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(72) Inventeurs/Inventors:
HESS, GUENTHER, AT;
PANHOLZER, HEINZ, AT

(73) Propriétaire/Owner:
VA TECH HYDRO GMBH, AT

(74) Agent: GOWLING LAFLEUR HENDERSON LLP

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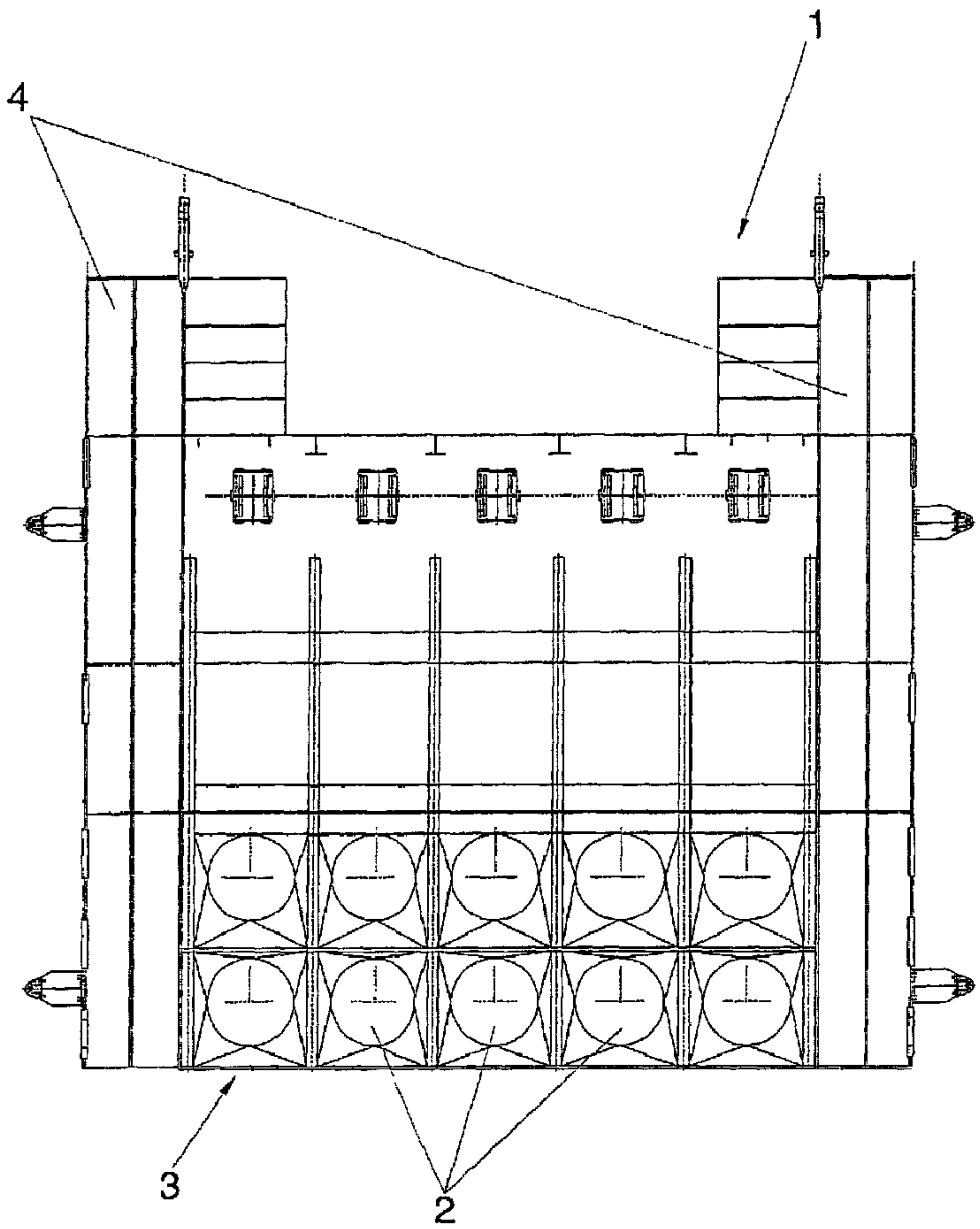


(57) Abrégé/Abstract:
The levels (P) of dam installations (1) are generally regulated by opening or closing weir systems. Such dam installations (1) can also be used to generate electrical power, by a large number of turbine generator units (2) or turbine generator modules (3) being

(57) **Abrégé(suite)/Abstract(continued)**:
integrated. The flow through these turbine generator units or turbine generator modules (3) is now used, according to the invention, to regulate the level (P) by means of the specific start or stop of individual or several turbine generator units (2) or turbine generator modules (3).

Abstract

The levels (P) of dam installations (1) are generally regulated by opening or closing weir systems. Such dam installations (1) can also be used to generate electrical power, by a large number of turbine generator units (2) or turbine generator modules (3) being integrated. The flow through these turbine generator units or turbine generator modules (3) is now used, according to the invention, to regulate the level (P) by means of the specific start or stop of individual or several turbine generator units (2) or turbine generator modules (3).

Method and System For Regulating the Level of a Dam

Field of the Invention

The invention relates to a method for regulating the level of a dam installation, preferably a dam or a weir, a number of turbine generator units, preferably with outputs between 100 kW and 1000 kW each, being arranged in the dam installation to generate electrical power, at least some units being arranged above one another and/or beside one another and being connected to one another to form one or more turbine generator modules, and also a plant for regulating the level of a dam installation having a plurality of turbine generator units which are arranged above one another and/or beside one another and are connected to one another to form one or more turbine generator modules and, if appropriate, a predetermined number of turbine generator modules are arranged beside one another and supported on the dam installation.

Related Art

Equipment for generating electrical power, in which a number of relatively small turbine generator units are arranged in rows and columns beside one another and above one another in a frame or a stiffened construction are disclosed, for example, by WO98/11343 or US 4,804,855. Because of their particularly short design and large inflow area, such equipment is preferably used on dam installations such as sluices, weirs, dams or the like, in order to use the quantity of water flowing through and normally unused in order to produce electrical power. In such dam installations, however, the water level must be regulated in order to fulfill the function of the dam installation, required depending on the application. For example, ship traffic on a river requires a specific water level, or an irrigation dam must have a minimum water level in order to be able to ensure the irrigation. For this purpose, weir systems have hitherto been wholly or partially opened.

Summary of the Invention

The invention now has the object of specifying a method for regulating the level of a dam installation which utilizes the existing possibilities and constructional conditions to the greatest possible extent, ensures the function of the dam installation and permits simple and accurate regulation.

According to the invention, this object is achieved by the level being regulated to a predefinable set point, at least to some extent, by starting or stopping individual or several turbine generator units or turbine generator modules.

These turbine generator units or turbine generator modules have an accurately known flow, as a result of which the quantity flowing away can be determined accurately. The quantity flowing away and, consequently, also the level of the dam installation can therefore be regulated very simply and accurately in small discrete steps by means of the individual turbine units. It is therefore no longer necessary in exceptional situations to open or to close the weir systems, which are generally very large, heavy and difficult to regulate.

As a result, the regulation becomes more flexible, since the regulation in small steps is consequently made possible and, furthermore, permits a quick reaction to changing conditions on the dam installation. Furthermore, as a result the level can be optimized very simply with regard to specific criteria.

The turbine generator units or turbine generator modules used to regulate the level can be designed very simply in constructional terms if these units or modules are operated with a substantially constant flow or with a constant output, since then no equipment for regulating the flow or the output has to be provided. The units or turbines therefore have only two operating points, namely in operation or out of operation, which also simplifies the regulation considerably.

If the level is regulated at least to some extent by opening or closing at least one weir system, in certain situations the quantity flowing away can be increased quickly. This is primarily expedient as a safety measure in situations where the flow through the turbine units is no longer sufficient to discharge the inflowing quantities of water again, or where the outflow from the dam installation has to be reduced very quickly.

It is particularly advantageous to predefine an upper turbine switching level or alarm level at which, when it is reached, turbine generator units or turbine generator modules are started and/or weir systems are opened.

It is likewise advantageous, when a predefined lower turbine switching level or alarm level is reached, to stop turbine generator units or turbine generator modules and/or to close weir systems.
As a result, the maintenance of the required limiting values for the level is ensured and, at the same time, the number of switching manipulations of the turbine units is reduced.

The generation of electrical power by the turbine units can be maximized if all the turbine generator units or turbine generator modules are started first and only then are the weir systems opened. Likewise, maximization of the generation of electrical power is achieved if all the weir systems are opened first and only then are the turbine generator units or turbine generator modules stopped. By means of these measures, the flow through the turbine units is maximized, which has a directly positive effect on the amount of power generated.

It is quite particularly advantageous if, when a predefined turbine switching level and/or alarm level is reached, an alarm signal is generated and/or indicated, since it is then possible to react directly and without any time delay to the current critical situation. These alarm signals can, for example, be of an acoustic and/or optical nature.

If automatic switching manipulation to start or stop turbine generator units or turbine generator modules and/or the opening or closing of weir systems are initiated by the triggering of an alarm, the regulation of the level can be carried out automatically to the greatest possible extent without any operating personnel required on site.

By drawing up predictions about levels to be expected in the future, and the associated opening and closing of turbine generator units or turbine generator modules and/or weir systems by using these predictions, it is possible to react in a predictive way to large level changes to be expected, as a result of which the switching frequency of the weir systems can be reduced.

If the regulation systems of the levels of a plurality of dam installations following one another are coupled to one another, and individual dam installations are regulated by a higher-order regulation system in such a way that the levels of these dam installations are optimized whilst taking each other into account, then an optimum level can be achieved far beyond a single dam installation, along a long section of the water course. As a result, the frequency of starting and stopping turbine units is reduced and, at the same time, more uniform power generation can be achieved over a relatively long time period.

A further advantageous expansion of the regulation concept can be achieved if the number of turbine generator units or turbine generator modules to be started or stopped is determined in advance and they are started and stopped at the same time, since then the switching manipulations required to correct the level can be carried out in one sequence.
It is beneficial to determine the number of turbine generator units or turbine generator modules to be started or stopped by using the current power demand and possibly also by using a level to be expected in the future, as a result of which optimum utilization with regard to the power demand, the units and modules is achieved.

It is quite particularly advantageous to optimize the regulation systems of the levels with regard to the power generation. The optimization is very advantageously carried out with the aid of a mathematical model which, in order to improve the optimization results, takes account of specific states and boundary conditions, such as the temporary opening or closing of weirs, dams, sluices and, if appropriate, the raising of turbine generator or turbine generator modules, inputs from the operating personnel, stored empirical values, physical laws, such as the amount of water evaporated or seeping away, and current or predictive meteorological data, such as rainfall to be expected, temperature predictions, etc. Furthermore, by using the mathematical model and taking account of the current inflow and outflow and/or that to be expected and the current power demand and/or that to be expected, the optimum number of turbine generator units or turbine generator modules to be started or stopped can be determined very advantageously.

The set point used for the regulation is advantageously level over a predetermined time period, such as a year. The power to be generated can be predefined over a predetermined time range, preferably one day, and the level can be regulated in such a way that the predefined power generation course can be maintained as accurately as possible. As a result, optimum utilization of the action of obtaining power is achieved whilst ensuring the actual function of the dam installation. At the same time, it is ensured by this means that the resources of the dam installation are utilized to the greatest possible extent.

If the levels of one or more dam installations can be regulated from a central control center, additional monitoring and control devices on site can be saved, which has a very positive effect on the costs.

If the set point for the level is predefined for a purpose which is not used for obtaining power, for example for ship traffic, irrigation, etc, the originally conceived operation of the dam installation is not impaired. Obtaining power is then an additional advantage, which can be achieved without any restrictions on the operation.

In practice, it proves to be advantageous if at least 10, preferably 20 to 500, turbine generator units which can be started and stopped are used on a dam installation.

It is furthermore very advantageous if the dam installation has a plurality of piers, between which the medium can flow past, a predetermined number of turbine generator units or turbine generator modules being arranged between two adjacent piers and supported on the piers. As a result, already existing structures of the dam installation can be used directly for retrofitting, as no complicated rebuilding work is necessary.

A very compact design variant is obtained by the equipment for starting and stopping turbine generator units or turbine generator modules being integrated in the units or modules and supported on the piers by the unit or the module. As a result, the necessary constructional measures on the dam installation are also minimized. A further variant provides for the equipment for starting and stopping turbine generator units or turbine generator modules being supported directly on the piers.

The turbine generating units or turbine generator modules can be removed very simply from their operating position, for example for maintenance work or to open the flow cross section in certain situations, if said units or modules are arranged such that they can be raised and lowered.

A quite particularly advantageous application finds the regulation according to the invention of the level of a dam installation in a drinking water reservoir, an irrigation dam, a flood retention basin, a dam for regulating a navigation or a dam station in a hydroelectric power station.

Brief Description of the Drawings

The present invention will be described by using the exemplary, simplified and nonrestrictive figures 1 and 2, in which

Fig. 1 shows a front view of a dam installation with turbine generator units,

Fig. 2 shows the basic principle of the regulation according to the invention and

Fig. 3 shows an extended regulation concept.

Detailed Description of the Preferred Embodiments

Fig. 1 shows, in schematic and simplified form, a dam installation 1, for example a dam, for damming a liquid, preferably water in the course of a river, having two piers 4 in this exemplary embodiment, between which a number of turbine generator units 2, ten here, are arranged. These turbine generator units 2 are in this case supported and held by the piers 4. The turbine generator units 2 are combined to form a turbine generator module 3 and, as required, can be lifted out of the dam installation 1 as a module by a lifting device, not illustrated. Furthermore, the dam installation 1 can comprise a weir system, not illustrated, with which the outflow of the medium from the dam installation 1 can be wholly or partially opened or stopped.

The turbine generator units 2 can be shut off in an adequately well-known manner, for example by an intake-pipe closure, such as a bulkhead or an iris diaphragm, individually or in groups, such as the entire turbine generator module 3, so that no water can flow through the turbine generator units 2 and consequently, no electrical power is generated by these units.

It is obvious that such a dam installation can also comprise more than two piers and that more than the turbine generator units 2 illustrated in fig. 1 can be arranged between two piers. In practice, it is entirely conceivable to integrate any desired number of such turbine generator units 2, preferably 20 to 500, in a dam installation.

Such turbine generator units 2 can of course also be used in any desired dam installations other than those described in fig. 1, such as drinking water reservoirs, irrigation dams, flood retention basins, etc, it being possible for the regulation concept described below to be used for the level of any type, however.

In the following text, by using fig. 2, the basic principle of the regulation concept according to the invention of the level of any desired dam installation with integrated turbine generator units 2 will be explained. Fig. 2 illustrates two graphs, the first shows the water level P over the time t, and the second the quantity Q_A flowing away from the dam installation over the time t. A target level ZP is predefined for the dam installation, for example by the operator. The current level P may then vary within likewise predefined upper and lower turbine switching levels TsP_O, TsP_U. These levels result from the requirements on the dam installation, for example the ship traffic on a river requires specific minimum and maximum water levels. Furthermore, upper and lower maximum levels MP_O, MP_U, which must not be violated, are defined for the dam installation. Should these maximum levels nevertheless be violated in exceptional situations, certain emergency measures, for example the shutting off or opening of further dam installations placed upstream, the opening of existing emergency sluices, the lifting of the turbine generator units 2 or modules 3, etc., can be initiated, depending on the dam installation.

The starting point of the description of the regulation method is a state in which the inflow and the outflow quantities are equal and the level P does not change. In this state, an arbitrary number of turbine generator units 2 or turbine generator modules 3 are already open, so that a certain quantity of water Q_A already flows away through these units and electrical power is generated.

At the time t_0, the level P of the dam installation then rises, for example because of rainfall, starting from the target level ZP and, at the time t_{s1} reaches the upper turbine switching level TsP_O. At the latest at this time t_{s1}, automatically or by the operating personnel, one or more further individual turbine generator units 2 or turbine generator modules 3 are then started in order to increase the quantity Q_A flowing away. As a result, more electrical power will be generated simultaneously, so to speak as a secondary effect. This increase in the quantity flowing away is a discrete increase ΔQ_{TE} or a multiple thereof, and corresponds exactly to that quantity of water which can flow through the turbine generator unit or turbine generator modules. Since the level P increases further, at the times t_{s2} and t_{s3} further turbine generator units 2 or turbine generator modules 3 are started, as a result of which the quantity Q_A flowing away is further increased discretely by ΔQ_{TE} or a multiple thereof in each case. This is repeated until the level falls below the upper turbine switching level TsP_O again. If all the turbine generator units 2 or turbine generator modules 3 should already have been started and the level P rises further, then further weir systems which may possibly be present can also be opened, as a result of which the quantity Q_A flowing away is increased further. Weir systems should in principle be opened only when all the turbine generator units 2 or turbine generator modules 3 are already started, since the generation of electrical power can then of course be maximized. However, it is of course also conceivable to open the weir systems at an earlier time for specific reasons.

As can further be gathered from fig. 2, the now falling level P reaches the lower turbine switching level TsP_U at the time t_{S4}, at which time the converse procedure begins. Turbine generator units 2 or turbine generator

modules 3 are gradually stopped automatically or by the operating personnel until the level P is again within the two limiting values, the upper and lower turbine switching levels TsP_O, TsP_U.
Of course, by using the level increase or the level decrease, by using empirical values or by using mathematical or simulation models, it is also conceivable to determine the required number of turbine generator units 2 or turbine generator modules 3 to be started or stopped and to open or close the latter simultaneously.

As long as the level P is within one of the two limiting values, as a rule no switching manipulations are carried out, so that the quantity Q_A flowing away during this time period remains substantially constant. In this exemplary embodiment, in simplified form, only three turbine generator units 2 or turbine generator modules 3 are started. In practice, however, 20 and more individually switchable turbine generator units 2 or turbine generator modules 3 are integrated in one dam installation, by which means very fine regulation of the water level P of the dam installation can be achieved.

When the upper or lower turbine switching level TsP_O, TsP_U is reached, an alarm can also be triggered, which is indicated, for example, in a control center or by means of an acoustic signal, and makes the operating personnel aware of the present situation, or triggers an automatic switching manipulation.

Fig. 3 now shows an extended regulation concept. In addition to the limiting levels already known from fig. 2, an upper and lower alarm level AP_O, AP_U are now also predefined. These levels will in practice lie close, for example 5 cm, above and below the upper and lower maximum levels MP_O, MP_U, respectively.

As already described in fig. 2, the level P rises from the time t_{s0} and, at the time t_{s3}, following two switching manipulations at the times t_{s1} and t_{s2}, reaches the upper alarm level AP_O. The dam installation is ideally designed in such a way that, at this time t_{s3}, all the turbine generator units 2 or turbine generator modules 3 are already started, so that the maximum flow through the turbines and therefore also the maximum power generation has been reached. At this time t_{s3}, in this example an acoustic alarm is generated, in order for example to make the operating personnel aware of the critical level P. Of course, this acoustic alarm can also be coupled to an automatic switching manipulation. Then, any weir systems which may still be present are opened, as a result of which the quantity Q_A flowing away is increased by ΔQ_w of the weir system, and the level P begins to fall again. As a further measure for reducing the level P, provision can also be made to raise the entire turbine generator units 2 or turbine generator modules 3.

At the time t_{s4}, the now falling level P reaches the lower turbine switching level TsP_U. If, at this time, weir systems are still open or not all of the turbine generator units 2 or turbine generator modules 3 which may have been raised have been lowered into their operating position, then these should be closed or lowered first, before turbine generator units 2 or turbine generator modules 3 are stopped, in order to maximize the power generation. In this example, at the time t_{s4} a weir system is stopped first and, in the further sequence, at the time t_{s5}, a turbine generator unit 2 or a turbine generator module 3 is stopped. At the time t_{s6}, the lower alarm level AP_U is then reached, an acoustic alarm is in turn triggered and at least one further turbine generator unit 2 or one further turbine generator module 3 is stopped, so that the level P again exhibits a rising trend. Of course, if necessary, a plurality of or even all the still active turbine generator units 2 or turbine generator modules 3 could also be stopped simultaneously at the time t_{s6}.

The examples described above are in each case based on current measurements of the level or the level change. However, it is also conceivable to make forecasts about future levels, for example by taking account of levels of dam installations located upstream, weather situations, empirical values, etc. and, by using these forecasts, to regulate the quantity Q_A flowing away in a predictive manner by starting or stopping individual turbine generator units 2 or turbine generator modules 3 in such a way that the level P lies as far as possible within the upper and lower turbine switching levels TsP_O, TsP_U and, if possible, does not violate said levels.

The power demand varies very greatly over a certain time period. For example, more power is consumed during the day than in the evening, or more power is consumed in winter than in summer. The method can then be applied particularly advantageously if the level P is also optimized with regard to the requirements, which are different over a time period, on the power generation. For example, overnight all the excess turbine generator units 2 or turbine generator modules 3 can be stopped. As a result, the level P rises overnight and then, can then be dissipated again by the turbine generator units 2 or turbine generator modules 3 for the purpose of generating power, as a consequence of the power demand peak times during the day.

Likewise, the level P could generally be kept at a high level in winter in order to be able to assist the coverage of power demand peaks.

Likewise, the level could also generally always be kept to the maximum level, in order that the power generation is always as high as possible.

The optimization is carried out by means of a mathematical model of the dam installation 1, in which, if required, specific other boundary conditions, such as the temporary opening or closing of additional weir systems, inputs by the operating personnel or meteorological data, can also be incorporated. At the same time, by using the mathematical model as required, specific parameters, such as the optimum number of turbine generator units 2 or turbine generator modules 3 and/or weir systems to be opened or closed can also be determined.

Expediently, the levels P of one or more dam installations 1 are regulated from one central control center. For this purpose, necessary data with regard to the levels P is transmitted to the control center, for example via a modem or by radio, and supplied to a regulation algorithm, which is preferably implemented on a computer. From the control center, the required control signals, primarily commands to open or close turbine generator units 2 or turbine generator modules 3, are then supplied back to the dam installation.

What is claimed is:

1. A method of regulating a water level of a dam installation comprising a plurality of turbine generator units for generating electrical power are arranged above another, one beside another, or combinations thereof, forming at least one turbine generator module, the method comprising:

regulating, at least to some extent, the water level to a predetermined set point by starting or stopping at least one of the plurality of turbine generator units; and

maintaining the water level between upper and lower predetermined set points, wherein the regulating step adjusts, in discrete steps, a quantity of water flowing through the dam installation, and

wherein a discrete step is defined by the quantity of water operatively flowing through a defined number of turbine generator units.

2. The method of claim 1, wherein the dam installation is arranged on a dam.

3. The method of claim 1, wherein the dam installation comprises a weir.

4. The method of claim 1, wherein each of the plurality of turbine generator units have an output which is between approximately 100 kW and approximately 1000 kW.

5. The method of claim 1, wherein the regulating step comprises regulating, at least to some extent, the water level to the predetermined set point by starting or stopping at least two of the plurality of turbine generator units.

6. The method of claim 1, wherein the regulating step comprises regulating, at least to some extent, the water level to the predetermined set point by starting or stopping at least one turbine generator module.

7. The method of claim 1, wherein the regulating step comprises regulating, at least to some extent, the water level to the predetermined set point by starting or stopping at least two turbine generator modules.

8. The method of claim 1, wherein the defined number of turbine generator units is one turbine generator unit.

9. The method of claim 1, wherein the defined number of turbine generator units is at least two turbine generator units.

10. The method of claim 1, wherein the defined number of turbine generator units is one turbine generator module.

11. The method of claim 1, wherein the defined number of turbine generator units is at least two turbine generator modules.

12. The method of claim 1, further comprising operating the at least one of the plurality of turbine generator units at constant output and with a substantially constant flow rate.

13. The method of claim 1, wherein the regulating step comprises at least one of opening and closing at least one weir system.

14. The method of claim 13, wherein the regulating step comprises at least one of opening and closing at least one additional weir system.

15. The method of claim 1, wherein the regulating step comprises starting the at least one of the plurality of turbine generator units when a predefined upper turbine switching level is reached.

16. The method of claim 15, further comprising, after the regulating step, opening a weir system when the predefined upper turbine switching level is reached.

17. The method of claim 1, wherein the regulating comprises starting the at least one turbine generator module when a predefined upper turbine switching level is reached.

18. The method of claim 1, wherein the regulating comprises opening a weir system when a predefined upper turbine switching level is reached.

19. The method of claim 1, wherein the predetermined set point is an upper turbine switching level.

20. The method of claim 1, wherein the predetermined set point is a predefined upper alarm level.

21. The method of claim 1, wherein the regulating step comprises starting the at least one of the plurality of turbine generator units when a predefined upper alarm level is reached.

22. The method of claim 21, further comprising, after the regulating step, opening a weir system when the predefined upper alarm level is reached.

23. The method of claim 1, wherein the regulating step comprises starting the at least one turbine generator module when a predefined upper alarm level is reached.

24. The method of claim 1, wherein the regulating step comprises opening a weir system when a predefined upper alarm level is reached.

25. The method of claim 1, wherein the regulating step comprises starting each of the plurality of turbine generator units when a predefined upper turbine switching level is reached, and further comprising, after the regulating step, opening a weir system when the predefined upper turbine switching level is reached.

26. The method of claim 1, wherein the regulating step comprises starting each of the plurality of turbine generator units when a predefined upper alarm level is reached, and further comprising, after the regulating step, opening a weir system when the predefined upper alarm level is reached.

27. The method of claim 1, wherein the regulating step comprises stopping the at least one of the plurality of turbine generator units when a predefined lower turbine switching level is reached.

28. The method of claim 1, wherein the regulating step comprises stopping the at least one turbine generator module when a predefined lower turbine switching level is reached.

29. The method of claim 1, wherein the regulating step comprises stopping the at least one of the plurality of turbine generator units when a predefined lower alarm level is reached.

30. The method of claim 1, wherein the regulating step comprises stopping the at least one turbine generator module when a predefined lower alarm level is reached.

31. The method of claim 1, wherein the regulating step comprises stopping the least one of the plurality of turbine generator units when a predefined lower alarm level is reached, and further comprising, after the regulating step, closing a weir system when the predefined lower alarm level is reached.

32. The method of claim 1, wherein the regulating step comprises stopping the least one of the plurality of turbine generator units when a predefined lower alarm level is reached, and further comprising, before the regulating step, closing each weir system when the predefined lower alarm level is reached.

33. The method of claim 1, wherein the predetermined set point comprises one of a predefined upper turbine switching level and a predefined lower turbine switching level.

34. The method of claim 1, wherein the predetermined set point comprises one of a predefined upper alarm level and a predefined lower alarm level.

35. The method of claim 34, further comprising generating an alarm signal when one of the predefined upper and lower alarms levels are reached.

36. The method of claim 35, wherein the alarm signal comprises at least one of an acoustic signal and an optical alarm signal.

37. The method of claim 1, further comprising starting automatically the at least one of the plurality of turbine generator units when the water level reaches the predetermined set point.

38. The method of claim 1, further comprising stopping automatically the at least one of the plurality of turbine generator units when the water level reaches the predetermined set point.

39. The method of claim 1, further comprising predicting a future water level and setting the predetermined set point based on the future water level.

40. The method of claim 1, further comprising sending information from the dam installation to at least one other dam installation.

41. The method of claim 1, further comprising coupling the dam installation to at least one other dam installation, controlling flow levels and electrical power output for each dam installation with a higher-order regulation system for optimizing performance of each dam installation along a section of a water course.

42. The method of claim 1, further comprising, before the regulating step, determining the defined number of turbine generator units, and wherein regulating further comprises regulating, at least to some extent, the water level to the predetermined set point by starting or stopping at least two of the plurality of turbine generator units substantially simultaneously.

43. The method of claim 1, further comprising determining the defined number of turbine generator units based on a current power demand.

44. The method of claim 1, further comprising determining the defined number of turbine generator units based on a future power demand or a predicted power demand.

45. The method of claim 1, further comprising optimizing power generation based on the water level regulating.

46. The method of claim 1, further comprising optimizing power generation using a mathematical model.

47. The method of claim 1, further comprising determining an optimum number of turbine generator units for power generation using a mathematical model that takes account of at least one of current water inflow, current water outflow, future water inflow, future water outflow, current power demand, and predicted power demand.

48. The method of claim 47, wherein the mathematical model takes account of at least one of a temporary opening of a weir, a dam, or a sluice.

49. The method of claim 47, wherein the mathematical model takes account of at least one of a temporary closing of a weir, a dam, or a sluice.

50. The method of claim 47, wherein the mathematical model takes account of at least one of a raised position of a turbine generator unit, a raised position of a turbine generator module, inputs from operating personnel, stored empirical values, physical laws, a quantity of water evaporating away, a quantity of water seeping away, current meteorological data, and predictive meteorological data, expected rainfall, and temperature predictions.

51. The method of claim 1, further comprising determining an expected water level of the dam installation for predetermined time period, and setting the predetermined set point based on the expected water level.

52. The method of claim 51, wherein the predetermined time period is one year.

53. The method of claim 1, further comprising determining an expected power demand of the dam installation for predetermined time period, and setting the predetermined set point based on the expected power demand.

54. The method of claim 53, wherein the predetermined time period is one day.

55. The method of claim 1, further comprising raising at least one of the plurality of turbine generator units in order to fully open a flow cross-section in the dam installation.

56. The method of claim 1, further comprising coupling the dam installation to at least one other dam installation and a central control center, wherein each dam installation is controllable via the central control center.

57. The method of claim 1, further comprising determining the predetermined set point based on at least one of an information unrelated to power generation, navigation considerations, and irrigation considerations.

58. The method of claim 1, wherein the plurality of turbine generator units comprises at least 10 turbine generator units.

59. The method of claim 58, wherein the plurality of turbine generator units comprises between 20 and 500 turbine generator units.

60. A plant for regulating a water level of a dam installation comprising a plurality of turbine generator units arranged one above another, one beside another, or combinations thereof, the turbine generator units connected to one another to form at least one turbine generator module, the plant comprising:

a regulating system structured and arranged to start and stop at least one of the plurality of turbine generator units for regulating, at least to some extend, the water level; and

the regulating system maintaining the water level between upper and lower predetermined set points by adjusting in discrete steps, a quantity of water flowing through the dam installation,

wherein a discrete step is defined by the quantity of water operatively flowing through a defined number of turbine generator units.

61. The plant of claim 60, wherein the dam installation is arranged on a dam.

62. The plant of claim 60, wherein the dam installation comprises a weir.

63. The plant of claim 60, wherein each of the plurality of turbine generator units have an output which is between approximately 100 kW and approximately 1000 kW.

64. The plant of claim 60, wherein the at least one of the plurality of turbine generator units operates based on one of a substantially constant flow rate or a substantially constant output.

65. The plant of claim 60, wherein the regulating system comprises a device for opening and closing at least one weir system.

66. The plant of claim 60, wherein the dam installation comprises a plurality of piers between which a medium can flow past, and wherein the plurality of turbine generating units are arranged between and supported by two adjacent piers.

67. The plant of claim 60, wherein the regulating system is integrated into at least one of the plurality of turbine generator units.

68. The plant of claim 60, wherein the regulating system is integrated into the at least one turbine generator module.

69. The plant of claim 60, wherein the regulating system is supported on piers of the dam installation.

70. The plant of claim 60, wherein the regulating system is supported directly on piers of the dam installation.

71. The plant of claim 60, wherein the plurality of turbine generator units are raised and lowered for increasing and respectively decreasing a flow cross-section in the dam installation.

72. The plant of claim 60, wherein the at least one turbine generator module is raised and lowered for increasing and respectively decreasing a flow cross-section in the dam installation.

73. The plant of claim 60, further comprising a central control center is provided for regulating the water level of the dam installation.

74. The plant of claim 73, wherein the central control center is provided for regulating the water level of another dam installation.

75. The plant of claim 60, wherein the dam installation is arranged on a navigation dam.

76. The plant of claim 60, wherein the dam installation is arranged on a drinking water reservoir.

77. The plant of claim 60, wherein the dam installation is arranged on an irrigation dam.

78. The plant of claim 60, wherein the dam installation is arranged on a flood retention basin.

79. The plant of claim 60, wherein the dam installation comprises a dam stage of a hydroelectric power station.

80. A method of regulating a water level of a dam installation between an upper predetermined set point and a lower predetermined set point, the method comprising:

starting a number of turbine generator units when the water level reaches the upper predetermined set point;

stopping a number of turbine generator units when the water level reaches the lower predetermined set point; and

controlling starting and stopping commands to ensure that the water level is maintained between the upper predetermined set point and the lower predetermined set point,

wherein the controlling step regulates a quantity of water flowing through the turbine generator units in discrete steps, and

wherein a discrete step is defined by the quantity of water operatively flowing through a defined number of turbine generator units.

81. A system for regulating a water level of a dam installation between an upper predetermined set point and a lower predetermined set point, the dam installation comprising turbine generator units, the system comprising:

means for indicating a current water level;

means for starting a number of turbine generator units when the water level reaches the upper predetermined set point and for stopping a number of turbine generator units when the water level reaches the lower predetermined set point; and

means for controlling starting and the stopping to ensure that the water level is maintained between the upper predetermined set point and the lower predetermined set point,

wherein the means for controlling starting and the stopping comprises one of a computer system and an alarm system,

wherein the system adjusts in discrete steps a quantity of water flowing through the dam installation, and

wherein a discrete step is defined by the quantity of water operatively flowing through a defined number of turbine generator units.

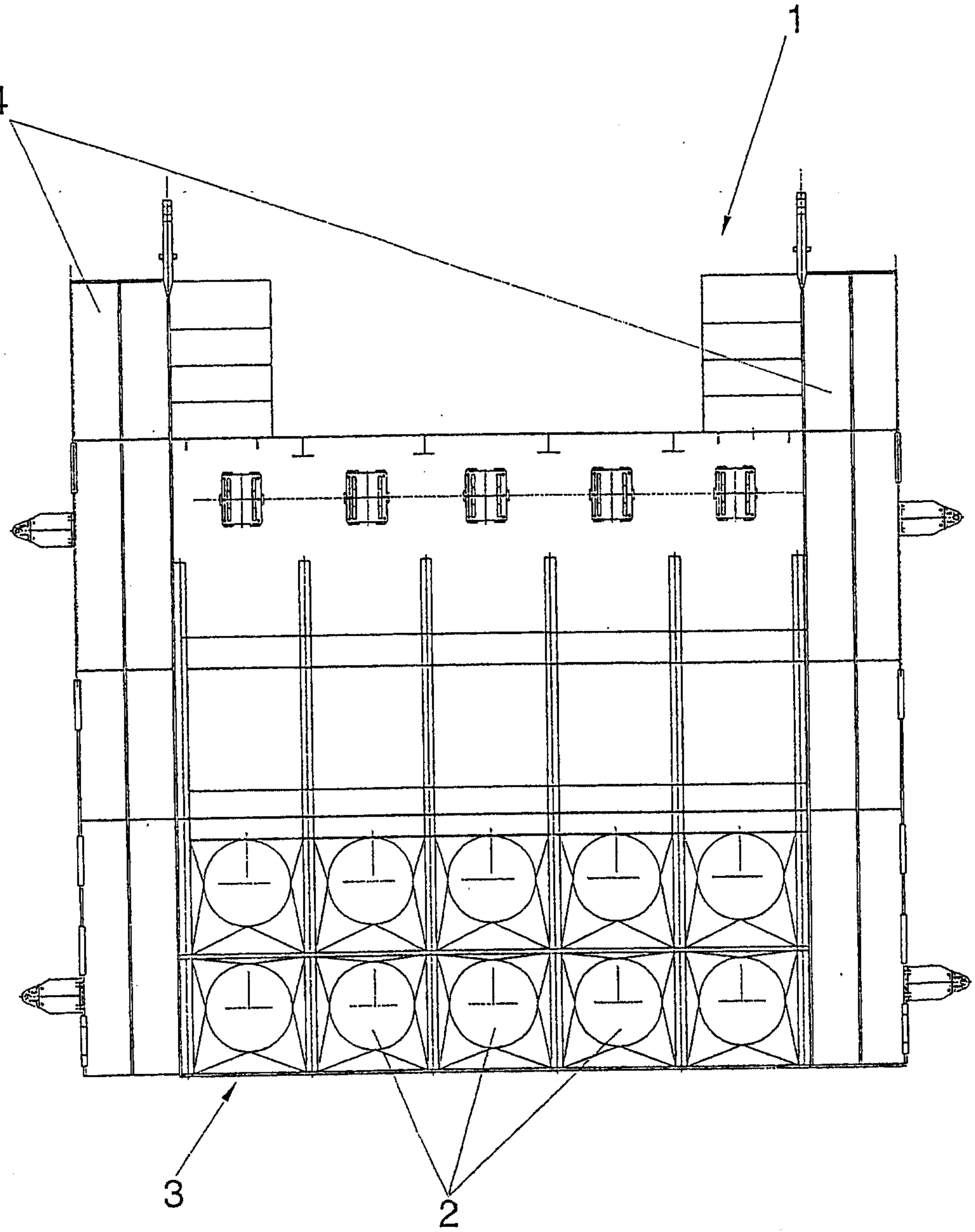
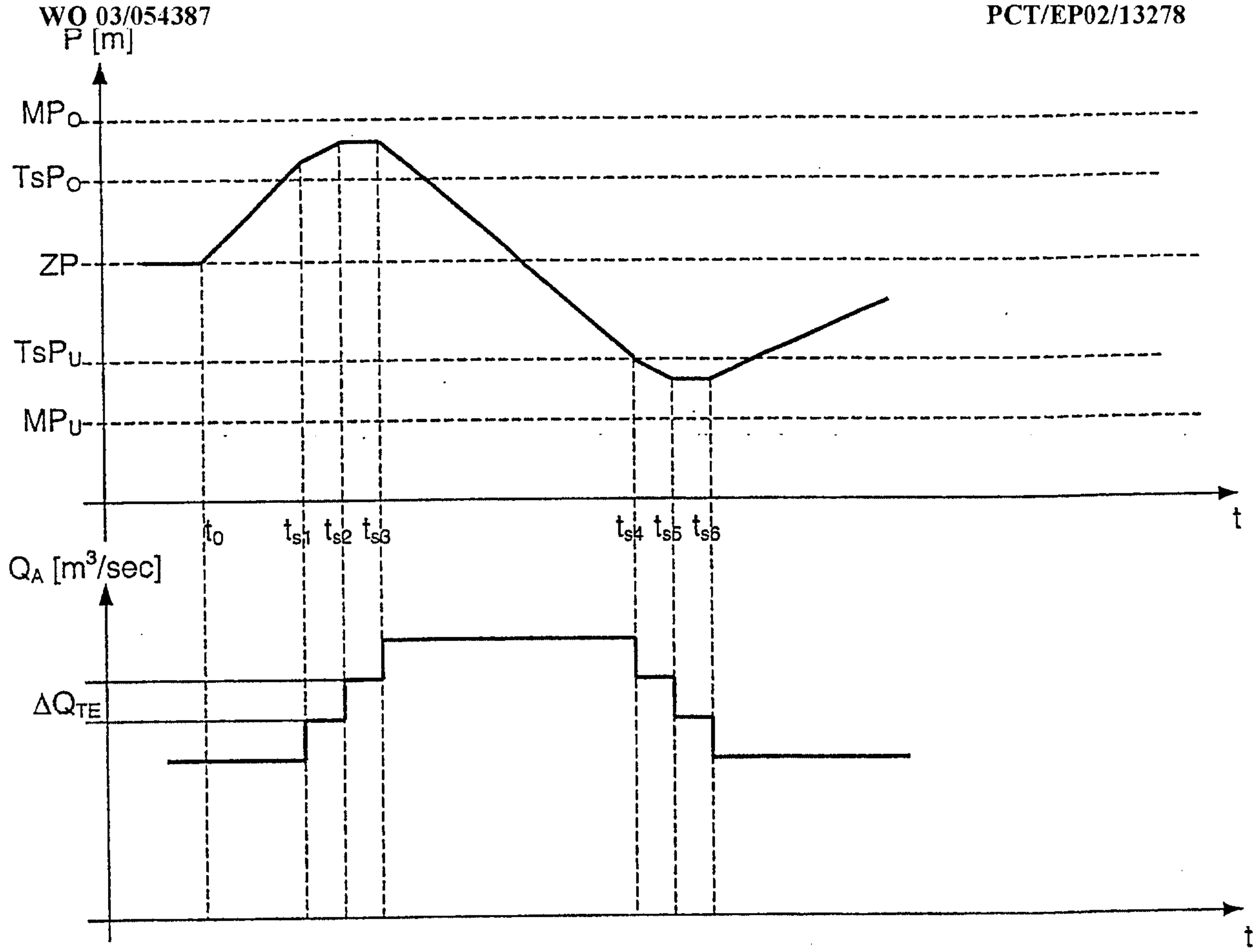


Fig. 1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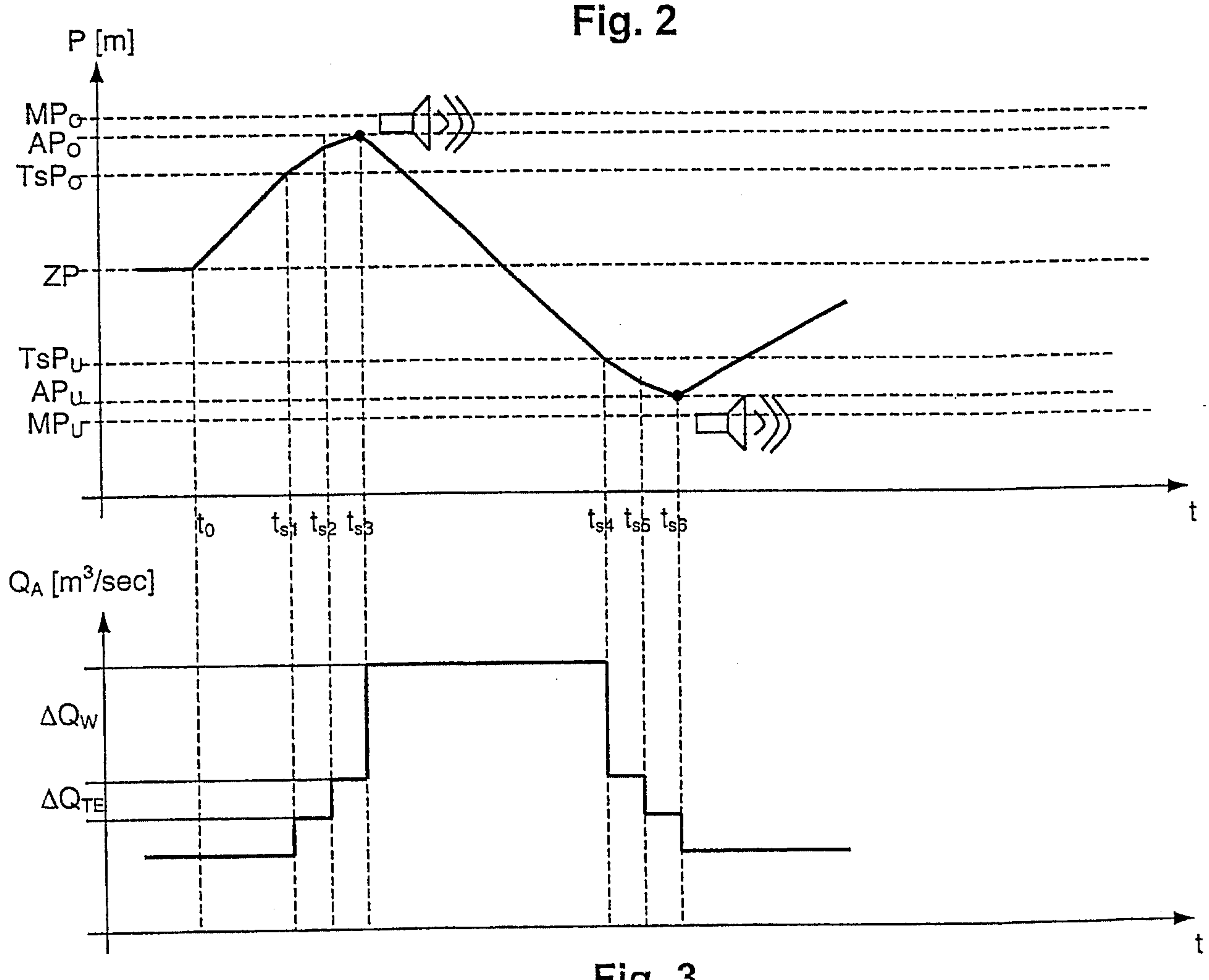
ZP
TsPu
MPu
t
t0 ts1 ts2 ts3 ts4 ts5 ts6
QA [m3/sec]
ΔQTE
t

Fig. 2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MPo
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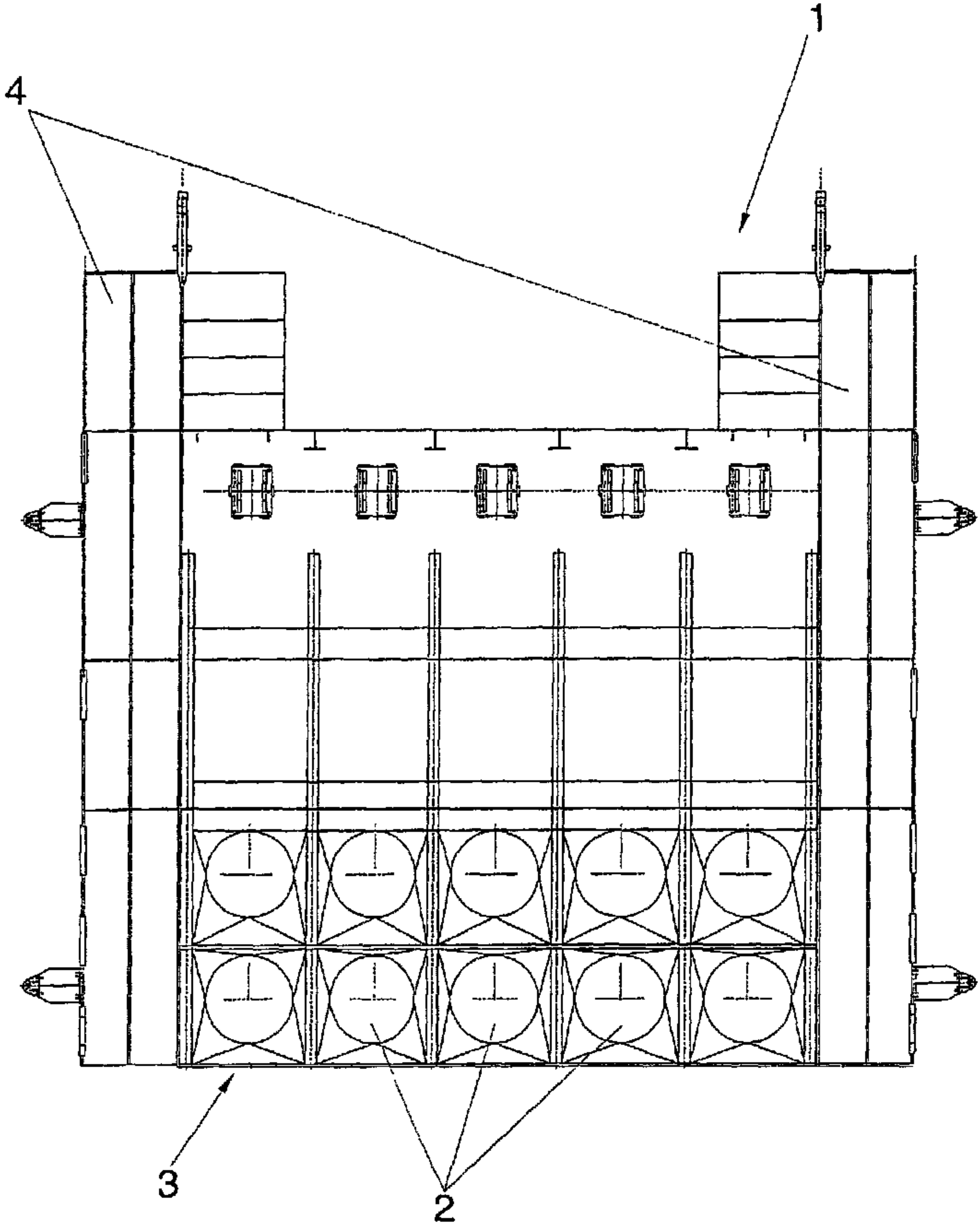
ΔQW
ΔQTE
t

Fig. 3



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