

Aug. 6, 1946.

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2,405,192

RESISTOR

Filed June 9, 1944

FIG. 1

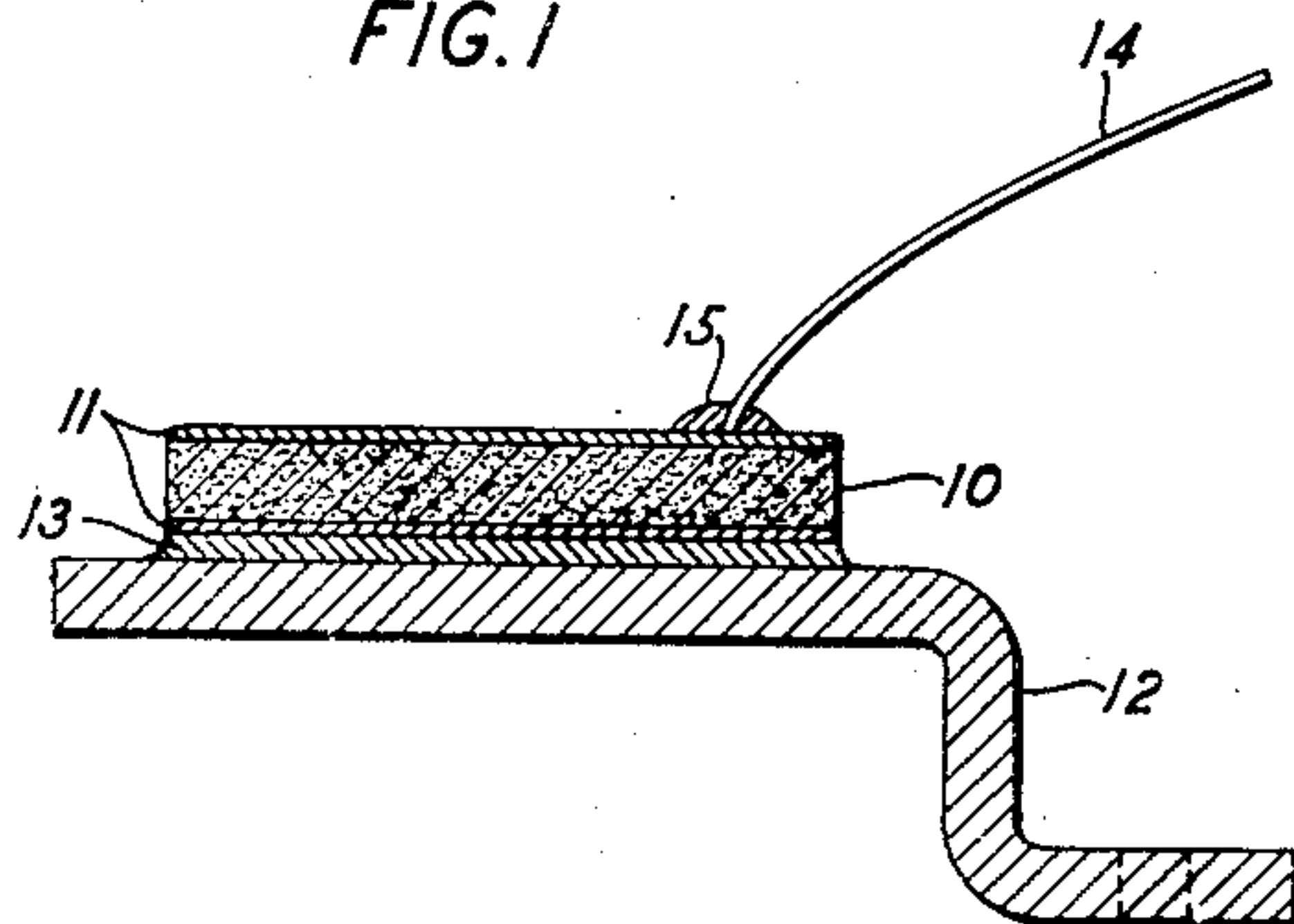
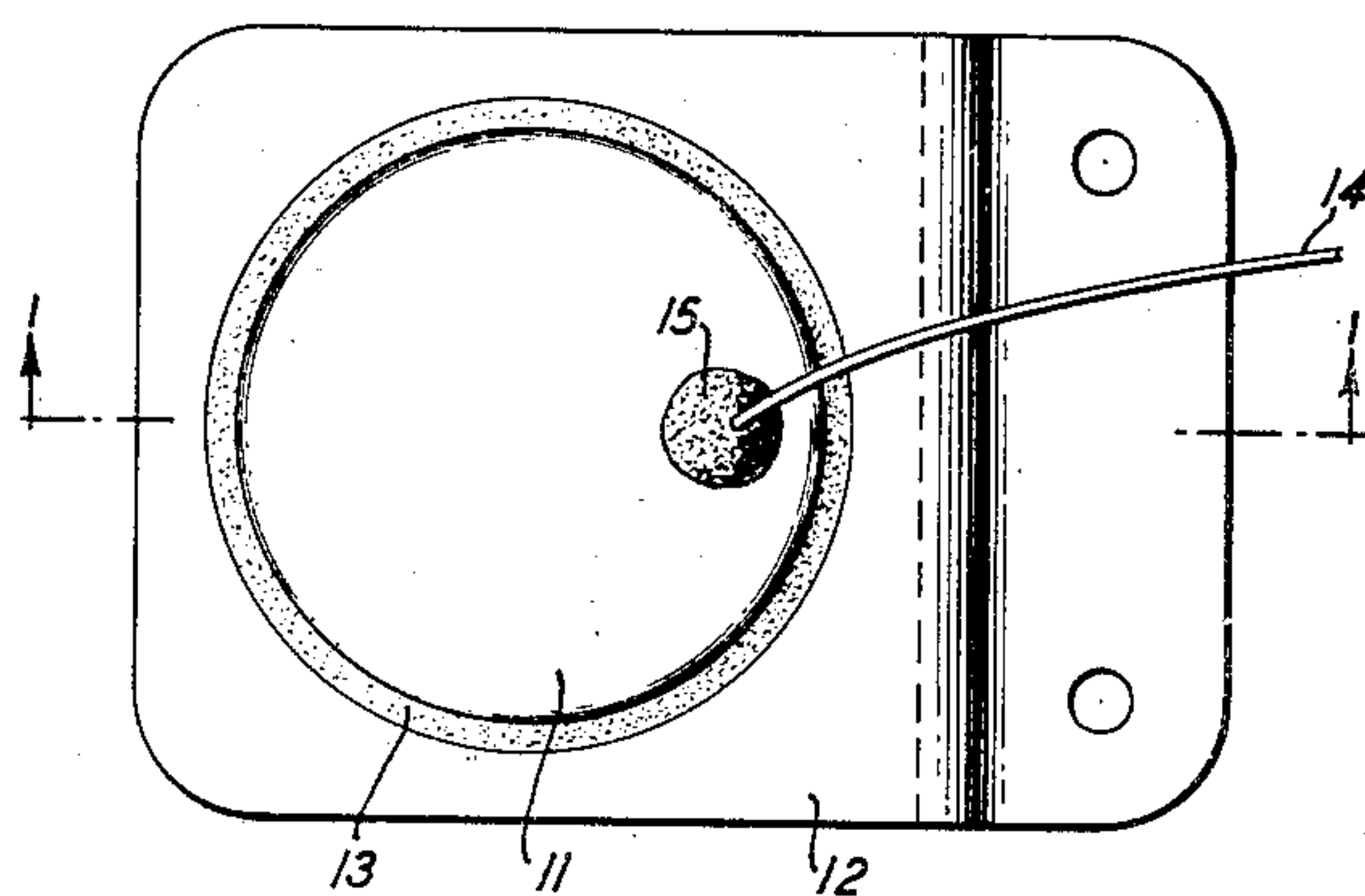


FIG. 2



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2,405,192

RESISTOR

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Application June 9, 1944, Serial No. 539,459

5 Claims. (Cl. 201—63)

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This invention relates to temperature dependent resistors and more particularly to a method of and means for mounting such resistors.

Because of their characteristic change of resistance with temperature many resistance materials have been employed in devices for measuring temperature. Certain materials, the resistance of which varies greatly with changes in temperature and which, for convenience of terminology have been called "thermistors," are particularly suitable for this purpose. Many materials which have been found suitable for making thermistors are non-metallic semiconductors. For example, the oxides of manganese, nickel, cobalt, copper, iron or zinc, or selected combinations of two or more of these oxides have been found to be particularly suitable for making thermistors.

In the measurement of temperature by means of thermistors it is often necessary to combine a body of thermistor material with a metallic member which serves as a mounting means. Since many of the metals economically suitable for making the mounting means have coefficients of thermal expansion varying greatly from the expansion coefficients of the thermistor material, difficulty may be encountered in combining the two into a unitary structure.

An object of this invention is to combine into a permanent unitary structure conductive materials having widely different temperature expansion coefficients.

A feature of this invention resides in the use of a cushioning layer or pad of relatively soft metal between the elements of the resistor device, that have widely different coefficients of thermal expansion.

A further feature of the invention lies in making the intermediate cushion or pad of sufficient thickness to absorb the strains due to difference in expansion without imposing an unduly high thermal impedance between the two elements.

Other and further objects and features of this invention will be understood more fully and clearly from the following description of illustrative embodiments thereof taken in connection with the appended drawing in which:

Fig. 1 is a sectional view of a resistor device made in accordance with this invention; and

Fig. 2 is a plan view of the device shown in Fig. 1.

Some of the dimensions, such as layer thickness, have been somewhat exaggerated in the drawing in the interest of clarity of illustration.

As may be seen from the drawing, one form

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of device made in accordance with this invention comprises a resistor body such as the disc or plate 10 of non-metallic resistance material, such as one or more of the metal oxides previously mentioned. The opposite faces of the disc or plate 10 may each be provided with a metallic coating 11, for example, of silver. These coatings may be applied in various ways. One way is to paint each surface to be silvered with a silver composition which may be "cured" by heating to form a layer that is essentially metallic silver. The painted layer upon heating forms an adherent silver film on the resistor element.

A bracket or mounting means 12 serves as a support for the resistor 10 and secures it in intimate thermal connection with the device or means, the temperature of which is to be measured. The bracket may be tinned brass or other suitable metallic material. Interposed between the resistor 10 and the bracket 12 is a cushion or pad 13 of a relatively soft metal, such as tin or lead, or an alloy of these or other similar metals. This layer 13 is relatively thick with respect to the thickness of a layer of solder which would ordinarily be used in sweating the parts 10 and 12 together. For example, in the usual sweating operation the solder layer may be of the order of a few thousandths of an inch in thickness, whereas the pad 13 is of the order of a few hundredths of an inch in thickness.

The pad 13 may be incorporated between the resistor element and the bracket in various ways. One way is to place a disc of solder of suitable diameter and thickness upon one silvered surface of the resistor and to heat the assembly sufficiently to melt the solder to cause it to adhere to the silver film. The bracket or member 12 is then applied to the surface of the solder and enough heat supplied to cause the parts to stick together upon cooling.

Another way is to form a solder pad on the surface of the bracket and then apply the resistor disc to it while the solder is molten. The solder pad may be formed on the bracket in any suitable manner. For example, a flat coil of wire solder may be laid on the bracket and melted into a pad. Various modifications or hybridizations of these methods may also be used.

The bracket 12 and layer 13 besides serving to support the resistor 10 serve as means for making electrical connection to one side of said resistor and also present a path of relatively high thermal conductivity between the temperature sensitive resistor and the part whose temperature is being measured. Electrical connection may

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be made to the other face of the disc 10 by means of a conductor 14, which may be secured to the silver layer 11 with a bit of solder 15.

If the resistor 10 were sweated directly to the member 12 it may be seen, that if this assembly were subjected to wide variations in temperature, the differences in thermal expansion between the two elements would tend to break the resistor 10 away from the member 12. Experience has shown that this is usually the case if a pad is not used. However, by employing the pad 13 the differences in expansion are absorbed in the pad and separation of the elements is avoided.

Although this invention has been disclosed by means of an illustrative embodiment thereof, it should be understood that the invention is not limited thereby but by the scope of the appended claims only.

What is claimed is:

1. A resistor device comprising a body of resistance material having at least one plane surface, a metallic mounting member having a plane surface comparable to that of the resistor body, said body and member each having relatively different coefficients of thermal expansion, and means comprising a relatively thick pad of soft metallic material interposed between said plane surfaces and adhering to each for securing the body and member together and compensating for their differences in thermal expansion.

2. A resistor device comprising a body of metal oxide resistance material, a supporting member of metal having a thermal coefficient of expansion differing widely from that of the resistor body, and means for securing said body and member together so that they will not be separated by expansion differences therebetween

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upon variations in temperature, that comprises a relatively thick pad of soft metallic material between said body and member and adhering to each.

3. A resistor device comprising a body of resistance material, a supporting member of metal having a thermal expansion coefficient differing greatly from that of said body of resistance material, and means for securing the body and member together comprising a layer of solder interposed between the body and member and adhering to each, said layer being of the order of ten times as thick as the usual layer of solder required to sweat the parts together.

4. The method of making a resistor device including a non-metallic resistance element and a metallic mounting element, said elements having widely different thermal expansion coefficients, that comprises applying to a surface of one of said elements, an adherent layer of solder, which is several times thicker than the usual layer required for sweating the elements together, applying a surface of the other element to the solder layer, and causing said other element to adhere to said solder layer.

5. The method of making a resistor device including a body of resistance material having at least one plane surface, and a metallic mounting bracket having a plane surface comparable to that of the resistor body, said body and bracket each having relatively different coefficients of thermal expansion, that comprises interposing between said plane surfaces a relatively thick pad of soft metallic material and heating the parts to cause adherence between the body, pad and bracket.

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