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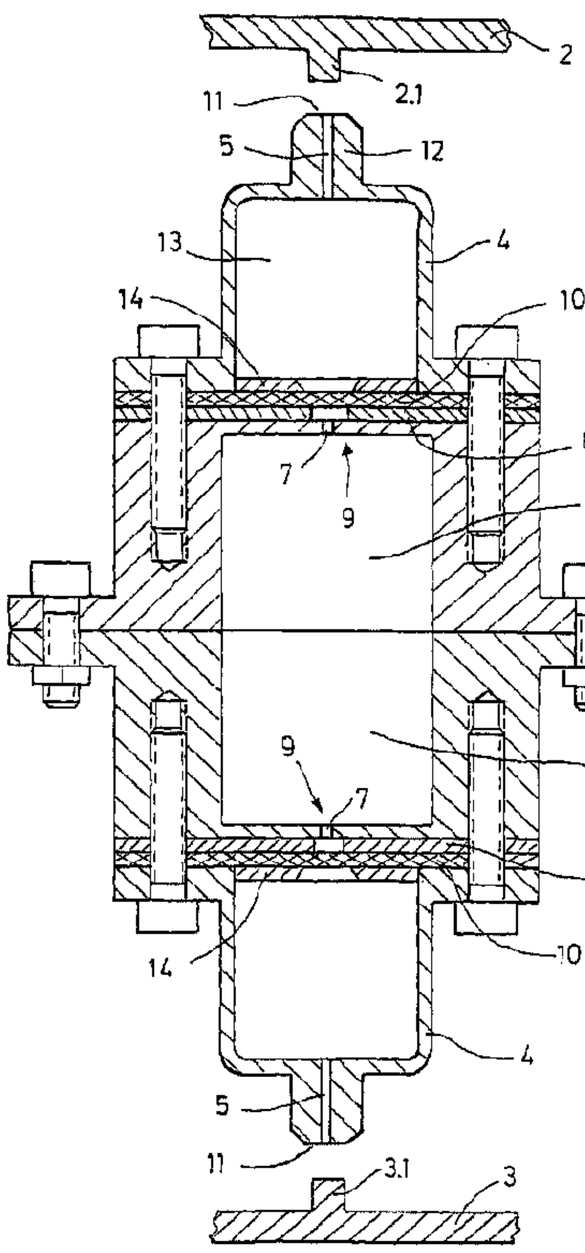
(54) **Titre : PROCEDE ET DISPOSITIF PERMETTANT D'AMENER A FUSION UNE MATIERE THERMOPLASTIQUE, EN PARTICULIER POUR LE SOUDAGE D'ELEMENTS EN MATIERE PLASTIQUE**

(54) **Title: METHOD AND DEVICE FOR MELTING A THERMOPLASTIC PLASTIC MATERIAL, IN PARTICULAR FOR WELDING PLASTIC PARTS**



(57) **Abrégé/Abstract:**
The invention relates to a method for melting a thermoplastic plastic material, particularly for welding plastic parts, wherein the plastic is heated by means of heat radiation via a radiation body (4) and simultaneously by the application of a hot gas, wherein the invention provides for the radiation body (4) to be heated on the interior thereof by burning a combustion gas, and for the exhaust resulting from the burning to be applied to the plastic material.

Abstract

The invention relates to a method for melting a thermoplastic plastic material, particularly for welding plastic parts, wherein the plastic is heated by means of heat radiation via a radiation body (4) and simultaneously by the application of a hot gas, wherein the invention provides for the radiation body (4) to be heated on the interior thereof by burning a combustion gas, and for the exhaust resulting from the burning to be applied to the plastic material.

DESCRIPTION

Method And Device For Melting A Thermoplastic Plastic Material, In Particular For Welding Plastic Parts

The invention relates to a method and a device for melting a thermoplastic plastic material, in particular for welding plastic parts, wherein the plastic material is heated by means of heat radiation via a radiation body and simultaneously by the application of a hot gas through convection.

As is known, when welding plastic parts, the surfaces of two joint parts to be joined are heated to a jointing temperature at which the plastic material is melted and the heated surfaces are then joined under pressure. Various physical means are used to melt the plastic along the weld line: heat conduction, inner and outer friction, convection and/or radiation. To ensure that the plastic parts to be welded together join, the plastic materials must be in a plastic state when jointing.

A method and device of the generic type are known from EP 1 415 789 B1, wherein, to melt the plastics, they are heated by means of heat radiation and simultaneously acted upon with a hot gas. As a hot gas, either heated air is used or an inert gas, e.g. nitrogen or another inert gas is used which is supplied to the plastic through openings in the radiation body. The gas is heated by means of heating elements, such as heating wires or heating cartridges.

The object of the invention is to provide a method and a device of the generic type wherein the energy is used very efficiently.

According to one aspect of the present invention, there is provided a method of melting surfaces of two thermoplastic parts, the method comprising the steps of: for each of at least two radiators, arranged opposite one another, spacedly juxtaposing each radiator provided internally with a burner with the surfaces of the parts; burning a combustion gas with the burner inside the radiator so as to directly heat an outer face of the radiator while creating hot exhaust gas inside the radiator; and exhausting the hot exhaust gas through an outlet in the outer face to direct a stream of the hot exhaust gas at the surfaces of the parts spacedly juxtaposed with the outer face to convectively heat and melt the surfaces while simultaneously radiating heat from the outer face of the radiator at the surfaces of the parts, whereby the parts are heated both radiantly and convectively.

According to another aspect of the present invention, there is provided a method of welding two thermoplastic parts, the method comprising the steps of: burning a gas with a burner inside each of a pair of radiators arranged opposite to one another so as to heat outer faces of the radiators and create hot exhaust gas inside the radiators; spacedly juxtaposing each of the thermoplastic parts with a respective one of the outer faces to radiantly heat regions of the thermoplastic parts; exhausting the hot exhaust gas through outlets in each of the faces to direct respective streams of the hot exhaust gas at the thermoplastic parts spacedly juxtaposed with the outer faces to

convectively heat and melt the regions thereof; and pressing together the melted regions.

The invention will be described in the following with reference to an example of an embodiment illustrated in a simplified manner, showing:

Fig. 1 the side view of a welding machine with the device according to the invention,

Fig. 2 the section through a device according to the invention,

Fig. 3 a perspective representation of the embodiment according to Fig. 2,

Figures

4 - 8 show the structure of the device according to Fig. 2,

Fig. 9 shows an alternative device in a perspective view which is used to melt a flat welded part.

As shown in Fig. 1, the device 1 for melting plastics is part of

a welding machine for welding plastic parts, which are provided with the reference numbers 2 and 3 in Fig. 2. As in the known heating element welding machines, the surfaces of two plastic parts 2, 3 to be joined are heated by means of the device 1 to the jointing temperature at which the plastics of both parts are in a plastic state along the weld line. The heated surfaces are then joined under pressure.

The device, shown in section and perspectively in Figs. 3 to 8, is used in each case to heat a straight, elongated and narrow jointing surface 2.1, 3.1 on the plastic parts 2, 3. The device has at least one tubular radiation body 4 which is heated on its inner side by burning a combustion gas and whose outer surface emits the combustion energy in the form of heat radiation. The radiation body 4 has outlets 5 for the combustion exhaust gases which are each directed to the jointing surfaces of the plastic parts 2, 3.

To heat both plastic parts 2, 3, the device has two radiation bodies 4 with exhaust openings 5 which are each arranged opposite one another and joined together. Preferably, the two radiation bodies 4 are built and arranged mirror-inverted to one another and have a common supply channel 6 for the heating gas, preferably a gas/air mixture. The outer contour of the radiation body 4 and the arrangement of the exhaust openings 5 is adapted to the jointing surfaces of the plastic parts 2, 3 to be heated.

In the embodiment according to Fig. 2, both parts of the device

each contain a feed channel 6 for the heating gas, wherein the two channels interlock when the two parts are screwed together, so that a jointly used feed channel 6 is produced in which the supplied heating gas is distributed uniformly. Both channels 6 each have a row of gas outlets 7 along their base which are covered by a seal 8. A fleece 10 rests on the seal, said fleece being covered in turn by a cover plate 14. The seal 8, the fleece 10 and the cover plate 14 also have openings, so that the openings 7 are not covered. The openings 7, the seal 8, the fleece 10 and the cover plate 14 form a burner 9, the flame and exhaust area of which is the interior of the radiation body 4. The fleece 10 thereby causes the heating gas to burn very uniformly in the burner 9.

On the exhaust side, the burner 9 is sealed by the tubular radiation body 4, so that all exhaust gases are transported outward through the radiation body 4 and then through the openings 5. The radiation body 4 is heated by means of the burner 9 over its interior, such that its outer surface radiates heat and emits it to the plastic part 2, 3.

At the start of the heating, the heating gas is fired by an ignition device. It burns uniformly in the burner 9 on the fleece 10. The burner 9 is operated in such a way that the radiation body 4 heats powerfully and emits radiation heat on its outer surface. This radiation heat is emitted via the correspondingly formed area 11 of the surface of the radiation body 4 to the jointing surface 2.1, 3.1 of the plastic parts 2, 3. The exhaust gas produced in the burner 9 collects

inside the tubular radiation body 4, then escapes through the openings 5 and strikes the jointing surfaces 2.1, 3.1. The radiating surface 11 of the radiation body 4 and the openings 5 are thereby designed and arranged in such a way that they follow the jointing surface 2.1, 3.1 to be heated.

To control the melting process, a temperature sensor 12 is arranged in the area of the radiating surface 11 of the radiation body 4 which measures the temperature of the surface 11. By means of the sensor 12, the burner 9 is operated in such a way that the desired temperature of the radiation surface 11 sets in. Preferably, a second temperature sensor 13 is situated inside the radiation body 4 by which the exhaust temperature is measured. As a result, the burner 9 can be adjusted or controlled in such a way that the desired exhaust temperature or temperature on the surface 11 sets in.

The jointing surface 2.1, 3.1 of the plastic parts 2, 3 can in this way be melted in a defined manner by the hot exhaust gas and by the radiating heat emitted by the radiation body 4.

Preferably, the gas/air mixture for the combustion is set such that the oxygen content in the exhaust gas is minimal. Thus, the exhaust gas simultaneously acts as an inert gas during heating of the plastic parts 2, 3. In this way, the formation of oxygen compounds on the surface of the plastic is reduced or even prevented during heating.

As noted above, the contour of the radiation body 4 is adapted to

the contour of the plastic parts 2, 3 to be heated. In the event that certain areas of a plastic part 2, 3 exposed to the heat radiation or convection are not to be heated, then this can be attained by screen-like covers. These covers are attached to the outside of the radiation body 4 at the corresponding points and prevent the corresponding areas of the plastic parts 2, 3 from being inadmissibly heated.

An embodiment is shown in Fig. 9 which is used to melt a flat plastic part. The radiating outer surface 11 of the radiation body 4 is, for example, circular on the outside and cross-shaped in the middle. A plurality of outlets 5 for the exhaust gas from the combustion are arranged inside the radiating surface 11. In this way, the contour of the parts to be welded is shown, here, for example, a circle and a cross. Any other contour desired corresponding to the weld seam run can also be shown. The openings 5 are arranged according to the weld seam run.

CLAIMS:

1. A method of melting surfaces of two thermoplastic parts, the method comprising the steps of:

for each of at least two radiators, arranged opposite one another,

spacedly juxtaposing each radiator provided internally with a burner with the surfaces of the parts;

burning a combustion gas with the burner inside the radiator so as to directly heat an outer face of the radiator while creating hot exhaust gas inside the radiator; and

exhausting the hot exhaust gas through an outlet in the outer face to direct a stream of the hot exhaust gas at the surfaces of the parts spacedly juxtaposed with the outer face to convectively heat and melt the surfaces while simultaneously radiating heat from the outer face of the radiator at the surfaces of the parts, whereby the parts are heated both radiantly and convectively.

2. The method according to claim 1 wherein the combustion exhaust is directed to the thermoplastic parts through a plurality of the outlets in the radiator.

3. The method according to claim 1 further comprising adjusting a gas/air mixture of the combustion gas such that an oxygen content in the exhaust gas is reduced.

4. The method according to claim 1, further comprising the step of:

measuring a temperature of the outer face of the radiator.

5. The method according to claim 1, further comprising the step of:

measuring an exhaust-gas temperature inside the radiator.

6. The method according to claim 1, further comprising the step of:

mounting shields on the surface of the radiator to prevent an improper heating of certain areas of the thermoplastic parts.

7. A method of welding two thermoplastic parts, the method comprising the steps of:

burning a gas with a burner inside each of a pair of radiators arranged opposite to one another so as to heat outer faces of the radiators and create hot exhaust gas inside the radiators;

spacedly juxtaposing each of the thermoplastic parts with a respective one of the outer faces to radiantly heat regions of the thermoplastic parts;

exhausting the hot exhaust gas through outlets in each of the faces to direct respective streams of the hot exhaust gas at the thermoplastic parts spacedly juxtaposed with the outer faces to convectively heat and melt the regions thereof; and

pressing together the melted regions.

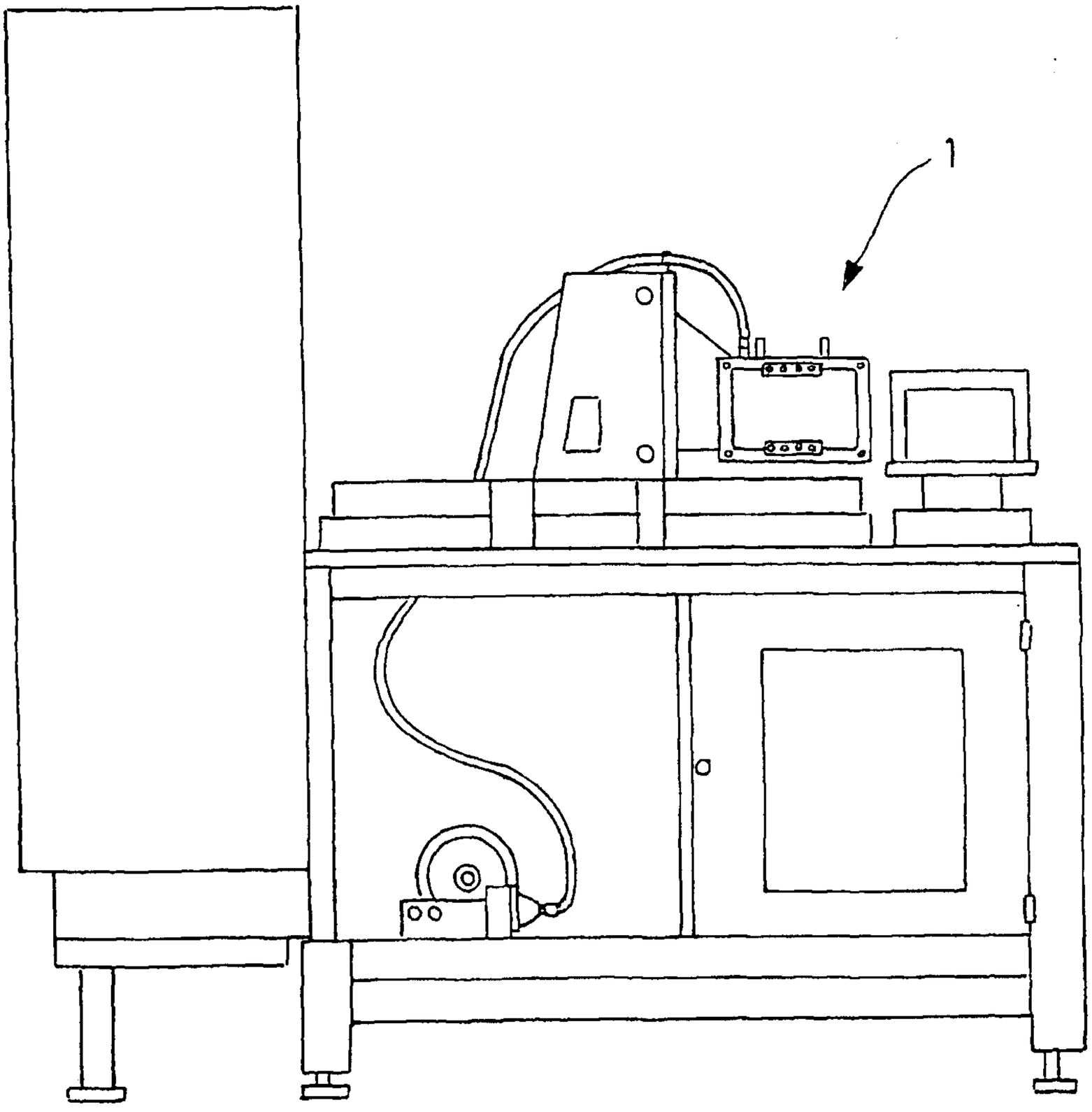


Fig.1

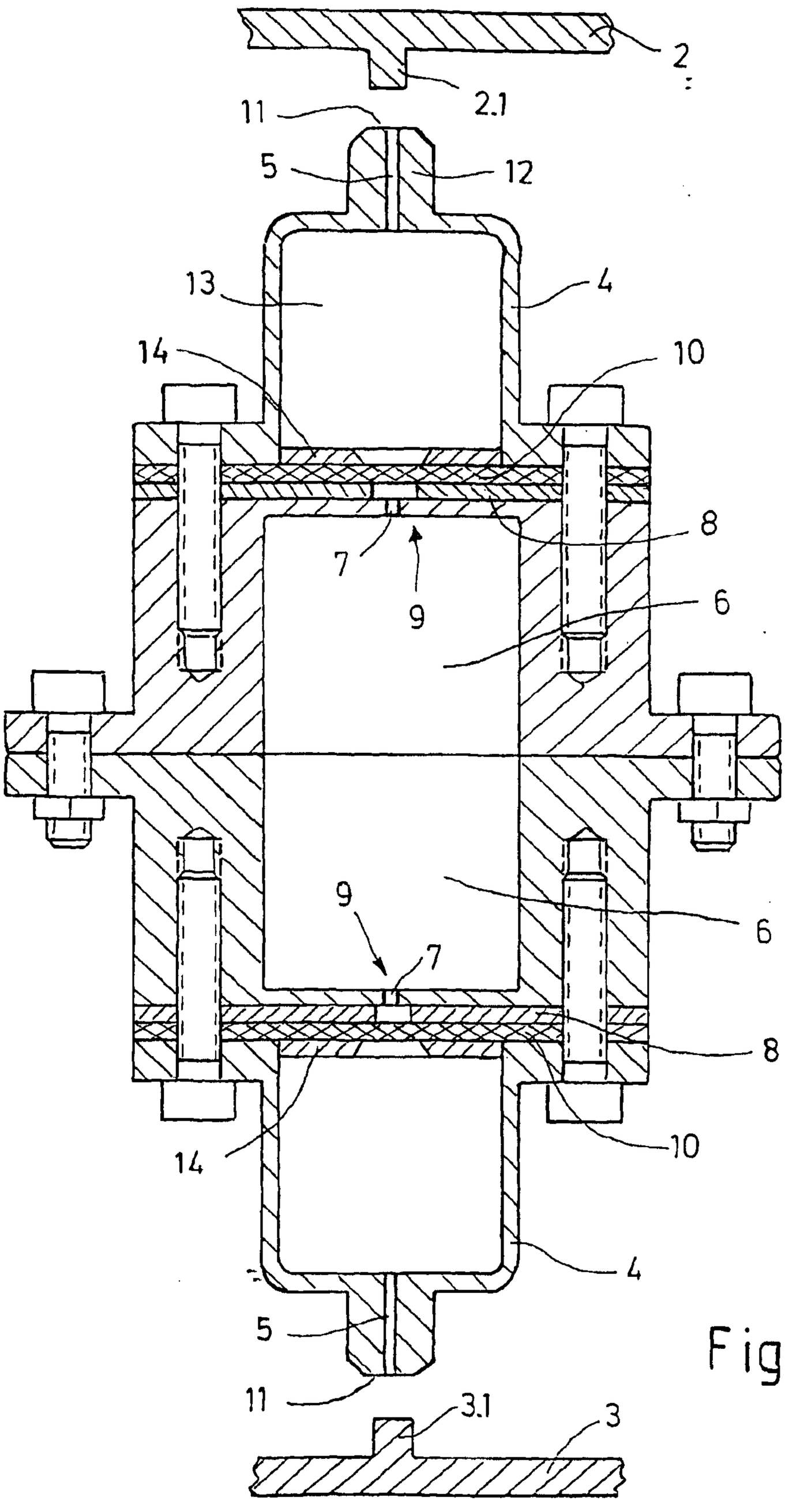


Fig.2

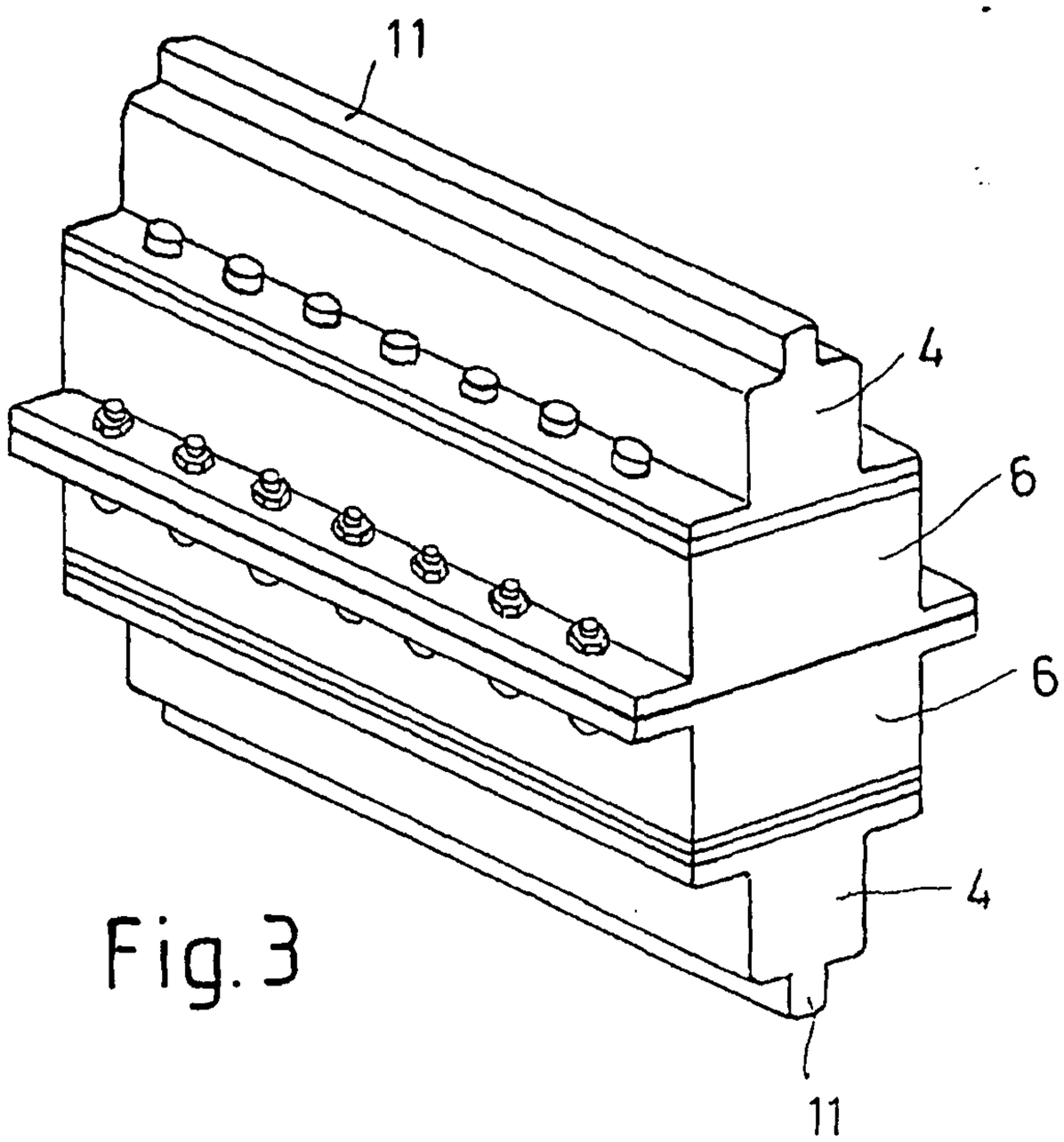


Fig. 3

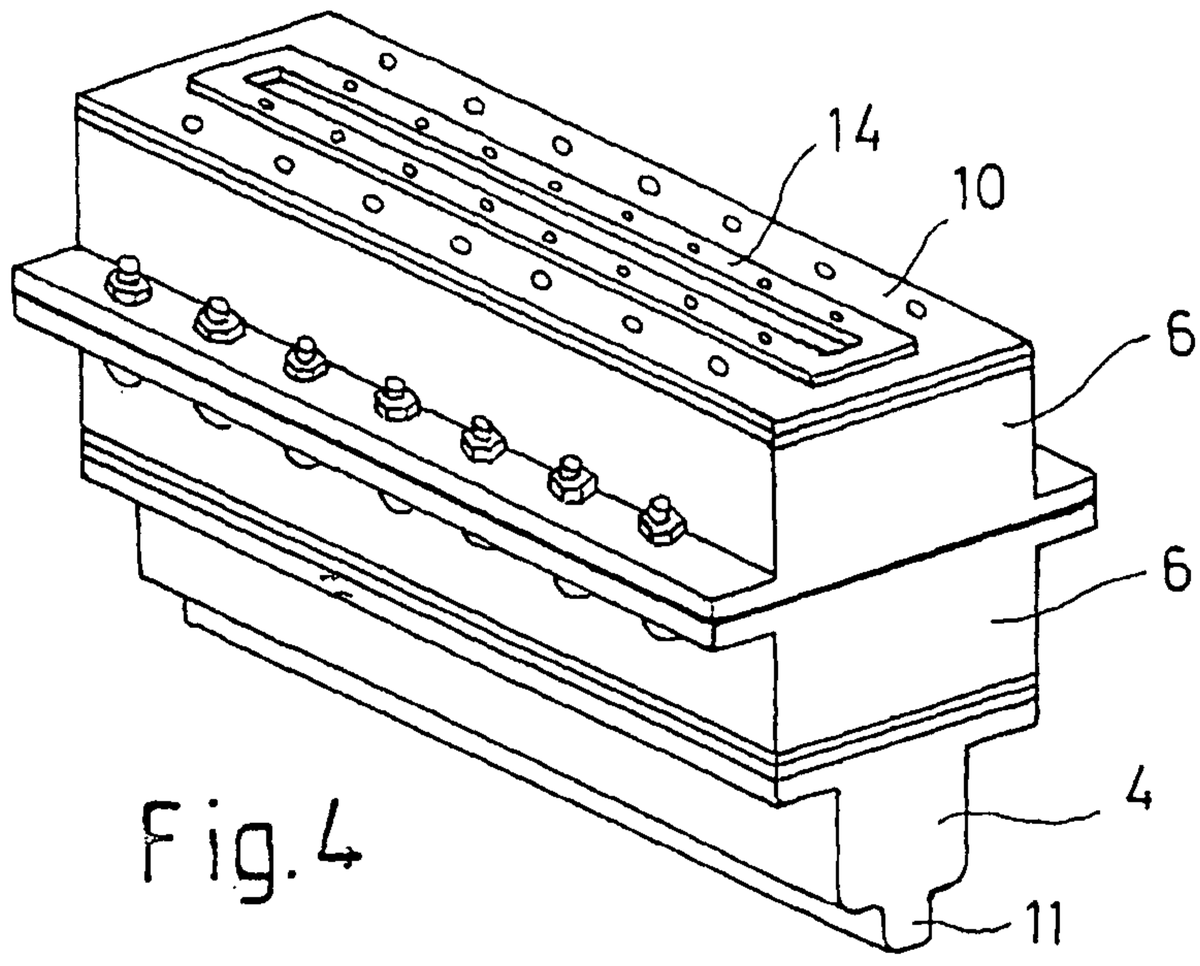


Fig. 4

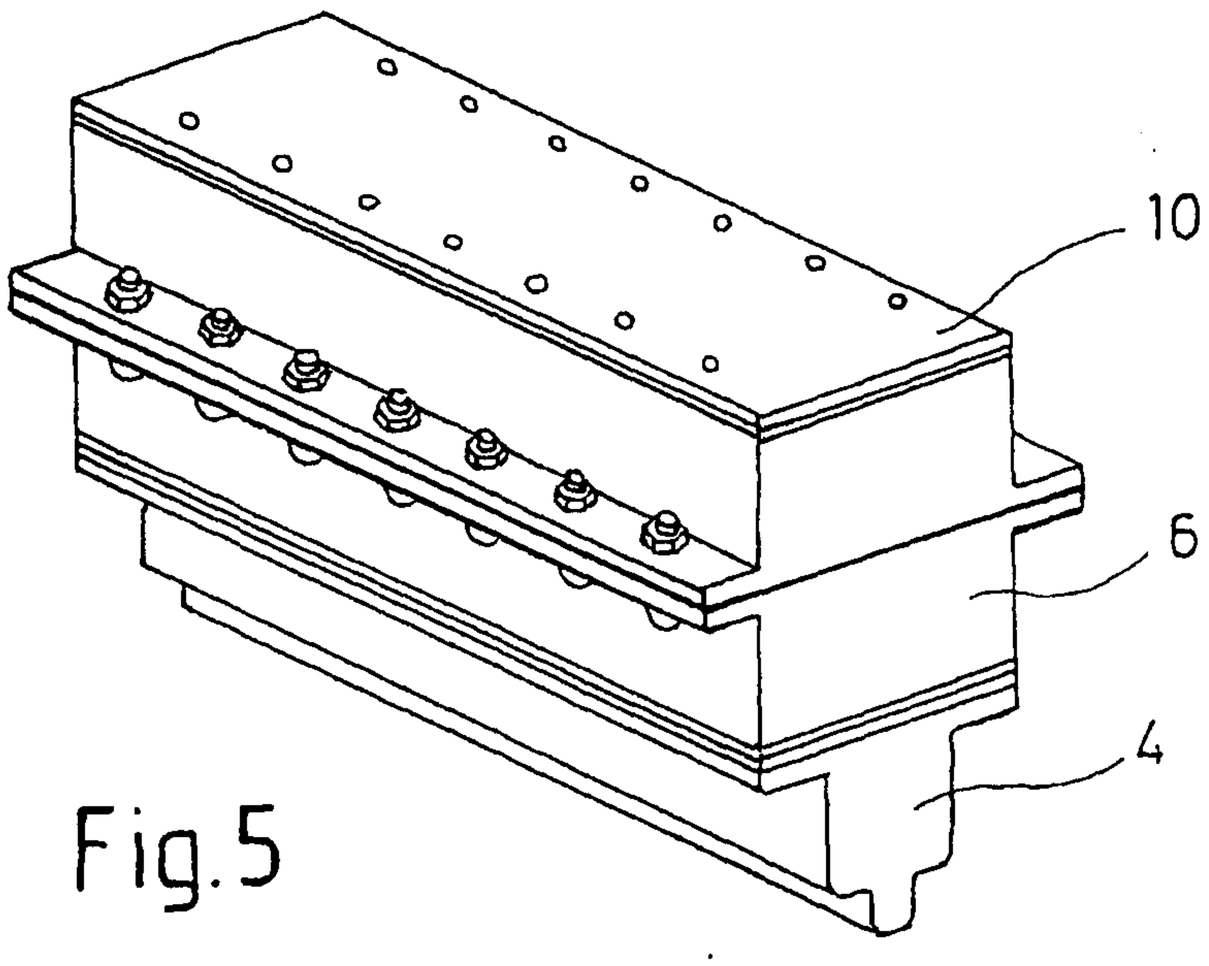


Fig.5

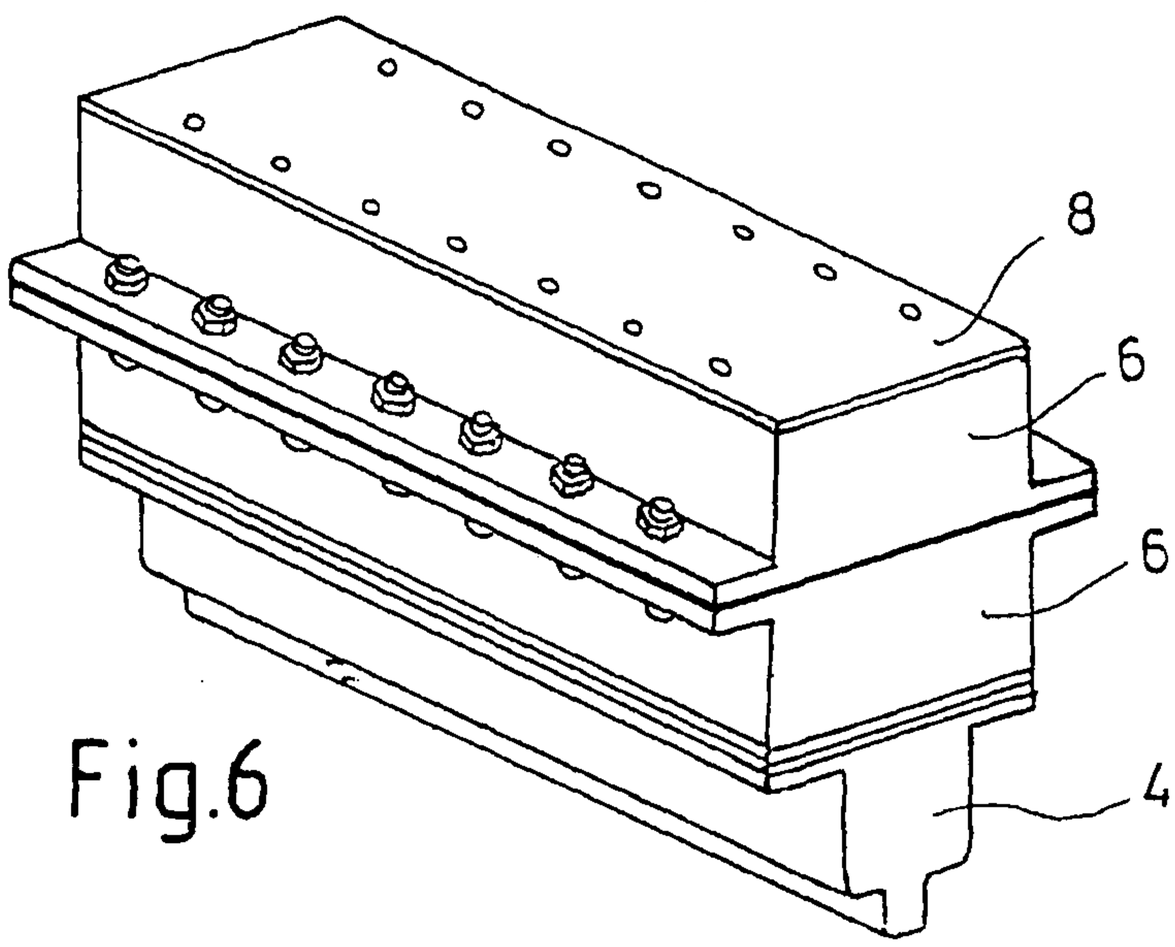


Fig.6

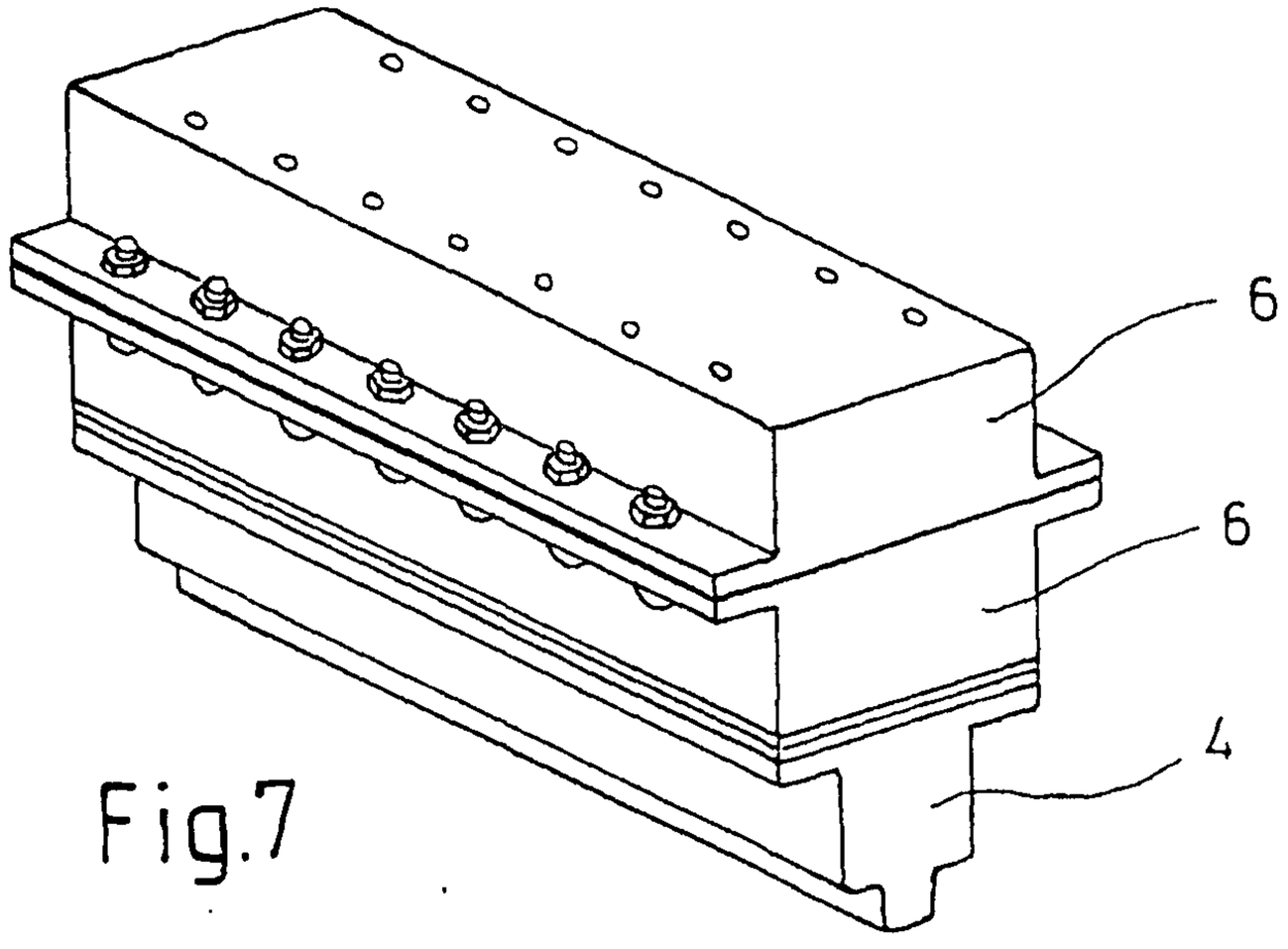


Fig.7

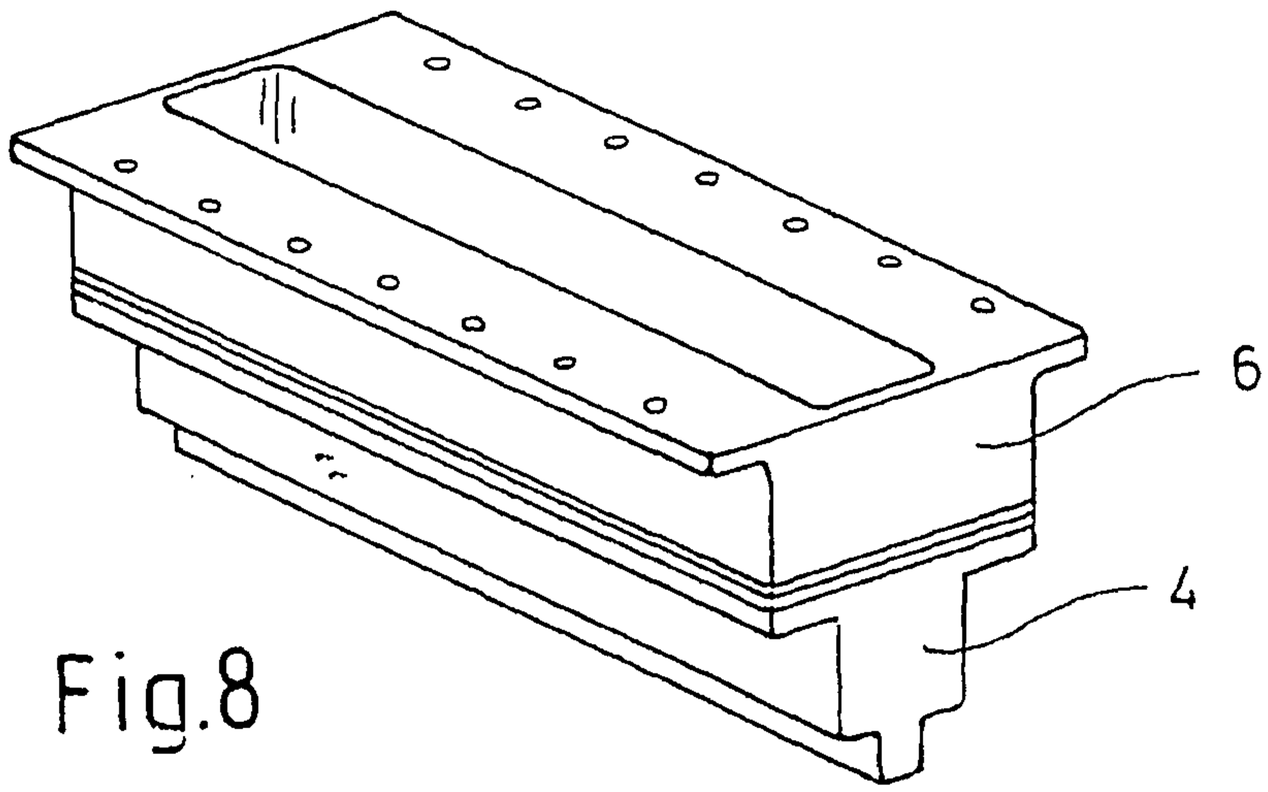


Fig.8

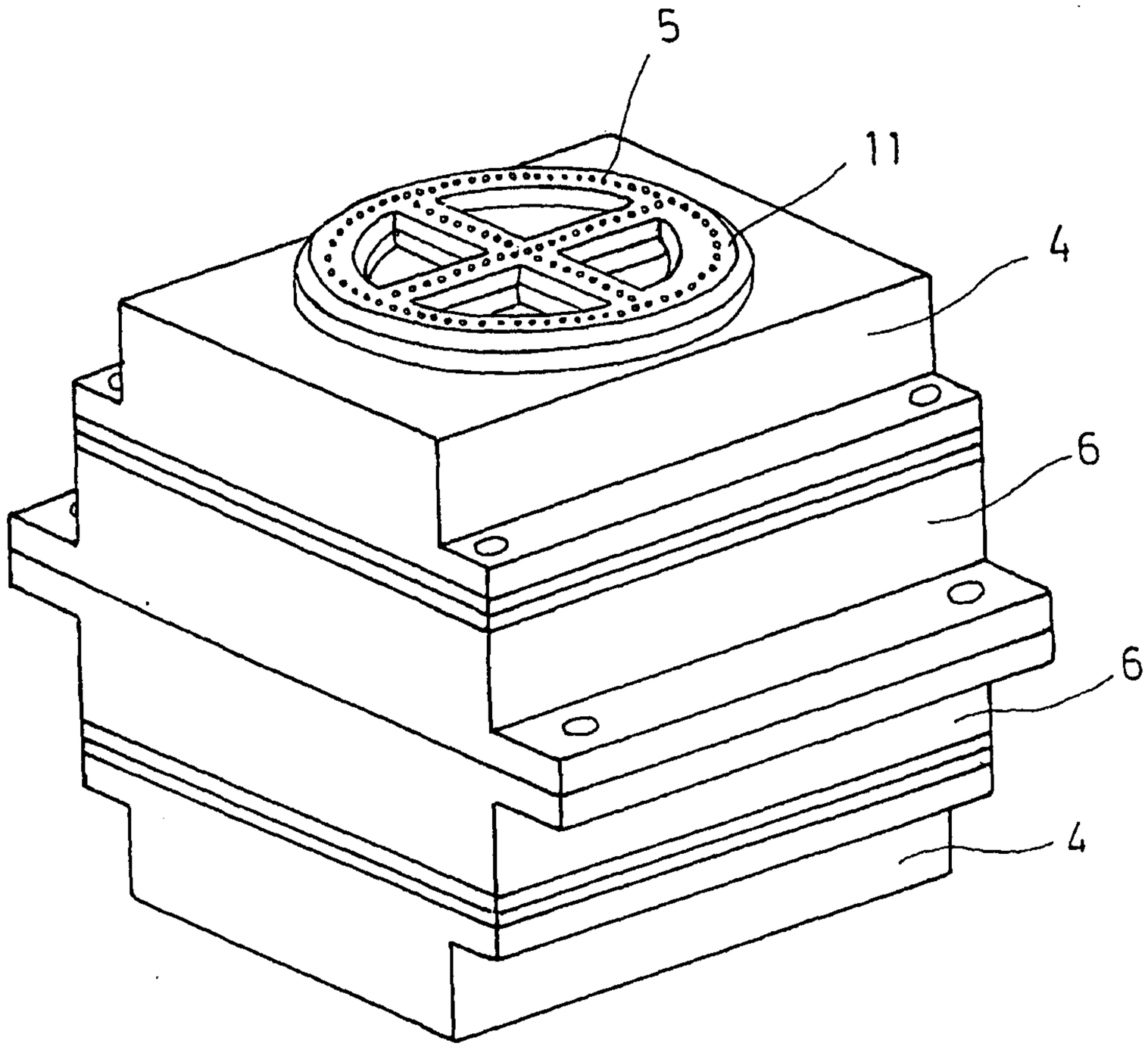
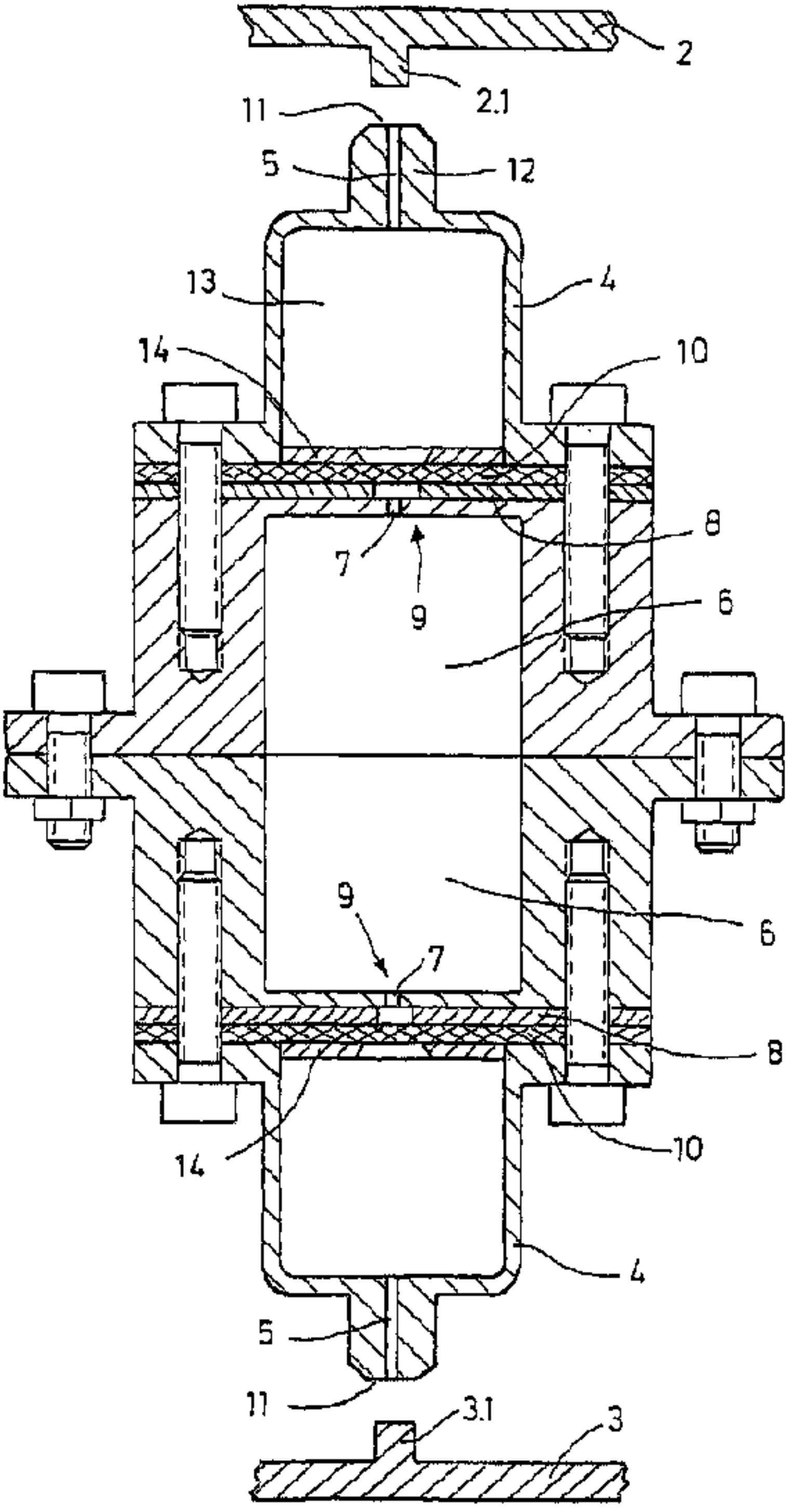


Fig.9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