



(86) Date de dépôt PCT/PCT Filing Date: 2010/12/21  
(87) Date publication PCT/PCT Publication Date: 2011/07/21  
(45) Date de délivrance/Issue Date: 2015/02/17  
(85) Entrée phase nationale/National Entry: 2011/12/09  
(86) N° demande PCT/PCT Application No.: AU 2010/001728  
(87) N° publication PCT/PCT Publication No.: 2011/085430  
(30) Priorité/Priority: 2010/01/15 (AU2010900171)

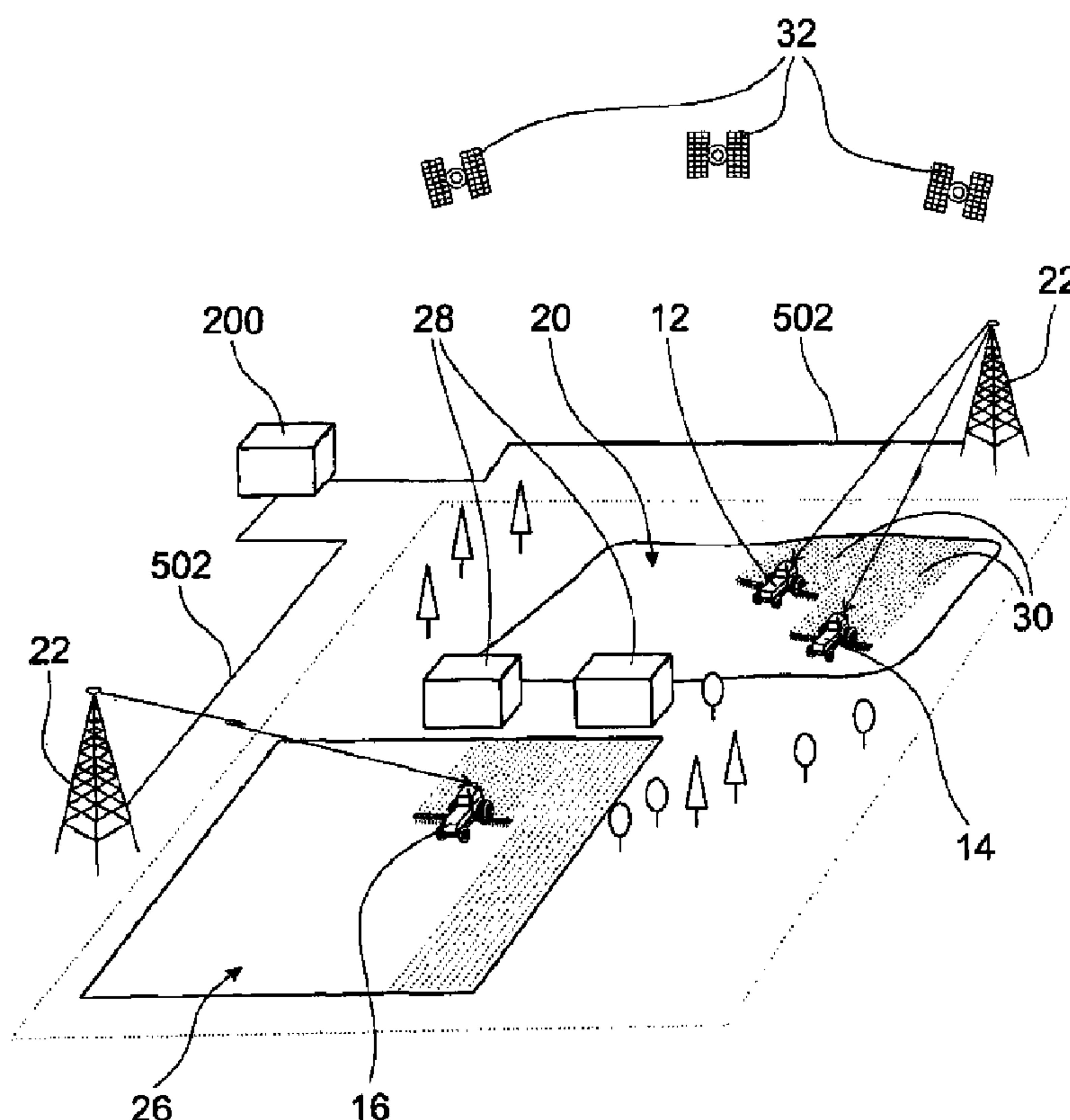
(51) Cl.Int./Int.Cl. *G05D 1/00* (2006.01),  
*G01C 21/00* (2006.01), *G08G 1/16* (2006.01),  
*H04W 4/04* (2009.01)

(72) Inventeurs/Inventors:  
ROBERTS, PETER JAMES, AU;  
BAILEY, PETER ANDREW, AU

(73) Propriétaire/Owner:  
LEICA GEOSYSTEMS AG, CH

(74) Agent: BORDEN LADNER GERVAIS LLP

(54) Titre : SYSTEME ET PROCEDE DE PARTAGE DE DONNEES ENTRE DES VEHICULES AGRICOLES ITINERANTS  
(54) Title: A SYSTEM AND METHOD OF DATA SHARING BETWEEN ROVING AGRICULTURAL VEHICLES



(57) Abrégé/Abstract:

Agricultural vehicles are guided to prevent overlap of areas operated on by the vehicles. Guidance data is shared between agricultural vehicles by coverage data of area covered by a first agricultural vehicle being wirelessly transmitted to a central server. Download guidance data is generated at the central server using the coverage data received at the central server. The download guidance data is wirelessly transmitted from the server to a second guidance device of a second agricultural vehicle. The second agricultural vehicle uses the download guidance data to not overlap with area covered by the first agricultural vehicle while operating.



## (12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau(43) International Publication Date  
21 July 2011 (21.07.2011)(10) International Publication Number  
**WO 2011/085430 A1**

## (51) International Patent Classification:

*G05D 1/00* (2006.01)      *G01C 21/00* (2006.01)  
*G08G 1/16* (2006.01)      *H04W 4/04* (2009.01)

## (21) International Application Number:

PCT/AU2010/001728

## (22) International Filing Date:

21 December 2010 (21.12.2010)

## (25) Filing Language:

English

## (26) Publication Language:

English

## (30) Priority Data:

2010900171      15 January 2010 (15.01.2010)      AU

(71) Applicant (for all designated States except US): **LEICA GEOSYSTEMS AG** [CH/CH]; Heinrich-Wild-Strasse, CH-9435 Heerbrugg (CH).

## (72) Inventors; and

(75) Inventors/Applicants (for US only): **ROBERTS, Peter James** [AU/AU]; 36 Diana Street, Springfield Lakes, Queensland 4300 (AU). **BAILEY, Peter Andrew** [AU/AU]; 27 Buckingham Road, Swan View, Western Australia 6056 (AU).(74) Agent: **FISHER ADAMS KELLY**; Level 29, 12 Creek Street, Brisbane, Queensland 4000 (AU).

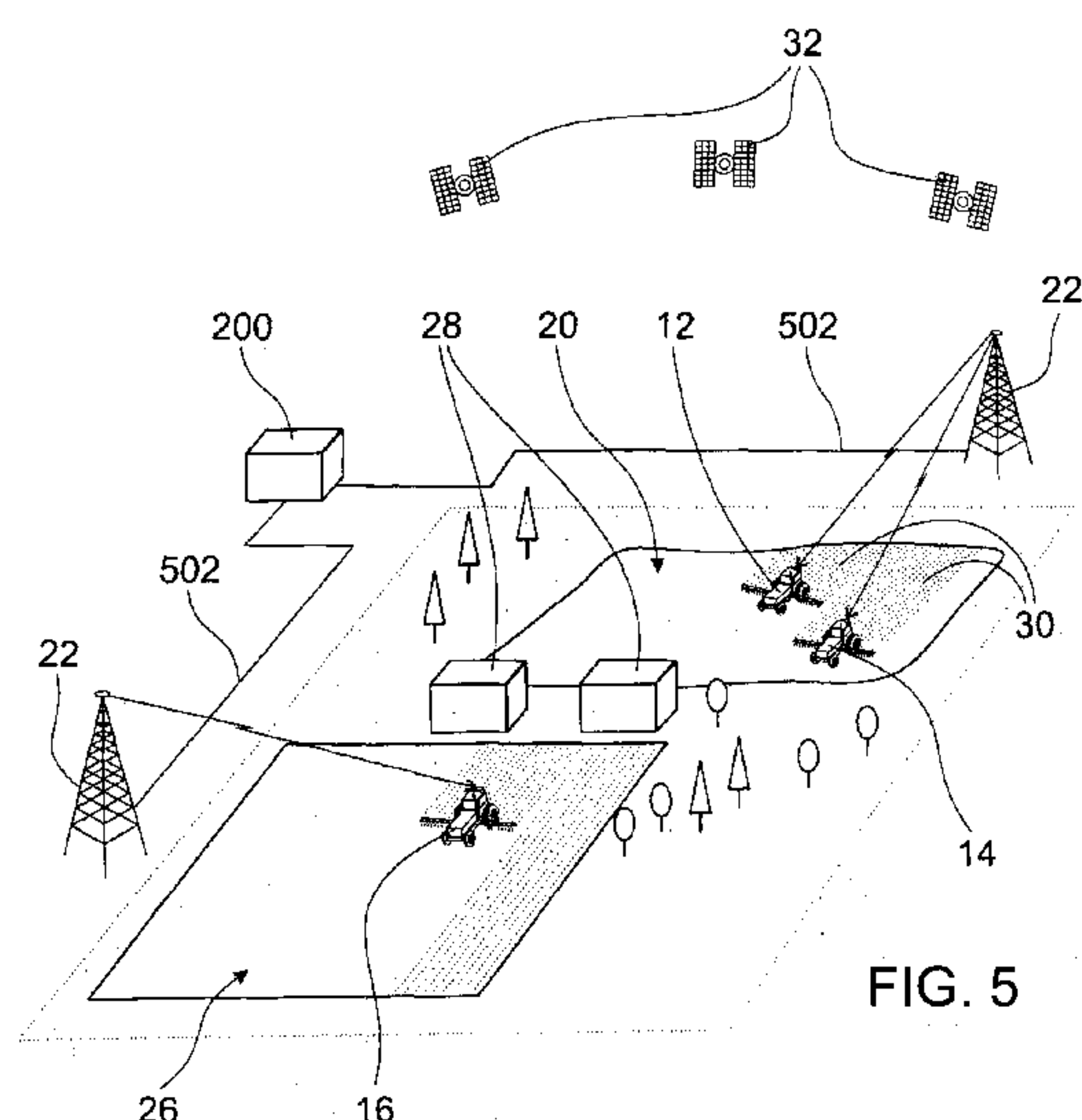
(81) Designated States (unless otherwise indicated, for every kind of national protection available): AE, AG, AL, AM, AO, AT, AU, AZ, BA, BB, BG, BH, BR, BW, BY, BZ, CA, CH, CL, CN, CO, CR, CU, CZ, DE, DK, DM, DO, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, GT, HN, HR, HU, ID, IL, IN, IS, JP, KE, KG, KM, KN, KP, KR, KZ, LA, LC, LK, LR, LS, LT, LU, LY, MA, MD, ME, MG, MK, MN, MW, MX, MY, MZ, NA, NG, NI, NO, NZ, OM, PE, PG, PH, PL, PT, RO, RS, RU, SC, SD, SE, SG, SK, SL, SM, ST, SV, SY, TH, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, ZA, ZM, ZW.

(84) Designated States (unless otherwise indicated, for every kind of regional protection available): ARIPO (BW, GH, GM, KE, LR, LS, MW, MZ, NA, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AL, AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HR, HU, IE, IS, IT, LT, LU, LV, MC, MK, MT, NL, NO, PL, PT, RO, RS, SE, SI, SK, SM, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

## Published:

— with international search report (Art. 21(3))

(54) Title: A SYSTEM AND METHOD OF DATA SHARING



(57) Abstract: Agricultural vehicles are guided to prevent overlap of areas operated on by the vehicles. Guidance data is shared between agricultural vehicles by coverage data of area covered by a first agricultural vehicle being wirelessly transmitted to a central server. Download guidance data is generated at the central server using the coverage data received at the central server. The download guidance data is wirelessly transmitted from the server to a second guidance device of a second agricultural vehicle. The second agricultural vehicle uses the download guidance data to not overlap with area covered by the first agricultural vehicle while operating.

TITLE

A SYSTEM AND METHOD OF DATA SHARING BETWEEN ROVING  
AGRICULTURAL VEHICLES

FIELD OF THE INVENTION

[0001] The present invention relates to a data sharing system and a method of data sharing. In particular, although not exclusively, the present invention relates to a system and method of data sharing between guidance devices mounted to roving agricultural vehicles.

BACKGROUND TO THE INVENTION

[0002] Off-road vehicles typically utilised in, for example, agricultural, construction, mining and forestry applications, such as tractors, harvesters, diggers, graders, dump trucks and other powered vehicles, commonly include electronic equipment designed to assist an operator in guiding the vehicle along a particular path.

[0003] In particular, agricultural vehicles, such as tractors, harvesters and the like, often include a guidance device that includes a Global Navigation Satellite System (GNSS) unit and display to guide the vehicle along a predetermined path using positional data provided by the GNSS constellation of satellites as an aide.

[0004] Moreover, it is known to use guidance devices that include GNSS units on agricultural vehicles such that a course may be stored within the guidance device and the guidance device operates the vehicle in a semi-autonomous manner. Alternatively, the guidance device provides direction to an operator of the agricultural vehicle to enable the operator to maintain a predetermined fixed path when, for example, harvesting crops or spraying a paddock utilising the vehicle.

[0005] These guidance devices may further be operable to automatically control equipment such as sprayers or seeders to not spray or seed on predefined exclusion zones, or zones where the vehicle overlaps its previous path.

[0006] It is often desirable to have more than one vehicle operate in the same paddock, or have different vehicles operate in the same paddock at different times.

### SUMMARY OF THE INVENTION

[0007] In one form, although it need not be the broadest form, the invention resides in a system for data sharing between guidance devices mounted to roving agricultural vehicles, the system comprising:

- a central server having:

- a communications module for receiving upload guidance data and for transmitting download guidance data; and

- a database for storing the upload guidance data;

- a first guidance device of a first agricultural vehicle, the first guidance device having a communication module for wireless transmission of upload guidance data to the central server, the first guidance data including coverage data of area covered by the first agricultural vehicle while operating; and

- a second guidance device of a second agricultural vehicle, the second guidance device having a communication module for wireless receipt of download guidance data from the central server;

- wherein the central server is configured so that at least part of the

download guidance data transmitted to the second guidance device comprises data generated by the server using at least part of the upload guidance data received from the first guidance device stored in the database of the central server.

[0008] Preferably, the communications modules of the first and second guidance devices may be configured to both transmit upload guidance data and receive download guidance data.

[0009] Preferably, the communication module of each of the guidance devices includes a wireless modem. In particular, the wireless modem may be a cellular modem.

[0010] Preferably, the first and second guidance devices each include a positioning module. The positioning modules are configured to track the position of a particular guidance device to generate position data used in generating the coverage data. The positioning module is preferably in the form of a GNSS unit.

[0011] Preferably, the first and second guidance devices each include a mapping and display module for recording coverage data of area covered by the vehicle while operating.

[0012] In another form, the invention resides in the central server which provides data sharing between guidance devices mounted to roving agricultural vehicles, the central server having:

a communications module connected to a wireless communications network for receiving upload guidance data from a first guidance device of a first agricultural vehicle and for transmitting download guidance data to a second guidance device of a second agricultural vehicle via the wireless communications

network;

a database for storing the upload guidance data; and

wherein the central server is configured so that at least part of the download guidance data transmitted to the second guidance device comprises data generated by the central server using at least part of the upload guidance data received from the first guidance device stored in the database of the central server.

[0013] In still another form, the invention resides in guidance device mountable to an agricultural vehicle, the guidance device including:

a positioning module, the positioning module configured to track the position of the agricultural vehicle;

a vehicle modeling unit operable to model the footprint of the agricultural vehicle while operating;

a mapping and display module, the mapping and display module operable to record coverage data of area covered by the agricultural vehicle while operating, and to store the coverage data of other agricultural vehicles;

a communication module adapted for wireless transmission of upload guidance data, including coverage data of area covered by the agricultural vehicle while operating, to a central server remote from the agricultural vehicle, the communication module adapted to receive download guidance data, including the coverage data of the other agricultural vehicles, from the central server.

**[0014]** In accordance with yet another form, the invention resides in a method of sharing guidance data between roving agricultural vehicles, the method including:

wirelessly transmitting upload guidance data from a first guidance device of first agricultural vehicle to a central server, the upload guidance data including coverage data of area covered by a first agricultural vehicle while operating;

receiving the upload guidance data at the central server;

generating download guidance data at the central server using at least part of the upload guidance data received from the first guidance device;

wirelessly transmitting the download guidance data from the server to a second guidance device of a second agricultural vehicle; and

wirelessly receiving the download guidance data at the second guidance device.

**[0015]** The invention extends to a method of guiding agricultural vehicles to prevent overlap of areas operated on by the roving agricultural vehicles, the method including:

sharing guidance data between roving agricultural vehicles as defined and described hereinabove; and

guiding the second agricultural vehicle using the download guidance data to not overlap while operating with area covered by the first agricultural vehicle while operating. Guiding the second agricultural vehicle includes controlling working equipment of the agricultural vehicle to not operate over area already

covered by first agricultural vehicle when the working equipment travels over the area already covered by the first agricultural vehicle.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0016] By way of example only, preferred embodiments of the invention will be described more fully hereinafter with reference to the accompanying drawings, wherein:

[0017] FIG 1 shows a schematic diagram of a system of data sharing according to an embodiment of the invention;

[0018] FIG 2 shows a schematic diagram of a guidance device of the system of FIG 1;

[0019] FIG 3 shows a schematic flow diagram of a method of data sharing according to further embodiments of the invention;

[0020] FIG 4 shows a schematic top plan view of agricultural vehicles using the system of data sharing of FIG 1; and

[0021] FIG 5 shows a schematic top plan view of another example, of agricultural vehicles using the system of data sharing of FIG 1.

### DETAILED DESCRIPTION OF THE INVENTION

[0022] The invention will be described in the context of data sharing between guidance devices mounted in roving agricultural vehicles via a remote server. Data is shared between the guidance devices to prevent unnecessary overlap between areas in a paddock operated on by each vehicle. A skilled person will appreciate that the method and system of the invention may be similarly applied

to data sharing of guidance devices mounted in non-agricultural vehicles.

[0023] FIG 1 shows a schematic view of a system 10 of data sharing according to an embodiment of the invention. The system 10 includes a first guidance device 100, a second guidance device 102, a third guidance device 104, a central server 200, a personal computer 300, a wireless communications network 400 and a fixed line telecommunications network 500. It must be appreciated that although only three guidance devices 100, 102, 104 are described and shown in FIG 1, the system 10 may include more guidance devices.

[0024] Wireless communications network 400 is preferably a cellular network which may be any of a GSM (Global System for Mobile Communications), GPRS (General Packet Radio Service), CDMA (Code Division Multiple Access), or EDGE (Enhanced Data for Global Evolution) network or the like. A skilled person will appreciate that network 400 may be in the form of any wireless communications network.

[0025] Fixed line telecommunications network 500 is preferably in the form of the internet. A skilled person will appreciate that network 500 may be in the form of any telecommunications network including any LAN (Local Area Network), or WAN (Wide Area Network).

[0026] Each guidance device 100, 102, 104 is mounted to a respective vehicle, such as a tractor or the like.

[0027] The guidance devices 100, 102 and 104 are the same and are described with reference to FIG. 2. The guidance devices 100, 102 and 104 comprise a processor 120 for controlling the components, discussed below, of the guidance devices 100, 102, 104. The processor 120 has a guidance device

identifier stored therein to uniquely identify each guidance device 100, 102, 104. Guidance devices 100, 102, 104 further comprise a positioning module 130 coupled to the processor 120. The positioning module 130 is preferably in the form of a GNSS unit such as Global Positioning System unit (GPS unit) or other known positioning units able to obtain positioning data.

[0028] Guidance devices 100, 102, 104 further comprise a mapping and display module 140 operatively coupled to the processor 120 and the positioning module 130. The mapping and display module 140 provides a user of the guidance devices 100, 102, 104 with positional data received from the positioning module 130, real time mapping of where a vehicle has operated, and records coverage data of where the vehicle has operated. The coverage data is generated from the positional data the mapping and display module 140 receives from the positioning module 130.

[0029] Each guidance device 100, 102, 104 of the system 10 also comprises a communication module 110 coupled to processor 120 and able to communicate with the central server 200 via networks 400 and 500. Suitably, communication module 110 is in the form of a cellular network module having a cellular modem able to communicate with wireless communications network 400 utilizing GSM, GPRS, CDMA, or EDGE communication systems or the like.

[0030] The communication module 110 preferably includes a unique identifier in the form of a network address to uniquely identify the communication module 110 of each guidance device 100, 102, 104 when communication module 110 is in communication with wireless communications network 400. Preferably, the network address may be in the form of a subscriber identity module (SIM) card or

may be an IP address assigned to the communication module 110 when the communication module 110 initiates wireless communication with network 400. Each guidance device 100, 102, 104 can be uniquely identified at the sever 200 by its network address.

[0031] The modules 110, 130, 140 of the guidance devices 100, 102, 104 may be separate units or may be integrated into single guidance device unit. Where the modules 110, 130, 140 are separate units from each other they are operatively linked by data cables.

[0032] Referring back to FIG 1, the central server 200 comprises a database 202, a processor 204 and a communications module 206. The central server 200 is configured to receive data from the guidance devices 100, 102, 104 and transmit data to the guidance devices 100, 102, 104.

[0033] Referring to both FIG's 1 and 2, the system 10 provides for guidance data to be shared between the guidance devices 100, 102 and 104 as described hereinbelow.

[0034] The first guidance device 100 is operable to transmit upload guidance data to the central server 200 via the wireless communications network 400. The first guidance device 100 is mounted in a first vehicle. It will be appreciated by those skilled in the art that the first guidance device may be part of the electronic equipment of the first vehicle. The upload guidance data comprises at least coverage data of area covered by the first vehicle while operating. The coverage data is data recorded by the mapping and display module 140 of area covered by the first vehicle. The first vehicle is typically harvesting crops, planting or spraying a paddock. The mapping and display module 140 is configured to

determine the footprint of the vehicle as it travels along guidance paths by taking into account the width of a boom of the vehicle or other working implement of the vehicle. As such, the guidance devices 100, 102, 104 include a vehicle modeling unit 150 which models the vehicle to allow accurate footprint calculation by the mapping and display module 140. The coverage data describes the area harvested, planted, sprayed, treated or alike by the vehicle in a specific paddock.

[0035] The upload guidance data may further include path parameters, geographical position data of the first guidance device 100, and other informational data such as data on fuel levels or product levels of the first vehicle. In certain instances the upload guidance data may comprise the informational data only and temporarily not include coverage data.

[0036] More than one vehicle may operate in the same paddock, or different vehicles may operate in the same paddock at different times. It is important that area covered by one vehicle is not overlapped by another vehicle. It is thus necessary for the coverage data of the first vehicle to be shared in real or near real time with other vehicles which may operate in the same paddock. The coverage data of one vehicle serves as guidance to another vehicle operating in the same paddock.

[0037] The upload guidance data from the first guidance device 100 is stored in the database 202 of the central server 200. The upload guidance data is processed by the processor 204 to generate download guidance data to be downloaded to the second and third guidance devices 102, 104. The download guidance data is generated using at least part of the upload guidance data from the first guidance device 100. The second and third guidance devices 102, 104

thus receive download guidance data of where the first vehicle has operated. The download guidance data is utilized by the mapping and display modules 140 of second and third guidance devices 102, 104 to guide respective second and third vehicles to not overlap with area in the paddock already covered by the first vehicle.

[0038] Although only the transmission of upload data from the first guidance device 100 is described, it must be appreciated that all of the guidance devices 100, 102, 104 may transmit upload guidance data to the central server 200 and the central server 200 may generate download guidance data for all the guidance devices 100, 102, 104. For example, download guidance data for the first guidance device 100 will be generated using upload guidance data from both the second guidance device 102 and the third guidance device 104. Similarly, download guidance data for the second guidance device 102 will be generated using upload guidance data from both the first guidance device 100 and the third guidance device 104.

[0039] The personal computer 300 is connected to the central server 200 via the fixed line telecommunications network 500. The computer 300 may also be connected to the fixed line telecommunications network 500 via the wireless communications network 400, as are the guidance devices 100, 102, 104. The personal computer 300 is operable to interface with the central server 200 to view and manage guidance of the vehicles in which the guidance devices 100, 102, 104 are mounted. The personal computer 300 can access the upload guidance data stored in the database 202 of the central server 200. The server 200 may be operable to store a digital site map updated by the upload guidance data from

the guidance devices 100, 102, 104. The site map is stored in the database 202 of the central server 200. The central server 200 is adapted to update the digital site map with coverage data received from the guidance devices 100, 102, 104. The digital site map is accessible by the personal computer over the telecommunications network. The position data of the respective guidance devices 100, 102, 104 (and hence the position of the agricultural vehicles) are recorded in the digital site model so as to be viewable via the personal computer 300.

[0040] The personal computer 300 is able to send instructions to the guidance devices 100, 102, 104 via the download guidance data from the central server 200. These instructions may include changes to maps and exclusion zones for the paddocks the vehicles will be operating in. The instructions may further be as basic as messages to be displayed to an operator via the mapping and display module 140.

[0041] FIG 3 shows a method 1000 of data sharing according to a further embodiment of the invention. The method starts at step 1002 with the first guidance device 100 recording coverage data of area covered by the first vehicle while operating. Recording the coverage data includes calculating the coverage data using the footprint of the first vehicle and the change in position data of the first vehicle.

[0042] The coverage data is then transmitted to the central server 200 via the wireless communications network 400 as upload guidance data, as indicated by step 1004.

[0043] The central server 200 receives the coverage data transmitted by the

first guidance device at step 1006.

[0044] The coverage data received at the server is stored in the database 202 of the server as indicated by step 1008.

[0045] A digital site model of the paddock or field in which the first vehicle operates is updated in the database 202 by the coverage data at step 1010.

[0046] At step 1012 the central server 200 generates download guidance data from the upload guidance data received. The download guidance data includes coverage data of the area on which the first vehicle has operated.

[0047] The download guidance data is wirelessly transmitted to the second and third guidance devices 102, 104 via the wireless communications network 400 as indicated by step 1014.

[0048] The second and third guidance devices receive the download guidance data at step 1016.

[0049] At step 1018 the second and third guidance devices 102, 104 use the download guidance data to guide the vehicles to prevent unnecessary overlap. Specifically, the mapping and display module 140 utilizes the download guidance data to guide respective vehicles to not overlap with area in the paddock already covered by the first vehicle.

[0050] The guidance devices 102, 104 display the download guidance data received by the guidance devices 102, 104 to provide an visual indication for avoiding overlap of treated areas.

[0051] Area already covered by a vehicle is the area on which the vehicle has operated by spraying, harvesting, seeding or the like the area, and is not merely area where the vehicle has travelled. The mapping and display module 140 is

operable to record the area covered and may be linked to switches or sensors of the vehicle to automatically determine whether the vehicle is merely travelling or is also operating by spraying, harvesting, seeding or the like. Alternatively, an operator manually enters when operation described above starts and stops.

[0052] The guidance devices 100, 102, 104 may further be operable to automatically control equipment such as sprayers or seeders to not spray or seed on predefined exclusion zones, or zones where the vehicle overlaps previously treated area. The guidance devices 100, 102, 104 are operatively connected to the working implements of the vehicles to actuate operation of the working implement or to cease operation of the working implement. This may, for example, be actuation of nozzles of a spray boom to either have the spray boom spray product or not. The guidance devices are thus operable to actuate the working implements to not operate on area previously operated on by another vehicle. This prevents, or at least minimizes, the spraying of the same product by two different vehicles on the same area.

[0053] FIG 4 shows a first vehicle 12 and a second vehicle 14 operating in a paddock 20. The vehicles 12, 14 have spray booms 18. The first vehicle 12 has the first guidance device 100 mounted therein and the second vehicle 14 has the second guidance device 102 mounted therein. The wireless communications network 400 described with reference to FIG 1 includes cellular towers 22 as shown in FIG 4. The guidance devices 100, 102 transmit upload guidance data and receive download guidance data via the cellular tower 22. The first guidance device 100 transmits upload guidance data, including coverage data of area 24 covered by the first vehicle 12 while operating in the paddock 20. The second

guidance device 102 receives download guidance data which includes coverage data recorded by the first guidance device 100. The second guidance device 102 utilizes the download guidance data to guide the second vehicle 14 to not overlap with the area 24 in the paddock 20 already covered by the first vehicle 12. The second guidance device 102 may also use the download guidance data to turn the nozzles of the spray boom 18 on and off, thereby to avoid overlap of treated area, even if the paths of the vehicles 12, 14 cross.

[0054] FIG 5 shows another example of vehicles 12, 14, 16 utilizing the system of data sharing in accordance with the invention. The same reference numerals are used in FIG 5 as used in FIG's 1 to 4 for the same features. FIG 5 shows the first vehicle 12 and second vehicle 14 operating in the paddock 20. A third vehicle 16 operates in another paddock 26. Between the paddocks 20 and 26 are buildings 28. Radio communication between the first vehicle 12 and second vehicle 14 may not be possible because of the buildings 28 blocking any radio signal. The third vehicle 16 may also be such a distance away from the other two vehicles 12, 14 that radio communication is not possible. The vehicles 12, 14, 16 are, however, able to share guidance data using the system 10 described hereinabove. The first vehicle 12 and second vehicle 14 have respective first and second guidance devices 100, 102 to transmit upload guidance data and receive download guidance data via one of the cellular towers 22. The third vehicle 16 has the third guidance device 104 to transmit upload guidance data and receive download guidance data via another the cellular tower 22. If the third vehicle 16 was to join the first vehicle 12 and second vehicle 14 in operating in the paddock 20, its guidance device 104 will already have received the

necessary download guidance data via the server 200 to avoid the third vehicle 16 from overlapping area 30 already operated on by the first vehicle 12 and second vehicle 14. The same applies if either of the first vehicle 12 and second vehicle 14 is moved to operate in the paddock 26.

[0055] The cellular towers 22 are connected to the central server 200 via telecommunications lines 502 of the fixed line telecommunications network 500.

[0056] The guidance devices 100, 102, 104 are thus in real time or near real time data sharing communication with each other, irrespective of the type of terrain or distance between the vehicles in which the guidance devices are mounted. Guidance data is shared between the guidance devices via the central server 200. As long as the guidance devices 100, 102, 104 are in wireless communication with the wireless communication network 400, guidance data is shared in real time or near-real time between the guidance devices 100, 102, 104.

[0057] FIG 5 further shows GNSS satellites 32 from which position determining signals are transmitted to the positioning modules 130 of the respective guidance devices 100, 102, 104.

[0058] Throughout the specification the aim has been to describe the present invention without limiting the invention to any one embodiment or specific collection of features. Persons skilled in the relevant art may realize variations from the specific embodiments that will nonetheless fall within the scope of the present invention.

[0059] In this specification, the terms "comprises", "comprising", "includes", "including" or similar terms are intended to mean a non-exclusive inclusion, such

that a method, system or apparatus that comprises a list of elements does not include those elements solely, but may well include other elements not listed.

**CLAIMS:**

1. A system for data sharing between guidance devices of roving agricultural vehicles, the system comprising:

a central server having:

a communications module for receiving upload guidance data and for transmitting download guidance data; and

a database for storing the upload guidance data;

a first guidance device of a first agricultural vehicle, the first guidance device having a communication module for wireless transmission of upload guidance data to the central server, the upload guidance data including coverage data of area covered by the first agricultural vehicle while operating; and

a second guidance device of a second agricultural vehicle, the second guidance device having a communication module for wireless receipt of download guidance data from the central server;

wherein the central server is configured so that at least part of the download guidance data transmitted to the second guidance device comprises data generated by the server using at least part of the upload guidance data received from the first guidance device stored in the database of the central server; and

wherein the central server is configured to receive instructions, directed to one of the first guidance device or the second guidance device, and transmit the instructions as download guidance data to the one of the first guidance device or the second guidance device.

2. The system of claim 1, wherein the communication module of the first guidance device includes a cellular modem and the communication module of the second guidance device includes a cellular modem.

3. The system of claim 1 or claim 2, wherein the communication module of the first guidance device and the communication module of the second guidance device are each configured to both transmit upload guidance data and receive download guidance data.

4. The system of any one of claims 1 to 3, wherein the download guidance data comprises coverage data of area covered by agricultural vehicles other than the agricultural vehicle to which the download guidance data is transmitted.
5. The system of any one of claims 1 to 4, wherein each of the first guidance device and the second guidance device includes a mapping and display module, the mapping and display module operable to record and display coverage data of area covered by the agricultural vehicle in which the respective guidance device is located and operable to display coverage data of agricultural vehicles other than the agricultural vehicle in which the guidance device is located, the coverage data of agricultural vehicles other than the agricultural vehicle in which the guidance device is located is received by the guidance device as download guidance data.
6. The system of any one of claims 1 to 5, wherein the communication module of the first guidance device and the communication module of the second guidance device each have a unique network address to uniquely identify the respective first guidance device and second guidance device.
7. The system of any one of claims 1 to 6, wherein each of the first guidance device and the second guidance device includes a positioning module, the positioning module configured to track the position of the respective guidance devices to generate position data used in generating the coverage data.
8. The system of claim 7, wherein the positioning module is in the form of a Global Navigation Satellite System unit.
9. The system of claim 7 or claim 8, wherein each of the first guidance device and the second guidance device include a vehicle modeling unit to model the footprint of the agricultural vehicle in which the guidance device is located, the first guidance device and second guidance device operable to calculate coverage data using the footprint of the agricultural vehicle in which the guidance device is located and changing position data of the agricultural vehicle.

10. The system of any one of claims 1 to 9, wherein the central server is configured to be accessible by a personal computer via a network.
11. The system of claim 10, wherein the instructions, directed to one of the first guidance device or the second guidance device, are received from the personal computer.
12. The system of claim 10 or claim 11, wherein the central server is operable to store a digital site map updated by the upload guidance data from the guidance devices and the digital site map is accessible for viewing by the personal computer.
13. The system of claim 12, wherein the upload guidance data includes position data of the first agricultural vehicle and the central server is operable to record the position of the first agricultural vehicle on the digital site map.
14. A central server which provides data sharing between guidance devices located in roving agricultural vehicles, the central server having:
  - a communications module connected to a wireless communications network for receiving upload guidance data from a first guidance device of a first agricultural vehicle and for transmitting download guidance data to a second guidance device of a second agricultural vehicle via the wireless communications network;
  - a database for storing the upload guidance data including coverage data of an area covered by the first agricultural vehicle while operating; and
  - wherein the central server is configured so that at least part of the download guidance data transmitted to the second guidance device comprises data generated by the central server using at least part of the coverage data stored in the database of the central server; and
  - wherein the central server is configured to receive instructions, directed to one of the first guidance device of the second guidance device, and transmit the instructions as download guidance data to the one of the first guidance device or the second guidance device.
15. The central server of claim 14, wherein the central server is configured to be

accessible by a personal computer via a network.

16. The central server of claim 15, wherein the instructions, directed to one of the first guidance device or the second guidance device, are received from the personal computer.

17. The central server of claim 15 or claim 16, wherein the central server is operable to store a digital site map updated by the upload guidance data from the guidance devices and the digital site map is accessible for viewing by the personal computer.

18. The central server of claim 17, wherein the central server is adapted to update the digital site map with coverage data of the upload guidance data received from the guidance devices.

19. A guidance device for an agricultural vehicle, the guidance device including:  
a positioning module, the positioning module configured to track the position of the agricultural vehicle;

a vehicle modeling unit operable to model the footprint of the agricultural vehicle while operating;

a mapping and display module, the mapping and display module operable to record coverage data of area covered by the agricultural vehicle while operating, and to store the coverage data of other agricultural vehicles; and

a communication module adapted for wireless transmission of upload guidance data, including coverage data of area covered by the agricultural vehicle while operating, to a central server remote from the agricultural vehicle, the communication module adapted to receive download guidance data, including the coverage data of the other agricultural vehicles and instructions directed to the guidance device, from the central server.

20. The guidance device of claim 19, wherein the communication module includes a cellular modem for wireless communication with the central server.

21. The guidance device of claim 19 or claim 20, wherein the communication module of

the guidance device has a unique identifier to uniquely identify the guidance device at the central server.

22. The guidance device of any one of claims 19 to 21, wherein the mapping and display module is operable to display coverage data of area covered by the agricultural vehicle in which the guidance device is located and operable to display coverage data of the other agricultural vehicles.

23. The guidance device of any one of claims 19 to 22, wherein the mapping and display module is adapted to guide the agricultural vehicle relative to the area covered by the other agricultural vehicles.

24. The guidance device of claim 23, wherein the mapping and display module is adapted to guide the agricultural vehicle to not overlap with the area covered by the other agricultural vehicles.

25. The guidance device of any one of claims 19 to 24, wherein the guidance device is operable to automatically control working equipment of the agricultural vehicle to not operate over area already covered by the other agricultural vehicles.

26. A method of sharing guidance data between agricultural vehicles, the method including:

- wirelessly transmitting upload guidance data from a first guidance device of a first agricultural vehicle to a central server, the upload guidance data including coverage data of area covered by the first agricultural vehicle while operating;

- receiving the upload guidance data at the central server;

- generating download guidance data at the central server using at least part of the upload guidance data received from the first guidance device and instructions directed to the second guidance device;

- wirelessly transmitting the download guidance data from the server to a second guidance device of a second agricultural vehicle; and

wirelessly receiving the download guidance data at the second guidance device.

27. The method of claim 26, including:

the second guidance device wirelessly transmitting upload guidance data, including coverage data of area covered by the second agricultural vehicle while operating, from the second guidance device to the central server; and

the first guidance device wirelessly receiving download guidance data generated by the central server from at least part of the upload guidance data received at the central server from the second guidance device.

28. The method of claim 26 or claim 27, including indentifying the first guidance device and the second guidance device at the central server by a unique network addresses of each of the first guidance device and the second guidance device.

29. The method of any one of claims 26 to 28, including:

modeling the footprint of the first agricultural vehicle; and

calculating the coverage data of the first agricultural device while operating using changing position data of the first agricultural vehicle and the footprint of the first agricultural vehicle.

30. The method of any one of claims 26 to 29, including storing a digital site map at the central server and updating the digital site map with the upload guidance data.

31. A method of guiding agricultural vehicles to prevent overlap of areas operated on by the agricultural vehicles, the method including:

sharing guidance data between agricultural vehicles as claimed in any one of claims 26 to 30; and

guiding the second agricultural vehicle using the download guidance data to not overlap while operating with area covered by the first agricultural vehicle while operating.

32. The method of guiding agricultural vehicles of claim 31, wherein guiding the second

agricultural vehicle includes controlling working equipment of the agricultural vehicle to not operate over area already covered by first agricultural vehicle when the working equipment travels over the area already covered by the first agricultural vehicle.

33. The method of guiding agricultural vehicles of claim 31 or claim 32, wherein the method includes:

displaying coverage data of area covered by the agricultural vehicle in which the respective guidance device is located on a display; and

displaying coverage data of agricultural vehicles other than the agricultural vehicle in which the guidance device is located on the display.

1 / 5

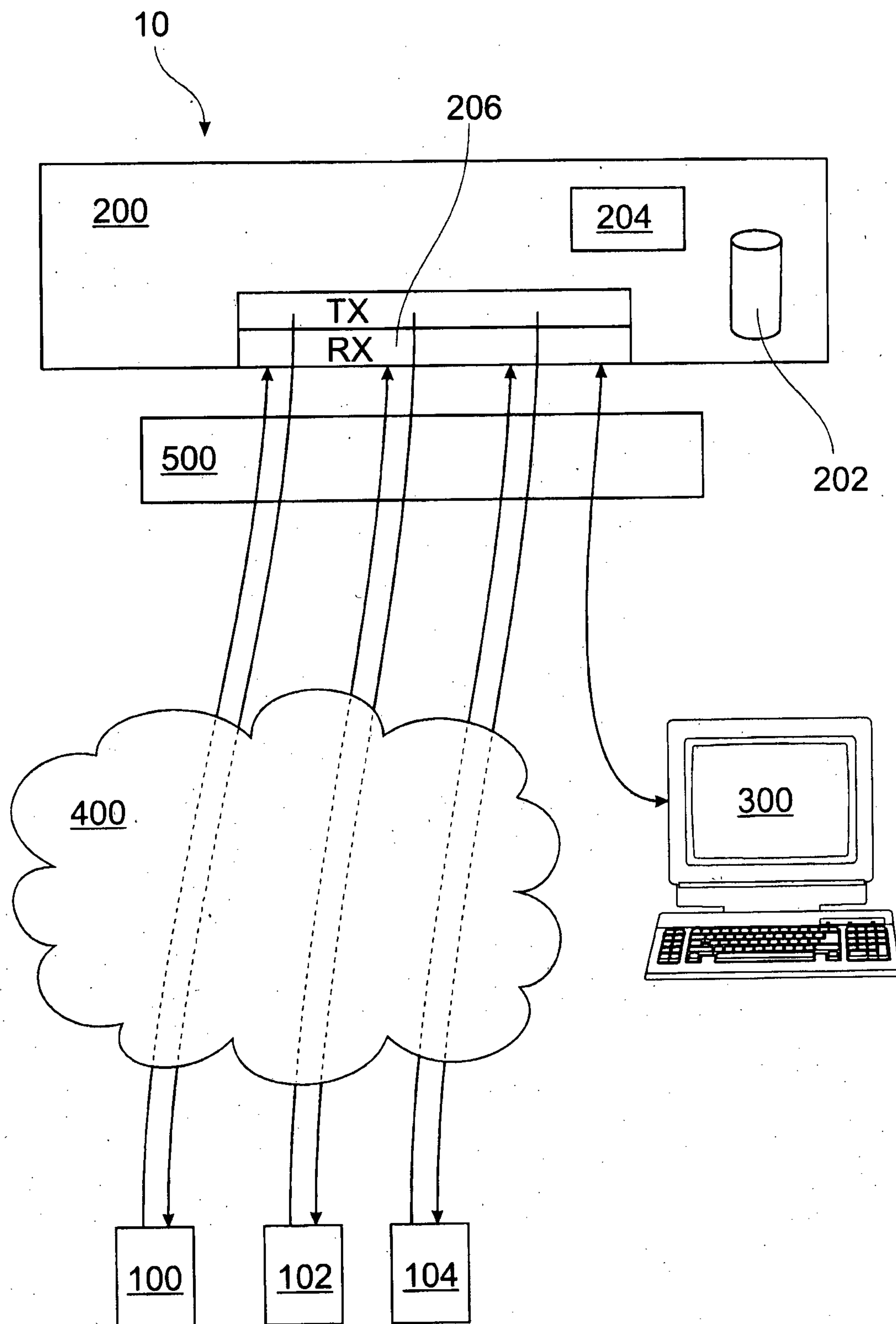


FIG. 1

2 / 5

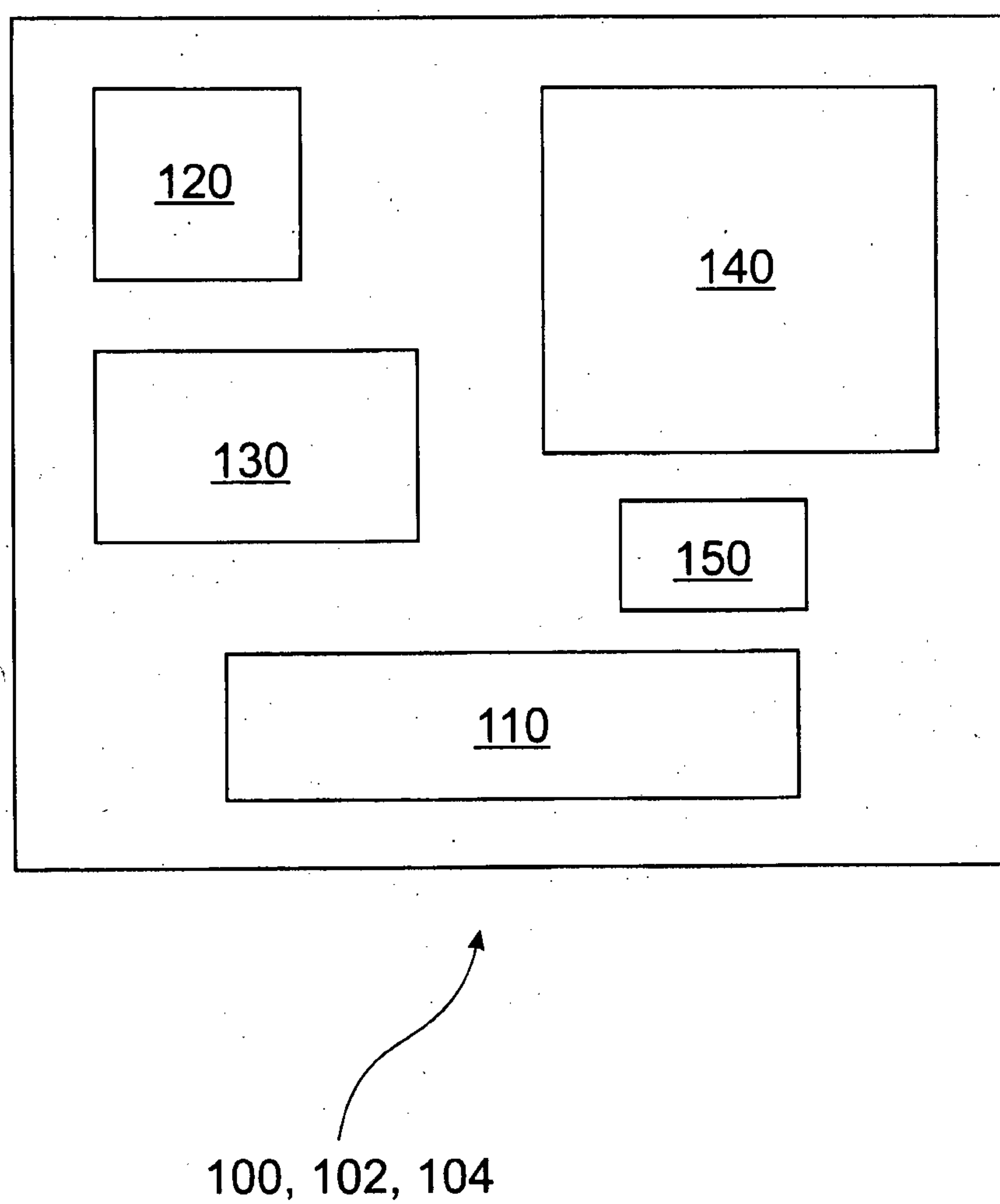


FIG. 2

3 / 5

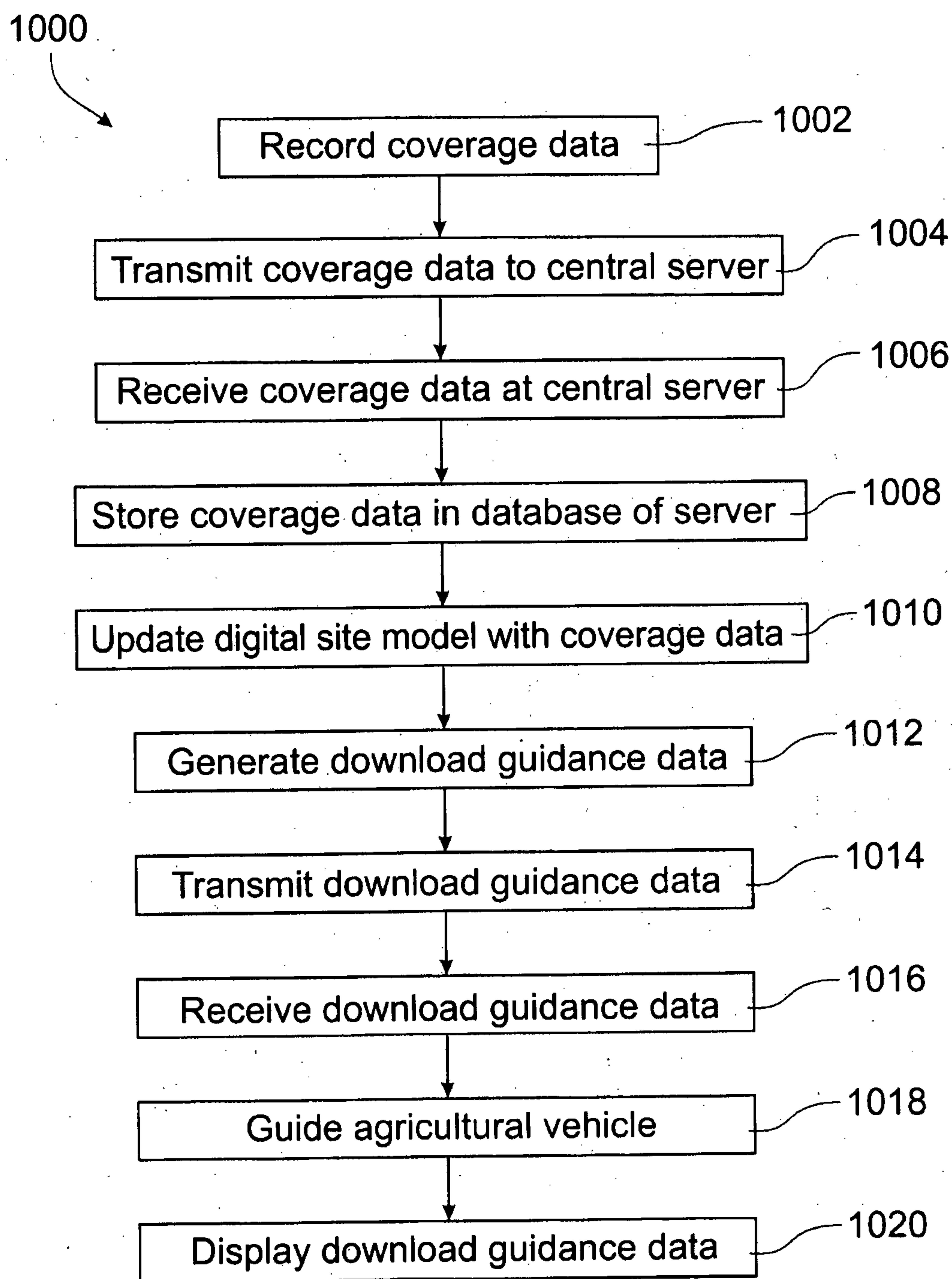


FIG. 3

4 / 5

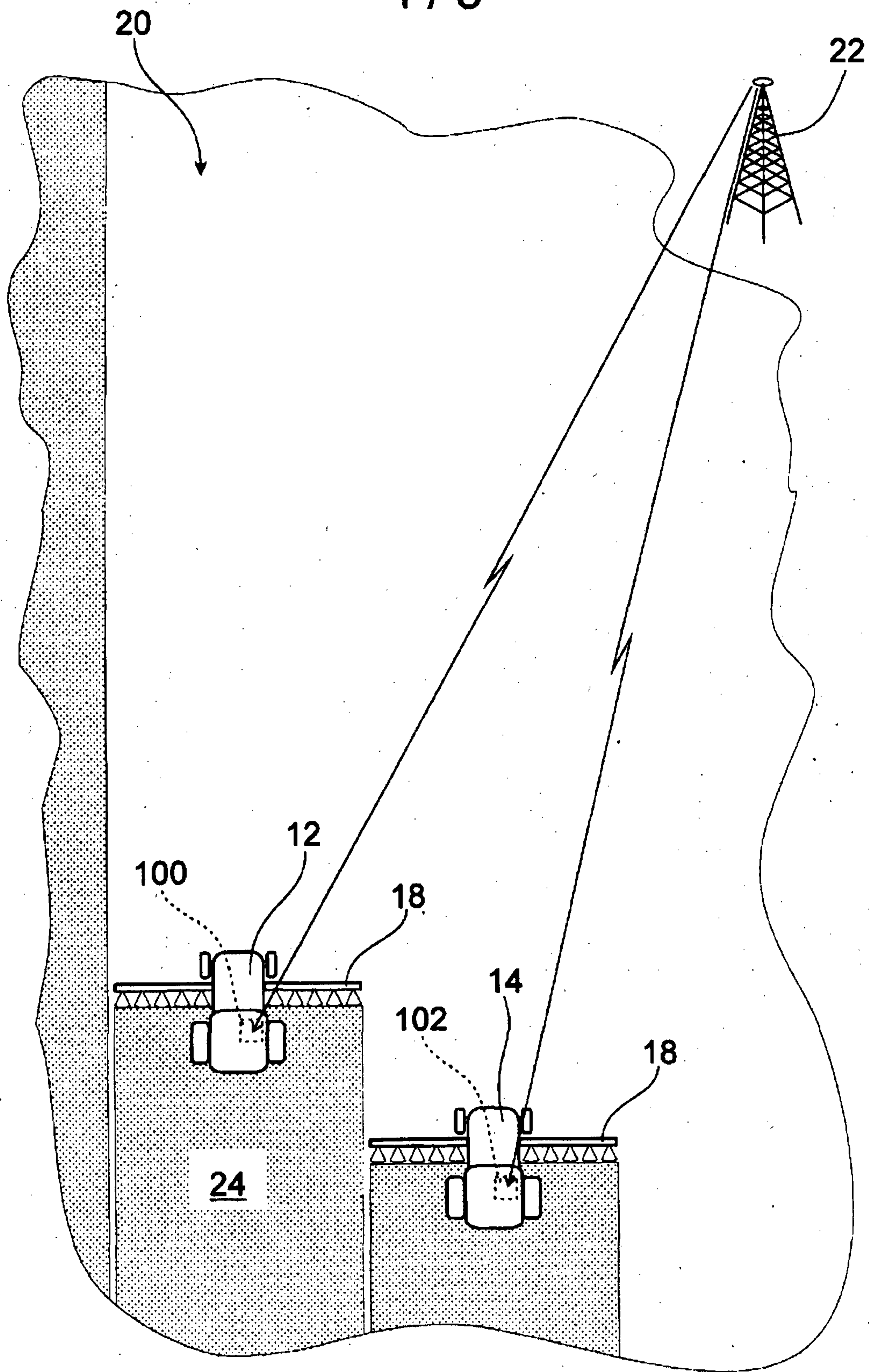


FIG. 4

5 / 5

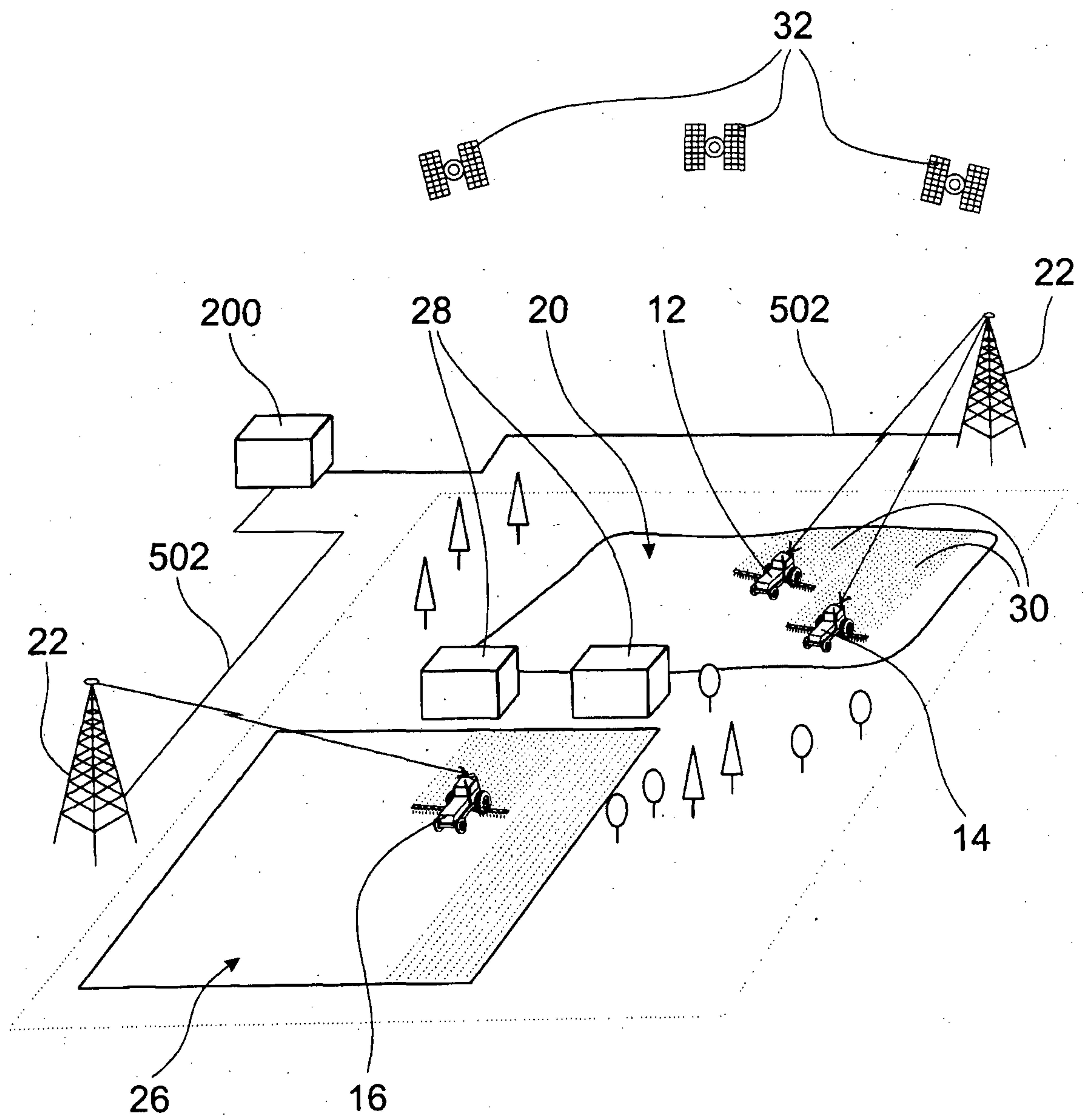


FIG. 5

