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(54) Silencer and method of producing of same.

(57) A silencer for an internal combustion engine is produced by wrapping a web (15) of mineral fibres around a pipe (11) to be incorporated in the silencer, then enclosing the pipe and the web of fibres in a plastics film (16) and heat-shrinking the film. This contracts the mass of fibres towards the pipe so that the fibres can readily be inserted into a housing (10) of the silencer.

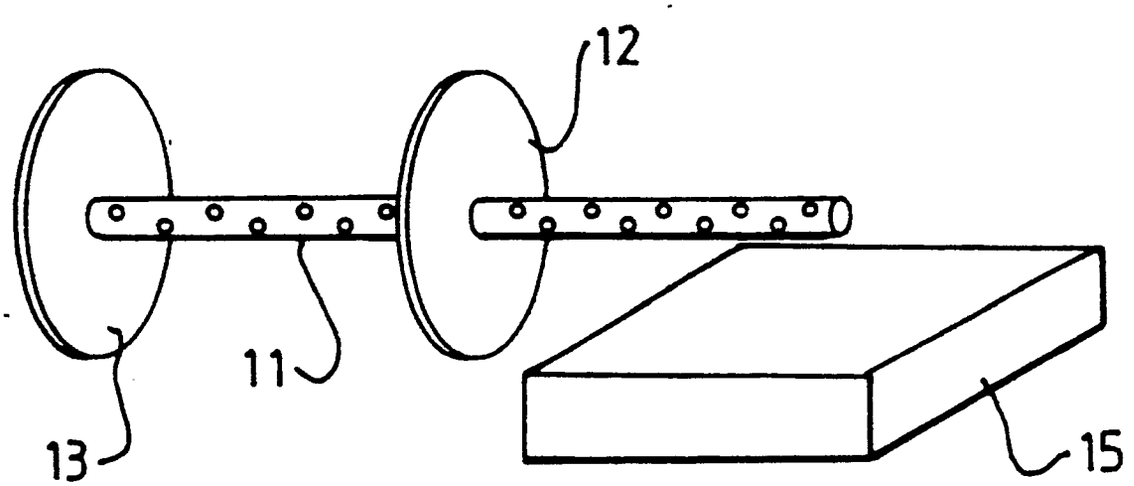

FIG. 1

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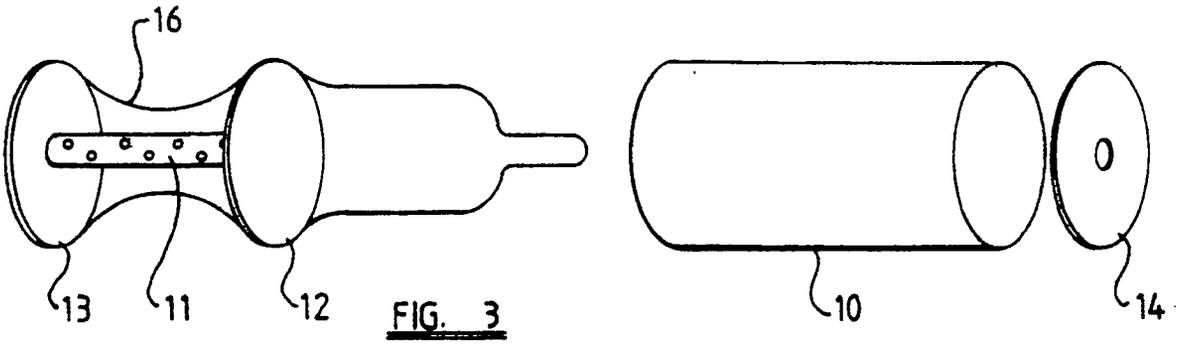

FIG. 3

SILENCER AND METHOD OF PRODUCING SAME

Description of Invention

The present invention relates to a silencer suitable for use in conjunction with an internal combustion engine, for example a reciprocating piston engine. A silencer is used to define a part of a path along which exhaust gases leave an engine and to reduce the transmission of noise along that path. A silencer commonly comprises a hollow housing, a member defining a duct which extends through the interior of the housing and a fibrous body which lies between said member and the housing. Typically the housing and said member are formed of metal and the fibrous body comprises mineral fibres. Provision is made for communication between the interior of the duct and the space containing the fibrous body. The fibrous body attenuates sound transmitted from the internal combustion engine to the silencer.

It is known to assemble the housing and the member which defines the duct and then to pack a space between these with a mass of mineral fibres. The latter operation is performed by hand, which is an unpleasant task. Furthermore, packing of the fibres into the housing represents a relatively slow step which cannot easily be integrated into a production system in which other operations are performed automatically by machines. It will be understood that the mass of fibres is resilient and, if unconfined, expands to a volume considerably greater than the space available in the housing to accommodate the fibrous body. Furthermore, the mass of fibres is usually available as a substantially flat web which, when uncompressed, is typically more than 50 mm thick. This web is not easily packed into the confined space inside the housing.

In GB 986377-A, there is disclosed a method of manufacturing a silencer in which a mass of mineral or glass fibres is packed into a polyethylene envelope to form a flat package which is then bent into an annular form and is inserted into a housing of the silencer. During initial use of the silencer, the polyethylene envelope will be degraded in consequence of being heated by exhaust gases from an associated engine.

In order to prepare the package, the polyethylene envelope is formed, leaving one end open, the glass or mineral fibres are wound on to a mandrel, the mandrel is removed, the resulting, annular body of fibres is flattened and is then inserted into the envelope, the envelope is closed and the package is then bent into the annular shape suitable for insertion into the housing of the silencer. This procedure includes a considerable number of steps which are of markedly different character. If these steps are performed by hand, the labour required to prepare the package and insert it into the silencer housing would contribute a considerable portion to the cost of the finished silencer. The provision of equipment for carrying out the steps automatically would be particularly expensive.

According to a first aspect of the present invention, there is provided the method of producing a silencer comprising a hollow housing, a member defining a duct which extends through the interior of the housing and a fibrous body which lies between said member and the housing, wherein a mass of fibres is placed around said member, a shrinkable film is placed around the mass, the film is shrunk to draw the fibres towards said member and the member, bearing the fibres and the shrunk film is inserted into the housing.

By shrinking the film, the mass of fibres is contracted. The contracted mass can be introduced into the housing more easily than an unconfined mass of fibres can be introduced into the housing. Contraction of the mass of fibres is preferably most severe adjacent to an end of that mass which will be a leading end, when the mass of fibres is introduced the housing.

According to a second aspect of the invention, there is provided a silencer comprising a hollow housing containing a mass of fibres and a pipe extending through the mass of fibres inside the housing, wherein the mass of fibres is confined by a film and there is a substantial clearance space between the film and the housing.

In the preferred silencer, the clearance space between the film and the housing is greater adjacent to one end of the mass of fibres than it is adjacent to an opposite end of the mass of fibres. Contraction of the transverse dimension of the mass of fibres more severely adjacent to an end of the mass which is a leading end when the mass of fibres is introduced into the housing facilitates insertion, either by hand or automatically.

An example of a silencer embodying the second aspect of the invention and of a method of producing the silencer will now be described, with reference to the accompanying drawings, wherein:

FIGURE 1 shows diagrammatically a pipe and baffle assembly to be incorporated in a silencer, together with a mass of fibres to be incorporated in the silencer with the pipe and baffle assembly,

FIGURE 2 shows the pipe and baffle assembly with the mass of fibres wrapped around the pipe of that assembly and the assembly being enclosed by a film, together with means for heat sealing and cutting the film, and

FIGURE 3 shows the pipe and baffle assembly,

together with a housing and end plate of the silencer.

In the drawings are represented certain components of a silencer which comprises an elongated housing 10, a pipe 11 which extends through the housing and a baffle 12 which is also disposed within the housing. The baffle is annular and the pipe 11 extends through the central opening of the baffle. The silencer further comprises annular end plates 13 and 14 which close opposite ends of the housing, the pipe 11 extending through the central openings of both end plates.

For the purpose of illustrating the invention, a simple structure comprising a relatively small number of components is shown. It will be understood that the silencer may comprise additional components. For example; the silencer may comprise more than one pipe, a first pipe extending into the housing from outside one end thereof and the second pipe extending into the housing from outside the other end thereof, provision being made within the housing for flow of exhaust gases from one pipe to the other.

Provision is made for communication between the interior of the pipe 11 and the space inside the housing 10 which lies outside the pipe. For this purpose, apertures of various shapes and sizes may be pierced in the pipe.

The silencer further comprises a fibrous body which, in the completed silencer, lies outside the pipe 11 but inside the housing 10 and typically occupies a part of the housing, for example a part of the housing which extends from the baffle 12 to the end plate 14. The fibres are mineral fibres which can withstand the action of hot exhaust gases from an internal combustion engine. The housing 10, pipe 11 and baffle 12 are typically formed of steel.

After the required openings have been pierced in the pipe 11, the end plate 13 and the baffle 12 are assembled with the pipe to form the pipe and baffle assembly illustrated in Figure 1. The mass of fibres is provided in the form of a block having a shape approximating to that of a rectangular prism. It will be understood that the mass of fibres is readily deformable and is resilient. The block 15 is typically cut from a relatively long roll.

The block 15 of fibres is wrapped around a part of the pipe 11 which projects from the baffle 12 in a direction away from the end plate 13. This wrapping operation may be performed by hand or by machine. The pipe and baffle assembly, bearing the block 15 wrapped thereon is then placed in a wrapping of plastics film 16. The film is conveniently provided as a roll of double thickness, the film having free edges at one end of the roll and a fold at the other end of the roll. A length of film is drawn from the roll onto a table 17 as a double layer. The uppermost layer of film is lifted away from the table and the lower layer of film to provide a space which receives the pipe and baffle assembly. The upper layer of film is drawn over the pipe and baffle assembly and down to the lower layer of film on the table 17. Heating and severing means 18 is then applied to the double layer of film to sever the portion of film containing the pipe and baffle assembly from the film extending to the roll and to heat seal the edges of the film wrapping containing the pipe and baffle assembly.

The film 16 is a heat-shrinkable film. The film envelope containing the pipe and baffle assembly is transferred from the table 17 to a conveyor which carries the envelope through a heating chamber. In this chamber, the film is heated sufficiently to shrink the film onto the pipe and baffle assembly. The film draws the fibres towards the pipe 11 so that the mass of fibres is contracted. Contraction is most severe at an end of the mass of fibres remote from the baffle 12. Accordingly, an end portion of the mass of fibres remote from the baffle adopts an approximately conical form, having a taper with the smaller diameter remote from the baffle 12. Since the film extends over the baffle 12, the baffle inhibits contraction of the film towards the pipe 11 in the vicinity of the baffle. Adjacent to the end of the mass of fibres remote from the baffle, there is no structure other than the mass of fibres and the pipe 11 to inhibit contraction of the film and the film therefore contracts more severely near to this end of the mass of fibres than occurs near to the baffle 12.

The entire pipe and baffle assembly, bearing the mass of fibres, is enveloped by the film 16. It will be understood that the diameter of the baffle 12 is substantially equal to the internal diameter of the housing 10. Shrinking of the film 16 contracts the mass of fibres to a diameter somewhat less than that of the baffle 12 so that the mass of fibres can be inserted easily into the housing 10. The conical form of an end portion of the mass of fibres facilitates insertion of the pipe and baffle assembly, bearing the mass of fibres, into the housing 10. Thus, this insertion may be performed by a machine or by hand without significant risk of a proportion of the mass of fibres remaining outside the housing or being transferred past the baffle 12.

After the pipe and baffle assembly has been inserted into the housing 10, the end plate 14 is applied to the housing and sealed to a protruding part of the pipe 11. The end plate 13 is sealed to the housing.

It will be understood that the film-wrapped pipe and baffle assembly can be handled, transported and stored conveniently without risk of the mass of fibres becoming displaced from the pipe 11. Furthermore, the film-wrapped assembly is not un-

pleasant to handle. Movement and handling of the assembly does not release fibres into the atmosphere.

In the newly-assembled silencer, the film wrapping maintains the mass of fibres in a compressed condition so that there is a significant clearance space between the mass of fibres and the wall of the housing 10. The clearance space is particularly large near to the end plate 14. When the silencer has been connected with an internal combustion engine and is subjected to flow of hot exhaust gases from the engine, the film 16 inside the silencer is destroyed by the elevated temperature so that the film no longer confines the mass of fibres. This mass expands to bear on the housing 10 and occupy substantially entirely that part of the housing which extends from the end plate 14 to the baffle 12.

The features disclosed in the foregoing description, or the following claims, or the accompanying drawings, expressed in their specific forms or in terms of a means for performing the disclosed function, or a method or process for attaining the disclosed result, as appropriate, may, separately or in any combination of such features, be utilised for realising the invention in diverse forms thereof.

Claims

1. A method of producing a silencer comprising a hollow housing (10), a member (11) defining a duct which extends within the interior of the housing and a fibrous body which lies between said member and the housing, wherein a mass (15) of fibres is placed around said member, a shrinkable film is placed around the mass, the film is shrunk to draw the fibres towards said member and the member, bearing the fibres and the shrunk film, is inserted into the housing.

2. A method according to Claim 1 wherein said member (11) and the mass (15) of fibres are enclosed in the film.

3. A method according to Claim 1 or Claim 2 wherein the mass (15) of fibres is contracted more severely adjacent to one end of that mass and less severely at positions spaced away from that end.

4. A silencer comprising a hollow housing (10) containing a mass (15) of fibres and a pipe (11) extending through the mass of fibres inside the housing, wherein the mass of fibres is confined by a film (16) and there is a substantial clearance space between the film and the housing.

5. A silencer according to Claim 4 wherein there is a greater clearance space between the mass (15) of fibres and the housing (10) adjacent to one end of said mass than exists between the mass and the housing adjacent to an opposite end of the mass.

6. Any novel feature or novel combination of features disclosed herein or in the accompanying drawing.

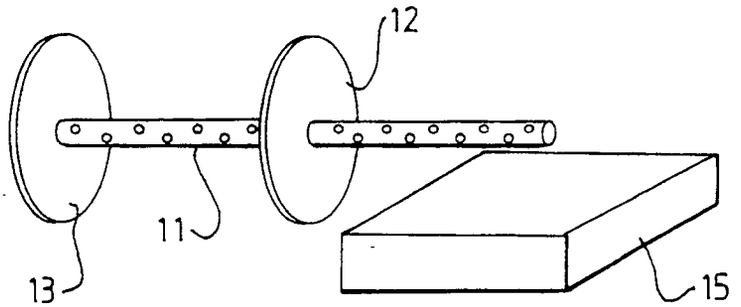

FIG. 1

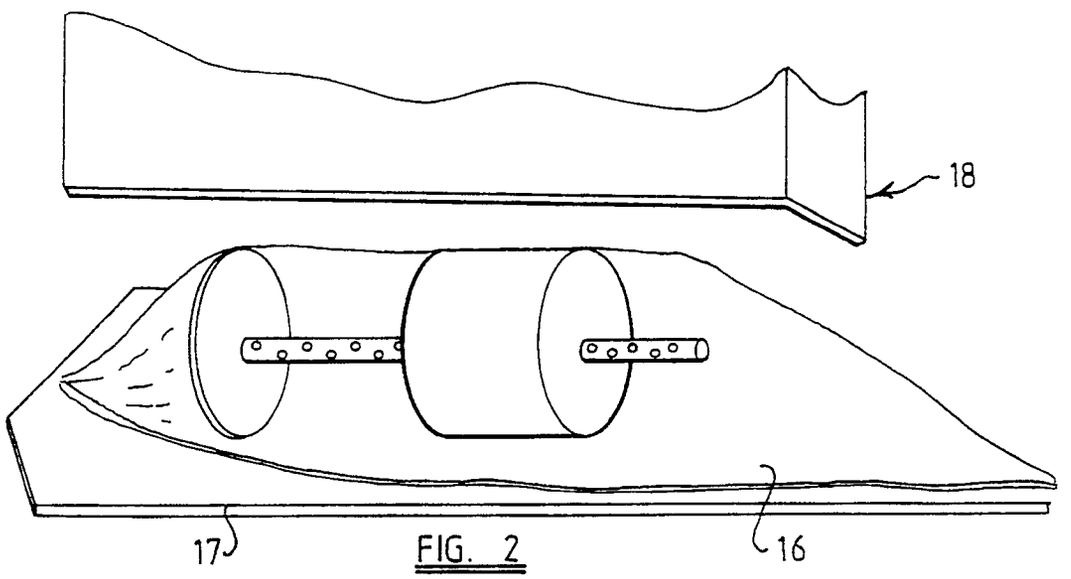

FIG. 2

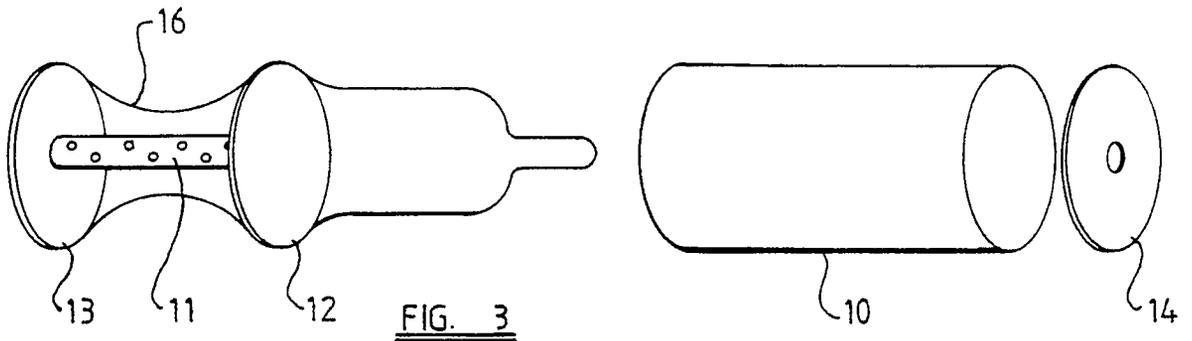

FIG. 3

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PARTIAL EUROPEAN SEARCH REPORT

which under Rule 45 of the European Patent Convention shall be considered, for the purposes of subsequent proceedings, as the European search report

Application number
EP 90 11 1336

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.4)
Y	EP-A-0 074 220 (LANCASTER GLASS FIBRE) * Page 4, line 27 - page 8, line 1; claims 1,5,8; figures 1,3 *	1,2	F 01 N 1/24 F 01 N 7/18
A	--	4	
Y	US-A-4 121 686 (KELLER) * Column 4, lines 21-41 *	1,2	
	--		
A	GB-A-2 065 596 (LANCASTER GLASS FIBRE) * Page 1, line 118 - page 4, line 115; figures 1-6 *	1,2	
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	./.		TECHNICAL FIELDS SEARCHED (Int. Cl.4) F 01 N

INCOMPLETE SEARCH

The Search Division considers that the present European patent application does not comply with the provisions of the European Patent Convention to such an extent that it is not possible to carry out a meaningful search into the state of the art on the basis of some of the claims.

Claims searched completely: 1-5
Claims searched incompletely:
Claims not searched: 6
Reason for the limitation of the search:

Claim number 6 does not comply with the requirements of Rule 29, paragraph 6 of the E.P.C.

Place of search	Date of completion of the search	Examiner
THE HAGUE	28-02-1991	FRIDEN

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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A : technological background
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E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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PARTIAL EUROPEAN SEARCH REPORT

Application number
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DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A,D	GB-A- 986 377 (VERSIL) * Page 1, line 53 - page 2, line 66; figures 1-3 *	1	
	----		TECHNICAL FIELDS SEARCHED (Int Cl 4)