July 7, 1936. J. W. SWAN 2,046,797

MANIFOLDING MEANS FOR MULTICYLINDER ENGINES

Original Filed Nov. 8, 1930 4 Sheets-Sheet 1

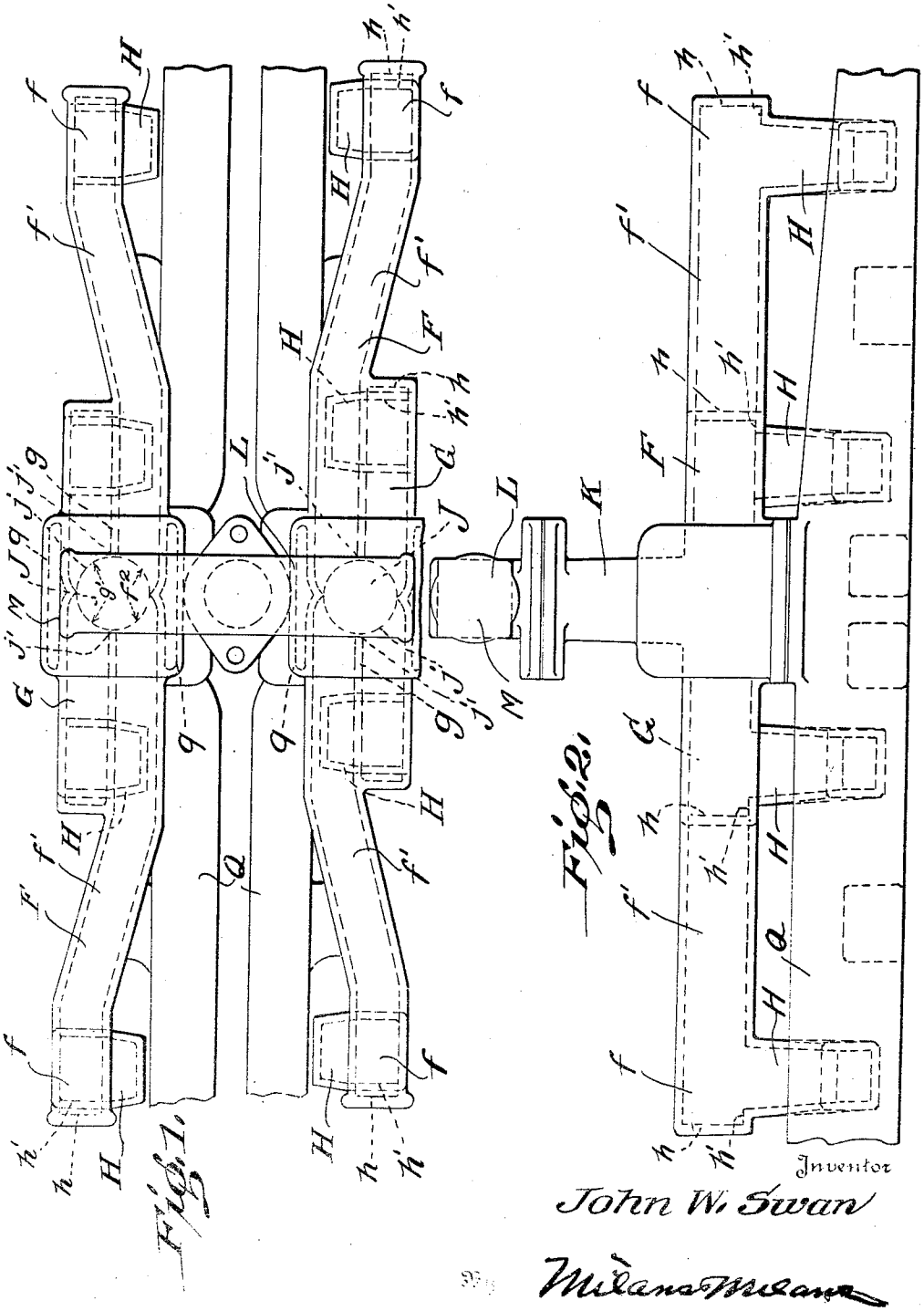

Fig. 1.

Fig. 2.

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Fig. 3.

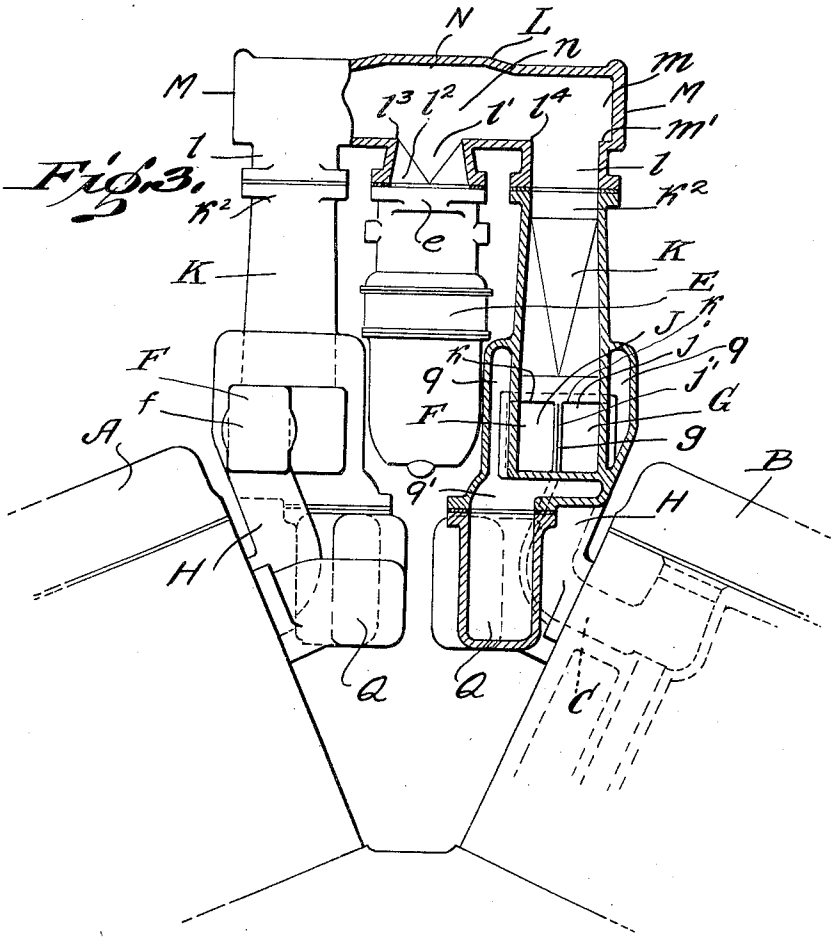
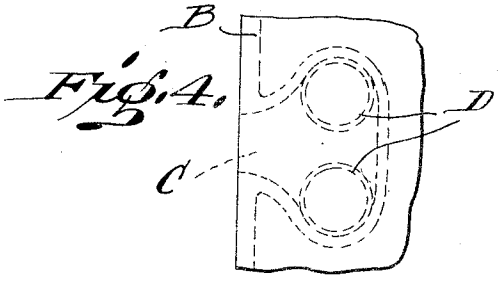


Fig. 4.



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MANIFOLDING MEANS FOR MULTICYLINDER ENGINES

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Fig. 5.

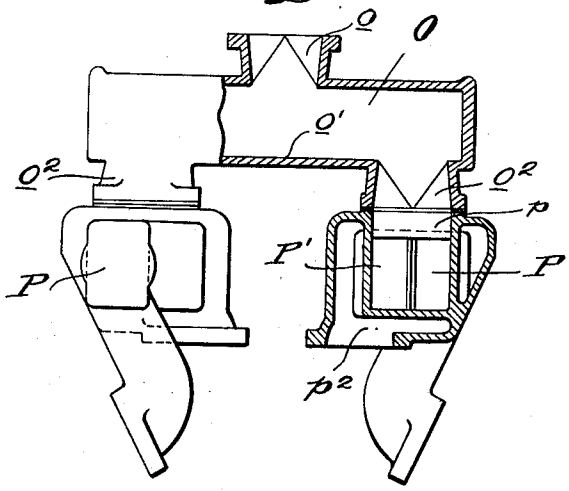
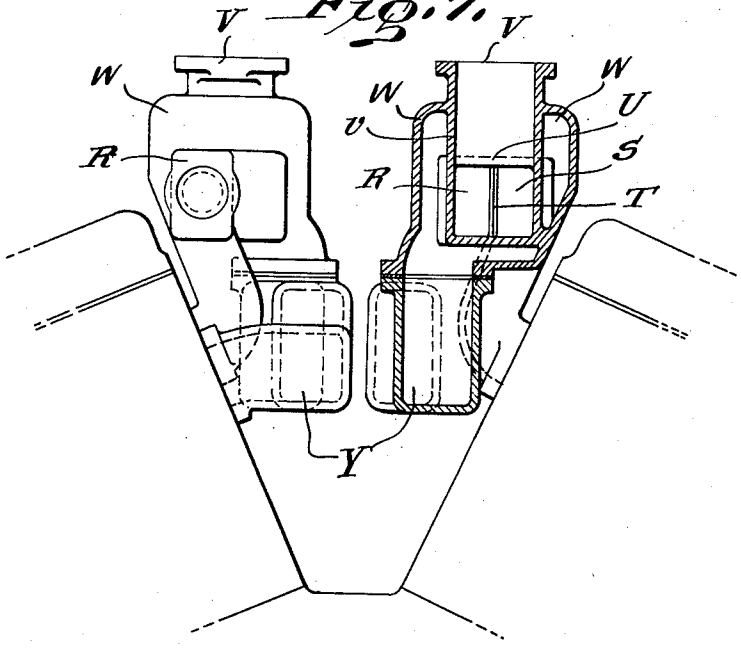


Fig. 7.



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MANIFOLDING MEANS FOR MULTICYLINDER ENGINES

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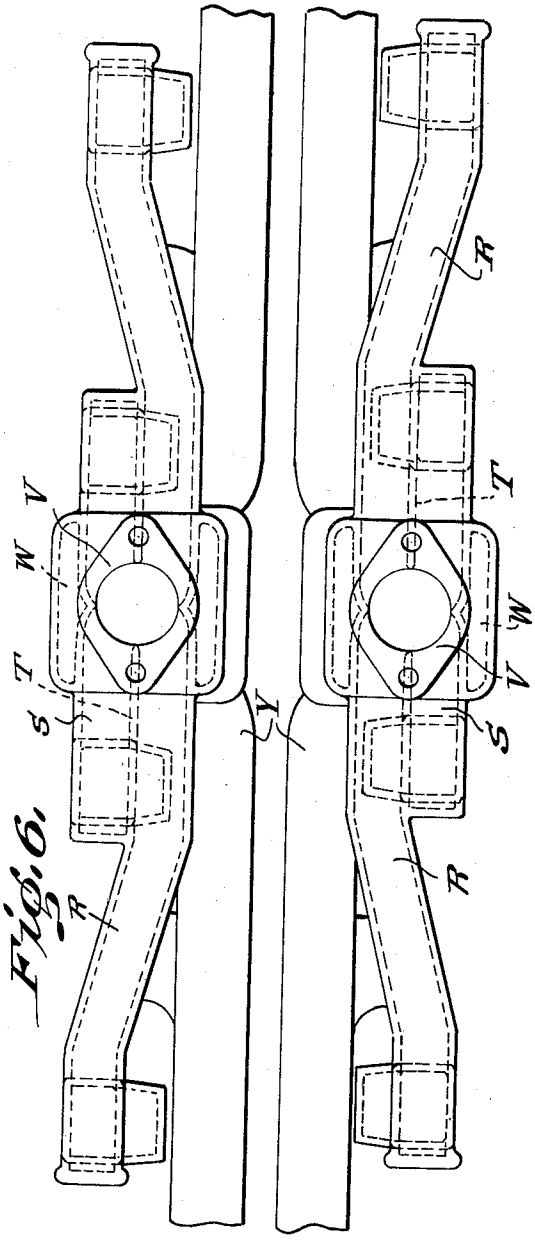

Fig. 6.

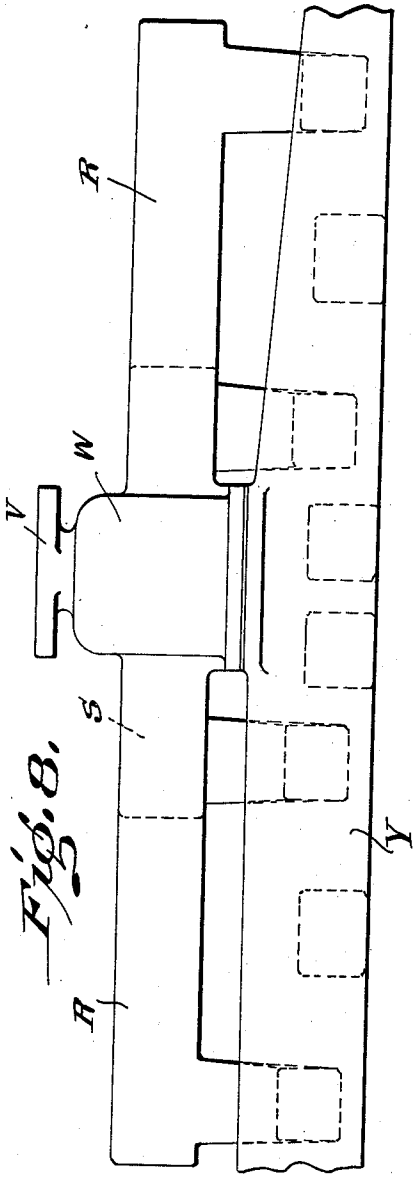

Fig. 8.

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MANIFOLDING MEANS FOR MULTI-CYLINDER ENGINES

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Application November 8, 1930, Serial No. 494,403
Renewed September 17, 1935

7 Claims. (Cl. 123—52)

This invention relates to improvements in manifold for multi-cylinder engines, and while capable of use in other respects, is primarily designed for employment in connection with engines wherein the cylinders are out of line, an instance of which is the so-called V-type engine now well known in the art.

It is universally recognized that as the gas engine art has developed in recent years, and more especially in the automobile field, resulting in the provision of increasing numbers of cylinders, the uniform supply of fuel to the cylinders has become correspondingly difficult.

The discovery and use of the Swan system of distribution illustrated and described in the John W. Swan Patent No. 1,536,044, granted April 28, 1925, has been of substantial advantage to the industry in obtaining satisfactory distribution of fuel in those engines where the cylinders are in line, customarily for six or eight cylinder engines.

The fundamental characteristics of the Swan system are, of course, applicable to engines wherein the cylinders are not in line, but separated in series as in the V-arrangement referred to. However, the latter type of engine inherently presents considerations and requirements, not attending an engine with the cylinders in line, and the present invention, therefore, is directed to certain improvements or special embodiments of the Swan principle facilitating its service in connection with multi-cylinder engines of preferably eight, twelve, sixteen or even more cylinders arranged in separated or parallel series.

The present improvements contemplate the provision of manifolding means adapted for association on the one hand with a carburetor of the up-draft type, or, on the other hand with a carburetor of the down-draft type.

The improvements also embrace the provision of manifolding means either of a joint arrangement whereby oppositely disposed manifolds each adapted to deliver fuel to a series of cylinders may receive fuel from a single source, as a carburetor, or may be individually employed, each in association with a separate carburetor devoted thereto.

The combinations of parts and details of various embodiments of my invention will be more readily understood from the specific description hereinafter presented in connection with the drawings forming part hereof and wherein the preferred embodiments of the invention are illustrated.

In said drawings:—

Figure 1 is a top view of jointly related manifold members connected and associated with an up-draft carburetor to receive fuel from the same as a single source of supply;

Figure 2 is a side view of the device illustrated in Figure 1;

Figure 3 is a vertical transverse view, parts being broken away on a line centrally of Fig. 1 to expose the interior construction; and

Figure 4 is a detail view.

Figure 5 is a view similar to Fig. 3, illustrating an embodiment of the invention enabling the manifold to be employed in connection with a down-draft carburetor;

Figure 6 is a view similar to Fig. 1, differing from the latter in that the manifolding means of the present figure is shown as combined with separate carburetors adapted to supply the fuel to the oppositely disposed manifold portions;

Figure 7 is a transverse vertical view showing the end of one of the manifold portions and a central section of the other manifold portion; and

Figure 8 is a side view of the device illustrated in Figure 6.

Referring more specifically to the drawings wherein like reference characters designate the same parts in the respective series of views, A and B represent the cylinders of a conventional V-type arrangement of cylinders in series, it being understood that any suitable number of cylinders A may be disposed in line and correspondingly any number of cylinders B may be similarly disposed in line.

The manifolding means and cylinders will be in keeping with the number of discharge portions from the manifold and inlet ports to cylinders of the particular combination desired. The inlet port for each cylinder B is represented at C, and the same may be confined exclusively to a single cylinder or to a pair of cylinders, as may be found expedient, in which latter instance, the cylinder ports may be siamesed, as at D, all as clearly understood in the art.

Arranged within the area between the oppositely aligned series of cylinders and positioned above the latter is a carburetor E of the up-draft type, the throat or discharge end of the carburetor being represented at *e*. This carburetor is designed to furnish the fuel supply to both series of cylinders A and B, and to afford uniform distribution of the fuel to the respective cylinders, the following manifolding instrumentalities are provided.

Approximately parallel with the series of the opposite series of cylinders A and B is a manifold section comprising a relatively long manifold por-

tion F and a relatively short manifold portion G, conveniently integrally formed and divided by a common wall or partition *g*. These manifold portions are preferably rectangular in cross section although they may be round or other shape as desired, and this is true with respect to all manifold portions referred to in this specification. The manifold portion F extends longitudinally well beyond the manifold portion G and to present its terminal portions *f* in line with the ends of the manifold portion G so as to have them in the same plane, intermediate slightly inclined portions *f'* are provided. Horizontally, the manifold portions F and G are preferably in the same plane throughout, although, of course, to meet conditions attending the manifolding of a particular engine, this may be departed from within reasonable limits. The terminal portions of the manifold portions F and G open through the bottoms thereof to depending and laterally discharging branches H adapted to register with a single or siamesed cylinder port C as the case may be, clearly indicated in Figs. 3 and 4.

The terminal portions *f* of the manifold portion F are straight to have the longitudinal axis thereof parallel with the central part of the manifold portion F, and axially in line with the longitudinal axis of the entire manifold portion G; and the end walls of the manifold portions F and G are formed with recesses *h* bordering abrupt or angular edges constituting ledges *h'* so that any wet constituents of fuel reaching said end walls will be directed back into the mixture stream rather than tend to flow downwardly along the adjacent walls of the branches H thereby possibly effecting a richer mixture reaching one of siamesed ports as compared to the mixture reaching the other port of the pair, all in keeping with the best practices under the system of distribution shown in Swan Patent No. 1,536,044.

Centrally of the manifold portions F and G, the top wall of the same is provided with an inlet *j* and the vertical dividing wall *g* therebelow is cut away as at *j'* to provide a correspondingly centrally disposed distributing zone J symmetrically arranged with reference to the communications f^2 and *g'* between the zone and the oppositely extending branches of said manifold portions F and G. These communications are respectively located between the inner ends of the cut away wall *g* and inwardly tapered front and rear wall portions of the manifold portions F and G, the same being centrally disposed and constituting vertical ribs or angles slightly dividing the distributing zone, the surfaces of the ribs merging gradually into the front and rear walls of the manifold portions F and G as seen in Figures 1 and 6. A pair of vertical conduits K axially at right angles to the manifold portions F and G and preferably having a sharp or abrupt juncture *k* with the top walls of said manifold portions surrounding the inlet opening *j* so that the liquid fuel fed downwardly through the conduits K will pass downwardly off the edges *k* into the air stream and travel onward therewith in a horizontal course at right angles to the vertical course through the conduits. The conduits may be square in transverse cross section throughout, or, as shown, may merge from a round end where the connection is made at the inlet opening J to a square upper end where connection is made with the cross head or manifold portion L now to be defined.

The cross head portion of the manifold L is of rectangular cross section and has similarly shaped depending end branches *l* and a middle branch *l'*, the latter merging into a round end l^2 for communication with the throat portion *e* of the updraft carburetor E. The end branches *l* communicate with the correspondingly square upper ends *k'* of the vertical conduits K. The inner angles of the cross head indicated at l^3 and l^4 are sharp or abrupt and the ends M of said cross head are formed with recesses *m* and lower sharp or abrupt corners *m'*, all for purposes as have been made apparent herein in connection with the formation of the manifold portions F and G. The top wall of the manifold portion L has a shallow dome N aligned with the manifold branch *l'* and carburetor throat *e* so that any wet constituents of the fuel reaching the top wall in its upward travel, will not tend to run along the adjoining top wall portions, but will either drop back toward the carburetor or be taken up by the mixture stream passing through the central distributing zone *n* below said dome N.

It will be understood that the desired fuel furnished by the carburetor E will move upwardly in a straight line through the central branch *l'* of the cross head portion L of the manifold, and taking a right angular or abrupt turn will move in a horizontal line towards one or the other of the end branches *l* whence the fuel will again take an abrupt or right angle turn and pass downwardly in a straight line through the vertical conduit into the central opening in the combined tops of the manifold portions F and G. Dependent upon the cycle of the engine, the fuel thus delivered to the distributing zone J will again take a right angle or abrupt turn to the particular lead of the manifold portions F and G at the time demanded by the particular cylinder to be supplied. Any fuel reaching the top of the cross head portion L of the manifold will, as stated, either fall back into the mixture stream or be taken up thereby, the symmetrical arrangement being such as to favor no particular direction or correspondingly any particular cylinder, and the end pockets *m* with bottom ledges or corners *m'* will cause any wet particles reaching said ends to be returned outwardly into the mixture stream away from the outer side walls of the vertical conduits K so that said wet particles may not cling or travel down said walls and thereby possibly feed said wet particles in an uneven manner to particular branches of the manifold portions F and G and correspondingly to different cylinders. Uniformity of distribution is thereby assured.

Now, as distinguished from the updraft carburetor of the embodiment of the invention just described, it will be understood by those skilled in the art that in lieu of use of an updraft carburetor, a down-draft carburetor may be employed. This simply requires the modification of the cross head or distributing portion L to accommodate the down-draft carburetor and the elimination of the vertical conduits K. A suitable formation and combination is illustrated in Figure 5 of the drawings wherein O represents the cross head portion of the manifold, the same possessing centrally of its top an upwardly directed branch *o* for coupling with the carburetor of the down-draft type. The bottom wall *o'* of the manifold portion O is continuous and flat in this instance so that any heavy or wet particles of fuel reaching the same in its downward course from the manifold and through the branch *o* will simply spread out uniformly on said bottom and be taken up by the fuel mixture stream passing thereover.

The cross section and end formation of the manifold portion O is preferably formed the same as in the instance illustrated in Figures 1 to 3, inclusive, the depending end branches being here indicated at o^2, the cross sections of which merge from square to round to correspond to the circular centrally arranged intake opening p in the top of the manifold portions P, P', corresponding to the manifold portions F and G of Fig. 3.

At times it may be desirable to heat the manifold portions, and for such purpose, the exhaust manifolds of the engine represented at Q, Fig. 3, may be utilized to communicate with jackets q, q', respectively, at the sides and bottom of the manifold portions F and G, Fig. 3, and at p^2 along the bottoms of the manifold portions P, P', Fig. 5.

In the embodiment of my invention illustrated in Figs. 6, 7 and 8, I again illustrate an arrangement for use with down-draft carburetors (not shown), the characteristic difference between the present embodiment and that illustrated in Fig. 5, being that the cross head manifold portion O is dispensed with so that a separate carburetor may be utilized to deliver fuel to each manifolding means for each series of cylinders as distinguished from utilizing a single carburetor combined with the cross head portion of the manifold for feeding the fuel to both of said series of cylinders. In the present arrangement, there are two pairs of oppositely disposed manifold portions R and S, the manifold portions of each pair is joined by an integral dividing wall T cut away centrally as already defined to provide a distributing zone and having an open top U directly above said zone and at the bottom of a short neck portion or conduit V, the upper end of which is designed to be coupled to and register with the downwardly discharging outlet of any suitable type of down-draft carburetor. In the embodiment of the invention now being described, the manifold portions R and S as well as the neck v for the major portion of its length are jacketed as at W to provide heat at the opposite sides of the manifold portions, around the neck portion and beneath the common bottom wall of the manifold portions. Here, as formerly, the jacketing is in communication with the exhaust Y of the engine and the associated parts, that is, the manifold portions, neck and jacketing means are preferably all formed integrally to obtain the better transmission of heat.

The arrangement of the parts of that embodiment of my invention illustrated in Figures 6, 7 and 8, lend themselves admirably to the employment of either a pair of carburetors or a single carburetor, it being understood that in connection with the latter, a cross head portion of the manifold, such as L, of Fig. 3, would be resorted to. In other instances, the individual carburetors will, as stated, be directly connected to the neck portions V of the combined manifold portions R and S.

While I have herein illustrated a number of embodiments of my invention, it is to be understood that the latter is capable of embodiment in still other combinations and arrangements, with departures or additions in detail, as may be included in the scope of the hereto appended claims.

What I claim is:

1. A down-draft manifold for internal combustion engines, comprising a substantially horizontal main manifold portion adapted to supply fuel mixture to the end cylinders of the engine, a sub-manifold portion adapted to supply fuel mixture to the intermediate cylinders of the engine and extending substantially parallel to said main manifold portion, a distributing zone common to both said manifold portions, a substantially vertical supply pipe adapted to carry the fuel mixture downwardly into the distributing zone, and manifold branches extending from the ends of said main and sub-manifold portions downwardly to the engine intake ports, said main and sub-manifolds being arranged to conduct the fuel mixture in substantially straight lines and around sharp corners throughout said main and sub-manifolds and into said manifold branches, said branches being arranged to sweep the fuel mixture downwardly and laterally into the engine ports.

2. A down-draft manifold for internal combustion engines, comprising a substantially horizontal main manifold portion adapted to supply fuel mixture to the end cylinders of the engine, a sub-manifold portion adapted to supply fuel mixture to the intermediate cylinders of the engine and extending substantially parallel to said main manifold portion, a distributing zone common to both said manifold portions and having a flat floor, a substantially vertical supply pipe adapted to carry the fuel mixture downwardly into the distributing zone, and manifold branches extending downwardly from the ends of said main and sub-manifold portions to the engine intake ports, there being sharp right angle turns between said branches and said manifold portions, and said branches being curved to sweep the fuel mixture downwardly and laterally into the engine ports.

3. A down-draft manifold for internal combustion engines, comprising a substantially horizontal main manifold portion, a sub-manifold portion, a distributing zone for said manifold portions, a substantially vertical supply pipe adapted to carry the fuel mixture downwardly into the distributing zone, and manifold branches extending downwardly from the ends of said main and sub-manifold portions to the engine intake ports, said main and sub-manifolds being arranged to conduct the fuel mixture in substantially straight lines and around sharp corners throughout said main and sub-manifolds and into said manifold branches, said branches being curved to conduct the fuel mixture downwardly and laterally into the engine ports.

4. A down-draft manifold for an internal combustion engine having four intake ports and having its cylinders inclined from the vertical, comprising a main manifold portion adapted to deliver fuel mixture to the end ports, a sub-manifold portion adapted to deliver fuel mixture to the intermediate ports, said manifold portions lying in the same horizontal plane and above said intake ports, a distributing zone common to both said manifold portions and having a flat horizontal floor, a vertical supply pipe adapted to conduct fuel mixture downwardly into said distributing zone, and manifold branches extending from the ends of said main and sub-manifold portions downwardly to said intake ports, said supply pipe, distributing zone, and main and sub-manifolds all being arranged to conduct the fuel mixture in substantially straight lines and around sharp corners from the point of delivery of fuel into said supply pipe throughout said manifold portions and into said manifold branches, said branches being arranged to sweep the fuel mixture downwardly and laterally into the engine ports.

5. A down-draft manifold for an internal combustion engine having four intake ports and having its cylinders inclined from the vertical, comprising a main manifold portion disposed above said intake ports and adapted to deliver fuel mixture to the end ports, a sub-manifold portion adjacent said main manifold portion and adapted to deliver fuel mixture to the intermediate ports, said manifold portions having a common intermediate wall, said wall having an opening therethrough to provide a distributing zone common to both said manifold portions and having a flat horizontal floor, a vertical supply pipe adapted to conduct fuel mixture downwardly into said distributing zone, and manifold branches extending downwardly from the ends of said main and sub-manifold portions and curving laterally to said intake ports.

6. A down-draft manifold for an internal combustion engine having four intake ports, comprising a main manifold portion disposed above said intake ports and extending to points opposite the end intake ports, a sub-manifold portion adjacent said main manifold portion and extending to points opposite the intermediate ports, a distributing zone intermediate the ends of said manifold portions and common to both said manifold portions and having a flat horizontal floor, a vertical supply pipe adapted to conduct fuel mixture downwardly into said distributing zone, and manifold branches extending from the ends of said main and sub-manifold portions downwardly to said intake ports, said supply pipe, distributing zone, and main and sub-manifolds all being arranged to conduct the fuel mixture in substantially straight lines and around sharp corners from the point of delivery of fuel into said supply pipe throughout said manifold portions and into said manifold branches.

7. A down-draft manifold for an internal combustion engine having four intake ports, comprising a main manifold portion disposed above said intake ports and adapted to deliver fuel mixture to the end ports, a sub-manifold portion adjacent said main manifold portion and adapted to deliver fuel mixture to the intermediate ports, said manifold portions having a common intermediate wall, said wall having an opening therethrough to provide a distributing zone common to both said manifold portions and having a flat horizontal floor, a vertical supply pipe adapted to conduct fuel mixture downwardly into said distributing zone, and manifold branches extending downwardly from the ends of said main and sub-manifold portions and curving laterally to said intake ports.

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