. However, there are also fitting situations in which an energy meter is installed in the feed line. As a result, there are typically special energy meters for the return line and special energy meters for the feed line. A possible incorrect fitting of a flow meter or energy meter, whether with respect to the throughflow direction or with respect to the fitting in the feed line or return line, is often not immediately recognizable to installers, but only becomes apparent when data are read out for the first time. A possible removal or correction of the error is complex and costly. Furthermore, energy meters have to be kept in stock for the feed line and the return line with installers, energy supply companies, distribution partners, and communities. Incorrect orders or required meter replacement measures also often occur.

Closest Prior Art

5 A flow meter according to the preamble of Claim 1 is known from DE 10 2010 011 272 A1. This known flow meter is based on the concept of establishing the throughflow direction on the basis of a positive or negative through flow and the positive or negative difference between feed line and return line temperature and displaying this in the form of arrows on a display unit arranged on the energy meter. The installer recognizes therefrom an incorrect installation of the energy meter with respect to the throughflow direction and an incorrect installation of the energy meter in the feed line or return line. In consideration of this, the installer can remove the energy meter and install it again at the correct fitting location and/or in the correct orientation. If an incorrect installation has taken place in this has remain unnoticed, incorrect temperature data, in particular in the form of negative temperature differences, are saved in a memory on the basis of an independent detection. This enables incorrect data to be detected later and the measurement results to be filtered in this regard.

25 An energy meter is known from DE 10 2007 014 810 B3, in which amounts of heat and/or cold not properly detected during the invoicing period are stored in a secondary data memory and are used for a more accurate estimation of the actual energy consumption.

30 An ultrasonic meter for detecting the flow rate of a fluid is described in EP 2 827 111 A1, in which the ultrasonic measuring section is formed in the measuring pipe housing as a bypass duct and in addition a through flow aperture in the form of a ring section for generating a pressure drop is provided in the region of the bypass channel.

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Object of the Present Invention

The object of the present invention is to provide a generic flow

meter which precludes incorrect installations in regard to the fitting direction and/or the fitting location with respect to feed line and return line.

5 Achievement of the Object

The above object is achieved by a flow meter having the features of Claims 1 and 2. Expedient embodiments of the invention are claimed in the dependent claims.

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In the flow meter according to the invention according to Claim 1, it is provided that with a first installation or re-installation of the flow meter, the control and evaluation unit is automatically configured, i.e., programmed, in such a way that during the continuous operation following the first installation or re-installation, the meter throughflow direction is matched to the fitting throughflow direction, so that the meter throughflow direction and the fitting throughflow direction coincide.

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In the flow meter according to the invention according to Claim 2, it is provided that with a first installation or re-installation of the flow meter, the control and evaluation unit is automatically configured, i.e., programmed, in such a way that, during the continuous operation following the first installation or re-installation, the first temperature sensor and the second temperature sensor are assigned to the feed line and return line, respectively, in a manner dependent on the measured temperature difference.

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The present invention is based on the concept of not predefining the fitting situation with respect to the throughflow direction or the installation location (in the feed line or in the return line) on the device, but rather establishing the actual fitting situation provided by the installer by the flow meter itself on the basis of the measurement data available to the flow meter. A subsequent removal/installation is dispensed with without replacement. Different devices do not have to be kept in stock.

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Rotatable or removable displays are no longer necessary. An independent data-processing detection and evaluation of amounts of data which are incorrect due to an incorrect installation during the invoicing period is not necessary. This operating
5 establishment can be secured with a calibration seal.

The flow meter is expediently constructed symmetrically in terms of flow. The measurement channel of the flow meter is thus subject to the same flow conditions in and opposite to the flow
10 direction. The flow meter can thus also be installed rotated by 180° in a feed line without the flow conditions and thus the measurement changing.

In particular, flow-guiding elements and/or flow screens and/or
15 reflectors and/or holders and/or the inlet/outlet region and/or the inner wall in contact with the flow are provided in a symmetrical arrangement and/or formation and/or orientation in a housing of the flow meter, preferably in the so-called attachment housing, which is inserted into the feed line.
20 Symmetrical conditions in terms of flow can insofar be provided in the measurement channel of the flow meter in this way.

In that the control and evaluation unit comprises a plausibility routine, an unclear status (air in the line, back flows in the
25 line, undefined conditions during flushing of the line, etc.) of the flow meter can be reliably precluded at the beginning of the configuration.

In the course of the plausibility routine, a detection of the
30 through flow over a predefined time t_x can preferably take place and it can be established here whether the measured through flow during this time span is inside or outside predefined limiting values of the flow rate.

35 If the flow meter has a temperature-measuring device, a detection of the temperature difference of the temperature sensors can take place in the course of the plausibility routine. A predefined temperature difference can preferably be provided

as a comparison value ΔT for this purpose.

If the control and evaluation unit comprises an alarm routine which can be activated by the controller and if the plausibility routine is negative, the installer receives an alarm at the device that the automatic configuration has not yet run correctly. In this case, it is expedient to flush the pipeline once again if necessary, for example, until a renewed attempt of an automatic configuration is started.

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As soon as the automatic configuration has been carried out successfully, the matching of the meter throughflow direction to the fitting throughflow direction and/or the assignment of the first temperature sensor and the second temperature sensor to the feed line and the return line, respectively, is unchangeably established by the control and evaluation unit. This autoinstallation is then no longer repeatable to prevent manipulations. The flow meter is then transferred into the calibrated and unchangeable operation.

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It is expediently a software-controlled process in which the flow rate data and/or the temperature difference data, which are available in any case, are evaluated and information on the throughflow direction and/or the fitting location is generated.

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Furthermore, provision can be made of a third temperature sensor which is situated on or in the housing of the flow meter, wherein during the first installation or re-installation, the temperature difference is determined by measuring the temperature difference between the third temperature sensor and the first temperature sensor and the temperature difference is determined by measuring the temperature difference between the third temperature sensor and the second temperature sensor, and the fitting location of the flow meter in the feed line or return line can be established as a function thereof.

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Advantageously, use can also be made of one of the three temperature sensors for correcting the determined flow rate

(temperature-related volume correction).

- For this purpose, provision can be made that for the volume correction, the temperature sensor from the pair comprising the first temperature sensor or the second temperature sensor which has the smaller temperature difference in relation to the third temperature sensor is selected. This detection can be displayed on a display unit, for example, an LCD display screen.
- 10 In that the automatic determination of the through flow data and/or the temperature difference is deactivated after the throughflow direction has been matched and/or after the temperature sensors have been assigned, respectively, the process is solely limited to the first installation or re-
- 15 installation and a manipulation is therefore not possible. A renewed detection routine or method is only possible by an inspecting authority with destruction or breaking of the calibration seal.
- 20 During the self-configuration, it can be necessary that the measurement data of the through flow for matching the meter throughflow direction to the fitting throughflow direction are interchanged and/or the measurement data of the temperature sensors for assignment of the first temperature sensor and the
- 25 second temperature sensor to the feed line and the return line, respectively, are interchanged. After the interchange, the measurement data determined in continuous operation are assigned correctly to the respective actual throughflow direction and the respective temperature sensors. If the fitting situation is
- 30 known correctly beforehand, the system "confirms" this state.

Description of the Invention on the Basis of Exemplary Embodiments

- 35 The invention is explained in more detail on the basis of advantageous exemplary embodiments according to the figures of the drawings. In the figures:

Figure 1 shows a very simplified schematic illustration of a flow meter fitted in a feed line;

5 Figure 2 shows a very simplified schematic illustration of a flow meter fitted in a return line;

Figure 3 shows a very simplified schematic illustration of a flow meter fitted in a return line with a third temperature sensor;

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Figure 4 shows a flow chart of the automatic determination of the throughflow direction of a flow meter;

15 Figure 5 shows a flow chart of the assignment of the temperature sensors and the throughflow direction and of the determination of the fitting location of a flow meter; and

20 Figure 6 shows a very simplified illustration for the explanation of the possible automatic interchange of measurement data.

25 Figure 1 shows a flow meter 1 according to the invention, which for detecting the flow rate of a flowing fluid 2 is fitted in a feed line 5 containing the fluid 2.

The flow meter 1 shown comprises a housing 17, in particular a so-called measuring pipe housing, which is flowed through by the fluid 2 in a throughflow direction 4 prevailing in the feed line 30 5. A first and a second ultrasonic transducer 11A, 11B are located on the upper side of the housing 17, which form a U-shaped measuring section 14 together with a first reflector 19A and a second reflector 19B. Also located on the upper side of the housing 17 are a measuring arrangement 3 and a control and 35 evaluation unit 6, which controls the measuring arrangement 3 and determines flow rate data from the electrical signals originating from the measuring arrangement 3. The measuring arrangement 3 and the control and evaluation unit 6 can be housed

in a shared housing 18 (electronics housing).

The flow rate is measured, for example, according to the so-called difference runtime method. For this purpose, ultrasonic signals are alternately emitted and received by each of the first ultrasonic transducer 11A and the second ultrasonic transducer 11B, the runtime difference is established, and the flow speed of the fluid and the flow volume are determined therefrom.

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As can furthermore be seen from Figure 1, the flow meter 1 is constructed symmetrically in terms of flow and is accordingly subject to the same flow conditions in and opposite to the throughflow direction 4. It is therefore possible to fit the flow meter 1 both in the throughflow direction 4 and also opposite to the throughflow direction 4 without this establishing a difference in terms of flow.

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For example, identical flow-guiding elements are provided both on the inlet side and also on the outlet side, as is illustrated by way of example in Figure 1 by a first flow guide 20A and an identical second flow guide 20B. Furthermore, additionally or alternatively to the flow-guiding elements, flow screens can be provided, for example, in the form of a first screen 21A and an identical second screen 21B. The flow conditions are thus always the same in the measuring section 14 independently of the fitting location, so that the fitting orientation cannot cause any effects on the measurement result.

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The measuring arrangement 3 contains first and second signal processing modules, for example, amplifiers 12A and 12B or the like. Furthermore, the measuring arrangement 3 comprises a changeover switch 13 on the control and evaluation unit 6 for switching on the respective ultrasonic transducer 11A, 11B during operation. The control and evaluation unit 6 can furthermore include a processor 15 and a memory 16, inter alia, for storing the determined measured value data. The measuring arrangement 3 can also be constructed symmetrically, as is

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apparent from Figure 1.

The flow meter has a device-specific predefined meter throughflow direction 4A. This meter throughflow direction 4A
5 corresponds to the exemplary installation of the throughflow direction 4 in the feed line 5 shown in Figure 1. The flow meter is thus fitted correctly from the beginning. According to the invention, the meter throughflow direction 4A can correspond to the fitting throughflow direction 4B, as in Figure 1, but does
10 not have to.

According to the invention, with installation or re-installation, the throughflow direction of the installed flow meter 1 is automatically determined by the control and evaluation unit 6
15 as the actual fitting throughflow direction 4B in the flow meter 1 on the basis of flow rate data available in any case during a configuration routine and compared to the meter throughflow direction 4A. If the throughflow directions correspond, the meter throughflow direction 4A is maintained. However, if they
20 do not correspond, the meter throughflow direction 4A is matched internally in the controller to the fitting throughflow direction 4B without removal/re-installation of the flow meter.

The operating parameters in the signal evaluation can be reversed similarly thereto. No effects results in this way on
25 the measurement result due to the symmetry in terms of flow.

The flow meter 1 thus matches itself to the conditions determined during the first configuration and can subsequently enter the
30 continuous operation directly. Accordingly, the same flow meter 1 can be installed in the feed line 5 both in the one direction and also rotated by 180° and thus used. Keeping corresponding flow meters in stock can thus be significantly reduced.

35 One example of the self-configuration is shown for the flow meter 1 of Figure 1 in the flow chart of Figure 4. After the installation of the flow meter 1 (first installation), the measuring pipe of the flow meter 1 is flowed through by the

fluid to be measured for the first time. The flow meter 1 detects the through flow and starts the configuration.

5 The position "meter detects throughflow direction" means that on the basis of the sign of the measured volume difference $V1 - V2 = \Delta V$ in the one and the other direction, the matching of the meter throughflow direction 4A to the fitting throughflow direction 4B takes place, so that the meter throughflow direction 4A and the fitting throughflow direction 4B correspond.
10 If the determined volume difference is negative (ΔV neg.), the assignment of the through flow data $V1$, $V2$ in the data processing is interchanged. If the measured volume difference is positive (ΔV pos.), the assignment of the through flow data $V1$, $V2$ remains unchanged (cf. Figure 6 in each case).

15 After the meter has detected the throughflow direction, the control and evaluation unit checks the data or the assignment of the through flow data for plausibility. Obvious errors or ambiguities, for example, due to air or back flows in the line,
20 can thus be precluded. The plausibility routine comprises, for example, a detection of the through flow over a predefined time t_x . For example, there is a check as to whether the throughflow direction and/or the flow rate is uniform within predefined limits over the time t_x .

25 If the plausibility routine is negative, an alarm and/or an abort of the configuration routine takes place. Further measures, for example, flushing of the feed line 5, possibly have to take place. However, if the plausibility check is positive, the
30 matching of the meter throughflow direction 4A to the fitting throughflow direction 4B is unchangeably established on the part of the system for the continuous operation. The flow meter can preferably also be calibrated in this state.

35 The flow meter in Figure 2 differs from the flow meter in Figure 1 in that a temperature-measuring device 7 is additionally provided. This flow meter 1 thus operates as a heat meter or energy meter. The temperature-measuring device 7 comprises a

first temperature sensor 8A and a second temperature sensor 8B, wherein the first temperature sensor 8A and the second temperature 8B are provided to determine a temperature difference between a feed temperature in the feed line 9 and a return temperature in the return line 10. On the basis of the temperature difference, the fitting location of the first temperature sensor 8A and of the second temperature sensor 8B in the feed line or return line, respectively, can be automatically determined by the control and evaluation unit 6.

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Accordingly, during installation or re-installation in the flow meter 1 with incorporation of the determined temperature data, for example the temperature difference, an assignment of the temperature sensors 8A, 8B to feed line 9 or return line 10, respectively, can be established in the scope of a configuration routine by the control and evaluation unit 6.

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In the associated flow chart according to Figure 5, after the start of the configuration either - as in the sequence according to Figure 4 - the through flow detection also takes place and subsequently or simultaneously a check of the temperature sensors 8A, 8B. The "check of the temperature sensors" means that the assignment of first temperature sensor 8A and second temperature sensor 8B to the feed line 9 or return line 10 takes place on the basis of the measured temperature difference ΔT between the temperature sensors 8A and 8B. If, for example, the measured value of the determined temperature difference is negative (ΔT neg.), the assignment of the temperature sensors 8A, 8B with respect to feed line 9 and return line 10 is exchanged. If, for example, the measured value of the determined temperature difference ΔT is positive (ΔT pos.), the assignment of the temperature sensors 8A, 8B with respect to feed line 9 and return line 10 remains unchanged (cf. Figure 6 in each case).

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A plausibility check also takes place subsequently here. The plausibility routine can comprise, for example, the comparison of a measured temperature difference ΔT to a predefined temperature difference. For example, measured values with a

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measured temperature difference of, for example, $\Delta T > 3 \text{ K}$ can be assigned as plausible.

5 If the plausibility check is positive, the assignment of the first and second temperature sensors 8A, 8B is established unchangeably on the part of the system for the continuous operation. The flow meter can preferably also be calibrated in this state. If the plausibility check is negative, an alarm takes place.

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The two possibilities for the automatic configuration, thus the automatic detection and matching of the throughflow direction and also the assignment of the temperature sensors can, cf. Figure 5, either both take place together or also each
15 alternatively as such. In any case, the flow meter matches itself to the measured values determined during the first configuration and can subsequently pass directly into the continuous operation. A re-installation of flow meter and/or the temperature sensors 8A, 8B is not necessary.

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If the assignment of the temperature sensors 8A, 8B to the flow meter 1 or to the inputs or ports of the temperature-measuring device 7 is known, the fitting location of the flow meter 1 in the feed line 9 or return line 10 can also be concluded from the
25 temperature difference and this can also be incorporated during the configuration. After the automatic configuration, the flow meter can be transferred into the calibrated and unchangeable operation.

LIST OF REFERENCE SIGNS

	1	flow meter
	2	fluid
5	3	measuring arrangement
	4	throughflow direction
	4A	meter throughflow direction
	4B	fitting throughflow direction
	5	feed line
10	6	control and evaluation unit
	7	temperature-measuring device
	8A	first temperature sensor
	8B	second temperature sensor
	8C	third temperature sensor
15	9	feed line
	10	return line
	11A	first ultrasonic transducer
	11B	second ultrasonic transducer
	12A	first amplifier
20	12B	second amplifier
	13	changeover switch
	14	measuring section
	15	processor
	16	memory
25	17	housing
	18	housing
	19A	first reflector
	19B	second reflector
	20A	first flow guide
30	20B	second flow guide
	21A	first screen
	21B	second screen

Patentkrav

1. Flowmåler (1) til detektering af flowmængden i en strømmende fluid (2) til montering i en forsyningsledning (5),
5 der indeholder fluiden (2), med
et målearrangement (3), der gennemstrømmes af fluiden (2) med en forudfastsat målerflowretning (4A), i hvilken flowmåleren (1) drives permanent,
en styre- og evalueringseenhed (6), der styrer målearrangementet
10 (3) og detekterer flowmængdedata,
kendetegnet ved, at
montagesituationen med hensyn til flowretningen ikke er defineret forudfastsat på apparatsiden, men fastlægges af flowmåleren selv på grundlag af de måledata, der står til
15 rådighed for flowmåleren,
idet der af styre- og evalueringseenheden (6) på grundlag af flowmængdedataene automatisk detekteres den montageafhængige flowretning som montageflowretning (4B), og
styre- og evalueringseenheden (6) ved en første installation
20 eller geninstallation af flowmåleren (1) som led i en konfigurationsrutine på grundlag af flowmængdedataene automatisk konfigurerer sig sådan, at i den efter den første installation eller geninstallation følgende kontinuerlige drift er målerflowretningen (4A) styringsinternt tilpasset til
25 montageflowretningen (4B), således at målerflowretningen (4A) og montageflowretningen (4B) stemmer overens.

2. Flowmåler (1) til detektering af varmemængden i en strømmende fluid (2) til montering i en forsyningsledning (5),
30 der indeholder fluiden (2), med
et målearrangement (3), der gennemstrømmes af fluiden (2) med en forudfastsat målerflowretning (4A), i hvilken flowmåleren (1) drives permanent,
en styre- og evalueringseenhed (6), der styrer målearrangementet
35 (3) og detekterer flowmængdedata, og
en temperaturmåleindretning (7), der omfatter en første temperatursensor (8A) og en anden temperatursensor (8B), hvor den første temperatursensor (8A) og den anden temperatursensor

(8B) er indrettet til detektering af en temperaturforskel mellem en fremløbstemperatur i fremløbet (9) og en returløbstemperatur i returløbet (10),

kendetegnet ved, at

5 montagesituationen med hensyn til installationsstedet i fremløbet eller i returløbet ikke er defineret forudfastsat på apparatsiden, men fastlægges af flowmåleren selv på grundlag af de måledata, der står til rådighed for flowmåleren, idet der af styre- og evalueringseenheden på grundlag af
10 temperaturforskellen automatisk detekteres den første temperatursensors (8A) og den anden temperatursensors (8B) monteringssted i henholdsvis frem- og returløbet, og styre- og evalueringseenheden (6) ved en første installation eller geninstallation af flowmåleren (1) som led i en
15 konfigurationsrutine på grundlag af temperaturforskellen automatisk konfigurerer sig sådan, at i den efter den første installation eller geninstallation følgende kontinuerlige drift tilordnes i afhængighed af den målte temperaturforskel den første temperatursensor (8A) og den anden temperatursensor (8B)
20 til henholdsvis fremløbet (9) og returløbet (10).

3. Flowmåler ifølge krav 1 eller 2,

kendetegnet ved, at

flowmåleren (1) er opbygget strømningsteknisk symmetrisk,
25 og/eller der er indrettet strømningselementer og/eller strømningssier og/eller reflektorer og/eller holdere i symmetrisk anbringelse og/eller udformning i et hus (17).

4. Flowmåler ifølge krav 1,

30 kendetegnet ved, at

styre- og evalueringseenheden (6) omfatter en plausibilitetsrutine, der fortrinsvis omfatter en detektering af flowet over en forudfastsat tid tx.

35 5. Flowmåler ifølge krav 2,

kendetegnet ved, at

styre- og evalueringsenheden (6) omfatter en plausibilitetsrutine, der fortrinsvis omfatter en detektering af en forudfastsat temperaturforskelle ΔT .

5 6. Flowmåler ifølge i det mindste et af de foregående krav 4 eller 5, kendetegnet ved, at styre- og evalueringsenheden (6) omfatter en alarmrutine, der kan aktiveres, såfremt plausibilitetskontrollens resultat er
10 negativt.

7. Flowmåler ifølge et af kravene 1, kendetegnet ved, at tilpasningen af målerflowretningen (4A) til
15 montageflowretningen (4B) fastlægges uforanderligt af styre- og evalueringsenheden (6) ved den første installation eller geninstallation, og/eller at det ved tilpasningen af målerflowretningen (4A) til montageflowretningen (4B) af styre- og evalueringsenheden (6) ved den første installation eller
20 geninstallation drejer sig om en softwarestyret proces, ved hvilken flowmængdedataene evalueres, og der genereres informationer om flowretningen.

8. Flowmåler ifølge i det mindste et af kravene 2, 3, 5 eller
25 6, kendetegnet ved, at tilordningen af første temperatursensor (8A) og anden temperatursensor (8B) til henholdsvis fremløbet (9) og returløbet (10) fastlægges uforanderligt af styre- og
30 evalueringsenheden (6) ved den første installation eller geninstallation, og/eller det ved tilpasningen af tilordningen af første temperatursensor (8A) og anden temperatursensor (8B) til henholdsvis fremløbet (9) og returløbet (10) af styre- og evalueringsenheden (6) ved den første installation eller
35 geninstallation drejer sig om en softwarestyret proces, ved hvilken temperaturforskelsdataene evalueres, og der genereres informationer om monteringsstedet.

9. Flowmåler ifølge et af kravene 2, 3, 5, 6 eller 8,
kendetegnet ved, at
der er indrettet en tredje temperatursensor (8C), der befinder
sig på eller i flowmålerens (1) hus (17),
5 der som led i den første installation eller geninstallation
detekteres temperaturforskellen ved måling af
temperaturforskellen mellem den tredje temperatursensor (8C) og
den første temperatursensor (8A) samt temperaturforskellen ved
måling af temperaturforskellen mellem den tredje
10 temperatursensor (8C) og den anden temperatursensor (8B).

10. Flowmåler ifølge krav 9,
kendetegnet ved, at
en temperatursensor (8A, 8B eller 8C) anvendes til en korrektion
15 af den detekterede flowmængde.

11. Flowmåler ifølge krav 9 eller 10,
kendetegnet ved, at
fra parret med den første temperatursensor (8A) eller den anden
20 temperatursensor (8B) udvælges der til volumenkorrektionen den
temperatursensor, der har den laveste temperaturforskel i
forhold til den tredje temperatursensor (8C).

12. Flowmåler ifølge et af kravene 1, 3, 4, 6 eller 7,
25 kendetegnet ved, at
den automatiske detektering af flowdataene deaktiveres, efter
at tilpasningen af flowretningen er sket.

13. Flowmåler ifølge et af kravene 2, 3, 5, 6 eller 8 til 11,
30 kendetegnet ved, at
den automatiske detektering af temperaturforskellen deaktiveres,
efter at tilordningen af temperatursensorerne (8A, 8B) er sket.

14. Flowmåler ifølge et af kravene 1, 3, 4, 6, 7 eller 12,
35 kendetegnet ved, at
som led i selvkonfigurationen udveksles indbyrdes måledataene
for flowet med henblik på tilpasningen af målerflowretningen
(4A) til montageflowretningen (4B).

15. Flowmåler ifølge et af kravene 2, 3, 5, 6, 8 til 11 eller 13,

kendetegnet ved, at

- 5 som led i selvkonfigurationen udveksles indbyrdes temperatursensorernes (8A, 8B) måledata med henblik på tilordningen af den første temperatursensor (8A) og den anden temperatursensor (8B) til henholdsvis fremløbet (9) og returløbet (10).

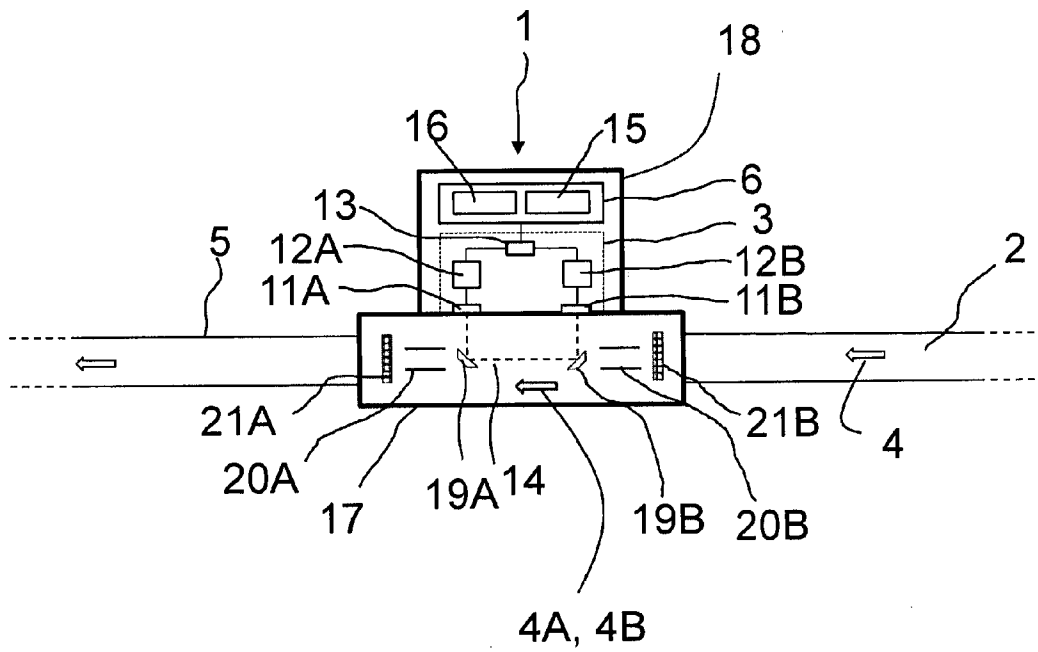


Fig. 1

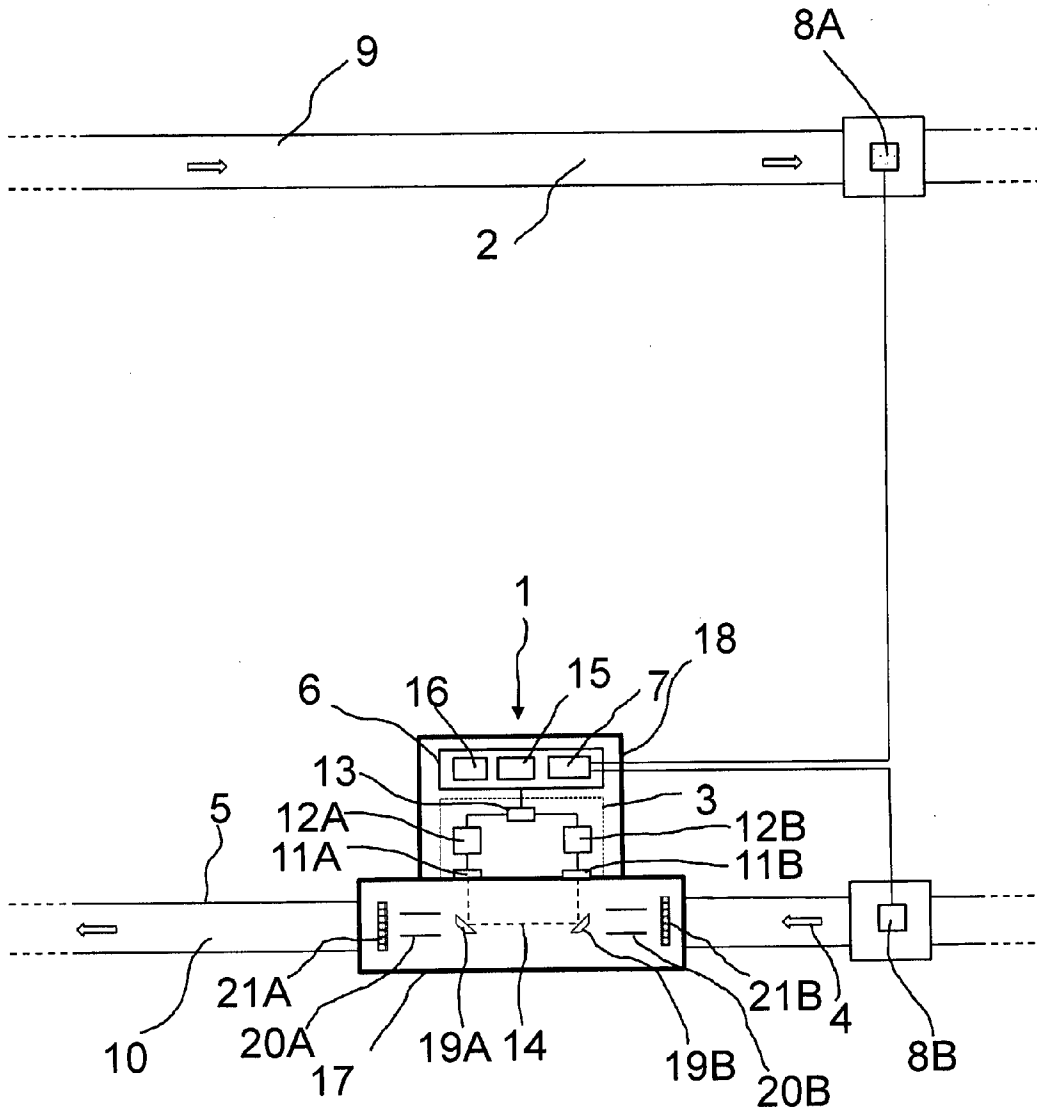


Fig. 2

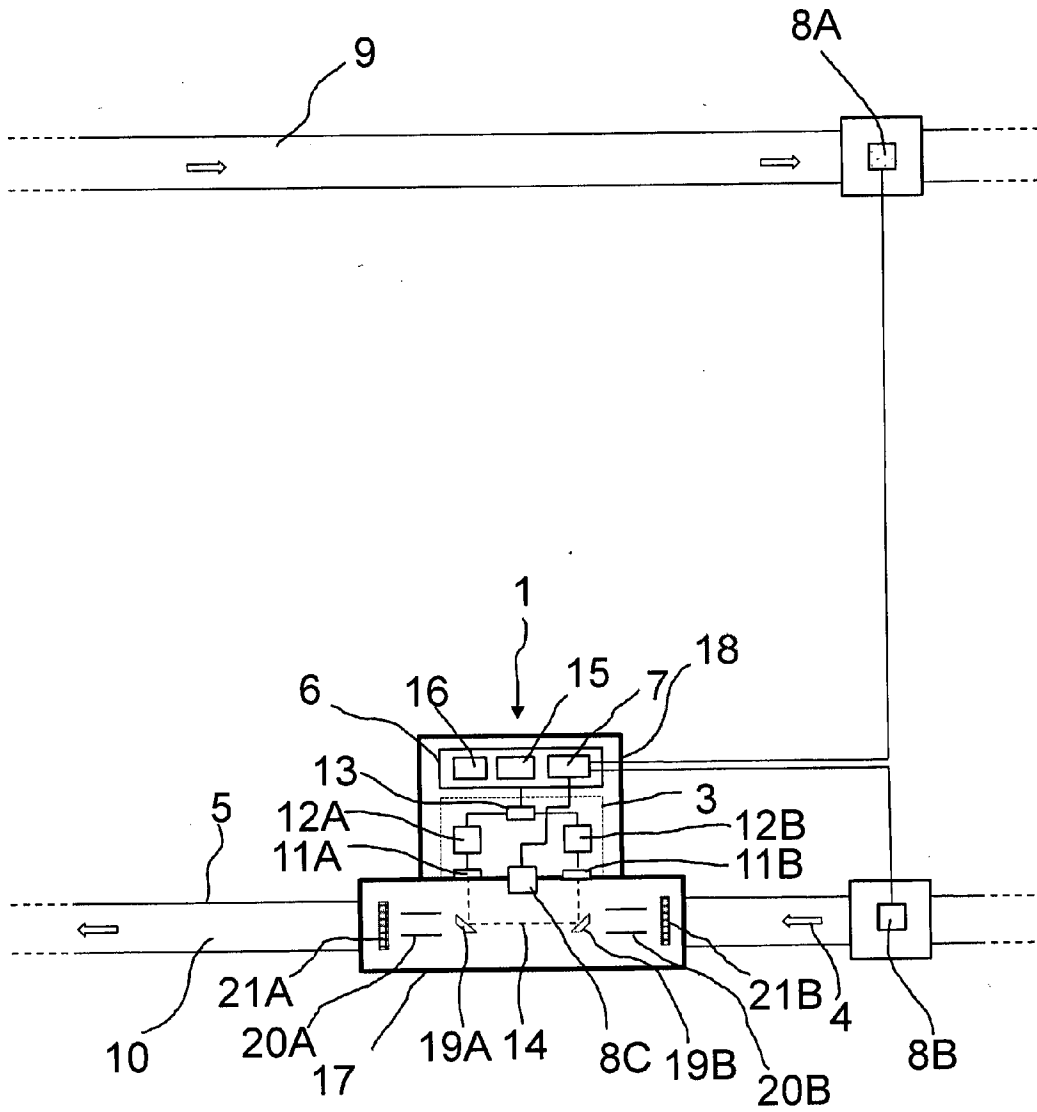


Fig. 3

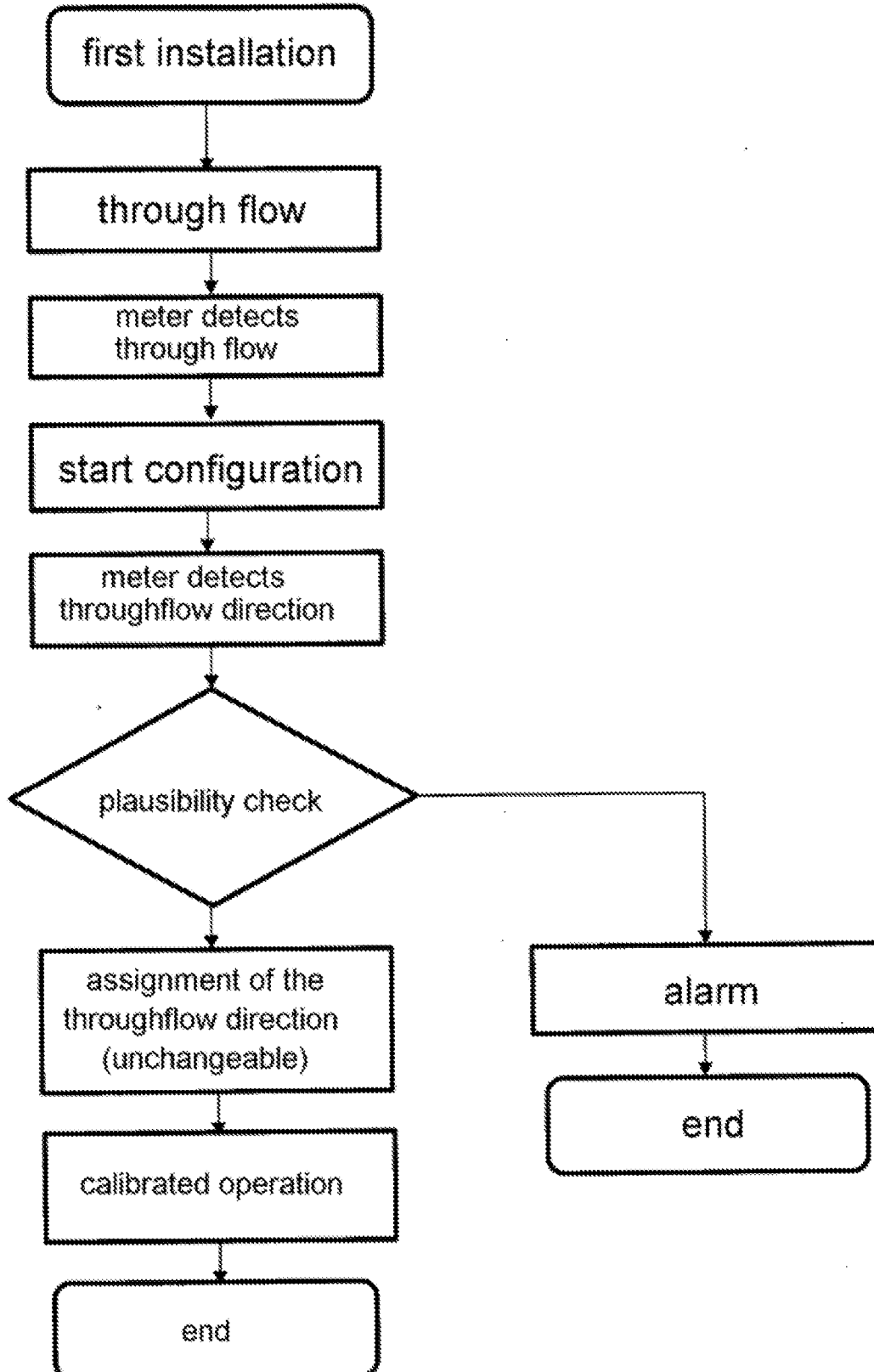


Fig. 4

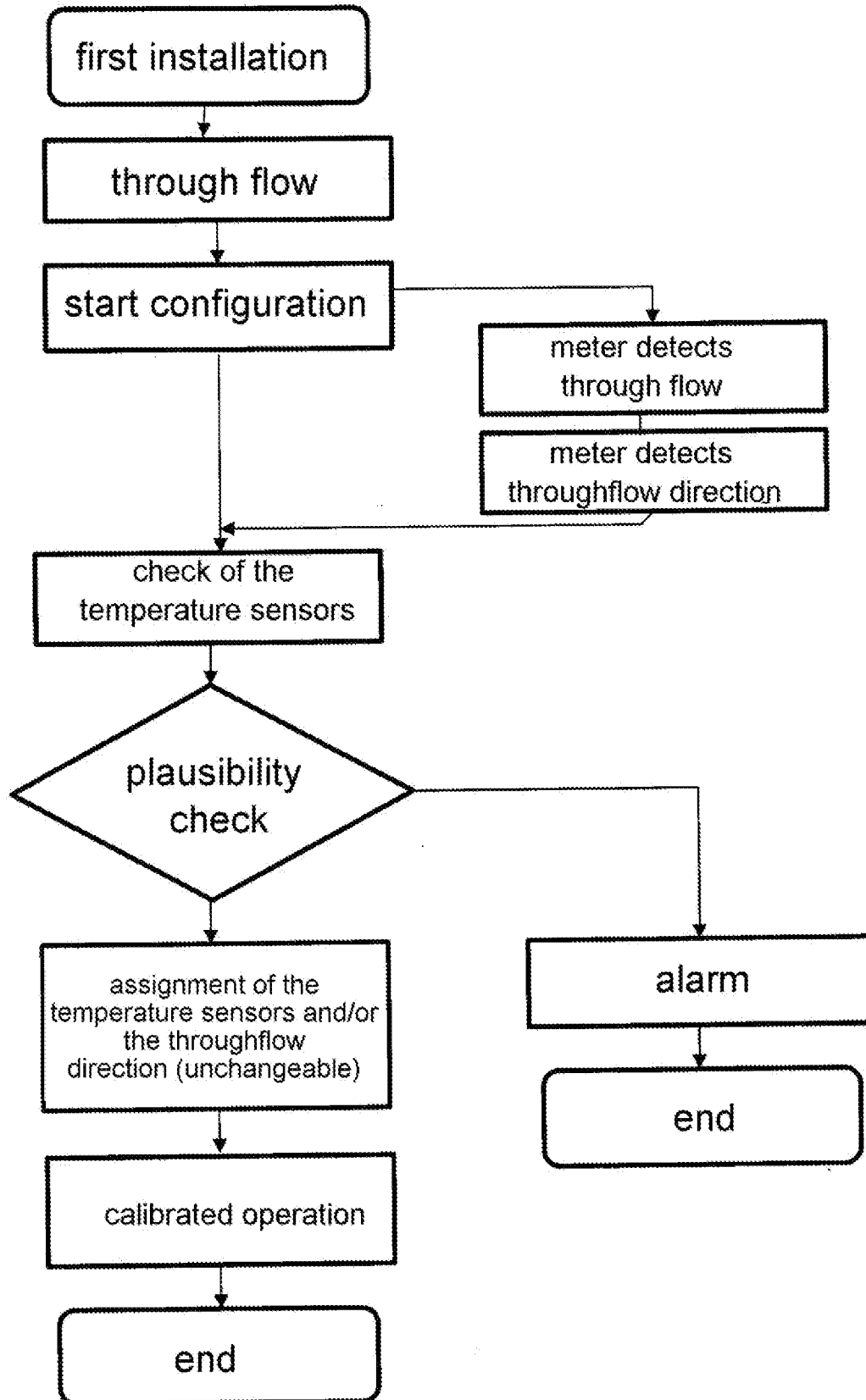


Fig. 5

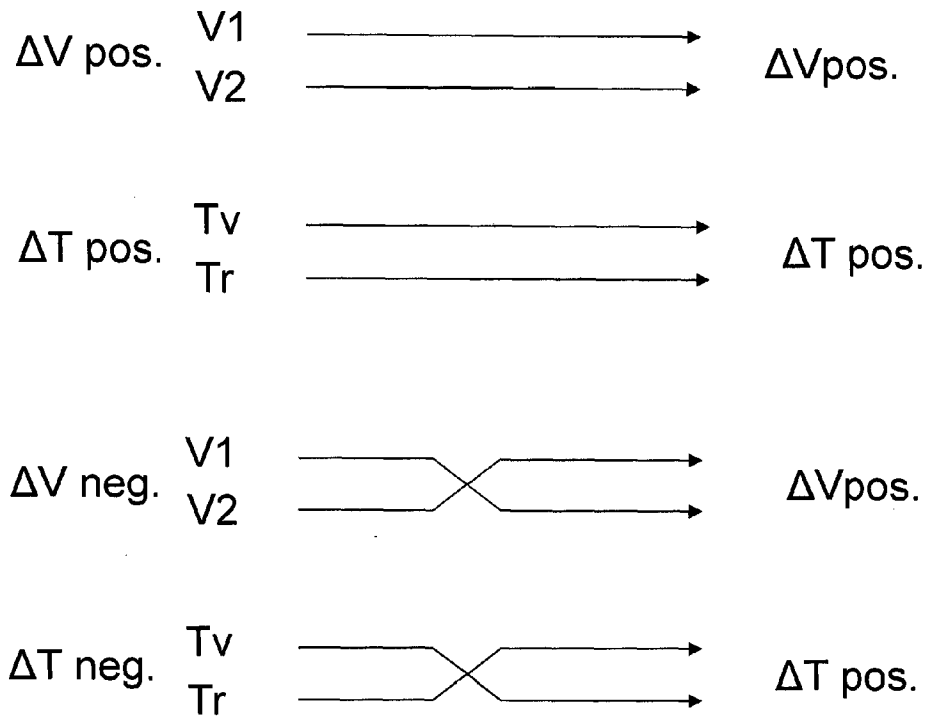


Fig. 6