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(54) **Method of terrain reconnaissance by means of a mortar bomb**

Verfahren zur Geländeaufklärung mittels Mörserbombe

Procédé de reconnaissance du terrain au moyen d'un obus de mortier

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(56) References cited:  
**US-A- 3 962 537 US-B1- 7 283 156**

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## Description

**[0001]** The subject of the invention is a method of terrain reconnaissance by means of a mortar bomb.

**[0002]** Methods of terrain reconnaissance are known for example from patent specification US 3,962,537. These methods consist in that a mortar bomb, equipped with an observation unit with a camera, a parachute, and a transmitter, is fired toward a terrain subject to a reconnaissance. When the mortar bomb is positioned above such terrain, the observation unit is disconnected from the shell of the mortar bomb in order to monitor the terrain by means of the camera falling down slowly with the parachute, simultaneously transmitting images of the terrain by means of radio, infrared or other radiation, to a receiver installed at a command post, where the received signals are suitably processed, registered or displayed directly on a display unit of a computer. However, the observation unit does not fall down steadily. The vertical fall trajectory is deviated by the wind, which creates crosswise image oscillations. However, the fact that the falling unit rotates is very disadvantageous as the picture seen on the display unit rotates as well. Any attempts to eliminate the rotation of the observation unit would result in an excessive enlargement of the observation unit and the mortar bomb itself. According to patent specification W02004 057263, the observation unit is not separated from the mortar bomb, but the mortar bomb trajectory is mechanically stabilized in such a way that the photographed terrain is always in a view of the camera.

**[0003]** The method of terrain reconnaissance is known, as well, from US 7,283,156 patent specification where in one embodiment, the airborne imaging system of the present invention includes a blister housing attached to a host vehicle. At the appropriate time in flight, a sensor suite is deployed from the blister housing. The sensor suite is eccentrically weighted to induce a pendular motion as it is suspended from a paradevice. To increase the imaging footprint of the system, the paradevice is designed for angular motion and the look down angle of the imaging system can be adjusted from the vertical. The data is broadcast to a receiving station that processes individual frames to create a continuously updated mosaic of the area of interest.

**[0004]** The object of the invention is to create a method eliminating the rotation of the image displayed on the display unit.

**[0005]** The essence of the method consisting in firing a mortar bomb, equipped with an observation unit comprised of a camera, a parachute, and a transmitter, toward a terrain subject to a reconnaissance, where after a specified time the observation unit is separated from the shell of the mortar bomb and monitors the terrain, simultaneously sending a signal from the camera by means of radio, infrared or other radiation to a receiver situated at a command post where signals received from the camera are displayed on a computer display unit after being converted into the digital format, lies in that a de-

viation value of a determined axis of the observation unit from the north-south direction N-S is detected in the observation unit for a single image by means of a magnetometer or a satellite navigation system GPS, said consecutive deviation values being converted into a N-S deviation signal sent synchronically with the signal from the camera to the receiver, in which the position of each consecutive image on the display unit is corrected by its corresponding value of the deviation from the N-S direction by means of a known image rotation algorithm. As a result, an image on the display unit of a computer does not rotate in spite of the rotation of the observatory unit.

**[0006]** An embodiment of this invention is shown in the drawing which depicts a block diagram of an electronic circuit by means of which the method according to the invention is realized.

**[0007]** A shell of a mortar bomb comprises an observation unit provided with a TV camera K, a parachute, a radio transmitter N, a magnetometer M, a disrupting charge L together with its fuse, a supply unit Zn for an observation unit with an inertial power-on switch Wb, with a time-lag cut-out switch Wc for switching off a supply unit Zn, as well as with a controller Sn. The mortar bomb is fired by means of a mortar. Before dropping the mortar bomb into a tube, a delay time is set for the disrupting charge L in the observation unit. The observation unit in the fired mortar bomb is fed with a supply voltage by means of the inertial power-on switch Wb, and after the determined delay time the disrupting charge L is initiated, the parachute is opened, and the observation unit slowly falls down. During the falling stage, the camera K generates a video signal corresponding to the observed terrain being in its view. At the same time, the values of a momentary deviation of the observation unit from the north direction are detected, and information concerning these deviation values is encoded in a sound channel of a TV signal, said signal being transmitted by the radio transmitter N to a command post. After receiving this signal by means of a receiver O at the command post, single images are separated from film frames, and a position of each of the consecutive images on a screen is corrected, by means of a known picture rotation algorithm, by its value of the deviation from the N-S direction. Thus obtained images are simultaneously registered in a memory P for future analysis, if required. Separate frames are converted in a functor F2 of the algorithm into separate appropriately positioned images. When watching an image on the screen, one may also use a functor F1 in order to magnify the image and to change its central point's position in relation to the centre of the screen of a display unit E.

Reference signs

**[0008]**

K - camera  
E - display unit

F1	- functor in the algorithm enlarging an image and moving its central point	
F2	- functor in the algorithm converting frames into images	
L	- disrupting charge with its fuse	5
M	- magnetometer	
N	- transmitter	
O	- receiver	
P	- memory	
Sn	- controller of a receiver	10
So	- controller of a transmitter	
Wb	- inertial power-on switch	
Wc	- time-lag cut-out switch	
Zn	- transmitter supply unit	
Zo	- receiver supply unit	15

stand befindet, wo die von der Kamera (K) empfangenen Signale nach Umsetzung in das digitale Format auf einem Computer-Bildschirmgerät (E) angezeigt werden, **dadurch gekennzeichnet, dass** ein Abweichungswert von einer spezifizierten Achse der Beobachtungseinheit von der Nord-Süd-Richtung N-S in der Beobachtungseinheit für ein einzelnes Bild mithilfe eines Magnetometers (M) oder eines Satelliten-Navigationssystems GPS erkannt werden, wobei die konsekutiven Abweichungswerte in ein N-S-Abweichungssignal umgewandelt werden, das synchron mit dem Signal von der Kamera (K) an den Empfänger (O) gesendet wird, in dem die Position jedes konsekutiven Bilds auf der Bildschirmeneinheit (E) durch ihren entsprechenden Wert der Abweichung von der N-S-Richtung mithilfe eines bekannten Bildrotationsalgorithmus korrigiert werden.

### Claims

1. A method for terrain reconnaissance by means of a mortar bomb, consisting in that the mortar bomb with an observation unit being comprised of a camera (K), a parachute and a transmitter (N) is fired toward a terrain subject to a reconnaissance, where the observation unit, after a specified time, is separated from the shell of the mortar bomb and monitors the terrain simultaneously sending a signal from the camera (K) by radio, infrared or other radiation to a receiver (O) situated at a command post, where signals received from the camera (K) are displayed on a computer display unit (E) after being converted into the digital format, **characterized in that** a deviation value of a specified axis of the observation unit from the north-south direction N-S is detected in the observation unit for a single image by means of a magnetometer (M) or a satellite navigation system GPS, said consecutive deviation values being converted into a N-S deviation signal, sent synchronically with the signal from the camera (K) to the receiver (O), in which the position of each consecutive image on the display unit (E) is corrected by its corresponding value of the deviation from the N-S direction by means of a known image rotation algorithm.

### Patentansprüche

1. Verfahren für Geländeaufklärung mithilfe einer Mörserbombe, bestehend daraus, dass die Mörserbombe mit einer Beobachtungseinheit, die eine Kamera (K), einen Fallschirm und einen Sender (N) aufweist, in Richtung eines aufzuklärenden Geländes abgeschossen wird, wobei die Beobachtungseinheit nach einer spezifizierten Zeit von der Hülle der Mörserbombe getrennt wird und das Gelände überwacht und gleichzeitig von der Kamera (K) über Funk, Infrarot- oder andere Strahlung ein Signal an einen Empfänger (O) sendet, der sich an einem Befehls-

### Revendications

1. Procédé de reconnaissance de terrain au moyen d'un obus de mortier, consistant en ce que l'obus de mortier ayant une unité d'observation se composant d'une caméra (K), d'un parachute et d'un émetteur (N) est tiré sur un terrain qui fait l'objet d'une reconnaissance, où l'unité d'observation, après un laps de temps spécifié, est séparée de l'enveloppe de l'obus de mortier et surveille le terrain en envoyant simultanément un signal à partir de la caméra (K) par un rayonnement radio, infrarouge ou autre à un récepteur (O) situé à un poste de commande, où des signaux reçus en provenance de la caméra (K) sont affichés sur une unité d'affichage d'ordinateur (E) après être convertis en format numérique, **caractérisé par le fait qu'**une valeur de déviation d'un axe spécifié de l'unité d'observation à partir de la direction nord-sud N-S est détectée dans l'unité d'observation pour une unique image au moyen d'un magnétomètre (M) ou d'un système de navigation par satellite GPS, lesdites valeurs de déviation consécutives étant converties en un signal de déviation N-S, envoyé de manière synchrone avec le signal provenant de la caméra (K) au récepteur (O), dans lequel la position de chaque image consécutive sur l'unité d'affichage (E) est corrigée par sa valeur correspondante de la déviation à partir de la direction N-S au moyen d'un algorithme de rotation d'image connu.

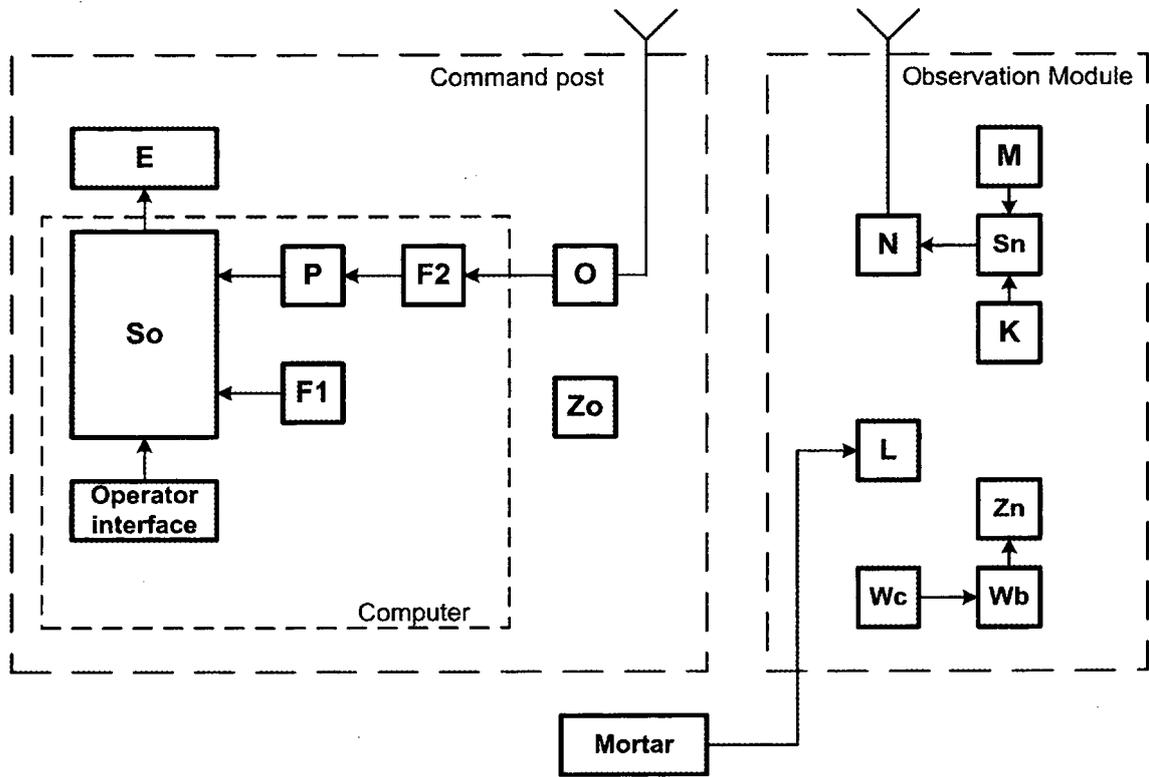


Fig.1

**REFERENCES CITED IN THE DESCRIPTION**

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**Patent documents cited in the description**

- US 3962537 A [0002]
- WO 2004057263 A [0002]
- US 7283156 B [0003]