April 30, 1940. J. A. H. BARKEIJ 2,199,276

INTAKE MANIFOLD FOR INTERNAL COMBUSTION ENGINES

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FIG. 1.

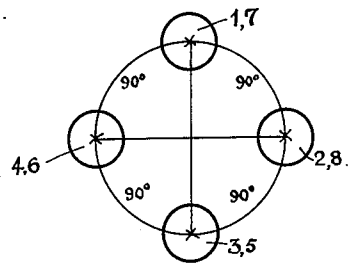


FIG. 3.

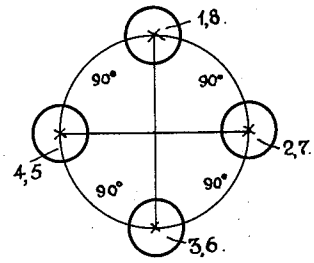


FIG. 2.

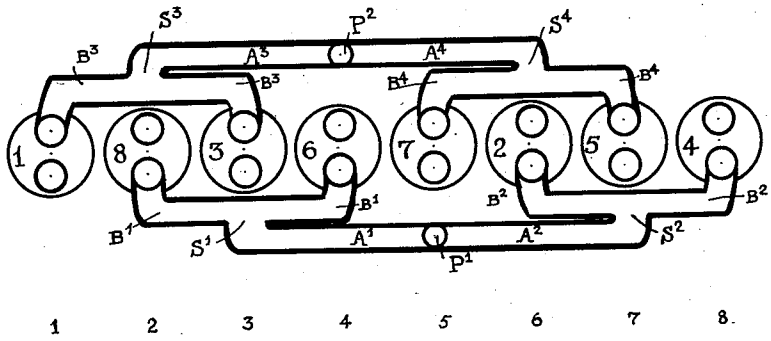
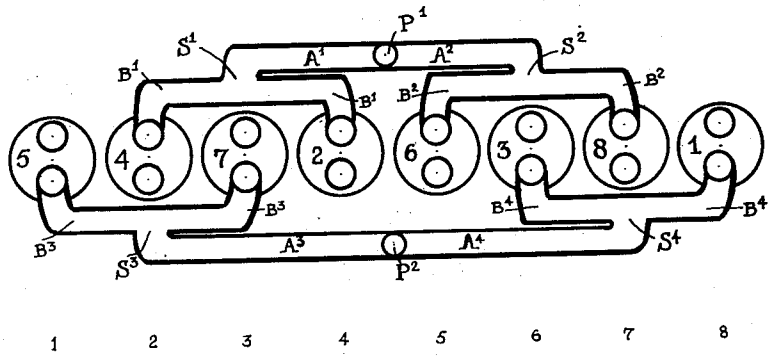


FIG. 4.



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FIG. 5

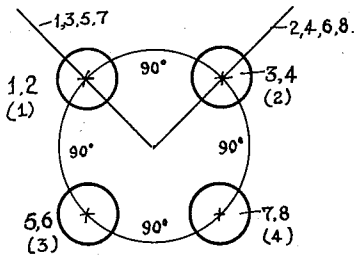


FIG. 6

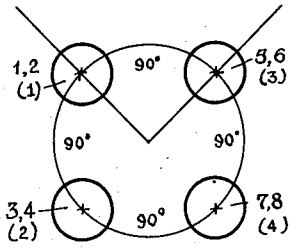


FIG. 7

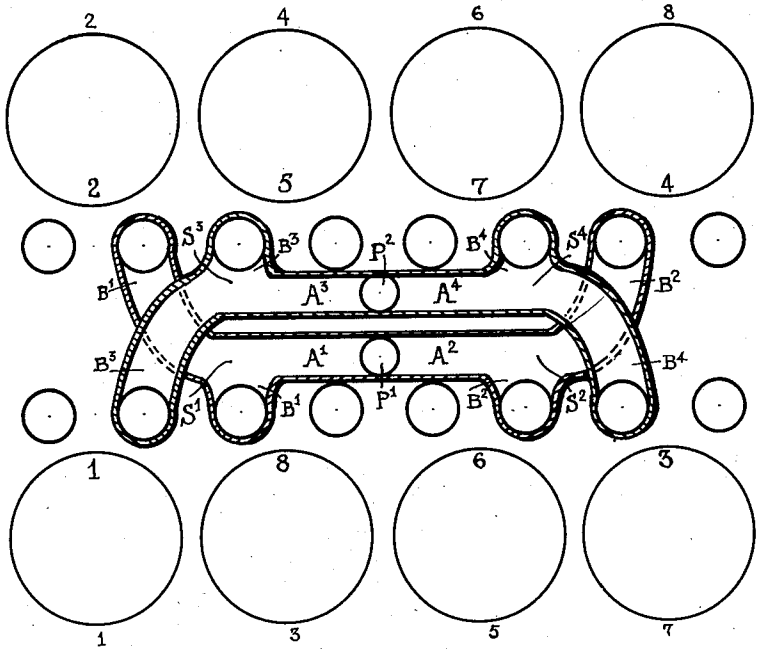
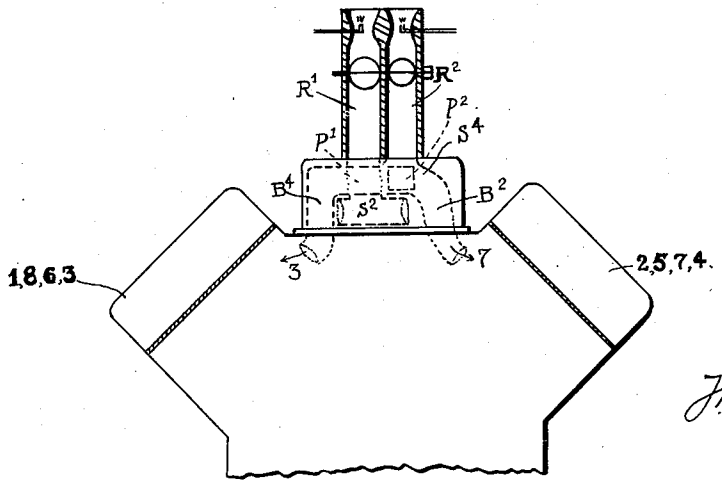


FIG. 8



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INTAKE MANIFOLD FOR INTERNAL COMBUSTION ENGINES

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Application February 21, 1938, Serial No. 191,599½

7 Claims. (Cl. 123—52)

The present application is a continuation in part of my application No. 632,006 of Sept 7, 1932, and of my application No. 702,970 of Dec. 18, 1933.

My invention relates more particularly to gas distribution systems for eight cylinder engines of the straight type and the V type.

The standard straight eight cylinder type, in which the cylinders 1, 2, 7, 8 form one group of cylinders having equal suction intervals of 180°, and the cylinders 3, 4, 5, 6 form the other group of four cylinders having equal intervals, have their valves arranged in line either on one side of the engine when the so-called L-head construction is used or have their valves arranged in a single line in the head. In either arrangement the branches of the inlet manifolds, connected to each group of said four cylinders, for the group of cylinders 1, 2, 7, 8 are considerably longer than for the inlet manifold for the intermediate group of four cylinders, 3, 4, 5, 6.

In the second place even if they are made of equal length, the shape of one manifold is always different from that of the other.

Besides attaching both manifolds to the same side of the engine together with the exhaust manifolding brings a lot of piping all on one side of the engine.

Having further all the exhaust valves and exhaust conduits on one side of the engine, the engine heats up much more on one side than on the other side.

Applicant has therefore as one of his objects to arrange the exhaust and inlet valves in two planes in the cylinders, each plane containing four exhaust valves and four inlet valves, and to arrange the inlet and exhaust manifolds on opposite sides of the engine.

Another object is to arrange the manifolds so that the ends of the two primary branches of each manifold, connected with four cylinders having suction intervals of 180°, are always connected to non-adjacent cylinders.

Another object is to apply the latter object also on a V-eight cylinder engine, obtaining thereby advantages which will be described in connection with the description of said manifolding as shown in the drawings.

Other objects appear during the description of the figures.

Figs. 1 and 3 represent diagrammatically the crankpin arrangements on two crankshafts, with which are connected two manifolding structures as shown in Figs. 2 and 4 respectively for the straight eight cylinder engine.

Figs. 5 and 6 show two different crankpin arrangements for the V-eight cylinder engine and Figs. 7 and 8 show the manifolding connected with such a crankshaft.

Fig. 1 shows diagrammatically a crankpin arrangement for a straight eight cylinder which effects a firing order in the eight cylinders of Fig. 2 as shown by the numbers inside the cylinders thereof. Only the numbers inside the cylinders are considered in the description and claims.

Fig. 2 shows two manifolds, each manifold being connected with four cylinders having a firing or suction interval of 180°. The lower manifold has a riser connected with a primary zone P^1, having two primary branches, one A^1 connected with the cylinders 8 and 6, and the other primary branch A^2 connected with cylinders 2 and 4. The upper manifold has two branches connected respectively with cylinders 1 and 3, and 7 and 5.

By placing these two manifolds on opposite sides of the engine, so that the inlet valves must be placed in two planes parallel to each other, I effect the great advantage that I may construct both manifolds of exactly the same form so that one may replace the other. Each of said primary branches having a secondary zone of distribution where each of said branches splits into secondary branches.

In Fig. 3 I show diagrammatically another crankpin arrangement for a straight eight cylinder engine, which effects a firing order in the eight cylinders of Fig. 4 as shown by the numbers inside the cylinders thereof.

Fig. 4 shows again two manifolds, entirely separate from each other on opposite sides of the engine. One manifold having a riser and fuel mixing means therein leading to a primary zone P^1 having a primary branch A^1 leading to the non-adjacent cylinders 4 and 2, and another primary branch leading to the non-adjacent cylinders 6 and 8. The other manifold has a riser and carbureting means connected with a primary zone of distribution P^2, having a primary branch A^3 leading to non-adjacent cylinders 5 and 7 and another primary branch A^4 leading to non-adjacent cylinders 1 and 3. Each of said primary branches having a secondary zone of distribution where it splits itself into two secondary branches leading to non-adjacent cylinders. It will be noted that in both manifolds the primary branches are connected to the same cylinders and the primary branches are all connected to non-adjacent cylinders or rather the ends of each primary branch are connected to non-adjacent cylinders in both types.

In Figs. 5 and 6 I have shown two crankpin arrangements for a V-eight cylinder engine effecting a perfect dynamic balance of the reciprocating parts therein. The type shown in Fig. 6 has been used before in the art, but the type shown in Fig. 5 is new. The firing orders compatible with one type are not the same as that of the other type. The crankpins 1 and 2, 3 and 4, 5 and 6, 7 and 8 are aligned in said pairs having the connecting rods side by side on said adjacent crankpins. The crankpins indicated by 1 and 2 are located at the front end of the engine and correspond with the cylinders 1 and 2 of the engine, shown in horizontal section in Fig. 7. Therefore when viewing the crankshaft of Fig. 5 from the front end, when the piston in cylinder 1 reaches its top position, piston 4 reaches top position in cylinder 4, and the crankpins 3, 4 appear to the right of crankpins 1 and 2 as shown in Fig. 5.

In Fig. 7 the crankshaft of Fig. 5 effects the firing order 2, 5, 7, 4 in one set of cylinders or one block of cylinders and 1, 3, 6, 8 in the other block of cylinders. Comparing this with the straight eight engines of Figs. 1 to 4 it appears that a perfect equivalence exists in this respect between the two.

Likewise here, one manifold has a primary zone P^1, having a primary branch A^1 connected with cylinders 2 and 8 and the other primary branch A^2 connected with cylinders 4 and 6. The other manifold has a primary zone P^2, having a primary branch A^3 connected with nonadjacent cylinders 1 and 5 and the other primary branch A^4 connected with the cylinders 3 and 7. Likewise here as in the types of Figs. 1 to 4, each primary branch has a secondary zone of distribution where the primary branch splits itself into two secondary branches leading to non-adjacent cylinders.

The only difference between the gas distribution of the two manifolds of Figs. 1 to 4 and that of Figs. 5 and 7 is this that in the first two types the successive suctions in the manifolds of Figs. 1 to 4 are non-alternative from the primary zone of each manifold to the four cylinders of each manifold. In Fig. 7, however, we obtain a different gas distribution in the two manifolds. Upon accurate analysis of the suction sequence taking place at the primary zone P^1, it appears that the successive suction periods at this zone proceed in non-alternative order like in the manifolds of the two straight eights, but the suction sequence at the primary zone P^2 is so that they are alternative in opposite directions. However, this difference of gas distribution in the two manifolds, is not objectionable, because the suction periods overlap each other at the start and the end of each period, when it lasts about 240° or more, about 60 degrees but the piston in the other cylinder is always in the neighborhood of upper or bottom dead center position so that that piston has little speed and the gases streaming into one cylinder cannot be aided or hampered very much by the inertia of gases streaming in the same or opposite direction to another cylinder. At the primary zone P^2 the two suction periods going to cylinders 1 and 5 do not assist each other because they are 360° apart, but are always somewhat opposed by the suction periods going to the cylinders 3 and 7 at the start and end of each single period. At the primary zone P^1, however, the suction periods going to cylinders 2 and 8 assist each other overlapping 60° and are only slightly opposed at the start and the end of the combined suction period by a suction period ending or starting towards the cylinders 4 and 6. Likewise the combined suction period in the same direction towards cylinders 4 and 6 are only slightly hampered at the start and end thereof by the end or start of the combined suction period in the same direction towards cylinders 2 and 8.

In Fig. 8 I have shown that the two manifolds can be connected with two adjacent risers each provided with fuel mixing means or carbureting means and the same thing can be applied above the cylinders of the straight eight by leading the risers of these two manifolds towards each other.

In Figs. 7 and 8, the fuel mixing means in the two risers are arranged side by side at the same level, leading to primary zones of distribution arranged side by side on the same level, so that the distances from the inlet openings of the two risers (which may have a common entry pipe for a choke-valve for starting purposes) to said primary zones are equal, or substantially equal.

From said primary zones the primary branches extend parallel to each other up to the point where the secondary zones are located. The longer secondary branches, extending from said secondary zones, have to cross under each other to reach the opposite cylinderblock.

These longer secondary branches of one manifold may both extend under the longer secondary branches of the other manifold, or one longer branch of one manifold may extend, at one side of the secondary zones, under the longer branch of the other manifold and the other longer branch of the first manifold may extend, at one side of the other secondary zone, above the longer branch of the other manifold. This is merely a matter of choice, provided the primary zones and primary branches are arranged lengthwise each other and lengthwise the cylinders so that their axes substantially form straight lines parallel to each other.

In the straight eight engines, the same advantage is obtained if the manifolds are connected to nonadjacent cylinders. If the valves (inlet and exhaust) were arranged in a single line and the two manifolds arranged on the same side, one has to curve around the other to reach the cylinderblock. In order to obviate such a positive disadvantage, I arrange the two manifolds on opposite sides of the engine, and the primary zones and primary branches can be equally arranged parallel to each other, their axes forming a straight line. Therefore the parallel between the specific inlet manifolds of the V-8 and the straight 8 is obvious. Only if the 2—4—2 crankshaft is used (standard type) and the valves arranged in one plane, the inlet manifold for the cylinders 3, 4, 5, 6 can be conveniently arranged inside the manifold for cylinders 1, 2, 7, 8, and the present construction becomes somewhat superfluous, though it still would have other advantages over the standard type.

The advantages of these double manifoldings, especially for the straight eight, resulting in substantially equal distances to the cylinders of each group to the cylinders thereof, are obvious and are new in the art. These same distances, however, are unequal for the double manifolding of the V-eight as clearly shown, but the V-eight being a far shorter and compacter engine, these differences are far less than they would be in the straight eight using other manifold arrangements.

It is understood that these systems of mani-

folding can be equally applied on 12 and 16 cylinder V types, having cylinders arranged at an angle in V formation, and the cylinders divided in two groups of cylinders having equal intervals between each group and alternating or non-alternating firing between the two banks. One manifold must be then connected with every branch to non-adjacent cylinders and the branches of the other manifold has to be connected with every branch to non-adjacent cylinders. Or in other words the cylinders are grouped in pairs of cylinders, each pair being composed of two adjacent cylinders but one cylinder of each pair being connected with one manifold, and the other cylinder of each pair being connected with the other manifold. Or in other words one inlet manifold is connected with cylinders having an even number of firing, the other with an uneven.

Fig. 8 shows that such manifolds can be cast in a single cover or coverplate fitting the two cylinderblocks cast integral between the V formed by the divergently disposed cylinderblocks. The bottom or undersurface of this cover is made flat and the openings of the inlet passages in the cover meet the inlet passages to the cylinders of the two cylinderblocks cast integral in one block. This cover is, of course, removable, in order to approach the valve mechanism, disposed between the cylinderblocks and actuated by a single camshaft, as is well known in the art for an L-head construction for the V-type engine.

In this cover plate the two risers of the two manifolds are parallel to each other, but one manifold is cast entirely below the other so that the branches of one manifold do not intertwine with those of the other.

I claim:

1. In a V-8 cylinder engine, having four inlet valves in one plane and four inlet valves in another plane, each for a group of four cylinders arranged at 90° angle, a double and separate inlet manifold structure, each connecting with four inlet valves having a suction interval of 180°, said manifolds having each two primary branches and each primary branch connected with the inlet valves to two non-adjacent cylinders, one of each group of four cylinders at 90°, the ends of one primary branch of one manifold being arranged over that of the other and each manifold having a riser and fuel mixing means therein, leading each to a primary zone of distribution, said latter zones however arranged side by side in the same horizontal plane and parallel to each other in vertical parallel planes.

2. In a V-8 cylinder engine, having two cylinder blocks arranged at 90° angle, having a crankshaft of which the crankpins are arranged at 90°, so that two adjacent cylinders at one end of one cylinder-block have immediately successive suction periods, a double and separate inlet manifold structure, each manifold connected with the two intermediate cylinders of one block and the two outer cylinders of the other block, each manifold having a riser leading to a primary zone of distribution, each riser having fuel mixing means at substantially the same height therein and in the same horizontal plane, said primary zones being arranged side by side in the same horizontal plane so that the distances from the fuel mixing means to said primary zones are the same, each manifold having two primary branches extending from said primary zones in opposite direction therefrom, and parallel to each other in parallel vertical planes, each primary branch being connected to an intermediate cylinder in one block and an outer cylinder of the other block.

3. The combination of claim 2, in which the primary branches each lead to a secondary zone of distribution, each primary branch having a short arm leading to an intermediate cylinder of one block and a long arm leading to an outer cylinder of the other block, the said latter secondary branches on the same side of said two primary zones being arranged, however, one above the other.

4. In a V-8 cylinder engine, having two blocks of four cylinders arranged at 90°, and having firing intervals of 90°, two groups of 4 cylinders having a suction interval of 180°, one group of four cylinders having fuel mixing means in a riser leading to a primary zone therein, having two primary branches extending therefrom in opposite direction lengthwise the engine, the gas distribution in said manifold being unbalanced, the other group of four cylinders having fuel mixing means in a riser leading to a primary zone of distribution, the gas distribution therein being balanced, having two primary branches extending therefrom in opposite directions, said primary zones of distribution of both manifolds being arranged side by side in substantially the same horizontal plane, and the said primary branches extending therefrom being substantially parallel to each other in parallel vertical planes, lengthwise the engine.

5. The combination of claim 4, in which each primary branch has a short secondary branch leading to an intermediate cylinder in one block and a long secondary branch leading to an outer cylinder of the other block, but which is nearest said intermediate cylinder of said first block, said latter long branches only laying one above the other on opposite sides of said primary zones of distribution.

6. In an eight cylinder engine of the V-type having suction intervals of 90°, two groups of four cylinders having an interval of 180°, each group provided with an inlet manifold, having a riser leading to a primary zone of distribution, each primary zone having two primary branches extending therefrom in a straight line so that said zones and branches form substantially a straight line, said primary branches and zones arranged in two parallel vertical planes lengthwise the engine, fuel mixing means in said risers, the distances in said risers from the fuel mixing means to the primary zones of said manifolds being of the same length, said primary zones being arranged in the same horizontal plane, said engine having its eight inlet valves arranged in two planes at right angles to each other, each of said primary branches of said manifolds being connected with non-adjacent cylinders, said engine having a crankshaft with four crankpins arranged at 90°, said crankshaft having crankpins 1 and 2 at 90°, so that crankpin 2 appears to the right of crankpin 1 from the front end of the engine when crankpin 1 is in top dead center position, crankpins 3 and 4 being arranged at 90°, so that crankpin 3 appears to the left of crankpin 4 when crankpin 1 is in top dead center position, said crankpins reading in clockwise direction from the front end of the engine 1, 2, 4, 3.

7. In a V-8 cylinder engine, having four inlet valves in one plane and four inlet valves in another plane, substantially at 90° angles to each other, a double and separate inlet manifold structure, each connecting with four inlet valves

having a suction interval of 180°, said manifolds having each a primary zone and two primary branches extending therefrom in a straight line so that the risers and said branches of each manifold are located each in a single vertical plane, said two vertical planes being parallel to each other, fuel mixing means in said risers substantially at the same height in said risers, each primary branch of each manifold having a short secondary and a long secondary branch, said long secondary branches arranged one above the other, and each secondary branch leading to a separate intake hole in the cylinderblock, and to a separate inlet valve of a single cylinder.

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