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54 **Cast reinforced bracket.**

57 A support bracket (10,50) is made of a cast material having an embedded reinforcing plate (36;62) with preformed holes (42,44,46;64) of a diameter greater than that of corresponding holes (22,24,26) drilled through the cast material. The cast material is preferably a relatively lighter and readily machinable material, such as aluminium, while the reinforcing plate is of a relatively stiffer and harder material, such as steel. The larger diameter of the reinforcing plate holes enables holes to be drilled through the support bracket without cutting into the hard material of the reinforcing plate. The reinforcing plate is advantageously configured to increase the natural frequency of vibration of the bracket.

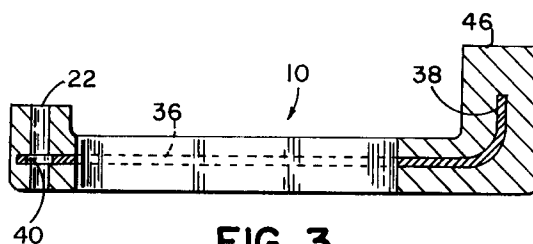


FIG. 3

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The present invention relates to cast metal brackets, and, more specifically, to cast metal brackets having an embedded stiffening plate.

Cast metal brackets are frequently used as support members in applications where the bracket must be formed in a special shape or configuration. A typical application is a mounting bracket for an internal combustion engine. The bracket is bolted to the engine and has support members extending outwardly for supporting components such as an alternator, power steering pump, or any of a wide variety of other devices.

In an application such as an internal combustion engine, the bracket must be specially shaped to avoid interferences with other components in the typically crowded engine compartment of modern vehicles. Furthermore, it is highly desirable to make the bracket as light in weight as possible to improve fuel economy. To meet these ends, such brackets will often be configured with rather slender support members and thin wall thicknesses. Cast metal, particularly aluminium, is well suited to meet such requirements.

Brackets as described above, particularly those used on engines, will be subject to significant stresses. The bracket must be able to withstand such stresses without excessive deflection. Vibrations may be severe, and it is particularly important that the natural frequencies of the vibration modes of the bracket be higher than the vibration frequencies of the engine to which the bracket is mounted; otherwise, the vibrations of the engine would induce excessive bracket vibration amplitudes and might even cause the bracket to crack and fail.

One approach to increasing the strength and natural frequency of vibration of the bracket is to thicken the bracket. However, this leads to an undesirable increase in weight and difficulties in fitting the bracket into cramped spaces. A second approach is to make the bracket out of stronger and stiffer materials. However, such materials tend to be heavier and harder. Material hardness is a significant problem in that machining of the bracket is made more difficult. A third approach is to manufacture the bracket with an embedded reinforcing plate, the reinforcing plate being designed to strengthen and increase the natural frequency of the bracket as needed.

Cast metal brackets are usually manufactured by first casting the metal, machining the casting to obtain precision surfaces, and by drilling to form holes for bolts or other fasteners or penetrations. Although the metal used for the outer body of the casting, typically aluminium, may be readily machinable, the reinforcing plate material, typically steel, will be more resistant to machining. Drilled holes will be particularly difficult to produce, since

the drill must pass through the hard reinforcing plate material as well as the softer outer body material of the bracket.

Accordingly, there is a heretofore unmet need for a cast bracket that may be made in shapes suitable for cramped spaces, that is light in weight yet strong and stiff enough to resist vibrations, and is readily machinable.

This need is met by the present invention which provides, according to one aspect, a support bracket which comprises a body cast of material having at least one drilled hole therethrough and a reinforcing plate embedded in the body, and is characterised in that the reinforcing plate has a preformed hole disposed in correspondence with the drilled hole, the preformed hole having a diameter greater than the diameter of the drilled hole. In this manner, on drilling a hole through the bracket the drill bit does not need to cut through the harder material of the reinforcing plate.

Brackets made according to the present invention may be made in any desired configuration. Since it is not necessary to machine through the reinforcing plate, the plate may be made of an extremely strong and tough material, thus enabling the bracket to be formed in shapes having thin members which would otherwise be unable to resist the forces imposed on the bracket.

The invention also includes, according to a second aspect, a method for making a support bracket comprising the steps of forming a reinforcing plate and casting a bracket body material around the reinforcing plate such that the reinforcing plate is embedded within said bracket body material, characterised in that the plate is formed with a hole and that after casting a hole is drilled through the bracket body material with a drill having a smaller diameter than the hole in the reinforcing plate, the drill passing through the hole in the reinforcing plate without cutting into the reinforcing plate.

The invention may be carried into practice in various ways but two brackets made and constructed in accordance with the invention will now be described by way of example with reference to the accompanying drawings, in which:

Fig. 1 is a front view of a first cast reinforced support bracket for an internal combustion engine;

Fig. 2 is a perspective view of the reinforcing plate used within the bracket of Fig. 1;

Fig. 3 is a sectional view taken along the line III-III of Fig. 1;

Fig. 4 is a sectional view taken along the line IV-IV of Fig. 1; and

Fig. 5 is a perspective view, partially sectioned, of the second cast reinforced support bracket.

There is shown in Fig. 1 a support bracket 10 for an internal combustion engine. In its general organisation, the bracket has a central section 12 which is adapted to be bolted to an engine or an engine component, and outwardly extending members 14,16 which are adapted to support other engine components such as an alternator 18 and a power steering pump 20. The central section 12 of the bracket is formed with three holes 22,24,26 which are drilled through the bracket. These holes are provided for the passage of bolts for attaching the bracket. Other holes 28,30,32 are provided for other fasteners as needed.

The other body of the bracket is made of a cast metal such as 280 aluminium chosen for its castability and light weight. Embedded within the aluminium body of the bracket generally surrounding a central opening 34 is a steel reinforcing plate 36. As best shown in Fig. 2, the reinforcing plate is a relative thin member shaped as a ring having a perpendicularly offset tongue 38. The shape of the reinforcing plate 36 is specific to the particular bracket shown in Fig. 1. It should be understood that the principles of the invention are applicable to an unlimited variety of other bracket and reinforcing plate shapes, sizes, and configurations.

The ring portion of the bracket is preformed with three holes 40, 42, and 44 which correspond in location to the holes 22, 24, and 26 of the finished bracket. As best shown in Figs. 3 and 4, each of the reinforcing plate holes has a diameter somewhat larger than the holes of the finished bracket. The reinforcing plate holes are substantially concentric with the finished holes 22, 24, 26.

Brackets according to the invention are manufactured by first forming the reinforcing plate with the desired shape and holes, then supporting the plate in the desired position within the cavity of a casting die. Molten metal is then poured into the die. As a result, the reinforcing plate is embedded within the bracket. Holes such as holes 22, 24 and 26 are then drilled through the bracket. Since the diameters of the reinforcing plate holes 40, 42, and 44 are greater than the diameters of the drilled holes 22, 24, and 26, the drill bit cuts only through the softer metal of the body 46 of the bracket, not through the harder, less machinable reinforcing plate metal. The resulting bracket is relatively light in weight, yet has sufficient strength and rigidity to resist the forces imposed by a harsh, vibrating environment, such as an engine compartment.

Fig. 5 shows a second example of a bracket 50 according to the invention. The configuration of bracket 50 contains a number of bends 52, 53, 54, surfaces 56, 57, 58, and a relatively narrow neck 60. The steel reinforcing plate 62 is conveniently bent, shaped, and preformed with holes such as hole 64 to be embedded within the cast aluminium

body 66 in the same manner as described above.

In each of the brackets shown in Figures 1 to 4 and Figure 5 respectively, the reinforcing plate being of steel is of a metal which has a greater stiffness than the material of which the remainder of the bracket is cast, namely aluminium. Moreover, the plate is configured to increase the natural frequency of vibration of the bracket in order to avoid dangerous vibrations being generated by running of the engine.

Claims

1. A support bracket (10;50) comprising a body of cast material having at least one drilled hole (22,24,26) therethrough and a reinforcing plate (36;62) embedded in the body, characterised in that the reinforcing plate has a preformed hole (42,44,46;65) disposed in correspondence with the drilled hole, the preformed hole (42,44,46;64) having a diameter greater than the diameter of the drilled hole.
2. A support bracket according to claim 1 wherein the cast material is metal and the reinforcing plate is of a metal having a stiffness greater than the cast material.
3. A support bracket according to claim 1 or claim 2 wherein the cast material is aluminium.
4. A support bracket according to any of claims 1 to 3 wherein the reinforcing plate metal is steel.
5. A support bracket according to any of claims 1 to 4 wherein the reinforcing plate is configured to increase the natural frequency of vibration of the bracket.
6. A support bracket according to any of claims 1 to 5 wherein the drilled hole and the preformed hole are substantially concentric.
7. A method of making a support bracket (10;50) comprising the step of forming a reinforcing plate (36;62) and casting a bracket body material around the reinforcing plate such that the reinforcing plate is embedded within said bracket body material, characterised in that the plate is formed with a hole (40,42,44;64) and that after casting a hole (22,24,26) is drilled through the bracket body material with a drill having a smaller diameter than the hole in the reinforcing plate, the drill passing through the hole in the reinforcing plate without cutting into the reinforcing plate.

8. A method according to claim 7 wherein the step of forming further includes forming said reinforcing plate of steel.
9. A method according to claim 7 or claim 8 wherein the step of casting further includes casting bracket body material of aluminium.
10. A method according to any of claims 7 to 9 wherein the step of forming further includes configuring the reinforcing plate to increase the natural frequency of vibration of the support bracket.

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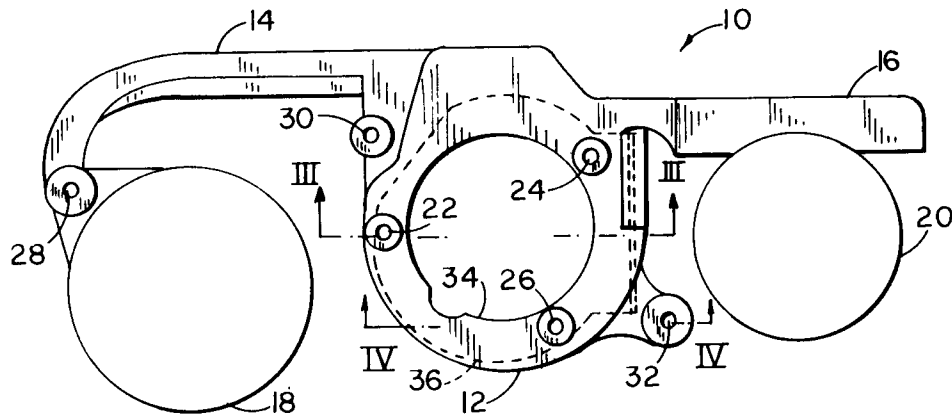


FIG. 1

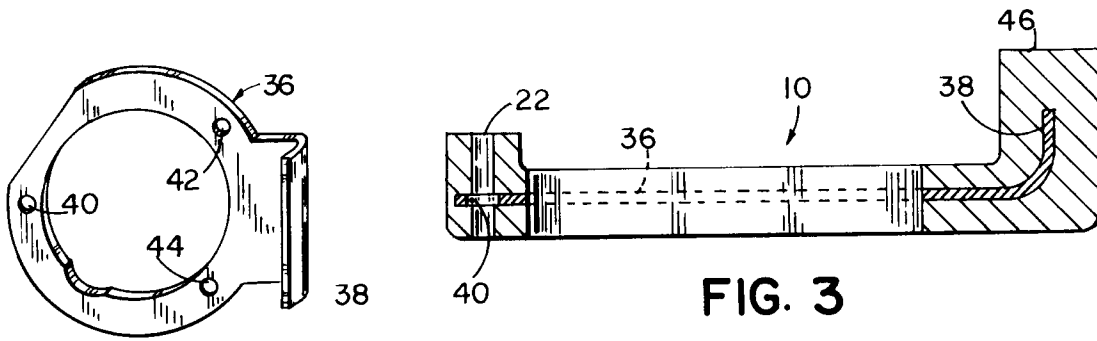


FIG. 2

FIG. 3

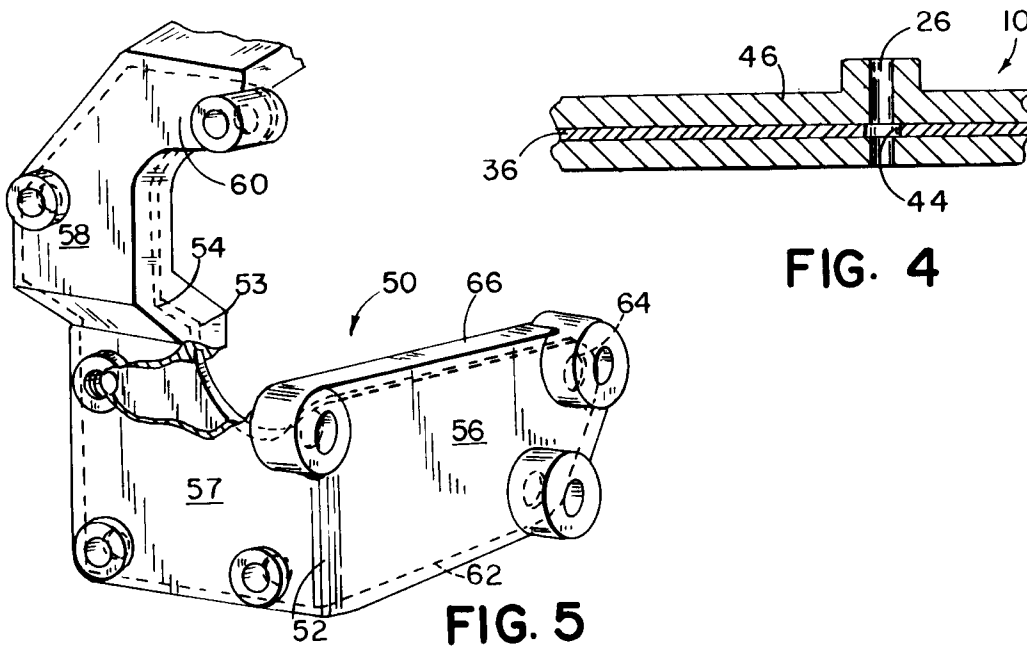


FIG. 4

FIG. 5



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EUROPEAN SEARCH REPORT

Application Number

EP 92 30 5592

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.5)
Y	PATENT ABSTRACTS OF JAPAN vol. 014, no. 399 (M-1017)29 August 1990 & JP-A-21 51 363 (MITSUBISHI MOTORS CORP) 11 June 1990 * abstract *	1-10	F02B77/00 F02B67/00 B22D19/00 B22D19/02 F02F7/00
Y	EP-A-0 052 818 (NISSAN MOTOR COMPANY, LIMITED) * page 5, line 16 - page 7, line 9; claim 6; figure 1 *	1-10	
			TECHNICAL FIELDS SEARCHED (Int. Cl.5)
			F02B B22D F02F
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 19 JANUARY 1993	Examiner WASSENAAR G.C.C.
CATEGORY OF CITED DOCUMENTS		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	
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			

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