

Dec. 20, 1966

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3,293,437

SCREEN FOR GUIDED MISSILES TO INHIBIT SPURIOUS RESPONSES

Filed June 30, 1959

4 Sheets-Sheet 1

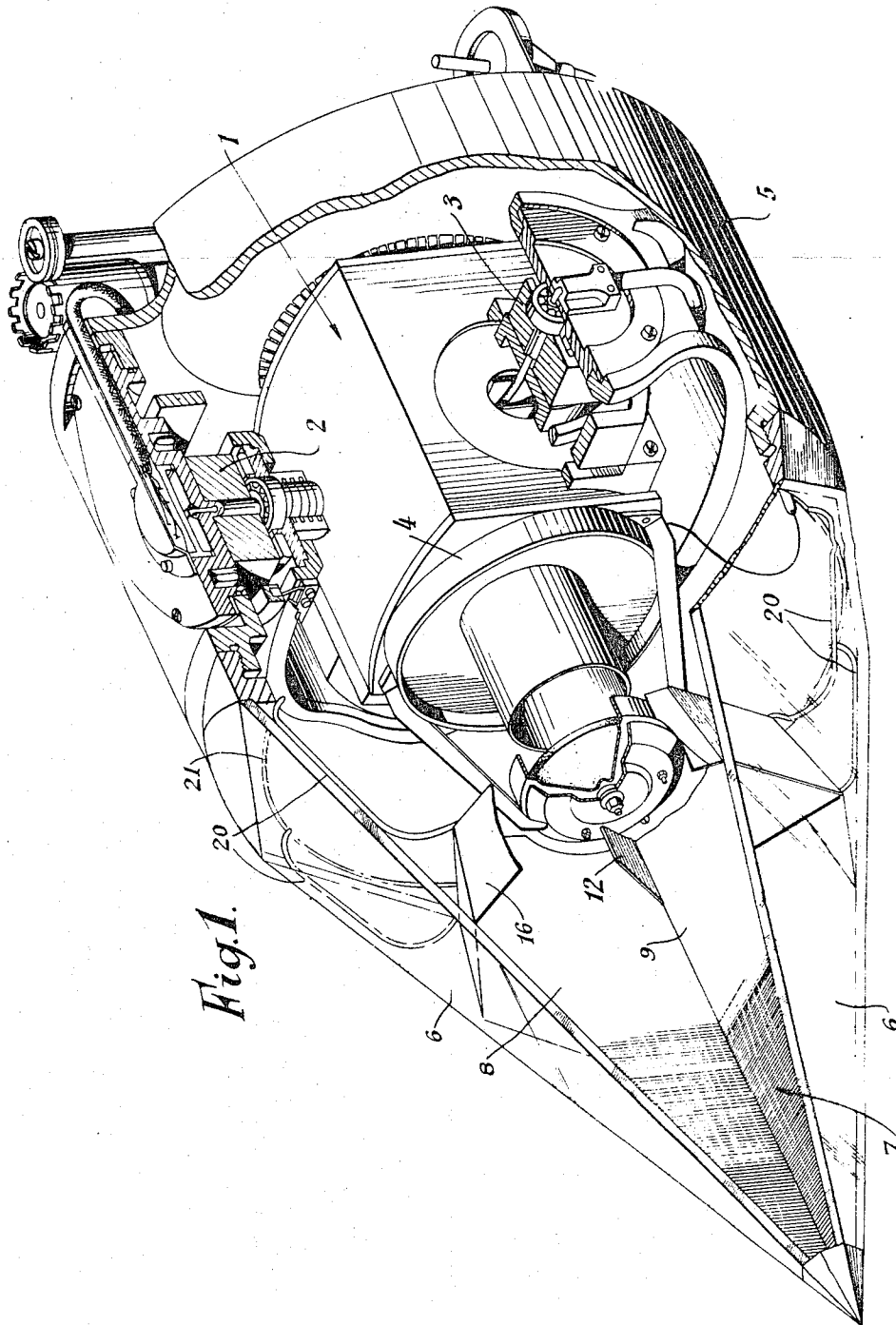


Fig. 1.

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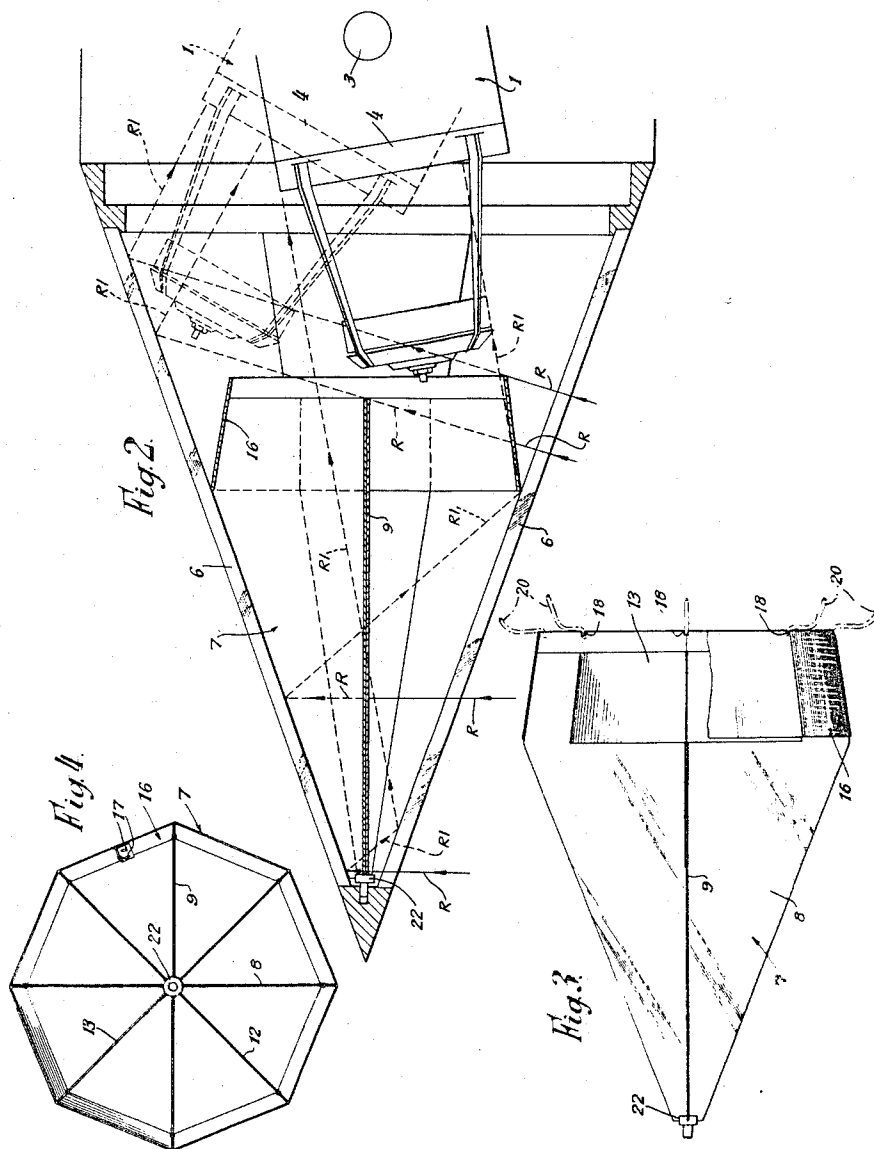
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4 Sheets-Sheet 2



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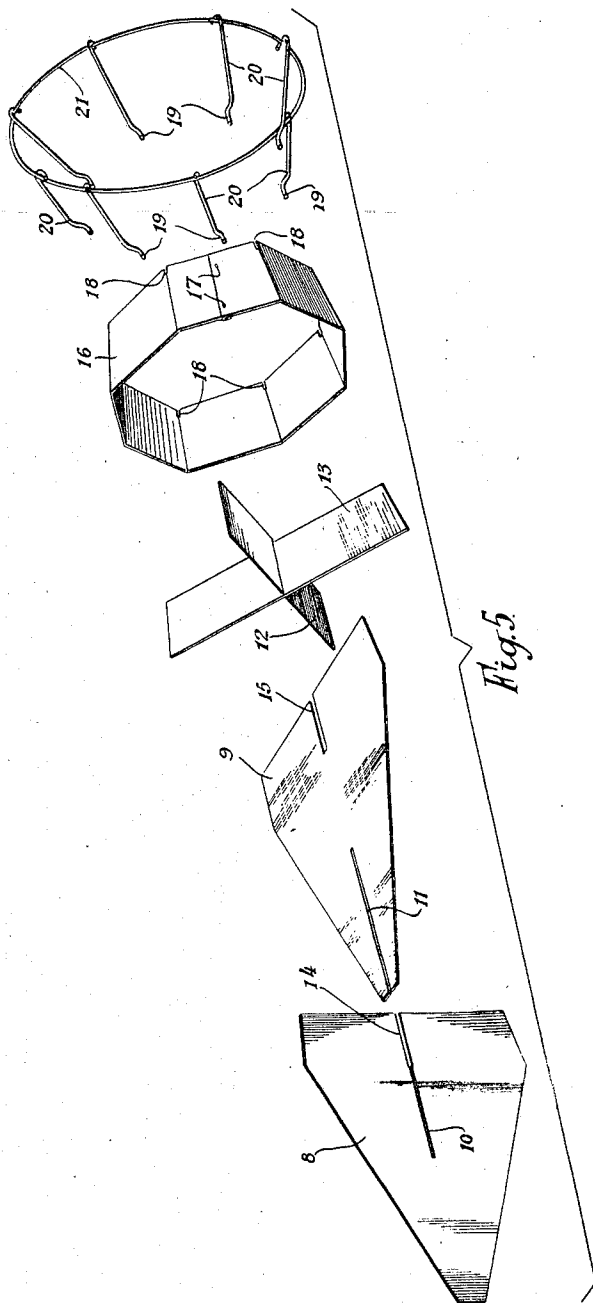
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4 Sheets-Sheet 3



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4 Sheets-Sheet 4

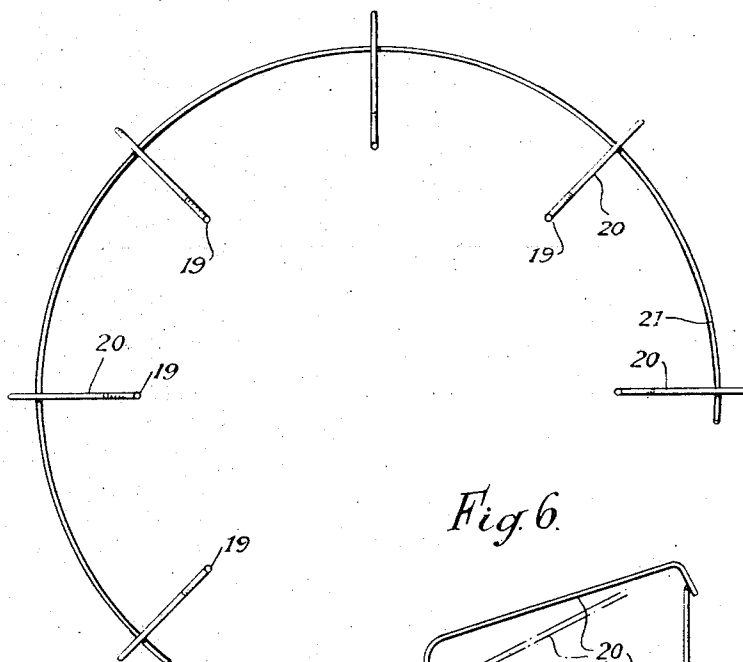


Fig. 6

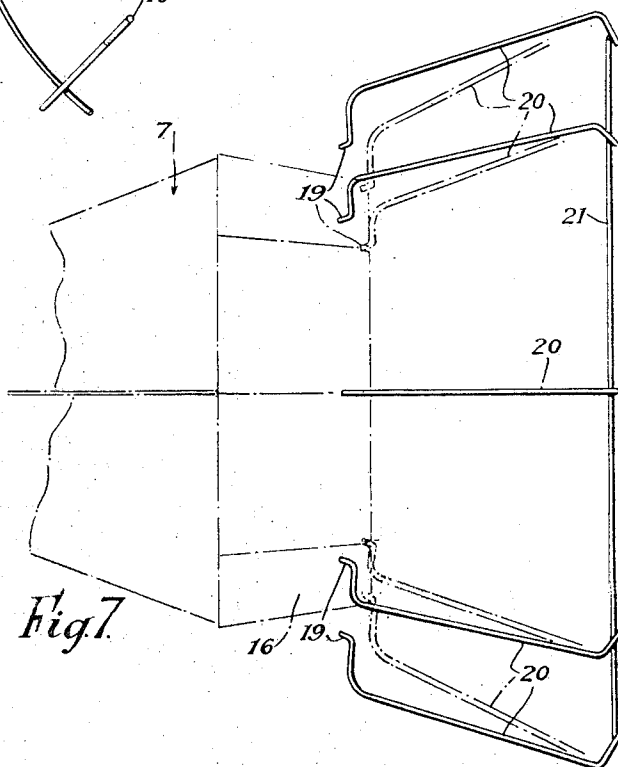


Fig. 7

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1

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**SCREEN FOR GUIDED MISSILES TO
INHIBIT SPURIOUS RESPONSES**

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Filed June 30, 1959, Ser. No. 824,137

Claims priority, application Great Britain, July 1, 1958, 21,122/58

9 Claims. (Cl. 250—83.3)

This invention relates to guided missiles, the missile to which the present invention is applied including a homing head consisting of a transparent nose piece through which infra-red radiations from the target are optically projected into a sensing system which centralises the target in the field of view and indirectly operates the control surfaces of the missile to thereby bring and maintain the missile on target. The transparent nose piece although of any suitable shape, is preferably built up of a plurality, for example, eight, optically flat transparent segments, the nose being therefore of octagonal pyramid shape.

The invention, although applicable to surface to air guided missiles is particularly applicable to guided missiles of the air to air type which are intended to be carried by and released from aircraft and are directed against aircraft targets.

It will be appreciated that for such a missile to operate efficiently, the missile must be so designed that it will reject spurious targets as far as possible and faithfully follow the movements of the target in the field of view.

The acceptance angle or field of view of the sensing system must, therefore, be a compromise between a very small angle which would necessitate a very careful initial aiming of the missile at the target and might also result in the loss of the target from the field of view, and a large angle which would include spurious targets which would be liable to adversely affect the missile's operational efficiency.

In order to increase the field covered by the sensing system, this is mounted on a gymbal system which enables it to scan over a much larger solid angle than that which it covers instantaneously. The area covered by the permitted angular movements of the sensing system is called the field of look.

It will be appreciated, therefore, that it is desirable to exclude as far as possible spurious targets from the field of look.

Spurious targets may be grouped into three distinct classes, namely, enemy counter-measures, clouds and the sun.

The present invention is concerned with the elimination of spurious targets in the third group, namely, solar radiations which do not pass directly into the sensing system but take the form of reflections from the inner surfaces of the transparent nose piece.

Instructions given to the pilot of the missile-carrying aircraft preclude the firing of the missile when the sun is in a position where it can be seen directly by the sensing system.

The invention consists broadly in providing the homing head with an internally positioned screen which will protect the sensing system from solar or other spurious target radiations which might otherwise be reflected off the internal surfaces of the transparent nose into the sensing system.

With such an arrangement, direct radiations from the target, when the latter is situated within the field of look will pass directly into the sensing system, provided this is suitably orientated, but reflections which might accidentally reach the sensing system and emanating from the sun or other spurious targets lying outside the field of

2

look will be intercepted and prevented from reaching the sensing system.

Referring to the accompanying drawings:

FIGURE 1 is a perspective view partly in section illustrating a homing head for a guided missile incorporating an internally positioned screen in accordance with the present invention;

FIGURE 2 is a longitudinal sectional view illustrating the manner in which the screen operates to intercept solar or other spurious target radiations;

FIGURE 3 is a side elevation partly in section of the screen removed;

FIGURE 4 is a front elevation;

FIGURE 5 is an exploded view illustrating the screen components and its wire support;

FIGURE 6 is a fragmentary front elevation of the screen support; and

FIGURE 7 is a side elevation of the same.

FIGURES 1 and 2 illustrate the main constructional parts of the homing head. The sensing system is indicated generally by reference numeral 1, the sensing system being in the form of a unit mounted on gymbals 2 and 3 so that it will have a limited universal angular movement, the sensing system including a sensing head 4, the area covered by the sensing head as a result of the permitted angular movement of the sensing system being referred to as the field of look, this angular movement of the sensing system being clearly depicted in FIGURE 2.

The sensing head is of conventional arrangement and includes an annular primary reflective surface (FIGURE 1) which receives radiations falling on it in directions parallel, or nearly so, to the axis of the sensing head normal to the surface. Such radiations are reflected on to a secondary reflective surface facing and spaced from the primary surface and again reflected through a cylindrical barrel into the sensing head for detection. The sensing head is indirectly connected to control surfaces of the missile to effect control thereof.

The field of acceptance is the space around the axis of the sensing head, within which radiations fall directly on the primary surface. If the sensing head has its axis pointed at, or within a predetermined angle of, a target then direct radiations fall upon the primary surface and are reflected into the sensing system. This is because the target is within the field of acceptance. As the sensing head is mounted in gymbals, its axis movable within a field of look and a target within the field of look will have its radiations received when the axis of the sensing head is so orientated within the field of look that the target is within the field of acceptance.

The control surfaces of the missile are so controlled as to bring the missile into a position in which the axis of the sensing head is centralised on the missile axis when the target is in the field of acceptance, that is when the sensing head is "looking" at the target. The limits of the field of acceptance are set by conventional cylindrical light stops or baffles.

The sensing system is contained within the forward part of the casing 5 of the missile, the casing carrying at its forward end a transparent nose piece of octagonal pyramid shape and built up from eight optically flat transparent segments 6.

If the sensing head is not orientated to "look" at the target, direct radiations close to but not within the field of acceptance are prevented from entering the sensing system in conventional manner by the light stops or baffles. However it is also important to prevent radiations from outside the field of acceptance entering, through the flat segments 6, the space within and being reflected by the internal surfaces of the segments until they are apparently within the field of acceptance being parallel or nearly so, to the axis of the sensing head 4 in one of its positions

of orientation in the field of look (FIGURE 2). Such radiations would, if not stopped, be received into the sensing system and give the impression that the sensing head was "looking" at a target.

Contained within the nose piece is a screen indicated generally by reference numeral 7 the positioning of the screen within the nose piece being clearly shown in FIGURES 1 and 2.

The screen as shown in detail in the remaining figures is built up from a series of metal blanks which are blackened to prevent reflections from their surfaces even at oblique angles, the screening system being so constructed and arranged that whilst effectively preventing spurious solar images indirectly reaching the sensing system, it presents the minimum amount of obstruction to target radiation for all possible target positions.

The screen fits closely within the transparent nose piece and in the case of an octagonal nose piece as illustrated the screen includes two main vanes 8 and 9 which intersect at right angles, vane 8 being formed with a centrally positioned longitudinally arranged slot 10 and vane 9 with a co-operating slot 11 thus enabling the vanes to be assembled together at right angles.

Subsidiary vanes 12 and 13 of shorter length again formed with interengaging slots are provided which enter at their points of intersection slots 14 and 15 formed in vanes 8 and 9 and lie in planes situated at 45° to the planes containing vanes 8 and 9, the outer edges of the vanes engaging the transparent segments of the nose piece at their points of intersection.

Surrounding vanes 12 and 13 is an additional screen or shroud 16 of octagonal shape which may conveniently be bent up from a single blank of sheet metal, the ends being rivetted together as at 17.

The walls of the additional screen 16 taper rearwardly, the rear edge of the additional screen being notched at 18 to receive the hooked ends 19 of a wire screen support including eight resilient wire arms 20 welded to an annular wire ring 21, the wire support locating the screen snugly in position within the transparent nose piece. The arms 20 normally occupy the position shown by full lines in FIGURE 7 but may be sprung inwardly into the dotted line position to engage the notches.

The operation of the screen to intercept spurious target radiations is shown clearly in FIGURE 2.

The sensing head is shown by full lines in an intermediate position within its range of angular movement and by dotted lines in its extreme position in one direction.

Spurious target radiations are shown in full and dotted lines and indicated by reference letters R and reflected images are shown by dotted lines and indicated by reference letters R1.

It will be seen that all the direct and reflected spurious target radiations R and R1 which would come within the field of look of the sensing system are effectively intercepted by the various opaque non-reflecting parts of the screen, the screen fitting closely within the octagonal nose piece as shown clearly in FIGURE 2.

The screen is supported at its forward end by a centrally positioned spigot 22 formed with slots which intersect at right angles and are intended to receive the extremities of vanes 8 and 9.

I claim:

1. In a guided missile including a homing head containing a sensing system sensitive to heat radiations emanating from a target and angularly movable to cover a predetermined field of look, the missile having a transparent nose piece through which the said radiations can pass into the sensing system, a screen adapted to fit closely within the length and breadth of the nose piece of opaque non-reflective material and radiating outwardly from a center line in the form of a cross, said screen comprising two substantially polygonal blanks, said blanks being formed of two similar substantially triangular portions, a forward elongated, substantially triangular, tapered por-

tion and a rearward truncated triangular portion, and subsidiary screens of opaque non-reflective material disposed between the rearward ends of said blanks adjacent the truncated triangular portion.

2. A screen as claimed in claim 1, including a shroud enclosing the two sets of blanks at their rearward ends.

3. A screen as claimed in claim 1, wherein the outer edges of the blanks at their rearward ends taper rearwardly and are enclosed by a shroud in the form of a multi-sided rearwardly tapering ring.

4. A screen as claimed in claim 1, positioned at its rearward end in said nose piece by a wire support in the form of a ring having a series of forwardly directed resilient wire arms adapted to engage the composite screen at its rear end.

5. In a guided missile including a homing head containing a sensing system sensitive to heat radiations emanating from a target and angularly movable to cover a predetermined field of look, the missile having a transparent nose piece through which the said radiations can pass into the sensing system, a screen adapted to fit closely within the length and breadth of the nose piece of opaque non-reflective material and radiating outwardly from a center line in the form of a cross, said screen comprising two substantially polygonal blanks, said blanks being formed of two similar substantially triangular portions, a forward elongated, substantially triangular, tapered portion and a rearward truncated triangular portion, the outer edges of the blanks at their rearward ends tapering rearwardly and being enclosed by a shroud in the form of a multi-sided, rearwardly tapering ring.

6. A screen as claimed in claim 5, positioned at its rearward end in said nose piece by a wire support in the form of a ring having a series of forwardly directed resilient wire arms adapted to engage the composite screen at its rear end.

7. A screen as claimed in claim 3, positioned at its rearward end in said nose piece by a wire support in the form of a ring having a series of forwardly directed resilient wire arms adapted to engage the composite screen at its rear end.

8. In a guided missile including a homing head containing a sensing system sensitive to heat radiations emanating from a target and angularly movable to cover a predetermined field of look, the missile having a transparent nose piece through which the said radiations can pass into the sensing system, a screen adapted to fit closely within the length and breadth of the nose piece of opaque non-reflective material and radiating outwardly from a center line in the form of a cross, said screen comprising two substantially polygonal blanks, said blanks being formed of two similar substantially triangular portions, a forward elongated, substantially triangular, tapered portion and a rearward truncated triangular portion, said screen being positioned at its rearward end in said nose piece by a wire support in the form of a ring having a series of forwardly directed resilient wire arms adapted to engage the composite screen at its rear end.

9. In a guided missile including a homing head containing a sensing system sensitive to heat radiations emanating from a target and angularly movable to cover a predetermined field of look, the missile having a transparent nose piece through which the said radiations can pass into the sensing system, a screen adapted to fit closely within the length and breadth of the nose piece, of opaque non-reflective material and radiating outwardly from a center line in the form of a cross, said screen being built up of vanes of opaque, non-reflective material comprising two main flat vanes intersecting at right angles and two shorter vanes also intersecting at right angles and arranged intermediate the main vanes, the main vanes and shorter vanes being enclosed at the rear end of the screen by a shroud in the form of an octagonal, rearwardly tapering ring.

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