(12) UK Patent Application (19) GB (11) 2 280 044 (13) A

(43) Date of A Publication 18.01.1995

(21) Application No 9314567.0

(22) Date of Filing 14.07.1993

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(51) INT CL^6
A63H 27/00 , G05D 1/04

(52) UK CL (Edition N)
G3N NGCA N286A
U1S S1205 S1839

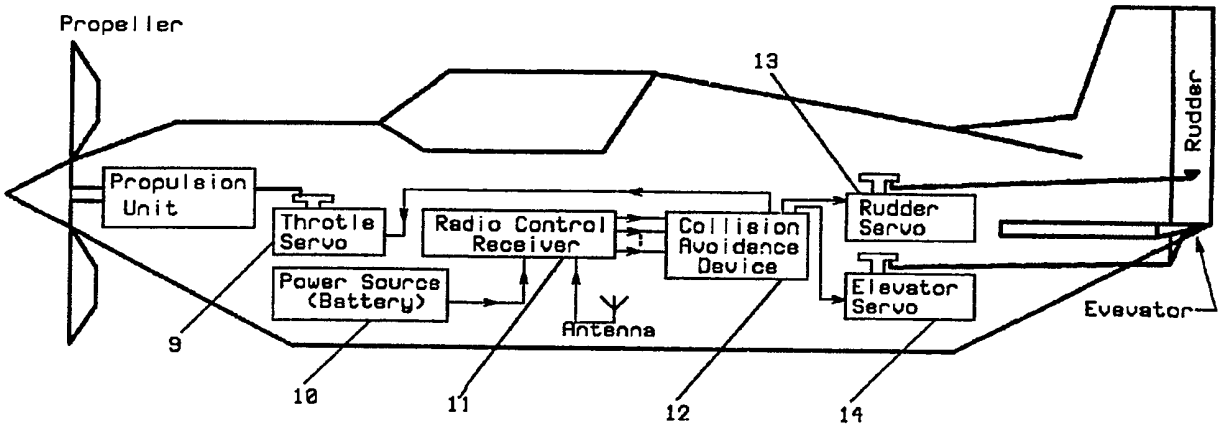
(56) Documents Cited
GB 1477656 A GB 1171044 A GB 1031251 A
GB 0931140 A

(58) Field of Search
UK CL (Edition L) **G3N NGA3 NGCA NGCA5 NGE1 , G3R RBD42 RBD49**
INT CL^5 **A63H 27/00 30/04 , G05D 1/00 1/04**
ONLINE DATABASES : WPI

(54) Model aircraft collision avoidance device

(57) A collision avoidance device (12) in a model aircraft prevents it flying into the flight paths of commercial, full sized aircraft by limiting the altitude of the aircraft to below that where commercial aircraft can be expected. A barometric pressure sensor provides a signal which when above a preset level is used to control the elevator servo or throttle servo to reduce the altitude of the aircraft. The collision avoidance device countermands the normal radio control signals.

Figure 2



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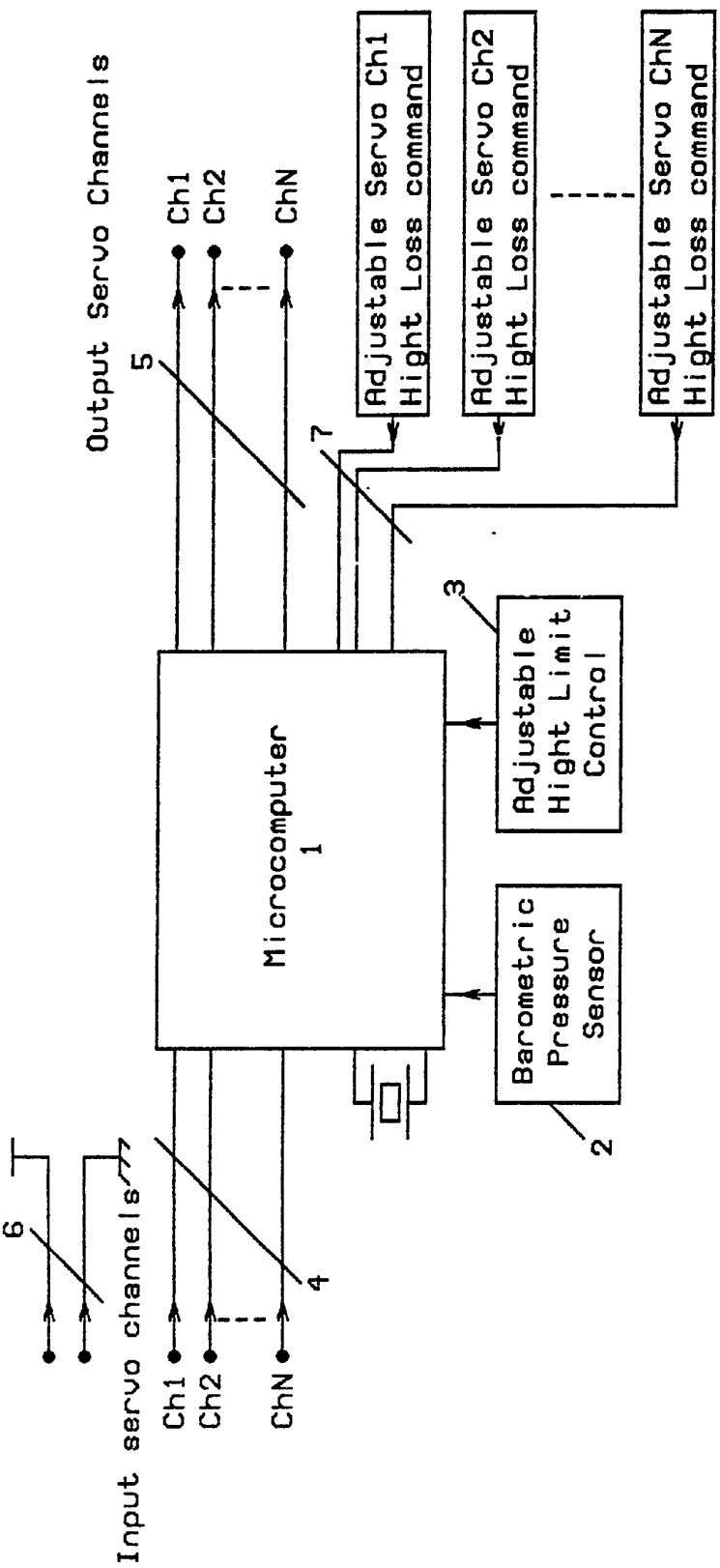
Output Servo Channels
Ch1
Ch2
ChN
5
7
Adjustable Servo Ch1
Hight Loss command
Adjustable Servo Ch2
Hight Loss command
Adjustable Servo ChN
Hight Loss command
3
Microcomputer
1
Adjustable
Hight Limit
Control
Barometric
Pressure
Sensor
2
6
4
Input servo channels
Ch1
Ch2
ChN

Figure 1

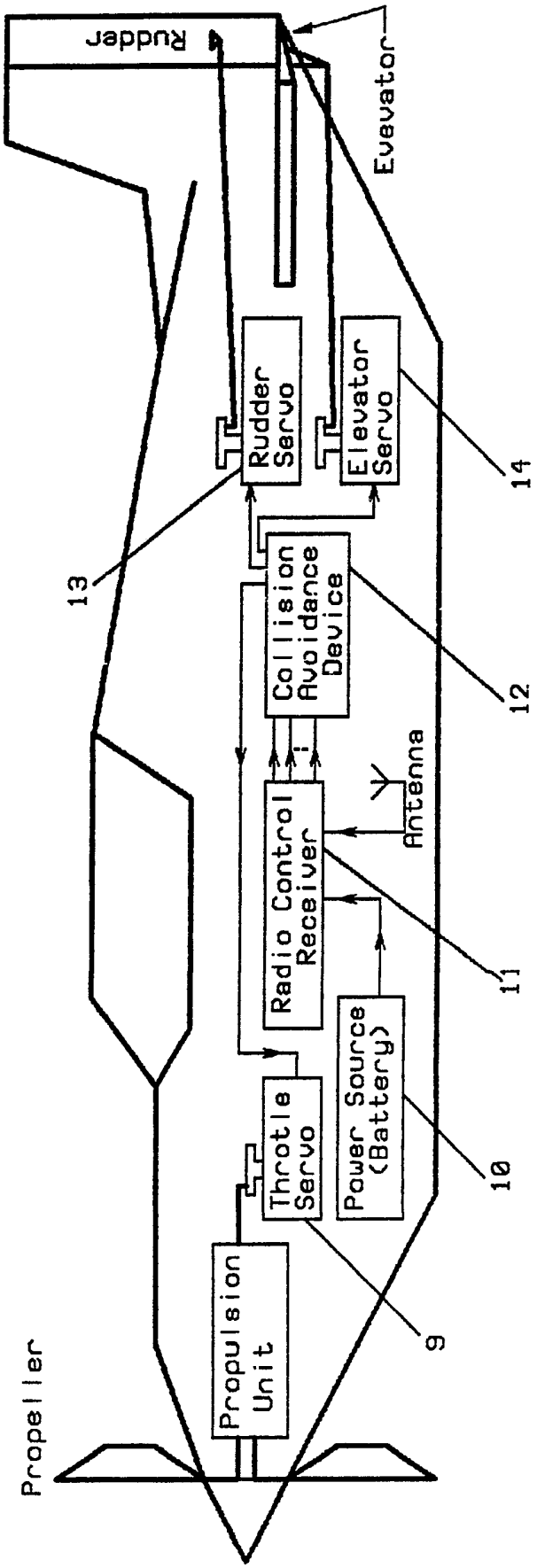
Rudder
Evevator
Rudder Servo
Elevator Servo
14
13
Collision Avoidance Device
12
Antenna
Radio Control Receiver
11
Power Source (Battery)
10
Throtle Servo
9
Propulsion Unit
Propeller

Figure 2

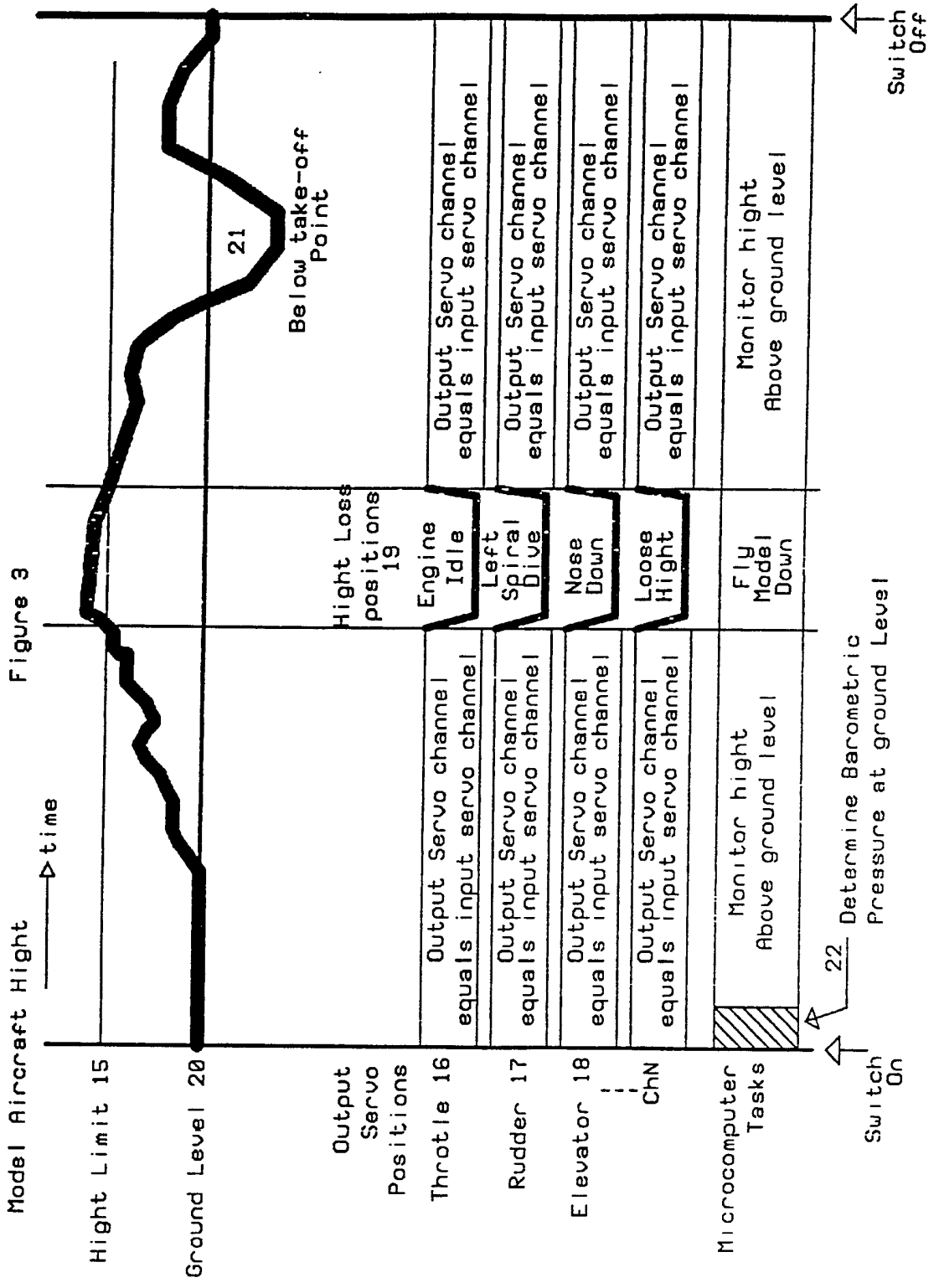
Model Aircraft Hight
time
Hight Limit 15
Ground Level 20
21
Below take-off Point
Output Servo Positions
Throtle 16
Rudder 17
Elevator 18
ChN
Microcomputer Tasks
Hight Loss positions 19
Engine Idle
Left Spiral Dive
Nose Down
Loose Hight
Fly Model Down
Output Servo channel equals input servo channel
Monitor hight Above ground level
22
Determine Barometric Pressure at ground Level
Switch On
Switch Off

Figure 3

Model aircraft collision avoidance device

This invention relates to a device which when installed to a model aircraft prevents collisions with full size aircraft.

Model and full size aircraft have shared the same airspace since the first manned flight. Initially, the chances of a collision between then were negligable. However, in recent times, the proliferation of both commercial aviation and the flying of large radio controlled aircraft as a hobby has lead to numerous 'near misses', and collisions that have resulted in the destruction of full size aircraft with consequent loss of life.

The flight paths of full size aircraft are governed by the various 'air navigaction orders'. Over open countryside, they are not permitted to fly below 500ft and over built up areas such as towns, the limit is 1500ft. Modellers on the otherhand are to be forbidden from flying within 5km of active airfields.

Unfortunately, tests on model aircraft outside UK airspace reveal that it is possible to fly a typical radio controlled aircraft up to 3,000 feet above the operator. Thus it is seen that the two flight envelopes overlap even well away from active airfields, and the potential for collision remains.

An object of the present invention is to provide a device which when installed into a model aircraft prevents it from straying into the flight paths of commercial aviation.

According to one aspect, the invention consists of a signal processing device installed in the model plane that continuously monitors both the hight above ground and the control surface movements received via the radio control receiver from the operator on the ground. Provided that the model is flying below the flight paths of commercial aviation (say 500ft) the device lets the operator on the ground control the model, however, in the event that the model strays above the 500ft hight limit, the device takes control of the plane, and gives control surface, and/or engine commands such as to cause the model to loose hight. As soon as the model is flying below the arbitrary hight limit, the device returns control of the model to the operator on the ground.

In one specific embodiment, the device consisting of a microcomputer having data input and output means for receiving control surface positional information from a radio control receiver, and for sending data to the control surface servos that fly the model aircraft.

The microcomputer may be arranged to calculate the hight that the model is flying at by means of an onboard barometric pressure sensor and by comparing such with the hight calculated from the barometric pressure at the time the device was switched on by the operator on the ground.

The microcomputer may be further arranged to compare the hight above ground calculated by previous means, with a hight limit setting read by means of an adjustable control on the device. In the event that the hight limit is exceeded, the microcomputer is preferably arranged to give control surface movements via the servos that cause the model aircraft to reduce its hight above ground. By previous means the model aircraft operator may be able to adjust the hight at which the model aircraft may be flown before the collision avoidance device operates.

According to another aspect, the device may be fitted to any flying object wether controlled or otherwise. Again, the device monitors the hight that the object is flying at and if it is below the hight limit does nothing. However, should the object fly above the hight limit, the device releases a parachute or takes other actions such as to cause the object to loose hight.

By means of the present invention, model aircraft are prevented from straying into the flight paths of full size aircraft and thus preventing collisions.

The invention will now be described by way of example, with reference to the accompanying drawings in which:

Figure 1 is a block diagram of the device according to one embodiment of the invention

Figure 2 shows a typical installation of the device within a model aircraft

Figure 3 shows the operating characteristics of a model aircraft with the device installed.

Referring first to Figure 1, a model aircraft collision avoidance device according to one embodiment of the invention has a microcomputer 1 which controls the control surfaces of the model plane by control lines 5. The device derives its power from input servo lines 6 together with the operators flying commands from input servo lines 4.

When the device is first switched on by the operator, the device deduces that it is at ground level, and the microcomputer 1 measures the ambient barometric pressure by means of the barometric pressure sensor 2. This ground level measurement is used as the referrence for determining how high the model is above ground level during the ensuing flight.

Immediately after taking the ground referrence measurement, the microcomputer 1 continually compares the models hight above ground level deduced from the variance of barometric pressure with altitude, with the maximum hight limit allowed, which is read in from the adjustable hight limit control 3. If the hight limit is never exceeded, then the servo output channels 5 follow the servo input channels 4 for the duration of the flight, and the collision avoidance device need take no actions.

In the event of the model aircraft equiped with the device flying above the hight limit set by the adjustable hight limit control 3, the microcomputer 1, takes actions such as to cause the model aircraft to loose hight. This is accomplished by the microcomputer 1 ignoring the input servo lines 4, and instead reading in the servo hight loss positions from servo hight loss position input lines 7, and using this information to generate the correct servo signals on servo output lines 5 that will cause hight loss in the desired manner chosen by the operator. The microcomputer 1 continually monitors the hight level through this phase of flight, and restores control of the model aircraft by allowing the servo ouput lines 5 to follow the servo input lines 4 as soon as the device detects that the model is flying below the hight limit set by the adjustable hight limit control 3.

In Figure 2, there is shown a typical installation of the collision avoidance device 12 within a model aircraft. The device is preferablely connected between the existing radio control receiver 11 with its power source (eg a battery 10) and the servos that move the control surfaces (elevator servo 14, rudder servo 13,...) or control the propulsion system(throtle servo 9).

In Figure 3, the operating characteristics of a model aircraft with the device installed is shown. Here it is seen that provided that the model aircraft flys below the hight limit 15, then the output servo channels 16-18 follow the input servo channels. When the model aircraft flys above the hight limit 15, it is seen that the servos go to the hight loss positions 19 untill the model aircraft is again flying below the hight limit 15. Note that the hight limit 15 only applies when the model aircraft flys too high ABOVE ground level 20. Should the model be flying below ground level 20 (as would be the case if the model aircraft were launched from the top of a hill and was flown in the valley below 21) the device continues to allow the operator to fly the plane. This is since the device assumes ground level 20 as being where the operator was standing at the time the device was switched on 22.

CLAIMS

1. A model aircraft collision avoidance device comprising a microcomputer and a pressure sensor.

2. A model aircraft collision avoidance device as claimed in Claim 1 with adjustable hight limit.

3. A model aircraft collision avoidance device as claimed in Claim 1 or Claim 2 with adjustable hight loss servo positions.

4. A model aircraft collision avoidance device as claimed in Claim 2 or Claim 3 where the ground level referrence is assumed as a consequence of the operator switching the device power source.

5 A model aircraft collision avoidance device as claimed in Claim 4 where the power source is derived from the servo drivers.

6 A model aircraft collision avoidance device substantially as described herein with referrence to figures 1-3 of the accompanying drawing.

Patents Act 1977 Examiner's report to the Comptroller under Section 17 (The Search report) -5-	Application number GB 9314567.0
Relevant Technical Fields (i) UK Cl (Ed.L) G3N (NGA3 NGCA5 NGCA NGE1) G3R (RBD42 RBD49) (ii) Int Cl (Ed.5) A63H (27/00, 30/04) G05D (1/00, 1/04)	Search Examiner MR D A SIMPSON Date of completion of Search 23 DECEMBER 1993
Databases (see below) (i) UK Patent Office collections of GB, EP, WO and US patent specifications. (ii) WPI	Documents considered relevant following a search in respect of Claims :- 1-6

Categories of documents

X: Document indicating lack of novelty or of inventive step.

Y: Document indicating lack of inventive step if combined with one or more other documents of the same category.

A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family; corresponding document.

Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 1477656	(BODENSEEWERK) page 1 lines 6 to 18	1, 2 and 3
X	GB 1171044	(HONEYWELL INC) page 2 lines 77 to 99	1, 2 and 3
X	GB 1031251	(THOMASON) page 1 lines 8 to 38	1, 2 and 3
X	GB 931140	(KOLLSMAN) page 1 lines 34 to 39	1, 2 and 3

Databases: The UK Patent Office database comprises classified collections of GB, EP, WO and US patent specifications as outlined periodically in the Official Journal (Patents). The on-line databases considered for search are also listed periodically in the Official Journal (Patents).