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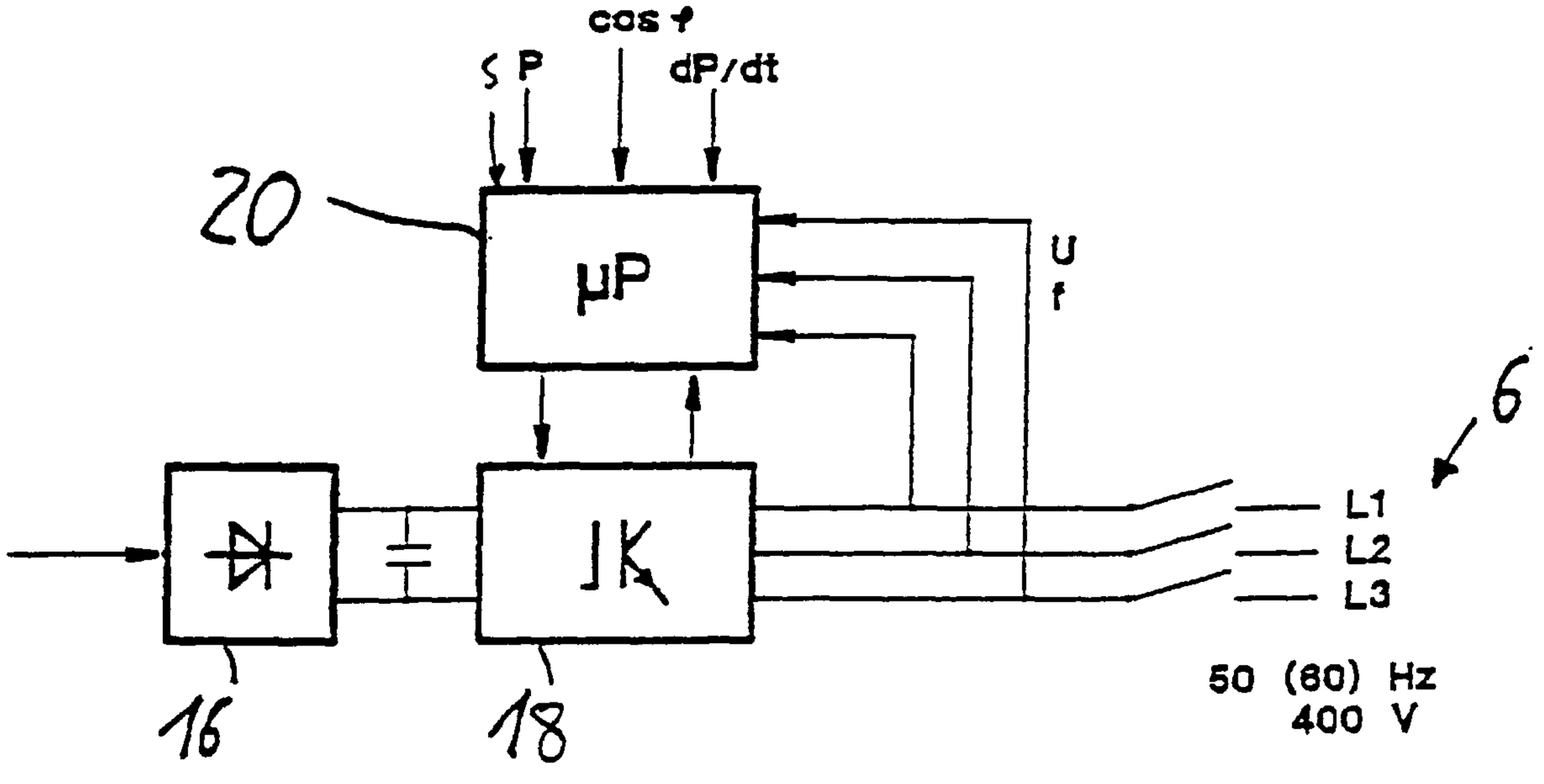
(54) Titre : INSTALLATION D'ENERGIE EOLIENNE OU PARC EOLIEN CONSTITUE DE PLUSIEURS INSTALLATIONS D'ENERGIE EOLIENNE

(54) Title: WIND ENERGY TURBINE AND WIND FARM CONSISTING OF A PLURALITY OF WIND ENERGY TURBINES



(57) Abrégé/Abstract:
The invention relates to a wind energy turbine and a wind farm consisting of a plurality of wind energy turbines. Wind energy turbines or a wind farm consisting thereof are regularly connected to a voltage grid, in which the generated electric current is stored or supplied. The aim of the invention is to ensure that a wind energy turbine or a wind farm consisting of a plurality of wind energy turbines continuously supplies a constant apparent power to the grid, irrespective of the current wind supply and the active power of the wind energy turbine that is to be made available as a result of said supply. The invention relates to wind energy turbines and/or a wind farm consisting of a plurality of wind energy turbines comprising a device for controlling (16, 18, 20) the power that is to be supplied to a voltage grid (L1, L2, L3), in such a way that a constant apparent power is continuously supplied to said grid.

Abstract

The present invention concerns a wind power installation or a wind park comprising a plurality of wind power installations. Wind power installations or a wind park consisting thereof are usually connected to a current voltage network into which the electrical current generated is fed or delivered.

The invention provides that, independently of the currently prevailing amount of wind and the active power which is thus available from the wind power installation a wind power installation or a wind park comprising a plurality of wind power installations always delivers a constant apparent power into the network.

A wind power installation and/or a wind park comprising a plurality of wind power installations having a device for regulating (16, 18, 20) the power to be delivered to a current voltage network (L1, L2, L3), wherein the regulation is so adjusted that a constant apparent power is always fed to the network.

(Figure 2)

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Wind power installation or wind park comprising a plurality of wind power installations (constant apparent power)

The present invention concerns a wind power installation or a wind park comprising a plurality of wind power installations.

Wind power installations or a wind park consisting thereof are usually connected to a current voltage network into which the electrical current generated is fed or delivered.

The particularity of the current feed in the case of wind power installations is that the greatly fluctuating wind conditions mean that the power which is fed in also correspondingly fluctuates. That is a great difference in relation to energy generators such as atomic power stations, water power stations, coal-fired or natural gas-fired power stations, in which admittedly fluctuations can possibly also be found over prolonged periods of time but which do not involve power fluctuations for relatively short periods of time. Therefore atomic power stations, water power stations, natural gas-fired power stations and so forth are rather used to furnish the basic load of a network while it is only in areas with continual wind that wind power installations are in a position also to provide a basic current load.

Therefore wherever wind power installations which provide in particular a greatly fluctuating feed of power are connected to the network, the electricity supply utility (ESU) also often has to implement a stabilising or supporting measure for the network as there is a wish on the part of the ESU that there are no current and voltage fluctuations in the network.

The object of the present invention is to avoid or at least reduce the above-indicated disadvantages.

That object is attained by a wind power installation or a wind park comprising a plurality of wind power installations, with the feature of claim 1. Advantageous developments are set forth in the appendant claims.

The invention provides that, independently of the currently prevailing amount of wind and the active power which is thus available from the wind

power installation a wind power installation or a wind park comprising a plurality of wind power installations always delivers a constant apparent power into the network.

That apparent power is calculated in accordance with the following formula:

$$S = \sqrt{P^2 + Q^2}$$

wherein S stands for the apparent power, P for the active power and Q for the reactive power. Accordingly if the available active power rises because of a corresponding amount of wind, the proportion of reactive power is also correspondingly reduced. That relationship can be seen in greater detail in accompanying Figures 1 and 2.

The advantage of the invention lies in a stabilising or supporting action on the current supply network. If little active power is available for example as a consequence of the wind being low, the quality of the network can be improved by the provision of reactive power. That in turn affords reduced voltage fluctuations which moreover can certainly mean that the delivery of electrical energy into the network has to be reduced if the voltage in the network reaches an upper limit value. The respective proportion of reactive power can be so adjusted that it is capacitance or inductive.

If there is sufficient active power, that is delivered to the network and supports the network in the event of a fluctuating power demand. The remaining proportion of reactive power can in turn be delivered in known manner as inductive or capacitive reactive power.

Flexible adjustment of the power gradient (dP/dt) permits adaptation to the reception capability of the network in relation to rapid changes in power. Even in a network with dominant wind power the described apparent power management can already be taken into account in the planning phase, in particular in relation to necessary network reinforcement measures in order to implement cost-reducing effects.

It is possible with the present invention that not only can the wind acting on a wind power installation be used in the optimum manner and converted into electrical energy, but in that respect networks are also not

only operated in a fault-free manner but they are also supported in terms of their operational efficiency. That therefore overall increases the quality standard of the current fed into the network or the entire wind power installation which also actively contributes to the network quality, this being possible by the wind power installation apparent power regulation in accordance with the invention.

The invention is described in greater detail hereinafter by means of an embodiment with reference to the drawings in which:

Figure 1 shows a reactive power/active power time diagram of a control of a wind power installation, and

Figure 2 is a view of a block circuit diagram of a regulating device of a wind power installation.

Figure 1 shows a reactive power/active power time diagram of a regulation in accordance with a wind power installation according to the invention. Therein P denotes the active power and Q the reactive power.

As can be seen from the diagram the values in respect of the active power and also in respect of the reactive power behave in reciprocal relationship with each other, that is to say with a rising active power the reactive power falls and vice-versa.

The sum of the squares of active power and reactive power is constant in that case.

Figure 2 shows a regulating device for implementation of the control according to the invention of a wind power installation. The control regulating device of the wind power installation firstly has a rectifier 16 in which the ac voltage generated in the generator of the wind power installation is rectified (dc voltage intermediate circuit). A frequency converter connected to the rectifier converts the dc voltage which is initially the same in the intermediate circuit into an ac voltage which is fed into the network in the form of a three-phase ac voltage, by way of the lines L1, L2 and L3. The frequency converter 18 is controlled by means of the microcomputer 20 which is part of the overall regulating device. For that purpose, the microprocessor is coupled to the frequency converter 18. The input parameters for regulation of the voltage and also the phase and the

current position, with which the electrical energy available from the wind power installation is fed into the network, are the apparent power S, the electrical power P of the generator, the reactive power factor cos_ and the power gradient dP/dt. Depending on the respective active power generated the reactive power is also adjusted, with a predetermined apparent power, in accordance with the following formula:

$$S = \sqrt{P^2 + Q^2}$$

It will be appreciated that it is also possible if necessary to alter the operating mode if for example it is to be provided that the active power or reactive power is not to exceed a given value. If for example the ESU of the connected network requires that a given amount of reactive power is always fed into the network, that must be taken into consideration by suitable regulation. The consequence of the feed in accordance with the invention of a constant apparent power into an energy supply network or the supply of the feed of a constant apparent power into the energy supply network is that, with a fluctuating active power, the reactive power is correspondingly regulated - in reciprocal relationship with the active power - in such a way that a constant apparent power is achieved.

In order still to be able to intervene in the network with a constant apparent power, naturally the active power generated by the wind power installation can also be specifically reduced (for example by pitch control of the rotor blades) in order in that way to be able to feed into the network a higher (capacitive or also inductive) proportion of reactive power. Such a measure means that the network can still be correspondingly positively influenced, even with a theoretically higher available active power.

In regard to the invention in accordance with the present application it is not for example keeping the voltage constant that is the foremost aim, but influencing the network voltage, in accordance with the wishes of the network operator. Thus, by supplementing the active power proportion by a reactive power proportion, it is possible to raise the voltage level in the network to a desired value. It will be appreciated that those effects are inter alia also dependent on the topology of the network. In the case of a high demand for reactive power in the proximity of the wind power

installation however, that reactive power does not have to be transported through the network over long distances with corresponding losses but can be furnished relatively close to the consumer by the wind power installation.

CLAIMS

1. A wind power installation and/or a wind park comprising a plurality of wind power installations having a device for regulating (16, 18, 20) the power to be delivered to a current voltage network (L1, L2, L3), wherein the regulation is so adjusted that a constant apparent power is always fed to the network.

2. A wind power installation and/or a wind park according to claim 1 characterised in that the apparent power is calculated in accordance with the following formula:

$$S = \sqrt{P^2 + Q^2}$$

wherein S is the magnitude of the apparent power, P the magnitude of the active power and Q the magnitude of the reactive power.

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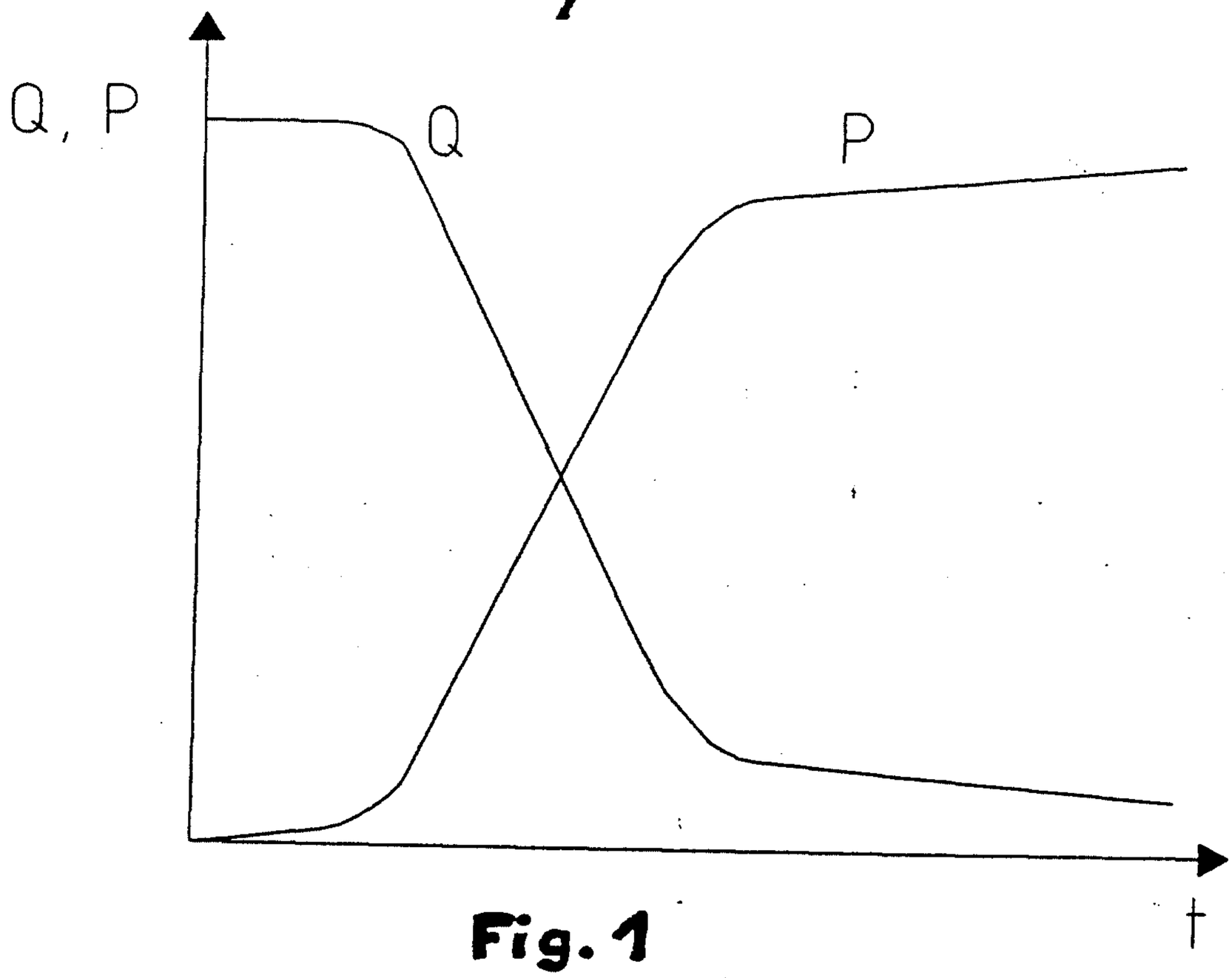


Fig. 1

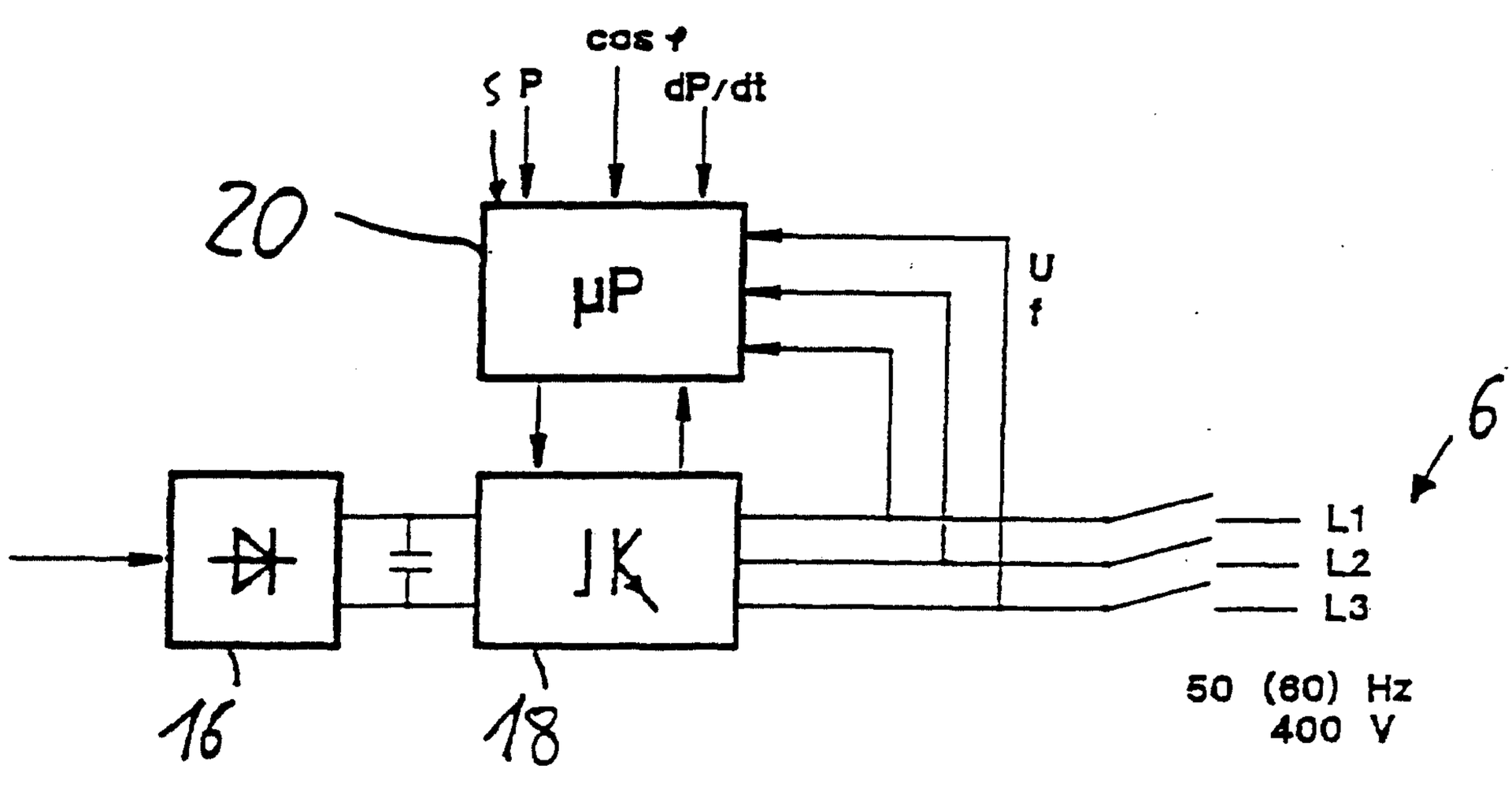
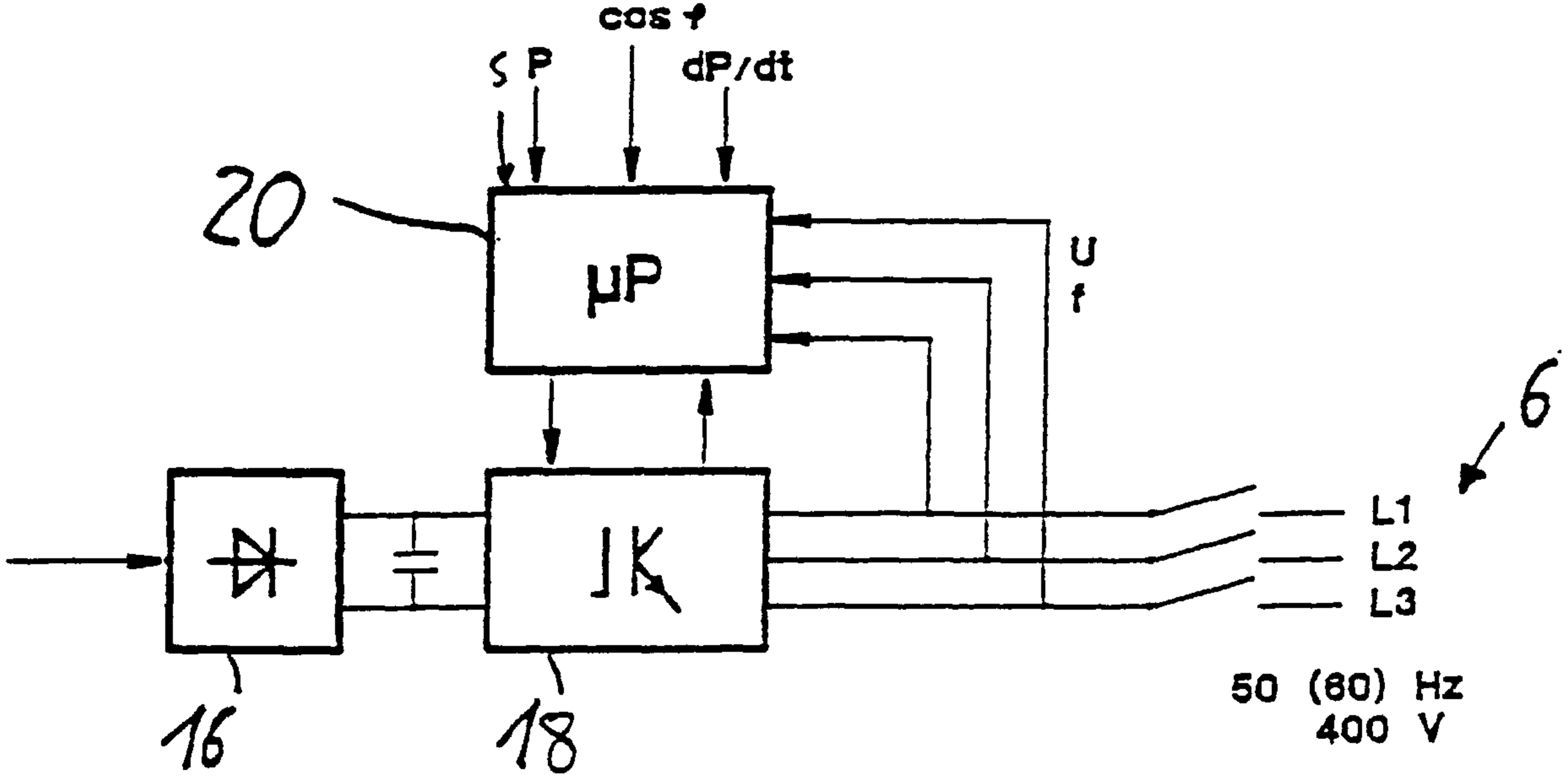


Fig. 2


cos f
ς P
dP/dt
20
µP
U
f
6
L1
L2
L3
50 (60) Hz
400 V
16
18