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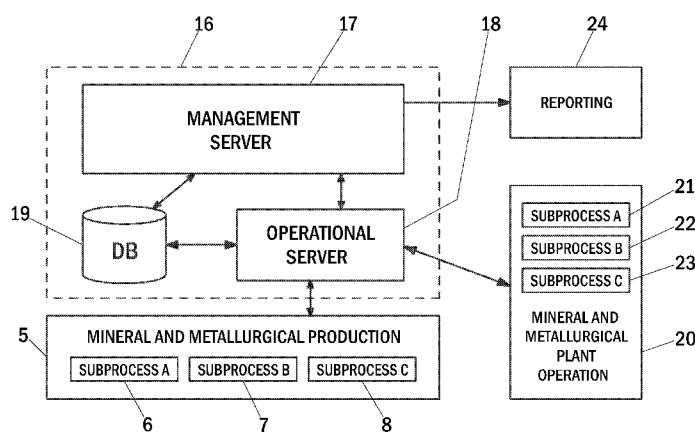
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TAINING METALS

Fig. 4

(57) Abstract: The present invention relates to the field of mineral and metallurgical processes in general, and more particularly to a method and system for managing of a mineral and metallurgical process for obtaining metals. A system for managing of a mineral and metallurgical process for obtaining metals according to the present invention comprises a management server (17), an operational server 18 and a database 19, wherein: said operational server (18) is configured to collect mineral and metallurgical data records from mineral and metallurgical production subprocesses (6-8) and/or from mineral and metallurgical plant operation subprocesses (21-23), and said management server (17) is configured: to receive mineral and metallurgical data records from said operational server (18) and/or from said database (19), to receive mineral and metallurgical data records from mineral and metallurgical auxiliary management processes (15), to generate a group of mineral and metallurgical configuration units, said configuration units defining the functionality of a mineral and metallurgical process management system (4), (13), (16), (25) based on the received mineral and metallurgical data records, and to generate (28) mineral and metallurgical services, said services being configured to forward the defined functionality associated with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.

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A METHOD AND A SYSTEM FOR MANAGING OF A MINERAL AND METALLURGICAL PROCESS FOR OBTAINING METALS

FIELD OF THE INVENTION

The present invention relates to the field of mineral and metallurgical processes in general, and more particularly to a method and system for managing of a mineral and metallurgical process for obtaining metals.

BACKGROUND OF THE INVENTION

The mineral and metallurgical processes deal with discovering ore body and taking the ore out from the nature, with extracting minerals and metals from ore and finally with returning the land to its natural state.

In the following, the prior art will be described with reference to the accompanying Figure 1, which shows a flow diagram of a mineral and metallurgical process according to the prior art.

Figure 1 shows a flow diagram of a mineral and metallurgical process according to the prior art. A mineral and metallurgical process according to the prior art comprises the process blocks for ore recovering process 1, mineral processing process 2, and metallurgical processing process 3.

In a mineral and metallurgical process according to the prior art the ore recovering process 1 is carried out first. In ore recovering process 1 the ore is recovered out from the nature e.g. by mine blasting or mine excavation. After the ore recovering process 1 the recovered ore is forwarded to mineral processing process 2. In mineral processing process 2 there are comminution processes, e.g. crushing processes and grinding processes first carried out. After comminution processing the sizing processing and concentration processing may be carried out. After the mineral processing process 2 the ore is forwarded to hydrometallurgical processing process 3. In metallurgical processing process 3 metallurgical technologies are used for obtaining or extracting metal compounds from their ores e.g. utilizing aqueous chemistry.

The prior art method and systems for managing of a mineral and metallurgical process for obtaining metals typically rely on separate control systems for each separate process. The prior art solutions for managing of a mineral and metallurgical process for obtaining metals have a very limited scope only covering a particular subprocess. There are currently no commercially available platforms being sold on the market today covering mineral and metallurgical process management.

The mineral and metallurgical processes for obtaining metals have huge operational expenditure costs. Optimization of operations, such as e.g. benchmarked optimization of operations has a potential to save a lot of capital and natural resources.

5 The problem therefore is to find a solution for managing of a mineral and metallurgical process for obtaining metals which can provide more reliable operations processes and maintenance processes as well as provide better enterprise support.

10 There is a demand in the market for a method for managing of a mineral and metallurgical process for obtaining metals which method would provide more reliable operations processes and maintenance processes as well as would provide better enterprise support when compared to the prior art solutions. Likewise, there is a demand in the market for an system for managing of a mineral and metallurgical process for obtaining metals which system
15 would have more reliable operations processes and maintenance processes as well as would provide better enterprise support when compared to the prior art solutions.

BRIEF DESCRIPTION OF THE INVENTION

20 An object of the present invention is thus to provide a method and an apparatus for implementing the method so as to overcome the above problems and to alleviate the above disadvantages.

 The objects of the invention are achieved by a method for managing of a mineral and metallurgical process for obtaining metals, which said method comprises steps of:

25 - collecting mineral and metallurgical data records from mineral and metallurgical production subprocesses and/or from mineral and metallurgical plant operation subprocesses and/or from mineral and metallurgical auxiliary management processes;

30 - generating a group of mineral and metallurgical configuration units, said configuration units defining the functionality of a mineral and metallurgical process management system based on the collected mineral and metallurgical data records; and

 - generating mineral and metallurgical services, said services being configured to forward the defined functionality associated with at least one

mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.

Preferably, said method comprises steps of monitoring performance indicator data of mineral and metallurgical production subprocesses and/or
5 from mineral and metallurgical plant operation subprocesses; and detecting mineral and metallurgical development units, said development units being triggered by said performance indicator data; so that in the step of configuration units generating, said configuration units define the said functionality based on the collected mineral and metallurgical data records and on the de-
10 tected mineral and metallurgical development units. Preferably, in the step of collecting optimization process data records are collected from optimization processes.

Preferably, said method comprises steps of receiving of an at least one optimization process event record from optimization processes; and gen-
15 erating an optimization process event response.

Preferably, in said method the said optimization processes include one or more of the following processes: a statistical probability modelling process, a supply chain management process, a future bottleneck prediction process, a capital expenditure management process, a financial cost and sales
20 analysis process, a customer value tree analysis process, a value proposition alignment process, a production requirement fit analysis process, a cost reduction process, a deployment optimization process, a business optimization process. Preferably, in the step of collecting benchmark process data records are collected from benchmark processes.

Preferably, said method comprises steps of receiving of an at least one benchmark process event record from benchmark processes; and gener-
25 ating a benchmark process event response. Preferably, in said method the said benchmark processes include one or more of the following processes: a mineral and metallurgical site benchmark process, a plant benchmark process, a process benchmark process, a sub-process benchmark process, an equip-
30 ment benchmark process, a value chain benchmark process, a supply chain benchmark process, a cost management benchmark process, a capital expenditure management benchmark process, environmental footprint benchmark process, and a deployment benchmark process.

Preferably, said method comprises steps of receiving of an at least one mineral and metallurgical event record from mineral and metallurgical pro-

duction subprocesses and/or from mineral and metallurgical plant operation subprocesses; and generating a mineral and metallurgical event response.

Preferably, said method comprises steps of receiving of an at least one mineral and metallurgical auxiliary event record from mineral and metallurgical auxiliary management processes; and generating a mineral and metallurgical auxiliary event response.

Preferably, in said method the said mineral and metallurgical production subprocesses include one or more of the following processes: a crushing process, a grinding process, a screening process, a classification process; a flotation process, a gravity separation process, an electrostatic separation process, a magnetic separation process, a dewatering process, a leaching process, a filtering process, a thickening process, a solvent extraction process, a stripping process, an electrowinning process, an electrorefining process, a precipitation process, a smelting process, an anode casting process, a furnace process, a calcination process, a roasting process, an agglomeration process, a direct reduction process, a smelting reduction process, a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process.

Preferably, in said method the said mineral and metallurgical plant operation subprocesses include one or more of the following processes: an ore blasting process, an ore distribution process, product logistics management process, a mineral and metallurgical site management process, a mineral and metallurgical plant management process, a mineral and metallurgical process management process, a mineral and metallurgical sub-process management process, a mineral and metallurgical equipment management process, a spare part logistics management process, a vendor logistics management process, a security process, an occupational health and safety process, a maintenance process, a periodical testing process.

Preferably, in said method the said mineral and metallurgical auxiliary management processes include one or more of the following processes: a minerals pricing process, a market intelligence and analysis process, an ore body life time analysis process, an equipment life time analysis process, a technology life time analysis process, a legal risk analysis process, a regulatory risk analysis process, an environmental risk analysis process, a supplier

intelligence and risk management process, a vendor intelligence and risk management process, a financial cost and sales analysis process, a capital expenditure management process, a value proposition alignment process.

Furthermore, the objects of the invention are achieved by a system
5 for managing of a mineral and metallurgical process for obtaining metals, said system comprising a management server, an operational server and a database, wherein:

- said operational server is configured to collect mineral and metallurgical data records from mineral and metallurgical production subprocesses
10 and/or from mineral and metallurgical plant operation subprocesses and to forward said mineral and metallurgical data records to said database and/or to said management server, and

- said management server is configured:
 - to receive mineral and metallurgical data records from said op-
15 erational server and/or from said database,

- to receive mineral and metallurgical data records from mineral and metallurgical auxiliary management processes,

- to generate a group of mineral and metallurgical configuration units, said configuration units defining the functionality of a mineral and metallurgical process management system based on the received mineral and metallurgical data records, and
20

- to generate mineral and metallurgical services, said services being configured to forward the defined functionality associated with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.
25

Preferably, said management server is configured to receive detected mineral and metallurgical development units, said development units being triggered by monitored performance indicator data of mineral and metallurgical production subprocesses and/or from mineral and metallurgical plant operation
30 subprocesses.

Preferably, said management server is configured to receive optimization process data records from optimization processes, and to generate a group of optimization process configuration units and optimization process services, said services being configured to forward the defined functionality associated with at least one optimization process configuration unit of the generated group of optimization process configuration units.
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Preferably, in said system said optimization processes include one or more of the following processes: a statistical probability modelling process, a supply chain management process, a future bottleneck prediction process, a capital expenditure management process, a financial cost and sales analysis process, a customer value tree analysis process, a value proposition alignment process, a production requirement fit analysis process, a cost reduction process, a deployment optimization process, a business optimization process.

Preferably, said management server is configured to benchmark process data records from benchmark processes, and to generate a group of benchmark process configuration units and benchmark process services, said services being configured to forward the defined functionality associated with at least one benchmark process configuration unit of the generated group of benchmark process configuration units.

Preferably, in said system said benchmark processes include one or more of the following processes: a mineral and metallurgical site benchmark process, a plant benchmark process, a process benchmark process, a sub-process benchmark process, an equipment benchmark process, a value chain benchmark process, a supply chain benchmark process, a cost management benchmark process, a capital expenditure management benchmark process, environmental footprint benchmark process, and a deployment benchmark process.

Preferably, in said system the said mineral and metallurgical production subprocesses include one or more of the following processes: a crushing process, a grinding process, a screening process, a classification process; a flotation process, a gravity separation process, an electrostatic separation process, a magnetic separation process, a dewatering process, a leaching processes, a filtering process, a thickening process, a solvent extraction process, a stripping process, an electrowinning process, an electrorefining process, a precipitation process, a smelting process, an anode casting process, a furnace process, a calcination process, a roasting process, an agglomeration process, a direct reduction process, a smelting reduction process, a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process. Preferably, the said mineral and metallurgical production subprocesses are realised as plant floor systems.

Preferably, in said system the said mineral and metallurgical plant operation subprocesses include one or more of the following processes: an ore blasting process, an ore distribution process, product logistics management process, a mineral and metallurgical site management process, a mineral and metallurgical plant management process, a mineral and metallurgical process management process, a mineral and metallurgical sub-process management process, a mineral and metallurgical equipment management process, a spare part logistics management process, a vendor logistics management process, a security process, an occupational health and safety process, a maintenance process, a periodical testing process.

Preferably, in said system the said mineral and metallurgical auxiliary management processes include one or more of the following processes: a minerals pricing process, a market intelligence and analysis process, an ore body life time analysis process, an equipment life time analysis process, a technology life time analysis process, a legal risk analysis process, a regulatory risk analysis process, an environmental risk analysis process, a supplier intelligence and risk management process, a vendor intelligence and risk management process, a financial cost and sales analysis process, a capital expenditure management process, a value proposition alignment process.

Preferably, the said management server has a reporting output for reporting and managing communications. Preferably, the said database is integrated to the said management server or to the said operational server. Preferably, the said management server and the said operational server are realised as one server. Further preferably, the said database is integrated to the said one server.

Furthermore, the objects of the invention are achieved by a use of said system for managing of a mineral and metallurgical process for obtaining metals.

BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 shows a flow diagram of a mineral and metallurgical process according to the prior art;

Figure 2 shows a schematic block diagram of one embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 3 shows a schematic block diagram of another embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 4 shows an architectural block diagram of one embodiment
5 of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 5 shows an architectural block diagram of another embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

10 Figure 6 shows a flow diagram of one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 7 shows a flow diagram of another embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention;
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Figure 8 shows a flow diagram of event handling in one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 9 shows a flow diagram of event handling in another embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention;
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Figure 10 shows a flow diagram of auxiliary event handling in one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention;

25 Figure 11 shows a flow diagram of optimization event handling in one embodiment of an optimized method for optimized managing of a mineral and metallurgical process for obtaining metals according to the present invention;

Figure 12 shows a flow diagram of benchmark event handling in one embodiment of a method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to the present invention.
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The prior art drawing of Figure 1 has been presented earlier. In the following, the invention will be described in greater detail by means of preferred embodiments with reference to the accompanying drawings of Figures 2
35 to 12.

DETAILED DESCRIPTION OF THE INVENTION

The present invention relates to a method and system for managing of a mineral and metallurgical process for obtaining metals, which provides more reliable operations processes and maintenance processes as well as provides better enterprise support when compared to the prior art solutions.

5 The mineral and metallurgical processes for obtaining metals typically deal with discovering ore body and taking the ore out from the nature, with extracting minerals and metals from ore and finally with returning the land to its natural state. The technological scope of the present invention includes metals and mining processes from ore body to final metal product (like cath-
10 odes, castings, etc.) and the side processes connecting to the metals and mining side products, including sulfuric acid, effluents. Some of the typical mineral and metallurgical processes for obtaining metals can be divided to ore recovery processes, mineral processing processes and hydrometallurgical processes.

15 One of the first processes in mining and metallurgy is the recovery of the ore out from the nature. Typical ore recovery processes are mine blasting and mine excavation. Mine blasting is the controlled use of explosives and other methods such as gas pressure blasting, pyrotechnics or plasma processes, to remove the ore out from the nature. Typically blasting produces par-
20 ticles in the size having a diameter of 500 mm or more. Mine excavation processes include surface mining and underground mining. In surface mining, including e.g. strip mining, open-pit mining and mountaintop removal mining, soil and rock overlying the mineral deposit are first removed. In underground mining the overlying rock is left in place, and the mineral removed through shafts
25 and/or tunnels.

 One of the most common processes in mining and metallurgy is the mineral processing of ore. Typical mineral processing processes are comminution processing, sizing processing and concentration processing. When processing material for the selective or collective recovery of valuable material
30 components, the processes concerned are preceded by comminution processing i.e. mechanical crushing or disintegration of the material in a manner to free the valuable components, one from the other. Comminution is particle size reduction or disintegrating of materials. Comminution is achieved by, crushing and grinding. After comminution the components are then mutually
35 isolated with the aid of known separation methods, this isolation being contin-

gent on differences in color, shape, density or in differences in their respective surface active and magnetic properties, or other properties.

Crushing is particle size reduction of ore or rock materials by using crushing devices i.e. crushers. Crushers e.g. jaw crushers, gyratory crushers
5 or cone crushers are used to reduce the size, or change the form, of materials so that pieces of different composition can be differentiated. In the crushing process the crushing devices hold material being crushed between two parallel or tangent solid surfaces of a stronger material and apply sufficient force to bring said surfaces together. Typically in a crushing process particles having a
10 diameter up to 1000 mm are crushed to particles having a diameter of 5 mm or more.

Grinding is particle size reduction of ore or rock materials in grinding mills. In hard rock mining and industrial mineral operations the demands for comminution processing equipment such as grinding mills are very high both in
15 terms of grinding efficiency and energy consumption. Typically in a grinding process particles having a diameter up to 1000 mm are grinded to particles having a diameter of 0,010 mm or more. This conventional grinding of materials results in considerable wear on the grinding bodies present in the mill, due to the hardness of the rock concerned, therewith also resulting in considerable
20 costs for the provision of such grinding bodies.

Sizing is the process for separation of particles according to their size. The most typical sizing process is screening, or passing the particles to be sized through a screen or number of different screens. Sizing classification processes exploit the differences in settling velocities exhibited by particles of
25 different size. Classification equipment may include ore sorters, gas cyclones, hydrocyclones, rotating trommels, rake classifiers or fluidized classifiers.

Concentration is the process for increasing the concentration of the valuable mineral in the concentrate. Gravity separation is the separation of two or more minerals of different specific gravity by their relative movement in response to the force of gravity and one or more other forces, one of which is resistance to motion by a viscous medium such as heavy media, water or, less
30 commonly, air. Other concentration processes are flotation, electrostatic separation, magnetic separation and dewatering.

One of the last processes in mining and metallurgy is the hydrometallurgical processing of ore. Hydrometallurgical technologies are used for obtaining or extracting metal compounds from their ores. Hydrometallurgical pro-
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cesses involve the use of aqueous chemistry for the recovery of metals from ores, concentrates, and recycled or residual materials. Hydrometallurgy is typically divided into three general areas: leaching, solution purification and recovery technologies.

5 Leaching involves the use of aqueous solutions, which contain a lixiviant brought into contact with a material containing a valuable metal. There are a number of leaching process options available for the hydrometallurgical treatment of ores and concentrates. In the leaching process, oxidation potential, temperature, and pH of the solution are important parameters. There are
10 several versatile leaching methods ranging from chloride to sulfate leaching and from atmospheric to pressure leaching. Leaching technologies include the leaching of e.g. zinc, copper, nickel, cobalt, gold, arsenic, silver, molybdenum, manganese and synthetic rutile.

 Typical solution purification processes are filtering process, thickening process, solvent extraction process and stripping process. In a solvent extraction process, the pregnant leach solution is first mixed into emulsion with the stripped organic stream and after mixing allowed to separate in a settler. The valuable metal will be exchanged from the pregnant leach solution to the organic phase stream. The resulting streams will be a loaded organic phase
15 stream and a raffinate stream. In a stripping process, the loaded organic phase is then mixed into emulsion with stripping liquor and allowed to separate in a settler. In stripping the metal will be exchanged from the organic phase to the stripping liquor. The resulting streams will be a stripped organic phase stream and a rich stripping liquor stream.

25 Recovery processes are final hydrometallurgical processes and may include e.g. electrowinning processes and precipitation processes. Metals suitable for sale as raw materials are often directly produced in the metal recovery process. In an electrowinning process, a current is passed from an inert anode through a liquid solution containing the metal so that the metal is extracted as it
30 is deposited in an electroplating process onto the cathode. Precipitation in hydrometallurgy involves the chemical precipitation of either metals and their compounds or of the contaminants from aqueous solutions.

 Optimization in the context of a mineral and metallurgical processing plant and equipment can be seen as using different analytical methods for finding
35 alternatives with the most cost effective or highest achievable performance under the given constraints in the process execution or in the process ramp up

and constantly adjusting the optimized process by maximizing desired factors and minimizing undesired ones.

Figure 2 shows a schematic block diagram of one embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention. The system for managing of a mineral and metallurgical process for obtaining metals according to the present embodiment comprises a mineral and metallurgical management system 4. Said mineral and metallurgical management system 4 has an operational interface for managing a mineral and metallurgical production block 5 as well as for managing different mineral and metallurgical production subprocesses 6-8. The said mineral and metallurgical production block 5 can be any kind of mineral and metallurgical production facility, e.g. a mineral and metallurgical site, a mineral and metallurgical plant, a mineral and metallurgical process, a part of a mineral and metallurgical process, or a mineral and metallurgical equipment.

Said mineral and metallurgical production subprocesses 6-8 may include one or more subprocesses 6-8 for comminution processes, e.g. crushing process, grinding process; sizing processes, e.g. screening process, classification process; concentration processes, e.g. flotation process, gravity separation process, electrostatic separation process, magnetic separation process, dewatering process; hydrometallurgical processes; leaching processes; solution purification processes, e.g. filtering process, thickening process, solvent extraction process, stripping process; recovery processes, e.g. electrowinning process, electrorefining process and precipitation process; pyrometallurgical processes, e.g. smelting process, anode casting process, furnace process, calcination process, roasting process, agglomeration process, direct reduction process and smelting reduction process; other mineral and metallurgical subprocesses, e.g. a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process. Said mineral and metallurgical production subprocesses 6-8 may also be realised as plant floor systems, such as e.g. DCS systems (DCS, distributed control system) and/or PLC controllers (PLC, programmable logic controller).

The mineral and metallurgical management system 4 according to the present embodiment has also an operational interface for managing ore feed acquisition and/or ore recovery i.e. managing an ore blasting block 9

and/or ore distribution block 10. This means that effectively mineral and metallurgical management system 4 can manage the mineral and metallurgical processes all the way from the feed acquisition e.g. ore blasting process to the producing of the final product.

5 The mineral and metallurgical management system 4 according to the present embodiment has an operational interface for managing a product logistics block 11. Furthermore, the mineral and metallurgical management system 4 according to the present embodiment has also an operational interface for managing communications and reporting towards customer 12.

10 Figure 3 shows a schematic block diagram of another embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention. The system for managing of a mineral and metallurgical process for obtaining metals according to another embodiment comprises a mineral and metallurgical management system 13. Said
15 mineral and metallurgical management system 13 has an operational interface for managing a mineral and metallurgical production block 5 as well as for managing different mineral and metallurgical production subprocesses 6-8. The said mineral and metallurgical production block 5 can be any kind of mineral and metallurgical production facility, e.g. a mineral and metallurgical site, a
20 mineral and metallurgical plant, a mineral and metallurgical process, a part of a mineral and metallurgical process, or a mineral and metallurgical equipment.

 Said mineral and metallurgical production subprocesses 6-8 may include one or more subprocesses 6-8 for comminution processes, e.g. crushing process, grinding process; sizing processes, e.g. screening process, classification process; concentration processes, e.g. flotation process, gravity separation process, electrostatic separation process, magnetic separation process, dewatering process; hydrometallurgical processes; leaching processes; solution purification processes, e.g. filtering process, thickening process, solvent extraction process, stripping process; recovery processes, e.g. electrowinning
25 process, electrorefining process and precipitation process; pyrometallurgical processes, e.g. smelting process, anode casting process, furnace process, calcination process, roasting process, agglomeration process, direct reduction process and smelting reduction process; other mineral and metallurgical subprocesses, e.g. a gas cooling process, a gas cleaning process, an aluminum
30 production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment
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process, a waste to energy process, oil wining process, a thermal process. Said mineral and metallurgical production subprocesses 6-8 may also be realised as plant floor systems, such as e.g. DCS systems (DCS, distributed control system) and/or PLC controllers (PLC, programmable logic controller).

5 The mineral and metallurgical management system 13 according to the another embodiment has also an operational interface for managing ore feed acquisition and/or ore recovery i.e. managing an ore blasting block 9 and/or ore distribution block 10. The mineral and metallurgical management system 13 according to the present embodiment has an operational interface
10 for managing a product logistics block 11. Furthermore, the mineral and metallurgical management system 13 according to the present embodiment has also an operational interface for managing communications and reporting towards customer 12. This means that effectively mineral and metallurgical management system 13 can manage the mineral and metallurgical processes all the
15 way from the feed acquisition e.g. ore blasting process to the producing of the final product.

 The mineral and metallurgical management system 13 according to another embodiment has also an operational interface for managing and outputting data to and receiving data from an optimization processes block 41.
20 The said optimization processes block 41 may include one or more optimization processes e.g. statistical probability modelling processes, supply chain management processes, future bottleneck prediction processes, capital expenditure management processes, financial cost and sales analysis processes, customer value tree analysis processes, value proposition alignment processes,
25 processes, production requirement fit analysis processes, cost reduction processes, deployment optimization processes, and business optimization processes.

 The mineral and metallurgical management system 13 according to another embodiment has also an operational interface for managing and outputting data to and receiving data from a benchmark processes block 51. The
30 said benchmark processes block 51 may include one or more benchmark processes e.g. mineral and metallurgical site benchmark processes, plant benchmark processes, process benchmark processes, sub-process benchmark processes, equipment benchmark processes, value chain benchmark processes, supply chain benchmark processes, cost management benchmark processes,
35 capital expenditure management benchmark processes, environmental footprint benchmark processes, and deployment benchmark processes.

The mineral and metallurgical management system 13 according to another embodiment has also an operational interface for managing mineral and metallurgical external processes block 14. The said mineral and metallurgical external processes block 14 may include one or more external processes
5 e.g. site/process/equipment management processes and spare part/vendor logistics management processes as well as processes for security, occupational health and safety, maintenance and periodical testing.

Furthermore, the mineral and metallurgical management system 13 according to another embodiment has an operational interface for managing
10 mineral and metallurgical auxiliary management processes block 15. The said mineral and metallurgical auxiliary management processes block 15 may include one or more auxiliary management processes e.g. minerals pricing and market intelligence and analysis processes, ore body, install base and technology life time analysis processes, legal and regulatory risk analysis processes,
15 es, environmental risk analysis processes, supplier/vendor intelligence and risk management processes, customer financial cost/sales analysis processes as well as capital expenditure and value proposition alignment processes.

Figure 4 shows an architectural block diagram of one embodiment of a system for managing of a mineral and metallurgical process for obtaining
20 metals according to the present invention. The system for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a mineral and metallurgical management system 16. Said mineral and metallurgical management system 16 comprises a management server 17, an operational server 18 and a database 19. Said operational server
25 18 of the mineral and metallurgical management system 16 according to the presented embodiment has an operational interface for managing a mineral and metallurgical production block 5 as well as for managing different mineral and metallurgical production subprocesses 6-8. The said mineral and metallurgical production block 5 can be any kind of mineral and metallurgical produc-
30 tion facility, e.g. a mineral and metallurgical site, a mineral and metallurgical plant, a mineral and metallurgical process, a part of a mineral and metallurgical process, or a mineral and metallurgical equipment.

Said mineral and metallurgical production subprocesses 6-8 may include one or more subprocesses 6-8 for comminution processes, e.g. crushing
35 process, grinding process; sizing processes, e.g. screening process, classification process; concentration processes, e.g. flotation process, gravity separa-

tion process, electrostatic separation process, magnetic separation process, dewatering process; hydrometallurgical processes; leaching processes; solution purification processes, e.g. filtering process, thickening process, solvent extraction process, stripping process; recovery processes, e.g. electrowinning process, electrorefining process and precipitation process; pyrometallurgical processes, e.g. smelting process, anode casting process, furnace process, calcination process, roasting process, agglomeration process, direct reduction process and smelting reduction process; other mineral and metallurgical subprocesses, e.g. a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process. Said mineral and metallurgical production subprocesses 6-8 may also be realised as plant floor systems, such as e.g. DCS systems (DCS, distributed control system) and/or PLC controllers (PLC, programmable logic controller).

The operational server 18 of the mineral and metallurgical management system 16 according to the presented embodiment has also an operational interface for managing a mineral and metallurgical plant operation block 20 as well as for managing different mineral and metallurgical plant operation subprocesses 21-23.

Said mineral and metallurgical plant operation subprocesses 21-23 may include one or more subprocesses 21-23 for ore handling processes, e.g. ore blasting process and ore distribution process; product logistics management processes; mineral and metallurgical external processes, e.g. site/process/equipment management process, spare part/vendor logistics management process, security process, occupational health and safety process, maintenance process and/or periodical testing process.

The operational server 18 of the mineral and metallurgical management system 16 according to the presented embodiment may also be used to receive information from said mineral and metallurgical plant operation subprocesses 21-23 as well as from said mineral and metallurgical production subprocesses 6-8 and the underlying layers, calculate and modify the received information in order to achieve actionable decisions. Said operational server 18 of the mineral and metallurgical management system 16 according to the presented embodiment is also connected to said management server 17 and said database 19 to enable the optimization in the larger context.

The management server 17 of the mineral and metallurgical management system 16 according to the presented embodiment may also be used to carry out management processes for managing of a mineral and metallurgical process for obtaining metals. Said management processes of the management server 17 may include one or more mineral and metallurgical management processes, e.g. customer value tree analysis processes, investment planning processes, capital expenditure processes, business optimization processes, future prognostics processes, supply chain management processes, time-to-market processes, benchmarking processes, cost reduction processes, environmental management processes and risk management processes. The management server 17 has also a reporting output towards reporting block 24 for reporting and managing communications towards customer.

The said database 19 may also be integrated to the said management server 17 or to the said operational server 18. The said management server 17 and the said operational server 18 may also be realised as one server. The said one server may also comprise the said database 19 as an integrated unit.

Figure 5 shows an architectural block diagram of another embodiment of a system for managing of a mineral and metallurgical process for obtaining metals according to the present invention. The system for managing of a mineral and metallurgical process for obtaining metals according to another embodiment comprises a mineral and metallurgical management system 25. Said mineral and metallurgical management system 25 comprises a management server 17, an operational server 18 and a database 19. Said operational server 18 of the mineral and metallurgical management system 25 according to the another embodiment has an operational interface for managing a mineral and metallurgical production block 5 as well as for managing different mineral and metallurgical production subprocesses 6-8. The said mineral and metallurgical production block 5 can be any kind of mineral and metallurgical production facility, e.g. a mineral and metallurgical site, a mineral and metallurgical plant, a mineral and metallurgical process, a part of a mineral and metallurgical process, or a mineral and metallurgical equipment.

Said mineral and metallurgical production subprocesses 6-8 may include one or more subprocesses 6-8 for comminution processes, e.g. crushing process, grinding process; sizing processes, e.g. screening process, classification process; concentration processes, e.g. flotation process, gravity separa-

tion process, electrostatic separation process, magnetic separation process, dewatering process; hydrometallurgical processes; leaching processes; solution purification processes, e.g. filtering process, thickening process, solvent extraction process, stripping process; recovery processes, e.g. electrowinning process, electrorefining process and precipitation process; pyrometallurgical processes, e.g. smelting process, anode casting process, furnace process, calcination process, roasting process, agglomeration process, direct reduction process and smelting reduction process; other mineral and metallurgical subprocesses, e.g. a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process. Said mineral and metallurgical production subprocesses 6-8 may also be realised as plant floor systems, such as e.g. DCS systems (DCS, distributed control system) and/or PLC controllers (PLC, programmable logic controller).

The operational server 18 of the mineral and metallurgical management system 25 according to the another embodiment has also an operational interface for managing a mineral and metallurgical plant operation block 20 as well as for managing different mineral and metallurgical plant operation subprocesses 21-23. Said mineral and metallurgical plant operation subprocesses 21-23 may include one or more subprocesses 21-23 for ore handling processes, e.g. ore blasting process and ore distribution process; product logistics management processes; mineral and metallurgical external processes, e.g. site/process/equipment management process, spare part/vendor logistics management process, security process, maintenance process and/or periodical testing process.

The operational server 18 of the mineral and metallurgical management system 25 according to the another embodiment may also be used to receive information from said mineral and metallurgical plant operation subprocesses 21-23 as well as from said mineral and metallurgical production subprocesses 6-8 and the underlying layers, calculate and modify the received information in order to achieve actionable decisions. Said operational server 18 of the mineral and metallurgical management system 25 according to another embodiment is also connected to the said management server 17 and said database 19 to enable the optimization in the larger context.

The management server 17 of the mineral and metallurgical management system 25 according to another embodiment has an operational interface for managing and outputting data to and receiving data from an optimization processes block 41. The said optimization processes block 41 may include
5 one or more optimization processes e.g. statistical probability modelling processes, supply chain management processes, future bottleneck prediction processes, capital expenditure management processes, financial cost and sales analysis processes, customer value tree analysis processes, value proposition alignment processes, production requirement fit analysis processes, cost re-
10 duction processes, deployment optimization processes, and business optimization processes.

The management server 17 of the mineral and metallurgical management system 25 according to another embodiment has an operational interface for managing and outputting data to and receiving data from a benchmark
15 processes block 51. The said benchmark processes block 51 may include one or more benchmark processes e.g. mineral and metallurgical site benchmark processes, plant benchmark processes, process benchmark processes, sub-process benchmark processes, equipment benchmark processes, value chain benchmark processes, supply chain benchmark processes, cost management
20 benchmark processes, capital expenditure management benchmark processes, environmental footprint benchmark processes, and deployment benchmark processes.

The said management server 17 of the mineral and metallurgical management system 25 according to another embodiment has an operational
25 interface for managing mineral and metallurgical auxiliary management processes block 15. The said mineral and metallurgical auxiliary management processes block 15 may include one or more auxiliary management processes e.g. minerals pricing and market risk analysis processes, ore body, install base and technology life time analysis processes, legal and regulatory risk analysis
30 processes, environmental risk analysis processes, supplier/vendor intelligence and risk management processes, customer financial cost/sales analysis processes as well as capital expenditure and value proposition alignment processes.

The management server 17 of the mineral and metallurgical management system 25 according to another embodiment may also be used
35 to carry out management processes for managing of a mineral and metallurgical

process for obtaining metals. Said management processes of the management server 17 may include one or more mineral and metallurgical management processes, e.g. customer value tree analysis processes, investment planning processes, capital expenditure processes, business optimization processes, future prognostics processes, supply chain management processes, time-to-market processes, benchmarking processes, cost reduction processes, environmental management processes and risk management processes. The management server 17 has also a reporting output towards reporting block 24 for reporting and managing communications towards customer.

The said database 19 may also be integrated to the said management server 17 or to the said operational server 18. The said management server 17 and the said operational server 18 may also be realised as one server. The said one server may also comprise the said database 19 as an integrated unit.

Figure 6 shows a flow diagram of one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 6 reference is made to an architectural block diagram presented in Figure 5. The method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of collecting 26 mineral and metallurgical data records, in which step of collecting 26 the operational server 18 of the mineral and metallurgical management system 4, 13, 16, 25 collects mineral and metallurgical data records from mineral and metallurgical production subprocesses 6-8 and/or from mineral and metallurgical plant operation subprocesses 21-23 and/or from mineral and metallurgical auxiliary management processes 15.

After the step of collecting 26 the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of generating a group of mineral and metallurgical configuration units 27. The generated mineral and metallurgical configuration units define the functionality of the mineral and metallurgical process management system 4, 13, 16, 25 based on the collected mineral and metallurgical data records.

After the step of generating mineral and metallurgical configuration units 27 the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of generating mineral and metallurgical services 28. The generated mineral and met-

allurgical services are configured to forward the defined functionality associated with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.

The said mineral and metallurgical services may be any kind of
5 mineral and metallurgical services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

Figure 7 shows a flow diagram of another embodiment of a method
10 for managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 7 reference is made to an architectural block diagram presented in Figure 5. The method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of collecting 26 mineral and metallurgical data
15 records, in which step of collecting 26 the operational server 18 of the mineral and metallurgical management system 4, 13, 16, 25 collects mineral and metallurgical data records from mineral and metallurgical production subprocesses 6-8 and/or from mineral and metallurgical plant operation subprocesses 21-23 and/or from mineral and metallurgical auxiliary management processes 15.

Respectively, the said method for managing of a mineral and metallurgical
20 process for obtaining metals according to presented embodiment comprises a step of detecting 265 mineral and metallurgical development units.

After the step of collecting mineral and metallurgical data records 26 and detecting mineral and metallurgical development units 265 the method for managing of a mineral and metallurgical process for obtaining metals according
25 to presented embodiment comprises a step of generating a group of mineral and metallurgical configuration units 27. The generated mineral and metallurgical configuration units define the functionality of the mineral and metallurgical process management system 4, 13, 16, 25 based on the collected mineral and metallurgical data records and on the detected mineral and metallurgical
30 development units.

After the step of generating mineral and metallurgical configuration units 27 the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of generating mineral and metallurgical services 28. The generated mineral and metallurgical
35 services are configured to forward the defined functionality associated

ed with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.

The said mineral and metallurgical services may be any kind of mineral and metallurgical services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

Figure 8 shows a flow diagram of event handling in one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 8 reference is made to an architectural block diagram presented in Figure 5. In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises a step of receiving of an at least one mineral and metallurgical event record 29, in which step of receiving 29 the operational server 18 of the mineral and metallurgical management system 4, 13, 16, 25 receives an at least one mineral and metallurgical event record from mineral and metallurgical production subprocesses 6-8 and/or from mineral and metallurgical plant operation subprocesses 21-23.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises after the step of receiving 29 a step of generating a group of mineral and metallurgical configuration units 30. The generated mineral and metallurgical configuration units define the functionality of the mineral and metallurgical process management system 4, 13, 16, 25 based on the said received at least one mineral and metallurgical event record and/or the collected mineral and metallurgical data records.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises after the step of generating mineral and metallurgical configuration units 30 a step of generating mineral and metallurgical services 31. The generated mineral and metallurgical services are configured to forward the defined functionality associated with the said received at least one mineral and metallurgical event record and/or at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units. The said mineral and metallurgical services may be any kind of mineral and metallurgical services, e.g. mineral and metallurgical production instructions,

mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling
5 comprises after the step of generating mineral and metallurgical services 31 a step of generating a mineral and metallurgical event response 32.

Figure 9 shows a flow diagram of event handling in another embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 9 reference is
10 made to an architectural block diagram presented in Figure 5. In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises a step of receiving of an at least one mineral and metallurgical event record 29, in which
15 step of receiving 29 the operational server 18 of the mineral and metallurgical management system 4, 13, 16, 25 receives an at least one mineral and metallurgical event record from mineral and metallurgical production subprocesses 6-8 and/or from mineral and metallurgical plant operation subprocesses 21-23.

Respectively, the said method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment comprises a step of detecting 265 mineral and metallurgical development units.
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In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises after the step of receiving an at least one mineral and metallurgical event record 29 and detecting mineral and metallurgical development units 265
25 a step of generating a group of mineral and metallurgical configuration units 30. The generated mineral and metallurgical configuration units define the functionality of the mineral and metallurgical process management system 4, 13, 16, 25 based on the said received at least one mineral and metallurgical event record and/or on the collected mineral and metallurgical data records
30 and/or on the detected mineral and metallurgical development units.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises after the step of generating mineral and metallurgical configuration units 30 a step of generating mineral and metallurgical services 31. The generated mineral and metallurgical services are configured to forward the defined
35 functionality associated with the said received at least one mineral and metallurgical

lurgical event record and/or at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units. The said mineral and metallurgical services may be any kind of mineral and metallurgical services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the event handling comprises after the step of generating mineral and metallurgical services 31 a step of generating a mineral and metallurgical event response 32.

Figure 10 shows a flow diagram of auxiliary event handling in one embodiment of a method for managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 10 reference is made to an architectural block diagram presented in Figure 5. In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the auxiliary event handling comprises a step of receiving of an at least one mineral and metallurgical auxiliary event record 33, in which step of receiving 33 the management server 17 of the mineral and metallurgical management system 4, 13, 16, 25 receives an at least one mineral and metallurgical auxiliary event record from mineral and metallurgical auxiliary management processes 15.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the auxiliary event handling comprises after the step of receiving 33 a step of generating a group of mineral and metallurgical configuration units 34. The generated mineral and metallurgical configuration units define the functionality of the mineral and metallurgical process management system 4, 13, 16, 25 based on the said received at least one mineral and metallurgical auxiliary event record and/or the collected mineral and metallurgical data records.

In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the auxiliary event handling comprises after the step of generating mineral and metallurgical configuration units 34 a step of generating mineral and metallurgical services 35. The generated mineral and metallurgical services are configured to forward the defined functionality associated with the said received at least one mineral and metallurgical auxiliary event record and/or at least one mineral and metallurgi-

cal configuration unit of the generated group of mineral and metallurgical configuration units. The said mineral and metallurgical services may be any kind of mineral and metallurgical services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

5 In the method for managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the auxiliary event handling comprises after the step of generating mineral and metallurgical services 35 a step of generating a mineral and metallurgical auxiliary event response 36.

10 Figure 11 shows a flow diagram of optimization event handling in one embodiment of a method for optimized managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 11 reference is made to an architectural block diagram presented in Figure 5. In the method for optimized managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the optimization event handling comprises a step of receiving of an at least one optimization process event record 42, in which step of receiving 42 the management server 17 of the mineral and metallurgical management system 4, 13, 16, 25 receives an at least one optimization process event record from optimization processes 41.

20 In the method for optimized managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the optimization event handling comprises after the step of receiving 42 a step of generating a group of optimization process configuration units 34. The generated optimization process configuration units define the functionality of the optimized mineral and metallurgical process management system 4, 13, 16, 25 based on the said received at least one optimization process event record and/or the collected mineral and metallurgical data records.

30 In the method for optimized managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the optimization event handling comprises after the step of generating optimization process configuration units 43 a step of generating optimization process services 44. The generated optimization process services are configured to forward the defined functionality associated with the said received at least one optimization process event record and/or at least one optimization process configuration

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unit of the generated group of optimization process configuration units. The said optimization process services may be any kind of optimization process services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

In the method for optimized managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the optimization event handling comprises after the step of generating optimization process services 44 a step of generating an optimization process event response 45.

Figure 12 shows a flow diagram of benchmark event handling in one embodiment of a method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to the present invention. With Figure 12 reference is made to an architectural block diagram presented in Figure 5. In the method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the benchmark event handling comprises a step of receiving of an at least one benchmark process event record 52, in which step of receiving 52 the management server 17 of the mineral and metallurgical management system 4, 13, 16, 25 receives an at least one benchmark process event record from benchmark processes 51.

In the method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the benchmark event handling comprises after the step of receiving 52 a step of generating a group of benchmark process configuration units 53. The generated benchmark process configuration units define the functionality of the benchmarked mineral and metallurgical process management system 4, 13, 16, 25 based on the said received at least one benchmark process event record and/or the collected mineral and metallurgical data records.

In the method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the benchmark event handling comprises after the step of generating benchmark process configuration units 53 a step of generating benchmark process services 54. The generated benchmark process services are configured to forward the defined functionality associated with the said received at least one benchmark process event record and/or at least one benchmark process configuration unit of the generated group of benchmark process configuration

units. The said benchmark process services may be any kind of benchmark process services, e.g. mineral and metallurgical production instructions, mineral and metallurgical plant operation instructions and/or mineral and metallurgical auxiliary management reporting.

5 In the method for benchmarked managing of a mineral and metallurgical process for obtaining metals according to presented embodiment the benchmark event handling comprises after the step of generating benchmark process services 54 a step of generating a benchmark process event response 55.

10 The presented solution for managing of a mineral and metallurgical process for obtaining metals captures the business value of the constraints and aims to provide a solution that not only optimizes the process to the maximum design specification but also optimizes the value stream of all incoming and outgoing materials, covering both the recovery of the ore body and/or the
15 forecasted market prices for the materials produced.

 The presented system for managing of a mineral and metallurgical process for obtaining metals will also provide best practices operations and maintenance processes and organizational structures. The presented system will dramatically shorten the time needed for any production facility to reach
20 optimal operations level. The presented system is connected to the customer enterprise level objects and activities as needed on each industry area. Consequently, the content and decision making principles are adapted with the presented system in accordance each customer enterprise. The presented system provides enterprise support through extensive service-oriented integration approach combined with enterprise level content. This enables easy connectivity to needed enterprise level objects which is supported by processes
25 and content.

 The presented system for managing of a mineral and metallurgical process for obtaining metals offers true end-to-end visibility of operations and
30 modern tools to manage their plants. This enables customer enterprise to take advantage of the best available technology. The presented system also enables collection of vast amounts of data which makes continuous improvement programs possible.

 The presented system for managing of a mineral and metallurgical
35 process for obtaining metals collects and optimizes operations and maintenance, and also simultaneously optimizes the supply chain. This will reap great

benefits in minimized stock values, cash to cash cycles and improved spare and wear availability.

With the help of the solution according to the present invention the manufacturers of mineral and metallurgical process equipment will be able to

5 provide a system for managing of a mineral and metallurgical process for obtaining metals which system has more reliable operations processes and maintenance processes as well as provides better enterprise support when compared to the prior art solutions.

It will be obvious to a person skilled in the art that, as the technology

10 advances, the inventive concept can be implemented in various ways. The invention and its embodiments are not limited to the examples described above but may vary within the scope of the claims.

CLAIMS

1. A method for managing of a mineral and metallurgical process for obtaining metals,

characterized in that said method comprises steps of:

5 - collecting (26) mineral and metallurgical data records from mineral and metallurgical production subprocesses (6-8) and/or from mineral and metallurgical plant operation subprocesses (21-23) and/or from mineral and metallurgical auxiliary management processes (15);

10 - generating (27) a group of mineral and metallurgical configuration units, said configuration units defining the functionality of a mineral and metallurgical process management system (4), (13), (16), (25) based on the collected mineral and metallurgical data records; and

15 - generating (28) mineral and metallurgical services, said services being configured to forward the defined functionality associated with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.

2. A method according to claim 1, **characterized** in that said method comprises steps of:

20 - monitoring performance indicator data of mineral and metallurgical production subprocesses (6-8) and/or from mineral and metallurgical plant operation subprocesses (21-23); and

 - detecting (265) mineral and metallurgical development units, said development units being triggered by said performance indicator data;

so that:

25 - in the step of configuration units generating (27), said configuration units define the said functionality based on the collected mineral and metallurgical data records and on the detected mineral and metallurgical development units.

3. A method according to claim 1 or to claim 2, **characterized** in that in the step of collecting (26) optimization process data records are collected from optimization processes (41).

4. A method according to any one of claims 1 to 3, **characterized** in that the said method comprises steps of:

35 - receiving of an at least one optimization process event record (42) from optimization processes (41); and

- generating an optimization process event response (45).

5 5. A method according to any one of claims 3 to 4, **characterized** in that the said optimization processes (41) include one or more of the following processes (41): a statistical probability modelling process, a supply chain management process, a future bottleneck prediction process, a capital expenditure management process, a financial cost and sales analysis process, a customer value tree analysis process, a value proposition alignment process, a production requirement fit analysis process, a cost reduction process, a deployment optimization process, a business optimization process.

10 6. A method according to any one of claims 1 to 5, **characterized** in that in the step of collecting (26) benchmark process data records are collected from benchmark processes (51).

7. A method according to any one of claims 1 to 6, **characterized** in that the said method comprises steps of:

15 - receiving of an at least one benchmark process event record (52) from benchmark processes (51); and

- generating a benchmark process event response (55).

20 8. A method according to any one of claims 6 to 7, **characterized** in that the said benchmark processes (51) include one or more of the following processes (51): a mineral and metallurgical site benchmark process, a plant benchmark process, a process benchmark process, a sub-process benchmark process, an equipment benchmark process, a value chain benchmark process, a supply chain benchmark process, a cost management benchmark process, a capital expenditure management benchmark process, environmental footprint benchmark process, and a deployment benchmark process.

9. A method according to any one of claims 1 to 8, **characterized** in that said method comprises steps of:

30 - receiving of an at least one mineral and metallurgical event record (29) from mineral and metallurgical production subprocesses (6-8) and/or from mineral and metallurgical plant operation subprocesses (21-23); and

- generating a mineral and metallurgical event response (32).

10. A method according to any one of claims 1 to 9, **characterized** in that said method comprises steps of:

- receiving of an at least one mineral and metallurgical auxiliary event record (33) from mineral and metallurgical auxiliary management processes (15); and

- generating a mineral and metallurgical auxiliary event response (36).

5 11. A method according to any one of claims 1 to 10, **characterized** in that the said mineral and metallurgical production subprocesses (6-8) include one or more of the following processes (6-8): a crushing process, a grinding process, a screening process, a classification process; a flotation process, a gravity separation process, an electrostatic separation process, a magnetic separation process, a dewatering process, a leaching processes, a
10 filtering process, a thickening process, a solvent extraction process, a stripping process, an electrowinning process, an electrorefining process, a precipitation process, a smelting process, an anode casting process, a furnace process, a calcination process, a roasting process, an agglomeration process, a direct
15 reduction process, a smelting reduction process, a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process.

20 12. A method according to any one of claims 1 to 11, **characterized** in that the said mineral and metallurgical plant operation subprocesses (21-23) include one or more of the following processes (21-23): an ore blasting process, an ore distribution process, product logistics management process, a mineral and metallurgical site management process, a mineral and metallurgical plant management process, a mineral and metallurgical process management process, a mineral and metallurgical sub-process management process, a mineral and metallurgical equipment management process, a spare part logistics management process, a vendor logistics management process, a security process, an occupational health and safety process, a maintenance process, a periodical testing process.
30

 13. A method according to any one of claims 1 to 12, **characterized** in that the said mineral and metallurgical auxiliary management processes (15) include one or more of the following processes (15): a minerals pricing process, a market intelligence and analysis process, an ore body life
35 time analysis process, an equipment life time analysis process, a technology life time analysis process, a legal risk analysis process, a regulatory risk analysis

sis process, an environmental risk analysis process, a supplier intelligence and risk management process, a vendor intelligence and risk management process, a financial cost and sales analysis process, a capital expenditure management process, a value proposition alignment process.

5 14. A system for managing of a mineral and metallurgical process for obtaining metals, **characterized** in that said system comprises a management server (17), an operational server (18) and a database (19), wherein:

 - said operational server (18) is configured to collect mineral and metallurgical data records from mineral and metallurgical production subprocesses
10 (6-8) and/or from mineral and metallurgical plant operation subprocesses (21-23) and to forward said mineral and metallurgical data records to said database (19) and/or to said management server (17), and

 - said management server (17) is configured:
 - to receive mineral and metallurgical data records from said
15 operational server (18) and/or from said database (19),

 - to receive mineral and metallurgical data records from mineral and metallurgical auxiliary management processes (15),
 - to generate a group of mineral and metallurgical configuration units, said configuration units defining the functionality of a mineral and metallurgical process management system (4), (13), (16), (25) based on the received mineral and metallurgical data records, and
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 - to generate (28) mineral and metallurgical services, said services being configured to forward the defined functionality associated with at least one mineral and metallurgical configuration unit of the generated group of mineral and metallurgical configuration units.
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 15. A system according to claim 14, **characterized** in that the said management server (17) is configured:

 - to receive detected (265) mineral and metallurgical development units, said development units being triggered by monitored performance indicator data of mineral and metallurgical production subprocesses (6-8)
30 and/or from mineral and metallurgical plant operation subprocesses (21-23).

 16. A system according to claim 14 or to claim 15, **characterized** in that the said management server (17) is configured:

 - to receive optimization process data records from optimization processes (41), and
35

- to generate a group of optimization process configuration units (43) and optimization process services (44), said services being configured to forward the defined functionality associated with at least one optimization process configuration unit of the generated group of optimization process configuration units.

17. A system according to claim 16, **characterized** in that the said optimization processes (41) include one or more of the following processes (41): a statistical probability modelling process, a supply chain management process, a future bottleneck prediction process, a capital expenditure management process, a financial cost and sales analysis process, a customer value tree analysis process, a value proposition alignment process, a production requirement fit analysis process, a cost reduction process, a deployment optimization process, a business optimization process.

18. A system according to any one of claims 14 to 17, **characterized** in that the said management server (17) is configured:

- to receive benchmark process data records from benchmark processes (51), and
- to generate a group of benchmark process configuration units (53) and benchmark process services (54), said services being configured to forward the defined functionality associated with at least one benchmark process configuration unit of the generated group of benchmark process configuration units.

19. A system according to claim 18, **characterized** in that the said benchmark processes (51) include one or more of the following processes (51): a mineral and metallurgical site benchmark process, a plant benchmark process, a process benchmark process, a sub-process benchmark process, an equipment benchmark process, a value chain benchmark process, a supply chain benchmark process, a cost management benchmark process, a capital expenditure management benchmark process, environmental footprint benchmark process, and a deployment benchmark process.

20. A system according to any one of claims 14 to 19, **characterized** in that the said mineral and metallurgical production subprocesses (6-8) include one or more of the following processes (6-8): a crushing process, a grinding process, a screening process, a classification process; a flotation process, a gravity separation process, an electrostatic separation process, a magnetic separation process, a dewatering process, a leaching processes, a

filtering process, a thickening process, a solvent extraction process, a stripping process, an electrowinning process, an electrorefining process, a precipitation process, a smelting process, an anode casting process, a furnace process, a calcination process, a roasting process, an agglomeration process, a direct
5 reduction process, a smelting reduction process, a gas cooling process, a gas cleaning process, an aluminum production process, a precious metals production process, a ferroalloys production process, a sulphuric acid plant process, an industrial water treatment process, a waste to energy process, oil wining process, a thermal process.

10 21. A system according to any one of claims 14 to 20, **characterized** in that the said mineral and metallurgical production subprocesses (6-8) are realised as plant floor systems.

22. A system according to any one of claims 14 to 21, **characterized** in that the said mineral and metallurgical plant operation subprocesses
15 (21-23) include one or more of the following processes (21-23): an ore blasting process, an ore distribution process, product logistics management process, a mineral and metallurgical site management process, a mineral and metallurgical plant management process, a mineral and metallurgical process management process, a mineral and metallurgical sub-process management process,
20 a mineral and metallurgical equipment management process, a spare part logistics management process, a vendor logistics management process, a security process, an occupational health and safety process, a maintenance process, a periodical testing process.

23. A system according to any one of claims 14 to 22, **characterized** in that the said mineral and metallurgical auxiliary management processes (15) include one or more of the following processes (15): a minerals pricing process, a market intelligence and analysis process, an ore body life time analysis process, an equipment life time analysis process, a technology life time analysis process, a legal risk analysis process, a regulatory risk analysis process, an environmental risk analysis process, a supplier intelligence and risk management process, a vendor intelligence and risk management process, a financial cost and sales analysis process, a capital expenditure management process, a value proposition alignment process.

24. A system according to any one of claims 14 to 23, **characterized** in that the said management server (17) has a reporting output
35 (24) for reporting and managing communications.

25. A system according to any one of claims 14 to 24, **characterized** in that the said database (19) is integrated to the said management server (17) or to the said operational server (18).

26. A system according to any one of claims 14 to 24, **characterized** in that the said management server (17) and the said operational server (18) are realised as one server.

27. A system according to claim 26, **characterized** in that the said database (19) is integrated to the said one server.

28. A use of a system according to any one of claims 14 to 27 for managing of a mineral and metallurgical process for obtaining metals.

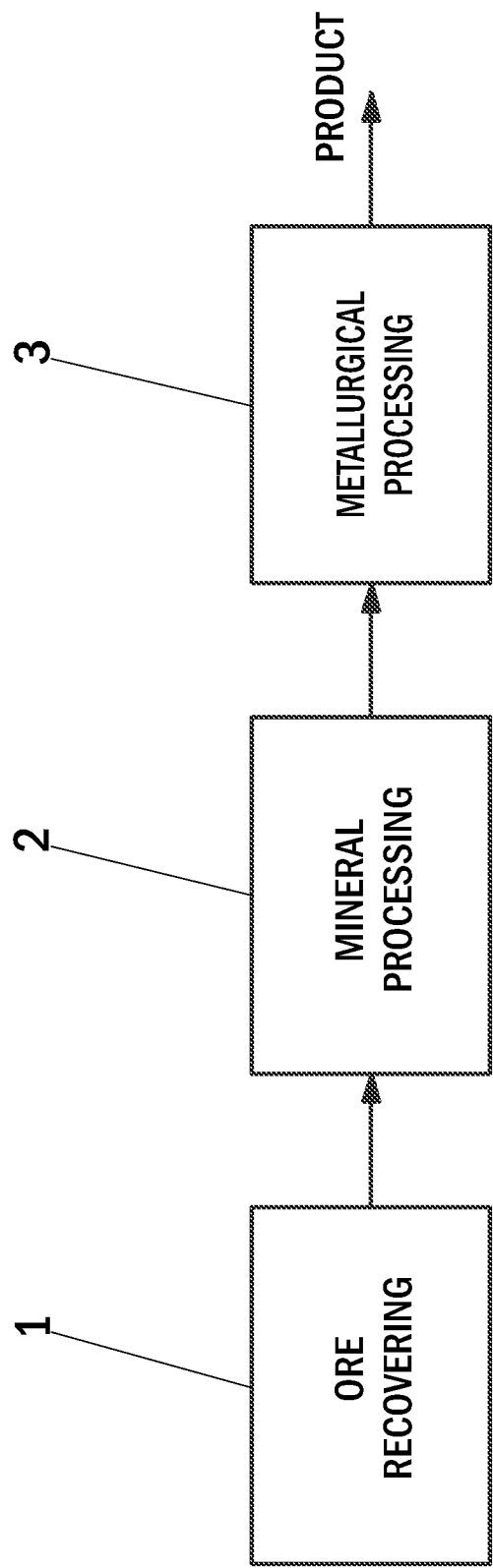


Fig. 1

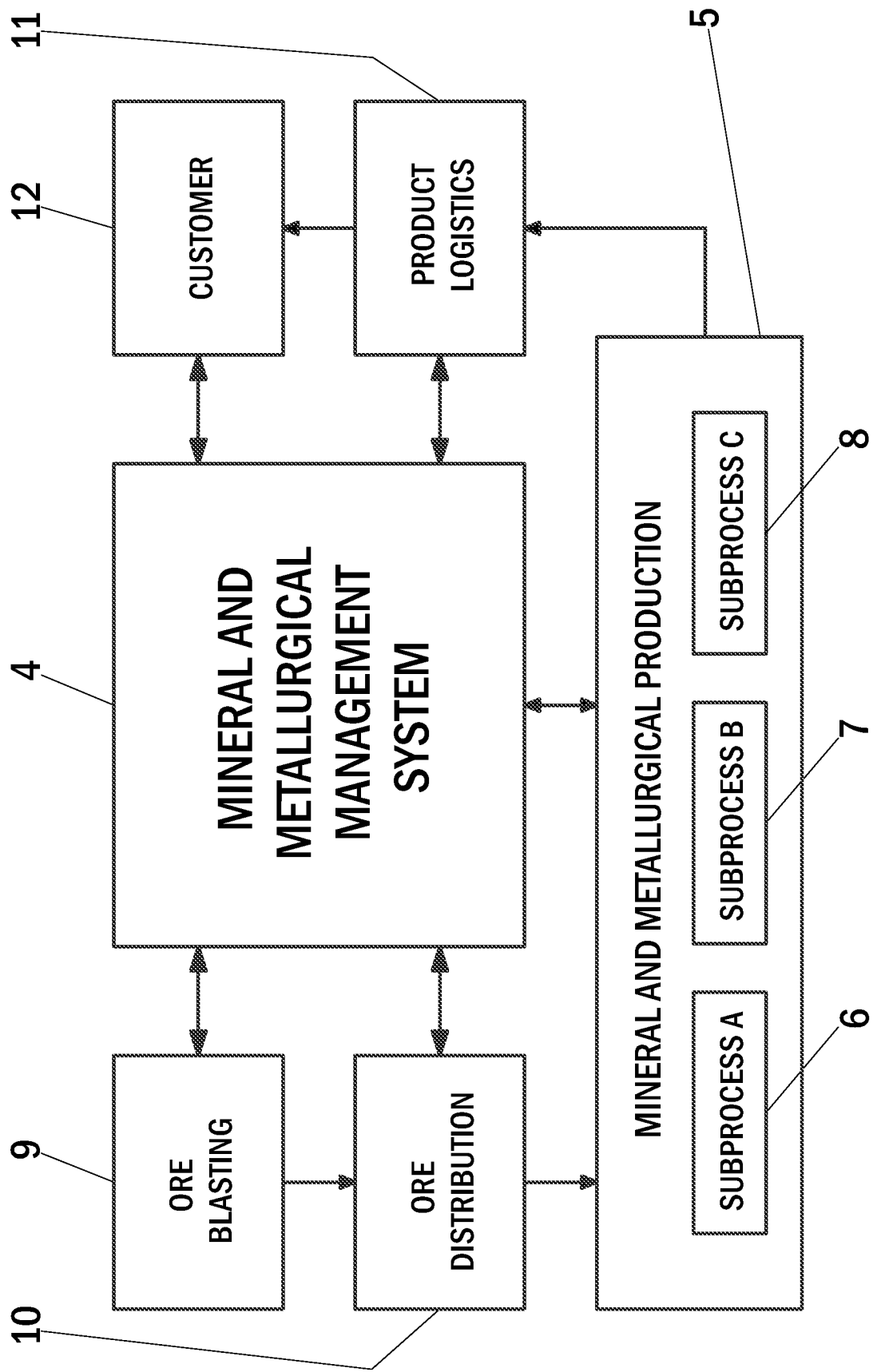


Fig. 2

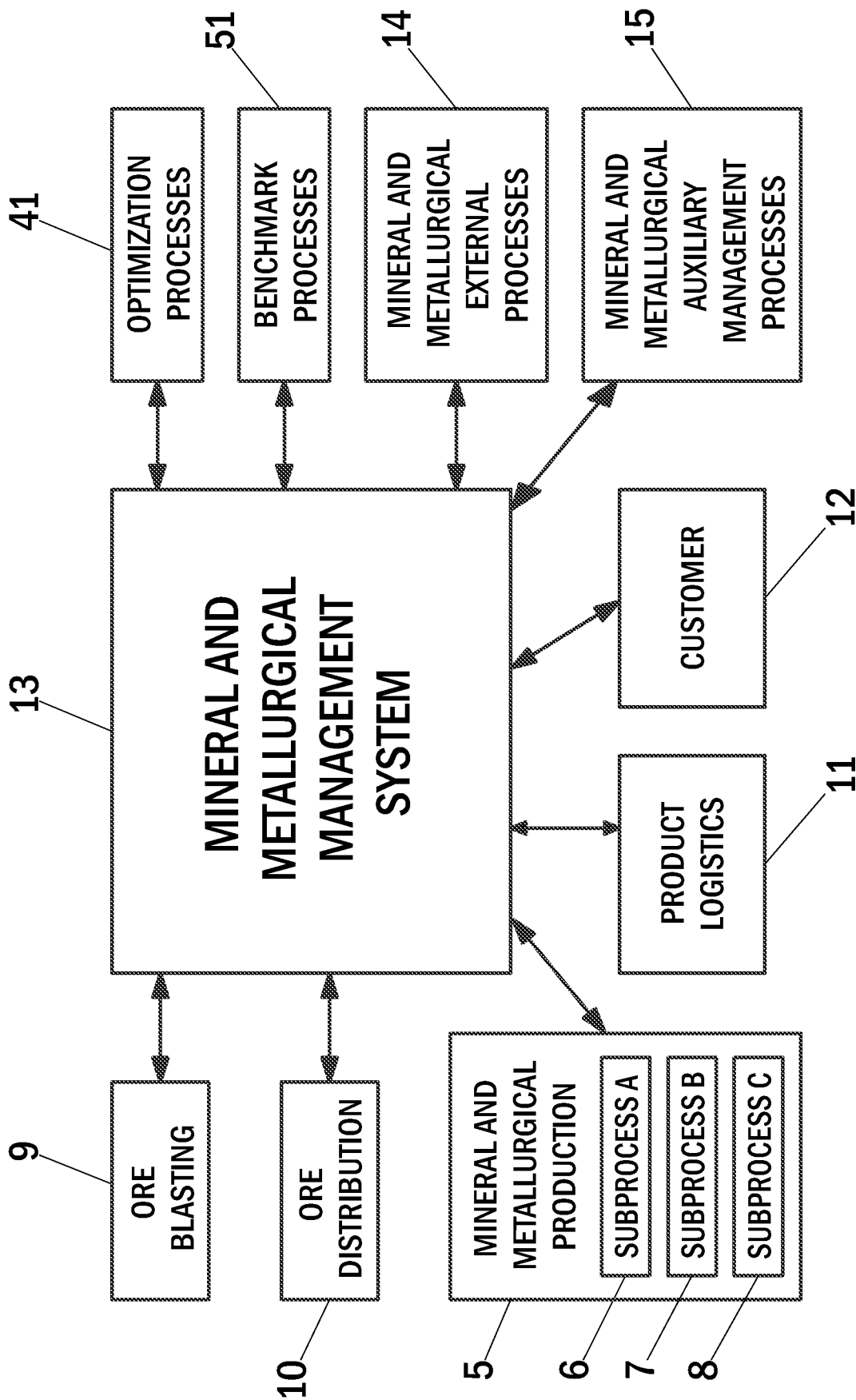


Fig. 3

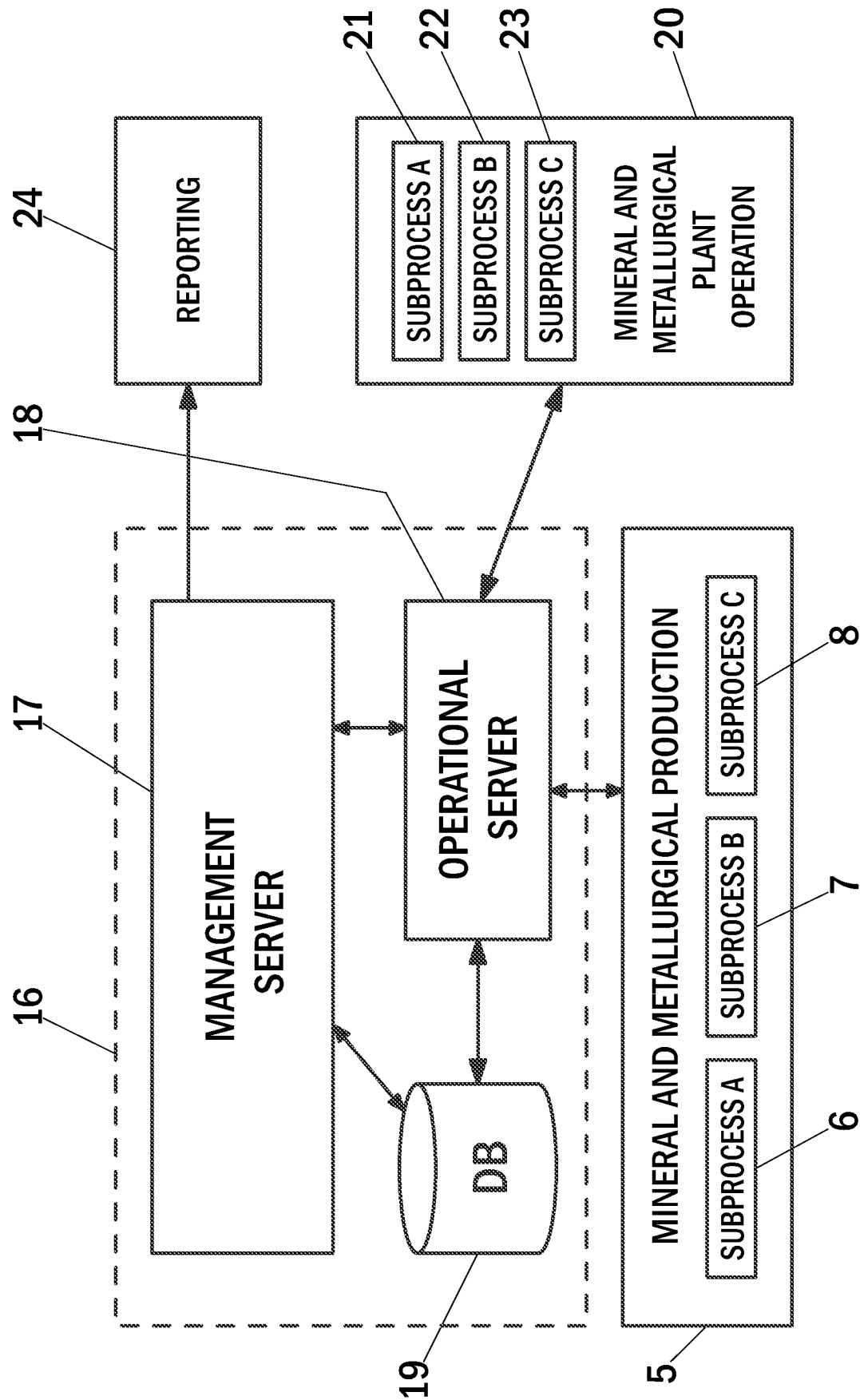


Fig. 4

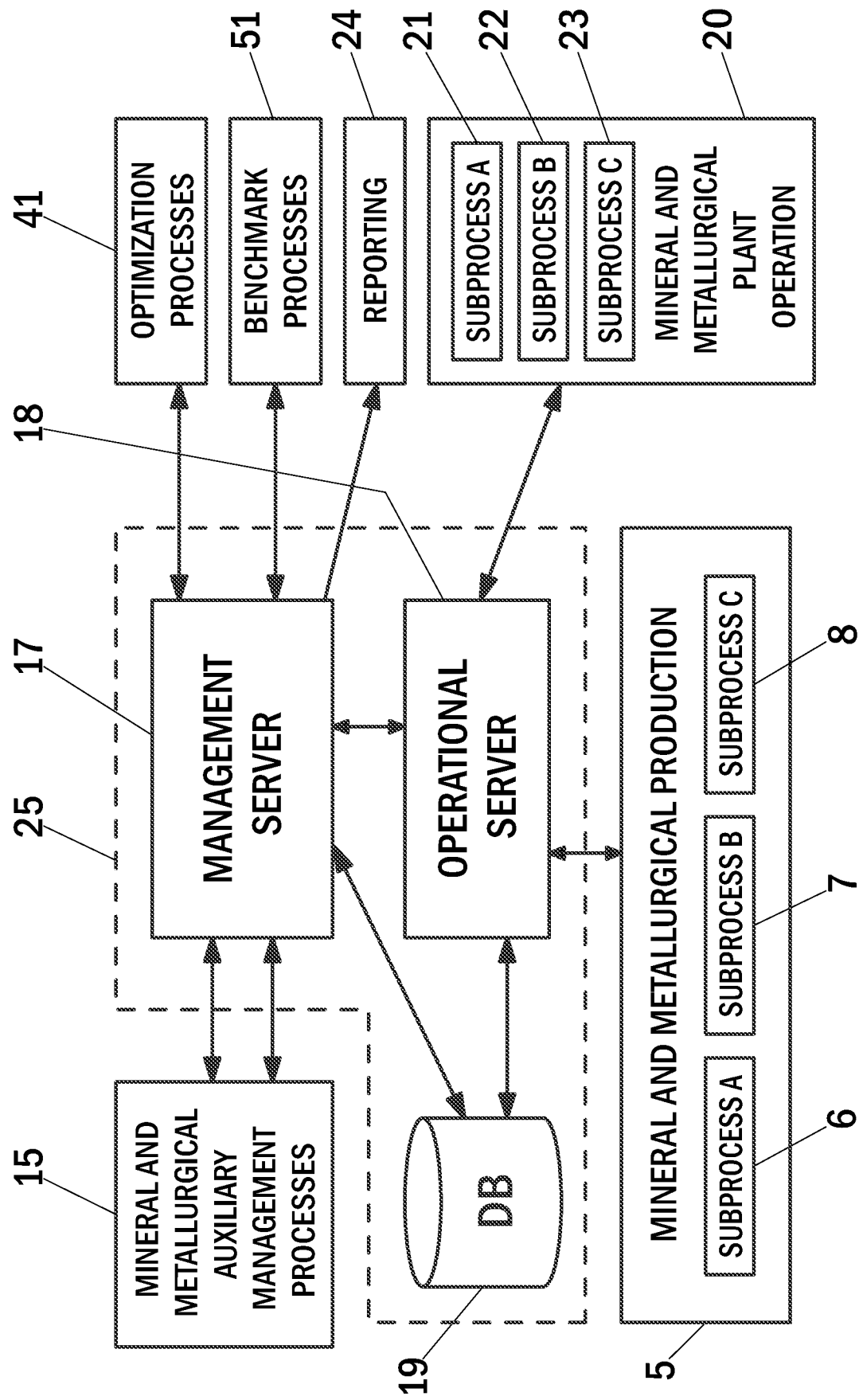
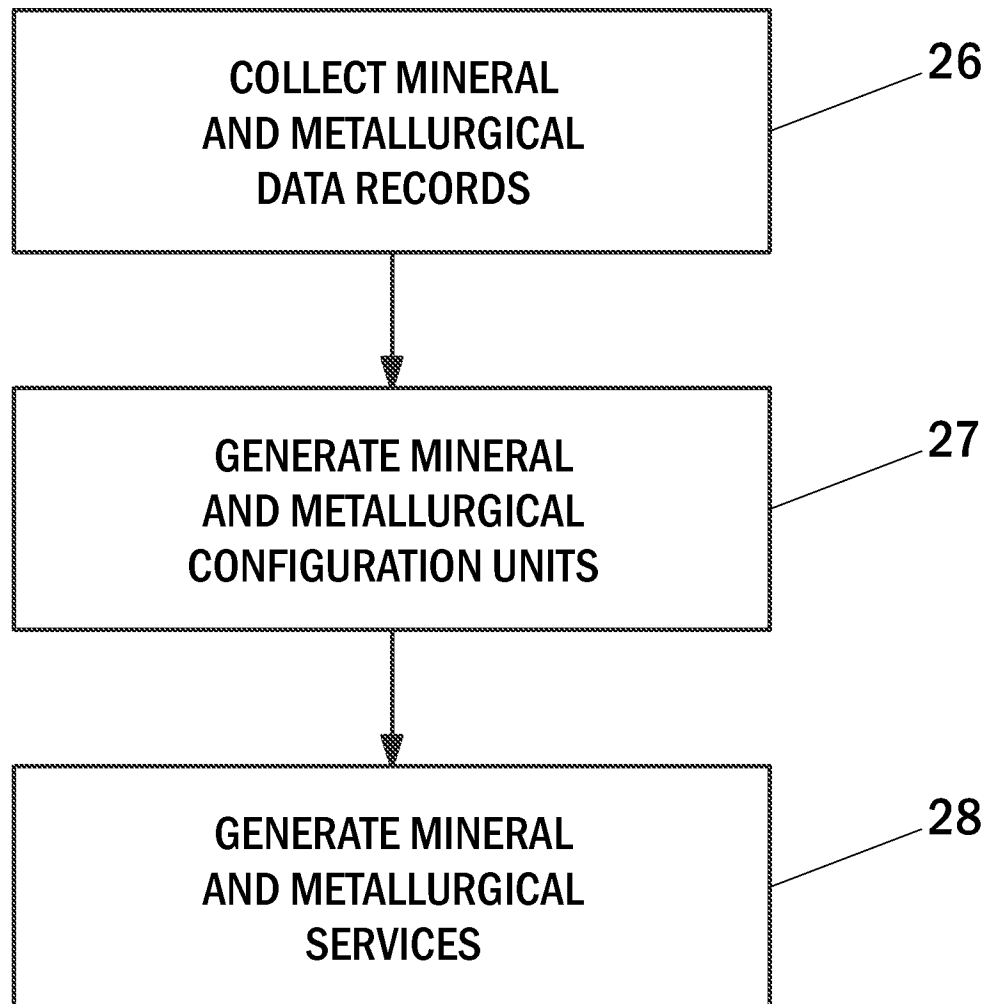
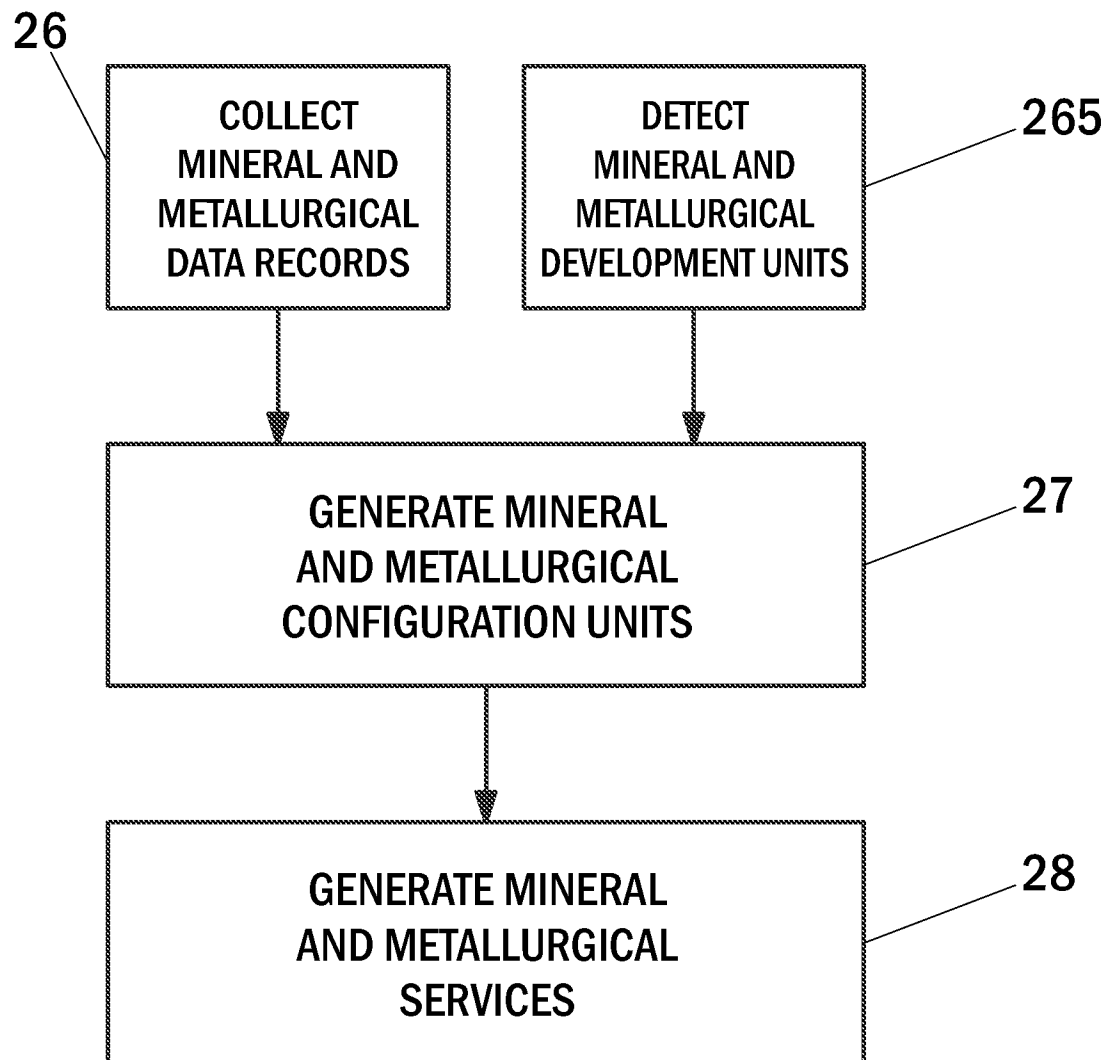


Fig. 5

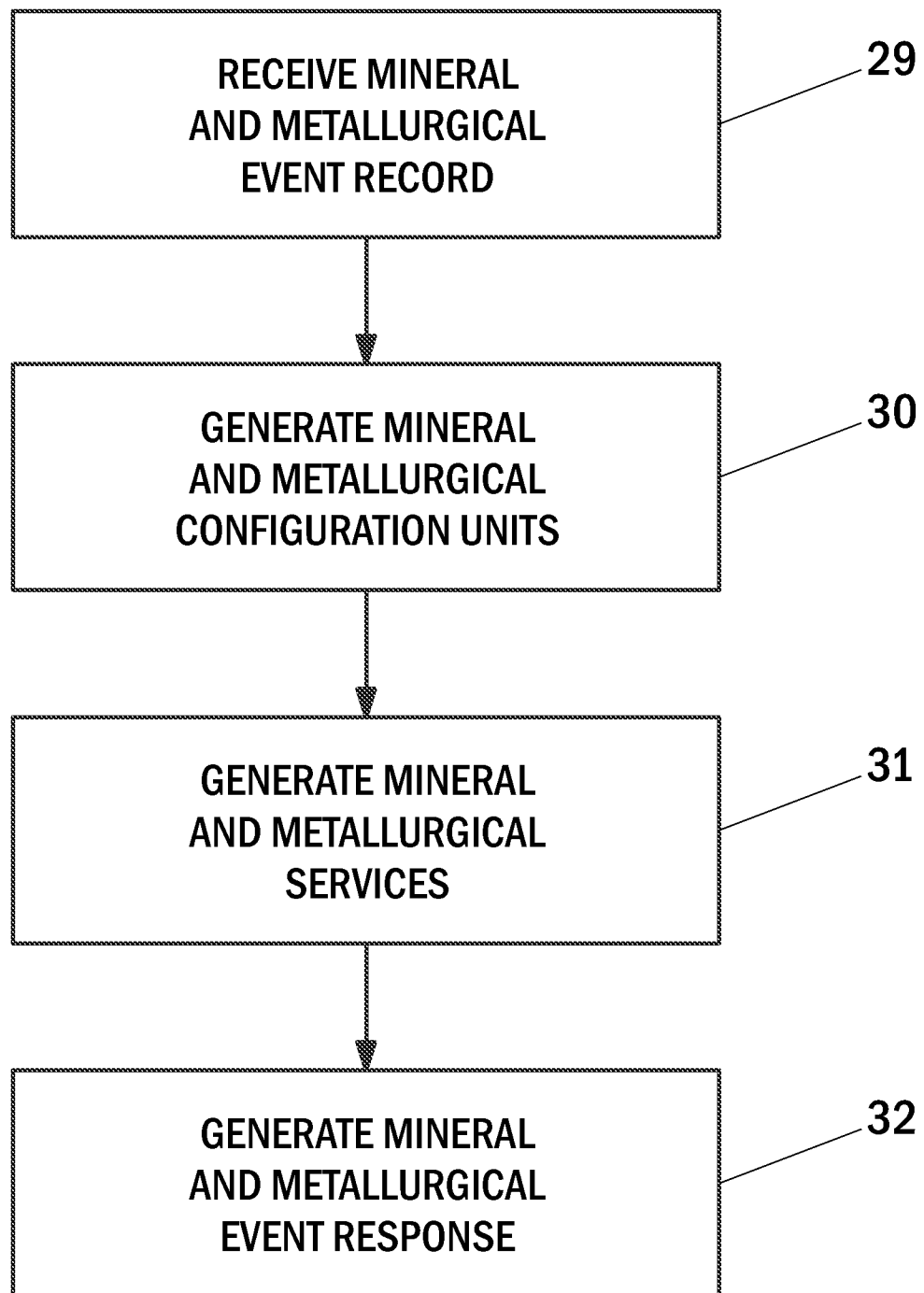
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**Fig. 6**

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**Fig. 7**

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**Fig. 8**

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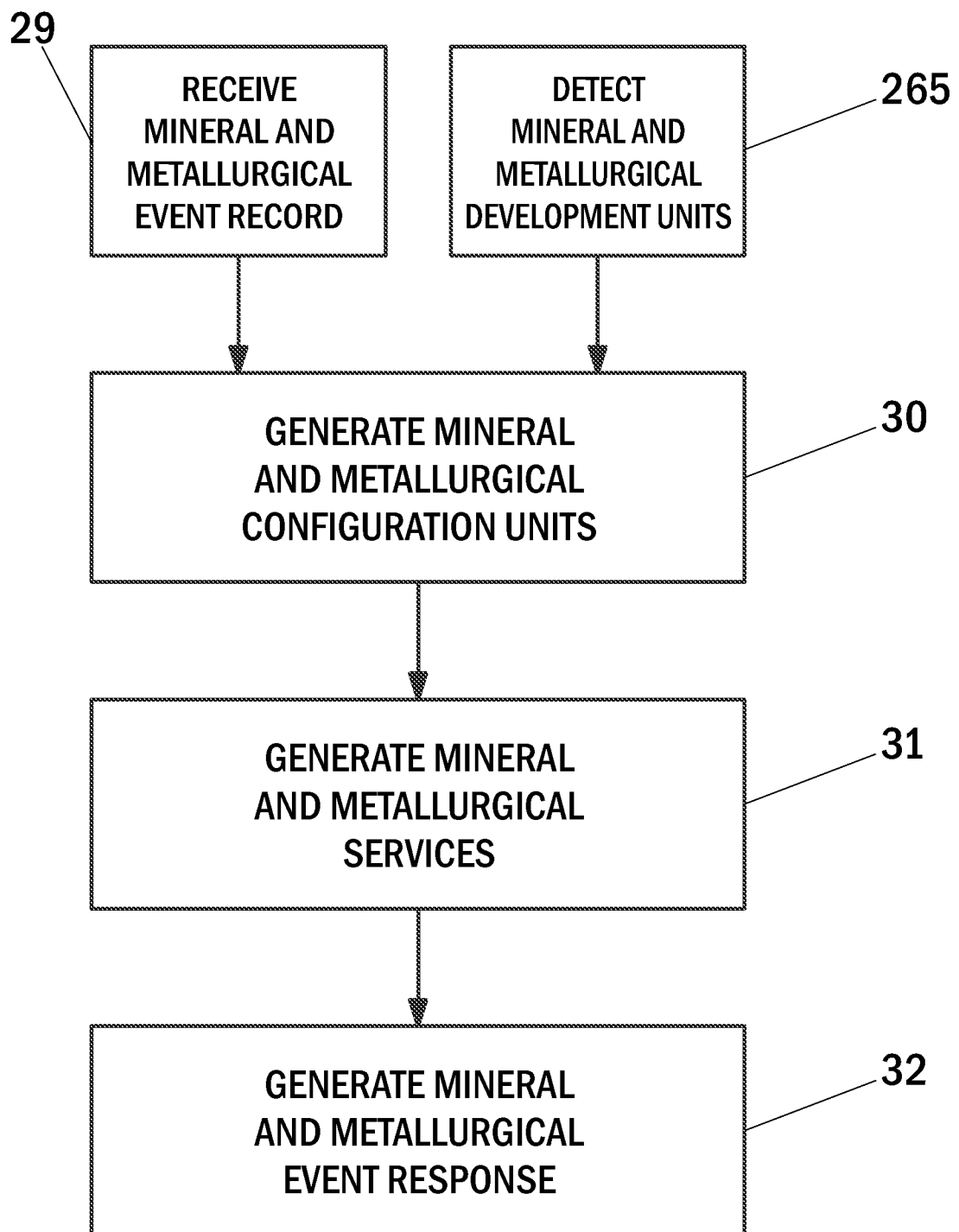


Fig. 9

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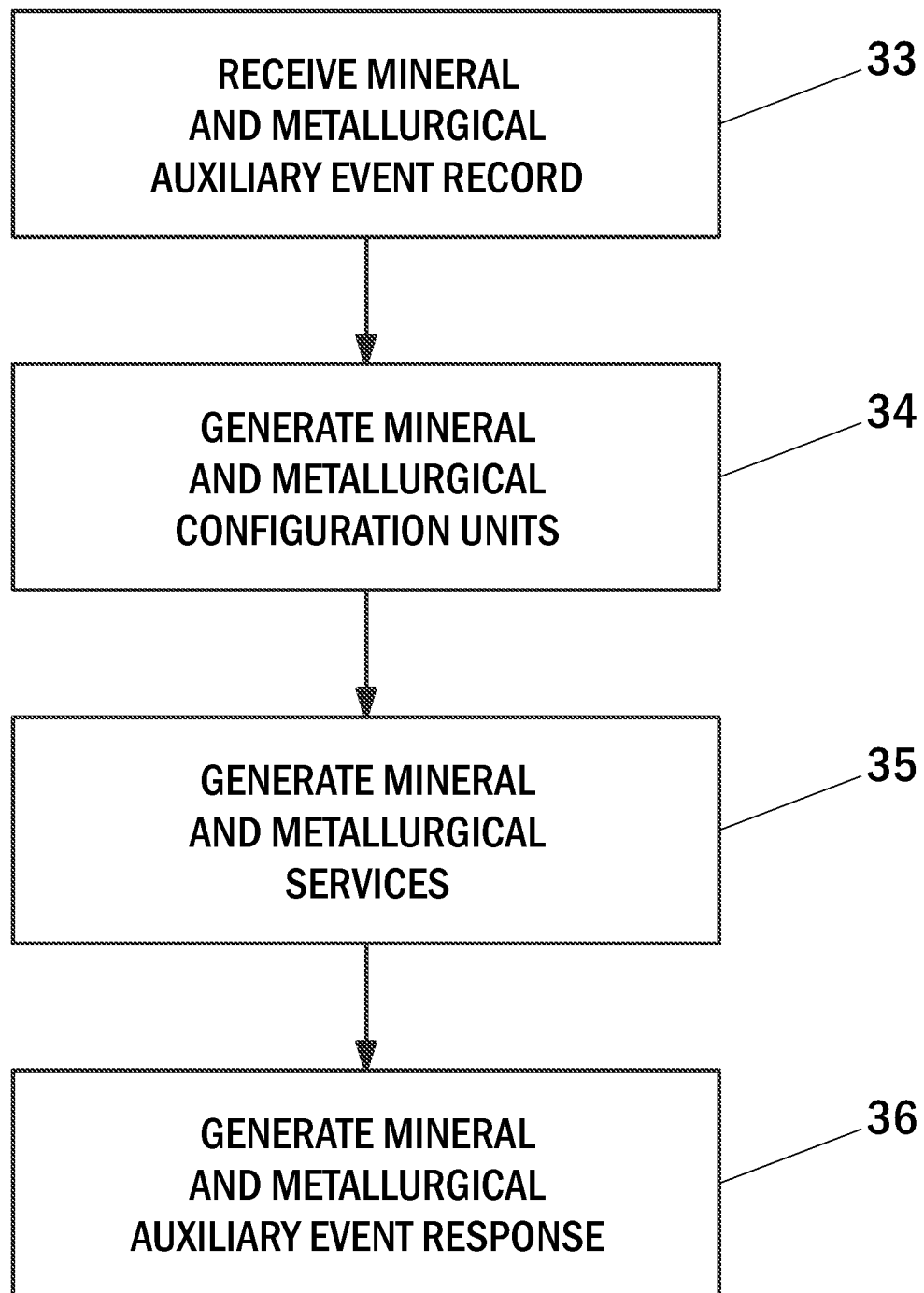
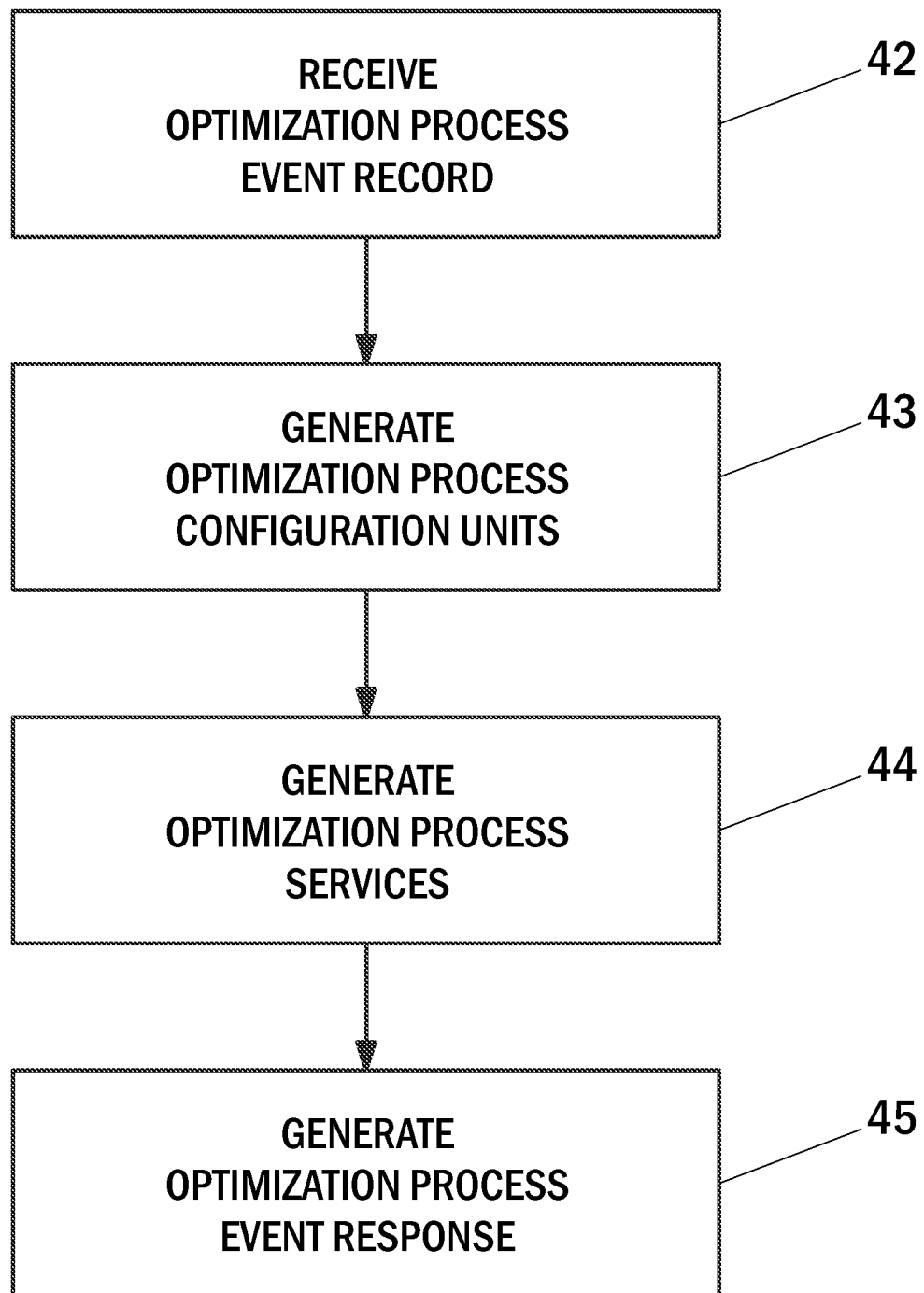


Fig. 10

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**Fig. 11**

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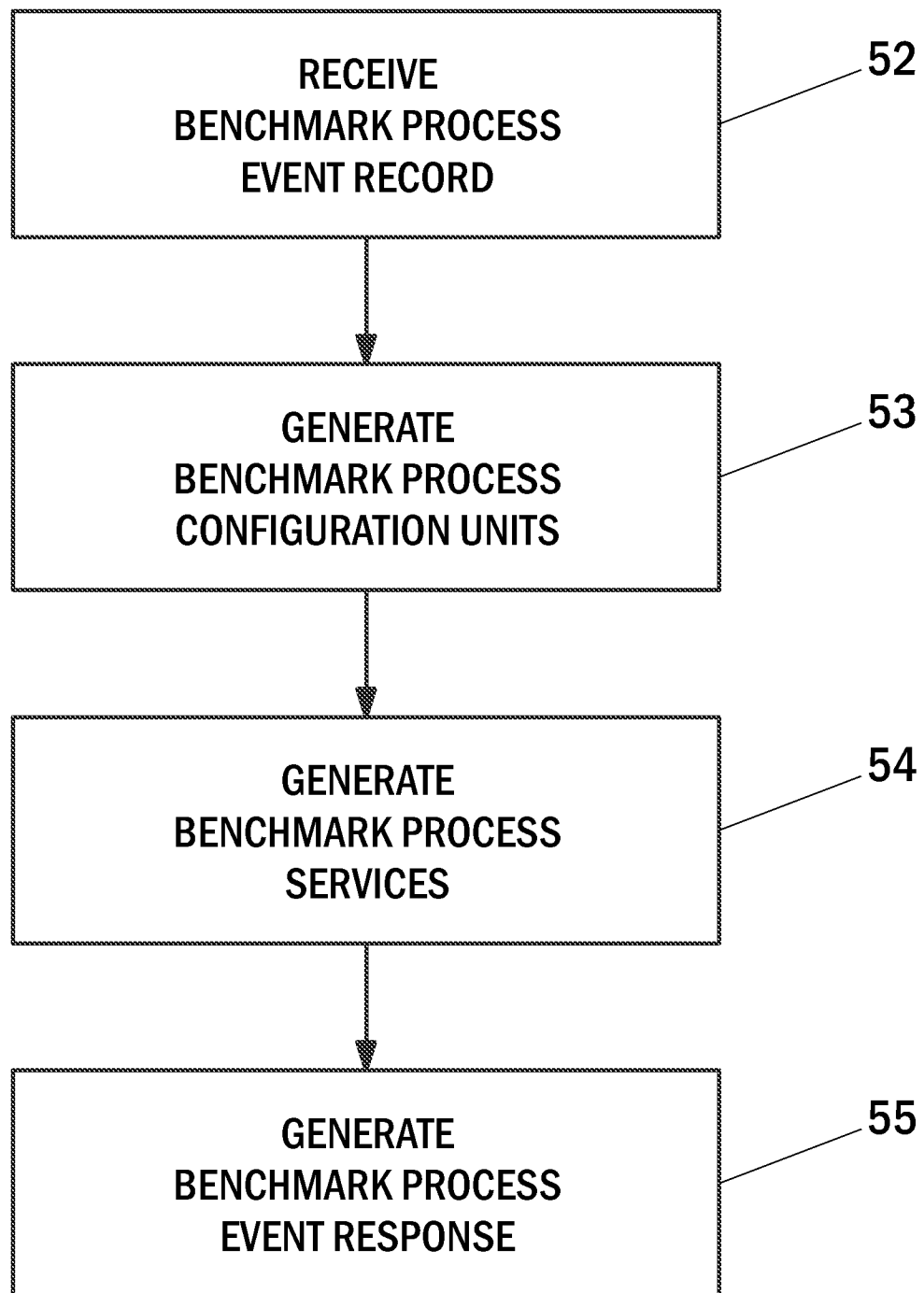


Fig. 12

INTERNATIONAL SEARCH REPORT

International application No

PCT/FI2015/050950

A. CLASSIFICATION OF SUBJECT MATTER

INV. G06Q10/04 G06Q10/06
ADD.

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

G06Q

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EP0-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
	The claimed subject-matter, with due regard to the description and drawings in accordance with Rule 33.3 PCT, relates to processes comprised in the list of subject-matter and activities for which no search is required under Rule 39 PCT. The information technology employed as an enabler for carrying out said processes is so well-known that its existence at the relevant date cannot reasonably be disputed. The claimed technical features, namely a database, several servers and data records, are therefore considered to be part of the notorious knowledge, for which no documentary evidence is deemed necessary. (see Guidelines for Search and Examination at the European Patent Office as PCT Authority, B-VIII, 2.2.1 and Euro-PCT Guide, C-III, 255) -----	

☐ Further documents are listed in the continuation of Box C.

☐ See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier application or patent but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art

"&" document member of the same patent family

Date of the actual completion of the international search

17 March 2016

Date of mailing of the international search report

29/03/2016

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