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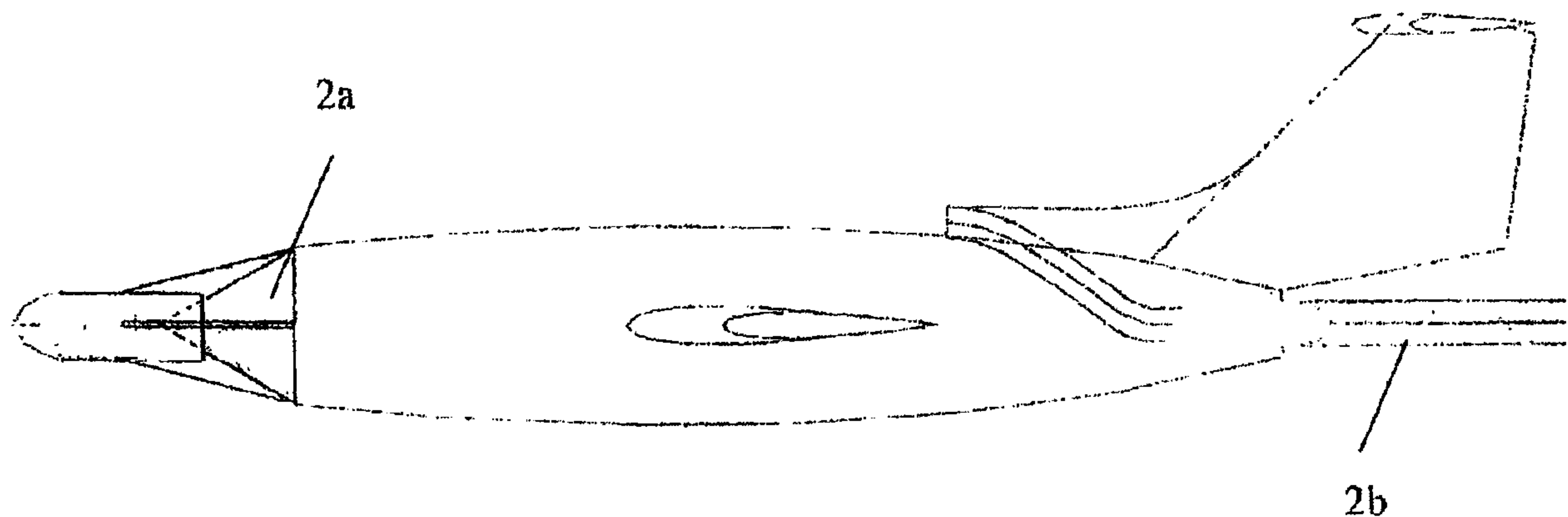
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(72) Inventeurs/Inventors:
OBKIRCHER, BERNT, DE;
STEINWANDEL, JUERGEN, DE;
HELLER, MARKUS, DE;
WILLNEFF, RAINER, DE

(73) Propriétaire/Owner:
EADS DEUTSCHLAND GMBH, DE

(74) Agent: ROBIC

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(57) Abrégé/Abstract:

The invention relates to an airborne vehicle for IR airborne target representation having at least one infrared transmitter (2). According to the invention, an infrared transmitter (2) is arranged within the exhaust gas flow of a heat-producing unit (1) which is also carried, in such a manner that the exhaust gas flow completely surrounds that surface of the infrared transmitter (2) which is subjected to the airflow.

Abstract

The invention relates to an airborne vehicle for IR airborne target representation having at least one infrared transmitter (2). According to the invention, an infrared transmitter (2) is arranged within the exhaust gas flow of a heat-producing unit (1) which is also carried, in such a manner that the exhaust gas flow completely surrounds that surface of the infrared transmitter (2) which is subjected to the airflow.

Airborne vehicle for IR airborne target representation

10 The invention relates to an airborne vehicle for IR
airborne target representation having at least one
infrared transmitter.

Unmanned airborne vehicles are used as airborne targets
15 in order to exercise ground to air or air to air weapon
systems which use infrared (IR) guidance. These
airborne vehicles may be towed airborne vehicles or
drones. As far as possible, they should not only
simulate the kinetic characteristics of the actual
20 targets (for example combat aircraft), but should also
have the same infrared (IR) emission.

Towed airborne vehicles and target drones which produce
the desired IR emission by means of so-called tracking
25 flares are known. These have the disadvantage that they
can be seen in the visual band and produce a smoke
trail after them. Furthermore, the spectral
characteristic of these flares is not matched to the
radiation of the real targets. In addition,
30 irregularities in the way in which the flares burn away

- 2 -

result in undesirable tracking problems in the IR homing head.

EP 0 876 579 B1 discloses a target drone which produces
5 IR emission by a burner, which is installed in the nose
of the drone, heating the nose from the inside. The
heated nose is in this case used as an infrared
transmitter. In addition to the complex burner
structure and the complicated air supply and exhaust
10 gas routing in order to ensure stable combustion, this
has the disadvantage that the nose is cooled to a major
extent from the outside by the wind of motion, so that
very high heating power levels are required in order to
achieve adequate IR emission.

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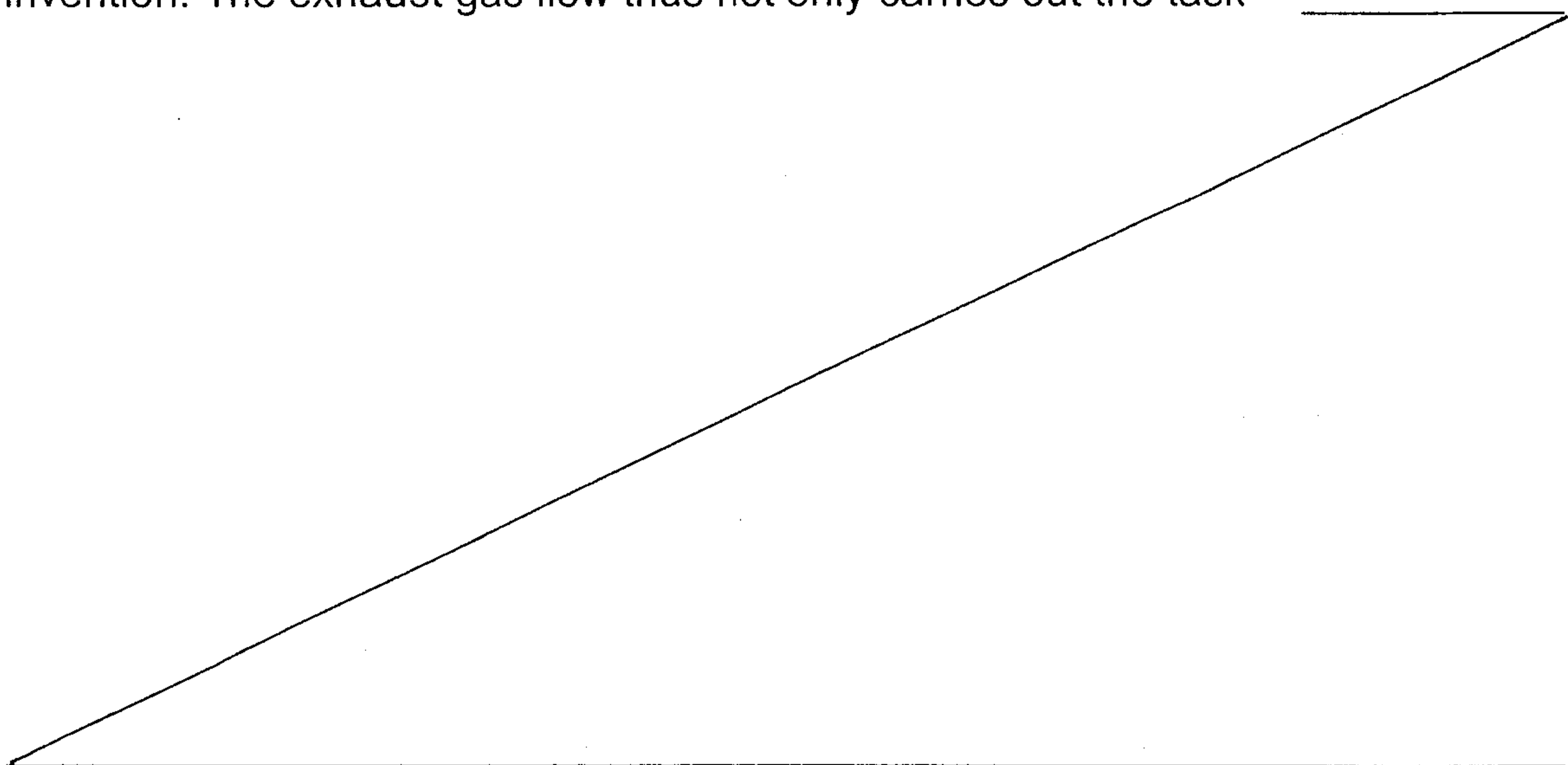
Furthermore, WO 00/29804 discloses an IR airborne
target vehicle, in which the IR emission is produced by
passing hot gas from the propulsion unit by means of a
pipeline to the nose of the airborne vehicle, and/or to
20 the leading edge of the wings and/or to external pods
on the airborne vehicle, by which means these parts are
heated from the inside and thus become infrared
transmitters. In addition to the design complexity,
another disadvantage here is that the parts which are
25 heated from the inside are cooled from the outside by
the wind of motion, so that only low-level IR emissions
can be achieved overall.

The object of the invention is to provide an airborne vehicle of this generic type for IR airborne target representation, whose design is simple and cost-effective and which has a high IR emission efficiency in terms of the amount of heating power that needs to be consumed.

This object is achieved with an airborne vehicle for IR airborne target representation having at least one infrared transmitter, characterized in that an infrared transmitter is arranged within the exhaust gas flow of a heat-producing unit which is also carried, in such a manner that the exhaust gas flow completely surrounds that surface of the infrared transmitter which is subjected to the airflow.

- 10 The airborne vehicle may be a towed or self-propelled airborne vehicle.

One advantage of the airborne vehicle according to the invention is that the exhaust gas flow prevents the infrared transmitter from being cooled by the cooling wind of motion. This is achieved in particular by the surface of the infrared transmitter, around which the wind of motion (airflow) would otherwise flow during flight, thus cooling it down, actually being surrounded by the exhaust gas flow, according to the invention. The exhaust gas flow thus not only carries out the task



- 4 -

of heating the infrared transmitter, that is to say those components which are intended to be used as the infrared transmitter, but also of acting as a type of screening protective sheath around the hot infrared
5 transmitter.

A further advantage of the airborne vehicle according to the invention is that the infrared transmitter arranged according to the invention allows IR emission
10 in virtually any desired direction. For example, it is thus possible to provide IR emission in the forward direction, to the rear and to the side, in each case seen in the direction of flight.

15 The heat-producing unit can advantageously be a propulsion unit for the airborne vehicle or an additionally burner, in particular a gas burner. The propulsion unit is expediently an airborne gas turbine or an internal combustion engine used for propulsion.

20

In one advantageous embodiment of the airborne vehicle according to the invention, the IR transmitter is a component which extends along the propagation direction of the exhaust gas flow and has a cruciform or
25 star-shaped cross section. However, it is also possible, in a further advantageous embodiment of the airborne vehicle according to the invention, for the infrared transmitter to be a conical component, whose axis extends along the propagation direction of the

- 5 -

exhaust gas flow. It is, of course, possible for the infrared transmitter to be composed of a number of components as well, for example of a number of plates, in particular thin metal sheets, which are connected to
5 one another in some suitable manner.

The infrared transmitter is advantageously composed of a temperature-resistant material, for example stainless steel or ceramic. These materials can be heated to
10 temperatures which are well above the normally expected exhaust gas temperatures of the heat-producing units. If, for example, airborne gas turbines are used as a propulsion unit and hence as the heat-producing unit for heating an infrared transmitter, the exhaust gas
15 temperatures are in the range 400-800°C, depending on the performance class (a few tens of Newtons to one hundred Newtons of thrust). It should be mentioned here that, although the exhaust gas from an airborne gas turbine or from an internal combustion engine is hot at
20 the stated temperatures, it is, however, unsuitable for use as an infrared transmitter in the medium IR band from 3 to 5 μm . In this wavelength band, the exhaust gas is virtually transparent, and thus emits virtually nothing, at least transversely with respect to the jet
25 direction. The heat of the exhaust gas can thus be used only indirectly, by heating up a solid body which then produces the desired IR emission on the basis of its temperature.

- 6 -

The components which are used as IR transmitters advantageously have a surface with a high emission capability in the infrared spectral band. The emission response of the components can then be adjusted in terms of the emitted infrared wavelength band. This is advantageously achieved by the surface of the components being coated with an electrically insulating material.

10 The thermal transport within the material, and hence the temperature distribution on the surface, can be influenced in order to achieve greater IR emission by varying the material thickness of the components which are used as IR transmitters so that greater overall IR emissions can be expected from a material with low thermal conductivity.

Furthermore, the temperature of the infrared transmitters, and hence the IR emission, can be influenced by varying the exhaust gas temperature. This may be achieved, for example, when using an airborne gas turbine as the heat-producing unit by means of an internal controller, which varies the cross-sectional area of the outlet nozzle of the turbine in order to increase the exhaust gas temperature.

The IR emission from the infrared transmitters may, of course, also be influenced by the geometrical size of the components which are placed in the exhaust gas

- 7 -

flow. Furthermore, when using propulsion units as the heat-producing units, the IR emission from the components can also be influenced by the exhaust gas from the propulsion units being routed in a manner
5 which is matched to the components.

In one advantageous embodiment of the airborne vehicle according to the invention, the heat-producing units are attached together with the IR transmitters arranged
10 in their exhaust gas flow, in front of the nose on the longitudinal axis of the airborne vehicle, and/or at the tail and/or on the wing surfaces and/or on the fuselage of the airborne vehicle.

15 If the heat-producing unit together with the IR transmitter is mounted in front of the nose on the longitudinal axis of the airborne vehicle, then the IR transmitter is expediently designed to be conical or virtually conical, thus resulting in relatively low
20 drag. In one advantageous embodiment of the airborne vehicle, the nose is itself conical or approximately conical and is in the form of an IR transmitter. This arrangement allows IR emission in the direction of flight of the airborne vehicle and, depending on the
25 beam angle of the conical IR transmitter, in the lateral direction as well.

If the heat-producing unit together with the IR transmitter is attached to the tail and/or to the wing

- 8 -

surfaces and/or to the fuselage of the airborne vehicle, then the IR transmitter is expediently a suitable component which extends along the propagation direction of the exhaust gas flow and has a cruciform or star-shaped cross section. The component thus has low drag, which reduces the thrust only to a minor extent when a propulsion unit is used as the heat-producing unit. This arrangement allows IR emission laterally with respect to the direction of flight of the airborne vehicle.

When using at least two propulsion units as the heat-producing units, the propulsion units may advantageously be aligned at an angle which can be predetermined with respect to the longitudinal axis of the airborne vehicle, in fact in such a way that the overall impulse of these propulsion units is directed along the longitudinal axis of the airborne vehicle. In addition to a lateral IR radiation component, this also results in an IR radiation component in the forward direction and to the rear (in each case seen in the direction of flight of the airborne vehicle).

It is, of course, also possible to provide a propulsion unit with an IR transmitter in front of the nose of the airborne vehicle, and further propulsion units on or in the fuselage of the airborne vehicle.

- 9 -

The invention as well as advantageous embodiments of the invention will be explained in more detail with reference to drawings, in which:

- 5 Figure 1 shows a perspective side view of a first embodiment of the arrangement of an IR transmitter in the exhaust gas flow of a heat-producing unit,
- 10 Figure 2 shows the IR transmitter from Figure 1 with an additional flame holder,
- Figure 3 shows a perspective side view of a second embodiment of the arrangement of an IR transmitter in the exhaust gas flow of a
- 15 heat-producing unit, and
- Figure 4 shows a side view of an airborne vehicle according to the invention with an IR
- 20 transmitter located in front of the nose and at the tail.

The left-hand illustration in Figure 1 shows, schematically, a perspective side view of a

25 heat-producing unit, for example an airborne gas turbine 1, with an IR transmitter 2 located in the exhaust gas flow (not shown). The IR transmitter 2 is connected to the nozzle 3 of the turbine 1. It is, of course, also possible, taking into account aerodynamic

- 10 -

aspects, to position the IR transmitter 2 in a different way in the exhaust gas jet of the turbine 1, for example by means of holding rods.

5 The IR transmitter 2 is in the form of a so-called cruciform plate, that is to say thin metal sheets with thin walls, for example 0.2-1 mm thick, are connected to one another in some suitable manner, for example, by being welded or else plugged into one another, such
10 that the cross section of the IR transmitter, as is shown in the right-hand illustration in Figure 1, is cruciform. The right-hand illustration in Figure 1 also shows that the IR transmitter 2 is aerodynamically inserted into the exhaust gas flow from the turbine 1,
15 and therefore does not significantly reduce the thrust of the turbine. Furthermore, both the illustrations in Figure 1 show that the IR transmitter 2 is located within the exhaust gas flow. The hot exhaust gas flow thus flows completely around the IR transmitter 2,
20 heating it up. Seen in the direction of flight of the airborne vehicle, this IR transmitter 2 ensures IR emission in the lateral direction as well in the upward direction and to the rear.

25 Figure 2 shows, schematically, the arrangement shown in Figure 1 with a further advantageous embodiment. In this case, a flame holder 4 is attached to the IR transmitter 2. The flame holder 4 makes it possible to produce a flame (not shown) which locally heats the IR

- 11 -

transmitter 2. It is thus possible to influence the temperature of the IR transmitter 2, and hence the IR emission, individually. The flame holder 4 may in this case be arranged on the IR transmitter 2, at a distance
5 which can be predetermined from the turbine 1. The flame holder 4 may be supplied, for example, by means of temperature-resistant supply pipelines 5, which lead into the interior of the airborne vehicle. Liquid fuel or a combustion gas, for example, may be used to
10 produce the flame in the flame holder 4.

The left-hand illustration in Figure 3 shows schematically and in the form of a perspective side view a second embodiment of the arrangement of an IR
15 transmitter 2 in the exhaust gas flow of a heat-producing unit 1, for example an airborne gas turbine. The turbine 1 and the IR transmitter 2 are positioned axially at a distance which can be predetermined in front of the nose of the airborne
20 vehicle 6. The turbine 1 is connected to the fuselage of the airborne vehicle 6 by means of holding rods 7. The holding rods 7 may be designed aerodynamically in particular such that they produce only a small amount of drag while the airborne vehicle is in flight.

25

A nozzle 3, for example an annular nozzle, is normally arranged at the outlet from the turbine 1. The conical IR transmitter 2 is expediently attached to the nozzle
3. The exhaust gas from the turbine 1 thus flows out of

- 12 -

the annular nozzle 3 and is deflected laterally by the conical IR transmitter 2 depending on the opening angle of the cone, such that a resultant thrust still remains for the airborne vehicle 6. At the same time, the conical IR transmitter 2 is heated by the exhaust gas. The exhaust gas thus flows over the entire cone of the IR transmitter 2, thus preventing the IR transmitter from being cooled by the wind of motion during flight.

10 The IR transmitter 2 in this illustration is a conical component, which is attached to the nose of the airborne vehicle 6. However, it is also possible for the nose of the airborne vehicle 6 to be conical and to form the IR transmitter 2. In both cases, the IR transmitter 2 produces only a small amount of drag.

The right-hand illustration in Figure 3 shows a schematic front view of the left-hand illustration. This shows that this arrangement allows IR emission to be produced in the forward direction, that is to say in the direction of flight of the airborne vehicle 6. The IR emission is reduced only to an insignificant extent by the turbine 1 and by the holding rods 7. Furthermore, IR emission in the lateral direction is also possible, depending on the opening angle of the cone.

Figure 4 shows a side view of an airborne vehicle according to the invention which, by way of example,

- 13 -

has an IR transmitter 2a on the nose and an IR transmitter 2b at the tail.

WHAT IS CLAIMED IS:

1. Airborne vehicle for IR airborne target representation having at least one infrared transmitter (2), characterized in that an infrared transmitter (2) is arranged within the exhaust gas flow of a heat-producing unit (1) which is also carried, in such a manner that the exhaust gas flow completely surrounds that surface of the infrared transmitter (2) which is subjected to the airflow.
2. Airborne vehicle according to claim 1, characterized in that the infrared transmitter (2) is a component which extends along the propagation direction of the
10 exhaust gas flow and has a cruciform or star-shaped cross section.
3. Airborne vehicle according to claim 2, characterized in that a flame holder (4) is provided on the infrared transmitter (2), for local heating of the infrared transmitter (2).
4. Airborne vehicle according to claim 1, characterized in that the infrared transmitter (2) is a conical component, which extends along the propagation direction of the exhaust gas flow.
5. Airborne vehicle according to any one of claims 1 to 4, characterized is that the infrared transmitter (2) is composed of one or more temperature-resistant materials.
- 20 6. Airborne vehicle according to any one of claims 1 to 5, characterized is that the surface of the infrared transmitter (2) has a high emission capability in the infrared spectral band.

7. Airborne vehicle according to claim 6, characterized is that the surface of the infrared transmitter (2) is coated with electrically insulating materials.

8. Airborne vehicle according to any one of claims 1 to 7, characterized in that a heat-producing unit (1) with an infrared transmitter (2) arranged in its exhaust gas flow is mounted: axially in front of the nose, at the tail, on the wing surfaces of the airborne vehicle, or on the fuselage of the airborne vehicle (6) or a combination thereof.

9. Airborne vehicle according to claim 8, characterized in that the nose of the airborne vehicle (6) is approximately conical, and is thus used as the infrared transmitter (2).
10

10. Airborne vehicle according to claim 8 or 9, characterized in that the heat-producing unit (1), which is located in front of the nose of the airborne vehicle (6), is attached by means of holding rods (7) to the fuselage of the airborne vehicle (6).

11. Airborne vehicle according to any one of claims 1 to 10, characterized in that that heat-producing unit (1) is a propulsion unit in particular an airborne gas turbine, an internal combustion engine or a gas burner.

12. Airborne vehicle according to claim 11, characterized in that at least two propulsion units (1) are provided, and are aligned with respect to one another such that the overall impulse of the propulsion units acts in the longitudinal direction of the airborne vehicle (6).
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13. Airborne vehicle according to claim 11, wherein the propulsion unit is an airborne gas turbine, an internal combustion engine, or a gas burner.

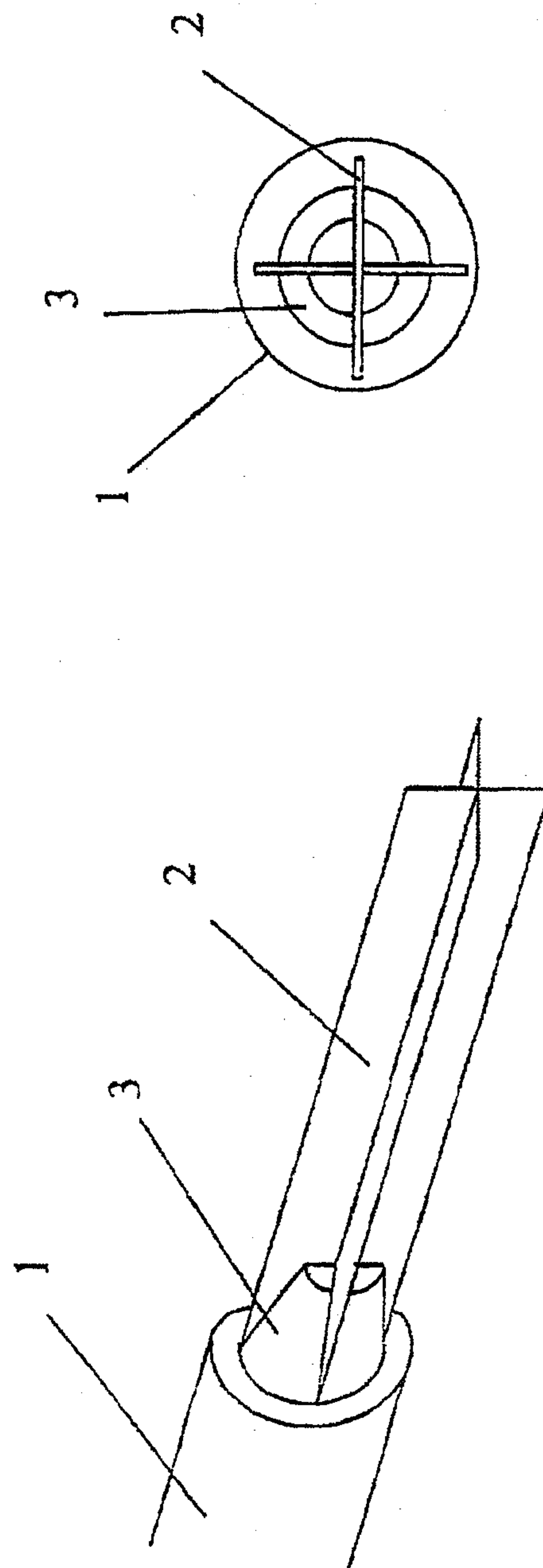


Fig. 1

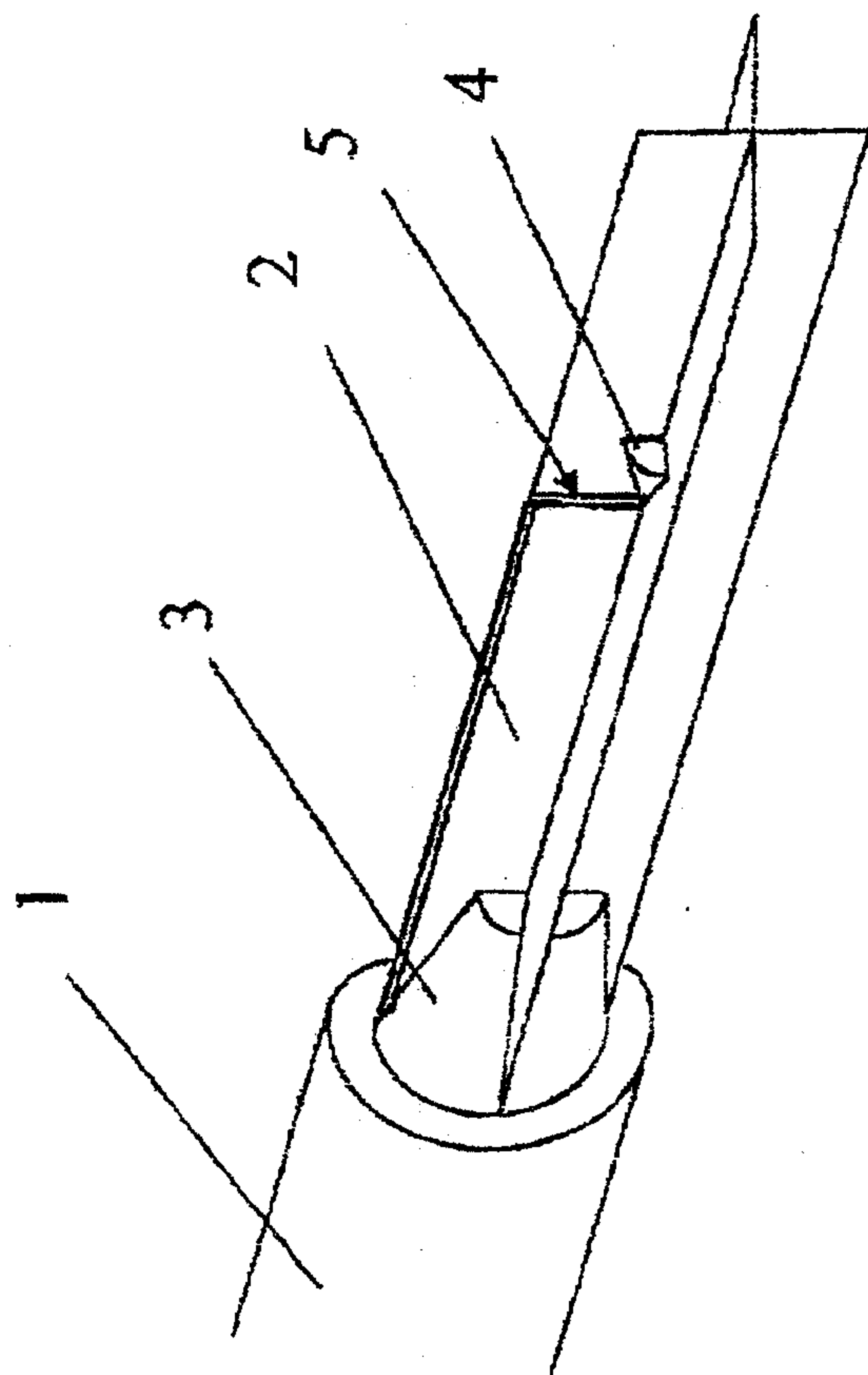


Fig. 2

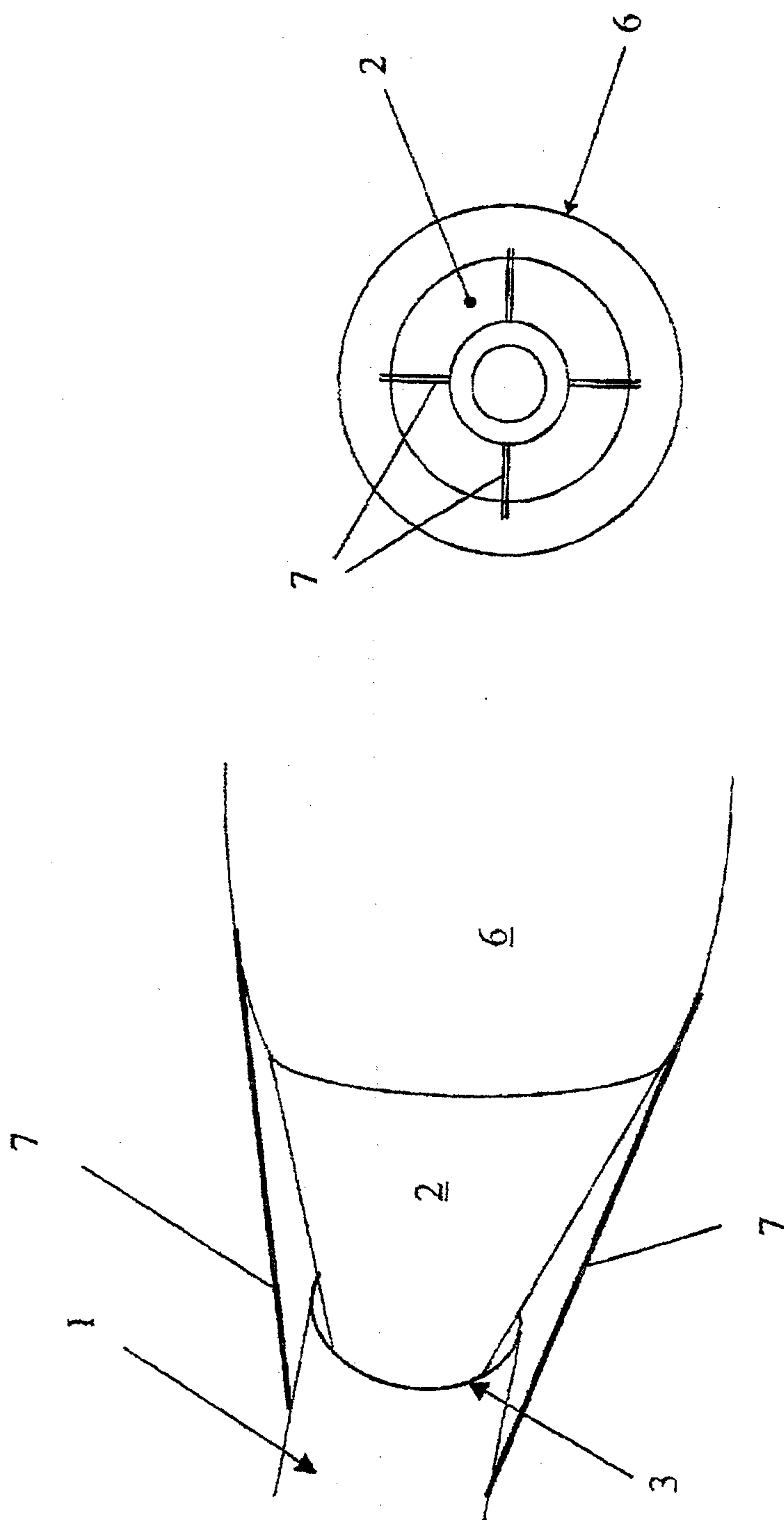


Fig. 3

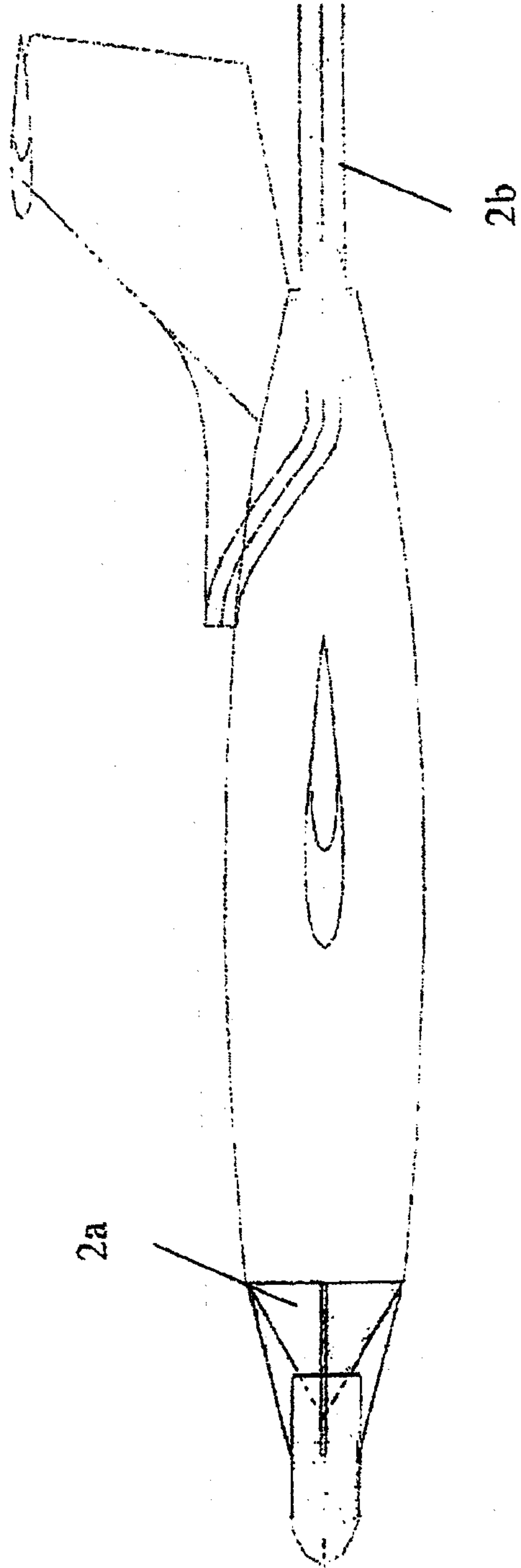


Fig. 4

