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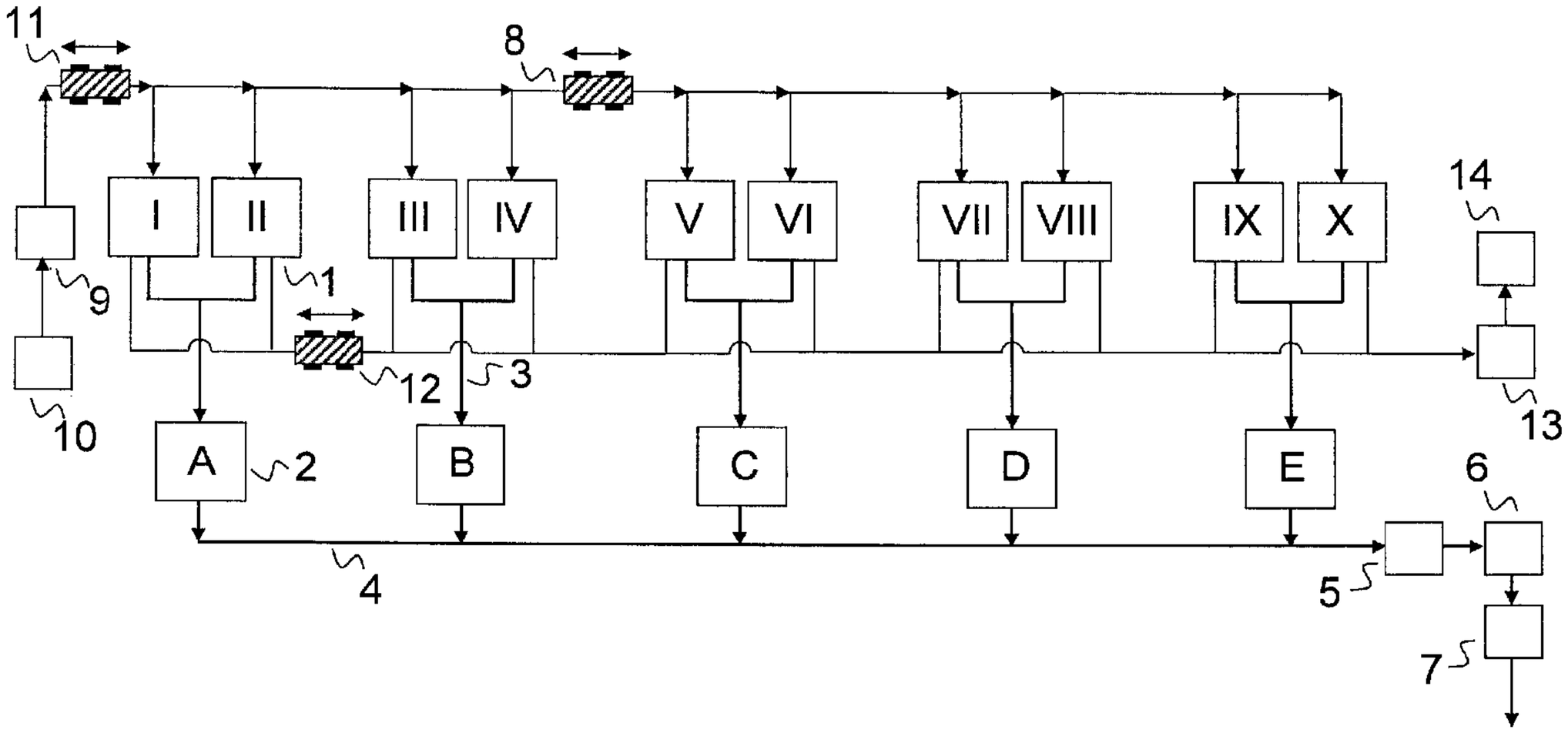
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(54) Titre : PROCEDE DE FONCTIONNEMENT CYCLIQUE DES BANCS DE FOURS DE COKEFACTION COMPOSES DE FOURS A CHAMBRE DE COKEFACTION A RECUPERATION DE CHALEUR

(54) Title: METHOD FOR CYCLICAL OPERATION OF COKE OVEN BANKS COMPRISED OF "HEAT RECOVERY" COKE OVEN CHAMBERS

FIG. 5



(57) Abrégé/Abstract:
The invention relates to a method for cyclical operation of a coke oven facility, said facility being comprised of an even number of coke oven banks which in turn are comprised of an even number of coke oven chambers. Located downstream of said coke oven banks are boiler facilities which drive turbines with the hot waste gases from the coke oven banks. Energy is recovered in this manner. The coke oven chambers are pushed and charged in an exactly determined cycle so that the production of hot waste gas over the temporal mean can be homogenized.

Abstract

The invention relates to a method for cyclical operation of a coke oven facility, said facility being comprised of an even number of coke oven banks which in turn are comprised of an even number of coke oven chambers. Located downstream of said coke oven banks are boiler facilities which drive turbines with the hot waste gases from the coke oven banks. Energy is recovered in this manner. The coke oven chambers are pushed and charged in an exactly determined cycle so that the production of hot waste gas over the temporal mean can be homogenized.

(Drawing to be published with the abstract: FIG. 5

Method For A Cyclical Operation Of Coke Oven Banks Comprised Of “Heat Recovery” Coke Oven Chambers

[0001] The invention relates to a method for a cyclical operation of coke oven chambers of the "Heat Recovery" type which form part of coke oven banks, said operation particularly relating to the cyclic phases of "charging – coking - pushing" and with the procedures of pushing determining the cycle being so arranged that the production of hot coking gases utilized according to the “Heat Recovery” process for the production of steam and energy is evenly distributed over the temporal mean of the entire coking process, thus substantially improving the production of steam and energy, and in particular of electrical energy downstream of the coking process.

[0002] On carbonization of coal, the coking gas evolving on carbonization can be utilized in different ways. In some design types, the coking gas is captured and utilized in order to recover and exploit the valuable substances contained therein, for example aromatic hydrocarbons, hydrogen, ammonia, and methane. In other design types, the coking gas is utilized to burn it and thereby to generate heat which is exploited for the process of coal carbonization. With these design types, in turn, it is possible to pass the coking gas after combustion and exploitation of the evolving thermal energy without any further use into the environment. These design types are called coke ovens of the “Non-Recovery” type. Other design types in turn utilize the waste heat to recover steam thereof. This can be utilized, for example, to generate electrical energy. These design types are called coke ovens of the “Heat Recovery” type.

[0003] The arrangement of coke ovens is basically so taken that between 6 and 34 coke ovens are grouped together to be linked to each other in a major unit, which is also called a coke oven bank. In this manner, the production of coke can be substantially homogenized. Since the coke oven chambers have to be charged to allow for production, the charging procedure can by noticeably simplified and automated by forming groups of several coke oven chambers. The reason is that coal carbonization is accomplished in a "charging - coking - pushing" phase cycle. While the coking cycle still lingers on with some coke oven chambers, other chambers can be charged or pushed. In this manner, a constant output of combustion gas is also achieved. Coke pushing is accompanied outside the coke oven chamber on the opposite side of a coke oven chamber by the filling of a coke quenching car. In the denomination of oven combinations the method applied is that a combination of several coke ovens of the

"Non-Recovery" type or "Heat Recovery" type is called "oven bank". Conversely, a combination of conventional coke ovens is called "oven battery".

[0004] WO 2006/128612 A1 describes a method for carbonization of coal in a coke oven with combustion of coking gas, said coking gas initially streaming into a gas space above the coke cake where it is partly burnt with an understoichiometrical volume of supplied combustion air. This process is called primary combustion and it utilizes so-called primary combustion air for combustion. Partly burnt coking gas is then passed via so-called "downcomer" channels into a secondary heating space where it is completely burnt with another quantity of supplied combustion air. This process is called secondary combustion and it utilizes so-called secondary combustion air for combustion. Thereby the lower section of the coke cake is also heated, thus improving the coke quality. The invention lays claim to a device and a method for homogenization of the supply of primary combustion air into the gas space above the coke cake, so that heat distribution in the upper section of the coke cake is homogenized and a better coke product is thus obtained. The invention is equally exploitable for a coke oven of the "Non-Recovery" or "Heat Recovery" type.

[0005] US 5968320 A describes a coke oven of the "Heat-Recovery" type which discharges the raw coking gas from the coke oven and burns it in a boiler system in order to generate heat and electric power. The raw coking gas is sprayed for cleaning with a flushing liquor and burnt in a burner where it is exploited to generate steam and mechanical energy. This can be utilized, in turn, to generate electrical energy. To facilitate combustion and to avoid costly installation of compressors and measuring equipment, a negative pressure furnished by installing a suction blower downstream of the combustion chamber is generated in the combustion chamber. By way of this device, the unevenness in furnishing waste gases from coal carbonization which occurs on operation of the described coke oven chambers is also homogenized. But viewed over the entire period of coal carbonization, homogenization is not complete.

[0006] Systems described hereinabove utilize the heat from coal carbonization and from the succeeding combustion process to recover steam and energy. But they have a drawback in that the output of hot combustion gas over the temporal mean must nearly be completely constant in order to ensure even supply of combustion gas to the boilers which generate steam from the effluent heat of coal carbonization. These boilers must be supplied with the most even possible quantity of combustion gas in order to ensure optimal operation of turbines and driven devices further downstream.

[0007] Viewed over a coking cycle, the output of combustion gas from a single coke oven chamber is not constant. It is known that a maximum quantity of raw gas is released during the initial 20 % of the coking cycle, said quantity decreasing strongly in the course of coal carbonization. A typical quantity of hot combustion gas measured over the time of one coking cycle of a coke oven chamber is shown as an example in FIG. 1. Now if all coke oven chambers of one bank were served consecutively within a short time interval, i.e. pushed and charged, then the corresponding boiler located further downstream would be overstressed by this instant over-supply of hot flue gas and it would no longer work within its optimal working range. For this reason it is of substantial interest to configure the controlled approach to the ovens in such a manner that only one oven each per boiler is served over the entire time period.

[0008] A control of the quantity of combustion gas is only feasible in a simple manner via a change in cycle times. For cost considerations, an intermediate arrangement of tanks or accumulator facilities for hot combustion gas is not desired. A change in cycle times, in turn, can only be accomplished via a precisely controlled temporal sequence of the controlled approach to the coke oven chambers. From conventional horizontal-type coking chamber technique, the sequence of such a controlled approach is known under the name “pushing schedule“. It is also determined by the duration of the coal charging procedure and by the maximum travel speed of the oven service machines. A precisely planned set-up of a pushing schedule allows for a simple homogenization of the stream of hot combustion gas.

[0009] Now, therefore, it is the object to provide a simple process and method that allows for controlling the quantity of combustion gas by changing the cycle times or the pushing schedule. Combustion gas is understood to cover a gas, too, that is completely burnt and streams out from a coke oven chamber. But it may also be a partly burnt coking gas if it is burnt in the succeeding auxiliary facilities or in the boilers.

[0010] The invention solves this task by providing a device that combines the coke oven chambers of the “Heat Recovery” type in a distinct number to coke oven banks and by providing a method that controllably approaches these coke oven chambers in an exactly determined sequence for coke pushing. Since the so-called "charging – coking – pushing“ cycle terminates with the pushing cycle, the entire cycle for the individual coke oven chambers is controlled with the end of this pushing cycle. The temporal approach to the individual coke oven chambers is so accomplished that the temporal duration of the charging and pushing procedures performed without production of hot combustion gas is distributed over all coke oven banks and over all

coke oven chambers. Hot combustion gas is then continually produced during the coking cycle. Owing to the exactly controlled temporal distribution of the cycles over all coke oven banks and coke oven chambers, the production of hot waste gas is so homogenized that control facilities like gas accumulator, tube switches or intermediate tanks are no longer required.

[0011] For the execution of the inventive device, the coke oven chambers are so configured that they are steadily linked in a spatial integration to form coke oven banks. The spatial integration can be accomplished in an even or odd number. A linkage is considered to be a constructive encirclement of coke oven chambers. It can be of any arbitrary configuration. It can be implemented by brickwork or jacketing around. But it may also be implemented by an intermediate wall. The term "pushing cycle“ is deemed to mean both parts of the coking cycle "pushing and charging". Coal is preferably not preheated and directly charged into the oven pre-warmed by the preceding coking cycle.

[0012] It is important that all coke oven chambers can be controllably approached by one charging machine and by one pushing machine so that the charging and pushing procedures can be executed by one machine. Basically the charging machine is always combined with a quenching car that can controllably approach the opening to be charged so as to allow for a pushing procedure. The pushing procedure is preferably so accomplished that the charging procedure is performed by proceeding from the frontal front-end side coke oven chamber wall while the pushing procedure is performed by proceeding from the frontal rear-end side coke oven chamber wall. An automation and a time-related non-retarded performance of the individual cycles is possible in this manner,

[0013] To execute the inventive device, preferably two coke oven banks each are connected in pairs to one boiler. For example, if the coke oven is comprised of ten coke oven banks, then the entire unit is comprised of five boilers. These are utilized to generate steam and energy. The boilers are supplied with hot coking gas coming from the coke oven banks. This is advantageously accomplished through a piping that is linked via a collecting device to the individual coke oven chambers.

[0014] A controlled approach to the individual coke oven chambers for charging is so accomplished that only one coke oven chamber of the individual coke oven bank is initially approached. For example, this is the first coke oven chamber of a coke oven bank. To distribute the charging procedures as evenly as possible over the entire time

duration, a coke oven chamber of the next but one third coke oven bank is approached after approaching the first coke oven chamber of the first coke oven bank. This is of some advantage because another boiler (boiler number 2) is linked to the third coke oven bank, thus avoiding an additional maximal volume flow which would lead to an uneven supply of combustion gas into the boilers. This proceeding is applied on all coke oven chambers of the first coke oven chambers each of the next but one coke oven bank each until the first coke oven chamber of the last but one coke oven bank has been pushed and charged. These procedures represent a first pushing cycle.

[0015] Other pushing cycles follow to charge and push the further coke oven chambers. These will then serve the next coke oven chamber each of the next coke oven bank each. In this manner, the second coke oven chambers of the coke oven chambers of the second and of the next but one coke oven chambers each are controllably approached until the second coke oven chamber of the last coke oven bank has been approached. In the next pushing cycle, the coke oven banks succeeding next in this sequence are pushed and charged. For example, these are the third coke oven chambers of the first and of the next but one coke oven bank(s).

[0016] A controlled approach to the individual coke oven chambers also depends on the temperature gradient in the coke oven bank. As the coal charging procedure initially entails a temperature drop in the oven, it is generally of some importance for a constant heat budget of an individual oven **y** that the adjacent ovens **y+1** and **y-1** are not served immediately, i.e. a few hours, after oven **y**, if possible. This would entail a temperature drop in an entire oven bank section. It is purposive to choose the charging cycle in such a manner that the adjacent ovens **y+1** and **y-1** are served only after at least 24 hours.

[0017] If all coke oven chambers except for the last ones have been pushed and charged, the pushing and charging of the last coke oven chambers of the first and of the next but one coke oven bank each is accomplished in the last cycle. In this manner, a very even production of waste heat is passed into the boiler facilities over the temporal mean of all coking cycles so that a very even supply of waste heat to the boilers is feasible.

[0018] Claim is particularly laid to a method for cyclical operation of a sequence of an even or odd number of coke oven banks of the “Heat Recovery” type comprised of an even or odd number of coke oven chambers, wherein

- the coke oven banks (1) proper are composed of a sequence of at least four coke oven chambers of the "Heat Recovery" type, and wherein
- the coke oven banks are linked to a boiler system in which the heat of hot waste gases from coke oven banks is utilized to generate steam, and
- the coke oven chambers are pushed and charged within exactly determined time intervals from the frontal side with a coke pusher machine into the opposite direction of a coke oven chamber, and that directly after pushing a renewed charging of the individual coke oven chambers and a renewed coking cycle are accomplished,

and which is characterized in that

- in a first pushing cycle the first coke oven chamber of the first coke oven bank is initially pushed and charged, and wherein the first coke oven chamber of the next but one coke oven bank is consecutively pushed and charged until the first coke oven chamber of the last but one coke oven bank has been pushed and charged, if the number of coke oven chambers per coke oven bank is an even number, and
- in a succeeding pushing cycle the next coke oven chamber of the next coke oven bank within this sequence is initially pushed and charged, and wherein then in successive order the coke oven chamber being the same in this sequence of the next but one coke oven bank is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank has been pushed and charged, and
- in a succeeding pushing cycle the next but one coke oven chamber in this sequence of the first coke oven bank is pushed and charged, and wherein then in successive order the coke oven chamber being the same in this sequence of the next but one coke oven bank is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank has been pushed and charged, and
- in a final pushing cycle the coke oven chamber being the last one in this sequence of the first coke oven bank is pushed and charged, and wherein then in successive order the last coke oven chamber each of

the next but one coke oven bank is pushed and charged until the coke oven chamber being the last one in this sequence of the last but one coke oven bank has been pushed and charged so that

- a very even production of waste heat can be passed in this manner into the boiler facilities so that the boilers can be supplied very evenly with waste heat.

[0019] In a preferred embodiment, the method is so devised that relative to the coke oven banks exactly half the number of boiler systems is existing so that these are linked in pairs to the boilers.

[0020] This method is characterized by the term "pushing schedule 2*x / 1*(x+1) / 2". X represents the number of coke oven chambers per coke oven bank. The designation 2 * x indicates the difference in the number of coke oven chambers on controlled approaching and it means that after coke oven chamber 1 the coke oven chamber 29 (difference 28 = 2 * 14) is approached. As has been described hereinabove, this is the first coke oven bank of the next but one coke oven chamber. Then, in the succeeding charging cycle, the second coke oven chamber of next coke oven bank is approached, i.e. coke oven chamber 16 (difference 15 = 1 * (14 + 1)). Finally, in the succeeding pushing cycle, the third coke oven chamber of the first coke oven bank is pushed (2''). With a coke oven chamber number of 14, the pushing schedule is then called 28 / 15 / 2.

[0021] The pushing schedule may be varied. This is feasible in the extent in which a substantial homogenization of the combustion gas stream is effected. For example, a pushing schedule "2*x / 1*x / 1'' is also feasible. It would mean that

- in a first pushing cycle the first coke oven chamber of the first coke oven bank is initially pushed and charged, and wherein the first coke oven chamber each of the next but one coke oven bank is consecutively pushed and charged until the first coke oven chamber of the last but one coke oven bank has been pushed and charged, if the number of coke oven chambers per coke oven bank is an even number, and
- in a succeeding pushing cycle the first coke oven chamber of the next coke oven bank is initially pushed and charged, and wherein then in successive order the first coke oven chamber each of the next but one coke oven bank is pushed and charged until the first coke oven chamber of the last coke oven bank has been pushed and charged, and

- in a succeeding pushing cycle the coke oven chamber being the next one in this sequence of the first coke oven bank is pushed and charged, and wherein then in successive order the coke oven chamber each being the same in this sequence of the next but one coke oven bank is pushed and charged until the coke oven chamber being the next one in this sequence of the last coke oven bank has been pushed and charged, and
- in a final pushing cycle the coke oven chamber being the last one in this sequence of the next coke oven bank is pushed and charged, and wherein then in successive order the last coke oven chamber each of the next but one coke oven bank is pushed and charged until the coke oven chamber being the last one in this sequence of the last coke oven bank has been pushed and charged.

[0022] In a preferred embodiment, the method is so devised that relative to the coke oven banks exactly half the number of boiler systems is existing so that these are linked in pairs to the boilers.

[0023] A simpler mode of operation consists in approaching the first coke oven chamber of the next coke oven bank each. The corresponding pushing schedule is then called 1*x / 2". This requires substantially less expenditure on movements of the charging machine. The homogenization of the combustion gas stream, however, will then be less. Likewise, adjacent coke oven chambers are more strongly charged with heat. The pushing schedule means that

- in a first pushing cycle the first coke oven chamber of the first coke oven bank is initially pushed and charged, and wherein the first coke oven chamber each of the next coke oven bank is consecutively pushed and charged until the first coke oven chamber of the last coke oven bank has been pushed and charged, if the number of coke oven chambers per coke oven bank is an even number, and
- in a succeeding pushing cycle the next but one coke oven chamber of the next coke oven bank within this sequence is initially pushed and charged, and wherein then in successive order the coke oven chamber being the same in this sequence of the next coke oven bank is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank has been pushed and charged, and

- in a final pushing cycle the last coke oven chamber of the first coke oven bank is pushed and charged, and wherein then in successive order the coke oven chamber being the last one each within this sequence of the next coke oven bank is pushed and charged until the last coke oven chamber of the last coke oven bank has been pushed and charged.

[0024] In a preferred embodiment, the method is so devised that relative to the coke oven banks exactly half the number of boiler systems is existing so that these are linked in pairs to the boilers.

[0025] In this manner, too, a homogenization of the volume of combustion gas stream is feasible.

[0026] The boilers are utilized to generate steam in order to drive a turbine. This propellant energy can be exploited arbitrarily. The propellant energy is preferably exploited to generate electrical energy. To this effect the boiler system is equipped with appropriate devices. These devices include heater facilities, boilers, turbines, steam separators, shafts and generators. Supplementary facilities may also be provided, if the mechanical energy is to be utilized in a different manner.

[0027] On passing through the boiler system, the waste gases are preferably fed into a device for gas cleaning to minimize environmental pollution possibly caused by the coke making process. In particular, sulfuric compounds are removed from the waste gas during the gas cleaning process so that the gas cleaning facility preferably is a desulphurization facility. For example, this may be a gas scrubbing unit applying a gas-absorbing solvent.

[0028] For charging, the coal is loaded by a coal charging car from the frontal side into the coke oven chamber. As a result of the preceding coking process, it is still hot so that no other procedures for coal carbonization are required. At the beginning of the coking process, the door is closed. After the coking process, the coke is removed from the coke oven chamber. Depending on the coal cake height, charging density, and coke oven type, the coking process basically takes approx. 20 to 90 hours. In an advantageous embodiment of the present invention, pushing is effected towards the other side of the coke oven chamber. Coke oven chamber doors easy and quickly to handle are located on either side of the coke oven chamber.

[0029] Upon charging, hot coke is pushed into a coke quenching car. To execute the invention, it can approach the single coke oven chambers individually. The coke quenching car may be provided with a cooling facility. But to be able to quickly execute the discharging processes, it is preferably equipped with a facility for protection from high temperatures. After pushing and discharging of the hot coke, it is preferably passed with the quenching car into a completely cooling facility. For example, this is a coke quenching tower. But it may also be, for example, a coke dry quenching facility.

[0030] To execute the inventive method, the coke oven chambers are combined in even or odd number to coke oven banks. In the inventive embodiment, the coke oven bank is preferably comprised of 6 to 34 coke oven chambers. In a particularly preferred version of the inventive embodiment, the coke oven bank is exactly comprised of 10 to 18 coke oven chambers. In a typical embodiment, the coke oven bank is comprised of 14 coke oven chambers. To supply the boilers or boiler facilities with hot waste gas, they are preferably linked to pairs of coke oven banks. This is accomplished via pipelines and appropriate collecting facilities. In theory, however, it is also conceivable to link the boilers or boiler facilities to three coke oven banks each, but in this case the distribution of hot gas is much more difficult. Preferably one boiler is linked to two coke oven banks. However, it is also conceivable to link one boiler to one, three or more coke oven banks.

[0031] The inventive method provides the benefit of a uniform supply of hot combustion gas to boilers or boiler facilities of coke oven systems. Consequently, the generation of steam by the boiler systems is substantially homogenized. As a result hereof, the generation of electrical energy is much easier. The output of contaminants and pollutants from a coke oven system is thus reduced noticeably. If electrical power is generated by the inventive process, then the generation of electrical power, too, is homogenized and optimized.

[0032] The inventive configuration of a method for carbonization of coal is explained in greater detail by way of five drawings, with the inventive method not being restricted to this embodiment.

[0033] FIG. 1 shows the quantity of raw gas from a coke oven that typically evolved in a coking cycle. FIG. 2 shows a cycle schedule of charging procedures for coke oven chambers that are linked in pairs to a system of boilers, with said cycle schedule having been set-up according to a 2*x / 1*(x+1) / 2“ pushing schedule. FIG. 3 shows a cycle schedule of charging procedures for coke oven chambers that are linked

in pairs to a system of boilers, with said cycle schedule having been set-up according to the 2*x / 1*x / 1“ pushing schedule. FIG. 4 shows a cycle schedule of charging procedures for coke oven chambers that are linked in pairs to a system of boilers, with the cycle schedule obeying to the 1*x / 2“ pushing schedule. FIG. 5 shows an inventive arrangement of coke oven banks in a coking system with boilers and downstream arranged auxiliary facilities.

[0034] FIG. 1 shows the raw gas quantity of coking gas evolving on coal carbonization above the coke cake and mainly comprised of hydrogen, carbon monoxide, methane, and water steam constituents. It is determined in volumetric units of standard cubic meters per hour over the entire time of the coking cycle. The raw gas quantity is directly proportional to the quantity of completely burnt coking gas that streams-in as combustion gas from a coke oven chamber.

[0035] FIG. 2 shows a cycle schedule for the „charging - coking – pushing“ cycle with the 28 / 15 / 2” pushing schedule. Each little rectangular square represents a coke oven chamber arranged in the coke oven bank. The individual coke oven banks are enumerated in the first line of the graphical representation and vertically confined by the beams. These bear a numbering from 1 to 10. Each coke oven bank is comprised of 14 coke oven chambers; these are numbered in the second line and bear a numbering from 1 to 140. The time periods of the individual cycles are indicated in the third and fourth line (fractions of an hour and hours, display in minutes). The second column at right from the fifth column on indicates a campaign cycle of the pusher machine. To begin with, the first coke oven chamber of the first coke oven bank is pushed. Next the first coke oven chamber of the third coke oven bank, and then the first coke oven chamber of the fifth, and then the first coke oven chamber of the seventh and finally the first coke oven chamber of the ninth coke oven bank is pushed. Next the second pushing cycle starts. It commences with the second coke oven chamber of the second coke oven bank. Then the second coke oven chamber of the fourth coke oven bank is pushed. The third pushing cycle starts upon the end of this cycle. It commences with the third coke oven chamber of the first coke oven bank. Finally, in the last pushing cycle, the last coke oven chamber of the first coke oven bank is pushed. Ultimately, coke oven chamber number 126, the last coke oven chamber of the ninth coke oven bank, is pushed. In this manner, a very uniform distribution of the cycles over the entire coking facility is achieved.

[0036] FIG. 3 shows another cycle schedule for the „charging - coking – pushing“ cycle with the “28 / 14 / 1” pushing schedule. To begin with, the first coke oven

chamber of the first coke oven bank is pushed. Next the first coke oven chamber of the third coke oven bank, and then the first coke oven chamber of the fifth, and then the first coke oven chamber of the seventh and finally the first coke oven chamber of the ninth coke oven bank is pushed. Next the second pushing cycle starts. It commences with the first coke oven chamber of the second coke oven bank. Then the first coke oven chamber of the fourth coke oven bank is pushed. The third pushing cycle starts upon the end of this cycle. It commences with the second coke oven chamber of the first coke oven bank. Finally, in the last pushing cycle, the last coke oven chamber of the second coke oven bank is pushed. Ultimately, coke oven chamber number 140, the last coke oven chamber of the last coke oven bank, is pushed. In this manner, a very uniform distribution of the cycles over the entire coking facility is also achieved.

[0037] FIG. 4 shows another cycle schedule for the „charging - coking – pushing" cycle with the "14 / 2" pushing schedule. To begin with, the first coke oven chamber of the first coke oven bank is pushed. Next the first coke oven chamber of the second coke oven bank is pushed and charged until the first coke oven chamber of the last coke oven bank has been pushed. The second pushing cycle starts next. It commences with the third coke oven chamber of the first coke oven bank. Finally, coke oven chamber number 140, the last coke oven chamber of the last coke oven bank, is pushed. Applying this pushing schedule allows for a simple mode of operation of the pusher machine and enables a uniform distribution of the cycles over the entire coking facility.

[0038] FIG. 5 shows an inventive coke oven arrangement including the boiler systems and the associated auxiliary devices. Shown here are the coke oven banks (**1**) I to X and the boilers facilities (**2**) A to E associated therewith. These are linked in pairs via supply lines (**3**) to the coke oven banks (**1**) including the associated supply facilities. They supply the boiler facilities (**2**) with hot waste gas. The boilers (**2**) supply steam energy to turbines located downstream. The cooled and flashed waste gas streaming from the boilers flows via waste gas lines (**4**) and is passed into a gas cleaning facility (**5**). A fan (**6**) generates a negative pressure in order to facilitate off-streaming. Waste gases are then passed through a waste gas line into a waste gas chimney (**7**). The charging machine (**8**) is also shown here. It supplies the coke oven chambers (**1**) of the coke oven banks (**2**) with coal, said charging machine being fed with coal from a compacting facility (**9**) and a coal reservoir (**10**). The charging machine (**8**) may be followed by a pusher machine (**11**) which pushes the coke from the coke oven chambers. Finally, the coke quenching car (**12**) is shown here, too. It discharges the

individual coke oven chambers and carries the coke into a coke quenching tower (**13**). Appropriate storage facilities (**14**) are located downstream.

[0039] List of Reference Symbols

1	Coke oven bank
2	Boiler
3	Supply line
4	Waste gas line
5	Gas cleaning facility
6	Fan
7	Waste gas chimney
8	Charging machine
9	Compacting facility
10	Coal reservoir container
11	Pushing machine
12	Coke quenching car
13	Coke Quenching Tower
14	Storage facilities

Claims

1. A method for cyclical operation of a sequence coke oven banks (1) of the "Heat Recovery" type in an even or odd number comprised of at least four coke oven banks (1), comprising of an even or odd number of coke oven chambers, wherein

   - the coke oven banks (1) proper are composed of a sequence of at least four coke oven chambers of the "Heat Recovery" type, and
   - the coke oven banks (1) are linked to a boiler system (2) in which the heat of hot waste gases from the coke oven banks (1) is utilized to generate steam, and
   - the coke oven chambers are pushed and charged within exactly determined time intervals from the frontal side with a coke pusher machine (11) into the opposite direction of a coke oven chamber, and that directly after pushing a renewed charging of the individual coke oven chambers and a renewed coking cycle are accomplished,

   characterized in that

   - in a first pushing cycle the first coke oven chamber of the first coke oven bank (1) is initially pushed and charged, and wherein the first coke oven chamber each of the next but one coke oven bank (1) is consecutively pushed and charged until the first coke oven chamber of the last but one coke oven bank (1) has been pushed and charged, if the number of coke oven chambers per coke oven bank (1) is an even number, and
   - in a succeeding second pushing cycle the next coke oven chamber of the next coke oven bank (1) within this sequence is initially pushed and charged, and wherein then in successive order the coke oven chamber being the same in this sequence of the next but one coke oven bank (1) is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank (1) has been pushed and charged, and
   - in a succeeding third pushing cycle the next but one coke oven chamber in this sequence of the first coke oven bank (1) is pushed and charged, and wherein then in successive order the coke oven chamber being the

same in this sequence of the next but one coke oven bank (1) is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank (1) has been pushed and charged, and

- in a final pushing cycle the coke oven chamber being the last one in this sequence of the first coke oven bank (1) is pushed and charged, and wherein then in successive order the last coke oven chamber each of the next but one coke oven bank (1) is pushed and charged until the coke oven chamber being the last one in this sequence of the last but one coke oven bank (1) has been pushed and charged so that
  - over the temporal mean of all coking cycles a very even production of waste heat can be passed in this manner into the boiler facilities (2) so that the boilers (2) can be supplied very evenly with waste heat.

2. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1), wherein
   - the coke oven banks (1) proper are comprised of a sequence of at least four coke oven chambers of the “Heat Recovery” type, and
   - the coke oven banks (1) are linked to a boiler system (2) in which the heat of hot waste gases from coke oven banks (1) is utilized to generate steam so that exactly half the number of boiler systems (2) is provided, and
   - the coke oven chambers are pushed and charged within exactly determined time intervals from the frontal side with a coke pusher machine (11) into the opposite direction of a coke oven chamber, and that directly after pushing a renewed charging of the individual coke oven chambers and a renewed coking cycle are accomplished,

characterized in that

- in a first pushing cycle the first coke oven chamber of the first coke oven bank (1) is initially pushed and charged, and wherein the first coke oven chamber each of the next but one coke oven bank (1) is consecutively pushed and charged until the first coke oven chamber of the last but one coke oven bank (1) has been pushed and charged, if the number of coke oven chambers per coke oven bank (1) is an even number, and

- in a succeeding pushing cycle the first coke oven chamber of the next coke oven bank (1) is initially pushed and charged, and wherein then in successive order the first coke oven chamber each of the next but one coke oven bank (1) is pushed and charged until the first coke oven chamber of the last coke oven bank (1) has been pushed and charged, and
- in a succeeding pushing cycle the coke oven chamber being the next one in this sequence of the first coke oven bank (1) is pushed and charged, and wherein then in successive order the coke oven chamber each being the same in this sequence of the next but one coke oven bank (1) is pushed and charged until the coke oven chamber being the next one in this sequence of the last coke oven bank (1) has been pushed and charged, and
- in a final pushing cycle the coke oven chamber being the last one in this sequence of the coke oven bank (1) being the next one in this sequence is pushed and charged, and wherein then in successive order the last coke oven chamber each of the next but one coke oven bank (1) is pushed and charged until the coke oven chamber being the last one in this sequence of the last coke oven bank (1) has been pushed and charged so that
  - over the temporal mean of all coking cycles a very even production of waste heat can be passed in this manner into the boiler facilities (2) so that the boilers (2) can be supplied very evenly with waste heat.

3. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1), wherein
   - the coke oven banks (1) proper are comprised of a sequence of at least four coke oven chambers of the “Heat Recovery” type, and
   - the coke oven banks (1) are linked to a boiler system (2) in which the heat of hot waste gases from coke oven banks (1) is utilized to generate steam so that exactly half the number of boiler systems (2) is provided, and
   - the coke oven chambers (1) are pushed and charged within exactly determined time intervals from the frontal side with a coke pusher machine (11) into the opposite direction of a coke oven chamber, and

that directly after pushing a renewed charging of the individual coke oven chambers and a renewed coking cycle are accomplished,

characterized in that

- in a first pushing cycle the first coke oven chamber of the first coke oven bank (1) is initially pushed and charged, and wherein the first coke oven chamber each of the next coke oven bank (1) is consecutively pushed and charged until the first coke oven chamber of the last coke oven bank (1) has been pushed and charged, if the number of coke oven chambers per coke oven bank (1) is an even number, and
- in a succeeding pushing cycle the next but one coke oven chamber of the next coke oven bank (1) within this sequence is initially pushed and charged, and wherein then in successive order the coke oven chamber being the same in this sequence of the next coke oven bank (1) is pushed and charged until the coke oven chamber being the same in this sequence of the last coke oven bank (1) has been pushed and charged, and
- in a final pushing cycle the last coke oven chamber of the first coke oven bank (1) is pushed and charged, and wherein then in successive order the coke oven chamber being the last one each within this sequence of the next coke oven bank (1) is pushed and charged until the last coke oven chamber of the last coke oven bank (1) has been pushed and charged so that
- over the temporal mean of all coking cycles a very even production of waste heat can be passed in this manner into the boiler facilities (2) so that the boilers (2) can be supplied very evenly with waste heat.

4. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in any of the preceding claims 1 to 3, **characterized in that** the hot steam from the boiler systems (2) is utilized to drive a turbine and to generate electricity.

5. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in any of the preceding claims 1 to 4, **characterized in that** the hot waste gases are passed to a desulphurization stage (5) after they have left the boiler system (2).

6. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in claim 5, **characterized in that** the device for desulphurization (5) is a gas scrubbing unit.

7. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in any of the preceding claims 1 to 6, **characterized in that** the hot coke is passed into a coke quenching car (12) after pushing, said coke quenching car (12) being able to approach the single coke oven chambers individually for coke pushing.

8. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in claim 7, **characterized in that** the hot coke from the coke quenching car (12) is passed into a facility suitable for coke quenching, this being for example a coke quenching tower (13).

9. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in claim 8, **characterized in that** the hot coke from the coke quenching car (12) is passed into a facility suitable for coke quenching, this being for example a coke dry quenching facility.

10. A method for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in any of the preceding claims 1 to 9, **characterized in that** the individual coke oven chamber ovens are charged by a coal charging machine (8) that can approach the single coke oven chambers individually.

11. A device for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) with a method as defined in any of the preceding claims 1 to 10, **characterized in that** the number of coke oven chambers per coke oven bank (1) ranges between six and thirty-four.

12. A device for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in claim 11, **characterized in that** the number of coke oven chambers per coke oven bank (1) amounts to exactly fourteen.

13. A device for cyclical operation of a sequence of an even or odd number of at least four coke oven banks (1) as defined in any of the preceding claims 11 or 12, **characterized in that** each coke oven bank (1) is linked to one boiler (2) each.

14. A device for cyclical operation of a sequence of an even number of at least four coke oven banks (1) as defined in any of the preceding claims 11 or 12, **characterized in that** the number of coke oven banks (1) per boiler (2) amounts to two, so that the boilers (2) are linked in pairs to the coke oven banks (1).

15. A device for cyclical operation of a sequence of an even or odd number of at least six coke oven banks (1) as defined in any of the preceding claims 11 or 12, **characterized in that** the number of coke oven banks (1) per boiler (2) amounts to three.

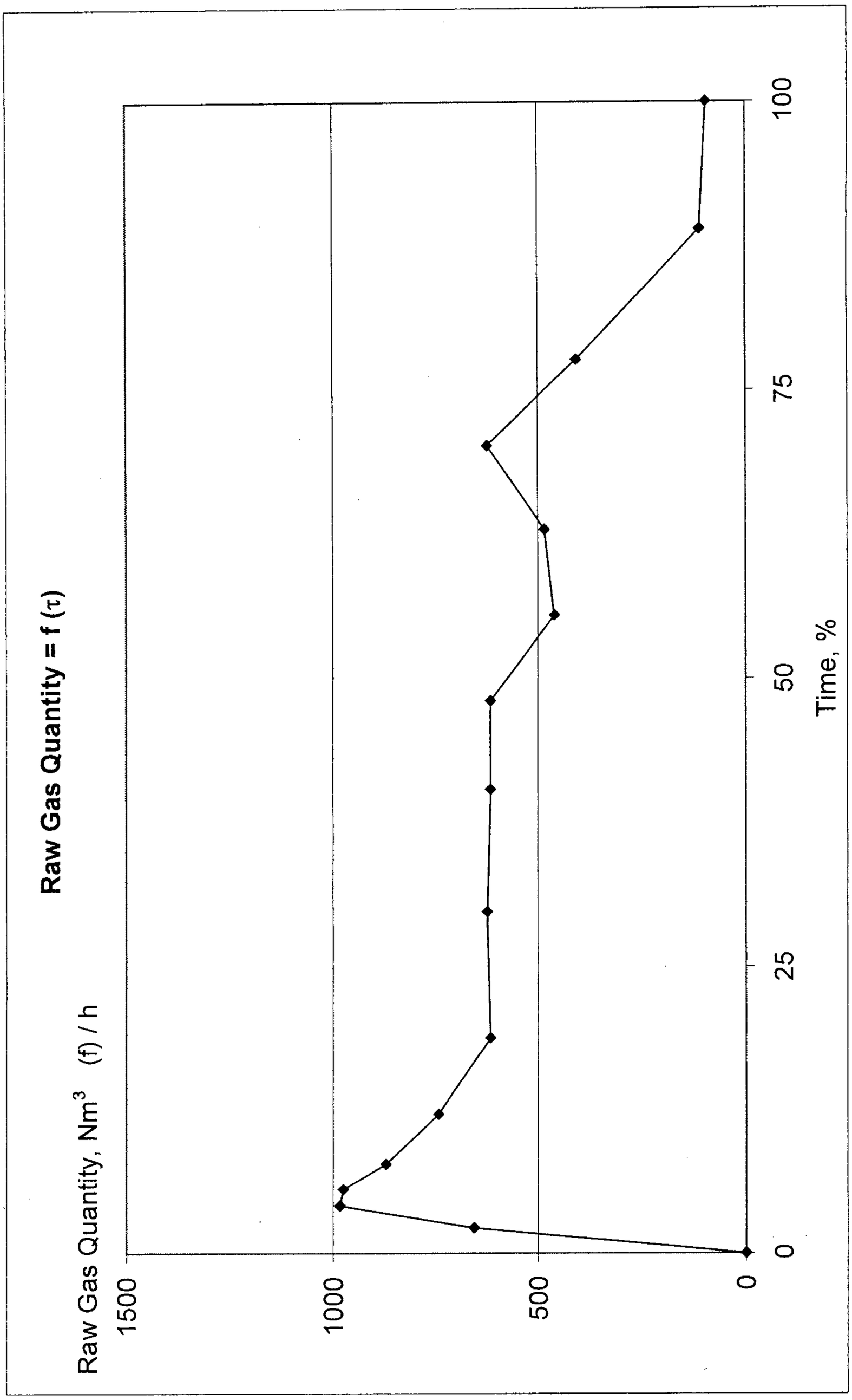

Raw Gas Quantity = f (τ)
Raw Gas Quantity, Nm3 (f) / h
1500
1000
500
0
0
25
50
75
100
Time, %

FIG. 1

FIG. 2

Bank
Ofen Nr.
Nummer des Zyklus
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
+2
+15
+28
1
2
3
4
5
6
7
8
9
10
Boiler 1
Boiler 2
Boiler 3
Boiler 4
Boiler 5

FIG. 3

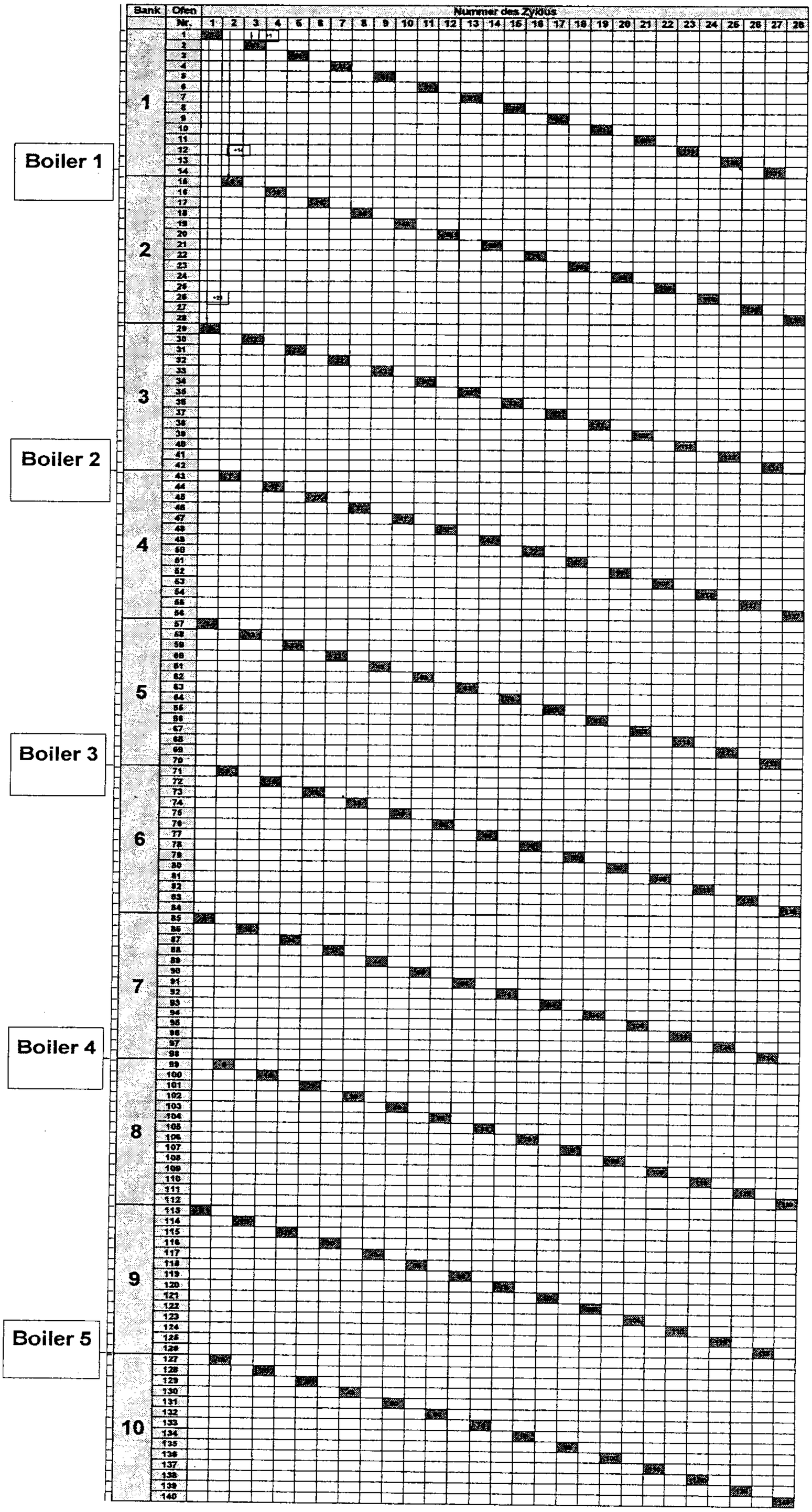
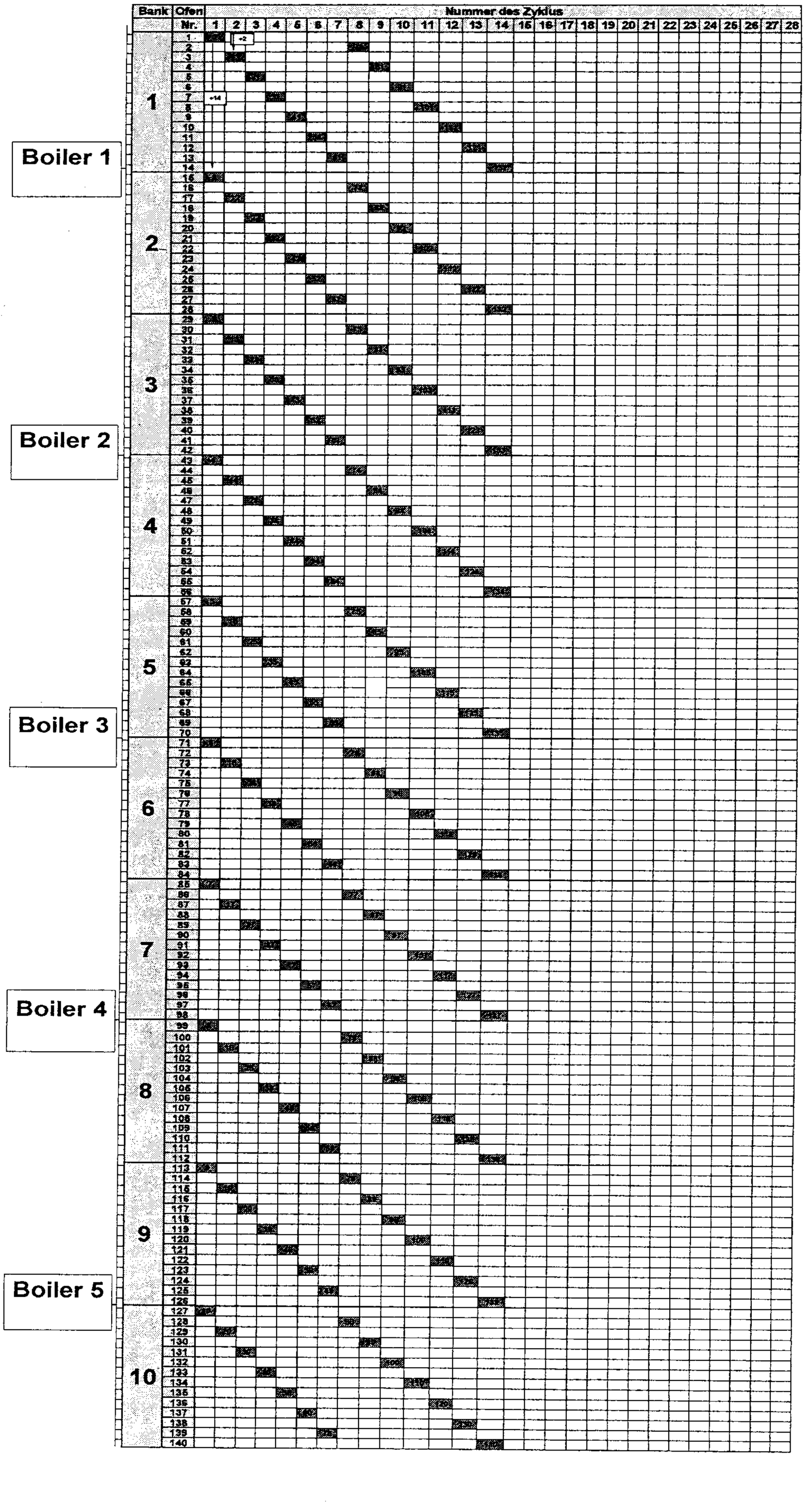

Bank
Ofen
Nr.
Nummer des Zyklus
1
2
3
4
5
6
7
8
9
10
Boiler 1
Boiler 2
Boiler 3
Boiler 4
Boiler 5

FIG. 4


Bank
Ofen Nr.
Nummer des Zyklus
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28
+2
+14
1
2
3
4
5
6
7
8
9
10
Boiler 1
Boiler 2
Boiler 3
Boiler 4
Boiler 5

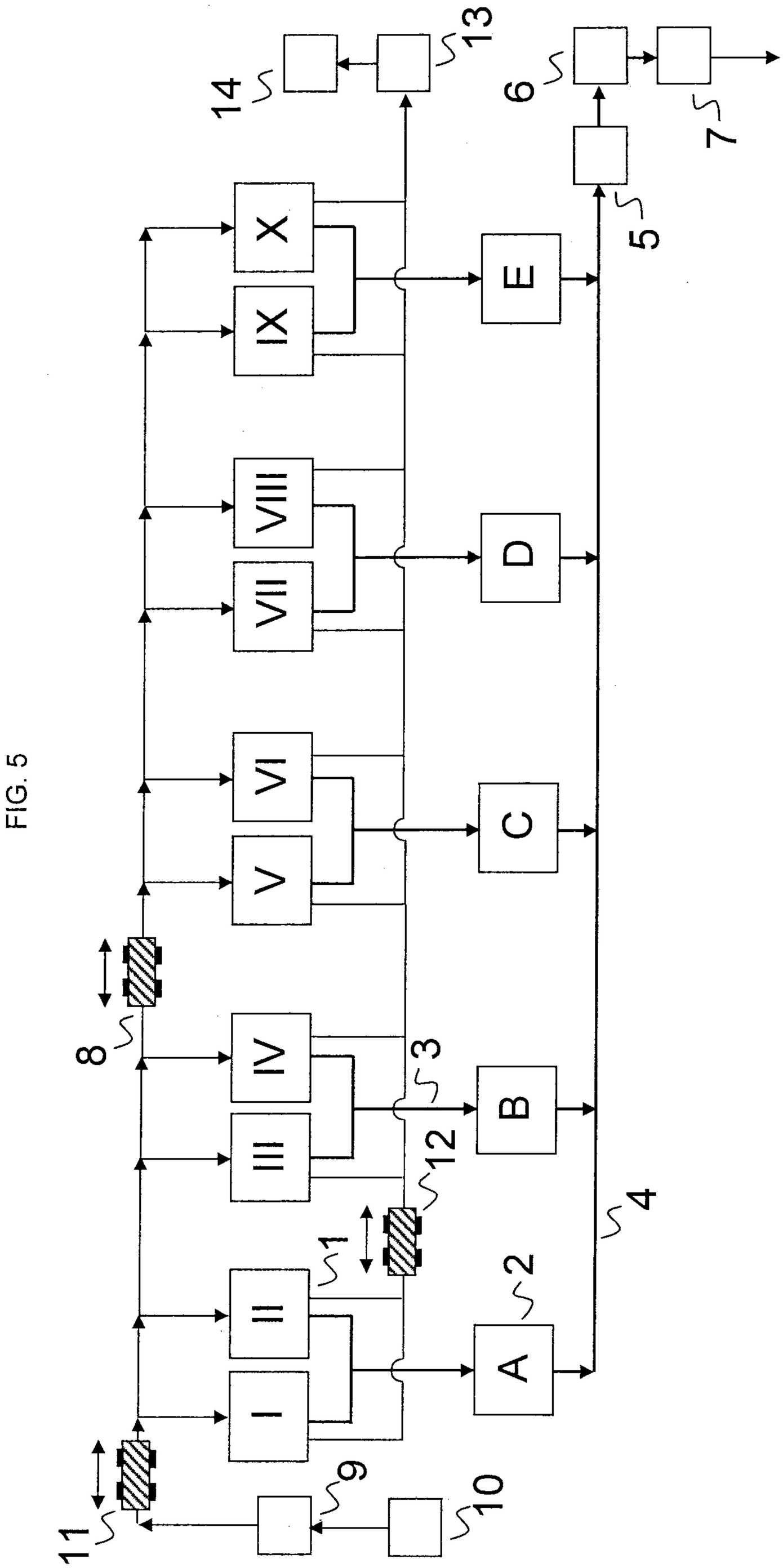


FIG. 5

FIG. 5

