March 27, 1956 A. G. BODINE, JR 2,739,583

ACOUSTIC DETONATION SUPPRESSION AND SPARK PLUG MOUNTING DEVICE FOR INTERNAL COMBUSTION ENGINES

Original Filed July 2, 1951 2 Sheets-Sheet 1

FIG. 1

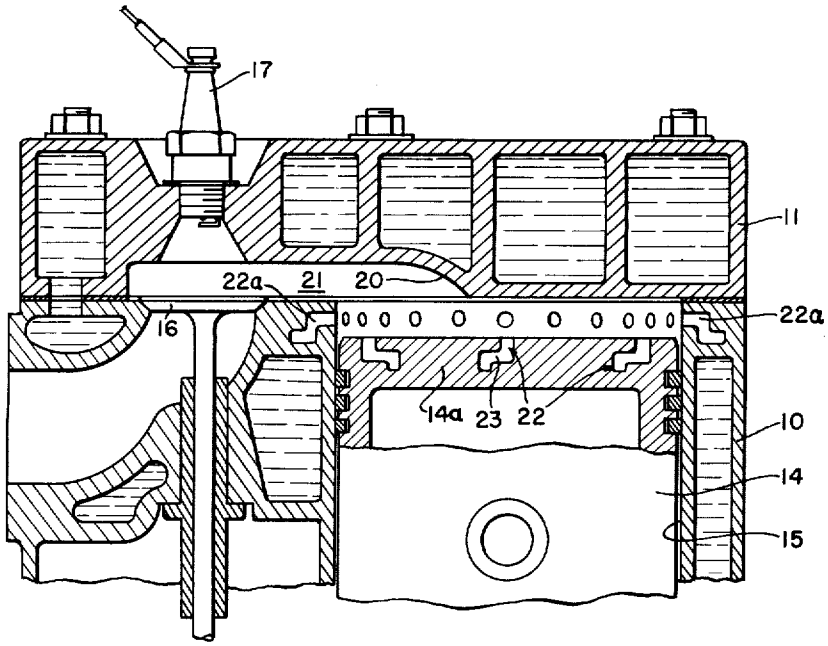


FIG. 3

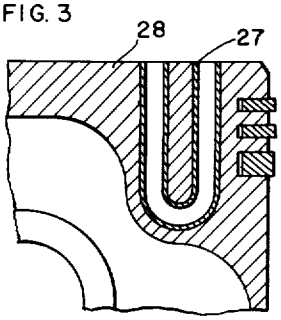
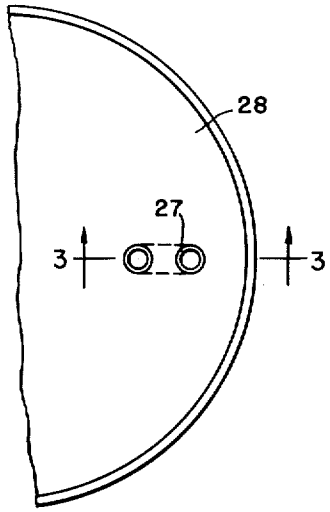


FIG. 2



INVENTOR.
ALBERT G. BODINE JR.
BY Ernest Hill
ATTORNEY

March 27, 1956 A. G. BODINE, JR 2,739,583

ACOUSTIC DETONATION SUPPRESSION AND SPARK PLUG MOUNTING DEVICE FOR INTERNAL COMBUSTION ENGINES

Original Filed July 2, 1951

2 Sheets-Sheet 2

FIG. 5

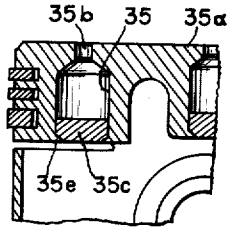


FIG. 4

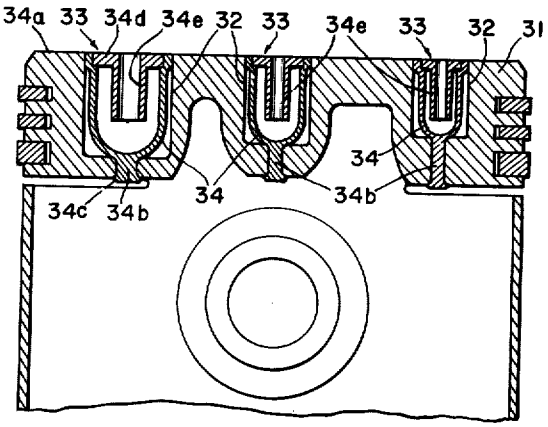


FIG. 6

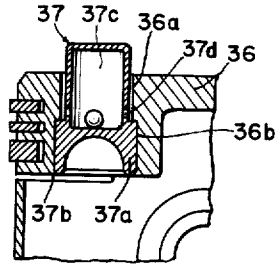


FIG. 8

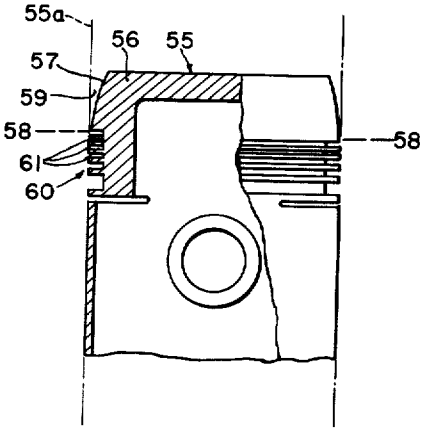
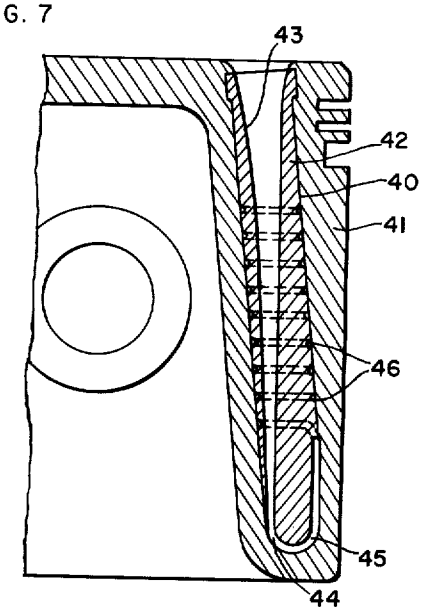


FIG. 7



INVENTOR.
ALBERT G. BODINE JR.
BY
ATTORNEY

United States Patent Office 2,739,583 Patented Mar. 27, 1956

2,739,583

ACOUSTIC DETONATION SUPPRESSION AND SPARK PLUG MOUNTING DEVICE FOR INTERNAL COMBUSTION ENGINES

Albert G. Bodine, Jr., Van Nuys, Calif.

Application October 24, 1951, Serial No. 252,818, which is a division of application Serial No. 234,688, July 2, 1951, now Patent No. 2,573,536, dated October 30, 1951. Divided and this application December 6, 1955, Serial No. 551,261

3 Claims. (Cl. 123—191)

This invention relates generally to internal combustion engines and to means for suppressing irregular burning and detonation of fuel-air mixture therein. The invention is based on my discovery that detonation in combustion engines involves acoustic phenomena and can be alleviated by means of certain acoustic apparatus used in combination with the combustion chamber.

The present application is a division of my copending application Serial No. 252,818, filed October 24, 1951, entitled Engine Detonation Control by Acoustic Methods and Apparatus, which was a division of my earlier application Serial No. 234,688, filed July 2, 1951, entitled Engine Detonation Control by Acoustic Methods and Apparatus (now Patent No. 2,573,536), which last-mentioned case was in turn a continuation-in-part of my prior parent application Serial No. 24,744, filed May 3, 1948, entitled Acoustic Means for Suppressing Detonation in Internal Combustion Engines, now abandoned.

The present invention is based on the fact that detonation in an engine combustion chamber produces sound waves, a large part of which are at high amplitude at resonant frequencies of the chamber, and on my discovery that the sound waves produce the various well-known and harmful manifestations of detonation. According to my basic invention, I inhibit or attenuate these harmful effects by interfering with or attenuating the high amplitude detonation-induced sound waves, and this is done by use in connection with the combustion chamber of acoustic attenuation means made responsive to the frequencies at which detonation induced sound waves appear at high amplitudes.

One type of acoustic attenuation means disclosed in my afore-mentioned earlier applications, with which the present application is connected by copendency, comprised a plug-in device adapted to be screwed into a part formed in a wall of the combustion chamber. The present invention is directed to a specific form of attenuator of this general character, including means for mounting a spark plug.

An object of the invention is the provision of an especially effective detonation controlling sound wave attenuator of a type capable of being screwed or plugged into a suitable port formed in a wall of the combustion chamber, such as the spark plug port with which the chamber is already equipped.

A further object is the provision of an acoustic sound wave attenuator capable of being plugged into the spark plug port of the combustion chamber wall and equipped with means for supporting the spark plug.

In my earlier aforementioned applications, detonation sound wave attenuators were described of a type involving porous absorbers as well as Helmholtz resonator forms embodying generally the concept of a Helmholtz resonator cavity with a porous plug or wall across the effective "neck" of the cavity. The basic theory and operation of said attenuators is fully set forth in said earlier applications, particularly in Patent No. 2,573,536.

An illustrative embodiment of the invention is shown in the drawing, which is a vertical medial section through an engine cylinder, cylinder head and piston.

The engine shown in the drawings is of the valve-in-head type, having a water-cooled block **10**, water-cooled head **11**, and piston **12** working in a cylinder **13** within block **10**. Head **11** comprises a generally domed or hemispherical chamber wall **14** defining a combustion chamber **15** over piston **12**. In the center of head wall **14** is a threaded port **16** which may be of a size and type to receive the conventional spark plug, but into which the attenuator **17** of the present invention is installed, the spark plug **18** being carried by the attenuator.

Continuing with the description of the illustrative engine, intake and exhaust valves will be understood to open to combustion chamber **15** through wall **14**, an exhaust valve **19** being shown, and it being understood that an intake valve (not shown) will be located symmetrically with respect to the exhaust valve, forwardly of the plane of the drawing.

Referring again to the attenuator **17**, the same incorporates or has provision for mounting spark plug **18**, as earlier mentioned, so that the device in this form may be used with conventional engines by simply screwing it into the spark plug port. Thus, into port **16** is screwed the externally threaded tubular stem **25** of a cylindrical porous body **26**, the latter having cylindrical interior cavity **27**, whose upper end is internally screw threaded to receive conventional spark plug **18**. The body **26** is here shown to be enclosed within a metal closure shell **28**, and is preferably formed, inside said shell, with an external circumferential channel **29** providing a Helmholtz resonator cavity space. It will be seen that I have thus interposed a porous body between the engine and the spark plug, the device serving as a spark plug adapter. The combustion chamber space immediately adjacent the spark plug is a common origin point for radial wave forms of detonation disturbance in engines like that shown in Fig. 1, and by having this space immediately adjacent porous wall **26**, the destructive detonation sound waves are materially absorbed in an area near their source. By employing the optional but preferred Helmholtz resonator cavity space **29**, the device is made more frequency selective, and by choice of proper design constants for frequency response, depending upon the volume and shape of the combustion chamber in any given case, the particular detonation frequency desired to be combated is thereby selectively attenuated. An obvious optional arrangement is to form the stem **25** of solid material, for mechanical strength, and form the balance of the member **26** of porous material. Various materials are suitable for the porous body, for example, sintered powdered metal. Suitable porous materials and methods of fabrication, as well as the specific effect of the porous materials on detonation, were disclosed fully in Patent No. 2,573,536, and need not be here repeated.

It will be understood that the drawings and description are merely illustrative of one specific embodiment of the invention, and that various changes in design, structure and arrangement may be made without departing from the spirit and scope of the appended claims.

I claim:

1. Detonation suppression means for an internal combustion engine having a combustion chamber, formed with a threaded port; a hollow porous body having a hollow, externally screw-threaded stem adapted to be screwed into said threaded port, said hollow body opening into said combustion chamber through said stem, said body having a multiplicity of fluid passageways of substantially capillary dimensions opening into its hollow interior.

2. Detonation suppression means for an internal com-

bustion engine having a combustion chamber, formed with a threaded port; a hollow porous body having a hollow, externally screw-threaded stem adapted to be screwed into said threaded port, said hollow body opening into said combustion chamber through said stem, said body having a multiplicity of fluid passageways of substantially capillary dimensions extending between an exterior surface of said body and the hollow interior thereof, and wall means enclosing a resonator cavity adjacent said exterior surface.

3. Detonation suppression means for an internal combustion engine having a combustion chamber, formed with a threaded port; a hollow porous body having a hollow, externally screw-threaded stem adapted to be screwed into said threaded port, said hollow body opening into said combustion chamber through said stem, said body having a multiplicity of fluid passageways of substantially capillary dimensions opening into its hollow interior, and said body having also a threaded spark plug port opening into its said hollow interior.

References Cited in the file of this patent

UNITED STATES PATENTS

1,116,364	Baker	Nov. 10, 1914
1,466,432	Gerleman	Aug. 28, 1923
1,490,849	Philip	Apr. 15, 1924