(19) DANMARK

(10) **DK/EP 3052446 T3**

Patent- og Varemærkestyrelsen

(12) Oversættelse af europæisk patentskrift

---

(51) Int.Cl.: ***C 02 F 3/00 (2006.01)*** ***C 02 F 3/12 (2006.01)*** ***C 02 F 3/30 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2021-04-19**

(80) Dato for Den Europæiske Patentmyndigheds bekendtgørelse om meddelelse af patentet: **2021-01-27**

(86) Europæisk ansøgning nr.: **14777326.1**

(86) Europæisk indleveringsdag: **2014-09-30**

(87) Den europæiske ansøgnings publiceringsdag: **2016-08-10**

(86) International ansøgning nr.: **EP2014070872**

(87) Internationalt publikationsnr.: **WO2015044440**

(30) Prioritet: **2013-09-30 EP 13186647**

(84) Designerede stater: **AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO RS SE SI SK SM TR**

(73) Patenthaver: **KRÜGER A/S, Gladsaxevej 363, 2860 Søborg, Danmark**

(72) Opfinder: **PEDERSEN, Jan, Dr. Abildgaards Allé 18 3. th., 1955 Frederiksberg C, Danmark**
LARSEN, Thomas Krahl, Thorupgård Alle 61, 2720 Vanløse, Danmark
THOMSEN, Henrik Andreas Rønnow, Jagtvej 183 2. tv., 2100 København Ø, Danmark

(74) Fuldmægtig i Danmark: **Inspicos P/S, Kogle Alle 2, 2970 Hørsholm, Danmark**

(54) Benævnelse: **PLANT AND METHOD FOR TREATMENT OF WASTE WATER IN AN ACTIVATED SLUDGE PLANT**

(56) Fremdragne publikationer:
EP-A2- 2 426 090
WO-A1-93/17974
DE-A1- 2 304 804
US-A- 5 332 502
US-A- 5 795 481

DESCRIPTION

Field of the invention

[0001] The present invention relates to a method for treatment of waste water in an activated sludge plant, wherein the plant comprises a plurality of process tanks comprising activated sludge with a treatment rate being variable. Each process tank has an inlet for receiving waste water and an outlet for supplying treated water to at least one clarification tank for separation into a water fraction and a sludge fraction.

Background of the invention

[0002] Traditionally, waste water is subjected to biological treatment in an activated sludge plant by passing it through at least one process tank and subsequently passing it through at least one clarification tank for separation into a water fraction and a sludge fraction.

[0003] In the process tank micro-organisms metabolize the suspended and soluble organic matter contained in the waste water. Furthermore, nitrification, de-nitrification, and biological removal of phosphate may take place. The process tanks traditionally include a system for aeration of the tank, as the micro-organisms need oxygen for the biological treatment of the waste water. The rate and efficiency of the treatment in the process tank is proportional with the amount of micro-organisms, and it is thus important that the micro-organisms are present in the process tanks in a sufficient amount.

[0004] In order to cope with the varying amount of waste water the plants are traditionally dimensioned so that they in the majority part of time are only exposed to a low percentage of the amount of waste water for which the plant is dimensioned.

[0005] As the micro-organisms need waste water to grow, the waste water is traditionally distributed between all the process tanks to ensure sufficient feeding of the micro-organisms. However, this is not efficient in periods with low load, and consequently the cost of operation will increase significantly compared to the amount of waste water treated.

[0006] Prior art document DE 23 04 804 discloses a sewage plant, using activated sludge, preventing long running below capacity and producing effluent superior in quality to that permitted by the authorities, so that economic and technically efficient operation is ensured. The treatment stage(s) is divided into a number of separate units which can be used as required, depending upon the rates of inflow and concentration of the sewage water as measured in the inlet.

[0007] WO 93/17974 discloses an effluent treatment system, where effluent to be treated passes initially through a primary stage in which it undergoes primary settlement and anaerobic treatment. The substantially liquid effluent is withdrawn from the primary stage by means of a balanced flow arrangement to provide a uniform rate of withdrawal of effluent from the stage for downstream treatment in subsequent stages of the system. Secondary treatment consists of a succession of aerobic treatment stages. At least one nitrification sub-stage and a de-nitrification sub-stage are provided during secondary treatment. The effluent then passes to clarification and settlement stage before entering a disinfection stage by way of a filter.

[0008] US 5,795,481 discloses a process for the treatment of aqueous effluent with a view to its purification, the process including at least one stage consisting of causing the water to pass into the interior of at least one battery of several biological filters with fixed cultures or other devices with fixed cultures operating in parallel, characterized in that it comprises supplying the filters at constant flow and to cause the number of filters supplied and the number of filters not supplied in the battery, to be varied, in accordance with the total flow of aqueous effluent to be treated.

[0009] US 5,332,502 discloses a method for efficiently treating wastewater by aerobic digestion whereby on-site oxygen generating equipment continually provides a predetermined quantity of dissolved oxygen to the wastewater, the dissolved oxygen content being maintained at a predetermined level during peak flows by air being dissolved into the wastewater.

[0010] EP 2 426 090 discloses a batch-wise wastewater treatment method, which comprises: (a) supplying wastewater into a aeration reactor; (b) aerating the activated sludge reactor contents; (c) stopping the aeration and dropping the sludge; and (d) withdrawing clear water and additionally at least a part of the settled sludge, where the dry substance content of activated sludge contained in the aeration reactor is determined. The ammonium concentration of the supplied wastewater per reactor filling is monitored.

Description of the invention

[0011] It is an object of embodiments of the invention to provide an improved method for treatment of waste water in an activated sludge plant.

[0012] It is a further object of embodiments of the invention to provide a treatment method being dynamically adaptable to the actual treatment rate of the activated sludge.

[0013] It is an even further object of embodiments of the invention to provide a treatment method which reduces the running cost for an activated sludge plant.

[0014] According to a first aspect, the invention provides a method for treatment of waste water in an activated sludge plant according to claim 1.

[0015] The process tanks may have different treatment zones where different processes are performed. As an example, aeration may take place only in a part of a process tank, thereby defining an aeration zone. Likewise stirring may take place in a stirring zone. It should however be understood, that a process tank may form one single zone.

[0016] Each process tank has an outlet for supplying treated water to at least one clarification tank. In one embodiment, the outlet of a process tank is connected to an inlet of an interrelated clarification tank. In an alternative embodiment, the outlets from the process tanks are connected and subsequently the treated water is supplied to one single clarification tank or supplied to a plurality of clarification tanks.

[0017] The treatment rate of the activated sludge may depend on different parameters, such as the actual performance of the sludge, including the actual metabolism rate of the biomass/micro-organisms, the amount of biomass/micro-organisms, and the organic matter/load composition contained in the waste water. As the biomass/micro-organisms are sensitive to temperature, the actual spare capacity may as an example be higher during summer than during winter.

[0018] The load rate is determined as the actual load relative to the capacity. The actual spare capacity may be determined based on one or more measurements and/or forecast(s) being indicative for the actual spare capacity.

[0019] The activated sludge plant is operated so that waste water is supplied only to a first group of process tanks and so that supply to a second group of process tanks is interrupted. The first group of process tanks is a subset of the plurality of process tanks. The number of process tanks in the first group is determined based on the actual spare capacity.

[0020] Dependent on the size of the plant, the number of process tanks in the first and second groups may be 1, 2, 3, ... , 7, 8, or even more. Dependent on the actual spare capacity, the number of process tanks in the first group of process tanks may be equal to the number of tanks in the second group or may be smaller or larger.

[0021] By automatically temporarily interrupting supply to the process tanks in the second group of process tanks, the operation of the plant can be dynamically adapted to the actual amount of waste water to be treated in dependency of the actual spare capacity, as the waste water is only supplied to the first group of process tanks based on the actual spare capacity. Consequently, the running cost can be reduced.

[0022] It should be understood, that by interruption of supply is understood, that supply of waste water is interrupted while the content is kept in the process tank(s) in question, i.e. the process tank(s) is(are) not emptied.

[0023] This method for treating waste water is in contradiction with traditional operating practice according to which continuously supply waste water to the process tanks and aeration hereof is required to ensure effective biological treatment. If supply is interrupted, the tanks are traditionally emptied, e.g. for cleaning purposes, during longer low load periods, and/or high temperature seasons.

[0024] The inventors have surprisingly found that in contradiction with traditional operating practice, supply can temporarily be interrupted to a second group of process tanks without emptying the tanks which leads to a significant reduction of cost of operation beyond what was expected.

[0025] The actual spare capacity may be determined based on the treatment rate of the sludge. Thus, the actual spare capacity may be determined based on at least one of actual performance of the sludge and the amount of biomass/micro-organisms. Other parameters may also be included, e.g. organic matter and/or nutrients.

[0026] The step of interrupting supply to the second group of process tanks is carried out automatically based on the actual spare capacity. A control system may receive a signal significant for the actual spare capacity, and thus control a valve or a plurality of valves to interrupt supply to the second group of process tanks.

[0027] Determination of the actual spare capacity may follow a predefined time schedule so that the actual spare capacity is determined e.g. every hour. Dependent on the size of the plant and/or the size of the sewer system supplying waste water to the plant, the actual spare capacity may however be determined more frequently or at larger time intervals, such as in intervals in the range of 0.5-6 hours.

[0028] The determination of the actual spare capacity may however change during the day, and/or the season, e.g. by dynamically changing the intervals for the determination e.g. based on recorded changes of the actual spare capacity.

[0029] Supply of the waste water to the second group of process tanks may e.g. be interrupted in up to 10 hours, up to 12-14 hours, up to a day, or even more days.

[0030] The step of interrupting supply to all the process tanks in the second group of process tanks may be carried out simultaneously. Alternatively, the step of interrupting supply to process tanks in the second group of process tanks may be carried out stepwise, e.g. by interrupting supply to the process tanks in the second group one by one, or in pairs comprising two or more process tanks. If the actual spare capacity is further increased, the number of process tanks in the second group is increased, so the number of process tanks in the first group is decreased and adapted to the actual spare capacity.

[0031] When the amount of waste water increases, supply of waste water may be resumed to at least one of the process tanks in the second group. The supply of waste water to at least one of the process tanks of the second group of tanks may thus be based on the actual spare capacity and may additionally be initiated based on a maximum interruption time. In the latter case, the process tanks in the second group may be exchanged so that waste water is supplied to a first group of process tanks based on the actual spare capacity. Resumption of supply to at least one of the process tanks in the second group of process tanks may be carried out automatically based on the actual spare capacity.

[0032] The step of resumption of supply to at least some of the process tanks in the second group of process tanks may be carried out simultaneously. Alternatively, the step of resumption may be carried out stepwise.

[0033] Thus, all process tanks may be back in normal operation with continuous inlet of waste water. When the actual spare capacity again increases, interruption of supply to a second group of process tanks will take place. The process tanks in the second group may be identical to the process tanks in the second group in the previous interruption period or may be different. As the number of process tanks in the second group varies with the actual spare capacity, interruption of supply to some process tanks may be more frequent than interruption of supply to other process tanks.

[0034] In order to ensure a sufficient amount of oxygen for the micro-organism for the biological comprises treatment of the waste water the plant comprises an aeration structure configured for comprises aeration of at least one of the process tanks. The method further comprises a step of interrupting aeration of at least one of the process tanks in the second group, whereby use of electricity can be reduced. The step of interrupting aeration may be performed substantially simultaneous with the step of interrupting supply to the process tanks of the second group of process tanks. Alternative the step of interruption of aeration may be carried out before or after the step of interruption of supply. The order of interruption may e.g. depend on the actual spare capacity, the actual size of the plant, and the plant configuration, such as the number of process tanks and how the tanks are connected.

[0035] As a positive side-effect of interrupting supply to at least one of the process tanks and of interruption the aeration, anaerobic conditions in the tanks in question will be created after a period of interruption. This may promote the growth of bio-P bacteria, which improves removal of bio-P and may further improve the settling properties of the sludge, which reduces the risk of sludge escape from the clarification tanks during high flow.

[0036] To improve conditions for the micro-organisms, aeration of at least one of the process tanks in the second group may be carried out periodically. This may further extend the time period in which supply to the process tank(s) in question is interrupted.

[0037] When the amount of waste water increases, it may be necessary to initiate supply to at least one of the process tanks of the second group again, as the actual spare capacity of the process tanks of the first group may be close or zero or may soon be close to zero. However, in order to prepare the micro-organisms for supply of waste water, aeration of the at least one process tank is initiated before supply of waste water to at least one of the process tanks of the second group of process tanks is initiated.

[0038] Aeration may be initiated based on different forms or forecast information, as described in more details below. The forecast information may be indicative for the actual spare capacity.

[0039] To improve the conditions for micro-organisms, the plant may further comprise a stirring structure configured for stirring of at least one of the process tanks. Thus, the method may further comprise a step of interrupting stirring in at least one of the process tanks in the second group of process tanks, whereby the running costs of the plant may be reduced further. The step of interrupting stirring may be performed substantially simultaneous with the step of interrupting supply to the process tanks of the second group of process tanks, and thus be based on the actual spare capacity. Alternative the step of interrupting stirring may be carried out before or after the step of interruption of supply.

[0040] The plant may further comprise a pumping structure configured for recirculation of at least a part of the treated water from at least one of the process tanks. I.e. treated water may be recirculated from one process tank to another process tank or from one process tank to the same process tank. Thus, the method may further comprise a step of interrupting recirculation from at least one of the process tanks in the second group of process tanks, whereby the running costs of the plant may be reduced further. The step of interrupting recirculation may be performed substantially simultaneous with the step of interrupting supply to the process tanks of the second group of process tanks, and thus be based on the actual spare capacity. Alternative the step of interrupting recirculation may be carried out before or after the step of interruption of supply.

[0041] As supply of waste water vary during day and night, e.g. may be higher during daytime than during nights, the actual spare capacity may additionally be determined based on a time schedule, so that the determination of the actual spare capacity includes predetermination based on time. The time schedule may however be divided into a more fine scale, such as an actual spare capacity being determined for each 8, 6, 4, or even every hour or every half hour.

[0042] In addition to the above, the method may comprise a step of determining a flow of waste water to the plant. Subsequently, the actual spare capacity may additionally be determined based on the determined flow. The flow may be determined directly in the inlet to the plant, or determined by measurements in the sewer system before or after the plant, or may alternatively be determined based on forecast information, or on measurement indicative for the flow.

[0043] In one embodiment, a control system may receive forecast information indicative for the flow, and subsequently the actual spare capacity may be determined including this forecast information. The forecast information may be selected from a group consisting of: information from one or more rain gauges, weather radar, weather forecasts, one or more flow measurements in a sewer system supplying waste water to the plant, and one or more signals from one or more pumping stations. Is should be understood, that additional parameters may also form part of the forecast information.

[0044] The number of parameters forming part of the forecast information may depend on the size of the plant, the size of the sewer system, the age of the plant and/or the sewer system, etc.

[0045] In order to optimise the treatment of waste water, measurements form part of the determination of the actual spare capacity. The method comprises a step of measuring a content of a substance/parameter characterising the process tanks, where the actual spare capacity is determined based on the content. The content is measured in the process tank(s)

[0046] When determining the actual spare capacity on the content of a substance/parameter characterising the process tanks, the substance/parameter is selected from a group consisting of: COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand), TOC (Total Organic Carbon),

[0047] O_2, N, NH_4-N, NH_4-N + NO_3-N, and OUR (Oxygen Uptake Rate).

[0048] To further reduce the running cost, the method may comprise a step of supplying treated water only to a first group of clarification tanks, and a step of interrupting supply to a second group of clarification tanks. The first group of clarifications tank is a subset of the plurality of clarification tanks, whereby a number, such as 1, 2, 3, ... 6, 7 or even more clarification tanks forming part of the second group of clarification tanks are not supplied with treated waste water from the process tank(s).

[0049] The step of supplying treated water only to a first group of clarification tanks, and the step of interrupting supply to a second group of clarification tanks may be based on the actual spare capacity.

[0050] The plant may comprise a sludge scraper structure configured for scraping of at least one of the clarification tanks. In one embodiment, the method may comprise a step of interrupting scraping in at least one of the clarification tanks in the second group of clarification tanks. The step of interrupting scraping may be based on the actual spare capacity. However, other aspects may also be used.

[0051] Furthermore, the plant may comprise a sludge pump configured for pumping sludge from at least one of the clarification tanks. In one embodiment, the method may comprise a step of interrupting pumping from at least one of the clarification tanks in the second group of clarification tanks. The step of interrupting pumping may be based on the actual spare capacity. However, other aspects may also be used.

[0052] The step of interrupting scraping and/or pumping may be performed substantially simultaneous with the step of interrupting supply to the at least one clarification tank of the second group of clarification tanks. Alternative the step of interruption of scraping and/or pumping may be carried out before or after the step of interruption of supply. The order of interruption may e.g. depend on the actual spare capacity, the size of the plant, and the size of the clarification tanks.

[0053] According to a second aspect, the invention provides an activated sludge plant for treatment of waste water according to claim 10.

[0054] The substance/parameter characterising the process tanks is one or more of: COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand), TOC (Total Organic Carbon), O_2, N, NH_4-N, NH_4-N + NO_3-N, and OUR (Oxygen Uptake Rate).

[0055] The control unit may be in data communication with valves and/or pumps and/or other flow controlling units to control supply and interruption of supply to the process tanks.

[0056] It should be understood, that a skilled person would readily recognise that any feature described in combination with the first aspect of the invention could also be combined with the second aspect of the invention, and vice versa.

[0057] The plant according to the second aspect of the invention is very suitable for performing the method steps according to the first aspect of the invention. The remarks set forth above in relation to the method are therefore equally applicable in relation to the plant.

Brief description of the drawings

[0058] Embodiments of the invention will now be further described with reference to the drawings, in which:

Fig. 1 schematically illustrates an activated sludge plant,

Fig. 1a schematically illustrates an alternative embodiment of an activated sludge plant having an alternative layout of a process tank with two different states of operation,

Fig. 2 schematically illustrates an activated sludge plant comprising a plurality of process tanks and a plurality of clarification tanks,

Fig. 3 schematically illustrates an alternative embodiment of an activated sludge plant comprising a plurality of process tanks and a plurality of clarification tanks,

Fig. 4 schematically illustrates an activated sludge plant in which supply is interrupted to a second group of process tanks,

Fig. 5 schematically illustrates an alternative embodiment of an activated sludge plant in which supply is interrupted to a second group of process tanks, and

Fig. 6 schematically illustrates an activated sludge plant in which supply is interrupted to a second group of process tanks, and in which supply of treated water is interrupted to a second group of clarification tanks.

Detailed description of the drawings

[0059] It should be understood that the detailed description and specific examples, while indicating embodiments of the invention, are given by way of illustration only, since various changes and modifications within the spirit and scope of the invention will become apparent to those skilled in the art from this detailed description.

[0060] Fig. 1 schematically illustrates an activated sludge plant 1. The plant 1 comprises a plurality of process tanks 2 (of which only one is illustrated) comprising activated sludge with a treatment rate being variable (not shown). Each process tank 2 has an inlet 3 for receiving waste water and an outlet 4 for supplying treated water to at least one clarification tank 5 (only one is illustrated) for separation into a water fraction and a sludge fraction. The clarification tank 5 of the present embodiment comprises a first outlet 6 for water and a second outlet 7 for water comprising sludge.

[0061] One fraction of the water comprising sludge may be returned to the inlet 3 via the return inlet 7a whereas another fraction comprising excess sludge may be removed via the excess outlet 7b.

[0062] In the present embodiment, the plant 1 comprises an aeration structure 8 configured for aeration of at least one of the process tanks 2 to ensure a sufficient amount of oxygen for the micro-organism for the biological treatment of the waste water.

[0063] Furthermore, the illustrated plant 1 comprises a stirring structure 9 configured for stirring of at least one of the process tanks 2 to improve the conditions for micro-organisms.

[0064] The illustrated plant 1 comprises a sludge scraper structure 10 configured for scraping of at least one of the clarification tanks 5, and a sludge pump 11 configured for pumping sludge from at least one of the clarification tanks 2.

[0065] Treatment of waste water in the plant 1 comprises at least the steps of determining an actual spare capacity indicating an amount of waste water which can be added to and treated in the activated sludge plant 1, supplying waste water only to a first group (see Figs. 4 and 5) of process tanks 2, the first group of process tanks 2 being a subset of the plurality of process tanks, wherein the number of process tanks in the first group is determined based on the actual spare capacity, and automatically interrupting supply to a second group (see Figs. 4 and 5) of process tanks 2 based on the actual spare capacity.

[0066] Supply and interruption of supply to the first and second groups of process tanks may be controlled by a control unit 12 which it configured for communication with a number of valves 13, 14 configured to interrupt supply to at least one process tank 2 and at least one clarification tank 5, respectively, by closing said valve. Supply may be resumed by opening of the valve 13, 14 and may be controlled by the control unit 12.

[0067] The activated sludge plant 1 further comprises a pumping structure 15 configured for recirculation of at least a part of the treated water from at least one of the process tanks 2.

[0068] Fig. 1a illustrates part of an alternative embodiment of an activated sludge plant 1 in which the process tank 2 is divided into two parts - P1' and P1". The two parts are connected to allow alternating supply to the process tank parts P1' and P1". In the upper part of Fig. 1a, waste water is initially lead to process tank part P1', and from here waste water is subsequently lead to process tank part P1" for further treatment. After treatment in the process tanks 2, treated water is lead to the clarification tank 5 marked C1. In the lower part of Fig. 1a, waste water is initially lead to process tank part P1". Whether process tank part P1 or P2 is selected as the initial tank is controlled by the switching mechanism 16. To ensure that the treated water has passed both parts of the process tank 2 before being lead to the clarification tank C1, the weir 17 is opened and closed in dependency of the switching mechanism 16. The two states of operation are performed in a periodic automatic cycles over some hours.

[0069] Fig. 2 schematically illustrates an activated sludge plant 1 comprising a plurality of process tanks 2 and a plurality of clarification tanks 5. In the present embodiment the number of process tanks 2 equals the number of clarification tanks 5. The process tanks 2 are numbered from P1 to PN, whereas the clarification tanks 5 are numbered from C1 to CN. Each process tank 2 has an outlet 4 for supplying treated water to a corresponding clarification tank 5.

[0070] Fig. 3 schematically illustrates an alternative embodiment of an activated sludge plant 1 comprising a plurality of process tanks 2 and a plurality of clarification tanks 5. In the present embodiment the number of process tanks 2 equals the number of clarification tanks 5. The process tanks 2 are numbered from P1 to PN, whereas the clarification tanks 5 are numbered from C1 to CN. Each process tank 2 has an outlet 4 for supplying treated water to the clarification tanks 5 via a common fluid connection 18.

[0071] In the illustrated embodiment, the number of process tanks 2 equals the number of clarification tanks 5, i.e. a total of N of each type of tank. It should however be understood, that the number may be different, so that the plant 1 may e.g. comprises N process tanks and M clarification tanks.

[0072] Fig. 4 schematically illustrates an activated sludge plant 1 in which supply is interrupted to a second group of process tanks 2. The second group of process tanks comprises the process tanks numbered P3 and P4. The interruption is illustrated by the cross 19. Due to the direct connection between each process tank 2 and a corresponding clarification tank 5, supply to the corresponding clarification tanks C3 and C4 is also interrupted.

[0073] Fig. 5 schematically illustrates an activated sludge plant 1 in which supply is interrupted to a second group of process tanks 2. The second group of process tanks comprises the process tanks numbered P2 and P3. The interruption is illustrated by the cross 19.

[0074] Fig. 6 schematically illustrates an activated sludge plant 1 in which supply of treated water is further interrupted to a second group of clarification tanks 5. Interruption of supply to the process tanks 2 numbered P2 and P3 is illustrated by the cross 19, whereas interruption of supply to the clarification tanks 5 numbered C1 and C2 is illustrated by the cross 20.

REFERENCES CITED IN THE DESCRIPTION

Patent documents cited in the description

- DE2304804 **[0006]**
- WO9317974A **[0007]**
- US5795481A **[0008]**
- US5332502A **[0009]**
- EP2426090A **[0010]**

PATENTKRAV

1. Fremgangsmåde til behandling af spildevand i et aktivt slamanlæg, hvor anlægget omfatter en flerhed af procestanke omfattende aktivt slam med en behandlingshastighed, der er variabel, hvor hver procestank har et indløb for modtagelse af spildevand og et udløb for tilførsel af behandlet vand til mindst en klaringstank til separation i en vandfraktion og en slamfraktion, en beluftningsstruktur konfigureret til beluftning af mindst en af procestankene og en styreenhed, hvilken fremgangsmåde omfatter trinnene:

- måling af et indhold af et stof/en parameter, der karakteriserer procestankene ved målinger i procestankene, hvor stoffet/parameteren er en eller flere af: COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand), TOC (Total Organic Carbon), O_2, N, NH_4-N, NH_4-N + NO_3-N og OUR (oxygenoptagelseshastighed) ved anvendelse af mindst en sensor konfigureret til at måle indholdet af stoffet/parameteren,

- bestemmelse af en faktisk ledig kapacitet, der angiver en mængde spildevand, der kan tilføjes og behandles i det aktive slamanlæg, hvor den faktiske ledige kapacitet bestemmes på baggrund af det målte indhold af stoffet/parameteren, der karakteriserer procestankene, hvor den faktiske ledige kapacitet bestemmes af styreenheden,

- forsyning af spildevand kun til en første gruppe af procestanke, hvor den første gruppe af procestanke er en delmængde af flerheden af procestanke, hvor antallet af procestanke i den første gruppe bestemmes på baggrund af den faktiske ledige kapacitet, hvor forsyningen styres af styreenheden, og

- automatisk midlertidig afbrydelse af forsyningen til en anden gruppe af procestanke baseret på den faktiske ledige kapacitet uden at tømme tankene, idet forsyningen styres af styreenheden,

hvor fremgangsmåden yderligere omfatter et trin med afbrydelse af beluftning til mindst en af procestankene i den anden gruppe og et trin til at igangsætte beluftning af den mindst ene procestank, før tilførsel af spildevand til mindst en af procestankene i den anden gruppe procestanke initieres.

2. Fremgangsmåde ifølge krav 1, hvor den faktiske ledige kapacitet bestemmes baseret på behandlingshastigheden af slammet.

3. Fremgangsmåde ifølge krav 1 eller 2, hvor trinnet med at afbryde forsyningen til alle procestanke i den anden gruppe af procestanke udføres samtidigt.

4. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor beluftning af mindst en af procestankene i den anden gruppe udføres periodisk.

5. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, hvor den faktiske ledige kapacitet yderligere bestemmes baseret på en tidsplan.

6. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, yderligere omfattende et trin til bestemmelse af et flow af spildevand til anlægget, hvor antallet af procestanke i den første gruppe yderligere bestemmes baseret på flowet.

7. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, yderligere omfattende et trin til modtagelse af prognoseinformation, hvor antallet af procestanke i den første gruppe yderligere bestemmes på basis af prognoseinformationen.

8. Fremgangsmåde ifølge krav 7, hvor prognoseinformationen er valgt fra en gruppe bestående af: information fra en eller flere regnmålere, vejrradar, vejrudsigter, en eller flere flowmålinger i et kloaksystem, der leverer spildevand til anlægget, og et eller flere signaler fra en eller flere pumpestationer.

9. Fremgangsmåde ifølge et hvilket som helst af de foregående krav, yderligere omfattende et trin til kun at forsyne behandlet vand til en første gruppe af klaringstanke, hvor den første gruppe af klaringstanke er en delmængde af flerheden af klaringstanke og et trin til at afbryde forsyningen til en anden gruppe af klaringstanke.

10. Aktivt slamanlæg til behandling af spildevand, anlægget omfatter:

- en flerhed af procestanke omfattende aktivt slam;

- mindst en sensor konfigureret til at måle i procestankene et indhold af et stof/parameter, der karakteriserer procestankene, hvor stoffet/parameteren er en eller flere af: COD (Chemical Oxygen Demand), BOD (Biochemical Oxygen Demand), TOC (Total Organic Carbon), O_2, N, NH_4-N, NH_4-N + NO_3-N og OUR (oxygenoptagelseshastighed);

- mindst en klaringstank til separation i en vandfraktion og en slamfraktion, hvor hver procestank har et indløb for modtagelse af spildevand og et udløb for tilførsel af behandlet vand til mindst en klaringstank; og

- en beluftningsstruktur konfigureret til beluftning af mindst en af procestankene;

hvor anlægget yderligere omfatter en styreenhed konfigureret til:

- bestemmelse af en faktisk ledig kapacitet, der angiver en mængde spildevand, der kan tilføjes og behandles i det aktive slamanlæg, idet bestemmelsen er baseret på målinger af indholdet af stoffet/parameteren, der karakteriserer procestankene,

- at styre en forsyning af spildevand kun til en første gruppe af procestanke, hvor den første gruppe af procestanke er en delmængde af flerheden af procestankene, hvor antallet af procestanke i den første gruppe bestemmes baseret på den faktiske ledige kapacitet,

- automatisk styring af midlertidig afbrydelse af forsyningen til en anden gruppe af procestanke baseret på den faktiske ledige kapacitet uden at tømme tankene, og

- afbrydelse af beluftning til mindst en af procestankene i den anden gruppe og igangsættelse af beluftning af den mindst ene procestank inden tilførsel af spildevand til mindst en af procestankene i den anden gruppe af procestanke initieres.

DRAWINGS

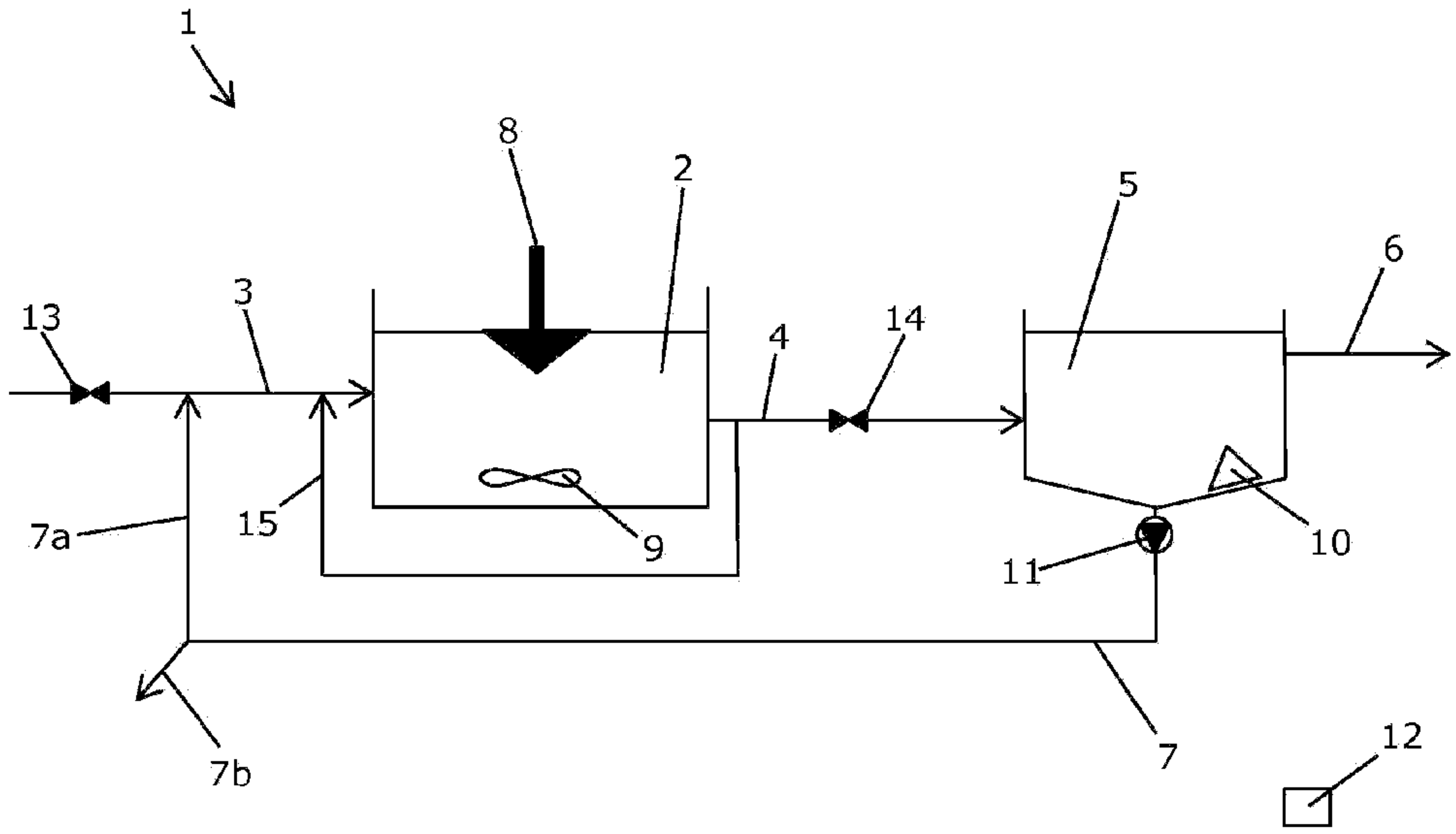

Fig. 1

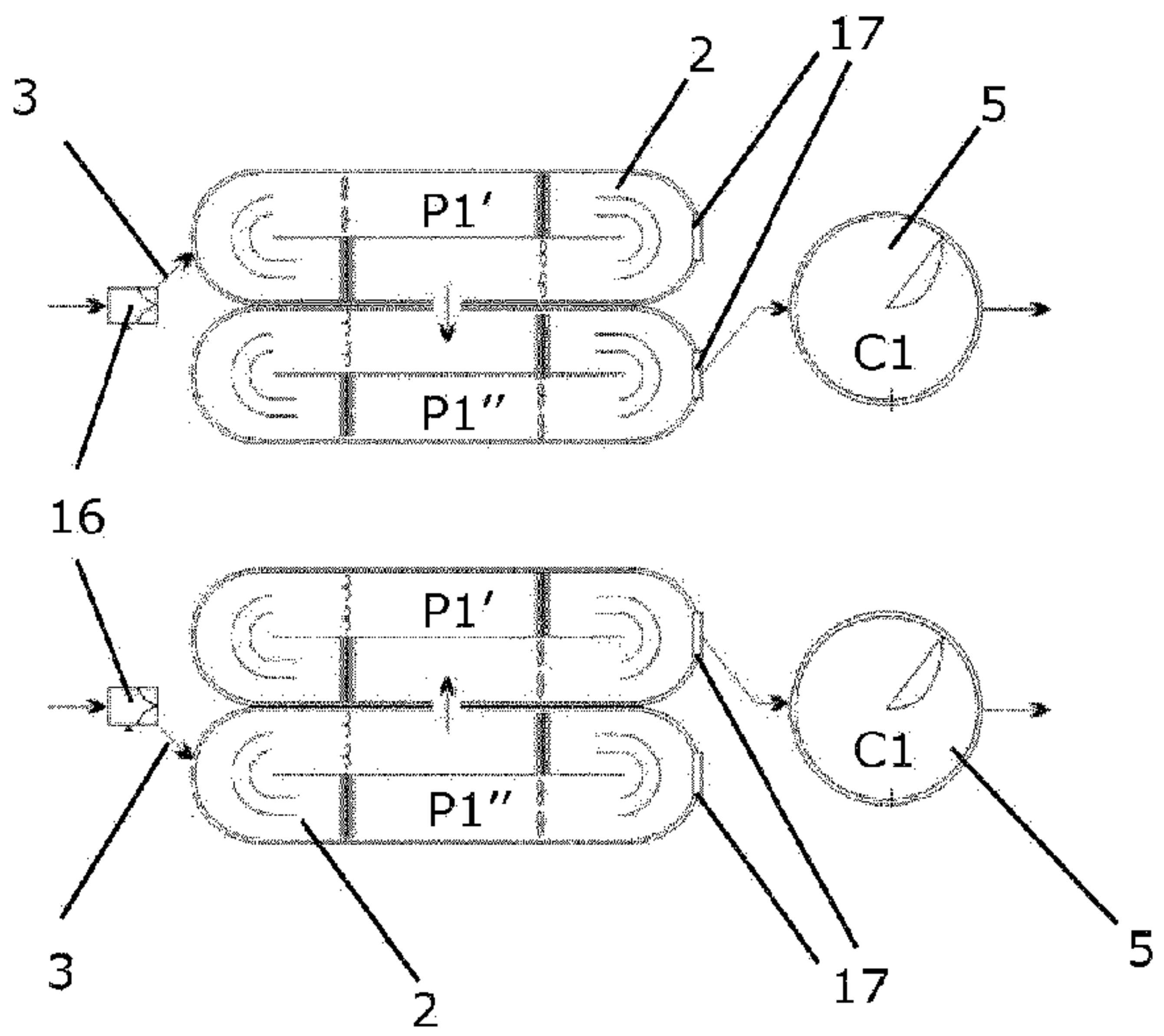

Fig. 1a

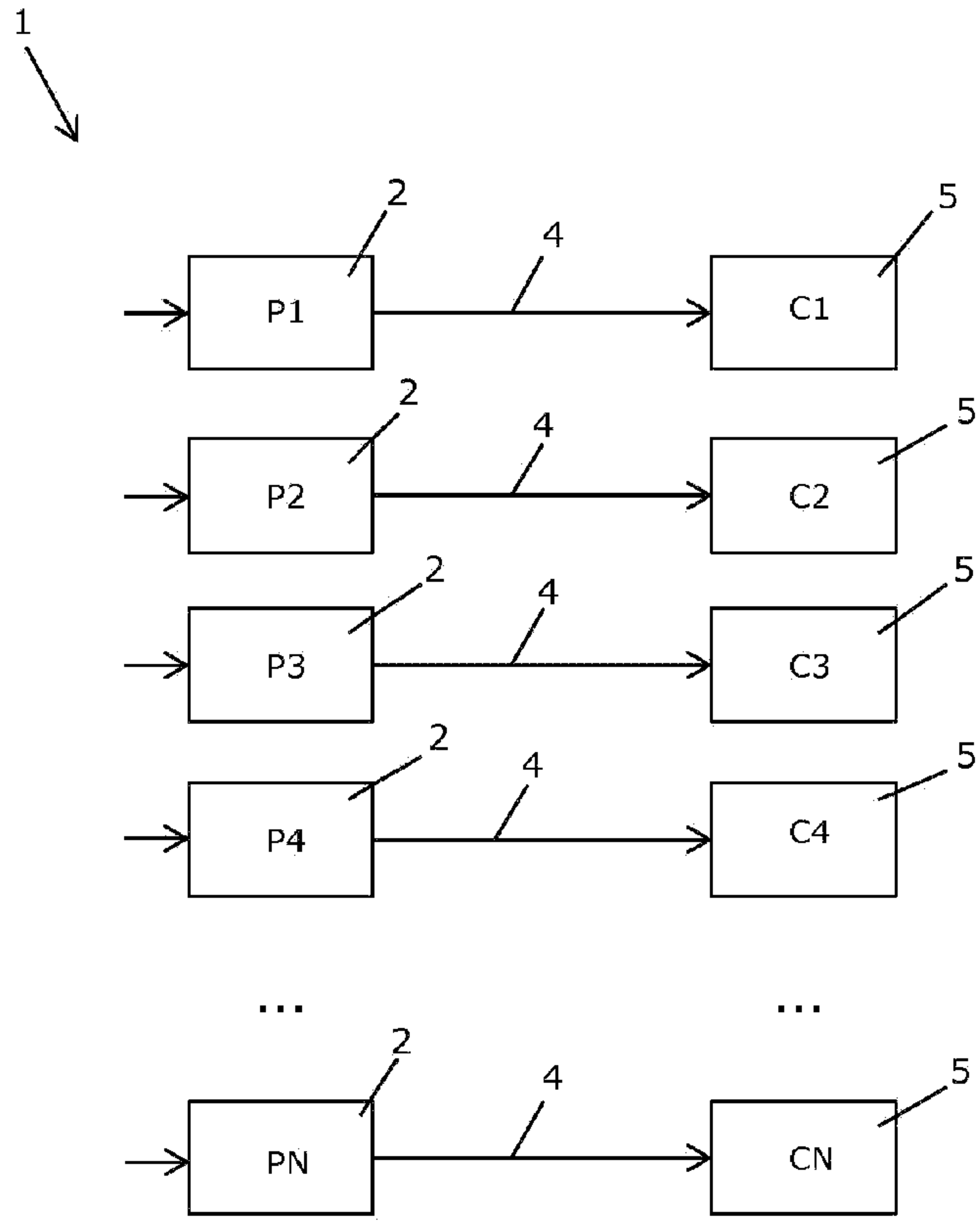

Fig. 2

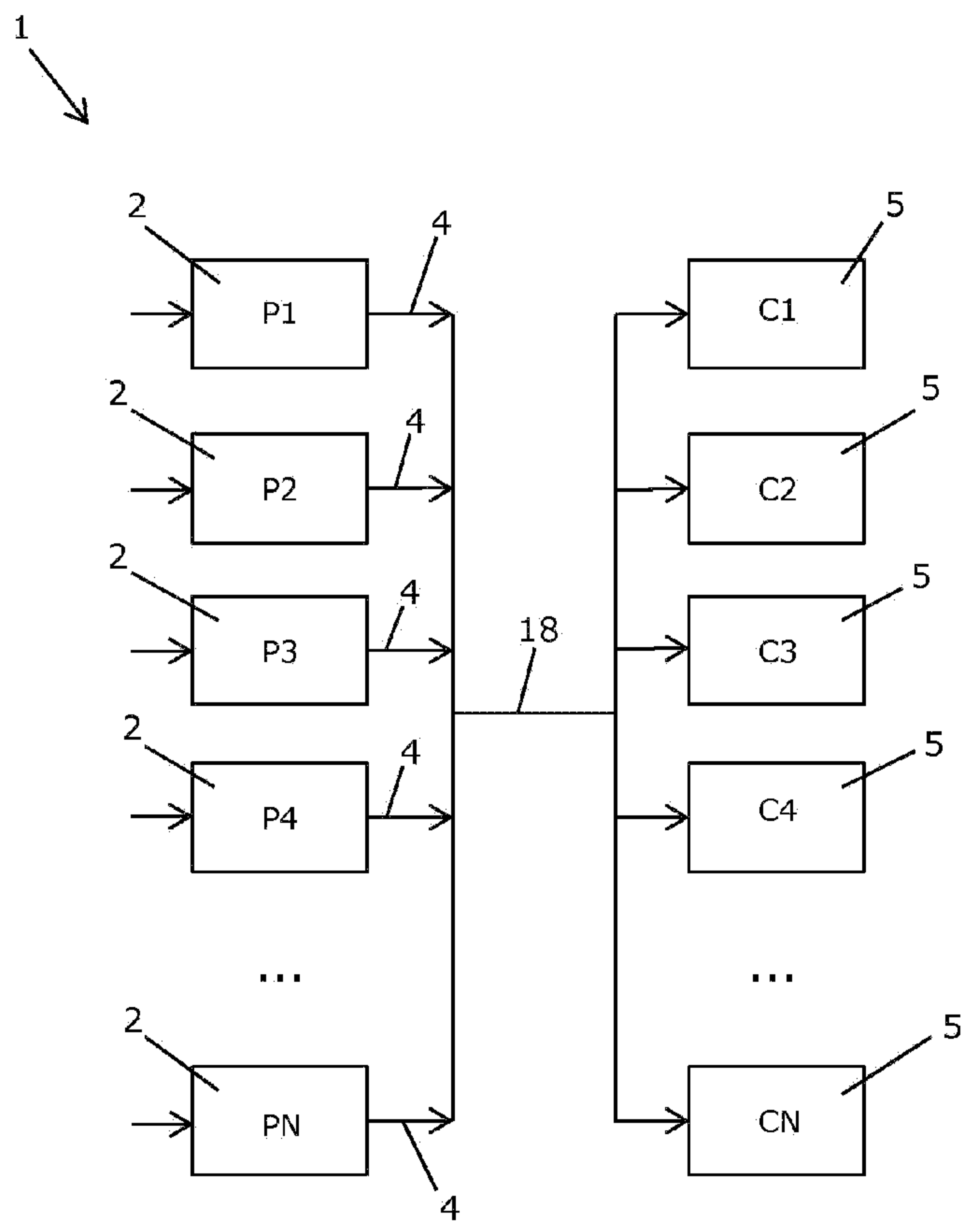

Fig. 3

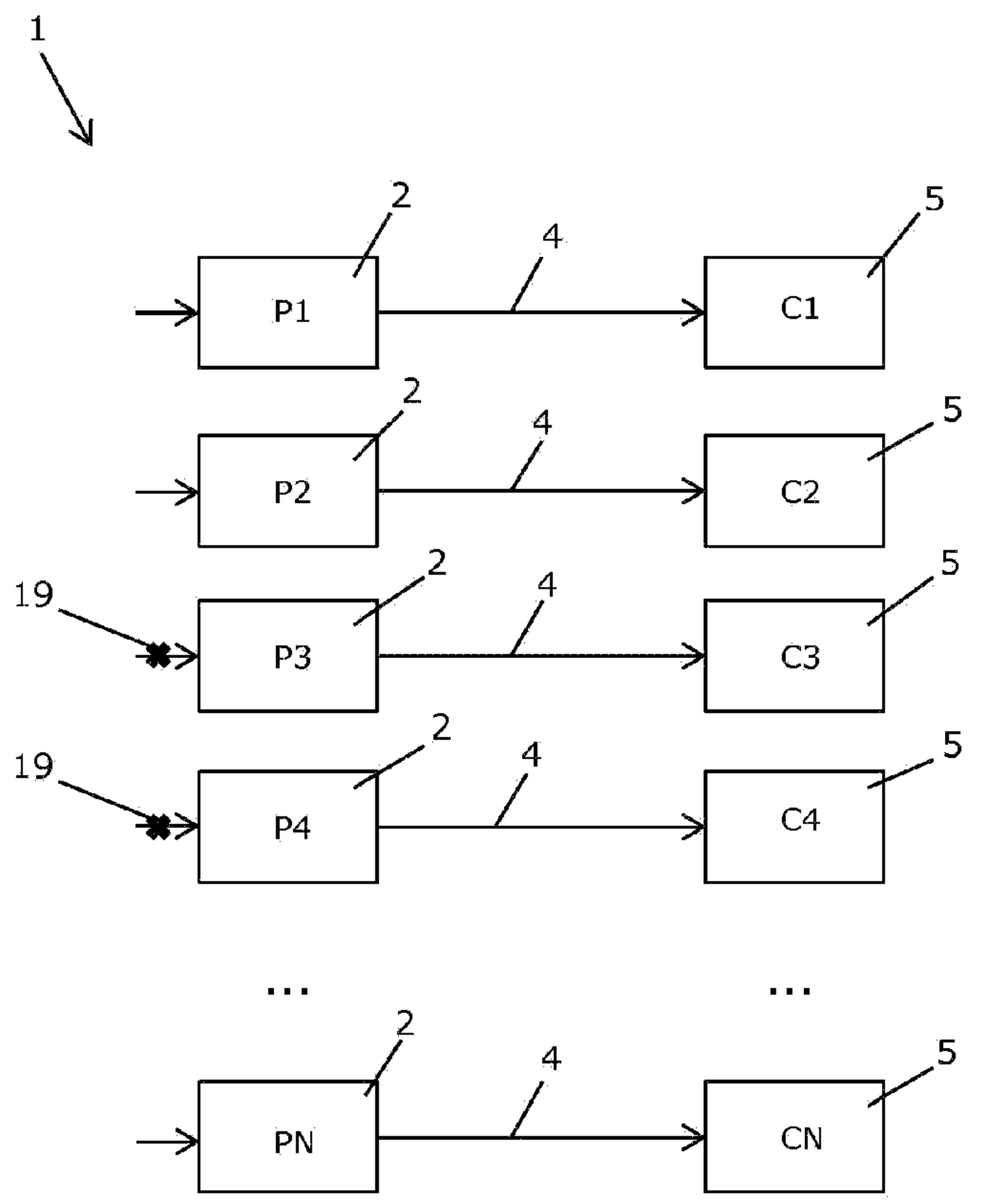

Fig. 4

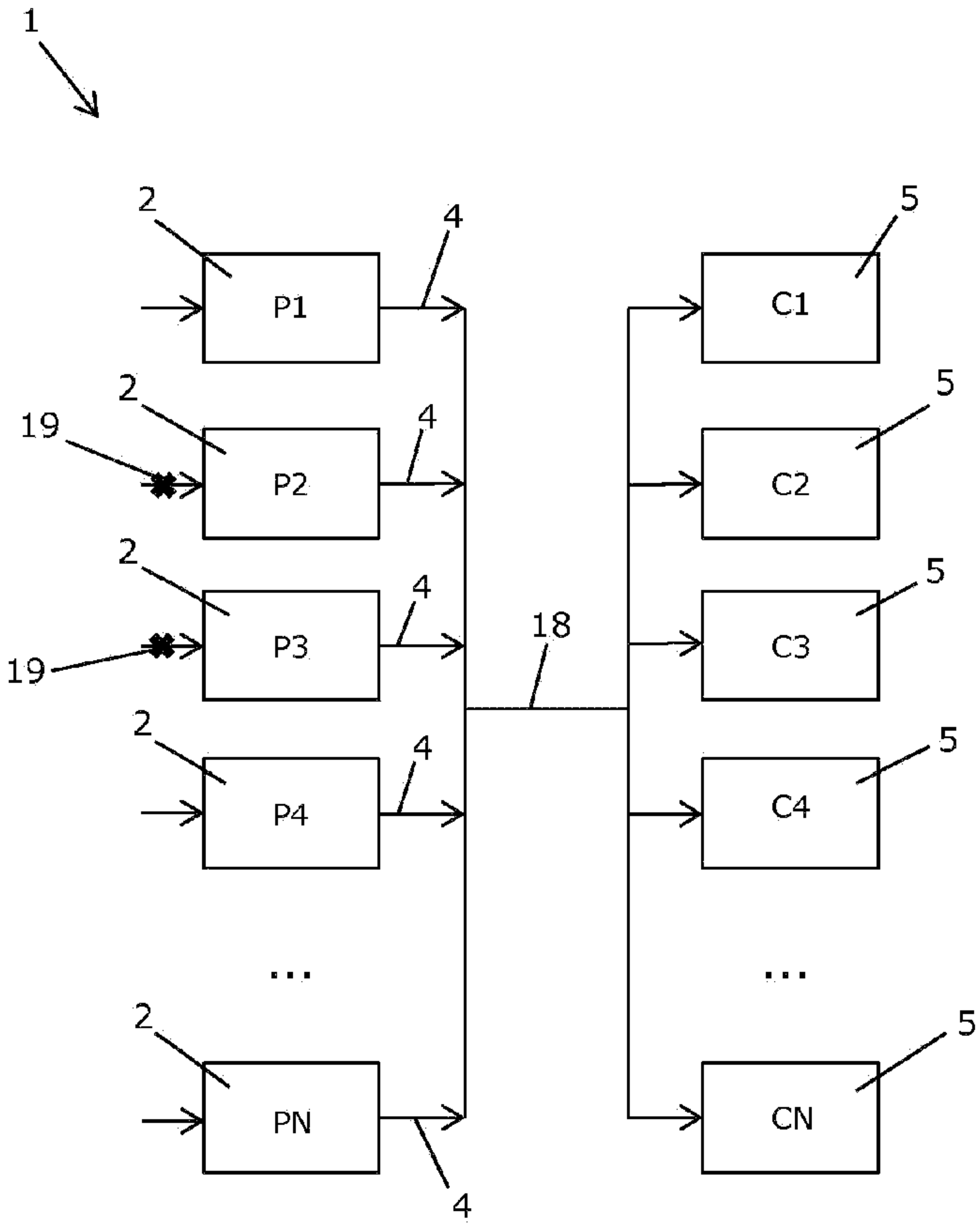

Fig. 5

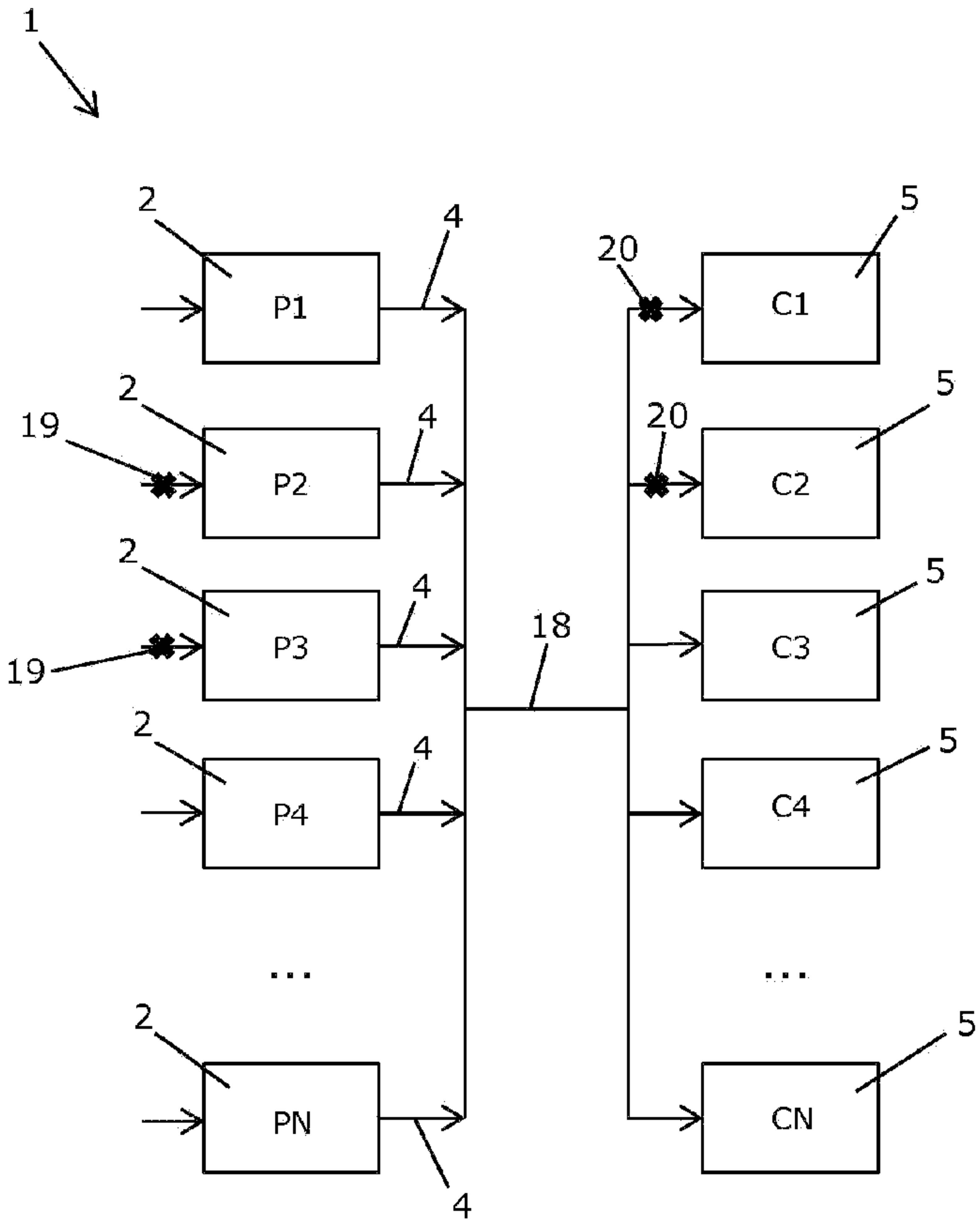

Fig. 6