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(54) Electric resistance heating assembly

(57) According to the invention, the said assembly comprises a ceramic body (1) inside of which an aperture is cut, in which a resistance subassembly (A) is mounted and is fastened between two micanite plates (2), the resistance subassembly (A) comprising a first micanite support which has a Kanthal D wire wrapped around it and a second micanite support, the ends of the wire being insulated through the two micanite plates (2) in between which the subassembly (A) is displayed, the charging of the electric resistance being effected through two cables (8) with a double thermo resistant insulation (9), the connection of the ends of the Kanthal wire being done in such a way that its noninsulated ends are fastened between the two micanite insulated plates (2), the ceramic body (1) having its filled with a thermo-resistant adhesive.

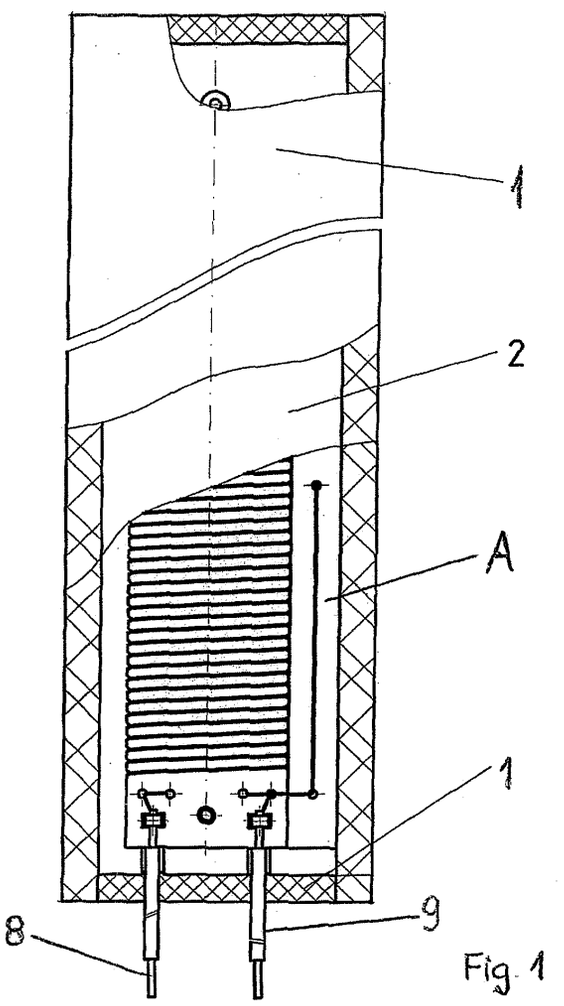

Fig. 1

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Description

[0001] The invention relates to an electrical resistance heating assembly for average temperatures, designed to function at temperatures of maximum 500 degrees Celsius, resistance that is used in thermo techniques.

[0002] At present, there are already known electric resistances that use ceramic material or hard glass as electric insulators. The heating elements are either placed in the interior of these ceramic materials or inserted through holes in the electric insulator. This type of electric resistance implies a higher consume of electric current and have a difficult production technology, considering that a high precision of execution is demanded. In addition, because of the contact with the air, the heating element can oxidize, especially in an average working time.

[0003] An electrical resistance which functions at temperatures up to 1000 degrees Celsius is known from the Romanian Patent RO 85804**,** which comprises a ceramic body having in interior two longitudinal apertures in which the heating element is inserted, the heating element being coated in glass which is used as an electric insulator, temperature transfer mass and as tightening and fastening mass at the same time, while the ceramic body has a layer of cement at the ends. The connection with the power supply is made with two copper conductors which are partially coated in fluid glass.

[0004] Another electrical resistance is known from the Romanian Patent RO 81149**,** which comprises a heating element welded by two copper conductors which connect with the control circuit, the electrical insulation being made of a glass wire wrapped around the heating element and around the two conductors and joined together through an adhesive. In another assembly alternative, the electric insulation is achieved through a pipe of fiber glass web, where the pipe has its ends solidarized through the heating and melting of the glass wires.

[0005] As far as the construction method is concerned, all the heating types already existent on the market are made of 2 main parts: a ceramic body made of hydroscopic material, 30% porosity and a resistance subassembly. The resistance is made of circular cross section wire, spirally wrapped at a 3 mm diameter, and it is rigidified with heat-insulation sand, whereas the free apertures are covered over with refractory adhesive. The protection against electric shocks is assured by the basic insulation.

[0006] The electric resistances known so far have the disadvantage of the heat loss due to the only thermo-insulating layer, they are fragile, have a higher thermic *inertia,* which implies a higher energy consumption, have a high sensitivity to humidity, there is a possibility that the wire breaks because of electric shocks, since the insulation material can move, there is the risk of the apparition of corrugations due to distortions from the heat when the coverage area of the heating element is not sufficiently thick.

[0007] The technical problem solved by the invention consists in the supplementary insulation of the conductive parts and the protection against the electric shocks and eliminates the disadvantages mentioned above by constructing an electric resistance heating which functions at temperatures of maximum 500 degrees Celsius, which comprises a ceramic body made of no hydroscopic material, 0% porosity, inside which a resistance sub -assembly is placed between two micanite plates, where the resistance subassembly itself comprises a first first micanite support which has a KANTHAL D wire wrapped around itself and a second micanite support, the ends of the wire being insulated by the two micanite plates, the charging of the electric resistance being done through two electrical, flexible cables having a double thermo resistant insulation, the connection to the ends of the Khanthal being done in such a way that the non insulated ends are fasten between the two micanite plates, the ceramic body having its ends filled with a thermo- resistant adhesive.

[0008] The electrical resistance according to this invention is used in the area of thermo **techniques and has the following advantages:**

- ○ double protection against electric shocks (insulation class 2)
- ○ higher safety in exploitation
- ○ reduces inertia to heat, which implies a low energy consumption
- ○ good control of the temperature
- ○ the operating average time is long , induced by the fact that the heating element doesn't get oxidized, since it is not in contact with the air.
- ○ The construction is simple and as a consequence, the setting up, the maintenance and the exploitation are easy.
- ○ High thermic and energy efficiency due to an adequate thermic insulation

[0009] Below is a presentation by way of example of the invention in connection with Figs 1-10 which represent:

Figure 1- front view and partial section of the heating electric resistance

Figure 2- lateral view of the electric resistance in fig. 1

Figure 3- front view of the first support for the Kanthal D wire

Figure 4- detail D in fig 3.

Figure 5- front view of the second support for the Kanthal D wire

Figure 6- front view of the resistance subassembly

Figure 7- view of the insulation plate

Figure 8- the resistance subassembly mounted on the insulation plate

Figure 9- lateral view and cross section of the ceramic body

Figure 10- cross section of the capsule

[0010] The electric resistance heating according to the invention, which operates at temperatures of maximum 500 degrees Celsius comprises a ceramic body **1** of rectangular shape, which has applied in its longitudinal section an almost rectangular cut **a,** where the ceramic body is made of no hydroscopic material, 0% porosity, for example -cordierite. Inside the cut **a,** the resistance subassembly is mounted between two micanite plates **2.** the resistance subassembly **a** comprises a first support **3** of rectangular shape made of micanite. On the lateral surfaces, lengthwise, the support **3** has applied on it some ditches **b** of 0,5 mm depth on which a resistance wire, preferably, a Kanthal D wire **4** is wrapped around. On the ends of the support **3** are applied some apertures c through which the wire **4** crosses and a **d** aperture for each.

[0011] Next to the support **3,** a second support **5** made of micanite is disposed, through the apertures **c** of which the Kanthal D wire **4** is also introduced, to mechanically fasten the supports. The two supports **3** and **5** are next to each other and mounted between two micanite **2** insulating plates, the assembly being solidarized by capsules **6** which penetrate the apertures **d.**

[0012] The ends of the wire **4** are fastened by the two crimps **7** and are insulated by the two micanite plates **2** in between which the subassembly **A** is positioned. The charging of the electrical resistance is done through two electrical, flexible cables **8** which are insulated with double thermo resistant insulation.

[0013] After mounting the subassembly **A** in the cut **a,** the ends of the ceramic body **1** are filled with a temperature resistant silicon adhesive 10.

[0014] The electrical resistance according to the invention is a class II device, where the protection against the electric shocks is secured not only by the basic insulation achieved by the two micanite plates but also through the ceramic body 1, made of cordierite, a no hydroscopic material and the temperature resistant adhesive **10** which insures the double protection of the device.

[0015] The Kanthal D wire **4** is an internationally accepted as a standard descriptive term which has acquired a precise meaning. In fact, the Kanthal D wire **4** concerns a specific class of resistance wires produced by the company "Kanthal™" (Address: Kanthal, Box 502, SE-734 27 Hallstahammar, Sweden, phone : +46 220 210 00; telefax: +46 220 163 50; e-mail: info@kanthal.com; web-page: www.kanthal.com) and described on page 21 of the Kanthal Handbook entitled "Resistance Heating Alloys and Systems for Industrial Furnaces" (for more details, see web-page: http://hitempproducts.thomasnet.com/Asset/The-Kanthal-Furnace-Mini-Handbook---Metric-version-.pdf) as mentioned below:

KANTHAL D

Wire and strip. Standard stock items.

Resistivity 1.35 Ω mm^2m^{-1}. Density 7.25 g cm^{-3}. To obtain resistivity at working temperature, multiply by factor C_t in following table.

°C	20	100	200	300	400	500	600	700	800	900	1000	1100	1200	1300
C_t	1.00	1.00	1.01	1.01	1.02	1.03	1.04	1.05	1.06	1.06	1.07	1.07	1.08	1.08

Wire dia mm	Resistance Ω/m 20˚C	Weight g/m	cm^2/Ω 20˚C	Strip*) WxT mm	Resistance Ω/m 20˚C	Weight g/m	cm^2/Ω 20˚C
1.0	1.72	5.7	18.3	5.0x0.1	2.70	3.6	43
1.1	1.42	6.9	24.3	5.0x0.2	1.35	7.3	76
1.2	1.19	8.2	31.6	5.0x0.3	0.900	10.9	118
1.3	1.02	9.6	40.2	5.0x0.4	0.657	14.5	160
1.4	0.877	11.2	50.2	10.0x1.2	0.113	87	1990
1.5	0.765	12.8	61.7	12.0x1.2	0.0938	104	2820
1.6	0.671	14.6	74.9	15.0x1.2	0.0750	131	4320
1.7	0.595	16.5	89.8	15.0x1.5	0.0600	163	5500
1.8	0.531	18.4	107	20.0x1.5	0.0450	218	9560
2.0	0.430	22.8	146	15.0x2.0	0.0450	218	7560
2.5	0.275	35.6	286	20.0x2.0	0.0338	290	13000
2.8	0.219	44.6	401	25.0x2.0	0.0270	363	20000
3.0	0.191	51.2	493	20.0x2.5	0.0270	363	16700
3.25	0.163	60.1	627				
3.5	0.140	89.8	784				
3.75	0.122	80.1	964				
4.0	0.107	91.1	1170				
4.25	0.0952	103	1403				
4.5	0.0849	115	1666				
4.75	0.0762	128	1959				
5.0	0.0688	142	2285				
5.5	0.0568	172	3041				
6.0	0.0477	205	3948				
6.5	0.0407	241	5019				
7.35	0.0318	308	7257				
8.0	0.0269	364	9358				

Claims

1. Electric resistance heating assembly, comprising a ceramic body and a resistance assembly, made of circular section wire which is temperature insulated, the free apertures of the ceramic body being filled with adhesive, **characterized in that** in view to the good functioning at temperatures of maximum 500 degrees Celsius, the resistance comprising a ceramic body (1), of rectangular shape, made of no hydroscopic material, 0% porosity, inside of which a rectangular aperture (a) is cut, in which a resistance assembly (A) is mounted and is fastened between two micanite plates (2), the resistance subassembly (A) comprising a first micanite support (3) which has a resistance wire (4) wrapped around it and a second support (5) made of mecanite the ends of the wire (4) being insulated through the two micanite plates (2) in between which the subassembly (A) is displayed, the charging of the electric resistance being effected through two electric, flexible cables (8) with a double thermo resistant insulation (9), the connection of the ends of the resistance wire being done in such a way that its noninsulated ends are fastened between the two micanite insulated plates (2), the ceramic body (1) having its filled with a thermo-resistant adhesive (10).

2. Electric resistance heating assembly according to claim 1, **characterized in that** the resistance wire (4) is a Kandal D wire (4).

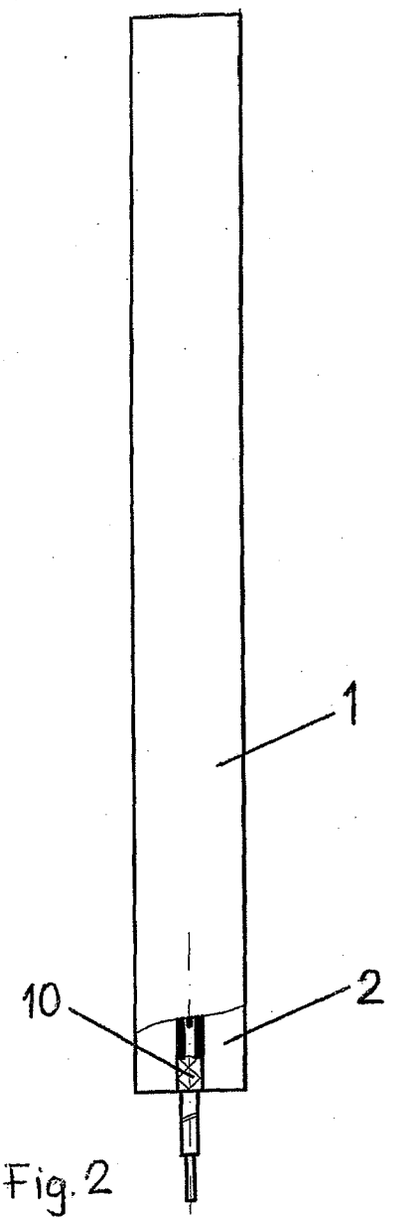


Fig. 2

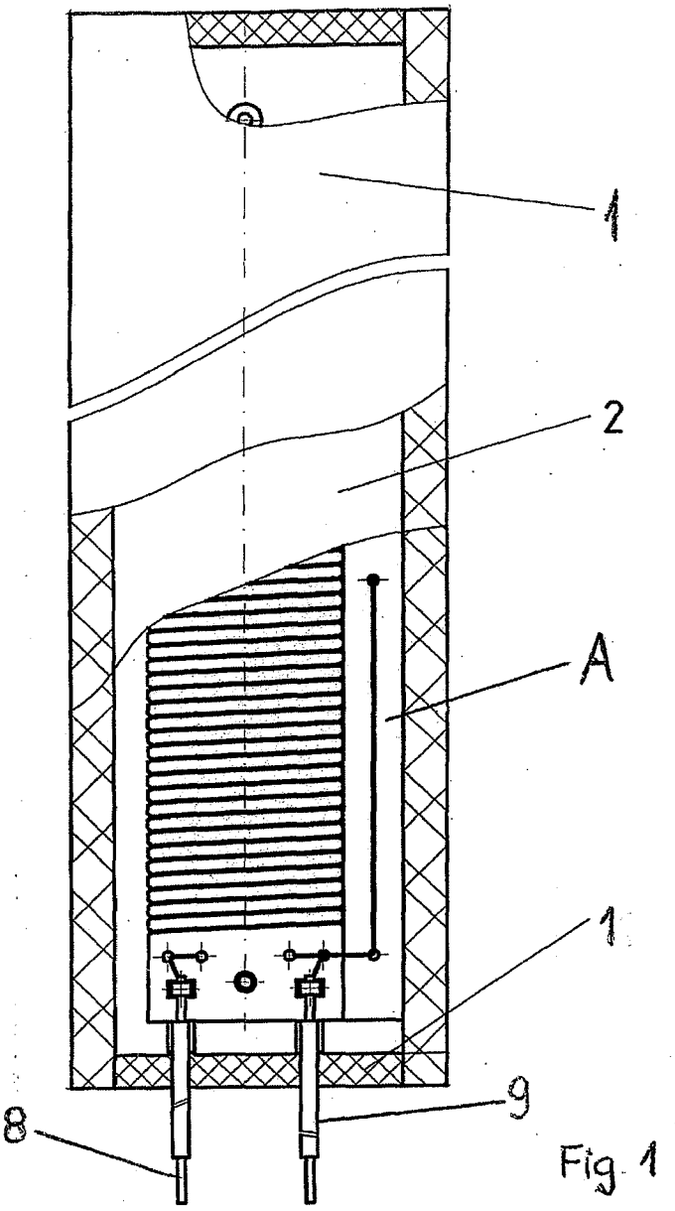


Fig. 1

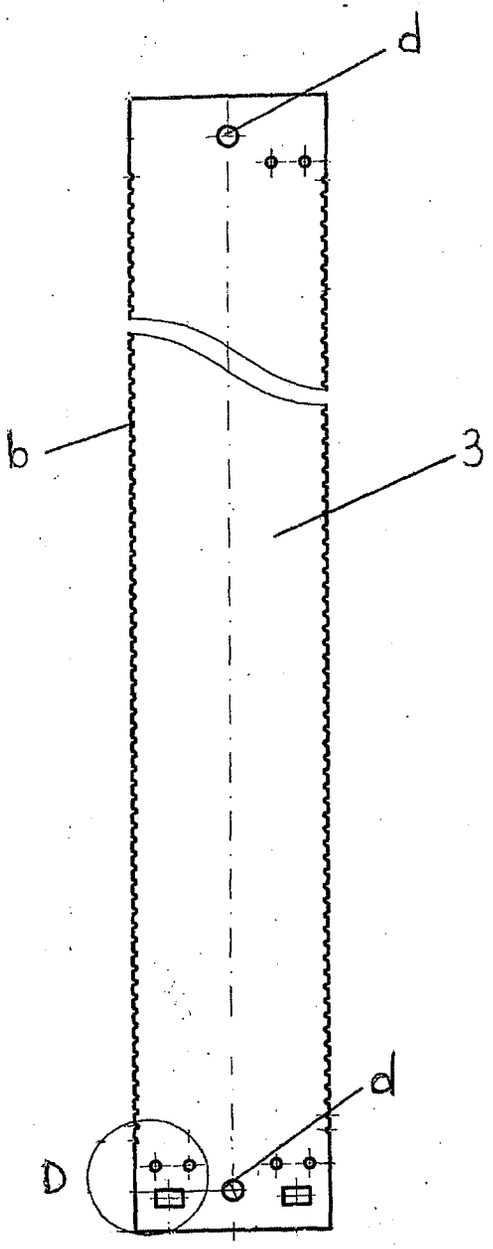


Fig. 3

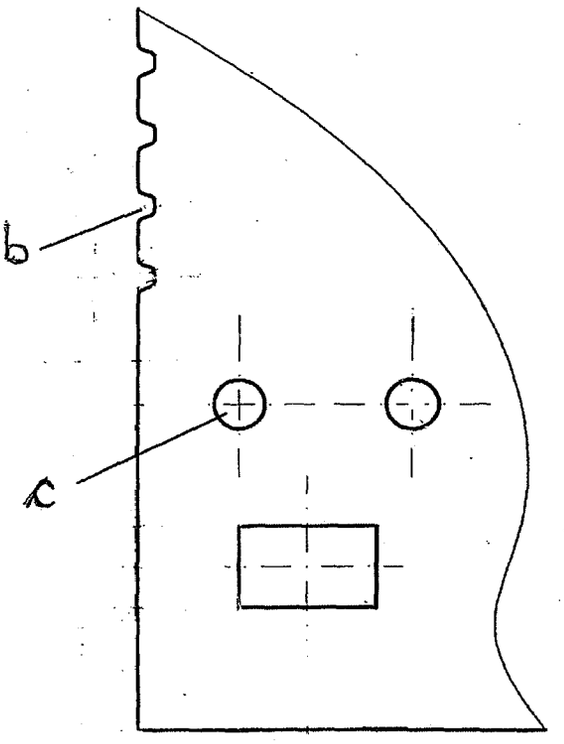


Fig. 4

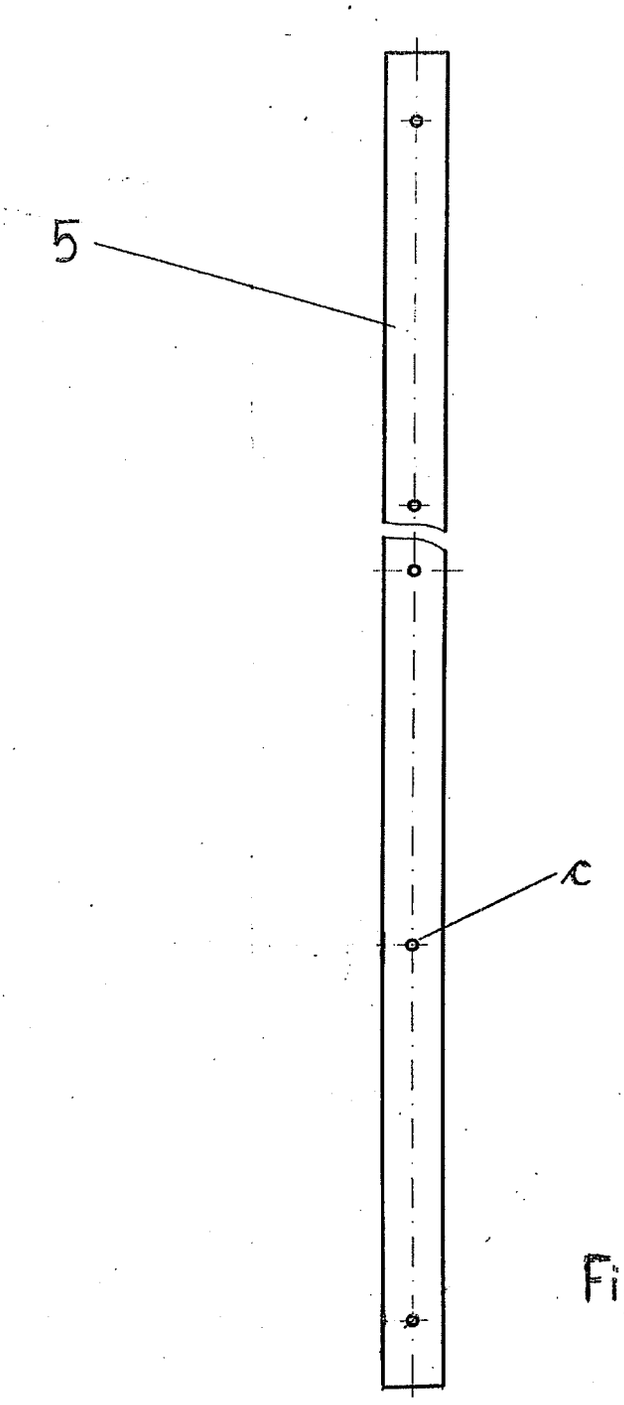


Fig. 5

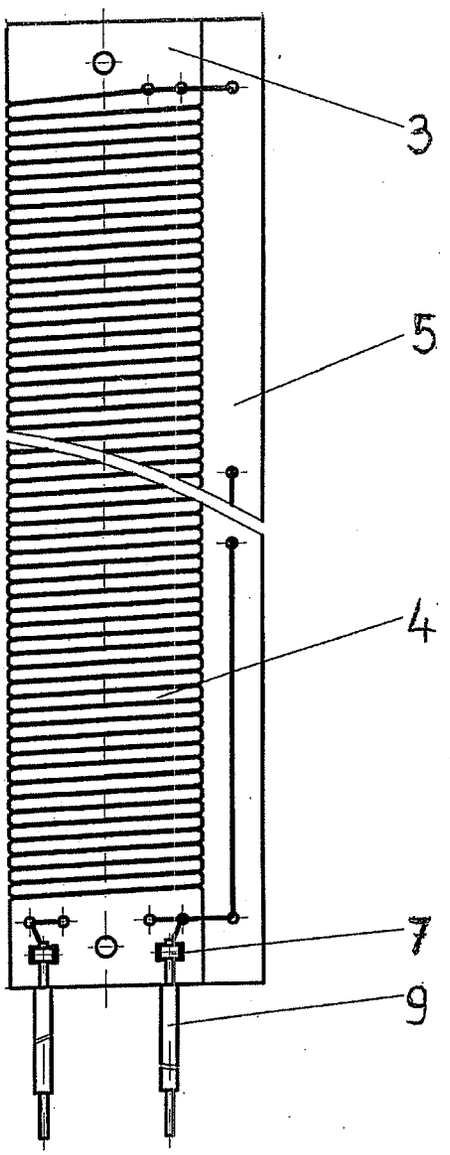


Fig.6

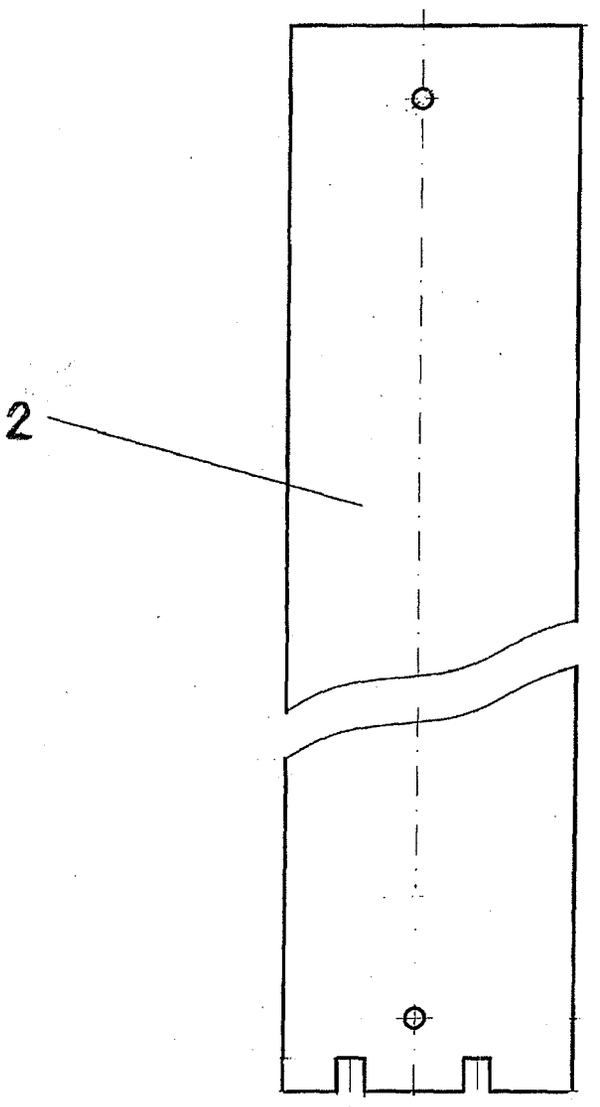


Fig. 7

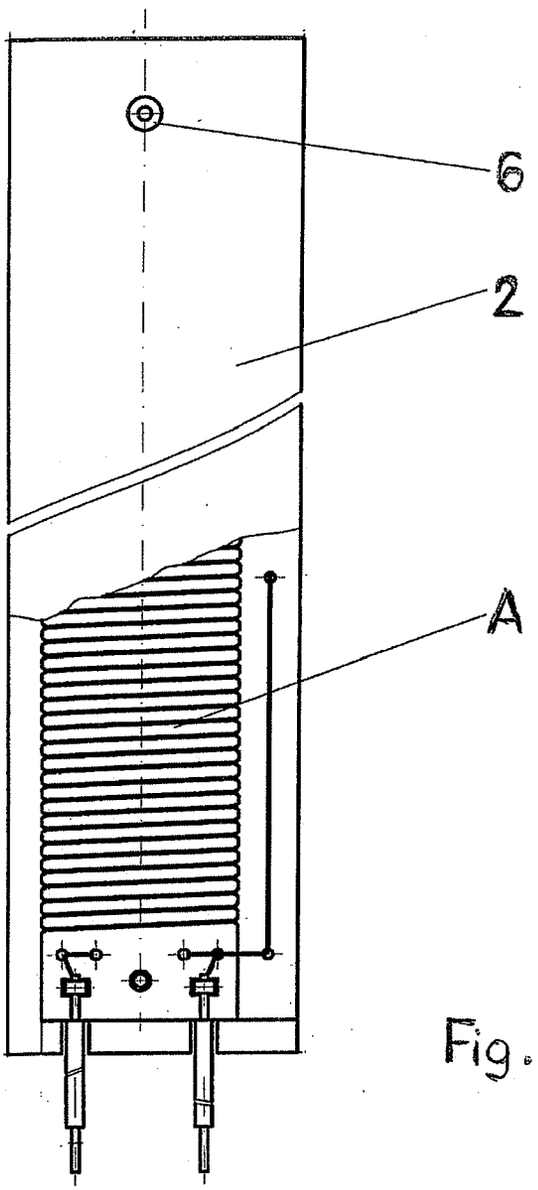
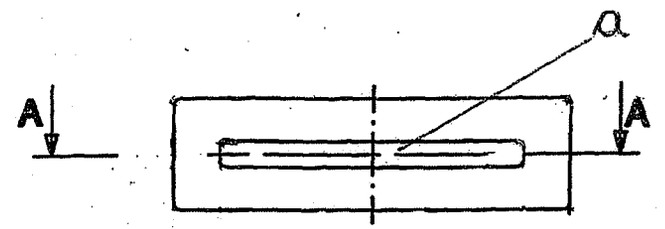


Fig. 8



A-A

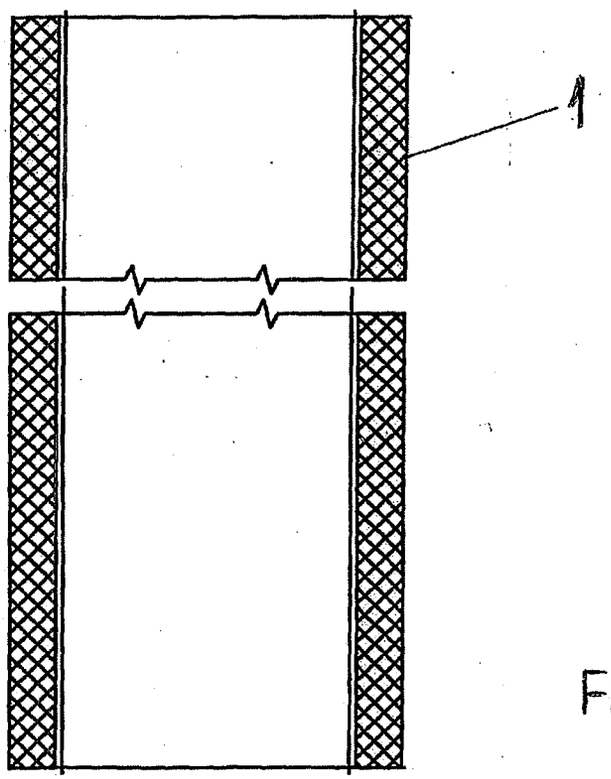


Fig. 9

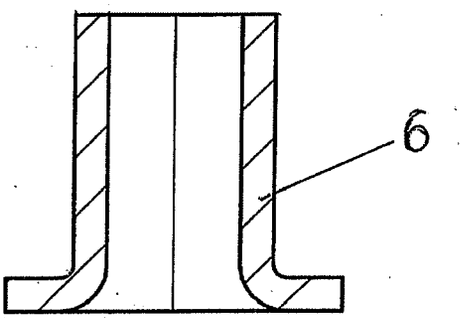


Fig. 10

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- RO 85804 **[0003]**
- RO 81149 **[0004]**