Sept. 27, 1960 A. LAMPREDI 2,954,023

COMBUSTION CHAMBER FOR INTERNAL COMBUSTION ENGINES

Filed Oct. 20, 1959 2 Sheets-Sheet 1

Fig.1

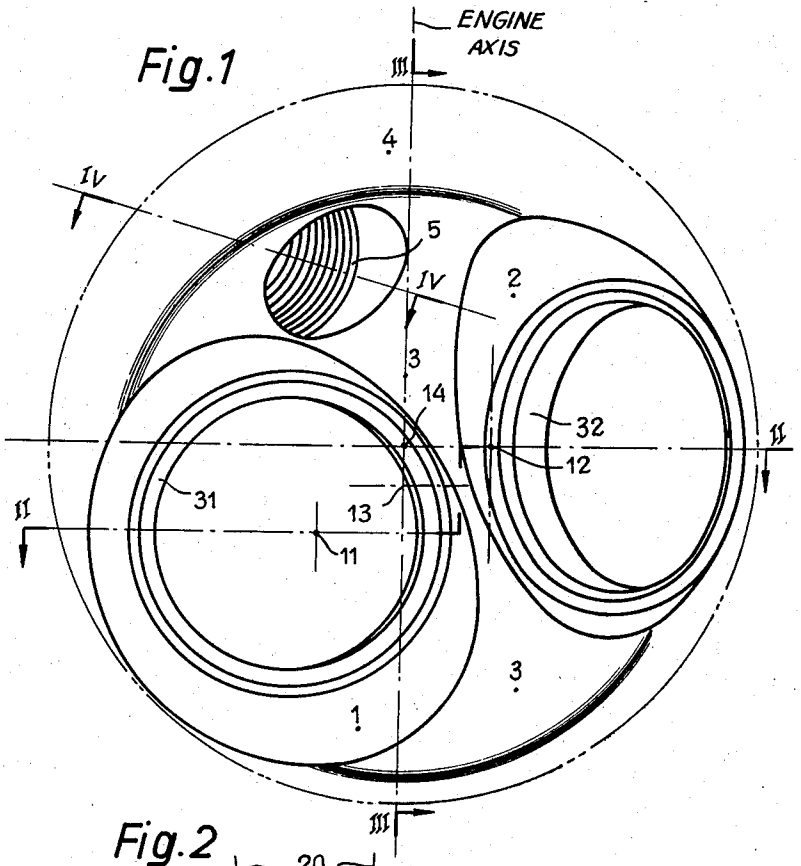
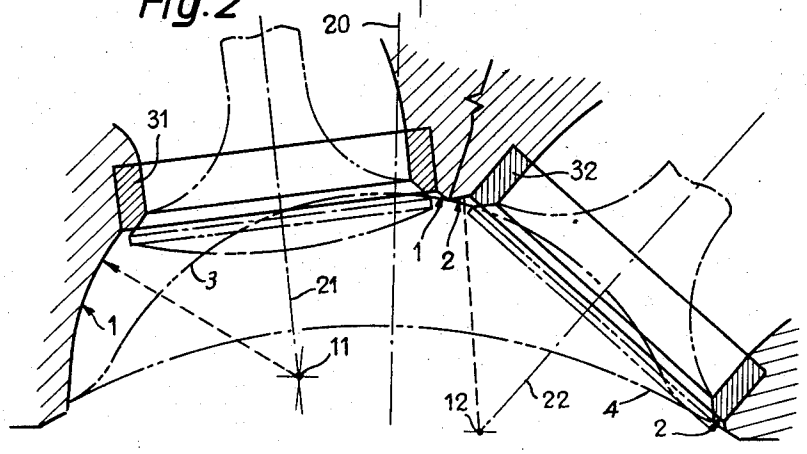


Fig.2



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Filed Oct. 20, 1959 2 Sheets-Sheet 2

Fig. 3

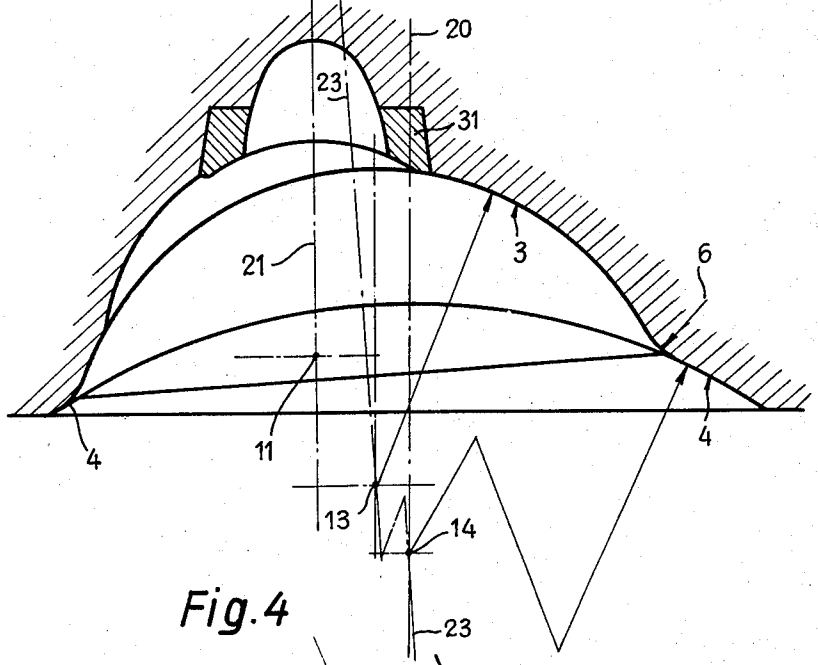
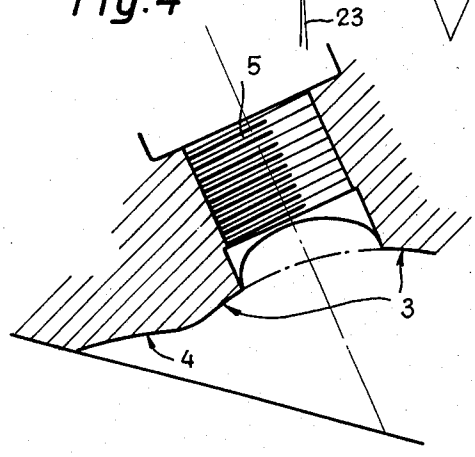


Fig. 4



United States Patent Office 2,954,023
Patented Sept. 27, 1960

2,954,023

COMBUSTION CHAMBER FOR INTERNAL COMBUSTION ENGINES

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Filed Oct. 20, 1959, Ser. No. 847,604

Claims priority, application Italy Nov. 11, 1958

5 Claims. (Cl. 123—191)

This invention relates to a combustion chamber for four-stroke internal combustion engines, preferably with spark plug ignition.

It is well known that the shape of the chamber, size and location of the valves and location of the spark plugs considerably affect the volumetric and thermal efficiencies of the engine.

One of the main characteristics determining the standard of a combustion chamber is a low value of the surface area/volume ratio; under this aspect the best chamber is the conventional hemispherical chamber, in which the valve axes extend through the center of the hemisphere.

However, this chamber is objectionable in that with valves of standard size the valve axes should diverge through an angle such that valve control is possible only by means of two cam-shafts arranged in the head and crankcase. When control is effected by means of one cam-shaft only, it is not possible to arrange the spark plug at a middle zone in the chamber, unless elaborate passages through the top cover are provided.

This invention provides a combustion chamber which affords the high efficiency of hemispherical chambers, and is on the other hand less binding upon the valve location, whereby devices can be employed for controlling the valves which compare in simplicity with control devices employed in dome-shaped chambers.

The improved combustion chamber permits of substantially reducing divergence of the valve axes and of biasing them to each other, whereby the spark plug may be brought nearer to the center of gravity of the chamber.

A further object of this invention is to provide a combustion chamber the surface of which can be machined throughout by a number of operations not exceeding the number required by a conventional hemispherical chamber.

The combustion chamber for internal combustion engines according to this invention is characterized in that its top surface is made up of a plurality of non-concentric spherical zones, two of which have their center situated on the axis of their respective valve, whereby the zones can each be machined at the same time as its respective valve seat.

Further characteristic features and advantages of this invention will be understood from the appended detailed description, referring to the accompanying drawings given by way of a non limiting example only, wherein:

Figure 1 is a plan view from below of the combustion chamber.

Figures 2, 3 and 4 are sectional views on lines II—II, III—III and IV—IV, respectively, of Figure 1.

According to this invention the surface of the combustion chamber in the engine head comprises two spherical zones **1** and **2** which are not concentric with each other. The centre **11** of the spherical zone **1** is situated on the axis **21** of the valve seat **31**. The center **12** of the spherical zone **2** is situated on the axis **22** of the valve seat **32**. The two spherical zones can therefore be each

manufactured simultaneously with their respective valve seat by means of a tool of a corresponding profile.

The substantially sharp edge formed by intersection of the spherical zones **1** and **2** is removed by machining a third spherical zone **3**, the diameter and location of the center of which, denoted by **13** are selected so that, though the above edge be removed, the zone **3** does not interfere with the valve seats **31**, **32**, situated on the zones **1**, **2**. Looking from below (Figure 1) the spherical zone **3** is substantially in the form of two curvilinear triangles joined at an apex. The spark plug seat **5** is formed in one of the curvilinear triangles.

The center **13** of the spherical zone **3** will not usually be situated on the axis of its respective cylinder in a preferred embodiment of this invention, the centers **11**, **12** and **13** are located on a common plane parallel to and off-set with respect of the general or longitudinal axis of the cylinder, as can be readily seen in Fig. 1 on comparing the relative positions of the points **11**, **12**, **13** and **14**. Moreover, in order to attain the high compression ratios presently required, the diameter of the spherical zone **3** should be kept within such limits that the zone **3** does not intersect the lower plane of the head along a circle of a diameter substantially smaller than the cylinder bore. The spherical zone **3** therefore conveniently merges into a fourth spherical zone **4** having its center **14** situated on the longitudinal axis **20** of the cylinder. The spherical zone **3** intersects the lower plane of the head along a circle fully or nearly coinciding with the cylinder bore, its surface, when the diameter is conveniently selected, extending parallel or nearly so with the usually convex piston top. A further feature of the invention resides in the fact that the spherical zones **3**, **4** and the radius **6** joining them (compare Figure 3) are machined by a single operation effected by means of a milling cutter of a corresponding profile rotating on an inclined axis **23** extending through the centers **13**, **14** of the spherical zones **3**, **4**.

The spherical zone **4** acts as a laminating zone for the mixture between the piston and head when the piston is at its top dead center. By varying its thickness and width the combustion process can be affected and best performances can be obtained from the chamber from the standpoint both of thermal efficiency and aging characteristics.

It will be understood from the above that with a combustion chamber of this shape a wider choice is left as to location of the valves and, as will be clearly seen from Figure 1, the valve axes need not be co-planar.

The volume required in order to obtain the desired compression ratio being the same, the surface exposed to the flame is substantially the same as with a hemispherical chamber and smaller than with a triangular chamber. The edges formed by intersection of the spherical zones **1**, **3** and **2**, **3** are rather obtuse, whereby no hot points or self-ignitions consequent thereto arise. The considerably sharper edges formed by the zones **1**, **4** and **2**, **4** are not objectionable, since they are situated quite near the piston top during combustion.

The valves may be made of large size and are not screened by the combustion chamber walls in their open condition, so that very high volumetric efficiencies can be obtained.

The angle between the valve axes can be considerably smaller than 90°, which is the average value required by a hemispherical chamber with one center. Therefore the valves can be controlled by one cam-shaft mounted in the crankcase through standard push-rod and beam units, the overall size in a transverse direction of the head cover being kept within reasonable limits.

The spark plug may be arranged near the center of gravity of the chamber at the hottest region of the chamber, so that the flame paths are relatively short and

smooth. Moreover, the limited overall size of the head cover in a transverse direction makes it accessible through lateral recesses without requiring elaborate passages through the said cover.

It will be understood that, the principle of the invention being left unaltered, the arrangement, number and radius of the spherical zones may be widely varied with respect to the disclosure in the drawings and specification without departing from the scope of this invention.

What I claim is:

1. In a cylinder head for an internal combustion engine including a combustion chamber, and a pair of annular seats in the chamber for the respective valves, and wherein the axes of the said seats are inclined towards each other and with respect to the longitudinal axis of the respective cylinder, the said combustion chamber defined substantially by a basic spherically curved surface, and by a pair of cavities in said surface defined each by a further spherically curved surface surrounding a respective valve seat, each of said further spherically curved surfaces having its center located on the axis of the respective seat.

2. In a cylinder head as claimed in claim 1, in which the center of the three spherically curved surfaces are located on a common plane parallel to and off-set with respect to the longitudinal axis of the cylinder.

3. In a cylinder head as claimed in claim 1, which the center of the basic spherically curved surface is located offset from the longitudinal axis of the cylinder, and an annular spherically curved concave surface disposed radially outwardly of the three first-mentioned surfaces and substantially enclosing said three first-mentioned surfaces, the said annular spherically curved concave surface having its center located on the longitudinal axis of the cylinder.

4. In a cylinder head as claimed 1, the centers of said further spherically curved surfaces are spaced therebetween lengthwise of the engine axis.

5. In a cylinder head as claimed in claim 1, in which the centers of the three spherically curved surfaces are located on a common plane parallel to and off-set with respect to the longitudinal axis of the cylinder, and a spark plug seat in the basic spherically curved surface located oppositely to said plane with respect to the axis of the cylinder.

References Cited in the file of this patent

UNITED STATES PATENTS

2,109,298	Mock	Feb. 22, 1938
2,669,227	Drinkard	Feb. 16, 1954
2,769,434	Witzky	Nov. 6, 1956
2,833,254	Carpentier et al.	May 6, 1958