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INTAKE MANIFOLD

Filed March 24, 1934

Fig. 1.

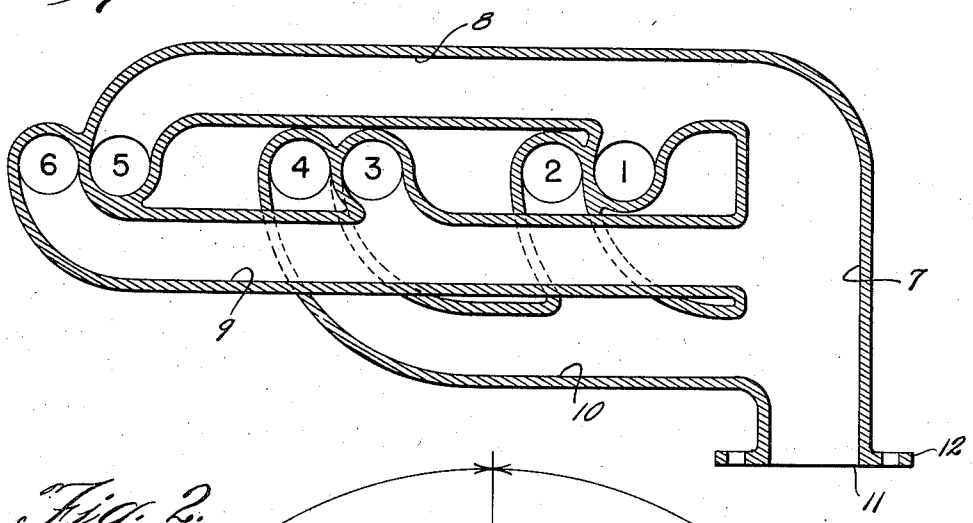
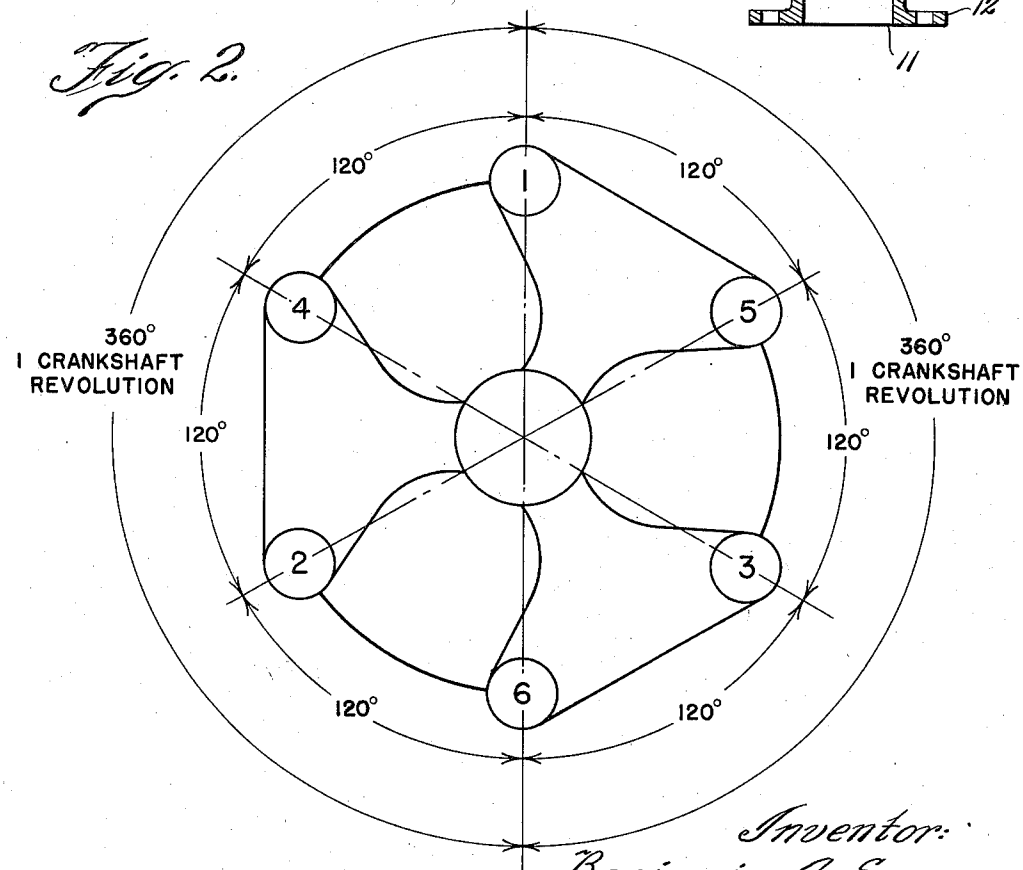



Fig. 2.




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## INTAKE MANIFOLD

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15 Claims. (Cl. 123—52)

The invention relates generally to an intake manifold for internal combustion engines and particularly to an intake manifold for a multi-cylinder engine.

In multi-cylinder engines, the cylinders are commonly designated by numbers running consecutively from the front to the rear of the engine. For purposes of balance, the firing order of the cylinders is not in consecutive order from front to rear but is commonly arranged so that no two adjacent cylinders fire in succession. Thus, in a six-cylinder engine a common firing order is 1—5—3—6—2—4. The sequence of operation of the intake valves for the cylinders corresponds to the sequence of firing order of the cylinders and thus requires that a combustible mixture be supplied first to the extreme forward cylinder, then to a cylinder positioned in the rear of the engine, then to a cylinder positioned intermediate the engine and so on.

The manifolds heretofore employed to provide a combustible mixture to the cylinders have been of a generally T-shaped formation with a horizontal portion providing a single passage communicating with each of the inlet ports, and a vertical portion, intermediate the ends of the horizontal portion, providing an intake passage communicating with the carburetor for the engine. As a result of the irregular firing order of the cylinders with the consequent necessity of supplying the combustible mixture first to one end of the engine and then to the opposite end, as above pointed out, there must be a constant reversal of the direction of flow of the combustible mixture in the horizontal portion of the manifold. This constant reversal of the direction of flow sets up a turbulent condition within the manifold and a surging back and forth resulting in a starving of some of the cylinders with a consequent impairment of efficiency of operation. Because of the setting up of different pressures at the intake passage, this turbulent condition also results in an irregular demand on the carburetor, thus varying the richness of the mixture supplied.

It is a general object of the invention, therefore, to provide an improved intake manifold of novel construction eliminating the surging and turbulent condition heretofore existing in manifolds to assure an equal supply of combustible mixture to each of the cylinders and a mixture of constant richness.

Another object of the invention is to provide an intake manifold in which the combustible mixture has a uni-directional flow thereby to eliminate the turbulent condition in the manifold.

Another object of the invention is to provide an intake manifold having a common intake passage at one end and a plurality of branched passages leading from the common passage and each branch communicating successively with the intake ports of cylinders firing in a sequence corresponding to the distance of the intake ports of the cylinders supplied by that branch away from the common passage.

Yet another object of the invention is to provide an intake manifold for use on a six-cylinder engine having the common intake passage at one end and three branch passages, each branch passage supplying two cylinders the ports of which are spaced from the common passage a distance corresponding to the firing order of the cylinders, and the branch passages communicating with the common passage at points spaced from the carburetor distances inversely proportional to the firing order of the cylinders supplied by the respective passages.

Other objects and advantages will become apparent from the following detailed description taken in connection with the accompanying drawing, in which:

Fig. 1 is a sectional partially diagrammatic view of a manifold embodying the features of the invention.

Fig. 2 is a diagrammatic view illustrating the firing order of a six-cylinder engine.

While the invention may, with slight modifications, be adapted for employment with engines having varying numbers of cylinders, it is, for purposes of disclosure, described and shown herein as adapted for use on a six-cylinder engine. It is to be understood however, that the invention is not to be limited to the specific embodiment shown but is to cover all modifications and alternative constructions falling within the spirit and scope of the invention as defined by the appended claims.

As above stated, the invention is herein shown as embodied in an intake manifold designed for use with a six-cylinder engine. Intake ports for the cylinders are diagrammatically shown in the drawing and numbered consecutively from 1 to 6 to correspond with the usual numbering of the cylinders.

It is well known to those skilled in the art that in six-cylinder, four-cycle internal combustion engines each cylinder fires once in every two revolutions of the crankshaft. Thus successive cylinders fire at every one-third revolution of the

crankshaft or 120 crankshaft degree intervals apart as shown in Fig. 2. The intake valves, being coordinated with the firing, will also operate at 120 crankshaft degree intervals apart so that the firing order or the order of valve operation may be interchangeably referred to. For purposes of this disclosure, it will be assumed that the firing order of the cylinders is 1—5—3—6—2—4, the order being shown in the circular diagram, Fig. 2, when traversed in a clockwise direction of rotation.

The invention contemplates the perfection of an intake manifold free of a surging and turbulent state of the combustible mixture with its resultant starving of certain cylinders and inefficient operation. To that end the manifold is designed to produce a substantially uni-directional flow of the combustible mixture in which the opening of a port gives to the mixture an impetus in the general direction of the subsequently opening port. Generally speaking, this uni-directional flow of the mixture is obtained by providing a manifold having a large common intake passage and a plurality of smaller branch passages supplying one or more cylinders selected with a view to having the intake ports in any one passage increasingly remote from the common passage in the order of firing of the cylinders.

In the present instance, the common intake passage 7 is located at one end of the manifold and has three branch passages 8, 9 and 10 extending laterally therefrom in the same general direction. One end of the passage 7 has an opening 11 for communication with a carburetor, not shown, and the manifold is formed at that end with a flange 12 by means of which it may be secured to the carburetor. At the end remote from the carburetor, the passage 7 merges gently into the branch passage 8 which communicates in succession with the intake ports 1 and 5. Consideration of Fig. 2 will show that cylinder 5 fires a 120 crankshaft degree interval after cylinder 1. As a result, opening of port 1 and a suction of combustible mixture into the cylinder causes the combustible mixture to have a movement along the passage 7 and the branch passage 8. The impetus thus given to the combustible mixture carries the same along the branch passage 8 so that a 120 crankshaft degree interval later, when the valve 5 opens, there is an ample supply of mixture available for that cylinder.

Likewise branch passage 9 communicates in succession with the intake ports of two cylinders in the order of firing, namely first with port 3 and at the extreme end with port 6. With this arrangement these ports are supplied without a reversal of the direction of flow thus assuring an adequate supply of combustible mixture. Thus, the flow of combustible mixture upwardly in the passage 7 started by the opening of ports 1 and 5 aids in assuring an adequate supply for port 3, while the impetus along the branch 9 given to the mixture by the opening of port 3 assures an adequate supply for the remote port 6. In like manner, branch passage 10 communicates with ports 2 and 4 which correspond in remoteness from the common passage 7 to the firing order of the corresponding cylinders.

Branch passage 10 communicates with the common passage 7 immediately adjacent the carburetor while passage 9 communicates at a point intermediate the passages 8 and 10. It will be noted that port 3, supplied by branch passage 9, opens a 120 crankshaft degree interval after port 5, supplied by branch 8, and that port 2, supplied by branch passage 10, opens a 120 crankshaft degree interval after port 6, supplied by branch passage 9. This arrangement further adds to the perfection of uni-directional flow obtained for not only are the ports in any one branch arranged to assure uniform flow but the several branches are also arranged so that there is no reversal of direction of flow in the passage 7. Thus it will be seen that the branch passages 8, 9 and 10 draw combustible mixture from the common passage in the order named.

It is believed apparent from the foregoing description that by providing a suitable number of branch passages supplying one or more intake ports selected to be increasingly remote from a common passage in the order of firing of the cylinders they supply, the manifold may be adapted for use with 4, 8 or any other number of cylinders. The manifold so designed would have the same uni-directional flow with a resultant uniform supply of combustible mixture to each of the cylinders and uniform and efficient operation.

I claim as my invention:

1. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage located at one end and a plurality of branch passages communicating at one end with said common passage and extending laterally therefrom in the same general direction, each of said branch passages communicating with at least one cylinder, and the intake ports of the cylinders supplied by any one branch passage located at relatively greater distances along the branch passage away from the common passage in the order of firing of the cylinders supplied.

2. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage located at one end and a plurality of branch passages communicating at one end with said common passage and extending laterally therefrom in the same general direction, each of said branch passages communicating in succession progressively away from the common passage with the intake ports of cylinders firing in a sequence corresponding to the relative distance of their intake port away from the common passage to obtain a unidirectional flow of combustible mixture in the passages of the manifold.

3. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage and a plurality of branch passages communicating at one end with said common passage and extending in substantially the same direction therefrom, each branch passage communicating with cylinders the intake ports of which are located increasingly remote from the common passage in the order of firing of the cylinders supplied by the respective branch passages.

4. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage located at one end and a plurality of branch passages communicating at one end with said common passage and with a plurality of cylinder-intake-ports of such engine, said branch passages extending substantially in the same direction from said common passage.

5. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage and a plurality of branch passages leading substantially in the same direction from the common passage and communicating respectively with the intake ports of such cylinders whereby

opening of a port for the intake of combustible mixture through one of said branch passages gives to the combustible mixture in such branch passage an impetus in the general direction of the intake port of a cylinder next in firing order.

6. An intake manifold for a six cylinder internal combustion engine with a 1—5—3—6—2—4-firing order having a common intake passage at one end for communication with a carburetor, a first branch passage leading from said common passage and communicating in succession with the intake ports of cylinders **1** and **5**, a second branch passage leading from said common passage and communicating in succession with the intake ports of cylinders **3** and **6** and a third branch passage leading from said common passage and communicating with the intake ports of cylinders **2** and **4**, said branch passages communicating with said common passage progressively toward the carburetor in the order of their numbering.

7. An intake manifold for a six-cylinder internal combustion engine having a common intake passage at one end for communication with a source of combustible mixture, a first branch passage supplying two cylinders and communicating with the common passage at the end remote from the source of supply, a second branch passage also supplying two cylinders and communicating with the common passage intermediate its ends and a third branch passage supplying the remaining two cylinders and communicating with the common passage adjacent the source of supply, the cylinders supplied by any one passage firing in immediate sequence with the intake port of the first cylinder to fire nearest the common passage, and the cylinders in the several branch passages firing in the sequence of the numbering of the branch passages.

8. An intake manifold for a six-cylinder internal combustion engine having a common intake passage at one end and three branch passages extending from said common passage in substantially the same general direction, each branch passage communicating with two cylinders, the inlet ports of which are located at relatively greater distances from the common passage corresponding to the firing order of the cylinders supplied.

9. An intake manifold for a multi-cylinder internal combustion engine having a common intake passage at one end for communication with a carburetor and a plurality of branch passages leading from said common passage, each of said branch passages communicating successively in progression away from said common passage with the inlet ports of a group of cylinders in the order of firing of the individual cylinders in such group and said branch passages communicating with said common passage in progression away from the carburetor in reverse order of the firing of the groups of such cylinders.

10. For use with a multi-cylinder internal combustion engine, a manifold having an intake passage and a plurality of branch passages leading in the same general direction from such intake passage, each branch passage having outlets for communication with a plurality of cylinders of said engine, the outlets of each branch being at different distances from the inlet passage and in accordance with the firing order of the cylinders for their communication.

11. An intake manifold comprising a vertically disposed mixing chamber at an end thereof, a fuel distribution passage extending laterally from said mixing chamber, and other fuel distribution passages respectively above and below the first named passage, all of said passages being substantially in the same vertical plane, there being a plurality of discharge openings in certain of said passages, and the discharge openings in each of said certain passages being spaced at varying selected distances from the mixing chamber.

12. For use with a multi-cylinder internal combustion engine, a manifold having a fuel passage and a plurality of distributive passages extending communicatively from such fuel passage, certain of said distributive passages having outlets for communication with a plurality of cylinders of said engine, the respective outlets of each of said certain distributive passages being at different distances from the inlet passage, such distances being in accordance with the firing order of the cylinders for such outlets.

13. An intake manifold for an internal combustion engine having cylinders fired in an order selected for preserving the equilibrium of such engine, said manifold comprising a common intake passage having an intake opening, and a plurality of branch passages communicating at an end with said common passage and extending in substantially the same direction from said passage, certain of said branch passages being adapted to communicate with a plurality of said cylinders, the cylinders for respective communication with a branch passage having a successive charging sequence without the intervention of charging of other cylinders thus causing prolonged periodic fuel movement in such branch passages, and the branch passages communicating with said intake passage at selectively different distances from said intake opening according to the order of such periodic fuel movement therein.

14. The combination with an internal combustion engine having cylinders in which are reciprocated pistons in an order selected for minimizing engine vibrations, of an intake manifold comprising a common intake passage having an intake opening, and a plurality branch passage communicating at an end with said common passage, certain of said branch passages being adapted to communicate with a plurality of said cylinders, and the cylinders for respective communication with each of said certain passages having fuel intake periods overlapping in time thus causing prolonged periodic fuel movement in such branch passages, and the branch passages communicating with said intake passages at selectively different distances from said opening according to the order of such periodic fuel movements therein.

15. An intake manifold as set out in claim 14, but wherein said branch passages extend substantially in the same direction from said common passage.

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