United States Patent

Thien et al.

[15] **3,695,386**

[45] **Oct. 3, 1972**

[54] **SOUND-PROOFING COMPONENT**

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[22] Filed: **March 18, 1970**

[21] Appl. No.: **20,758**

[30] **Foreign Application Priority Data**

March 20, 1969 Austria .....A 2802/69

[52] **U.S. Cl.** .....**181/33 K,** 123/195 C

[51] **Int. Cl.** **F02f 7/00,** F16m 1/00, G10k 11/00

[58] **Field of Search**.....181/33 K, 33 A, 33 G, 33 R; 123/195 C, 198 E, 52 MC, 41.70, 41.07

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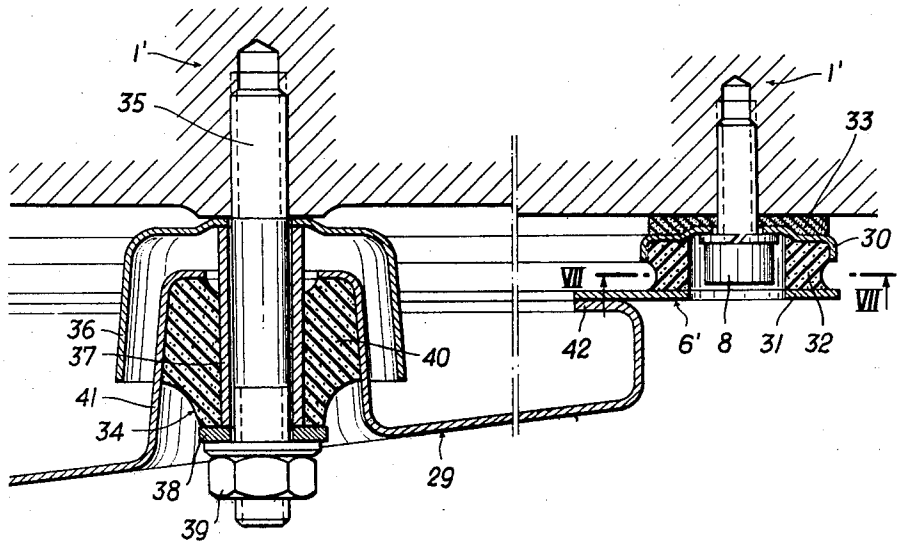
[57] **ABSTRACT**

A component for sound proofing internal combustion engines having two frame members attached to the surface of the engine and arranged in spaced relation to the engine and spaced from each other with sound proofing packing between the frame members.

5 Claims, 7 Drawing Figures



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SHEET 1 OF 2

FIG. 1

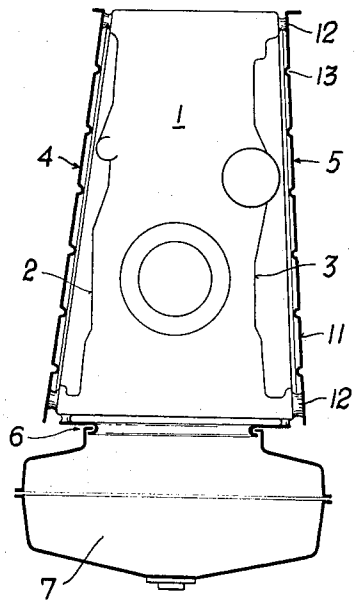

FIG. 2

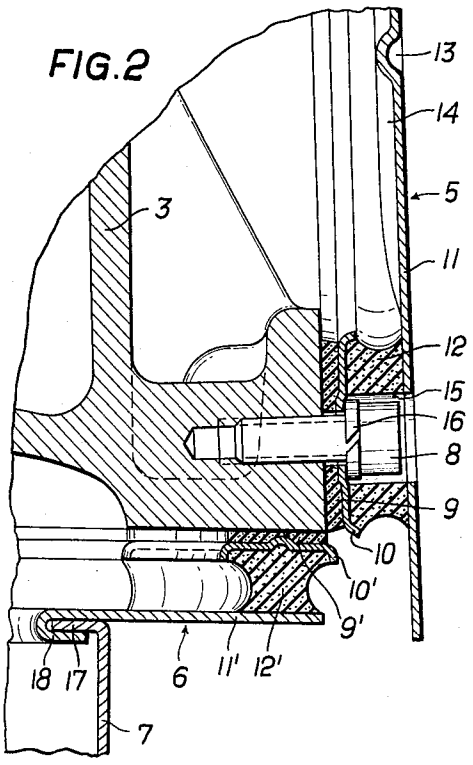

FIG. 3

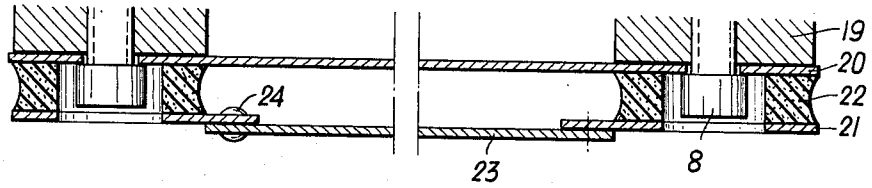

FIG. 4

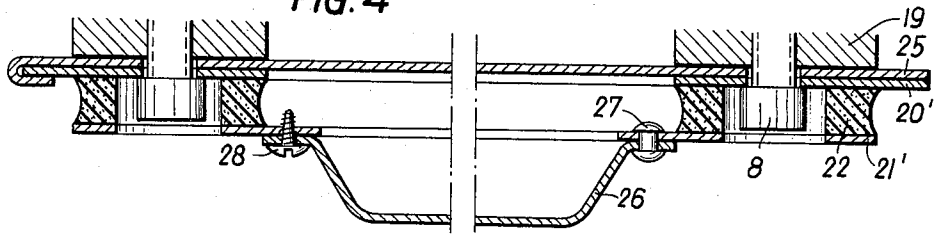

FIG. 5

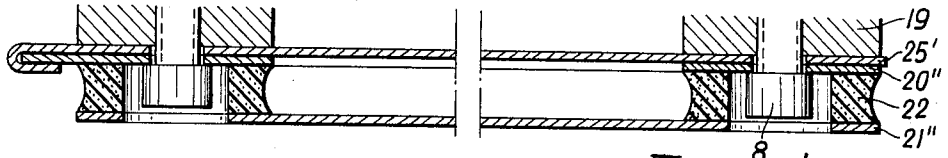

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FIG.6

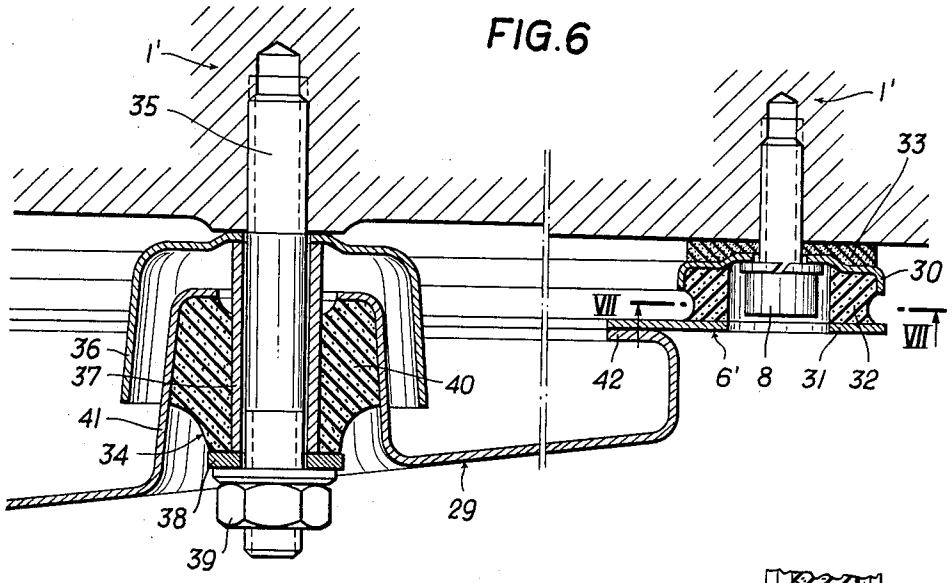
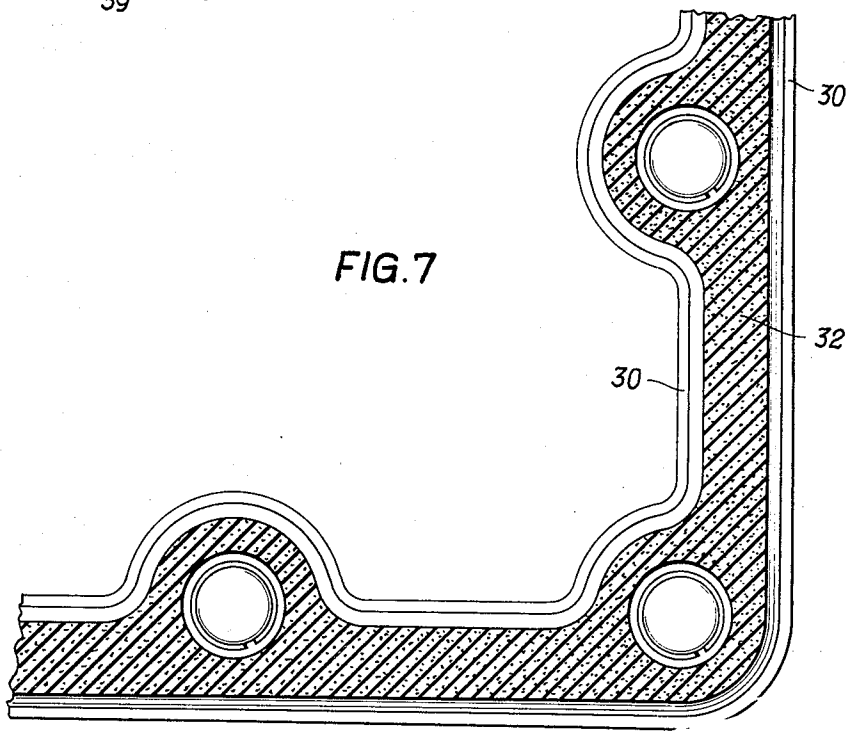


FIG.7



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SOUND-PROOFING COMPONENT

The invention relates to a sound-proofing component for the sheathing of machines, particularly of internal combustion engines.

Efforts to control excessive engine noise have been responsible for the development of a number of more or less effective components for the principal purpose of screening the machine off sound radiations emanating from the outer walls of the machine. However, similar components of conventional design present certain shortcomings both with regard to their installation and operation, in addition to being generally responsible for a considerable increase of the weight of the machine.

Particularly in an internal combustion engine of a known design, the cylinder block, as different from conventional casting types, is formed by a framework made of steel plates and covered on both sides and in the area of the crankcase by sound-proofing multilayer plates called sandwich metal sheets. In their plainest form these sound-proofing elements consist of two massive steel plates arranged in spaced relation to each other, and interconnected by means of an interposed layer of sound-proofing material in such a manner that the inside steel plate only is screwed onto the crankshaft housing with the interposition of packing strips. However, this type of sound-proofing is highly objectionable insofar as it strongly impairs the abduction of heat from the cylinder block towards its surroundings, inasmuch as in view of its low thermal conductively the sound-absorbing material also acts in a heat-insulating capacity. This leads to an objectionable rise of the oil temperature which will have to be compensated by appropriate measures such as for example, the provision of a large-sized oil cooler.

It is therefore, the object of the present invention to provide an easily installable and adaptable component for the sound-proof sheathing of machines avoiding the shortcomings of known devices. According to the invention such a component is characterized by a first frame member rigidly attached to the outside of the machine and by a second frame member arranged in spaced relation to and in front of, the first and connected with the same by means of a sound-proofing packing along a continuous series of lines, the said second frame member covering at least part of the outer surface of the machine and/or serving as a support for one or several encasements.

Experience goes to show that such a component of plain design presents sound-proofing properties of a surprisingly high degree despite the deliberate omission of sound-absorbing intermediate layers, without impairing the exchange of heat between the machine and its surroundings.

The framework construction of the component according to the invention offers not only the advantage of its low weight, but in addition the possibility of providing a component of appropriate rigidity to be used also as a supporting element. Furthermore, where the external second frame member is so designed as to serve as a support for encasements, it will be possible for such elements as are directly associated with the machine, such as the oil sump of an internal combustion engine for example, to be attached to the said second frame member as encasements. This further

simplifies the overall design of the machine and additionally helps reduce its weight.

According to a preferred embodiment of the invention, one of the two frame members is designed as a closed, possibly arched plate and/or reinforced by means of corrugations. This design is particularly suitable for the sound-proofing encasement of large surfaces of the machine. Where a very tight connection between the component and its mounting surfaces on the machine is required, it will be preferable to attach the component with its plate-shaped rim rigidly to the machine and to provide an additional sealing between the plate and its mounting surfaces on the housing, such as by means of a sealing compound of profile washers.

According to another embodiment of the invention at least one of the two frame members can be designed at least one of the two frame members can be designed as a strip having a mounting rim protruding from the packing either on one side or both. The encasements provided can be attached to the mounting rim in any convenient manner such as by screwing, gluing or rivetting. If desirable in view of the particular shape of the encasements to be mounted, it is also possible for the mounting rim of the strip-shaped frame member to be of angular-shaped or of any other convenient form.

According to a further feature of the invention the strip-shaped frame member can be attached alongside its mounting rim to the rim of a connecting plate provided on the outer surface of the machine by welding, gluing, flanging or the like. In that case, the additional connecting plate provides positive sealing of the encased machine compartment against the outside. The encasements mounted on the second sound-proofing frame member or the external frame member designed as a plate are exclusively used for sound-proofing purposes. The distance between the additional connecting plate and the sound-proofing plate in front of it is of particular importance for the sound-proofing capacity of the component according to the invention. The most convenient distance should be determined by trial and error.

According to a further embodiment of the invention the packing made of rubber, synthetic material or the like is attached to the two frame members by vulcanization or gluing. In particular, attachment by vulcanization is feasible only in connection with a component according to the invention, since at least one of its frame members is open-worked so that the packing can be easily heated to the required uniform vulcanization temperature.

In some cases it will be preferable to provide an additional support for the second frame member or for an encasement attached thereto by means of at least one sound-proofing supporting element mounted on the outer surface of the machine or on the first frame member. This helps eliminate objectionable vibrations particularly where large-sized encasements are used. The provision of additional supporting elements may, however, prove useful also for considerations of a mechanical nature.

Further details of the invention will appear from the following description of several embodiments of the invention with reference to the accompanying drawing in which

FIG. 1 shows a diagrammatic cross-sectional view of the cylinder block of an internal combustion engine encased by means of sound-proofing components according to the invention,

FIG. 2 illustrates a detail of FIG. 1 on a larger scale, and

FIGS. 3 to 5 are cross-sectional view of various types of sound-proofing components according to the invention,

FIG. 6 is a diagrammatic cross-sectional view of yet another embodiment of the invention, and

FIG. 7 is a cross-sectional view on line VII—VII of FIG. 6.

As shown in FIG. 1, the housing 1 of an internal combustion engine is provided with a sound-proofing sheathing substantially comprising two sound-proofing components 4 and 5 spaced in front of the two sidewalls 2 and 3 of the housing 1, and a further sound-proofing component 6 arranged on the lower rim of the housing 1 and to which the oil sump 7 is attached.

The essentially identical components 4 and 5 comprise a first frame member 10 rigidly mounted on the housing 1 by means of bolts 8 with the interposition of a continuous profile washer 9 and connected to a plate-shaped second frame member 11 by means of a continuous elastic packing 12 in such a manner as to provide effective sound isolation. The packing 12 made of rubber for example, extends alongside the first-mentioned frame member 10 and is positively and tightly attached thereto and also to the plate-shaped frame member 1 by vulcanization or gluing. The plate-shaped frame member 11 is reinforced by means of horizontal and vertical corrugations 13 and 14.

At the points of attachment of the sound-proofing components 4 and 5 on the housing 1, the frame member 10 and the packing 12 are somewhat enlarged for receiving the bolts 8. The bolts 8 are countersunk in a stepped through bore 15 and rest with the interposition of a circlip 16 upon the annular shoulder formed by the bore 15 on the inner frame member 10.

The component 6 mounted on the underside of the housing 1 also comprises two frame members 10' and 11' interconnected by means of a sound-proofing elastic packing 12' and screwed to the lower rim of the housing 1 with the interposition of a continuous profile washer 9'. The strip forming the outer frame member 11' presents a mounting rim protruding inwardly from the packing 12', the upper rim 17 of the oil sump 7 being attached to the said mounting rim by means of an oiltight flange 18. Thus the coil sump 7 forms a sound-proofing encasement attached to the housing 1 and serving to screen off sound radiation from the housing 1 downwards.

The oiltight and substantially bend-resisting design of the sound-proofing components 4 and 5 makes is possible for the sidewalls 2 and 3 of the housing 1 to be provided with large-area recesses in such a manner that the components 4 and 5 themselves form the oil-wetted outer walls of the housing 1. This eliminates the need for providing double-walled outer surfaces of the housing and helps save much weight. Likewise, the front walls of the housing 1 could be sheathed by means of sound-proofing components of a similar design in such a manner as to inhibit heat radiation from the machine on all sides.

FIG. 3 shows a particularly plain type of component designed according to the invention. The inner frame member 20 directly adjoining the body 19 of the machine to be sound-proofed is designed as through plate and the second frame member 21 connected therewith by means of a sound-proofing elastic packing 22 as a strip with an inwardly protruding mounting rim. Alongside this rim a plate-shaped encasement 23 is positively connected with the frame member 21 in any convenient manner such as by gluing the members 21 and 23 (right side of FIG. 3) or by means of rivets 24 (left side of FIG. 3).

According to the embodiment of the invention illustrated in FIG. 4, the two frame members 20' and 21' of the sound-proofing component are designed as strips having a laterally protruding mounting rim, a separate connecting plate 25 directly adjoining the machine body 19 presenting a laterally protruding rim to which the inner frame member 20' of the sound-proofing component is attached. The members 20' and 25 can be interconnected by any convenient method, such as for example by welding (right side of FIG. 4) or by flanging (left side of FIG. 4). An encasement 26 forming a salient bonnet is attached to the mounting rim of the outer frame member 21 by means of rivets 27 (right side of FIG. 4) or self-tapping screws 28 (left side of FIG. 4).

The component shown in FIG. 5 comprises a strip-shaped inner frame member 20'' and a plate-shaped outer frame member 21' connected therewith by means of a sound-proofing elastic packing 22. This design also uses a separate connecting plate 25' directly adjoining the machine body 19. The plate 25' can either by mounted on the machine body 19 jointly with the frame member 20'' by means of bolts 8 (right side of FIG. 5) or else the members 25' and 20'' are interconnected by flanging at the rim (left side of FIG. 5).

FIG. 6 illustrates the sound-proofing connection of an oil sump 29 to the lower rim of the housing 1' of an internal combustion engine (not shown). The oil sump is mounted thereon by means of a sound-proofing component 6' comprising a first frame member 30 designed as a sectional strip and a second strip-shaped frame member 32, interconnected by means of a sound-proofing elastic packing 32. The component 6' is mounted on the housing 1' by means of bolts 8 with the interposition of a profile washer 33. The frame member 31 has an inwardly protruding mounting rim to which the inwardly bent upper rim 42 of the oil sump 29 is attached by welding.

The oil sump 29 rests upon the housing 1 of the machine supported by an additional supporting element 34 in such a manner as to provide positive sound-proofing. The supporting element 34 comprises a stay bolt 35 screwed into the housing 1' and carrying a covering hood 36, an adjacent tubular sleeve 37, a washer 38 and a nut 39. Shrunk on the sleeve 37 is an elastic bushing 40 made of sound-proofing material such as rubber, and preferably positively connected with the sleeve 37 by vulcanization or gluing. The elastic bushing 40 protrudes into a bell-shaped recess 41 of the oil sump 29 and rests on the open-worked bottom of same. The bushing 40 can be mounted in the recess 41 also by vulcanization or gluing. The addi-

tional supporting element **34** carries part of the weight of the oil sump **29** and at the same time serves to suppress any operational vibrations of the oil sump.

We claim:

1. A component for the soundproof sheathing of internal combustion engines, comprising a first frame member rigidly attached to an outer surface of the internal combustion engine, a second frame member covering at least part of the said outer surface and arranged in spaced relation to and in front of the said first frame member, a soundproofing packing located between the said two frame members and tightly connected with same along a continuous series of lines, at least one of the said frame members being a strip having a mounting rim laterally protruding from the said packing.

2. A component according to claim **1**, comprising a connecting plate mounted on the outer surface of the internal combustion engine, the said strip-shaped frame member being rigidly connected with the outer rim of the said connecting plate along its mounting rim.

3. A component according to claim **2**, wherein the said rims of the strip and of the connecting plate are interconnected by welding.

4. A component according to claim **2**, wherein the said rims of the strip and of the connecting plate are interconnected by gluing.

5. A component according to claim **2**, wherein the said rims of the strip and of the connecting plate are interconnected by flanging.

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