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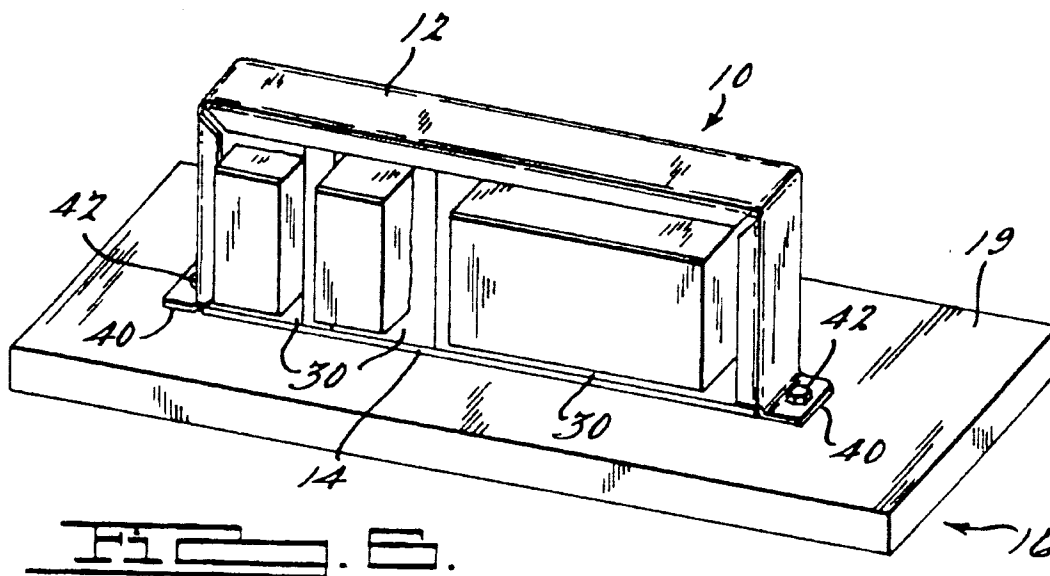
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(54) Electromagnetic apparatus support mechanism

(57) A support mechanism for an electromagnetic apparatus having a plurality of magnetic cores (30) with substantially planar bases aligned in coplanar relationship by a fixture (18), a transformer (28), and a plurality of inductors (26) includes, a bracket (12) adapted to receive the magnetic cores (30) having a plurality of legs (36) with outwardly projecting coplanar feet (40) extending a predetermined distance beyond the coplanar bases

of the magnetic cores (30), an elastomeric pad (14), disposed along the coplanar bases of the magnetic cores, and a thermally conductive plate (16) adapted to receive the coplanar feet (40), upon separation of the electromagnetic apparatus from the fixture (18), so as to uniformly compress the elastomeric pad (14) between the plate (16) and the coplanar bases of the magnetic cores (30).



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Description

[0001] The present invention relates to an automotive electromagnetic apparatus, and more specifically, to a support mechanism for such an electromagnetic apparatus.

[0002] In the development of an electronic automotive vehicle many problems invariably arise. One set of problems is associated with the use of an electromagnetic apparatus in a vehicular environment. An electromagnetic apparatus has magnetic cores. These magnetic cores generate heat which must be dissipated. One way of cooling an electromagnetic device is to place the magnetic cores of the apparatus in direct contact with a metallic heat sink. The heat sink acts to draw heat away from the cores, and thereafter dissipate the heat.

[0003] However, in a vehicular environment such an arrangement is undesirable. The magnetic core, a sintered powder metal iron, is very brittle and will crack and chip under very low stresses. Placing the magnetic cores in direct contact with a metallic heat sink can cause damage to and possible failure of the core. Using such an arrangement in harsh vibrating environments as found in automotive vehicles only exacerbates this problem.

[0004] One approach to remedy this problem is to apply a thermally conductive elastomeric pad to the base of the cores prior to placing them in contact with the heat sink. However, this may create other problems. The manufacture of magnetic cores is a very inexact science in which the height of the cores may vary ± 2.0 mm. In order to have a thermally efficient heat transfer between the heat sink and the cores, it is preferred that the bases of the cores be equidistant from the heat sink. The high tolerance associated with the manufacture of the cores makes aligning the bases of the cores prior to applying the elastomeric pad a cumbersome and inexact process.

[0005] Accordingly, it is seen that a need exists in the art for an electromagnetic apparatus support mechanism which insulates the magnetic cores from damage due to vibration while providing efficient cooling of the cores.

[0006] According to the present invention, there is provided a support mechanism for an electromagnetic apparatus having a plurality of magnetic cores with substantially planar bases, the magnetic cores adapted to receive a transformer and a plurality of inductors, the support mechanism comprising:

a fixture adapted to align the planar bases of the magnetic cores in a coplanar relationship; a bracket adapted to receive the magnetic cores having a top portion with a core receiving side and a plurality of leg portions with outwardly projecting coplanar feet extending a predetermined distance beyond the coplanar bases of the magnetic cores; an elastomeric pad, adapted for attachment along the coplanar bases of the magnetic cores, having a substantially planar pad surface parallel

to the coplanar feet and the coplanar bases, the planar pad surface extending a predetermined distance beyond the coplanar bases of the magnetic cores; and a thermally conductive plate adapted to receive the coplanar feet, upon separation of the electromagnetic apparatus from the fixture, so as to uniformly compress the elastomeric pad between the plate and the coplanar bases of the magnetic cores thereby providing a thermally efficient and shock resistant support mechanism.

[0007] The support mechanism further includes a resilient adhesive applied along the core receiving side of the bracket so as to fasten the bracket to the magnetic cores.

[0008] An advantage of the present invention is that the support mechanism provides the electromagnetic apparatus with a thermally efficient cooling and shock resistant support structure.

[0009] The invention will now be described, by way of example, with reference to the accompanying drawings, in which:

Figure 1 is a perspective view of a fixture for an electromagnetic apparatus;

Figure 2 is a perspective view of an electromagnetic apparatus placed upon a fixture according to the present invention;

Figure 3 is a perspective view of a bracket for an electromagnetic apparatus according to the present invention;

Figure 4 is a perspective view of a bracket mounted upon an electromagnetic apparatus utilising a fixture according to the present invention;

Figure 5 is perspective view of an electromagnetic apparatus support mechanism with a base mounted elastomeric pad according to the present invention; and

Figure 6 is a perspective view of an electromagnetic apparatus support mechanism mounted upon a thermally conductive plate according to the present invention.

[0010] Turning now to the drawings, and in particular to Figures 5 and 6 thereof, an electromagnetic apparatus support mechanism 10 is shown. The support mechanism 10 has a bracket 12, an elastomeric pad 14, and a thermally conductive plate 16. The support mechanism 10 is assembled utilising a fixture 18 as shown in Figure 1.

[0011] As shown in Figure 1, the fixture 18 is substantially rectangular and has a planar fixture surface 20. A planar base receiving surface 22 is located central to the fixture surface 20. The base receiving surface 22 is elevated a predetermined distance above and parallel to the fixture surface 20.

[0012] As shown in Figure 2, an electromagnetic apparatus may have a pair of inductors 26, a transformer 28, and a plurality of magnetic cores 30. The manufacturing tolerances of the cores 30 may be as high as ± 2.0

mm. Each inductor 26 and the transformer 28 has a corresponding magnetic core 30.

[0013] The bracket 12, as shown in Figure 3, has a planar top portion 32 and a core receiving side 34. Projecting downward from the top portion 32 are flanges 35 which are adapted to receive the magnetic cores 30, and thereby restrict lateral movement of the cores 30. Also projecting downward from the top portion 32 are a plurality of leg portions 36 of equal, predetermined length. The leg portions 36 have inwardly directed flanges 38 which are also adapted to receive the magnetic cores 30. Projecting outward of the leg portions 36 are a plurality of coplanar feet 40. The feet 40 have holes 42 therein for receiving a conventional fastener, such as a screw (not shown), therethrough.

[0014] As shown in Figure 5, an elastomeric pad 14 is formed in a substantially rectangular shape with a predetermined thickness. The pad 14 has a planar adhesive surface 15 and a planar base surface 17 parallel to the adhesive surface. The pad 14 is preferably thermally conductive.

[0015] As shown in Figure 6, the thermally conductive plate 16 is substantially rectangular with an upper, electromagnetic apparatus receiving surface 19. The plate 16 has fastener receiving holes (not shown) which are adapted to align with the holes 42 of the bracket 12 during assembly. The plate 16 is preferably made out of a metal with high thermal conductivity such as aluminium.

[0016] In assembly, the fixture 18 of Figure 1 is placed on a flat surface. As shown in Figure 2, the magnetic cores 30 are then placed and aligned on the base receiving surface 22 of the fixture 18 and bonded together in conventional fashion. The bases of the magnetic cores 30 thereby form a coplanar base surface such that any tolerance variance of the cores 30 is realised on the top side. A resilient adhesive, such as a silicon adhesive (not shown), is then applied to the core receiving side 34 of the bracket 12 as shown in Figure 3. As shown in Figure 4, the bracket 12 is then placed over the magnetic cores 30 so that the feet 40 come into coplanar contact with the planar fixture surface 20. This contact insures that the coplanar feet 40 extend a predetermined distance beyond, and are parallel with, the coplanar bases of the magnetic cores 30. After the adhesive cures affixing the bracket 12 to the magnetic cores 30, the assembly is removed from the fixture 18. As shown in Figure 5, the planar adhesive surface 15 of the elastomeric pad 14 is then brought into contact with the bases of the magnetic cores 30. The planar base surface 17 of the pad 14 extends a predetermined distance beyond, and is parallel with, the coplanar bases of the magnetic cores 30 as well as the coplanar feet 40. As shown in Figure 6, the holes 42 of the feet 40 are aligned with the fastener receiving holes of the upper receiving surface 19 of the thermally conductive plate 16. A conventional fastener is then used to attach the bracket 12 to the plate 16. As the fasteners are tightened the pad 14 is uniformly compressed between the bases of the magnetic cores

30 and the plate 16.

[0017] The resulting electromagnetic apparatus support mechanism 10 is advantageous for a number of reasons. First, the only points of contact of the magnetic cores 30 are with the resilient adhesive of the bracket 12 and the elastomeric pad 14. This arrangement provides a protective cushion for the brittle magnetic cores 30 and helps to prevent cracking and chipping. Second, the coplanar bases of the magnetic cores 30 are in a coplanar relationship and they are parallel with the planar base surface 17 of the pad 14 as well as the coplanar feet 40 of the bracket 12. Thus, upon fastening of the bracket 12 to the plate 16, the pad 14 is evenly compressed and the bases of the magnetic cores 30 are thereby parallel to, and equidistant from, the plate 16. This arrangement provides an even and efficient thermal transfer between the cores 30 and the plate 16 via the pad 14.

Claims

1. A support mechanism for an electromagnetic apparatus having a plurality of magnetic cores (30) with substantially planar bases, the magnetic cores (30) adapted to receive a transformer (25) and a plurality of inductors (26), the support mechanism comprising:

a fixture (18) adapted to align the planar bases of the magnetic cores in a coplanar relationship;

a bracket (12) adapted to receive the magnetic cores (30) having a top portion (32) with a core receiving side (34) and a plurality of leg portions (36) with outwardly projecting coplanar feet (40) extending a predetermined distance beyond the coplanar bases of the magnetic cores (30);

an elastomeric pad (14), adapted for attachment along the coplanar bases of the magnetic cores (30), having a substantially planar pad surface (12) parallel to the coplanar feet (40) and the coplanar bases, the planar pad surface (17) extending a predetermined distance beyond the coplanar bases of the magnetic cores (30); and

a thermally conductive plate (16) adapted to receive the coplanar feet (40), upon separation of the electromagnetic apparatus from the fixture (18), so as to uniformly compress the elastomeric pad between the plate (16) and the coplanar bases of the magnetic cores (30) thereby providing a thermally efficient and shock resistant support mechanism.

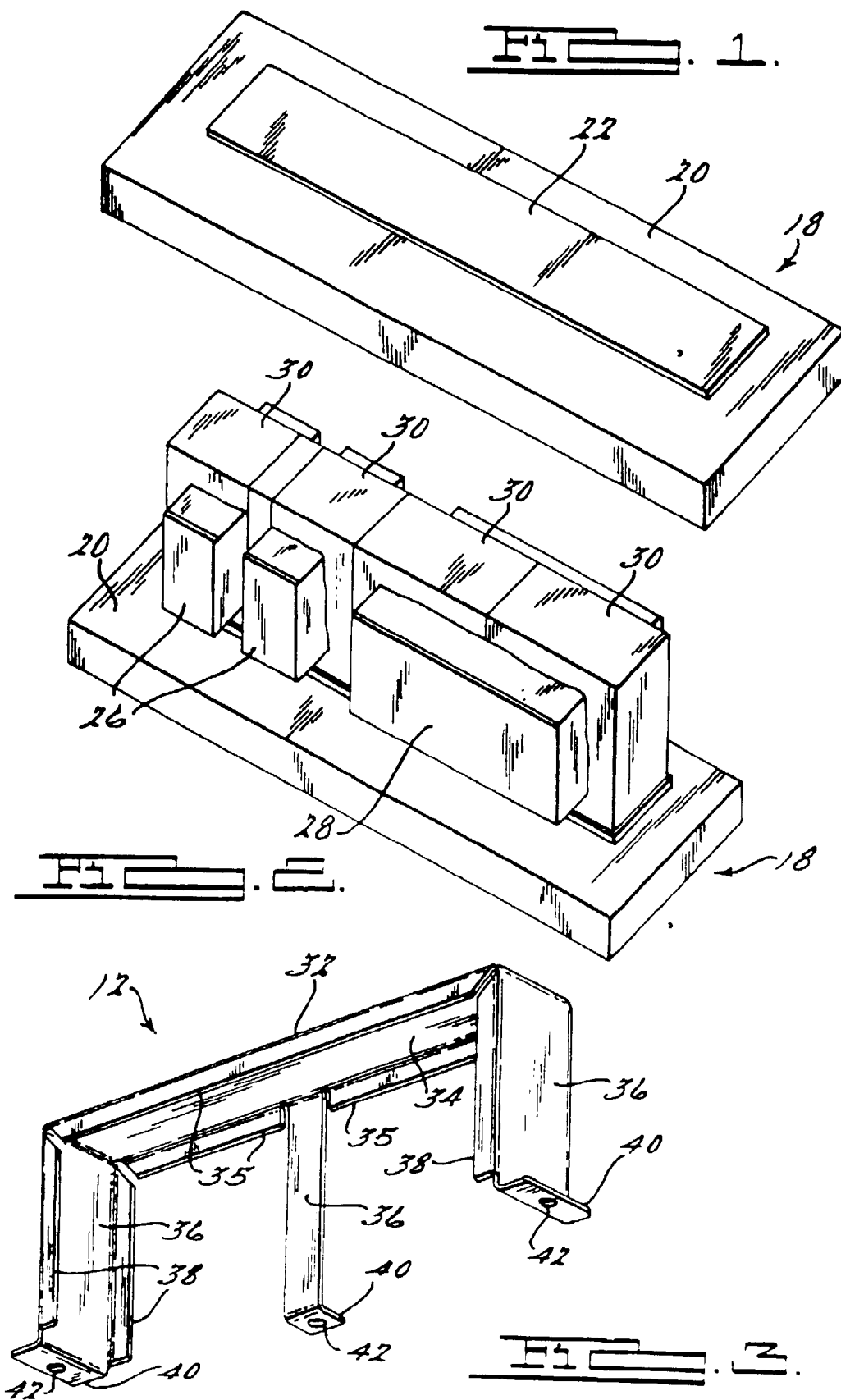
2. A support mechanism according to claim 1, wherein the fixture has a planar fixture surface and a central

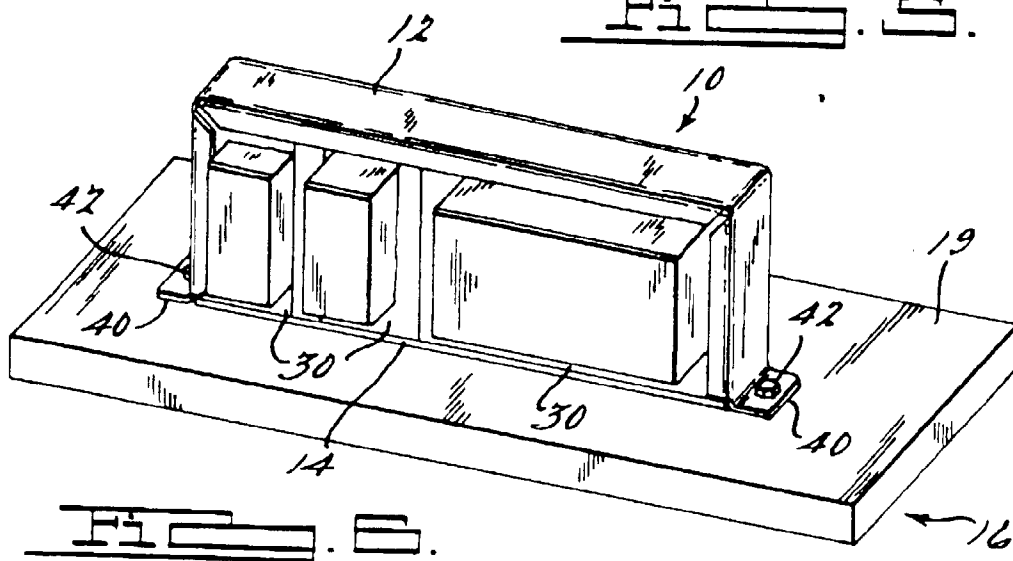
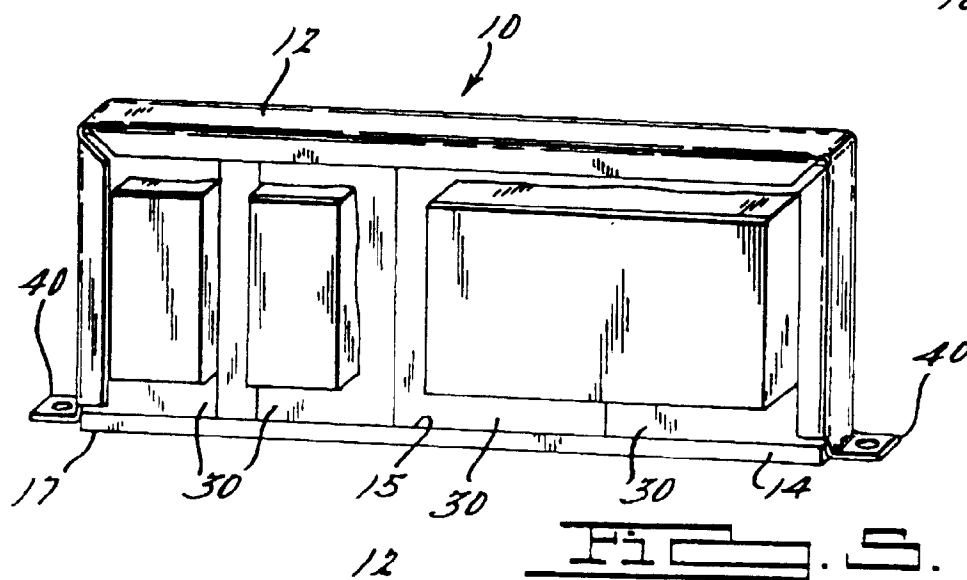
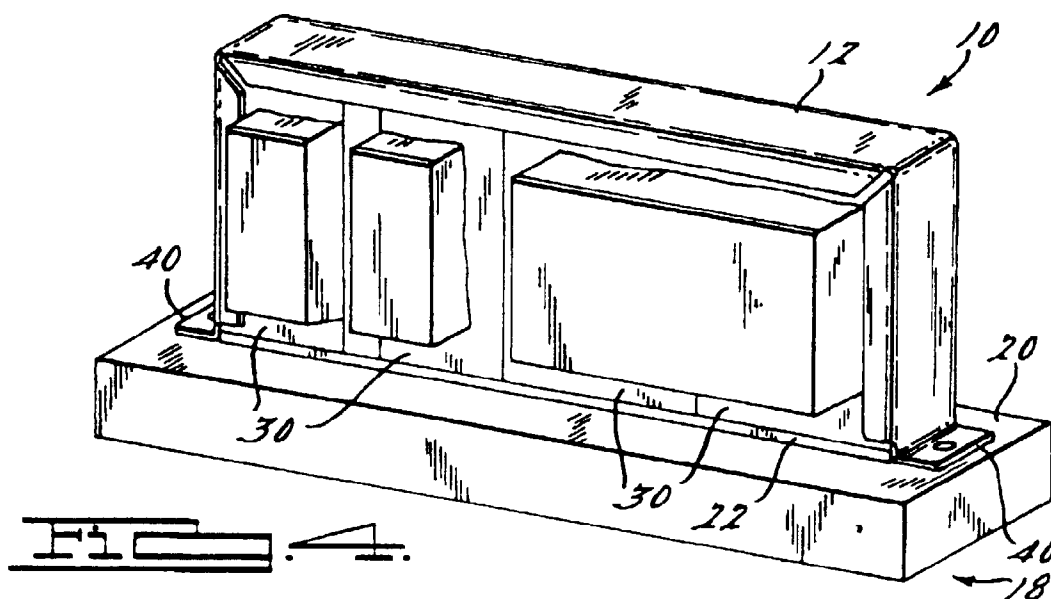
planar portion elevated a predetermined distance above and parallel to the planar fixture surface.

3. A support mechanism for an electromagnetic apparatus having a plurality of magnetic cores (30) with substantially planar bases aligned in coplanar relationship by a fixture (18) with a planar fixture surface (20) and a central planar base receiving portion (22) elevated a predetermined distance above and parallel to the planar fixture surface (20), a transformer (28) and a plurality of inductors (26), the support mechanism comprising:
 - a bracket (12) adapted to receive the magnetic cores having a top portion (32) with a core receiving side (34) and a plurality of leg portions (36) with outwardly projecting coplanar feet (40) extending a predetermined distance beyond the coplanar bases of the magnetic cores; an elastomeric pad (14), adapted to be disposed along the coplanar bases of the magnetic cores (30), having a substantially planar pad surface (17) parallel to the coplanar feet and the coplanar bases, the planar pad surface (17) extending a predetermined distance beyond the coplanar bases of the magnetic cores (30); and
 - a thermally conductive plate (16) adapted to receive the coplanar feet (40), upon separation of the electromagnetic apparatus from the fixture, so as to uniformly compress the elastomeric pad (14) between the plate (16) and the coplanar bases of the magnetic cores (30) thereby providing a thermally efficient cooling and shock resistant support mechanism.
4. A support mechanism according to claim 1 or 3, wherein the predetermined distance above the planar fixture surface is equal to the predetermined distance the feet extend beyond the coplanar bases of the magnetic cores.
5. A support mechanism according to claim 1 or 3, wherein the bracket further includes inwardly projecting flange portions adapted to receive the magnetic cores.
6. A support mechanism according to claim 1 or 3, wherein the elastomeric pad is a thermally conductive elastomeric pad.
7. A support mechanism according to claim 1 or 3, further including a resilient adhesive applied along the core receiving side of the bracket so as to fasten the bracket to the magnetic cores in supportive and shock absorptive relationship.
8. An electromagnetic assembly for an automotive ve-

hicle, comprising:

- an electromagnetic device having a plurality of magnetic cores with substantially planar bases, the magnetic cores adapted to receive a transformer and a plurality of inductors;
- a fixture having a planar elevated portion and a planar recessed portion being parallel to and terminating a predetermined distance therefrom, the elevated portion adapted to align the planar bases of the magnetic cores in a coplanar relationship;
- a bracket having a top portion with a core receiving side and inwardly projecting flange portions and a plurality of leg portions with inwardly projecting flange portions and outwardly projecting coplanar feet, the flange portions of the top and leg portions adapted to receive the magnetic cores and the coplanar feet extending a predetermined distance beyond the coplanar bases of the magnetic cores;
- a resilient adhesive applied along the core receiving side of the bracket for fastening the bracket to the magnetic cores;
- a thermally conductive elastomeric pad disposed along the coplanar bases of the magnetic cores having a substantially planar surface parallel to the coplanar feet and the coplanar bases, the planar surface extending a predetermined distance beyond the coplanar feet;
- and
- a thermally conductive plate adapted to receive the coplanar feet, upon separation of the electromagnetic apparatus from the fixture, so as to uniformly compress the elastomeric pad between the cold plate and the coplanar bases of the magnetic cores thereby providing a thermally efficient and shock resistant support mechanism.
9. A support mechanism according to claim 8, wherein the distance between the planar elevated portion and the planar recessed portion is equal to the predetermined distance the feet extend beyond the coplanar bases of the magnetic cores.







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EUROPEAN SEARCH REPORT

Application Number
EP 98 30 8727

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
A	EP 0 564 315 A (THOMSON CSF) 6 October 1993 * column 5, line 9 - line 15 * ---	1	H01F27/26 H01F27/06
A	US 4 622 627 A (RODRIGUEZ EDWARD ET AL) 11 November 1986 ---		
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			H01F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 29 January 1999	Examiner Vanhulle, R
CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

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**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 98 30 8727

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
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29-01-1999

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