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(73)	Innehaver	VINCORION Advanced Systems GmbH, Feldstraße 155, 22880 Wedel, Tyskland
(72)	Oppfinner	OTTO, Stephan, 22549 Hamburg, Tyskland
(74)	Fullmektig	BRYN AARFLOT AS, Stortingsgata 8, 0161 OSLO, Norge

(54) Benevnelse **METHOD AND EMERGENCY AIMING CONTROL UNIT FOR OPERATING AN EMERGENCY AIMING SYSTEM FOR AN ARTILLERY APPARATUS, ARTILLERY APPARATUS AND VEHICLE**

(56) Anførte publikasjoner

US-A- 4 686 888
US-A1- 2004 033 472
US-A- 4 885 977

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METHOD AND EMERGENCY AIMING CONTROL UNIT FOR OPERATING AN EMERGENCY AIMING SYSTEM FOR AN ARTILLERY APPARATUS, ARTILLERY APPARATUS AND VEHICLE

Prior art

The invention is based on a method and a back-up aiming control unit for operating a back-up aiming system for an artillery device, an artillery device and a vehicle according to the preamble of the independent claims. One object of the present invention is also a computer program.

A main drive of turrets in military vehicles is operated electrically or hydraulically. The weapon is tracked using a sighting device, ensuring that the fire control computer adjusts the elevation and lead angle so that the target is hit. The sighting device remains stabilized and aligned with the target, and the main drives guide the weapons accordingly.

Document US 4 686 888 A discloses a turret system for a light military vehicle.

Document US 2004/033472 A1 discloses an all-optical simulation method and system for precision shooting.

Document US 4 885 977 A discloses a stabilized line-of-sight targeting system for use with fire control systems.

Against this background, the approach presented here presents an improved method and an improved back-up aiming control unit for operating a back-up aiming system for an artillery device, an improved artillery device, an improved vehicle and finally a corresponding computer program according to the main claims. The measures listed in the dependent claims enable advantageous embodiments and improvements of the device specified in the independent claim.

The approach presented here presents a possibility to reduce the time required to align an artillery unit using a back-up aiming system.

A method is presented of operating a back-up aiming system for an artillery device having at least one back-up aiming drive unit and an artillery unit for a vehicle connected to the backup aiming drive unit, the back-up aiming system being operated at least in the event of a failure of a main aiming system of the artillery device. The method comprises a step of providing an activation signal to an interface to a back-up aiming activation unit, wherein the activation signal is configured to activate the back-up aiming system. In a reading step, a setpoint signal is read via an interface to a detection device or fire control computer to generate an alignment signal from the setpoint signal , the alignment signal providing the at least one back-up aiming drive unit with a setpoint position for a movement of the artillery device or a weapon. The method also comprises a step of outputting at least one alignment signal for aligning the at least one back-up aiming drive unit after the step of reading to align the artillery unit with the setpoint speed and/or the setpoint torque represented by the alignment signal at least during the failure of the main alignment system. Furthermore, the method may comprise a step of outputting at least one release signal for releasing a shot after the step of reading in order to safely enable a shot to be fired at the target.

The artillery device can be used, for example, for military vehicles, such as tanks. The back-up aiming system can, for example, be carried out automatically, so that, for example, intervention by a user is not a prerequisite for the functionality of the back-up aiming system. The back-up aiming drive unit can, for example, be designed as a motor which can be configured to move an artillery unit of the artillery device. The detection device can, for example, be designed as a sighting device, which can be designed to detect, for example, the surroundings of the vehicle. The aiming position can, for example, be a position at which the artillery unit should aim. Advantageously, the approach presented here allows a detected target to be continuously monitored using at least one sighting device even if the main aiming system fails.

According to one embodiment, the method may comprise a step of receiving a change signal prior to the step of outputting, wherein the change signal may represent a change of the aiming position by a user. Furthermore, in the step of outputting, the change signal is output to the artillery unit to align the artillery unit with the aiming position changed by the change signal at least during the failure of the main aiming system. In particular, an alignment of the artillery unit with the setpoint speed and/or the setpoint torque represented by the alignment signal is suppressed if a change of the aiming position intended by a user has been detected. The change signal can, for example, represent a manual intervention by the user. Advantageously, a manual intervention can be given a higher priority than an automatically detected aiming position.

In the step of providing the activation signal, the at least one back-up aiming electronics unit is electrically connected to a supply network in response to activating the back-up aiming system. Advantageously, this can prevent damage from, for example, a nuclear pulse, which can damage active supply networks, for example.

According to one embodiment, the step of providing the release signal can be performed when the vehicle is stationary. Advantageously, aiming and, for example, stabilization of the artillery unit during a shot is improved. The artillery unit can, for example, include a turret and a weapon.

In the step of providing the activation signal, the activation signal can be provided in response to a failure signal representing the failure of the main aiming system.

The approach presented here further creates a back-up aiming control unit that is designed to carry out, control or implement the steps of a variant of a method presented here in corresponding equipment. This embodiment of the invention in the form of a device also enables the object of the invention to be solved quickly and efficiently.

For this purpose, the back-up aiming control unit can have at least one computing unit for processing signals or data, at least one storage unit for storing signals or data, at least one interface to a sensor or an actuator for reading sensor signals from the sensor or for outputting data or control signals to the actuator and/or at least one communication interface for reading or outputting data that is embedded in a communication protocol. The computing unit can be, for example, a signal processor, a microcontroller or the like, wherein the storage unit can be a flash memory, an EEPROM or a magnetic storage unit. The communication interface can be designed to read in or output data wirelessly and/or via a cable, wherein a communication interface that can read in or output cable-based data can read this data, for example, electrically or optically from a corresponding data transmission line or output it to a corresponding data transmission line.

In this case, a back-up aiming control unit can be understood as an electrical device that processes sensor signals and outputs control and/or data signals depending on them. The device may have an interface which may be implemented in hardware and/or software. In a hardware-based design, the interfaces can, for example, be part of a so-called system ASIC, which contains various functions of the device. However, it is also possible that the interfaces are separate integrated circuits or at least partly consist of discrete components. In a software-based design, the interfaces can be software modules that are present, for example, on a microcontroller alongside other software modules.

Furthermore, an artillery device for a vehicle is presented, wherein the artillery device comprises an artillery unit, at least one back-up aiming drive unit connected to the artillery unit and a back-up aiming control unit in an aforementioned variant for controlling the back-up aiming drive unit and the artillery unit.

The artillery device can be used, for example, in the event of war. The artillery unit can, for example, have a weapon and/or a turret, wherein the weapon is movably arranged on the turret. The back-up aiming drive unit can, for example, have at least one motor designed to move the weapon or the turret.

Furthermore, a vehicle with an artillery device as presented here is presented.

The vehicle can, for example, be designed as a military vehicle, such as a tank.

Exemplary embodiments of the approach presented here are shown in the drawings and explained in more detail in the following description. In the drawings:

Fig. 1 is a schematic representation of a vehicle with an artillery device according to one exemplary embodiment;

Fig. 2 is a flowchart of a method for operating ab ack-up aiming system for an artillery device for a vehicle;

Fig. 3 is a block diagram of a back-up aiming control unit according to on exemplary embodiment; and

Fig. 4 shows an exemplary embodiment of a block diagram for an artillery device for a vehicle.

In the following description of expedient exemplary embodiments of the present invention, the same or similar reference numerals are used for the elements shown in the various figures and having a similar effect, whereby there is no repeated description of these elements.

If an exemplary embodiment includes an "and/or" connection between a first feature and a second feature, this is to be read as meaning that the exemplary embodiment according to one embodiment has both the first feature and the second feature and according to another embodiment has either only the first feature or only the second feature.

Fig. 1 shows a schematic representation of a vehicle 100 with an artillery device 105 according to one exemplary embodiment. According to this exemplary embodiment, the vehicle 100 is realized as a tank. For this purpose, the vehicle 100 has the artillery device 105, which has an artillery unit 110 and at least one back-up aiming drive unit 115 connected to the artillery unit 110. The artillery device 105 further has a back-up aiming control unit 120. The back-up aiming control unit 120 is designed, for example, to control the back-up aiming drive unit 115 and thus the artillery unit 110. The back-up aiming control unit 120 is implemented, for example, as a control device that is designed to control or carry out a method for operating a back-up aiming system for the artillery device 105, as explained in more detail in one of the following figures. According to this exemplary embodiment, the vehicle 100 also comprises at least one detection device 125, which can also be referred to as a sighting device, for detecting an environment of the vehicle 100.

Such a military vehicle 100 typically has a main aiming system and a back-up aiming system that is activated if the main aiming system fails. This ensures that the artillery device 105 is ready for use at all times.

The main drive of turrets, referred to here as artillery device 105, is operated electrically or hydraulically in military vehicles 100. The weapon 130 is tracked on a sighting device, which is referred to here as a detection device 125, thus ensuring that a fire control computer adjusts the elevation and lead angle in such a way that a targeted target is hit. The detection device 125 remains stabilized and aligned with the target and the main drives track the weapon 130 and the artillery unit 110 accordingly. If, for example, one or both main drives fail, the artillery device 105 has a back-up aiming drive unit 115. This is either activated and operated mechanically by gunners via a manual back-up aiming control unit 135 or it is electrically controlled and activated via an independent back-up aiming control unit. This back-up aiming drive unit 115 should be operational under all conditions. Even a nuclear pulse should not lead to the destruction of the back-up aiming system.

However, with the introduction of unmanned turrets and remote-controlled gun carriages, it is not possible to integrate mechanical back-up aiming drives into the artillery device 105. For this reason, electric back-up aiming drives are installed in modern systems. These are usually always disconnected from a supply network when not in use to protect against a nuclear pulse. If the main drive fails partially or completely due to a fault or a nuclear pulse, the weapon can still be aimed and targets can be engaged by activating the back-up aiming drive unit.

Therefore, the approach presented here presents and describes a possibility to continue to track the weapon 130 and the artillery unit 110 to the detection device 125 when a back-up aiming drive is active.

More specifically, an electric back-up aiming drive system is described which controls an operating state that allows the weapon 130 to be tracked by the back-up aiming drive unit 115 of the detection device 125. For this purpose, the electric back-up drive unit 115 has two ways in which it can be activated. Both ways only supply power to a back-up aiming drive unit when necessary to prevent damage from a nuclear pulse. In a first way, the electronics are only activated via the manual back-up aiming control unit 135 when the gunner actuates a switch or the back-up aiming handle of the manual back-up aiming control unit 135. The second way describes how a higher-level back-up aiming control unit can switch on the back-up aiming drive unit via another input without an operator.

The first case describes the tried and tested back-up aiming operation, in which the detection device 125 follows the weapon 130. However, this means the stabilized view of the target is lost. In the second case, however, it is possible to continue to stay on target with the detection device 125 in the event of a failure of the main aiming drives and/or electronics. For this purpose, the back-up aiming electronics are switched on by the back-up aiming control unit such as a main aiming system or the fire control computer 401. Subsequently, communication is established and the back-up aiming drive unit 115 can be controlled such that the weapon 130 follows the detection device 125. For the gunner, nothing changes compared to the operation of the artillery device 105 with fully functional aiming drives. They can use all the sighting devices of the detection device 125 to reconnoiter and target objects even while moving. To fight, only the vehicle 100 should now be stopped briefly because the back-up aiming drives do not have enough power to stabilize the weapon while moving. If the vehicle 100 has stopped, the weapon 130 moves towards the detection device 125 with the help of the back-up aiming drive unit and a shot can be fired at the target immediately.

Since the back-up aiming is also active while moving, the time until the detection device 125 is reached is shortened because the weapon 130 is always aimed in the direction of the detection device 125 while moving. This approach to integrating an electric back-up aiming drive makes it possible to keep the target in view with the detection device 125 in the event of failure of the main aiming drive and to reduce to a minimum the downtime required to aim at the target with the aid of the back-up aiming drive. Should manual intervention by the gunner be necessary, tracking of the detection device 125 can be stopped at any time with the aid of a manual back-up aiming control unit 135. This allows the gunner, in cooperation with the driver, to roughly align the weapon 130 before the weapon 130 finally approaches the detection device 125. Operation via the manual back-up control unit 135 therefore always has the highest priority and ensures that the gunner can always access a safe back-up aiming function even in other fault situations.

Fig. 2 shows a flowchart of a method 200 for operating a back-up aiming system for an artillery device 105 for a vehicle. The method 200 can be carried out, for example, in a vehicle 100 as described in Fig. 1. The back-up aiming system is operated at least in the event of a failure of a main aiming system of the artillery device 105, so that the artillery device 105 is ready for use at any time. The back-up aiming system is automatically controlled by the back-up aiming control unit 120, as described for example in Fig. 1. The method 200 comprises a step 205 of providing an activation signal to an interface to a back-up aiming activation unit, wherein the activation signal is configured to activate the back-up aiming system. In a step 210 of reading, the position of the detection device 125 is read via an interface in order to calculate a setpoint signal therefrom. The setpoint signal specifies one or more setpoint torques or setpoint speeds for the at least one back-up aiming drive unit with respect to a movement of the artillery unit and/or the weapon. Furthermore, the method 200 comprises a step 215 of outputting at least one alignment signal or control signal for aligning the at least one back-up aiming drive unit after the step 210 of reading to move the artillery unit to the aiming speed represented by the setpoint signal or with the setpoint torque at least during the failure of the main aiming system.

According to this exemplary embodiment, the activation signal is provided in step 205 of providing in response to a failure signal representing the failure of the main aiming system. Further optionally, in step 205 of providing, the back-up aiming drive unit is electrically connected to a supply network in response to the activation of the back-up aiming system. This ensures, for example, that the artillery device remains ready for use. According to this exemplary embodiment, the method 200 comprises a step 220 of reading a change signal before the step 215 of outputting. The change signal represents a change of the setpoint signal by a user who, for example, operates the back-up aiming handle of the manual back-up aiming control unit of the vehicle. This means that the change is only optionally initiated manually.

The alignment signal is output using the change signal in order to align the artillery unit with the speed of the weapon changed by the change signal, at least during the failure of the main aiming system. Such manual intervention by the user has a higher priority than the setpoint speeds or setpoint torques specified using the sighting device. Furthermore, the method 200 comprises a step 225 of providing a release signal for firing the artillery unit when the weapon is properly aligned and the vehicle is no longer moving.

In other words, the approach presented here describes a method 200 for weapon tracking using back-up aiming drives with the release for firing when the vehicle is stationary.

Fig. 3 shows a block diagram of a back-up aiming control unit 120 according to one exemplary embodiment. The back-up aiming control unit 120 corresponds, for example, to the back-up aiming control unit 120 described in Fig. 1 and is designed, for example, to control a method for operating a back-up aiming system for an artillery device for a vehicle, as described, for example, in Fig. 2. The back-up aiming control unit 120 has a providing unit 305, a reading unit 310 and an output unit 315. The providing unit 305 is designed to send an activation signal 320 to an interface to a back-up aiming activation unit 325, wherein the activation signal 320 is designed to activate the back-up aiming system. The reading unit 310 is designed to read a setpoint signal 330 via an interface to a fire control computer or stabilization computer 401, wherein the setpoint signal 330 indicates to the at least one back-up aiming drive unit a setpoint speed or a setpoint torque for a change of the artillery unit and/or the weapon. The output unit 315 is designed to output at least one alignment signal 335 for aligning the at least one back-up aiming drive unit 115 after reading in the setpoint signal 330. As a result, the artillery unit is aligned with the setpoint speed and/or the setpoint torque represented by the alignment signal 335, at least during the failure of the main aiming system.

It should also be noted that the back-up aiming control unit can be part of a stabilization unit or a fire control computer. This then specifies, for example, speed or torque target setpoint values to the back-up aiming control unit, which cause the weapon 130 to follow the sighting device 125, taking into account the elevation and lead angles. If the gunner presses the button on the aiming handle, the gunner can now prevent these specifications at any time and specify speed specifications to the back-up aiming control unit themselves. A stabilization unit or fire control computer is thus overridden by the gunner.

Fig. 4 shows an exemplary embodiment of a block diagram for an artillery device 105 for a vehicle 100. The block diagram shown here shows, according to this exemplary embodiment, a schematic structure of components that are used to carry out and/or control a method for operating a back-up aiming system 400, as described in Fig. 3. The artillery device 105 has, for example, a fire control computer 401 which is designed to supplement the setpoint signals 415 of the detection device 125 with ballistic setpoint values and to supply these new setpoint signals 330 to a back-up aiming control unit. The back-up aiming control unit 120 includes a stabilization computer designed to track the turret unit 110 and the weapon 130 to the setpoint values 330, for example by controlling a main aiming system 402 using a control signal 403.

The fire control computer 401 calculates the elevation and lead and specifies higher-level operating modes. The back-up aiming control unit 120, which operates as a stabilization control unit, then carries out the control by outputting the activation signal 320, the alignment signal 335 and taking into account other signals and sensor values, for example the failure signal 455 or the setpoint signal 330. The back-up aiming control unit 120 has a back-up aiming control device 404 and a back-up aiming electronics unit 325, which regulates and implements the control of the back-up aiming motors 450.

The back-up aiming control unit 120 is designed to activate the back-up aiming drive unit 115 using an activation signal 320 and a back-up aiming activation unit 325. Furthermore, the back-up aiming drive unit 115 is designed to read an alignment signal 335 via an interface to the back-up aiming control unit 120 in response to the activation signal 320. From the setpoint signal 330, the back-up aiming control unit 120 calculates an alignment signal 335 for at least one back-up aiming drive unit 115. In response, the back-up aiming control unit 120 outputs at least one alignment signal 335 for aligning the at least one back-up aiming drive unit 115 in order to align the artillery unit 110 with the setpoint speed and/or the setpoint torque represented by the alignment signal 335, at least during the failure of the main aiming system 402, which is also designed as a main aiming drive, for example. Furthermore, a change signal 430 can be specified by the gunner of the back-up aiming unit 115 via the manual back-up aiming control unit 135, which overrides the alignment signal 335. The change signal 430 represents, for example, a manual change of the aiming position by a user. Furthermore, the back-up aiming control unit 120 is designed to provide at least one release signal 340 to the fire control computer 401. The artillery unit 110, for example, has a weapon 130 and a turret 445, which are controlled by the back-up aiming drive unit 115. The back-up aiming drive unit 115 comprises, for example, at least one motor 450 which is driven by the back-up aiming electronics 460 via motor control signals 435.

List of reference symbols

100	vehicle
105	artillery device
110	artillery unit/turret
115	back-up aiming drive unit
120	back-up aiming control unit
125	detection device
130	weapon
135	manual back-up aiming control unit
200	method
205	providing an activation signal
210	reading the setpoint signal
215	outputting
305	providing unit
310	reading unit
315	output unit
320	activation signal
325	back-up aiming activation unit
330	setpoint signal
335	alignment signal
340	release signal
400	back-up aiming system
401	fire control computer
402	main aiming system
403	control signal
404	back-up aiming control device
415	setpoint signal
430	change signal
435	control signal
445	turret
450	back-up aiming motors

455 failure signal

460 back-up aiming electronics

Patentkrav

1. Fremgangsmåte (200) for å betjene et reservesiktesystem (400) for en artillerianordning (105) som har minst én reservesiktedrivenhet (115) og en artillerienhet (110) for et kjøretøy (100) koblet til reservesiktedrivenheten (115), reservesiktesystemet (400) betjenes minst i tilfelle feil i et hovedsiktesystem (402) av artillerianordningen (105), **karakterisert ved at** fremgangsmåten (200) omfatter trinnene:

- å tilveiebringe (205) et aktiveringssignal (320) til et grensesnitt til en reservesikteelektronikkenhet (325), hvori aktiveringssignalet (320) konfigureres til å aktivere reservesiktesystemet (400), hvori aktiveringssignalet (320) tilveiebringes som respons på et feilsignal (455) som representerer feilen til hovedsiktesystemet (402);

- å lese (210) et settpunktsignal (330) via et grensesnitt til en brannkontrolldatamaskin (401) for å generere et innrettingssignal (335) fra settpunktsignalet (330), idet innrettingssignalet (335) tilveiebringer den minst ene reservesiktedrivenheten (115) med en settpunkthastighet og/eller et settpunktmoment i forhold til en endring av artillerianordningen (105); og

- å mate ut (215) minst ett innrettingssignal (335) for innretting av den minst ene reservesiktedrivenheten (115) etter trinnet (210) med lesing for å innrette artillerienheten (110) med settpunkthastigheten og/eller settpunktmomentet representert av innrettingssignalet (335) minst under feilen i hovedinnrettingssystemet (402).

2. Fremgangsmåten (200) ifølge krav 1, med et trinn (220) med å lese et endringssignal (430) før trinnet (225) med utmating, hvori endringssignalet (430) representerer en endring av sikteposisjonen til en bruker, hvori endringssignalet representerer en endring av settpunktsignalet av brukeren, og hvori i trinnet (225) med utmating, mates endringssignalet (430) ut til artillerienheten (110) for å innrette artillerienheten (110) med sikteposisjonen endret av endringssignalet (430) minst under feilen i hovedsiktesystemet (402), spesielt hvori innretting av artillerienheten (110) med settpunkthastigheten og/eller settpunktmomentet representert av innrettingssignalet (335) undertrykkes hvis en endring av sikteposisjonen beregnet av en bruker er blitt detektert.

3. Fremgangsmåte (200) ifølge et hvilket som helst av de foregående kravene, hvori den minst ene reservesiktedrivenheten (115) kobles elektrisk til et forsyningsnettverk i trinnet (205) med å tilveiebringe aktiveringssignalet (320) som respons på å aktivere reservesiktesystemet (400).

4. Fremgangsmåte (200) ifølge et hvilket som helst av de foregående kravene, med et trinn (225) for å tilveiebringe et frigjøringssignal (340) for å avfyre artillerienheten etter trinnet (215) med utmating.

5. Fremgangsmåte (200) ifølge krav 4, hvori trinnet (225) med å tilveiebringe frigjøringssignalet (340) utføres når kjøretøyet (100) står stille.

6. Reservesiktekontrollenhet (120), konfigurert til å utføre og/eller kontrollere trinnene i fremgangsmåten ifølge et hvilket som helst av kravene 1 til 5 i en tilveiebringende enhet (305), en leseenhet (310) eller en utmatingsenhet (315).

7. Datamaskinprogram konfigurert til å utføre og/eller kontrollere trinnene i fremgangsmåten ifølge et hvilket som helst av kravene 1 til 5 med en reservesiktekontrollenhet (120) ifølge krav 6.

8. Maskinlesbart lagringsmedium, på hvilket datamaskinprogrammet ifølge krav 7 er lagret.

9. Artillerianordning (105) for et kjøretøy (100), artillerianordningen (105) har egenskapene:

- en artillerienhet (110);
- minst én reservesiktedrivenhet (115) koblet til artillerienheten (110); og
- en reservesiktekontrollenhet (120) ifølge krav 6 for å kontrollere reservesiktedrivenheten (115) og artillerienheten (110).

10. Kjøretøy (100) med en artillerianordning (105) ifølge krav 9.

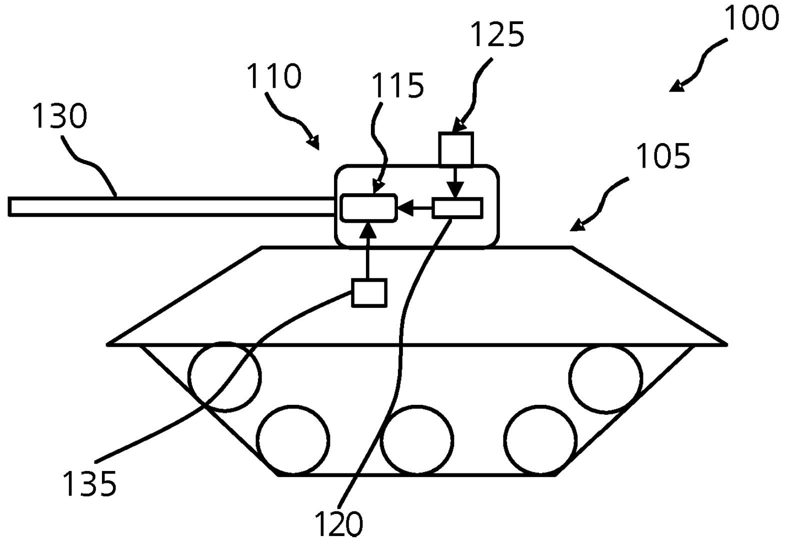


FIG 1

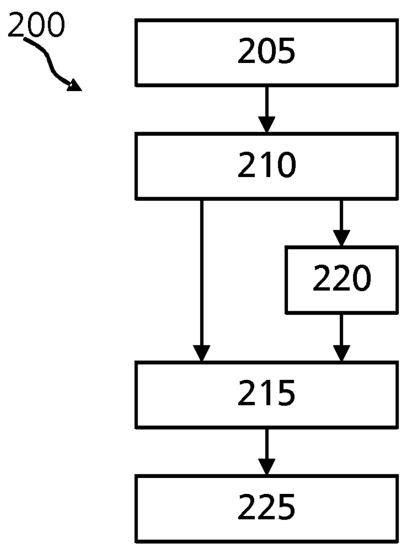


FIG 2

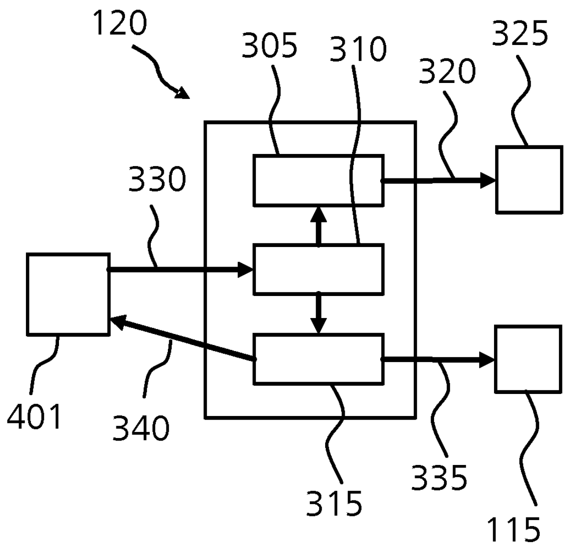
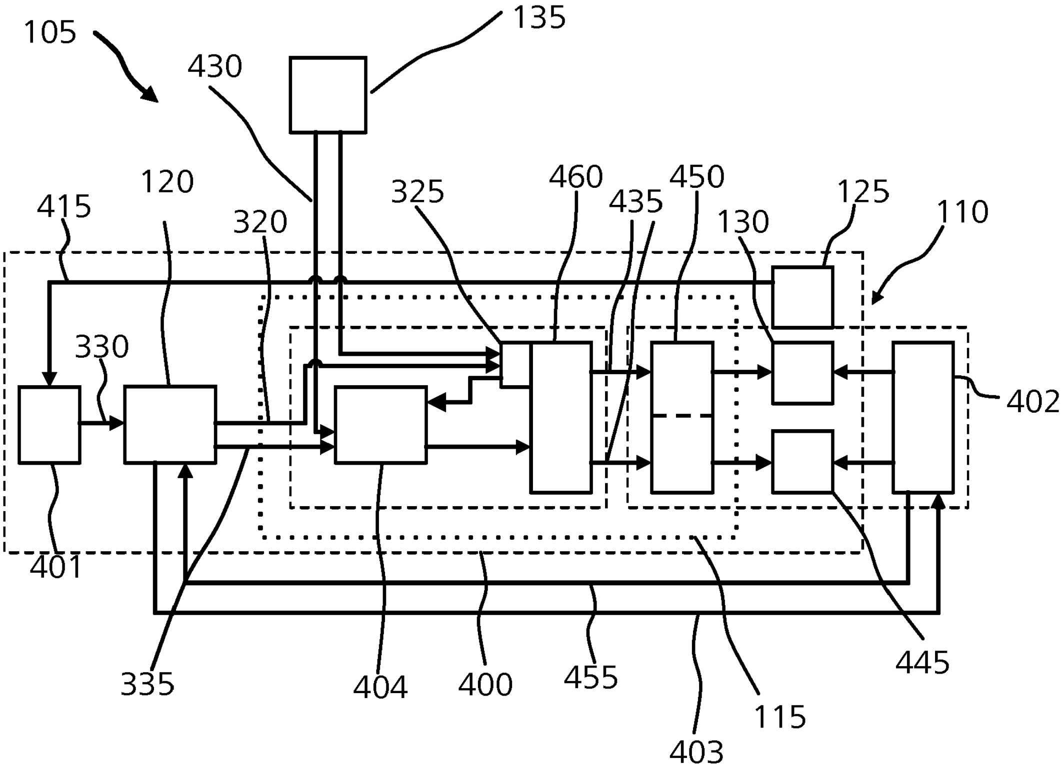


FIG 3


105
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115
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FIG 4