March 16, 1965 G. SLAYTER 3,173,451

CAST MANIFOLD WITH LINER

Filed June 23, 1960 2 Sheets-Sheet 1

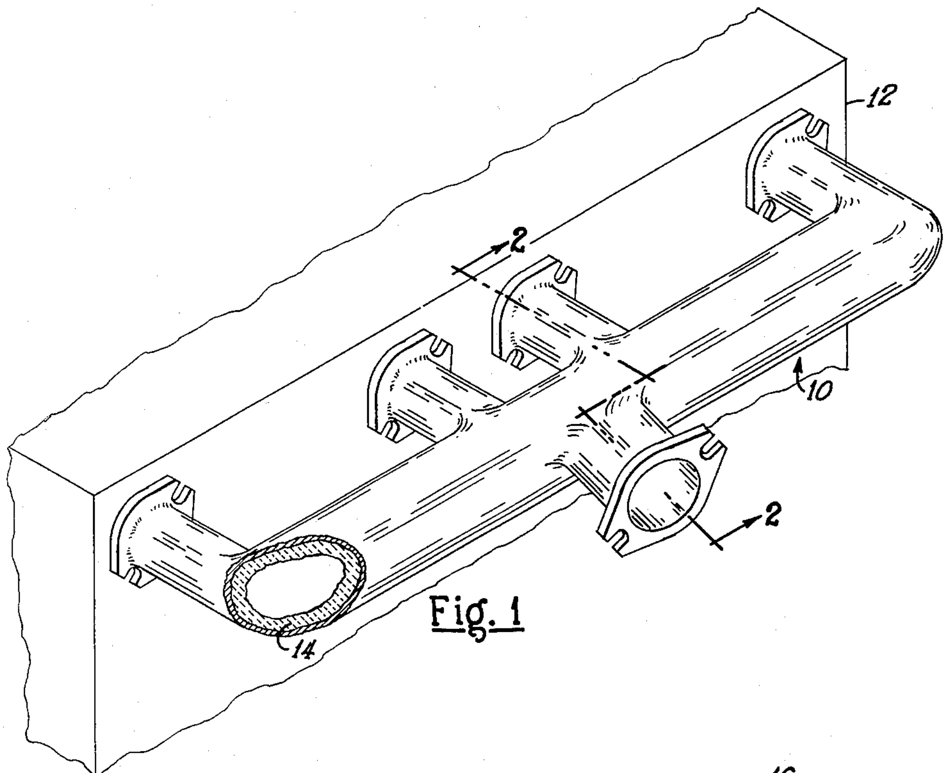

Fig. 1

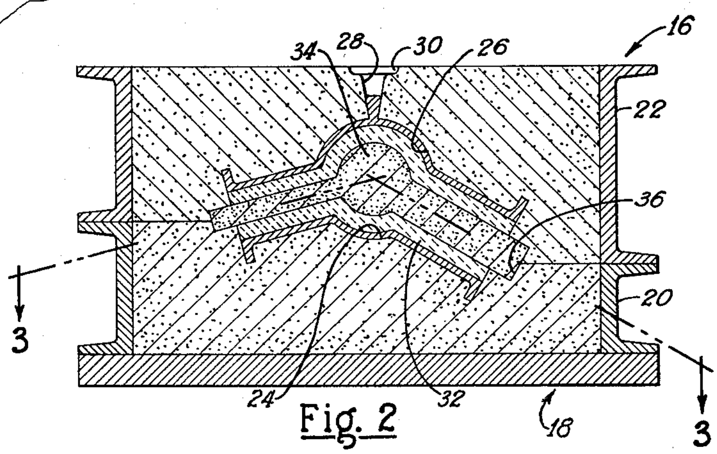

Fig. 2

INVENTOR
GAMES SLAYTER
BY Staelin & Overman
ATTORNEYS

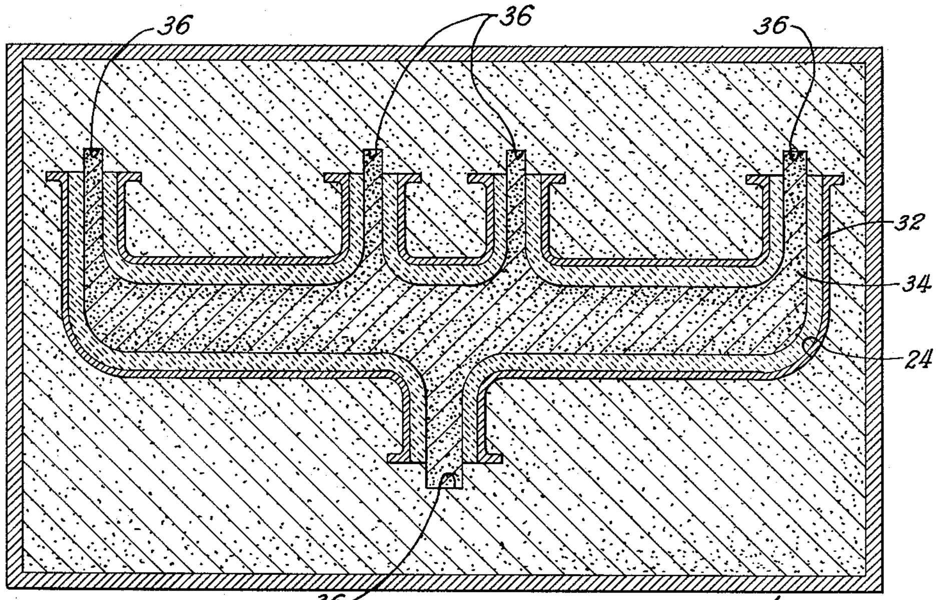

Fig. 3

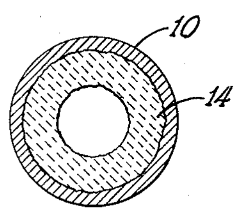

Fig. 4

INVENTOR
GAMES SLAYTER
BY
Staelin & Overman
ATTORNEYS

United States Patent Office

3,173,451

Patented Mar. 16, 1965

3,173,451

CAST MANIFOLD WITH LINER

Games Slayter, Newark, Ohio, assignor to Owens-Corning Fiberglas Corporation, a corporation of Delaware

Filed June 23, 1960, Ser. No. 38,188
3 Claims. (Cl. 138—145)

This invention relates to a technique for making lined cast bodies and more particularly to a technique for making lined cast bodies in which a fibrous liner functions as a core and also forms a part of the finished casting.

The principles of the invention have been found to be particularly effective in the manufacture of muffling systems for internal combustion engines. It has been discovered that the use of an insulating, refractory liner in one or more components of an exhaust system has a beneficial effect in reducing deleterious contaminants in exhaust gases in several ways. The insulating effect of the liner enables heat of the exhaust gases to be retained for a longer period of time. As a consequence, the gases will remain longer at a temperature sufficiently high for secondary combustion to occur, and the combustion of a greater portion of the hydrocarbons is enabled. The liner also prevents contact between the exhaust gases and cast iron or steel components of the muffling system, and thus prevents the possibility of a reaction which would otherwise cause certain hydrocarbons in the exhaust gases to be increased. Finally, when the liner includes titania fibers, a reduction of hydrocarbons in the exhaust gases is achieved by virtue of catalysts, more complete combustion apparently being accomplished.

Because of these beneficial effects, it has been proposed to use such a liner on the interior surfaces of manifolds, exhaust pipes, and mufflers. While the liners can be used in most mufflers and exhaust pipes in the form of separate cylindrical bodies, many manifolds are of cast iron and are of rather complicated shapes which prevent the use of similar separate liner bodies therein.

In accordance with the instant invention, it has been discovered that lined manifolds and similar cast bodies can be produced by employing the liner material as at least a part of a mold core and casting metal therearound. The liner consists of highly refractory fibers, such as crystalline titania fibers, and a suitable binder. The cast metal flows partially into interstices between portions of the fibers of such a liner and thereby forms an interlocking bond therewith.

The technique according to the invention can also be used for casting lined cylinder heads. Such heads retain more heat and may be maintained above the ignition point of the incoming air-fuel mixture in a suitable engine to provide a continuous ignition point therefor without the continuous use of spark plugs.

It is, therefore, an object of the invention to provide an improved technique for producing lined castings.

Another object of the invention is to provide a simpler technique for producing cast bodies having at least one surface covered with a fibrous liner.

A further object of the invention is to provide a technique for producing cast bodies with fibrous liners effectively bonded thereto.

Still another object of the invention is to provide a cast component for a muffling system in which a liner is cast into the component.

Still a further object of the invention is to provide a component for a muffling system, which component contains a fibrous liner effectively bonded thereto.

Other objects and advantages of the invention will be apparent from the following detailed description of a preferred embodiment thereof, reference being made to the accompanying drawings, in which:

FIG. 1 is a somewhat schematic view in perspective

of an engine employing a lined, cast manifold, with parts broken away and with parts in cross section, made according to the principles of the invention;

FIG. 2 is a view in cross section, taken along line 2—2 of FIG. 1, of a mold including a core for use according to the principles of the invention;

FIG. 3 is a view in cross section taken along the line 3—3 of FIG. 2; and

FIG. 4 is a view in vertical cross section of a completed casting which includes a liner in accordance with the invention.

Referring to FIG. 1, a manifold **10** made in accordance with the invention is shown connected to one bank of four cylinders of an engine **12**. The manifold **10** includes a liner **14** which was a core in the original mold from which the manifold **10** was cast. The manifold **10** was made by pouring molten metal into the mold, around and directly in contact with the core to form an integral bond therewith. It will be readily understood that most manifolds are of such relatively complex shape that it is physically impossible for separate liner segments to be inserted therein after casting thereof.

Referring to FIGS. 2 and 3, the manifold **10** is made in a suitable mold **16** which is disposed within a flask **18** composed of a drag **20** and a cope **22**. The drag **20** includes a lower mold cavity **24** formed in foundry sand according to usual foundry practices and the cope **22** includes an upper mold cavity **26** which is also formed in foundry sand according to usual foundry techniques. The cavities **24** and **26** each can be formed in several parts when dictated by sound foundry practices. The lower and upper cavities **24** and **26** form the outer surfaces of the manifold **10** when molten cast iron is poured into a sprue **28** having the usual pouring basin **30**.

Within the mold cavity is a core **32** comprising highly refractory fibers, preferably of crystalline titania, and a binder. The fiber core **32** is produced by forming a moldable mixture of the fibers and binder material and molding the mixture into the shape of the interior of the manifold **10** by means of a core mold, in a manner which is well known in the art. The core **32** is preferably hollow to provide for passage through the manifold **10** of exhaust gases, although the material of which the core **32** is made can be sufficiently porous that the entire manifold **10** can be filled therewith, the exhaust gases then passing directly through the resulting porous body. However, in most instances it is desirable to form an unobstructed passage through the core **32**. This can be accomplished by providing the core **32** with its own inner core **34** of sand and a binder. An inorganic binder of montmorillonite has been found to be particularly effective for the core although the usual organic binder used in ordinary foundry practices can be employed. The sand core **34** is made by usual core-molding techniques and is subsequently placed in the mold for the fibrous core **32**, with the core **32** then being formed therearound. The fibrous core **32** and the inner, sand core **34** can be held in the mold cavities **24** and **26** by any conventional means, the particular method of support for the cores **32** and **34** forming no part of the invention. For example, the sand core **34** can extend beyond the fibrous core **32** and be supported in recesses **36** of the mold cavities **24** and **26**, or chaplets can be employed. If the fibrous core **32** is used without the sand core **34**, then the core **32** can be supported by chaplets or can extend into the recesses **36** and be subsequently trimmed off when the casting is completed.

According to one specific technique employed in making cast bodies with fibrous liners, a mixture was prepared from, by weight, 70 parts of crystalline titania fibers at least ¼″ long and preferably in the order of ½″ long, 20 parts of montmorillonite, 10 parts of soda-lime glass, and 20 parts of wood sawdust. Enough water was added to this mixture to provide a mortar-like consistency and it was then shaped around the sand core **34**, the sand core previously having been made of the same shape as the exhaust gas passage within the manifold **10**. The resulting combination core was fired at 2500° F. to form a hardened body, the fibrous core being, by volume, 70% air, 20% titania crystals, and 10% binder. The fibrous core was then supported in the position in the mold recess indicated in FIGS. 2 and 3 and molten iron was poured therearound and allowed to solidify. After the cast iron had cooled, the mold was disassembled and the inner, sand core was then removed to leave the completed casting with the fibrous liner effectively bonded to the iron by virtue of interlocking.

Another lined, cast body was made by the same technique set forth above except that the fibrous core and sand core were placed in the mold in their green, unfired state. The heat from the cast iron which was then poured thereover at approximately 2600° F. caused the binder of the fibrous case to harden and leave an integral liner in the resulting cast body.

Other binders, such as bentonite, koalinite, or similar clays, can be used in place of the montmorillonite and soda-lime glass, and other organic particles can be used in place of the sawdust. In many instances, sufficient porosity can be obtained by reducing the amount of binder without using any organic material at all.

If the degree of penetration of the molten cast iron into the fibrous core is excessive, additional binder can be used or the exterior of the fibrous core can be sprayed with any of a number of mold coating materials known in the art to reduce the porosity thereof. Similarly, if penetration is not sufficient, less binder can be used or a greater amount of organic material can be employed in the fibrous core mixture to increase porosity thereof. If the thickness of the inner relative to the thickness of the core is sufficiently high so that the heat of the cast iron does not fully harden the fibrous core, the completed lined casting can be fired at a temperature below the melting point of the cast iron to complete the curing of the fibrous core.

While titania fibers are preferred in the fibrous core **32**, other highly refractory fibers which will withstand the heat of the molten iron can be employed. For example, zircon and zirconia fibers are suitable for this purpose, the titania fibers being preferred only because of a catalytic effect they have on the combustion of exhaust gases.

It has been found that blue titania fibers, made by heat-treating the fibers in an oxygen deficient atmosphere or by subjecting them to an oxygen deficient atmosphere after formation, are more effective as a catalyst and are preferred where a catalytic effect is desired. The blue fibers can also be made by adding 20 parts of zinc or magnesium powder to the previously described fibrous core composition, the metal powder apparently removing oxygen from the fibers, either directly or indirectly, by removing oxygen from the atmosphere which in turn removes oxygen from the titania fibers.

Various modifications of the above described embodiments of the invention will be apparent to those skilled in the art and it is to be understood that such modifications are within the spirit and scope of the invention, as defined in the appended claims.

I claim:

1. A lined, cast metal manifold including a main chamber and a plurality of connecting passages for connecting the main chamber with exhaust ports of an internal combustion engine, said manifold comprising a layer including separate, particulate, highly refractory fibers and a refractory, inorganic binder, and a body of a cast metal effectively bonded to said layer with part of the cast metal extending partially into said layer, said binder having a melting point in excess of the melting point of the metal constituting said cast metal body.

2. A lined, cast manifold including a main chamber and a plurality of connecting passages for connecting the main chamber with exhaust ports of an internal combustion engine, said manifold comprising a porous layer including separate, particulate, highly refractory fibers and a refractory, inorganic binder, and a body of a metal cast therearound and effectively bonded to said layer with part of the cast metal extending into interstices of said layer.

3. A body according to claim 2 wherein the pores in said porous layer are present in an amount of at least approximately 70% by volume.

References Cited in the file of this patent

UNITED STATES PATENTS

713,123	Lougee	Nov. 11, 1902
889,071	Van Voorhis	May 26, 1908
1,512,862	Sayre	Oct. 21, 1924
1,664,296	Hamerstadt	Mar. 27, 1928
1,703,417	Donaldson	Feb. 26, 1929
1,909,975	Mackey et al.	May 23, 1933
1,961,721	Van Lautschoot	June 5, 1934
2,048,247	Davis	July 21, 1936
2,431,143	Schulte	Nov. 18, 1947
2,459,907	Winslow et al.	Jan. 25, 1949
2,728,124	Sofield	Dec. 27, 1955
2,745,437	Comstock	May 15, 1956
2,897,556	Chini	Aug. 4, 1959
2,907,084	Wood	Oct. 6, 1959
2,962,806	Stumbods	Dec. 6, 1960
2,968,652	Mertes	Jan. 17, 1961
2,971,251	Willemse	Feb. 14, 1961
2,977,326	Nixon	Mar. 28, 1961
3,002,920	Porter	Oct. 3, 1961
3,043,094	Nichols	July 10, 1962
3,066,365	Moore	Dec. 4, 1962

FOREIGN PATENTS

496,537	Great Britain	Dec. 1, 1938

OTHER REFERENCES

Elam: Product Engineering, July 1954, pages 166–169.