(19) DANMARK

(10) **DK/EP 3016272 T3**

Patent- og
Varemærkestyrelsen

(12) Oversættelse af
europæisk patentskrift

(51) Int.Cl.: ***H 02 P 9/04 (2006.01)*** ***F 03 D 7/02 (2006.01)*** ***H 02 P 25/22 (2006.01)***

(45) Oversættelsen bekendtgjort den: **2020-08-10**

(80) Dato for Den Europæiske Patentmyndigheds
bekendtgørelse om meddelelse af patentet: **2020-05-27**

(86) Europæisk ansøgning nr.: **14191070.3**

(86) Europæisk indleveringsdag: **2014-10-30**

(87) Den europæiske ansøgnings publiceringsdag: **2016-05-04**

(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**

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(54) Benævnelse: **Styring af energistrøm fra en elektrisk maskine med ubalanceret impedans**

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# DESCRIPTION

## Field of invention

**[0001]** The present invention relates to the field of wind turbines, more particular to the field of permanent magnet machines.

## Art Background

**[0002]** In most electrical alternating current machines, impedance is balanced. Thus, machine impedance is equal for different phases. However, machine impedance may be unbalanced in some special electrical machines.

**[0003]** For example, in order to achieve redundancy especially for off-shore wind turbines, generators with multiple three-phase winding are used for big wind turbines. Each set of three-phase winding may have a separately controlled frequency converter. With this kind of set up, a wind turbine can still produce electricity as long as at least one set of winding and its converter is in a good condition, even if all other windings and converters are broken. For a machine with multiple three-phase windings, mutual inductance between windings may change after one winding or its converter is broken. This causes an unbalanced impedance from the remaining windings. An unbalanced impedance may cause an unbalanced current or voltage at a machine stator and/or a converter. Due to unbalanced voltage and/or current, the stator power of the generator for example may have a harmonic at two times of the electrical frequency of the generator. As normally a bandwidth of a DC link voltage control loop is lower than this frequency, the balance of a grid power and the generator power cannot be achieved in such a situation. The harmonic in the stator power may cause a harmonic voltage at a same frequency at DC link capacitors of the frequency converter. The DC link voltage waveform in such a situation may comprise unwanted harmonics, which are not preferred, because a high harmonic at the DC link voltage may cause an over-modulation of the frequency converter and eventually trips the frequency converter.

**[0004]** Zhou et al. ("operation of grid-connected DFIG under unbalanced grid voltage condition"; IEEE transactions on energy conversion, IEEE service center, Piscataway, NJ, US; vol. 24, no. 1; 2009; pages 240-246) describes an operation of a grid-connected doubly-fed induction generator under unbalanced grid voltage condition. Hereby, Zhou et al. describes that reference currents of a grid VSC are calculated from a DC link voltage.

**[0005]** Blaabjerg et al. describes an "overview of control and grid synchronization for distributed power generation systems" (IEEE transactions on industrial electronics; vol. 53, no. 5; 2006; pages 1398-1409).

**[0006]** EP 2 546 969 A1 describes a method of controlling a frequency converter with a rectifier (AC to DC) and an inverter (DC to AC) which is connected via a DC link to the rectifier. Furthermore, the frequency converter comprises a rectifier controller and an inverter controller.

**[0007]** Mishra et al. describes "a fast-acting DC-link voltage controller for three-phase DSTATCOM to compensate AC and DC loads" (IEEE transactions on power delivery, IEEE service center New York, NY, US; vol. 24; no. 4; 2009; pages 2291-2299).

**[0008]** Hence, there is a need for driving an electrical machine with an unbalanced impedance.

## Summary of the Invention

**[0009]** This need may be met by the subject matter according to the independent claim. Advantageous embodiments of the present invention are described by the dependent claims.

**[0010]** Therefore, according to the invention there is provided a method for controlling an energy flow from an electrical alternating current machine, in particular an electrical alternating current generator of a wind turbine, with unbalanced impedance to a grid, wherein the machine comprises multiple three-phase windings, wherein the machine impedance is not equal for different phases, and/or wherein a mutual inductance between windings changed after one winding or its converter is broken. The method comprising:

1. i) obtaining a first power signal (P1) representing a first power command,
2. ii) obtaining a second power signal (P2) representing a second power command,
3. iii) obtaining a first current signal (I1) indicative for a feedback current from the electrical alternating current generator,
4. iv) obtaining a second current signal (I2) indicative for a feedback current from a grid converter,
5. v) determining a first internal signal (int1) as a result from a first current reference calculation procedure (crc1) making use of the first power signal (P1), the first internal signal (int1) corresponding to a current command for the electrical alternating current machine,
6. vi) determining a second internal signal (int2) as a result from a second current reference calculation procedure (crc2) making use of the second power signal (P2), the second internal signal (int2) corresponding to a current command for the grid converter,
7. vii) determining a first output signal (OUT1) as a result from a first current controller procedure (cc1) making use of the first current signal (I1) and the first internal signal (intl), the first output signal (OUT1) representing a voltage command for a first axle of a machine synchronous rotating frame, the voltage command for the first axle being applicable for controlling the energy flow from the electrical alternating current machine, and
8. viii) determining a second output signal (OUT2) as a result from a second current controller procedure (cc2) making use of the second current signal (I2), the second

internal signal (int2) and a compensation calculation procedure, the second output signal (OUT2) representing a voltage command for a second axle of a grid synchronous rotating frame, the voltage command for the second axle being applicable for controlling the energy flow from the electrical alternating current machine. The method further comprises:

9. ix) obtaining a voltage signal (V1) indicative for a direct current link voltage, and
10. x) obtaining a reference voltage signal (V2) indicative for a direct current link voltage reference,
11. xi) performing a direct current link procedure (dc1) making use of the voltage signal (V1) and the reference voltage signal (V2). Hereby, obtaining the second power signal (P2) comprises making use of the direct current link procedure (dcl), and the method moreover comprises :
12. xii) determining a fourth power signal (P4) by a compensation power calculation procedure (cpc) for calculating a power compensation value, wherein the compensation power calculation procedure (cpc) corresponds to the compensation calculation procedure, and xiii) obtaining the second power signal (P2) by adding the fourth power signal (P4) to a result from the direct current link procedure (dcl).

**[0011]** The compensation power calculation procedure (cpc) comprises: receiving a result from a filter procedure (f) for filtering the reference voltage signal (V2), receiving a result from a resonant regulator procedure (rr) for regulating the result from the filter procedure (f), receiving a result from a power calculation procedure (pc) for calculating a power from the result from the resonant regulator procedure (rr), and receiving the fourth power signal (P4) from a gain-phase-compensation procedure (gpc) for compensating a gain and/or phase of the result from the power calculation procedure (pc). Hereby, the gain-phase compensation procedure includes providing a compensation of the gain phase differences between generator power and grid power.

**[0012]** The advantage of this concept is that it may allow for a post-fault operation of a multi-winding alternating current generator/turbine.

**[0013]** This aspect of the invention is based on the idea that by regulating the energy transfer from the alternating current machine to the grid, a multi-winding alternating current machine may be connected to the grid without stressing the grid in the case of an unbalanced impedance of the machine.

**[0014]** According to an embodiment of the invention the first internal signal is corresponding to the current command for the first axle of the synchronous rotating frame. The second internal signal is corresponding to the current command for the second axle of the synchronous rotating frame. The first current signal is indicative for the feedback current for the first axle of the synchronous rotating frame. And the second current signal is indicative for the feedback current for the second axle of the synchronous rotating frame.

**[0015]** According to a further embodiment of the invention, the first output signal is serving as a first input signal to a pulse-width-modulation procedure. And the second output signal is serving as a second input signal to the pulse-width-modulation procedure.

**[0016]** According to a first aspect for providing a better understanding of the disclosure which does not form part of the scope of protection there is provided an arrangement for controlling the operation of an electrical alternating current machine with unbalanced impedance, in particular an electrical alternating current generator of a wind turbine, the arrangement being configured for performing a method according to any one of the preceding embodiments of the invention. The advantage of this concept is that it may allow for a post-fault operation of a multi-winding alternating current generator/turbine.

**[0017]** This first aspect of the disclosure is based on the idea that by providing an energy regulation circuit to the machine, the energy transfer from the alternating current machine to the grid may be provided without stressing the grid in the case of an unbalanced impedance of the machine.

**[0018]** According to a further embodiment of the disclosure which does not form part of the scope of protection the arrangement comprises a compensation power calculation unit for calculating a compensation power command of a grid converter based on at least one value, wherein the value is chosen from a value group. The values of the value group are respectively representing a DC link voltage, a generator power, a generator torque, a generator current or a generator voltage. The compensation power command is a harmonic with a frequency proportional to an electrical frequency of the electrical alternating current generator. The arrangement moreover comprises a grid power reference and/or a grid power command from either a turbine controller or a DC link voltage controller; and a summation element configured for adding the compensation power command to the grid power reference and/or the grid power command, in order to achieve a grid power command control signal. Moreover, the arrangement comprises a power controller, the power controller being adapted for allowing a grid power to follow the grid power command signal.

**[0019]** According to a further embodiment of the disclosure which does not form part of the scope of protection the arrangement comprises a compensation current calculation unit for calculating a compensation current command of the grid converter based on at least a value, wherein the value is chosen from the value group. The compensation current is a harmonic with a frequency proportional to the electrical frequency of the generator. The arrangement moreover comprises a grid active current reference and/or a grid active current command. Therein, the grid active current reference and/or the grid active current command each are received from the DC link voltage controller and/or a calculation unit. The arrangement moreover comprises a summation element configured for adding a current command in order to achieve a grid active current command control signal. Moreover, the arrangement comprises a current controller, the current controller being adapted for allowing a current to follow the grid active current command control signal.

**[0020]** The calculation unit according to the disclosure which does not form part of the scope of protection may be for example a Grid fault ride-through.

**[0021]** According to a second aspect for providing a better understanding of the disclosure which does not form part of the scope of protection there is provided a computer program for processing a physical object according to any one of the preceding embodiments of the second aspect of the invention, the computer program, when being executed by a data processor, is adapted for controlling and/or for carrying out the method as set forth in any one of the preceding embodiments of the first aspect of the invention.

**[0022]** This aspect of the disclosure which does not form part of the scope of protection is based on the idea that the control method for the energy transfer from the machine to the grid may be provided in a very flexible way.

**[0023]** It has to be noted that embodiments of the invention have been described with reference to different subject matters. In particular, some embodiments have been described with reference to method type claims whereas other embodiments have been described with reference to apparatus type claims. However, a person skilled in the art will gather from the above and the following description that, unless other notified, in addition to any combination of features belonging to one type of subject matter also any combination between features relating to different subject matters, in particular between features of the method type claims and features of the apparatus type claims is considered as to be disclosed with this document.

**[0024]** The aspects defined above and further aspects of the present invention are apparent from the examples of embodiment to be described hereinafter and are explained with reference to the examples of embodiment. The invention will be described in more detail hereinafter with reference to examples of embodiment but to which the invention as defined in the annexed independent claim is not limited.

## Brief Description of the Drawing

**[0025]**

Figure 1 shows a schematically drawing of a proposed method according to an exemplary embodiment for providing a better understanding of the invention.

Figure 2 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.

Figure 3 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.

Figure 4 shows a schematically drawing of a proposed method according to another exemplary embodiment of the invention.

Figure 5 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.

Figure 6 shows a schematically drawing of a proposed compensation power/current calculation procedure according to an exemplary embodiment for providing a better understanding of the invention.

Figure 7 shows a schematically drawing of a proposed regulation block procedure of the compensation power/current calculation procedure of Figure 6 according to an exemplary embodiment for providing a better understanding of the invention.

Figure 8 shows a schematically drawing of a proposed regulation block procedure of the compensation power/current calculation procedure of Figure 6 according to another exemplary embodiment of the invention.

## Detailed Description

**[0026]** The illustration in the drawing is schematically. It is noted that in different figures, similar or identical elements or features are provided with the same reference signs or with reference signs, which are different from the corresponding reference signs only within the first digit. In order to avoid unnecessary repetitions elements or features which have already been elucidated with respect to a previously described embodiment are not elucidated again at a later position of the description.

**[0027]** Figure 1 shows a schematically drawing of a proposed method according to an exemplary embodiment for providing a better understanding of the invention.
In figure 1 is shown a method for controlling an energy flow to a grid, from an electrical alternating current machine with unbalanced impedance, in particular an electrical alternating current generator of a wind turbine, the method comprising: obtaining a first power signal P1 representing a first power command; obtaining a second power signal P2 representing a second power command; obtaining a first current signal I1 indicative for a feedback current from the electrical alternating current generator; obtaining a second current signal 12 indicative for a feedback current from a grid converter; determining a first internal signal int1 as a result from a first current reference calculation procedure crc1 making use of the first power signal P1, the first internal signal int1 corresponding to a current command for the electrical alternating current machine; determining a second internal signal int2 as a result from a second current reference calculation procedure crc2 making use of the second power signal P2, the second internal signal int2 corresponding to a current command for the grid converter; determining a first output signal OUT1 as a result from a first current controller procedure cc1 making use of the first current signal I1 and the first internal signal intl, the first output signal OUT1 representing a voltage command for a first axle of a machine synchronous rotating frame, the voltage command for the first axle being applicable for controlling the energy flow

from the electrical alternating current machine to the grid; and determining a second output signal OUT2 as a result from a second current controller procedure cc2 making use of the second current signal 12, the second internal signal int2 and a compensation calculation procedure, the second output signal OUT2 representing a voltage command for a second axle of the grid synchronous rotating frame, the voltage command for the second axle being applicable for controlling the energy flow from the electrical alternating current machine to the grid.

**[0028]** Figures 2, 3 and 5 each show another embodiment for providing a better understanding of the invention and figure 4 shows an exemplary embodiment according to the invention of the provided method shown in Figure 1 according to exemplary embodiments of the invention.

**[0029]** Therein, obtaining the first power signal P1 or obtaining the second power signal P2 comprises: making use of a direct current link procedure dcl.

**[0030]** Moreover, the illustrated methods of Figures 2 to 5 each comprise: obtaining a voltage signal V1 indicative for a direct current link voltage; obtaining a reference voltage signal V2 indicative for a direct current link voltage reference; and the direct current link procedure dcl making use of the voltage signal V1 and the reference voltage signal V2.

**[0031]** Therein, the first internal signal int1 is corresponding to the current command for the first axle of the synchronous rotating frame. The second internal signal int2 is corresponding to the current command for the second axle of the synchronous rotating frame. The first current signal I1 is indicative for the feedback current for the first axle of the synchronous rotating frame. And the second current signal 12 is indicative for the feedback current for the second axle of the synchronous rotating frame.

**[0032]** Moreover, the first output signal OUT1 is serving as a first input signal to a pulse-width-modulation procedure, and the second output signal OUT2 is serving as a second input signal to the pulse-width-modulation procedure.

**[0033]** Figure 2 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.

**[0034]** In Figure 2, if obtaining the first power signal P1 comprises making use of the direct current link procedure dcl, the method moreover comprises: obtaining the first power signal P1 as a result from the direct current link procedure dcl; obtaining a third power signal P3 representing an operational condition of the electrical alternating current machine; determining a fourth power signal P4 by a compensation power calculation procedure cpc for calculating a power compensation value; and obtaining the second power signal P2 by adding the third power signal P3 to the fourth power signal P4.

**[0035]** Figure 3 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.

**[0036]** In Figure 3, if obtaining the first power signal P1 comprises making use of the direct current link procedure dcl, the method moreover comprises: obtaining the first power signal P1 as a result from the direct current link procedure dcl, the second power signal P2 corresponding to a third power signal P3 representing an operational condition of the electrical alternating current machine; receiving a further result from the second current reference calculation procedure crc2 making use of the second power signal P2; determining a third current signal 13 by a compensation current calculation procedure ccc, the third current signal 13 representing a compensation current; and determining a forth internal signal int4 by adding the third current signal 13 to the further result from the second current reference calculation procedure crc2. Therein, the second current controller procedure cc2 moreover is making use of the third internal signal int3.

**[0037]** Figure 4 shows a schematically drawing of a proposed method according to an exemplary embodiment of the invention. In Figure 4, if obtaining the second power signal P2 comprises making use of the direct current link procedure dcl, the method moreover comprises: the first power signal P1 corresponding to a third power signal P3 representing an operational condition of the electrical alternating current machine; determining a fourth power signal P4 by a compensation power calculation procedure cpc for calculating a power compensation value; and obtaining the second power signal P2 by adding the fourth power signal P4 to a result from the direct current link procedure dcl.

**[0038]** Figure 5 shows a schematically drawing of a proposed method according to another exemplary embodiment for providing a better understanding of the invention.
In Figure 5, if obtaining the second power signal P2 comprises making use of the direct current link procedure dcl, the method moreover comprises: the first power signal P1 corresponding to a third power signal P3 representing an operational condition of the electrical alternating current machine; obtaining the second power signal P2 as a result from the direct current link procedure dcl; receiving a further result from the second current reference calculation procedure crc2 making use of the second power signal P2; determining a third current signal 13 by a compensation current calculation procedure ccc, third current signal 13 representing a compensation current; and determining a forth internal signal int4 by adding the third current signal 13 to the further result from the second current reference calculation procedure crc2. Therein, the second current controller procedure cc2 moreover is making use of the third internal signal int3.

**[0039]** Figure 6 shows a schematically drawing of a proposed compensation power/current calculation procedure according to an exemplary embodiment for providing a better understanding of the invention.
In Figure 6 the compensation power calculation procedure cpc comprises: obtaining a frequency signal w indicative for a frequency of the electrical alternating current machine, and/or obtaining the second voltage signal V2; and receiving the fourth power signal P4 and/or the third current signal 13 from a gain-phase-compensation procedure gpc for compensating a gain and/or phase from the result from a regulation block procedure.

**[0040]** Figures 7 shows another embodiment for providing a better understanding of the invention and figure 8 shows an exemplary embodiment according to the invention of the provided method shown in Figure 6 according to exemplary embodiments of the invention.

**[0041]** Figure 7 shows a schematically drawing of a proposed regulation block procedure of the compensation power/current calculation procedure of Figure 6 according to an exemplary embodiment for providing a better understanding of the invention. In Figure 7 the compensation power/current calculation procedure cpc of Figure 6 comprises: obtaining a frequency signal w indicative for a frequency of the electrical alternating current machine; determining a fifth power signal P5 by a power calculation procedure pc for calculating a power; and receiving a result from a filter procedure f for filtering the fifth power signal p5 by making use of the frequency signal w and the fifth power signal P5.

**[0042]** If taking into account the shaded block cc in Figure 7, Figure 7 moreover shows receiving a result from a current calculation procedure cc for calculating a current from the result from the filter procedure f.

**[0043]** Figure 8 shows a schematically drawing of a proposed regulation block procedure of the compensation power/current calculation procedure of Figure 6 according to another exemplary embodiment of the invention.

**[0044]** In Figure 8 the compensation power/current calculation procedure cpc of Figure 6 comprises: receiving a result from a filter procedure f for filtering the second voltage signal V2; and receiving a result from a resonant regulator procedure rr for regulating the result from the filter procedure f.

**[0045]** If taking into account the shaded block pc in Figure 8, Figure 8 moreover shows receiving a result from a power calculation procedure pc for calculating a power from the result from the resonant regulator procedure rr.

**[0046]** It should be noted that the term "comprising" does not exclude other elements or steps and the use of articles "a" or "an" does not exclude a plurality. Also elements described in association with different embodiments may be combined. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

**[0047]** It should be noted that the term "attaching" may comprise bolting, riveting, welding or any other bonding of two materials, depending of the use of the materials and/or parts attached to each other. Where possible and useful, welding, bolting or riveting may be substituted by each other.

**[0048]** It is noted that it may also be possible in further refinements of the invention to combine features from different illustrative embodiments described herein. It should also be noted that reference signs in the claims should not be construed as limiting the scope of the claims.

**[0049]** In order to recapitulate the above described embodiments of the present invention one can state:
The present invention may allow for a post-fault operation of a multi-winding generator/turbine, may minimize the DC link voltage oscillation due to unbalanced machine impedance, and may reduce converter trips due to over-modulation. Moreover, the present invention may cause nearly no additional costs, and may cause no major change requirements for the hardware of available products in the market.

**[0050]** Therefore, the present invention provides a solution for the issue of power unbalance at DC link capacitors. The method can be used for machines with unbalanced impedance. The method can be used mainly in variable speed wind turbine. Nevertheless, it may also be possible to use the principles of the provided invention for other applications like for motor drives and electrical cars.

# REFERENCES CITED IN THE DESCRIPTION

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## Patentkrav

**1.** Fremgangsmåde til styring af en energistrøm fra en elektrisk vekselstrømsmaskine, især en elektrisk vekselstrømsgenerator til en vindmølle, med ubalanceret impedans til et net,
hvor maskinen omfatter flere trefaseviklinger,
hvor maskinens impedans ikke er ens for forskellige faser, og/eller
hvor en gensidig induktans mellem viklinger er ændret, efter en vikling eller dens konverter er brudt,
hvilken fremgangsmåde omfatter:
- at opnå et første effektsignal (P1), der repræsenterer en første effektkommando,
- at opnå et andet effektsignal (P2), der repræsenterer en anden effektkommando,
- at opnår et første strømsignal (I1), der er indikativt for en feedbackstrøm fra den elektriske vekselstrømsgenerator,
- at opnå et andet strømsignal (I2), der er indikativt for en feedbackstrøm fra en netkonverter,
- at bestemme et første internt signal (int1) som et resultat fra en første strømreferenceberegningsprocedure (crc1) ved anvendelse af det første effektsignal (P1), idet det første interne signal (int1) svarer til en strømkommando for den elektriske vekselstrømsmaskine,
- at bestemme et andet internt signal (int2) som et resultat fra en anden strømreferenceberegningsprocedure (crc2) ved anvendelse af det andet effektsignal (P2), idet det andet interne signal (int2) svarer til en strømkommando for netkonverteren,
- at bestemme et første outputsignal (OUT1) som et resultat fra en første strømstyreenhedsprocedure (cc1) ved anvendelse af det første strømsignal (I1) og det første interne signal (int1), idet det første outputsignal (OUT1) repræsenterer en spændingskommando for en første aksel af en maskinsynkron drejeramme, idet spændingskommandoen for den første aksel kan anvendes til at styre energistrømmen fra den elektriske vekselstrømsmaskine, og
- at bestemme et andet outputsignal (OUT2) som et resultat fra en anden strømstyreenhedsprocedure (cc2) ved anvendelse af det andet strømsignal (I2), det andet interne signal (int2) og en kompensationsberegningsprocedure, idet det andet outputsignal (OUT2) repræsenterer en spændingskommando for en anden aksel af en netsynkron drejeramme, idet spændingskommandoen for den anden aksel kan anvendes til at styre energistrømmen fra den elektriske vekselstrømsmaskine,
**kendetegnet ved, at** fremgangsmåden endvidere omfatter:

- at opnå et spændingssignal (V1), der er indikativt for en jævnstrøm-forbindelsesspænding, og
- at opnå et referencespændingssignal (V2), der er indikativt for en jævnstrømforbindelsesspændingsreference,
- at udføre en jævnstrømsforbindelsesprocedure (dc1) ved anvendelse af spændingssignalet (V1) og referencespændingssignalet (V2),

yderligere **kendetegnet ved, at** opnåelse af det andet effektsignal (P2) omfatter anvendelse af jævnstrømsforbindelsesproceduren (dcl),
og, at fremgangsmåden desuden omfatter:

- at bestemme et fjerde effektsignal (P4) med en kompensationseffekt-beregningsprocedure (cpc) til beregning af en effektkompensations-værdi, hvor kompensationseffektberegningsproceduren (cpc) svarer til kompensationsberegningsproceduren, og

at opnå det andet effektsignal (P2) ved at tilføje det fjerde effektsignal (P4) til et resultat fra jævnstrømsforbindelsesproceduren (dc1), yderligere
**kendetegnet ved, at**
kompensationseffektberegningsproceduren (cpc) omfatter:

- at modtage et resultat fra en filterprocedure (f) til filtrering af referencespændingssignalet (V2),
- at modtage et resultat fra en resonansregulatorprocedure (rr) til regulering af resultatet fra filterproceduren (f),
- at modtage et resultat fra en effektberegningsprocedure (pc) til beregning af en effekt fra resultatet af resonansregulatorproceduren (rr), og
- at modtage det fjerde effektsignal (P4) fra en forstærkningsfasekompensationsprocedure (gpc) til at kompensere for en forstærkning og/eller fase af resultatet fra effektberegningsproceduren (pc),

hvor forstærkningsfasekompensationsproceduren indbefatter at tilvejebringe en kompensation for forstærkningsfaseforskellene mellem generatoreffekt og neteffekt.

**2.** Fremgangsmåde ifølge det foregående krav, hvor
det første interne signal (int1) svarer til strømkommandoen for den første aksel af den maskinsynkrone drejeramme,
det andet interne signal (int2) svarer til strømkommandoen for den anden aksel af den netsynkrone drejeramme,
det første signal (I1) er indikativt for feedbackstrømmen for den første aksel af den maskinsynkrone drejeramme, og hvor
det andet strømsignal (I2) er indikativt for feedbackstrømmen for den anden aksel af den netsynkrone drejeramme.

**3.** Fremgangsmåde ifølge et af de foregående krav, hvor
det første outputsignal (OUT1) tjener som et første inputsignal til en pulsbred-demoduleringsprocedure, og hvor
det andet outputsignal (OUT2) tjener som et andet inputsignal til pulsbredde-moduleringsproceduren.

# DRAWINGS

FIG 1

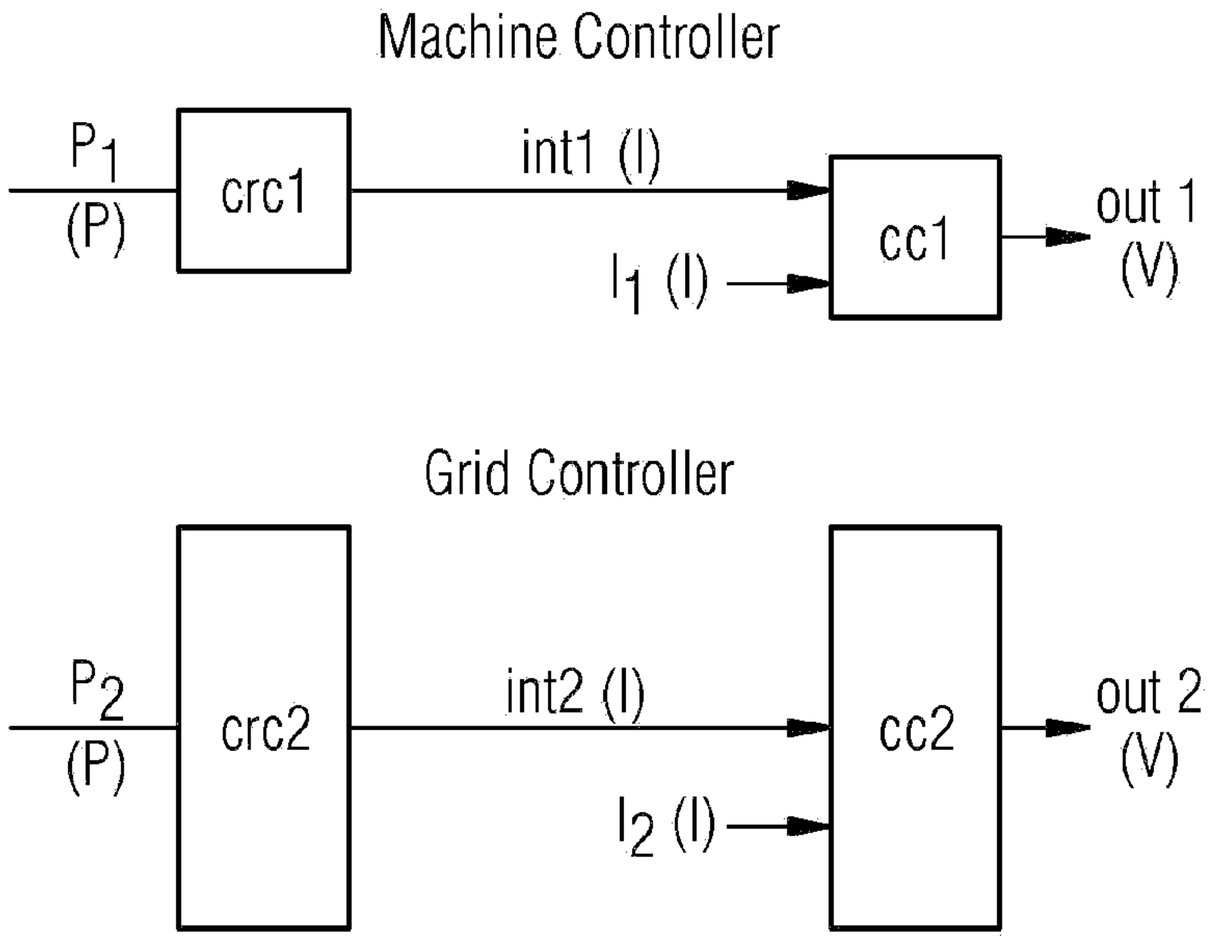



FIG 2

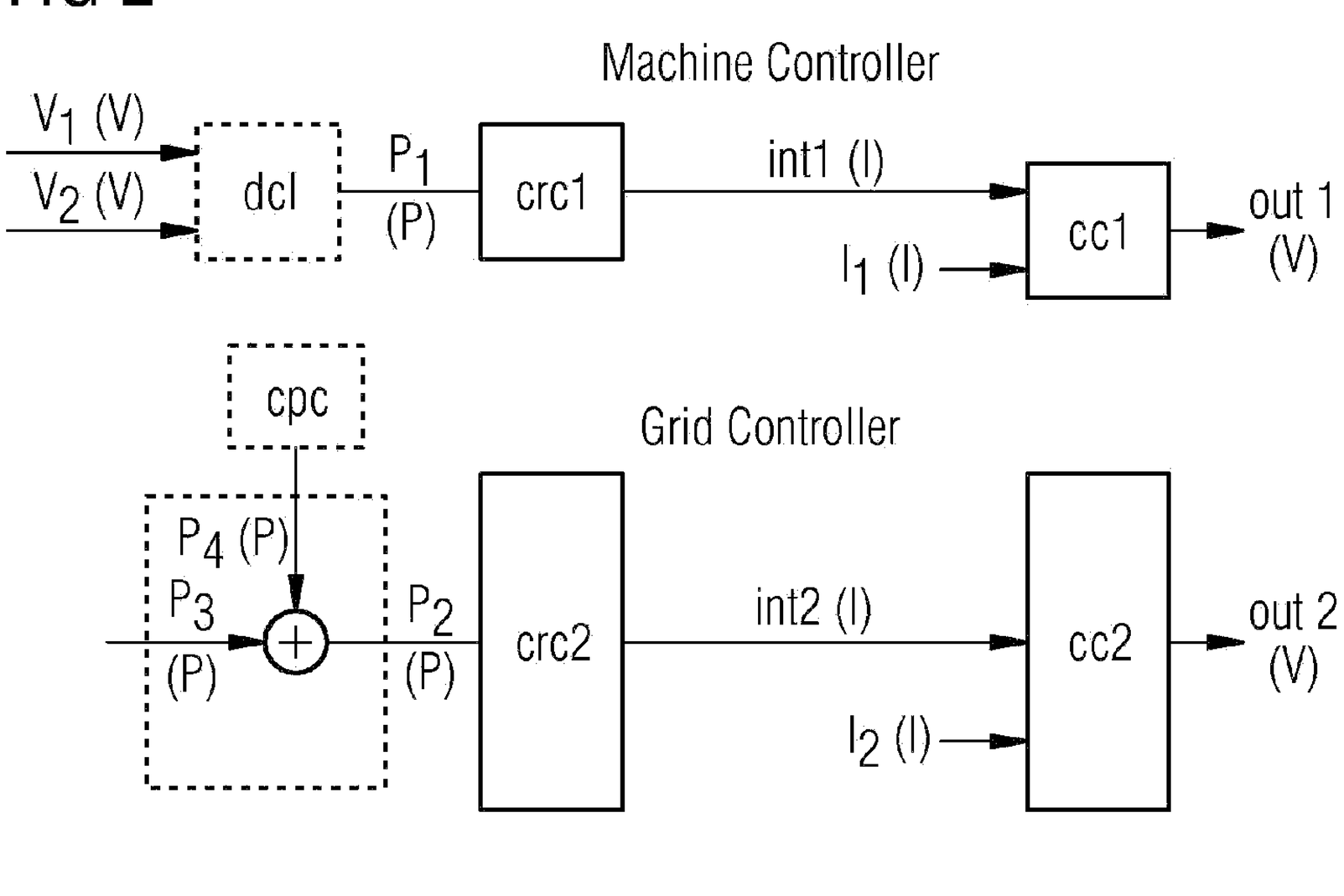


FIG 3

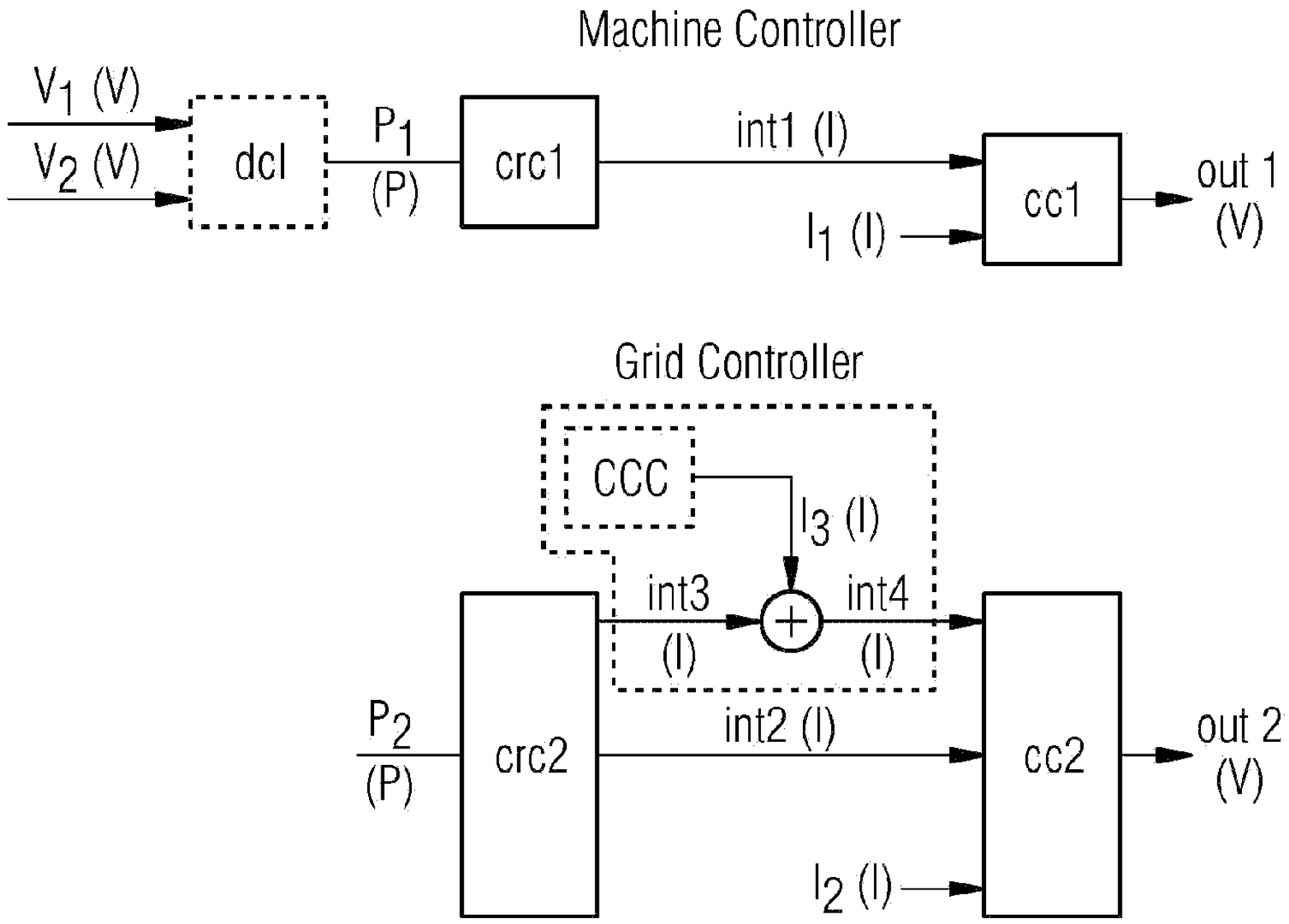

Machine Controller
V1 (V)
V2 (V)
dcl
P1
(P)
crc1
int1 (I)
I1 (I)
cc1
out 1
(V)
Grid Controller
CCC
I3 (I)
int3
(I)
int4
(I)
P2
(P)
crc2
int2 (I)
I2 (I)
cc2
out 2
(V)

FIG 4

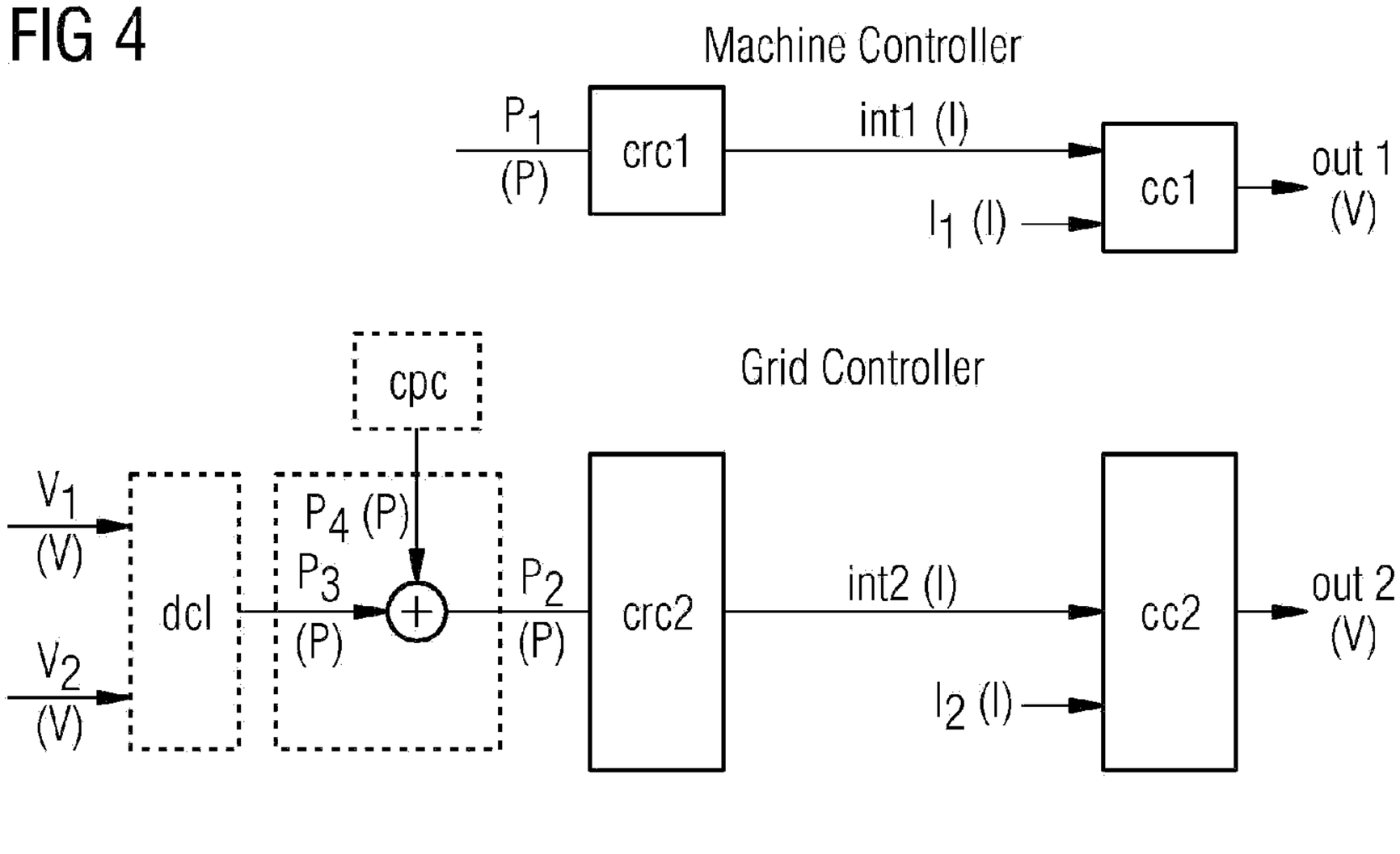

Machine Controller
P1
(P)
crc1
int1 (I)
I1 (I)
cc1
out 1
(V)
Grid Controller
cpc
V1
(V)
V2
(V)
dcl
P4 (P)
P3
(P)
P2
(P)
crc2
int2 (I)
I2 (I)
cc2
out 2
(V)

FIG 5

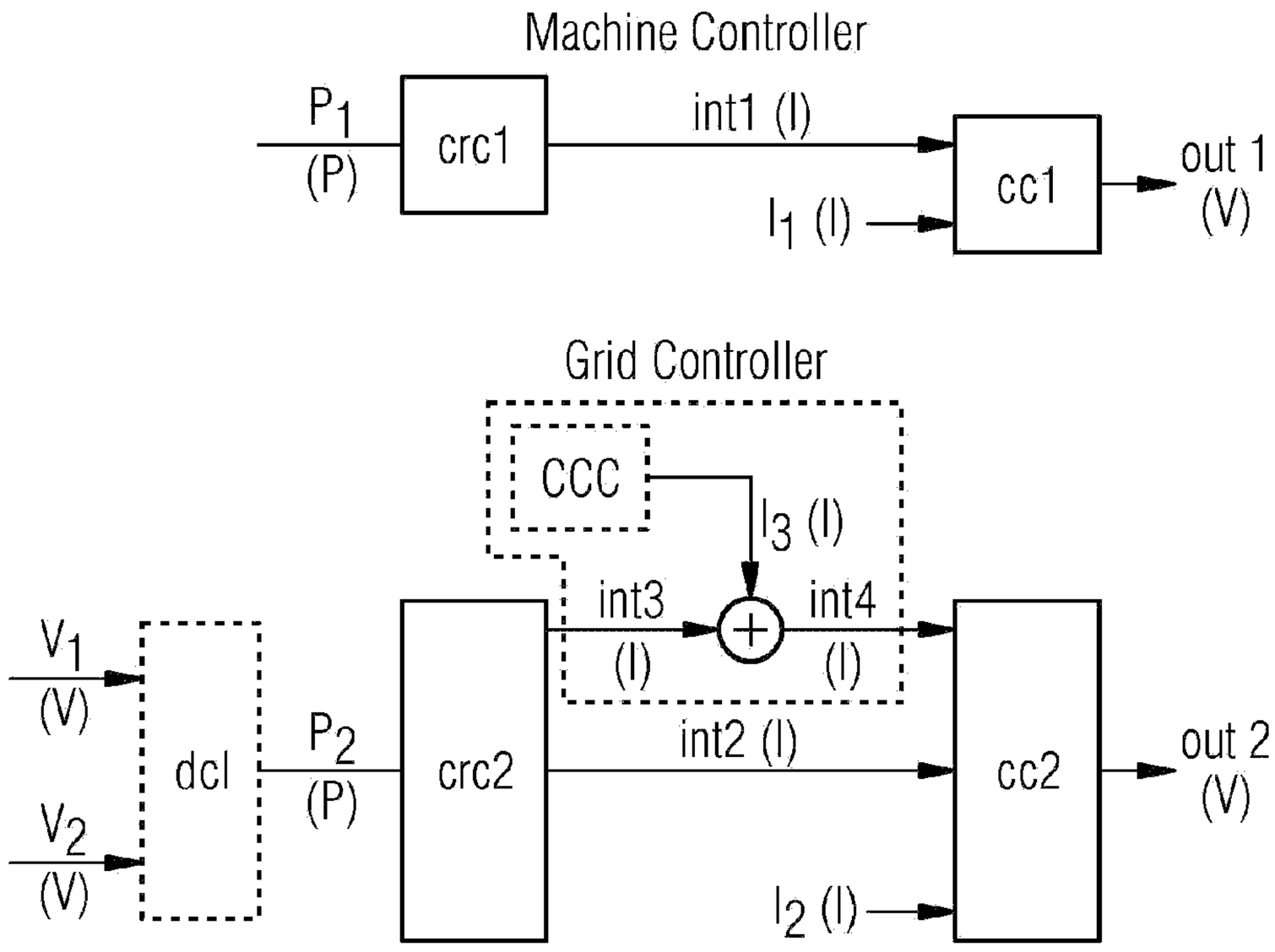

Machine Controller
P1
(P)
crc1
int1 (I)
cc1
out 1
(V)
I1 (I)
Grid Controller
CCC
I3 (I)
int3
(I)
int4
(I)
V1
(V)
V2
(V)
dcl
P2
(P)
crc2
int2 (I)
cc2
out 2
(V)
I2 (I)

FIG 6

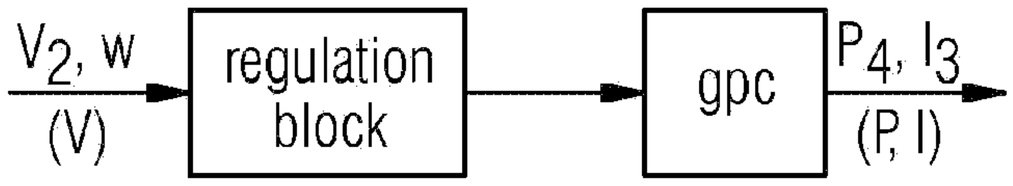



FIG 7

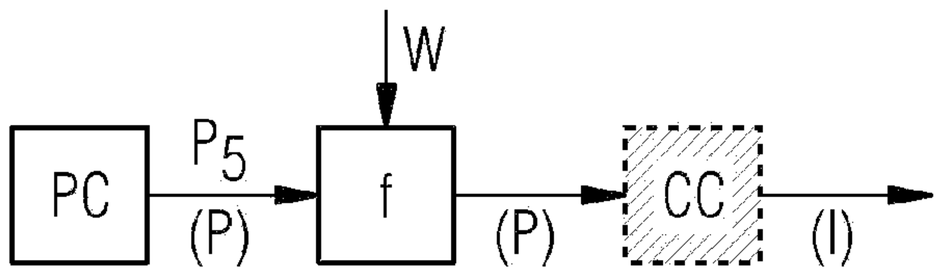



FIG 8

