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MULTI-CYLINDER INTERNAL COMBUSTION ENGINES

Filed Oct. 17, 1960

Fig. 2

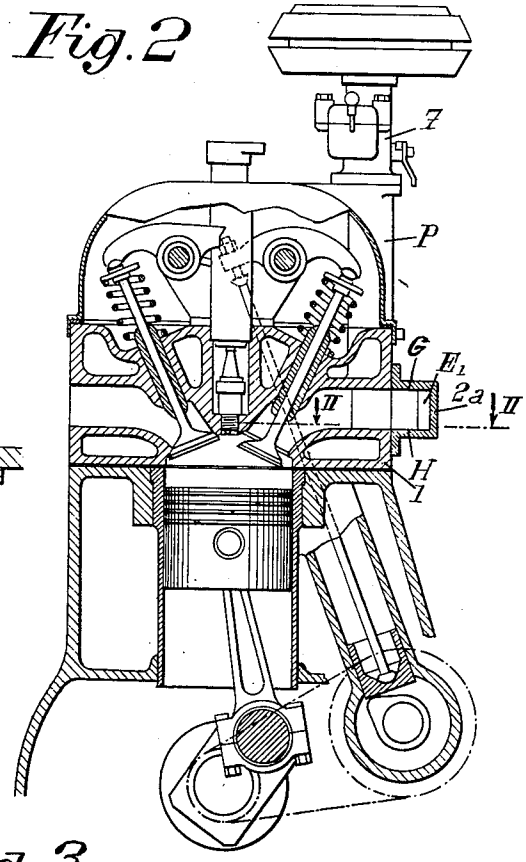


Fig. 1.

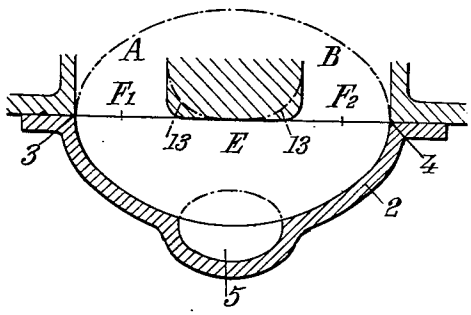
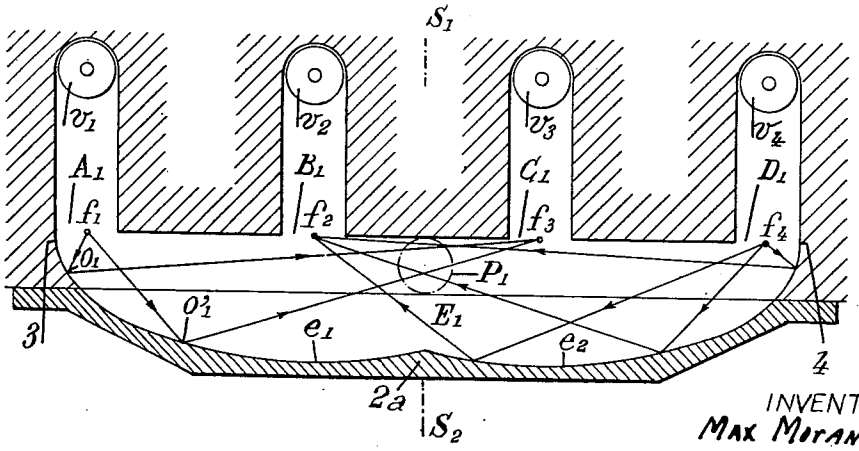


Fig. 3.



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MULTI-CYLINDER INTERNAL COMBUSTION ENGINES

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The present invention relates to multi-cylinder internal combustion engines and more particularly, but not exclusively, to multi-cylinder engines wherein the cylinders are fed with a carburetted fuel-air mixture from a single carburetor at least for each group of cylinders of the engine.

The object of my invention is to provide an engine of this type which is better adapted to meet the requirements of practice than those known up to this time, and in particular to achieve an improved distribution of fuel mixture to the engine cylinders.

Preferred embodiments of my invention will be hereinafter described, with reference to the appended drawings given by way of example and in which:

FIG. 1 is a sectional view illustrating the intake ports and the intake manifold of a two-cylinder two-stroke engine made according to this invention.

FIG. 2 is a cross section of a four-cylinder four-stroke engine, according to another embodiment of this invention.

FIG. 3 is a sectional view on the line III—III of FIG. 2.

In accordance with this invention, the engine comprises as many cylinders as there are strokes in the operating cycle thereof, i.e. two cylinders in the case of a two-stroke engine or four in the case of a four-stroke engine. The intake ports A, B (FIG. 1) or A_1, B_1, C_1, D_1 (FIG. 2) leading to the engine cylinders are fed from a manifold chamber E, in the case of FIG. 1, and E_1, in the case of FIGS. 2–3. Said manifold is limited on one side by a flat wall formed in the cylinder block and in which are provided said intake ports, and, opposite said flat wall, by a curved wall capable of reflecting toward the intake port of one cylinder the pressure wave determined in the gaseous stream by the closing of the intake port of the cylinder precedingly fed with fuel mixture.

The following description refers to an engine the cylinders of which are supplied with a carburetted fuel-air mixture from a single carburetor through the above mentioned intake ports which are located along a straight line. In the case of FIG. 1, this engine is a two-cylinder two-stroke engine, while in FIG. 2, it is a four-cylinder four-stroke engine.

A cover 2 (FIG. 1) is disposed opposite intake ports A, B, to form, in cooperation with the cylinder block flat wall in which said ports are located, a manifold chamber E, through which said ports are provided with fuel mixture. This cover 2 is adapted to form the reflecting wall of the said chamber.

In the construction of FIG. 1, the section of the inner wall of cover 2, at least in the horizontal plane passing through the centers of intake ports A and B (i.e. in the plane of FIG. 1) is in the form of one half of an ellipse extending from the opposed edges 3 and 4 of ports A and B, the foci of the ellipse being located at the respective centres of the latter.

Cover 2 is besides connected with a carburetor, not illustrated, by means of an intake pipe 5, disposed at right angles with respect to the horizontal plane of the intake ports and equidistant from said ports.

In operation the first cylinder of the engine draws the gaseous carburetted mixture through its intake port A which is then open. The arrangement should be such that the intake port B of the second cylinder shall already be

open when port A closes, in such a manner that the gaseous stream which was flowing towards port A should continue its movement under the effect of inertia, thus creating a pressure wave at F_1, the said wave being reflected by the elliptical inner wall of cover 2 towards the second focus F_2 of the ellipse, i.e. towards the second intake port B, for supercharging the corresponding cylinder. The same operating cycle thereafter takes place between the intake port B and the intake port A, and so on.

The improved admission chamber according to this invention effects supercharging of the engine cylinders and moreover it avoids that the pressure wave produced by closure of an intake port may return towards the gas conduit 5 where it would hinder the flow of the carburetted mixture towards the other intake port.

In the case of a four-cylinder four-stroke engine (FIGS. 2 and 3) having its cylinders disposed in line with the intake ports A_1, B_1, C_1, D_1 located along a horizontal straight line in a vertical flat wall of the cylinder block, said cylinders are cyclically supplied in succession with fuel mixture through said intake ports in the order A_1, C_1, D_1, B_1 (corresponding to the conventional order I, III, IV, II).

The intake pipe from carburetor 7 opens into manifold chamber E at P, in the middle part of said chamber indicated by the vertical plane of symmetry thereof S_1S_2.

According to my invention, the horizontal section of the reflecting inner wall of the cover 2*a* of manifold chamber E_1 is made of two portions of two ellipses, the first ellipse portion extending from point 3 to the vertical plane of symmetry S_1S_2 and having its foci f_1 and f_3 at the centers of ports A_1 and C_1 respectively, the second ellipse portion extending from said plane S_1S_2 to point 4 and having its foci at f_2 and f_4 respectively. Thus the pressure wave determined by the closing of the intake valve v_1 corresponding to the first cylinder is reflected as at O_1, O'_1 by said inner wall toward the already open intake port C_1 of the third cylinder, the mean path of the said pressure wave being illustrated by line $f_1O_1f_3$.

When the intake valve v_3 of the cylinder fed through intake port C_1 closes, the intake valve v_4 of the next cylinder to be fed with fuel mixture is already open. The fuel mixture supplied through the orifice P_1 of the intake pipe must then travel to port D_1. In this case the pressure wave formed at port C_1 is not focussed by reflection toward port D_1 but as the stream of fuel mixture was already flowing toward the right (from P_1 toward C_1), when C_1 is stopped, this stream first naturally flows by inertia toward D_1 to fill the cylinder the intake valve of which is shown at v_4.

When this valve v_4 closes the fuel mixture stream which was flowing from orifice P_1 toward port D_1, i.e. toward the right, must suddenly flow from P_1 toward B_1, i.e. toward the left. This reversal of the direction of flow is facilitated by the fact that the pressure wave originated at, or near, f_4 is reflected on the right hand portion of wall 2_a (portion of an ellipse having its foci at f_2 and f_4) and focussed at, or near f_2.

When valve v_2 closes, the fuel mixture stream, already flowing toward the left, has no difficulty in flowing toward A_1 which is now open.

In both embodiments, i.e. in FIG. 1 as well as in FIGS. 2–3, it may be of advantage to round off the edges of the intake ports except where these edges join the inner wall of cover 2 or 2_a, i.e. except for the outer edge of each outermost port. This has been shown in dash-and-dot lines at 13 in FIG. 1.

In both of the embodiments of my invention above described, the reflecting face of the wall (2 or 2_a) facing the intake ports is preferably in the form of a cylindrical surface the generatrices of which are vertical and the

direction of which is a portion of an ellipse (FIG. 1) or two portions of two ellipses (FIGS. 2 and 3), the other walls of the manifold chamber (E or E_1) being flat horizontal walls located respectively above and below the horizontal plane pasing through the intake ports (as shown at G and H in FIG. 2) for the second embodiment.

In a general manner, while I have, in the above description, disclosed what I deem to be practical and efficient embodiments of my invention, it should be well understood that I do not wish to be limited thereto as there might be changes made in the arrangement, disposition and form of the parts without departing from the principle of the present invention as comprehended within the scope of the accompanying claims.

For instance intake pipe P, instead of opening at P_1 into the manifold chamber in a direction perpendicular to the plane of FIG. 3, might was well open in a direction parallel to said plane or more generally in any direction oblique to said plane, provided that the opening P_1 has its center located in plane S_1S_2.

This application is a continuation-in-part of my U.S. patent application Ser. No. 732,281 filed on May 1, 1958, and now abandoned.

What I claim is:

1. In an internal combustion engine having two cylinders working on the two-stroke cycle, the combination of a cylinder block having a flat wall provided with two ports the centers of which are located along a straight line itself located in the plane of said flat wall, said cylinder block being provided with passages leading from said ports respectively to the intakes of said two cylinders, an intake manifold forming with said flat wall a closed manifold chamber, the inner wall of said chamber located opposite said flat wall being shaped so that all the sections thereof by planes perpendicular to said flat wall and parallel to said straight line are portions of ellipses the foci of which are located at said port centers respectively, and an intake pipe opening into said manifold chamber at a place substantially at the same distance from said two ports.

2. A combination according to claim 1 in which said wall opposite to said flat wall portion is a portion of a cylinder having its generatrices parallel to said flat wall and perpendicular to said straight line, said manifold chamber having two other flat walls perpendicular to said first mentioned flat wall and both parallel to said straight line and located on opposite sides thereof.

3. In an internal combustion engine having four cylinders operating on the four-stroke cycle, the combination of a cylinder block having a flat wall provided with four ports having their centers located along a straight line itself located in the plane of said flat wall, said ports being numbered successively, the first one, the scond one, the third one and the fourth one, the first port being symmetrical to the fourth one and the second port symmetrical to the third one with respect to a plane of symmetry perpendicular to said straight line, and said cylinder block being provided four passages leading respectively from said ports to the intakes of said cylinders, means forming an intake manifold enclosing between it and said flat wall area a closed manifold chamber, all the sections of the inner wall of said chamber opposite to said flat wall by planes perpendicular to said flat wall and parallel to said straight line consisting of two portions of two ellipses respectively, the first of said ellipses having as foci the center of said first port and the center of said third port respectively, the second of said ellipses having as foci the center of said second port and the center of said fourth port respectively, said first ellipse portion extending opposite said first and second ports from the end of said chamber adjoining said first port to said plane of symmetry and said second ellipse portion extending opposite said third and fourth ports, from said plane of symmetry to the end of said chamber adjoining said fourth port, and an intake conduit opening into said manifold chamber through an orifice having its center located in said plane of symmetry.

4. A combination according to claim 1 in which said wall opposite to said flat wall is a portion of a cylindrical surface having its generatrices parallel to said flat wall and perpendicular to said straight line, said manifold chamber further having two other flat walls perpendicular to said first mentioned flat wall and parallel to said straight line, on opposite sides thereof respectively.

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