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(54) Benævnelse: **RINGSPINDEMASKINE MED EN ANORDNING TIL FREMSTILLING AF EN TRÅD UD FRA ET GARN**

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RINGSPINNING MACHINE WITH A DEVICE FOR PRODUCING A THREAD FROM A YARN

Description

The invention relates to a ring spinning machine having a device for producing a thread from a yarn, according to the preamble of claim 1.

Such a ring spinning machine is known, for example, from CN 207 244 082 U. Reference should also be made to CH 556 923.

EP 2 826 899 B1 discloses a different ring spinning machine having a ring rail on which spinning rings are arranged. The spinning rings form a ring spinning station with the movement element; a thread is made from a yarn and connected to a rotationally symmetrical body. The rotationally symmetrical body is rotated about its own longitudinal axis via a belt drive, for example, so that the thread is wound around the body. The movement elements in the form of spinning rings each rotate about the longitudinal axis of the body so that the threads do not hinder each other. The movement element is therefore moved and thus set in rotation by the thread.

The rotations of the movement elements must be permanently monitored in order to detect any faults at an early stage and to switch off the ring spinning machine before a complex knotting of the given threads occurs. The rotation of the actuating element is detected using a microphone. The microphone generates electrical signals as the movement element passes through, which are then transmitted to a circuit board. Visual indicators are positioned on the circuit board in such a way that they can be seen from the outside.

One type of metal detection has become known through EP 0 816 870 B1. This metal detector is designed to detect metals in floors, walls, etc. This involves the stationary or local determination of cables in house walls or of metals in the subsurface. An oscillator generates sinusoidal alternating fields that are emitted into the existing region which contains metallic object. The object made of an electrically conductive material changes the magnetic fields upon penetrating

them. Such changes in the magnetic fields are measurable and can therefore be evaluated.

The disadvantage of both known devices and methods for operating a metal detector has been found to be that, on the one hand, they have a very complex structural design and, on the other hand, their production is very costly since a large number of high-quality electronic components have to be used.

It is therefore the object of the invention to provide a ring spinning machine having a device of the type mentioned.

The aim is to further develop these types of devices in such a way that they work reliably and without disruption in the long term and are also much cheaper to manufacture than the devices that have become known.

This object is achieved according to the invention by the features of the characterizing part of claim 1.

Further advantageous refinements of the invention emerge from the dependent claims.

By virtue of the fact that at least two specific coils, each with at least two windings, are arranged on the ring flange, that the coils are coupled to an electrical switching circuit by which the coils are excited at a constant frequency, and that the movement element is made of an electrically conductive material and brings about an amplitude change in the region of the coils, which is evaluated in the electrical switching circuit and passed on to an external electrical device, permanent measurements are created by which the movements or rotations of the movement element are reliably detected and any possible changes in the ambient temperature, air humidity or other environmental influences that affect the oscillation behavior of the coil are immediately compensated for by means of the electrical switching circuit and/or the external electrical device.

The electrical components used are inexpensive to purchase as standard mass-produced goods, so that the switching circuit thus formed can be built with minimal resources. The manufacturing costs for evaluating the rotational behavior of the movement element are therefore kept extremely low.

In addition, existing ring spinning machines can be retrofitted with such coils and switching circuit, as they can be made available as a retrofittable kit.

Furthermore, the electrical switching circuit provides clear measuring signals which allow detecting disturbances in the operating sequence of the ring spinning machine and keeping these as low as possible by means of early intervention options.

The drawing shows an embodiment according to the invention, which is explained in more detail below. In the figures in detail:

Figure 1 shows a schematic structural design of a ring spinning machine, by means of which a thread is produced from a frayed yarn, having a storage container accommodating the yarn, having a guide device arranged downstream of the storage container, by means of which the yarn is oriented in the direction of the ring spinning machine, having a rotationally symmetrical body on which the thread is wound, and having a drive device by means of which the body is driven to rotate about its own longitudinal axis,

Figure 2 shows an enlarged detail of the ring spinning machine according to Figure 1, to which a ring flange is functionally assigned, encasing the rotationally symmetrical body - and into which a guideway is incorporated - in which a movement element, in which an opening for receiving the thread is provided, is movably mounted; two coils are provided on the outside of the guideway, which are electrically coupled via an electrical coupling to a switching circuit by which the coils are excited at a constant frequency,

Figure 3 shows a voltage/time diagram showing an increase in amplitude while the movement element according to Figures 1 and 2 passes in the region of the coil,

Figure 4 shows a voltage/time diagram based on the voltage curves according to Figure 3, with a suppressed high frequency,

Figure 5 shows a voltage/time diagram departing from the voltage according to Figure 4, after its amplification,

Figure 6 shows a structural design of a printed circuit board as part of the electrical switching circuit according to Figures 1 and 2,

Figure 7 shows a first embodiment of an analog operating point controller as part of the electrical circuit according to Figures 1 and 2,

Figure 8 shows a second embodiment of a partially digitized operating point controller and signal detector for the switching circuit according to Figures 1 and 2

Figure 9 shows a third embodiment of a fully digitalized operating point controller and signal detector for the switching circuit according to Figures 1 and 2,

Figure 10 shows a structural design of a motherboard as part of the electrical circuit according to Figures 1 and 2 for the operation of multiple coils,

Figure 11 shows a schematic structure of an interface for the operation of multiple coils by the electrical switching circuit according to Figures 1 and 2, designed as a bus system, and

Figure 12 shows the interconnection of multiple switching circuits according to Figure 11 with an interface on a motherboard.

Figures 1 and 2 show a device 1 for producing a thread 2 from a yarn 3, which in technical terminology is also referred to as a ring spinning machine 1.

As a starting material, yarn 3 has a very frayed surface structure, which is not suitable for further processing in the textile industry. The ring spinning machine 1 therefore serves to produce the thread 2 from the yarn 3 with a surface structure that is as homogeneous or smooth as possible. For this purpose, the yarn 3 is stored as a continuous web in a storage container 4, which can be transported to the ring spinning machine 1. The ring spinning machine 1 conveys the yarn 3 from the storage container 4, and the surface structure of the yarn 3 is homogenized or smoothed by twisting.

This is accomplished in that the yarn 3 is first picked up by a guide groove device 5 and transported in the direction of a rotationally symmetrical body 6. In order to optimally align the yarn 3, a spinning triangle 13 is provided in the guide device 5

as a yarn guide and a ring 15 is provided spatially downstream of this. The yarn 3 is passed through the ring 14. Thus, both the guide device 5 and the ring 14 form a kind of hinge or pivot joint around which the yarn 3 is twisted or rotated.

The end of the thread 2 is connected to the rotationally symmetrical body 6 at a fastening point 12. By means of a drive device 11, for example a V-belt, the body 6 is set in rotation about its longitudinal axis, so that the thread 2 connected to the body 6 is wound on the outer surface of the body 6, which in technical terminology is also referred to as a balloon. As a result of this winding process, a tensile force acts on the thread 2 and the yarn 3 connected to it, wherein the thread 2 and the yarn 3 are pulled out of the storage container 4 in the direction of the body 6.

In order to twist the thread 2 after leaving the ring 15 and thus to create the most homogeneous surface structure possible, the thread 2 is pulled through an annular thread guide 16 for optimized guidance, which is arranged spatially above the body 6. A ring flange 7 must be used at a distance from the thread guide 16, with a closed guideway 8 running around the body 6. The guideway 8 is spaced from the surface of the rotationally symmetrical body 6. A movement element 9 is movably mounted in the guideway 8. In technical terminology, the movement element 9 is often referred to as the so-called traveler.

In the embodiments shown, the movement element 9 is ring-shaped. The movement element 9 therefore has an opening 10 through which the thread 2 is guided. In the initial state of the ring spinning machine, the movement element 9 is arranged at the same height as that of a fastening point 12, so that the first winding of the thread 2 on the body 6 runs in this plane. As soon as a certain number of windings on the body 6 is reached, the ring flange 7 and thus the movement element 9 can be moved in the direction of the thread guide 16, so that the subsequent windings of the thread 2 are defined on the entire surface of the body 6.

The rotation of the body 6 and the associated rotational movement of the thread 2 results in a force exerted by the thread 2 on the movement element 9, by which the movement element 9 is set in rotation in the guideway 8 about the longitudinal axis of the body 6. A reverse winding of the thread 2 is possible in that the

movement element 9 is driven in the guideway 8, for example magnetically or inductively, and the body 6 is stationary. The thread 2 is thus wound around the outer surface of the body 6 by the movement element 9.

The rotational movements of the movement element 9 should be measured by at least two coils L1, L2 and an electrical switching circuit 23 and transmitted to an external electrical device 24 for controlling the coil L1, L2 and for evaluating the rotational movements of the movement element 9.

The coils L1, L2 each have at least one or a plurality of windings 22, which are powered by the switching circuit 23 or the external electrical device 24. In the embodiment shown, the coils L1, L2 consist of a total of 28 windings 22 to 22^{28} and are arranged directly in the vicinity of the movement element 9, namely on the outside of the guideway 8. Thus, the movement element 9, the material of which is electrically conductive, influences the oscillation behavior of the coils L1, L2 as soon as the movement element 9 enters or leaves the magnetic field emitted by the coils L1, L2. This is a feedback between the first and second coil L1, L2.

In particular, Figure 2 shows how the electrical switching circuit 23 is constructed and/or from which electrical components it is formed, and how these components are connected together for their calibration and permanent setting to evaluate the amplitude changes at the coils L1, L2, which can be regarded as sensors.

The switching circuit 23 substantially consists of an LC oscillator L2, C2, T1 and R3, which are electrically coupled to an inductive feedback K via the first coil L1, a demodulator T2, C3, R4 and an amplifier T3 and R5. The electrical components essential to the invention and their interconnection are described in more detail below. The electrical component T1 is the first transistor. Its base, collector and emitter are denoted by the reference numbers 26, 27 and 28.

In the switching circuit 23 of Figure 2, L2 and C2 form a parallel resonant circuit which is excited by the transistor T1, namely at its collector 27. The first coil L1 with a coupling capacitor C1 is arranged between the voltage supply, which is symbolically marked with a +, and the base 26 of the transistor T1. The arrangement of the coils L1 and L2 creates a feedback K depending on the set operating point AP. The switching circuit 23 oscillates. The presence of the

movement element 9 in the proximity of the coils L1 and L2 therefore increases this coupling K, resulting in an amplitude increase as shown in Figure 3. To stabilize the oscillator circuit part, the emitter resistor R3 is provided for negative current feedback.

In such an amplitude modulation, the high frequency HF is modulated in its amplitude by the feedback K. In this switching circuit 23 according to the invention, the amplitude modulation is carried out by the movement element 9 and its rotational movements about the longitudinal axis 6'. The proximity of the movement element 9 to the coils L1, L2 modulates the high frequency HF accordingly. The signal peaks of the curve NF of Figure 4 are marked with the reference number 42. The demodulator consists of the transistor T2 and the capacitor C3. This interconnection creates the curve NF, which is shown in Figure 4. The high frequency HF is no longer part of the NF curve shown there.

Proceeding from the curve NF shown in Figure 4, the curve signal NF is amplified by a third transistor T3 in such a way that a higher signal-to-noise ratio is created, and the movement element 9 can be further processed into a sensor signal 43 at the output A. This is shown schematically in Figure 5. SNR is an abbreviation for Signal-to-Noise Ratio.

Figure 6 shows the structure of a printed circuit board 33 for the switching circuit 23 and for the operation of the coils L1, L2. The components 34 are electrically connected to the coils L1, L2 at a tap 30 which is electrically coupled to the first winding 22 of the coils L1, L2. The printed circuit board 33 has a plurality of conductor tracks 34 which run in different levels arranged one above the other to save space. It is possible to arrange further electrical components, for example the transistor and coil resistors forming the demodulator, in the various levels of the circuit board 33.

The beginnings of each of the coils L1, L2 are provided with the reference number 25, and the ends are provided with the reference number 25'.

The printed circuit board 33 therefore forms a single component with the coils L1, L2, so that the distance between the coils L1, L2 and the electrical components

measuring and amplifying the amplitude changes are arranged as close as possible to one another.

Figure 7 shows the setting of an analog operating point controller. The operating point of the oscillator can be controlled using a DC voltage via the operating point input. This allows the oscillator to be set in such a way that feedback occurs and it begins to oscillate, as shown and explained in Figure 3. At this operating point AP, the switching circuit 23 is most sensitive.

In order to make the switching circuit 23 independent of exact distances, temperature and/or humidity changes, the operating point AP can be programmed and thus controlled. These programming options can be implemented via a known analog controller - as explained with reference to Figure 6 - with an operational amplifier 35 as the control element and low-pass filter 36. The optimal operating point AP can be programmed and thus set using a specified direct voltage as a reference variable. The low-pass filter 36 is necessary because only a direct voltage without influences from the electrical switching circuit 23 is required to control the operating point AP.

Figure 8 shows a partially digitized operating point controller and its signal detector as a circuit diagram. To calibrate the switching circuit 23, the DC voltage component is filtered out as output signal A - as shown in Figure 5 - with a low-pass filter 36, and the DC voltage is sampled with an A/D converter 37 in a microcontroller 31. At the same time, the voltage of a D/A output of the microcontroller 31, which is connected to the operating point controller AP of the switching circuit 23, is varied. As soon as a certain value is reached at the A/D converter 37, the variation of the voltage of the D/A output is stopped. The switching circuit 23 is thus calibrated.

The DC voltage component of the switching circuit signal A according to Figure 5 is suppressed by a high-pass filter 38, and a hardware interrupt 39 is triggered by the pulses caused by the movement element 9. With each hardware interrupt 39, the counter reading of a measuring element 40 is read with the aid of suitable algorithms in the microcontroller 31 assigned to the external electrical device 24, and the measuring element 40 is then reset to zero. Using the counter reading, the

speed or the number of revolutions per minute of the movement element 9 in the guideway 8 can be calculated using a further algorithm.

Figure 9 shows a circuit diagram for the fully digitalized operating point controller and its signal detector via DSP. As an alternative to the partially digitalized operating point controller and calibration of the electrical switching circuit 23 and the signal detector of the movement element 9, one of the specific microcontrollers 31 integrated digital signal processing DSP can also be used. The output signal A of the switching circuit 23 according to Figure 5 is sampled directly by the A/D converter 37 without any upstream analog filtering. The DC voltage component of the switching circuit signal A can be calculated according to Figure 5 by means of a software program stored in the microcontroller 31 as a low-pass filter, or on the basis of mathematical averaging. At the same time, the voltage at the output of a D/A converter to which the operating point control AP of the switching circuit 23 is connected is changed. As soon as a certain calculated limit or DC voltage value is reached, the voltage variation is stopped. The switching circuit 23 is calibrated.

The software is then used to switch the low-pass filtering to high-pass filtering, thus suppressing the DC voltage components. The algorithm used therefore provides the detected signal of the movement element 9, which can then be further evaluated using the software used to determine the speed and rotational speed of the movement element 9. For example, this method can also be used to make conclusions about the position or current state of the movement element 9 in the guideway 8 based on the curve shape using artificial intelligence.

Figure 10 shows the structural design of an interface for connecting multiple switching circuits 23.

Since the switching circuit system according to the invention on the ring spinning machine 1 should be as cost-effective to manufacture as possible, the individual switching circuits 23 should, if possible, make do without further expensive electronic components. Therefore, the control process for all switching circuits 23 used can be incorporated in the motherboard 33. To control the operating point AP and to evaluate the signals, multiple switching circuits 23 can be connected to the microcontroller 31 and can be controlled by it. All switching circuits 23 connected

to the motherboard 33 can be calibrated one after the other with time slots, as explained in Figures 7 to 9. Because of the open collector output of the switching circuits 23, all outputs can be connected to a common A/D converter 37.

Figure 11 shows a BUS interface for the switching circuit 23, as shown by way of example in Figure 12. If the individual switching circuits 23, for example eight of them, are constructed with different graduated voltage dividers R1/R2, each of the switching circuits 23 has a different operating point AP. This means that multiple switching circuits 23 and only two lines can be operated. This measure saves costs and the switching circuits 23 can be assembled with less outlay. A type of bus system with two interface conductors A and AP is thus possible, wherein the voltage supply "+" can also be integrated into this conductor system. The ring flange 7 can be used as a shared ground (-).

In Figure 12, the microcontroller 31 is connected to an industrial interface. This is denoted by the reference number 44. In this way, the switching circuit 23 can be connected to a network and/or to a cloud. The data from each ring spinning station 17 are therefore evaluated together and can be compared with other machine data or with each other.

PATENTKRAV

1. Ringspindemaskine (1) til fremstilling af en tråd (2) ud fra et garn (3), hvilken ringspindemaskine består af:

- en opbevaringsbeholder (4), der leverer garnet (3), fra hvilken opbevaringsbeholder garnet (3) indledningsvist tages op af en styreanordning (5) associeret med ringspindemaskine (1) og føres i retning af et rotationssymmetrisk legeme (6), der befinder sig i en afstand fra styreanordningen (5),

- hvor en form for drejeled dannes af styreanordningen (5) og en efter denne i en afstand følgende ring (14), om hvilket drejeled garnet (3) snos til fremstilling af tråden (2),

- og tråden (2) spundet af garnet (3) vikles på det rotationssymmetriske legeme (6),

- en ringformet flange (7), der omgiver legemet (6) og er anbragt i en afstand derfra, i hvilken ringformet flange et omløbende styrespor (8) er indarbejdet,

- et bevægelseselement (9), der er anbragt bevægeligt i den ringformede flanges (7) styrespor (8), og i hvilket der er tilvejebragt en åbning (10), der modtager tråden (2),

- og en drivanordning (11), ved hjælp af hvilken bevægelseselementet (9) kan bevæges i styresporet (8), hvor

i det mindste to strømførende spoler (L1, L2), hver med i det mindste en vikling (22, 22^1, 22^2-22^n), er anbragt på ringflangen (7) på styresporets (8) yderside umiddelbart nær bevægelseselementet (9), hvor den respektive spole (L1, L2) er elektrisk koblet til en koblingskreds (23), ved hjælp af hvilken den respektive spole (L1, L2) exciteres ved en konstant frekvens, og hvor bevægelseselementet (9) er fremstillet af et elektrisk ledende materiale og, i området for spolerne (L1, L2), bevirker en amplitudeændring via rotation om det rotationssymmetriske legemes (6) længdeakse (6') nær spolerne (L1, L2), hvilken amplitudeændring evalueres i den

elektriske koblingskreds (23) og overføres til en ekstern elektrisk anordning (24), fra hvilken kredsen (23) får tilført en programmerbar jævnspænding,

kendetegnet ved, at

kredsen (23) i det væsentlige omfatter en LC-oscillator bestående af en anden spole (L2), en anden kondensator (C2), en første transistor (T1) og en tredje modstand (R3), dvs. en emittermodstand,

hvor, i den elektriske koblingskreds (23), den anden spole (L2) og den anden kondensator (C2) danner en parallel resonanskreds, som exciteres af den første transistor (T1) ved dennes kollektor (27),

hvor en første spole (L1) med en koblingskondensator (C1) er anbragt mellem en spændingsforsyning (+) og en base (26) for den første transistor (T1) på en sådan måde, at placeringen af spolerne (L1, L2) medfører tilbagekobling som en funktion af det indstillede arbejdspunkt AP,

hvor bevægelseselementet (9) fungerer som modulator, og der i den elektriske strømkreds (23) er tilvejebragt en demodulator (T1, T2) i form af en anden transistor (T2), der er forbundet til en tredje kondensator (C3) og en fjerde modstand (R4) og er elektrisk koblet til en forstærker omfattende en tredje transistor (T3) og en fjerde modstand (R5), ved hjælp af hvilken demodulator en amplitudeændring af spolerne (L1, L2) detekteres som en elektrisk spænding eller signal, og hvor hver af transistorerne (T1, T2, T3) har en base (26), en kollektor (27) og en emitter (28).

2. Ringspindemaskine ifølge krav 1, **kendetegnet ved, at**

transistorens (T1) base (26) er elektrisk forbundet til spolens (L1, L2) sidste vikling (22^n), og transistorens (T2) kollektor (27) er elektrisk forbundet til spolens (L1, L2) første og anden vikling (22 eller 22^1), og **ved, at** en modstand til strømtilbagekobling eller kredsstabilisering er forbundet til transistorens (T1) emitter (28).

Figure 1

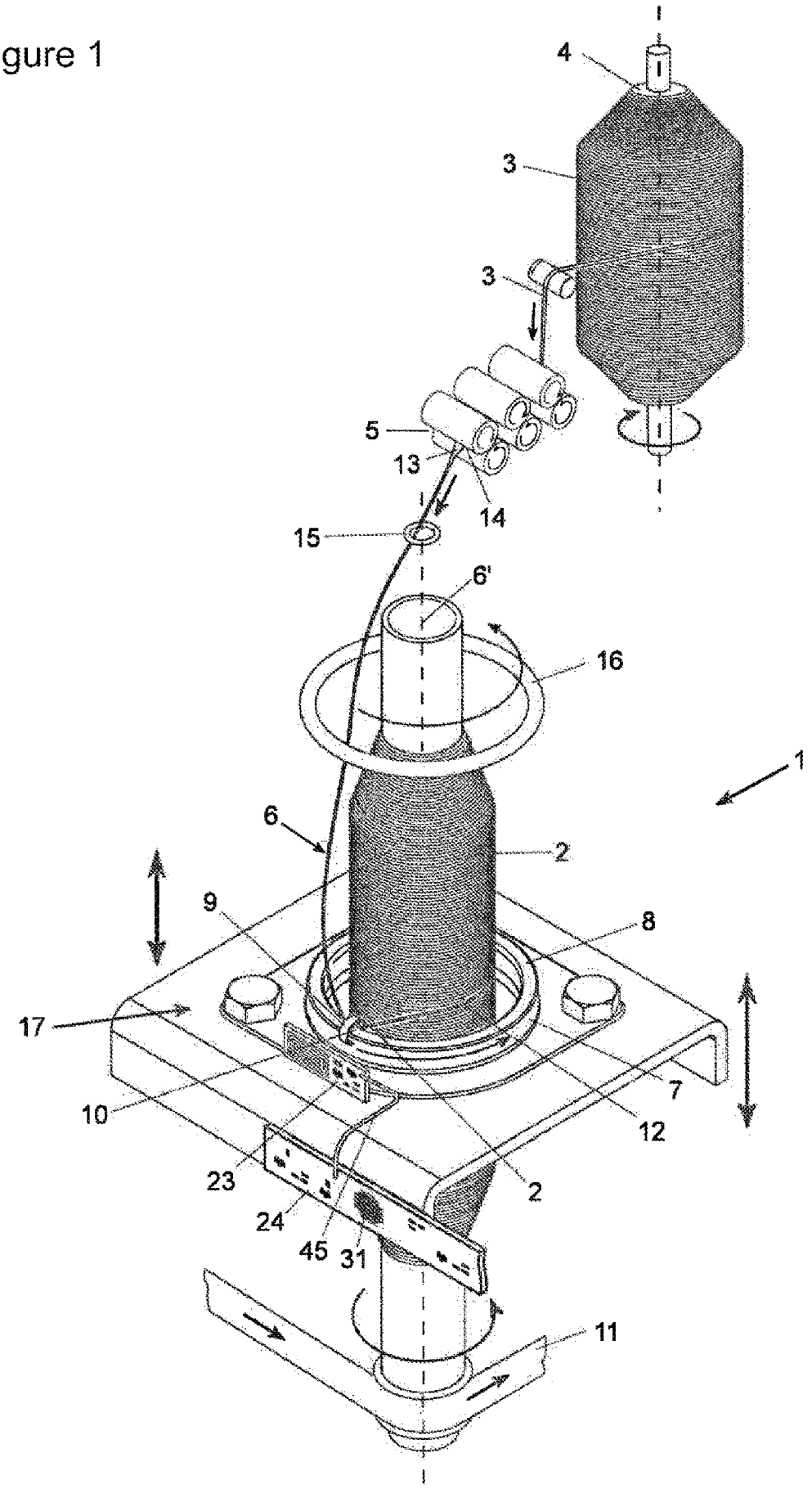
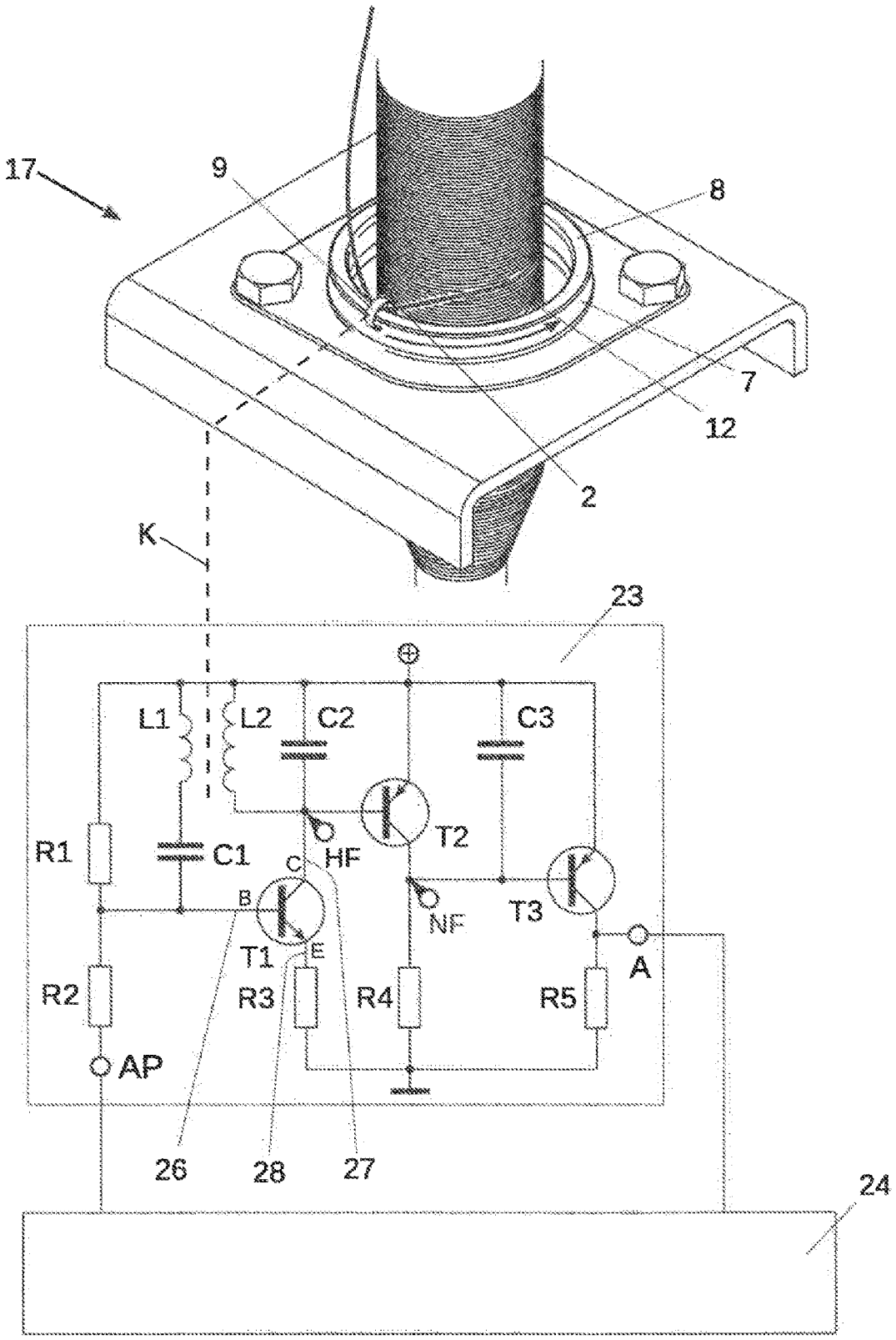


Figure 2


17
9
8
7
12
2
K
23
L1
L2
C2
C3
T2
R1
C1
HF
C
B
NF
T3
T1
E
A
R2
R3
R4
R5
AP
26
28
27
24

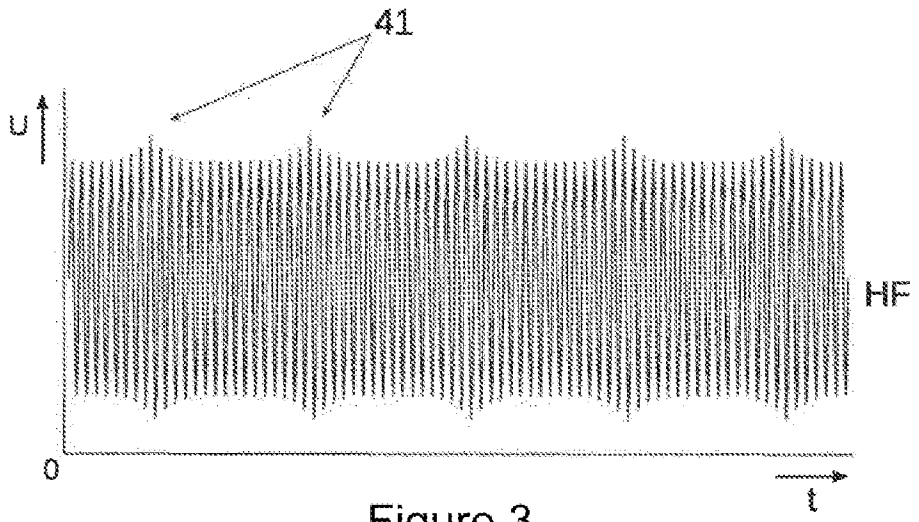


Figure 3

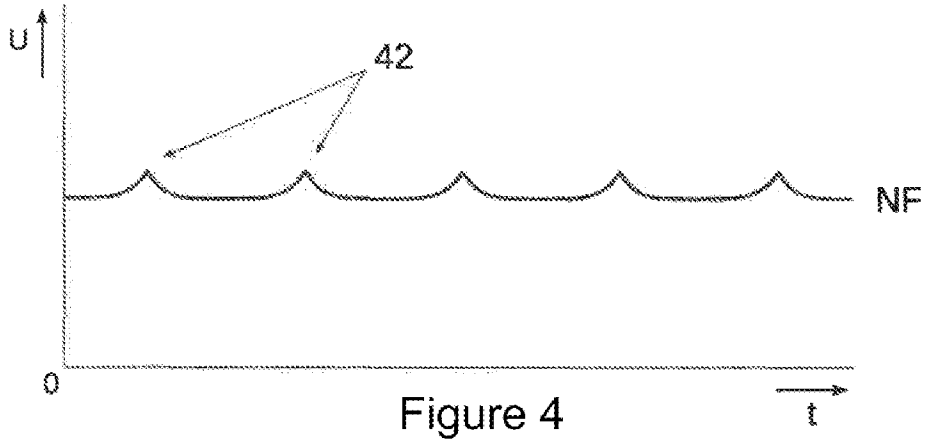


Figure 4

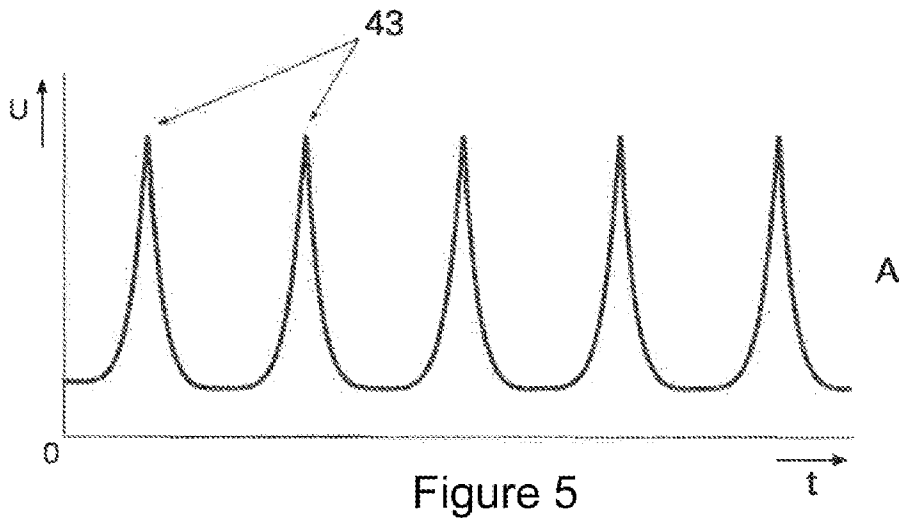


Figure 5

Figure 6

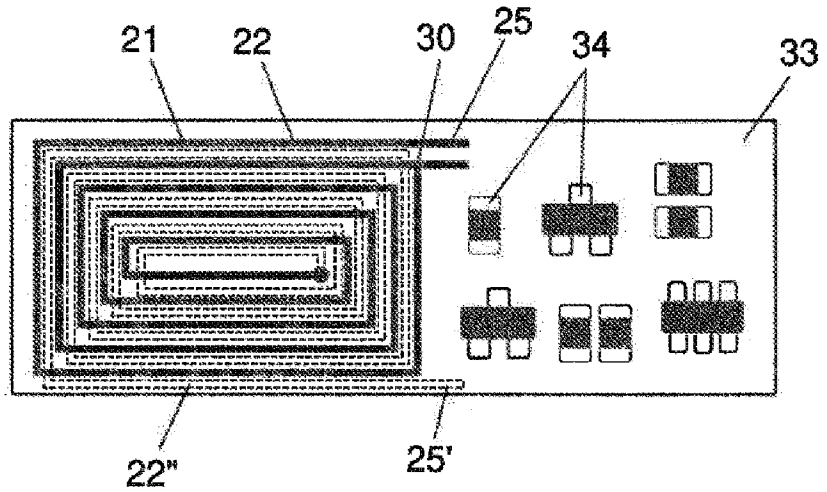


Figure 7

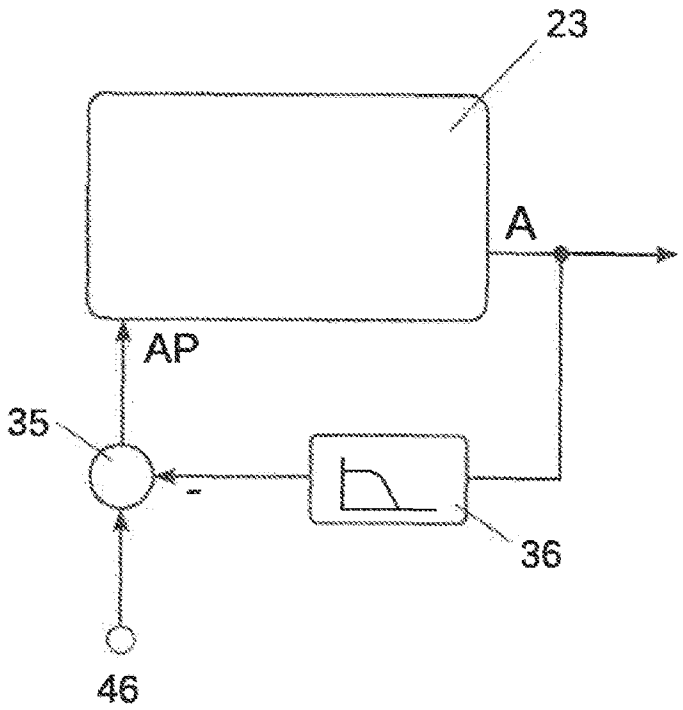


Figure 8

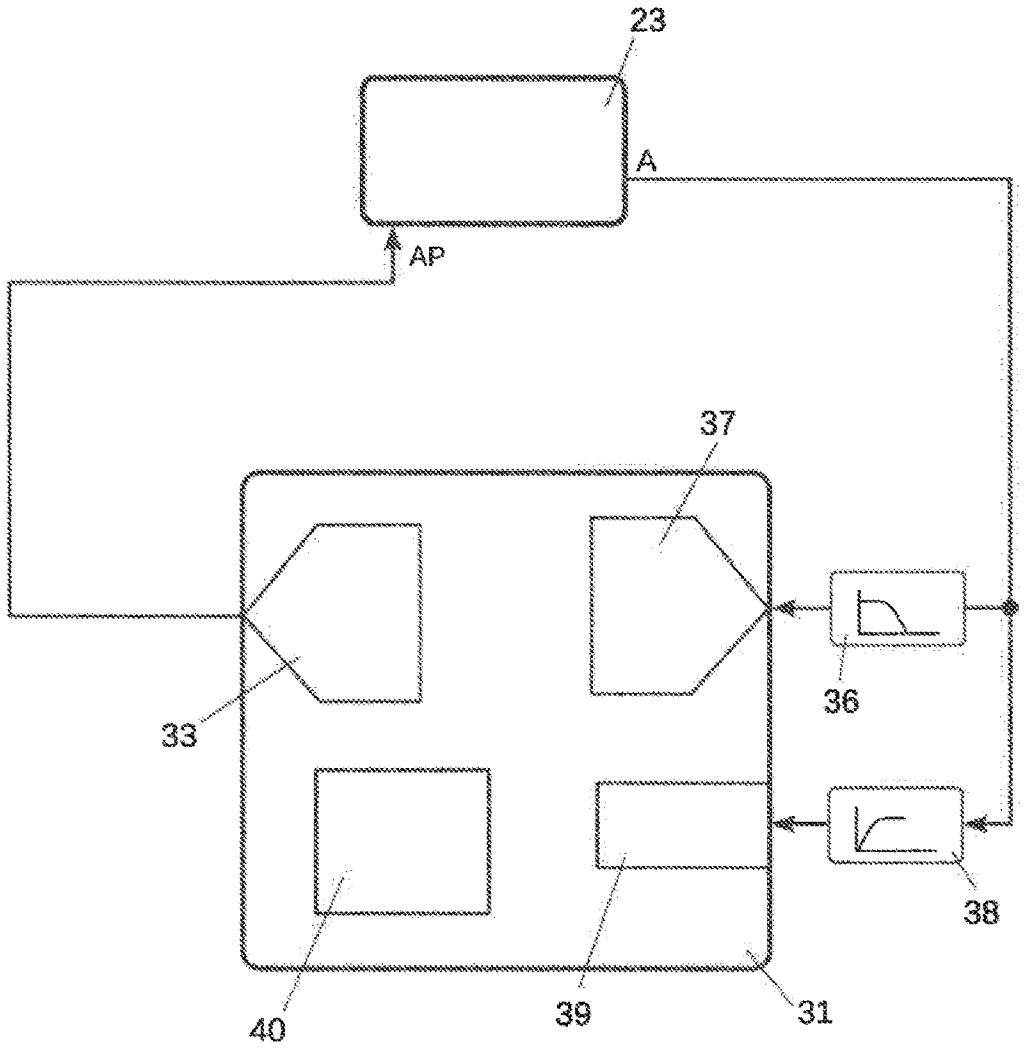


Figure 9

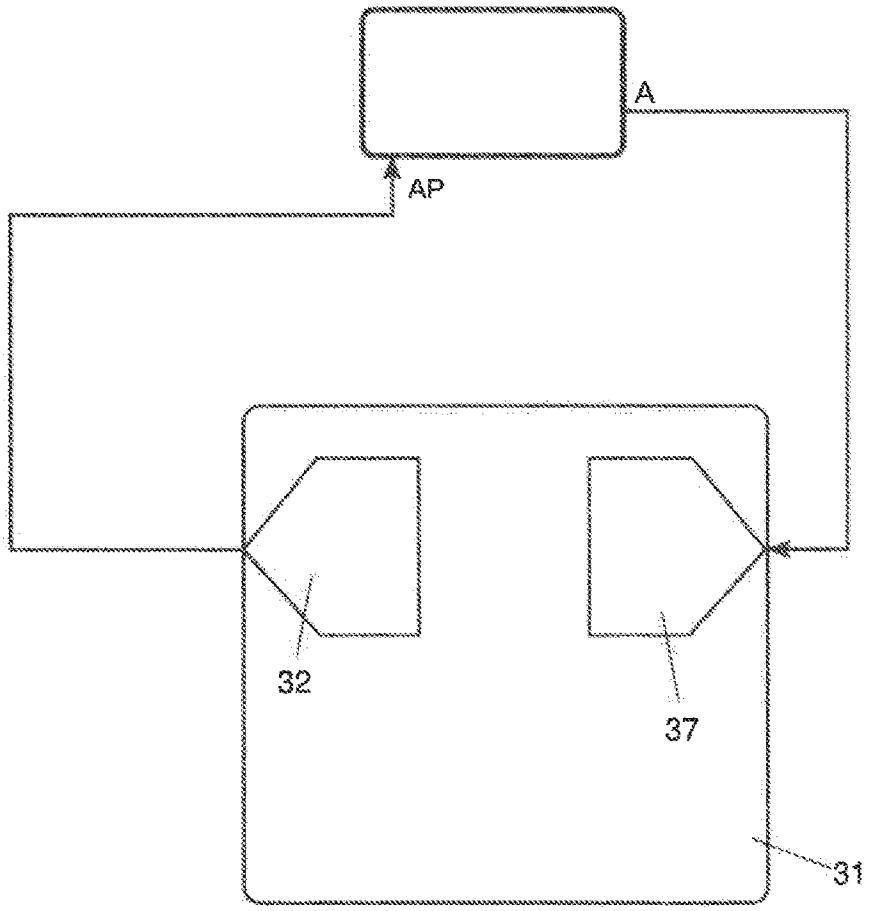


Figure 10

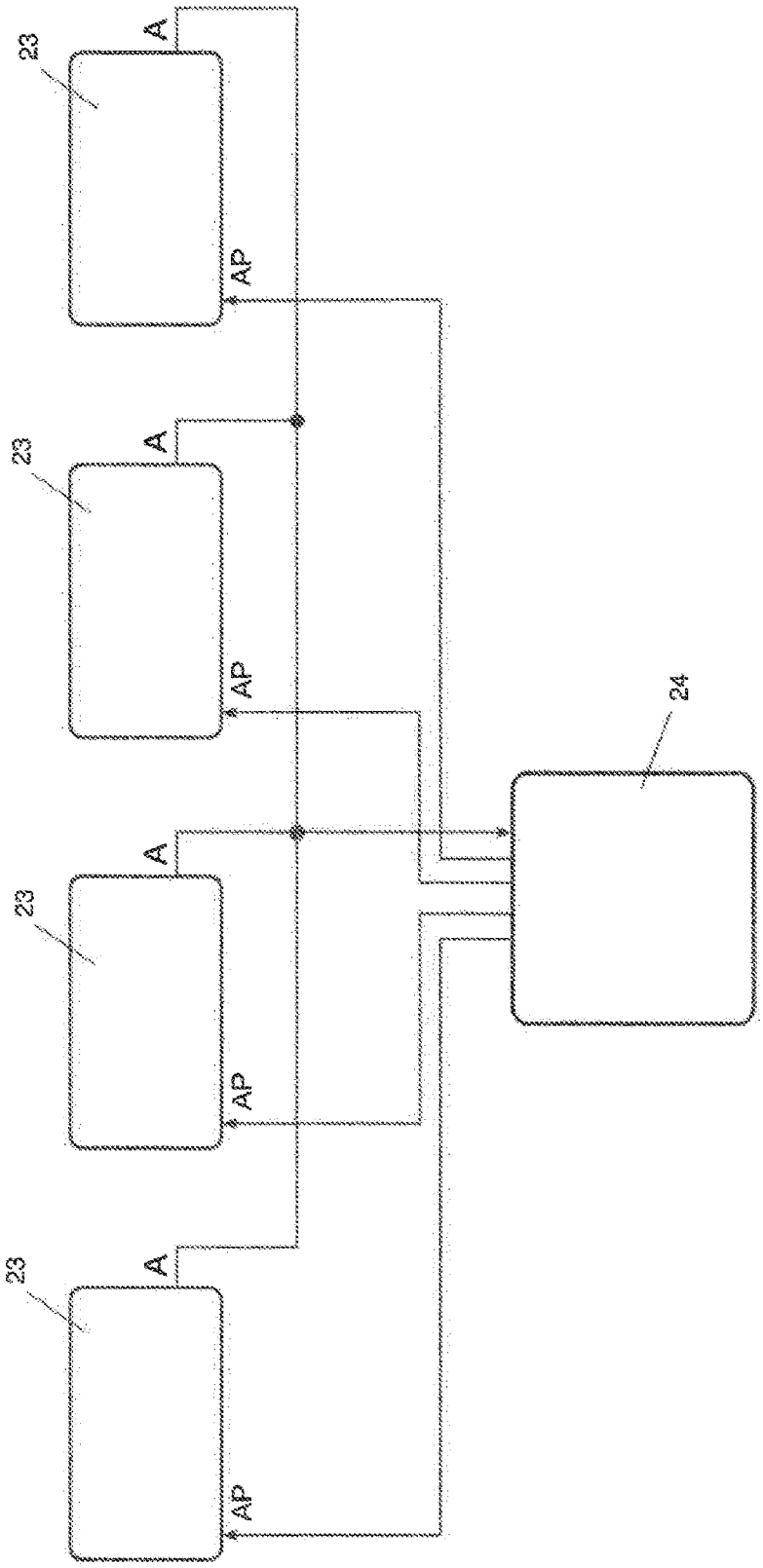


Figure 11

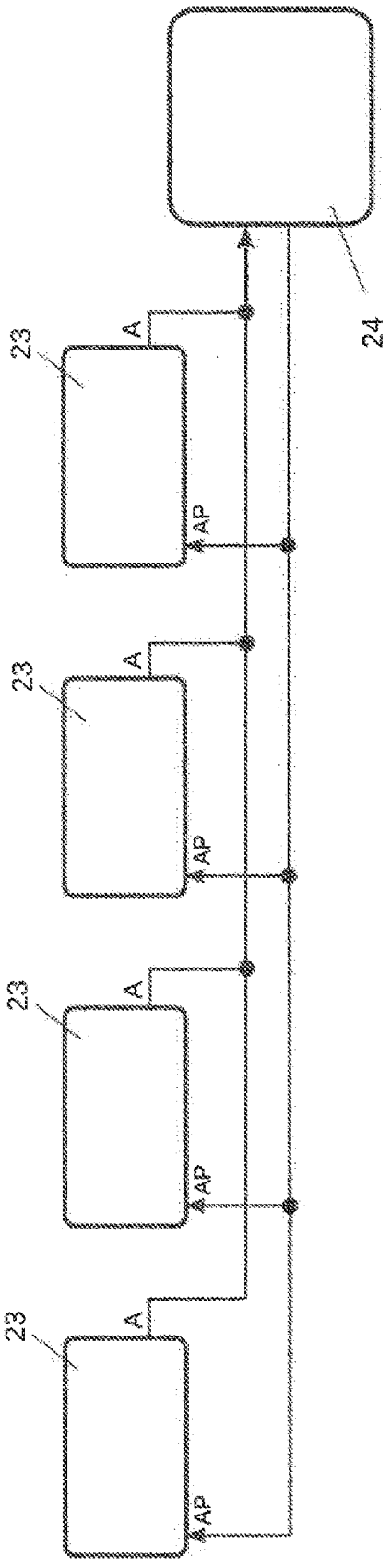


Figure 12

