(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) Publication number: **0 245 030 A2**

(12) EUROPEAN PATENT APPLICATION

(21) Application number: **87303859.0**

(22) Date of filing: **30.04.87**

(51) Int. Cl.⁴: **G 08 G 5/06**

(30) Priority: **01.05.86 GB 8610666**

(43) Date of publication of application: **11.11.87 Bulletin 87/46**

(84) Designated Contracting States: **AT BE CH DE FR GB IT LI NL SE**

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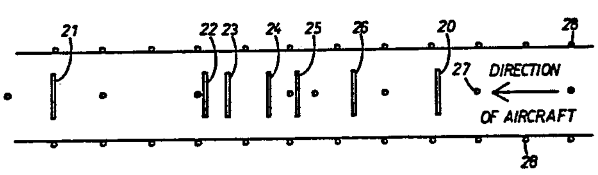
(54) **Aircraft identification device.**

(57) A device for identifying aircraft on a runway has a plurality of sensors (20, 21, 22, 23, 24, 25, 26) spaced apart along a runway. A reference sensor (21) is adapted to be operated by the nosewheel of an aircraft and several of the other sensors (22, 23, 24, 25, 26) is spaced apart from the reference sensor (21) at distances corresponding to known wheelbases of different aircraft. By detecting coincident signals from the reference sensor (21) and one of the other sensors (22, 23, 24, 25, 26) it is possible to determine the wheelbase of the aircraft and thereby to determine which type of aircraft is travelling along the runway. By having a further sensor (20) situated before the other sensors, then by timing the interval between a signal from the further sensor (20) and the reference sensor (21), it is possible to obtain a value for the average speed of the aircraft along the runway.



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DESCRIPTION

AIRCRAFT IDENTIFICATION DEVICE.

The present invention relates to an aircraft identification device, and in particular to a device for identifying different types of aircraft when taxiing along an airport runway.

There are problems in monitoring aircraft movement on the ground at major airports, from the point of landing on the runway to actually docking at an airport terminal for disembarking. It is not uncommon for an aircraft to take the wrong turning or to be given a wrong instruction by the airport control tower, resulting in arrival of the aircraft at the wrong disembarking point. It is also a problem to identify the type of aircraft approaching the disembarking point so that the correct taxiway lighting to the disembarking point may be operated and so that unnecessary lighting may be switched off. It is necessary to identify an aircraft correctly so that it may be directed to the correct disembarkation point, i.e. one which has the correct facilities for that type of aircraft and which has the capacity to deal with that aircraft.

In accordance with a first aspect of the present invention, there is provided an aircraft identification device comprising a plurality of sensors spaced apart along a runway, the sensors comprising a reference sensor which is adapted to be operated by a first portion of the aircraft, and a plurality of sensors, adapted to be operated by a second portion of the aircraft, spaced apart from the reference sensor at distances corresponding to known measurements of a plurality of aircraft.

Preferably, the sensors which are spaced apart from the reference sensor are adapted to be operated by a wheel or wheels of the aircraft.

In one embodiment, an aircraft identification device comprises a plurality of sensors spaced apart along a runway, the sensors comprising a reference sensor which is adpated to be operated by the front, nosewheel of an aircraft and a plurality of sensors spaced apart from the reference sensor at distances equal to the wheel bases of different aircraft.

Alternatively, the reference sensor may be adapted to be operated by the tail fin of an aircraft. There may be a plurality of sensors at different heights.

In this way, by detecting simultaneous signals from the reference sensor and from one of the other sensors as an aircraft taxis along the runway, it is possible to identify the type of aircraft by identification of the known measurement, e.g. the wheel base.

Preferably, at least some of the sensors are on, or buried in, the runway.

In accordance with a second aspect of the present invention, there is provided a device for monitoring the speed of an aircraft, the device comprising means for measuring the time taken for a particular point of the aircraft to move through a known distance.

Preferably, the device comprises two spaced-apart sensors adapted to be activated by a particular point, e.g. a wheel or nosewheel, of an aircraft.

In accordance with a third aspect of the invention, a device for monitoring the speed of an aircraft on a runway comprises means for identifying the type of aircraft and means for measuring the time taken for a particular part of known length of that aircraft to pass a fixed point on the runway. In one embodiment, said part of known length is the aircraft tail fin at a particular height.

There may be a plurality of vertically-spaced sensors adapted to sense the tail fin of a plurality of different sizes of aircraft. There may also be a further sensor adapted to be activated by a different point on the aircraft, such that a signal from one of the vertically-spaced sensors is only accepted when it is coincident with a signal from the further sensor.

By way of example only, specific embodiments of the present invention will now be described with reference to the accompanying drawings, in which;-

Fig. 1 is a plan view of an airport runway having a first embodiment of sensing device in accordance with the present invention;

Fig. 2 is a plan view of an airport runway having a second embodiment of sensing device in accordance with the present invention;

Fig. 3 is a side elevation of an aircraft on the runway illustrated in Fig. 2; and

Fig. 4 is a view of the sensing device of Fig. 2, looking in the direction along the runway.

Referring firstly to Fig. 1, buried in the runway are first and second, pressure-actuated, reference sensors 20, 21 and a plurality of secondary, pressure-actuated sensors, 22, 23, 24, 25, 26, the distances between the second reference sensor 21 and the secondary sensors corresponding to the wheel bases of various aircraft. Suitable sensors are those described in my copending European Application No. 84304635.0.

In use, an aircraft lands on the runway and taxis along it towards the aircraft terminal. As the aircraft taxis along the runway, its nosewheel crosses sensor 20 and starts an electronic timer. As the aircraft moves along the runway, the nosewheel crosses the sensor 21 and simultaneously the main undercarriage crosses another sensor 22, 23, 24, 25 or 26, depending on the type of aircraft.

Activation of the sensor 21 stops the electronic timer and a microprocessor calculates the average speed of the aircraft between the sensors 20, 21. Furthermore, simultaneous signals from the reference sensor 21 and one other, secondary, sensor give a measure of the wheel base of the aircraft taxiing along the runway, and thus provide a means for identifying the aircraft. Preferably, the signals from the sensors are fed to a microprocessor or computer based system which gives an automatic identification of the aircraft by reference to its memory in which is stored the types of aircraft corresponding to operation of each of the secondary sensors simultaneously with the reference sensor. The microprocessor may be arranged to produce a display of the aircraft speed, if the aircraft has been identified.

Only five secondary sensors have been illustrated in Fig.1, but it will be appreciated that the number of secondary sensors will depend upon the number of aircraft which it is desired to identify in this way.

As an example, if the sensor 22 were placed 11.38 metres from the reference sensor 21, simultaneous signals from these sensors would indicate that a Boeing 737-200 is taxiing along the runway. If sensor 24 were placed 18.60 metres from the reference sensor 21, then simultaneous signals from these two sensors would indicate that an Airbus A300-600 is taxiing along the runway.

A second embodiment of the present invention is illustrated in Figs. 2 to 4, and comprises a runway having a timing sensor 20A and a plurality of secondary sensors 34, 35, 36, 37, 38, which are all buried in the runway, as in the first embodiment. In addition to the runway sensors, a second sensor system

39 is provided. The sensor system 39 comprises two vertical supports 48, one on each side of the runway, one support being provided with three infrared lasers, 45, 46, 47, and the other support being provided with three infrared detectors 45', 46', 47' at the same height as their corresponding lasers, and arranged to detect radiation from their corresponding laser only. Instead of lasers, other transmission devices may be used with their appropriate sensors. For example, ordinary infrared or white light may be used. The lasers or other transmission devices are at different heights for three groups of aircraft such that the beams are above the level of fuselage of each group of aircraft.

In use, an aircraft lands on the runway and taxis along it. The leading edge 50 of the aircraft tail fin breaks the beam from the appropriate transmitter, in this example transmitter 39, which is used to start a timer. At the same time, the nosewheel 70 of the aircraft 49 crosses one of the secondary sensors 34, 35, 36, 37 or 38, depending on the type of aircraft. Thus, the type of aircraft can be identified by detection of simultaneous signals from detector 45' and one of the secondary sensors. This movement is different in every type of aircraft, since the tail fins of different aircraft are different, and this embodiment is of particular use where one or more types of aircraft have an identical wheelbase.

As the aircraft continues along the runway, as the trailing edge 60 of the tail fin passes the sensor 39, the signal at the detector 45' is re-established and is used to stop the timer. Since the aircraft has been identified, the width of the tail fin of the aircraft at the height of the detector 45' is known, and the measurement of the time between the leading edge 50 and the trailing edge 60 passing the sensor 39 may be used to calculate the speed of the aircraft along the runway, using information stored in the microprocessor.

Alternatively, the speed of the aircraft along the runway may be calculated by measuring the time between the leading edge 50 passing the sensor 39 and the nosewheel 70 activating the timing sensor 20A. Since the aircraft will already have been identified as before in the second embodiment, the measurement factor between the nosewheel 70 and the leading edge 50 of the tail fin at a given height, which is stored in the microprocessor, may be used to calculate the speed of the aircraft using the time obtained as above.

When a large aircraft passes sensors 46' and 47' which are at a lower level the fuselage will trip those sensors but as the nosewheel of the aircraft would not have crossed a ground sensor simultaneously no signal is allowed to pass to the control system.

Either of the above embodiments can also activate additional sensors at the airport terminal to give the pilot an indication when to stop at the correct position at the docking bay for that particular type of aircraft. This may be done by providing a single sensor at the docking bay, which, with the previous identification of the aircraft, can be used to display to the pilot when the aircraft is in the correct position at the docking bay.

Both embodiments may also be used to display to the pilot that he is exceeding a given speed.

All the sensors can be supplied via a transformer connected to the existing wiring for the centre line lighting 27 or edge lighting 28 without affecting the main supply from the constant current regulators. A separate connection via the same or other cables will allow the cable to be used for passing high frequency telemetry, which would allow the sensor systems to be transmitted to the docking bay to activate the correct stop sensor, and to the air traffic control.

Thus, existing wiring may be used, and additional wiring and trenching is not required. Also, the sensors may be installed wherever any existing supply cables are present.

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CLAIMS

1. An aircraft identification device comprising a plurality of sensors (21 to 26; 34 to 39) spaced apart along a runway, the sensors comprising a reference sensor (21,39) which is adapted to be operated by a first portion (50,70) of an aircraft, and a plurality of sensors (22 to 26, 34 to 38) adapted to be operated by a second portion of an aircraft, spaced apart from the reference sensor (21,39) at distances corresponding to known measurements of a plurality of aircraft.

2. A device as claimed in claim 1, wherein the sensors (22 to 26, 34 to 38) which are spaced apart from the reference sensor (21,39) are adapted to be operated by a wheel or wheels of an aircraft.

3. A device as claimed in claim 2, wherein the reference sensor (21) is adapted to be operated by the front nosewheel of an aircraft and the other sensors (22 to 25) are spaced apart from the reference sensor (21) at distances equal to the wheel bases of different aircraft.

4. A device as claimed in claim 1 or claim 2, wherein the reference sensor (39) is adapted to be operated by the tail fin of an aircraft.

5. A device as claimed in claim 4, wherein the reference sensor (39) comprises a plurality of sensors (45', 46', 47') at different heights.

6. A device as claimed in any of claims 1 to 5, wherein one or more of the sensors (21 to 26) is/are situated on the runway.

7. A device as claimed in any of claims 1 to 6, wherein one or more of the sensors (21 to 26) is/are buried in the runway.

8. A device for monitoring the speed of an aircraft on a runway, the device comprising means for measuring the time taken for a particular point of the aircraft to move through a known distance.

9. A device as claimed in claim 8, comprising two spaced-apart sensors which are adapted to be activated by a particular point of the aircraft.

10. A device for monitoring the speed of an aircraft on a runway, the device comprising means for identifying the type of aircraft and means for measuring the time taken for a particular part of known length of that aircraft to pass a fixed point on the runway.

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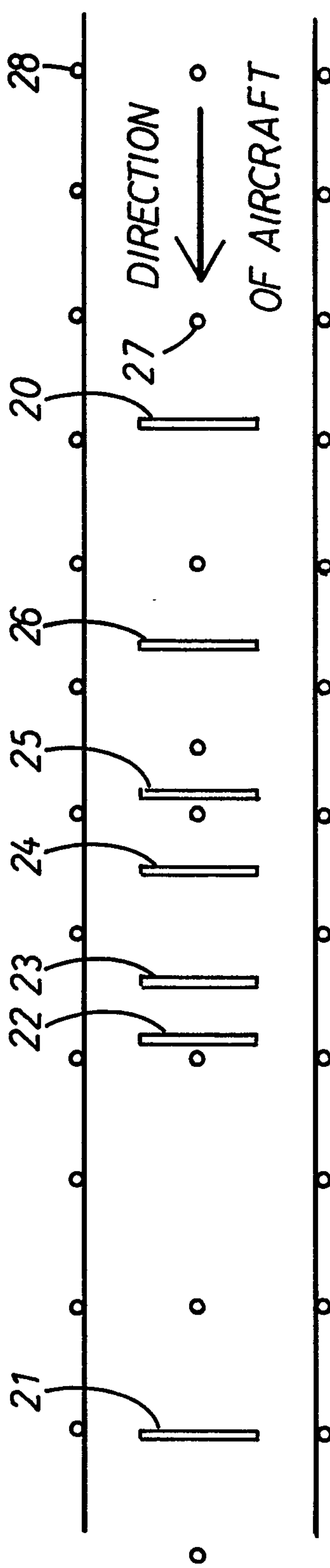

Fig 1

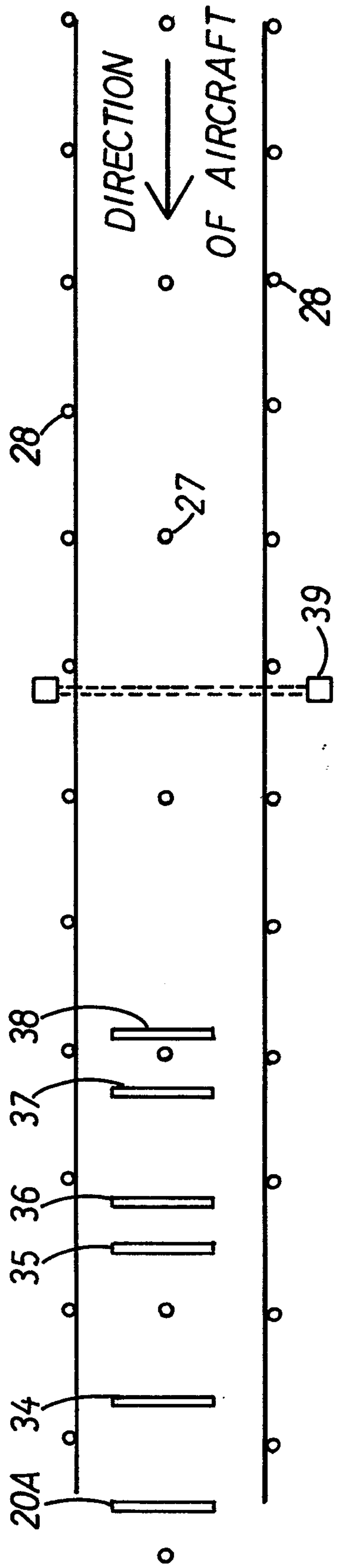

Fig 2

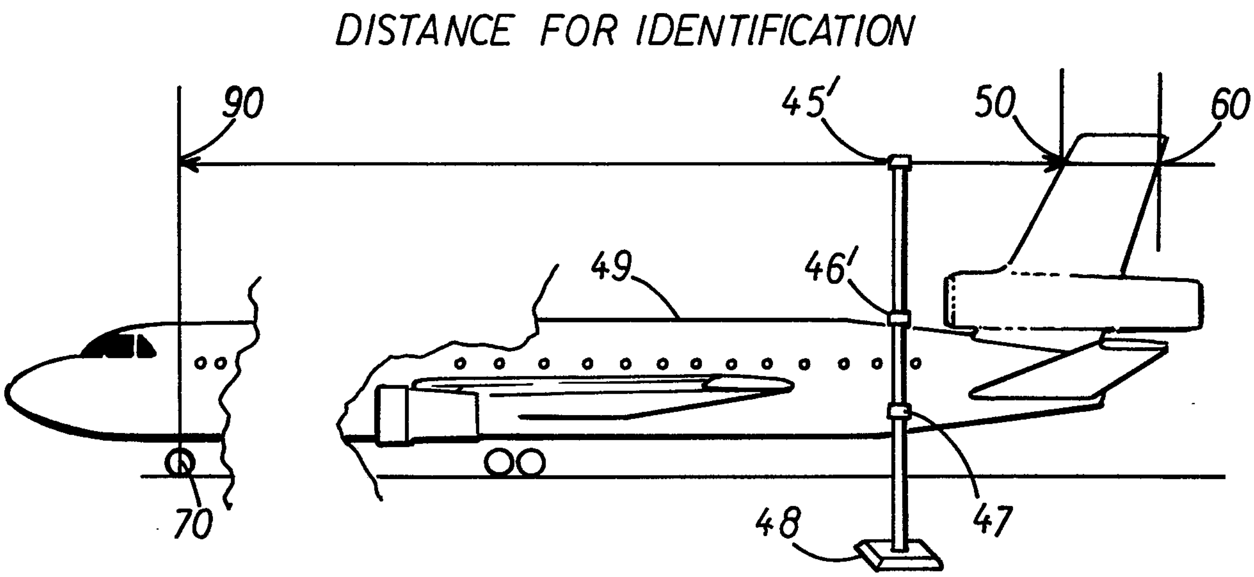
DISTANCE FOR IDENTIFICATION
90
45'
50
60
49
46'
70
48
47

Fig 3

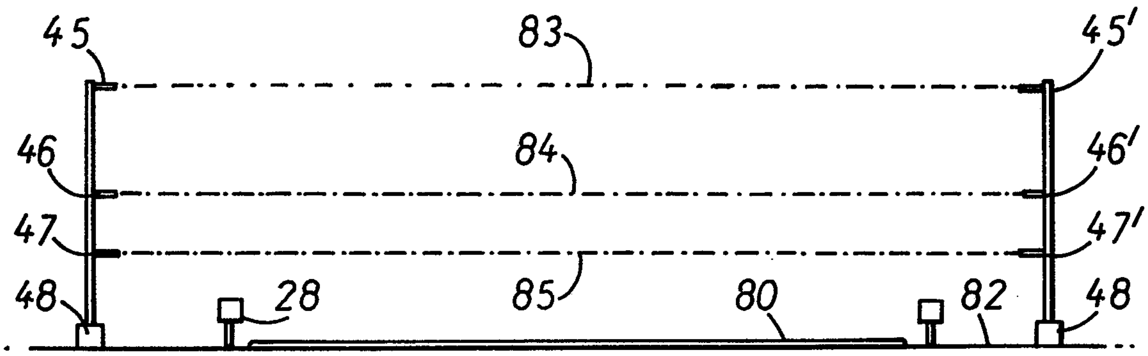
45
83
45'
46
84
46'
47
47'
48
28
85
80
82
48

Fig 4