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(54) METHOD OF AND APPARATUS FOR THE SCATTER DROPPING OF BOMBS

(71) We, MESSERSCHMITT - BÖLKOW-BLOHM Gesellschaft mit beschränkter Haftung, of 8000 Munchen, German Federal Republic, a Company organised and existing under the laws of the German Federal Republic, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to a method of attacking ground targets by scatter dropping of bombs which are carried into the vicinity of a target area by a carrier aircraft, and to a weapons system for carrying the method into effect.

The radius of effect of conventional unguided bombs is of the same magnitude as the path error, and therefore the probability of success (destruction of the target) of a single bomb of this kind is limited. A possible solution is the use of a larger size bombs, in order to increase the radius of effect. The disadvantage is that an increase in the explosive charge causes the area of destruction to increase less than proportionally. Therefore, very large bombs are required for sufficient probabilities of destruction, more particularly against hard targets where radii of effect are small. In modern strategy use is made of what is known as dispersive or scatter weapons by which larger areas are covered as uniformly as possible with a number of smaller explosive charges, in order to achieve what is known as a constant probability of hitting a target.

U.S.A. Patent Specification 2,809,583, describes a cluster bomb with a plurality of small child bombs in a bomb casing which after release from the carrier aircraft is broken apart explosively by means of a time fuse, to enable the small bombs to be scattered over a large area.

In a method of this kind the size of the area covered depends on many incidental factors, such as for instance the speed of the

carrier aircraft, the prevailing wind speed, and the position occupied by the container at the instant when it is broken apart. This is particularly disadvantageous when a particular density of coverage is necessary for the destruction or neutralization of a target which is to be attacked.

Reducing the path error of separately dropped bombs in order to increase their effectiveness is also known. For this purpose the bombs must be provided with guiding devices by which they can be guided on to a target manually from a carrier aircraft or automatically. Such self-guiding devices are known for separately dropped bombs. These devices effect control according to specific target characteristics, for instance electromagnetic radiation from the target permits high accuracy of hitting but call for expensive guiding devices, or they control blindly according to a predetermined programme which can be done with a relatively low cost guiding devices but gives no accuracy of hitting.

The invention seeks to provide a method of attacking a ground target by scatter dropping of bombs by which the density of coverage over a selected target, more particularly a hard or armoured target, can be determined from the carrier aircraft.

According to this invention there is provided a method of attacking a ground target by scatter dropping a number of bombs carried into the vicinity of a target area by a carrier aircraft, each bomb having guidance means and a programmable storage device, the method comprising creating a predetermined guidance programme made up in dependence on the target location in relation to the aircraft, the flight and guidance characteristics of the bombs and the preselected coverage pattern required, converting the programme into separate guidance commands for each bomb, storing the guidance commands in the storage devices of the individual bombs, and simultaneously releasing the bombs whereby the bombs are guided on their respective flight paths by the stored

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guidance commands acting on the guidance means to strike the target area in accordance with the preselected pattern.

Modern high-performance aircraft are 5 equipped with computers for the various weapon systems carried and into which all information regarding the state of flight of the carrier aircraft and the target positions relative to the carrier aircraft are fed and in 10 which this information is stored until it is used or new information is fed in. Therefore, in addition to this it is only necessary to store the flight and guidance characteristics of the individual bombs and to feed in 15 the required scatter pattern to provide the guidance programme from which guidance commands for the bombs can be obtained. Control can effectively be by critical measured values at which the control surface or 20 rudder deflection of the bombs is to be cancelled, i.e. rendered inoperative.

A weapon system for carrying out the method of the invention is also provided, comprising a number of bombs each including 25 a guidance means, an electrical connector means, a programmable storage device for storing measured values fed through the connector and for forming guidance commands for the guidance means, a device for actuating the guidance means in response to the guidance commands to a selected state and a switch which is released when critical measured values fed in to the storage device are reached and which is connected 30 with a device that moves the guidance means on the bombs into an inoperative position when the measured value is reached.

With the method of the invention, which 40 is relatively simple, there are few targets which ballistically cannot be reached or can be reached only unsatisfactorily, can be directly attacked with a predetermined coverage pattern. It is possible for the bombs to 45 be changed over from guided flight to ballistic flight when certain pre-programmed parameters are reached. By this means the possibility of defence both against the scatter weapons and against aircraft carrying 50 the scatter weapons on to the target is greatly restricted. Moreover, the directed engagement permits a great reduction of the weapon quantity as compared with unguided scatter weapons. Lastly the control 55 devices of the bombs used in this case are substantially less costly than those in known guided bombs.

The invention is further described and 60 illustrated with reference to an embodiment described in conjunction with the accompanying drawings, wherein:—

Figure 1 shows a diagrammatically the 65 use of scatter bombs in accordance with the method of the invention;

Figure 2 shows a block circuit diagram of

an apparatus for carrying the method into effect;

Figure 3 shows a perspective view of the guidance means of a guided bomb for carrying the method of the invention into 70 effect;

Figure 4 shows a block circuit diagram of the guidance means of the guided bomb.

In a carrier aircraft 3 (of. Fig. 2) a radar device 4 with an antenna 5, which is used interalia for the location of targets, a weapon computer 6 and an infeed and indicating apparatus 7 are provided. A control device 8 is connected to the weapon computer. By way of this device the bombs or 75 bomblets 10 (cf. also Figure 3), which are arranged in pods 1 of the carrier aircraft or which alternatively are suspended separately in the carrier aircraft, are adjusted 80 as regards their storage devices and are released. 85

Each bomb 10 is formed as a guided bomb with four rudders 11 to 14 which are locked in a deflected position selected by the computer 6 by means of catches 15, 16 90 and 17. With each rudder a power device with a return spring 18 to 20 is provided. The power devices act to shift the rudders to the control position and return springs act to shift them into the inoperative position, not shown in the drawings. Each catch is released, to enable the return springs to shift the rudders to their inoperative positions to switch the bomb from guided to ballistic flight, by time switch 21 or 22 100 95 which is programmed by the computer 6. The time switches are connected by way of connection members 23 and 24, and conductors 25 and 26, to a connection plug device 27 through which the electrical connection to the control device 8 and thus the computer can be made.

Alternatively, of course, storage devices other than time switches can be used, the 110 only essential thing is that the guidance programme obtained from the weapon computer 6 can be stored for the duration of the flight in the guided bomb and can be recalled. Other rudder arrangements and other power devices are of course also possible, for instance the movement of the 115 rudders may alternatively be effected by stepping motors.

As can be seen from Figure 3, the rudders 11 and 12 are actuated in the same direction; they are used for controlling the path curvature of the guided bombs, whereas the plane of the path curvature can be determined by means of the rudders 13 and 14 adapted to be actuated in opposite directions.

A block circuit diagram of the guidance means included in a guided bomb is shown in Figure 4.

The guidance programme obtained from 130

the weapon computer of the carrier aircraft is fed to the bomb and stored in a programmable storage device 28 which is followed by an actuator switch 29. The angular position of the rudder 33, obtained from an angle sensor 30, is also fed into the actuator command switch at the same time. The rudder position command, being the difference formed in the switch 29 from the guidance programme in 28 and the actual angular position in 30 is fed to a rudder actuator 31, which uses power from a power supply 32 to adjust the rudder 33 to the required extent. The device 28 also serves as a time switch and produces a command to render the rudder inoperative at the required instant through switch 29 and actuator 31.

The manner of operation of the arrangement described is as follows. As soon as the target to be attacked, for example a convoy of vehicles 40, is recognised or known from the carrier aircraft or from a command post by radio, for instance in the position 3a shown Figure 1 the space coordinates of the target are determined by means of the radar device and fed into the weapon computer. At the same time the required pattern of coverage of the target 42, in this case an in-line drop, is also fed into the weapon computer by the pilot of the aircraft with the aid of the infeed apparatus 7. From these values that have been fed in, from the flight and guidance characteristics of the guided bombs forming the weapon system, which are stored in the weapon computer, from the height and speed of flight of the carrier aircraft and from the speed of the detected target if necessary, the initial setting of the rudders of the bombs and the time sequences of points at which the rudders are rendered inoperative, are calculated in advance in the weapon computer, so that these bombs, starting from the release point T_a in the flight position 3b, will strike the located target in approximately uniform distribution at the end of their flight time. The values calculated in advance are stored in the storage devices of the individual guided bombs. As soon as the carrier aircraft has reached the position 3b, the guided bombs are released by means of the weapon computer. They move, in accordance with the previously set values, along the different flight paths to the target 40. The flight paths may include a guided phase and a ballistic phase. The flight path 50 of the carrier aircraft ensures that little time is spent in the region of effectiveness of any defence weapons installed in the area target.

Instead of calculation of the programme instructions during the attack, it is of course alternatively possible to store the necessary guidance commands in the bombs in advance and manoeuvre the aircraft into a release position suitable for that stored programme.

WHAT WE CLAIM IS:—

1. A method of attacking a ground target by scatter dropping a number of bombs carried into the vicinity of a target area by a carrier aircraft, each bomb having guidance means and a programmable storage device, the method comprising creating a predetermined guidance programme made up in dependence on the target location in relation to the aircraft, the flight and guidance characteristics of the bombs and the preselected coverage pattern required, converting the programme into separate guidance commands for each bomb, storing the guidance commands in the storage devices of the individual bombs and simultaneously releasing the bombs whereby the bombs are guided on their respective flight paths, by the stored guidance commands acting on the guidance means to strike the target area in accordance with the preselected pattern. 70
2. A method of attacking a ground target by scatter dropping of bombs in accordance with Claim 1, wherein the guidance programme is determined beforehand and the carrier aircraft is brought into a position in relation to the target area which can be predetermined by an on-board weapons computer from which position the guided bombs are released all together. 85
3. A method of attacking a target by scatter dropping of bombs in accordance with Claim 1, wherein the predetermined guidance programme is made up in the carrier aircraft, the guidance commands being fed to the storage devices of each bomb during an attack phase prior to release of the bombs. 90
4. A weapon system for carrying out the method according to Claim 1 or 2 or 3, comprising a number of bombs each including a guidance means, an electrical connector means, a programmable storage device for storing measured values fed through the connector and for forming guidance commands for the guidance means, a device for actuating the guidance means in response to the guidance commands to a selected state and a switch which is released when critical measured values fed in to the storage device are reached and which is connected with a device that moves the guidance means on the bombs into an inoperative position when the measured value is reached. 105
5. A method of attacking a target by scatter dropping bombs carried out substantially as herein described with reference to and as shown in the accompanying drawings. 110
6. A weapons system including a number of guided bombs constructed and arranged to operate substantially as herein de- 120

scribed with reference to and as shown in Figures 3 and 4 of the accompanying drawings.

7. A weapon system in accordance with 5 claim 4 comprising in combination a number of said bombs and an aircraft having a weapons system computer arranged to produce guidance commands for each bomb.

8. A weapons system in accordance with

Claim 7, constructed and arranged to function substantially as herein described with reference to the accompanying drawings.

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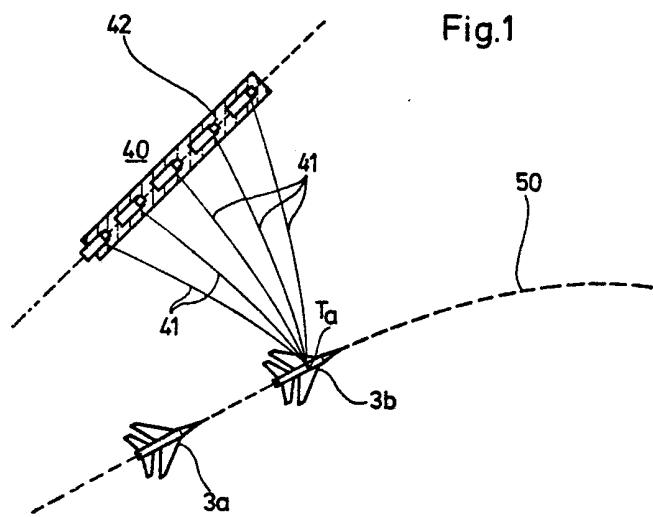


Fig.1

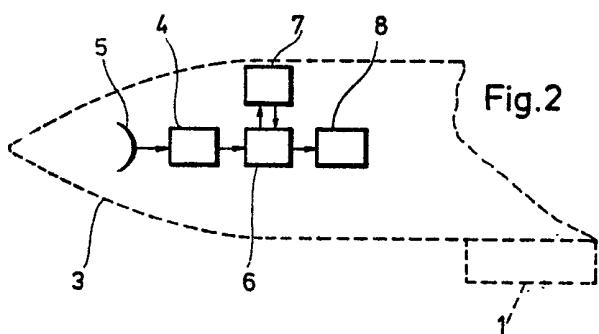


Fig.2

Fig.3

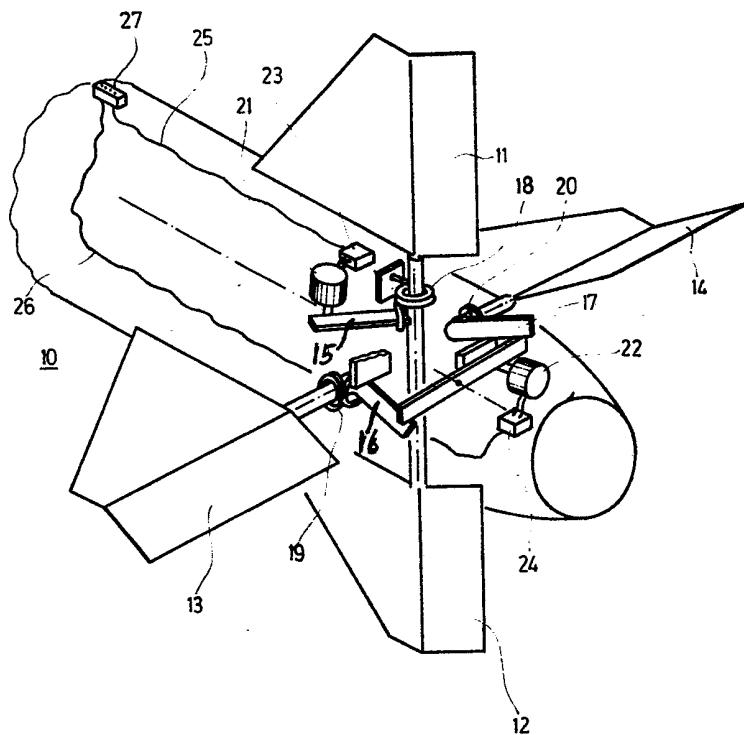


Fig.4

