Nov. 8, 1938. H. F. SMITH 2,135,628

MANIFOLD

Filed Oct. 17, 1935 4 Sheets-Sheet 1

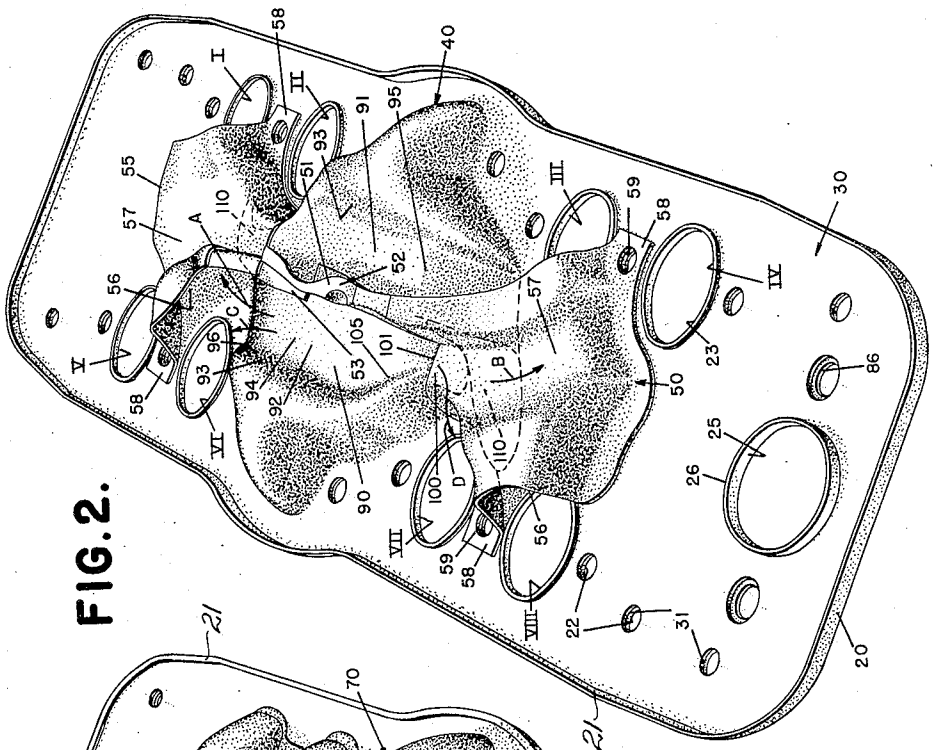


FIG. 2.

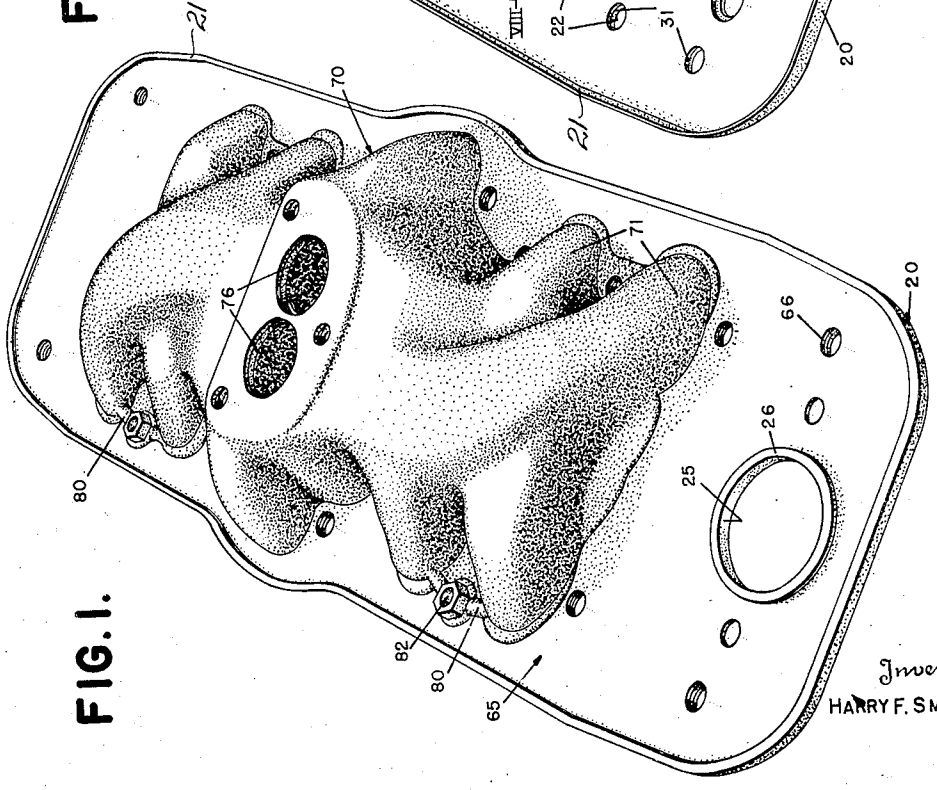


FIG. 1.

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MANIFOLD

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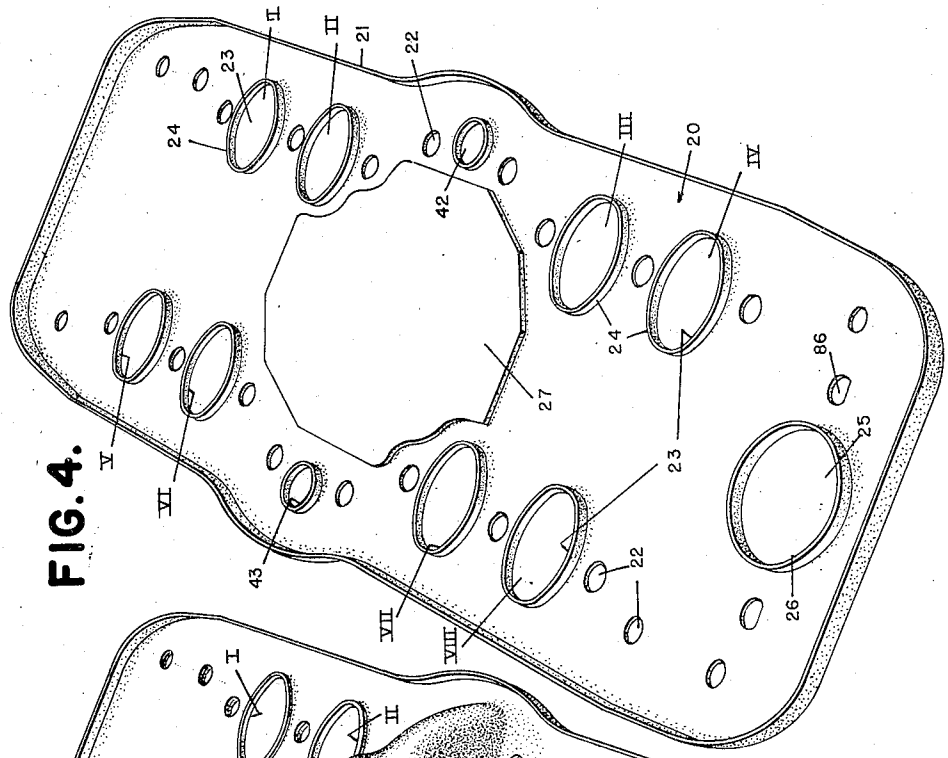


FIG. 4.

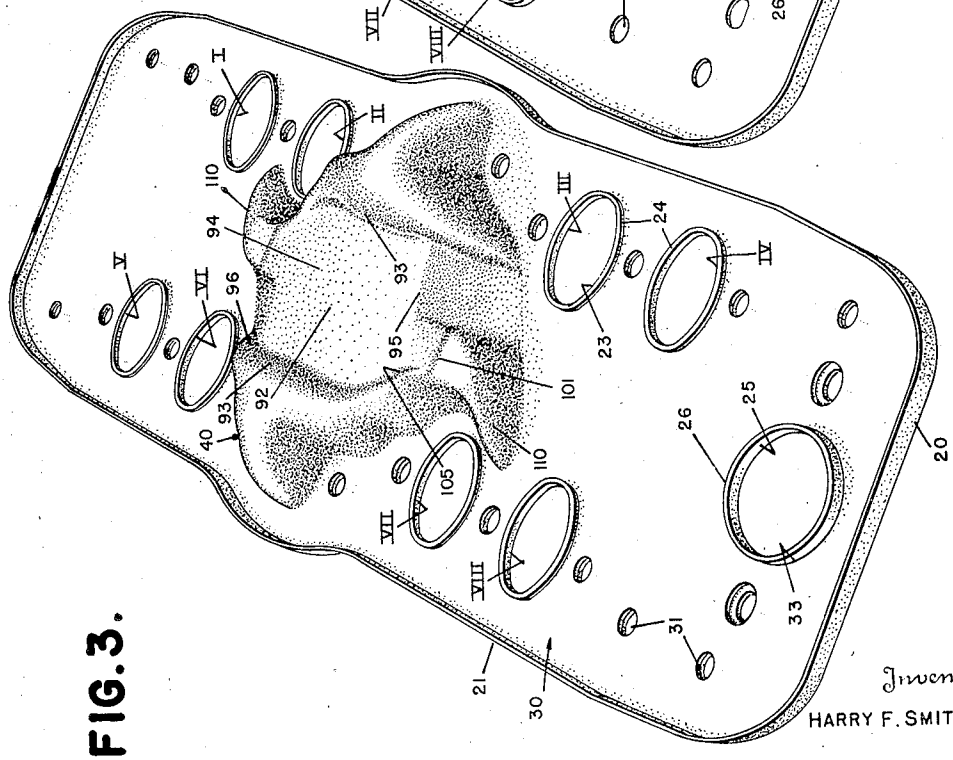


FIG. 3.

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Nov. 8, 1938. H. F. SMITH 2,135,628

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FIG. 5.

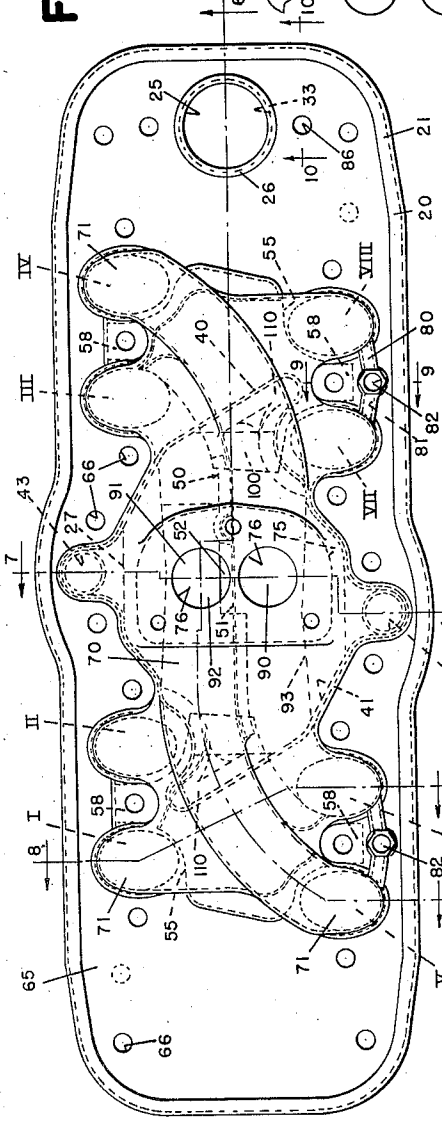


FIG. 15.

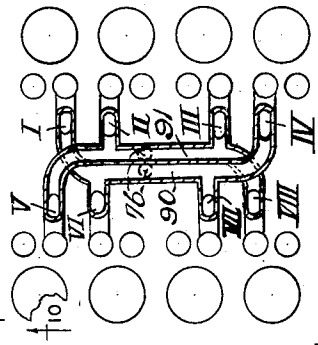


FIG. 6.

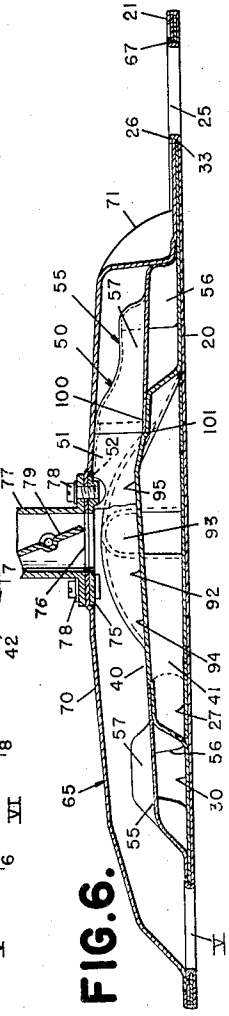


FIG. 7.

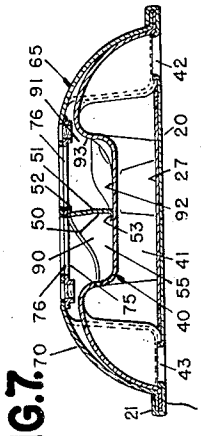
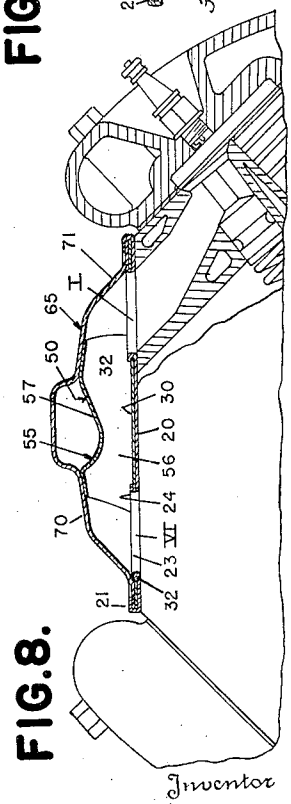


FIG. 8.



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MANIFOLD

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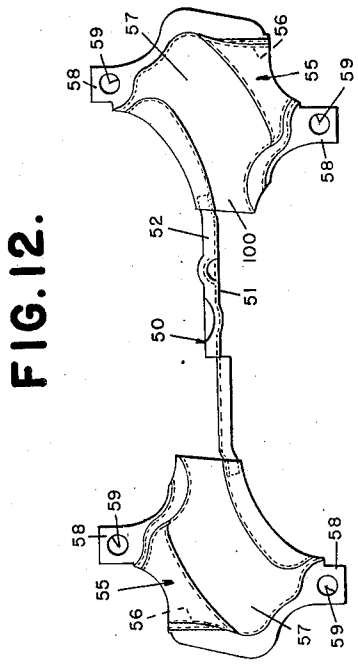


FIG. 12.

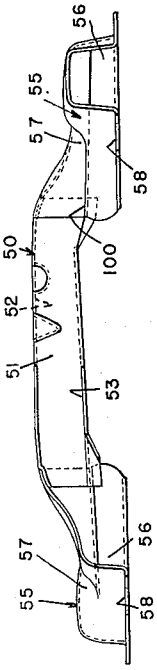


FIG. 13.

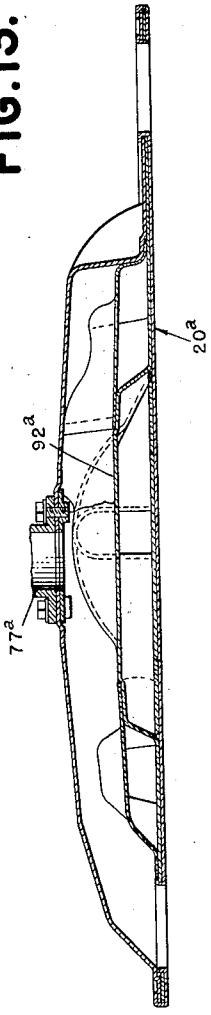


FIG. 14.

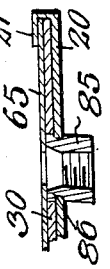


FIG. 10.

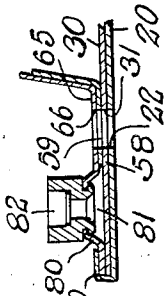


FIG. 9.

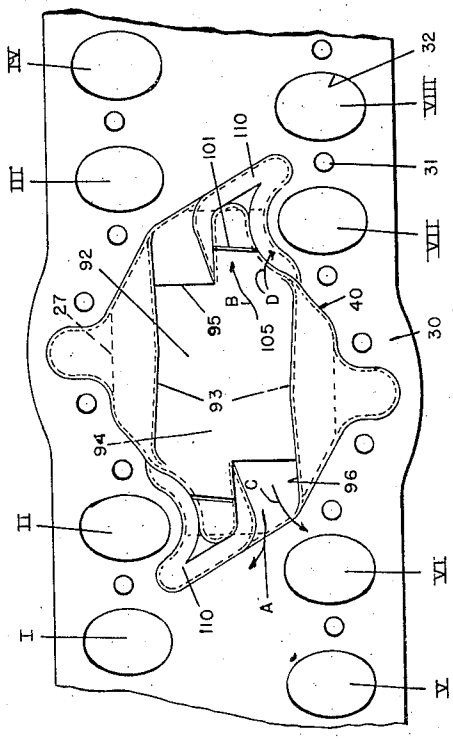


FIG. 11.

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Patented Nov. 8, 1938

2,135,628

UNITED STATES PATENT OFFICE

2,135,628

MANIFOLD

Harry F. Smith, Toledo, Ohio, assignor to The Acklin Stamping Company, Toledo, Ohio, a corporation of Ohio

Application October 17, 1935, Serial No. 45,375

4 Claims. (Cl. 123—52)

This invention relates to manifolds for internal combustion engines and has particular reference to an intake manifold designed to supply an explosive mixture to the intake ports of a multicylinder engine.

One of the primary objects of this invention is to provide an intake manifold which will include two systems of passages so arranged that two succesively firing cylinders will not draw fuel from the same passage.

The invention further contemplates an intake manifold in which the fuel will be delivered to a pair of inlet chambers, the floors of which are disposed in the same horizontal plane and in which the fuel flowing from these chambers to the cylinders of the engine will not have to flow over any raised portions but will rather flow substantially continuously in a downward direction.

Additionally the invention provides a manifold preferably formed of pressed steel and in which the parts of the manifold are fixed together for the major part by crimping or the like so that few welded joints are required.

The invention contemplates further the provision of a manifold in which the passages leading from the inlet chambers to the several cylinders will be symmetrical and substantially uniform and in which these passages will taper from the inlet chambers to the several cylinders to thus increase the velocity of the fuel flow to the cylinders.

The invention further contemplates the provision of a manifold, the passages of which will have raised portions or abutments to curtail the flow of liquid gasoline or wet mixture to those cylinders which are close adjacent the inlet chambers and to thereby facilitate the flow of this wet mixture toward those cylinders remote from the inlet chambers whereby a more efficient distribution of the wet mixture will be obtained.

The above and numerous other objects of this invention will become more apparent as the following description proceeds particularly when reference is had to the accompanying drawings wherein

Fig. 1 is a perspective view of a manifold constructed in accordance with the teachings of this invention;

Fig. 2 is a perspective view of the manifold shown in Fig. 1 with the top thereof removed to illustrate more clearly the several passages within the manifold;

Fig. 3 is a perspective view of the manifold with the top and the bridge removed;

Fig. 4 is a perspective view of the base of the manifold;

Fig. 5 is a top plan view of the manifold;

Fig. 6 is a sectional view taken substantially on the line 6—6 of Fig. 5;

Fig. 7 is a sectional view taken substantially on the line 7—7 of Fig. 5;

Fig. 8 is a sectional view taken substantially on the line 8—8 of Fig. 5;

Fig. 9 is an enlarged fragmentary sectional view taken on the line 9—9 of Fig. 5;

Fig. 10 is an enlarged fragmentary sectional view taken on the line 10—10 of Fig. 5;

Fig. 11 is a fragmentary plan view of the "hot spot" structure forming a part of the manifold;

Fig. 12 is a plan view of the bridge forming a part of the manifold;

Fig. 13 is a side elevational view of the bridge shown in Fig. 12;

Fig. 14 is a view similar to Fig. 6 showing a slightly modified form of construction;

Fig. 15 is a diagrammatic view showing the path of fuel flow through the manifold.

For the purposes of illustration, the manifold will be described as being adapted to supply an explosive mixture to a V-type of eight-cylinder engine such, for example, as the Ford V-8 engine. It is to be understood however, that the manifold may be adapted for the supplying of an explosive mixture to any multicylinder internal combustion engine.

Additionally, the manifold will be described as being formed of sheet metal parts suitably assembled into a unitary structure since this is the preferred form of construction. It is to be understood, however, that certain of the inventive principles disclosed may be embodied in a manifold which is cast or which is otherwise produced.

Referring now particularly to the drawings wherein like reference characters designate corresponding parts throughout all views, the numeral 20 designates generally a sheet metal base, the marginal edge of which is turned upwardly to form a flange 21. The base is provided with suitable openings 22 by which it may be bolted to the block or blocks of the internal combustion engine with which it is associated. In this connection it might be noted that when the manifold is associated with a V-type motor it is secured to the divergently disposed cylinder blocks of the motor in such a manner that it in substance constitutes a cover which closes the open space between the cylinder blocks at the upper ends thereof, which open space constitutes the valve chamber of the engine.

The base is additionally provided with eight oval or elliptically shaped openings **23**, each of these openings being surrounded by an up-turned flange **24**. These openings correspond in number and arrangement to the intake ports of the cylinders of the internal combustion engine with which the manifold is associated. To facilitate further description of the operation of the manifold the openings are numbered I, II, III, IV, V, VI, VII and VIII, these numbers corresponding to the numbering of the cylinders in a Ford V-8 motor, and it will be understood that the openings I to IV inclusive register with the cylinder inlet openings in one block of the engine while the openings V to VIII inclusive register with the cylinder intake openings in the other block of the engine.

At its one end the base **20** is provided with an opening **25** for receiving the base of the fuel pump (not shown) and this opening is also provided with an up-turned marginal flange **26**. Substantially centrally of the base there is secured to the inner surface thereof, as by spot welding or the like, a plate **27** for a purpose which will later be more fully described.

Referring now to Figs. 3 and 11, the numeral **30** designates a sheet metal plate adapted to rest upon the base **20** within the marginal flange **21** thereof. This plate **30** has openings **31** and **32** corresponding in number and arrangement with the openings **22** and **23** respectively which are formed in the base, the openings **32** however, being slightly larger than the openings **23** so that the flanges **24** project upwardly through the openings **32**. As illustrated in Figs. 6 and 8, the flanges **24** are turned over to firmly clinch or fasten the plate **30** to the base **20**.

The plate **30** has an additional opening **33** which registers with the opening **25** in the base and this opening is slightly larger than the opening **25** in order that the flange **26** may project upwardly through the opening **33**.

While as illustrated, in Figs. 6 and 8, the larger portion of the plate **30** lies flat against the base **20**, the plate **30** is provided substantially centrally with an upwardly pressed or raised portion designated generally by the reference character **40**. This raised portion cooperates with the base **20** to provide a chamber **41** and a heating medium such, for example, as exhaust gases is supplied to this chamber by means of conduits (not shown) which communicate with the chamber **41** through openings **42** and **43**, shown more particularly in Figs. 5 and 7 of the drawings. The upper surface of the raised portion **40** constitutes portions of the floors and side walls of the fuel conducting passages so that the heating of the raised portion **40** by the heating means in chamber **41** will aid in vaporizing the fuel.

It might be noted that the plate **27** is of a size and shape which corresponds substantially to the size and shape of the raised portion **40** of the plate **30** with the result that when the manifold is fully assembled, substantially the entire floor thereof is formed of two thicknesses of metal. This metal plate **27**, forming as it does a double floor for the heating chamber **41**, deadens the sound waves and noises within the chamber **41**. This likewise retards the transmission of sound waves from the valve chamber between the banks of cylinders while at the top of the manifold the cover, which will later be described, aids in deadening the sound waves which might pass upwardly from the heating chamber with the result that the manifold is substantially noiseless despite the fact that exhaust gases surge backwardly and forwardly through the heating chamber.

As previously mentioned, parts of the raised portion **40** of the plate **30** aid in defining the fuel inlet chambers and passages of the manifold. Cooperating with the plate **30** and the raised portion thereof is a bridge member designated generally by the reference character **50**, this member likewise defining parts of the fuel inlet chambers and passages. The manner in which this bridge member is associated with the plate **30** is illustrated in Fig. 2, while the details of construction of this member are illustrated in the sectional views **6**, **7** and **8** and in the detail views **12** and **13**.

As illustrated, the member comprises a mid-portion **51**, which overlies the raised portion **40** of the plate **30**, this mid-portion being a relatively thin plate as illustrated in Fig. 7 and being provided at its upper and lower edges with laterally turned flanges **52** and **53** respectively, the former being adapted to engage a cover which will later be described and the latter resting upon the upper surface of the raised portion **40** of the plate **30**.

Secured to the ends of the mid-portion **51** of the bridge member are substantially inverted U-shaped members **55** which cooperate with the plate **30** to provide tunnels **56**. The upper surfaces of the bases of these U-shaped members are channelled as at **57** for a purpose which will later be described. The members **55** are provided with ears **58** having openings **59** which register with certain of the openings in the base **20** and plate **30**, whereby when the manifold is bolted in position the bridge member is held securely in place.

From the above description it will be noted that the bridge member is formed in three parts, namely, the mid-portion **51** and the two end members **55**. The end members **55** are preferably welded or otherwise secured to the mid-portion **51** and it is a feature of this invention that in assembling the bridge member it is possible to accurately position the end members with reference to the mid-portion of the bridge member so that the completely assembled unit will properly fit within the manifold. Thus the end members **55** may be moved toward or away from each other to the desired position before they are finally secured to the mid-portion of the bridge member.

Referring now to Figs. 1 and 6, the numeral **65** designates the cover of the manifold, this cover being adapted to lie flush against the plate **30** and to rest within the marginal flange **21** of the base **20**. The cover is firmly clinched to the base by turning over the marginal flange **21** of the base and the flange **26** of opening **25** as illustrated in Fig. 6 of the drawings.

The cover is provided with suitable openings **66** corresponding in number and arrangement to the openings **22** in the base and is also provided with an opening **67** registering with the opening **25** in the base.

The cover **65** is provided with the raised or upwardly pressed portion **70** which cooperates with the plate **30** and the raised portion thereof and with the bridge **50** to define the inlet chambers and fuel passages of the manifold. It will be noted that the raised portion **70** of the cover has branches or protruding portions **71** which overlie the intake ports **23** and it might be noted

that the portions 71 of the cover are disposed at such an angle to the openings 23 that passages substantially circular in cross section are produced. Thus with the openings 23 true ellipses and the portions 71 of the cover meeting the plane of these openings at an angle of 45° conduits of circular cross sectional shape will be formed.

Secured to the undersurface of the raised portion 70 of the cover and disposed substantially centrally thereof is a plate 75 and this plate and the adjacent portion of the cover are provided with openings 76 with which the downtakes of carburetors 77 comunicate as illustrated in Fig. 6. The downtakes of the carburetors are bolted to the cover and to the plate 75 as at 78, while the downtakes of the carburetors are provided with the usual butterfly valves 79.

The cover is also preferably provided with raised portions 80 providing channels 81 shown in Fig. 9, which channels communicate with ports 82. There are two sets of channels 81, one set extending between the inlets of cylinders V and VI and the other set extending between the inlets of cylinders VII and VIII. The ports 82 are adapted to be connected to the windshield operating mechanism so that the suction used to actuate this mechanism will be taken from both systems of passages within the manifold as will later be described.

It will be apparent that when the marginal flange 21 of the base plate is turned over, the base, plate 30, bridge 50 and cover 65 are all secured together to form a unitary construction which may be bolted to the engine block or blocks with the ports 23 communicating with the intake ports of the cylinders of the engine. Additionally, it might be noted that adjacent the fuel pump opening 25, suitable nuts 85 may be fixed in the manifold in the openings 86 to provide for the attachment of the fuel pump in position.

As previously mentioned, the several parts of the manifold which have been above described cooperate to produce two inlet chambers and two systems of passages, each inlet chamber and the passages associated therewith supplying fuel to four of the cylinders of an eight-cylinder engine. The inlet chambers extend longitudinally of the manifold on opposite sides of the median plane thereof and thus are arranged between and parallel to the two banks of cylinders. The arrangement is such that two successively firing cylinders do not draw from the same inlet chamber and additionally each inlet chamber supplies fuel to the two center cylinders on the side of the manifold on which the inlet chamber is located and the two end cylinders on the side opposite to the side on which the inlet chamber is located.

This will be more clearly brought out as the following description proceeds, which description will trace the flow of the fuel from the inlet chambers to the several intakes 23. Referring first to Figs. 5 and 7 it will be noted that the central portion 51 of the bridge 50 extends between the two carburetor throats and thus produces two inlet chambers 90 and 91, each inlet chamber being disposed immediately below one of the carburetor throats. The floors of the inlet chambers are defined by the portion 92 of the raised part 40 of the plate 30 with the result that the floors of the two inlet chambers are on the same horizontal plane. Obviously, the tops of the inlet chambers are defined by the under-face of the raised portion 70 of the cover 65, while the outer side walls of the inlet chambers are defined by the portions 93 of the part 40. It will thus be apparent that the bottom and one side wall of each inlet chamber is heated by the heating means admitted to the chamber 41.

Referring to Fig. 2, the inlet chambers 90 and 91 are disclosed with the cover removed and from this figure and from Fig. 15 the course of travel of the explosive mixture supplied to the inlet chambers may be readily traced. The explosive mixture flows from chamber 90 to the intakes of cylinders VI and VII, which it is noted are adjacent to and on the same side of the manifold as intake chamber 90 and the explosive mixture also flows from chamber 90 to cylinders or intakes I and IV, which it is noted are the end cylinders on the side of the manifold opposite the intake chamber 90. The explosive mixture from chamber 91 flows to the two central cylinders or intakes II and III disposed on the same side of the manifold as intake chamber 91 and also to cylinders V and VIII which are the end cylinders disposed on the opposite side of the manifold from the intake chamber 91.

Since the fuel flows from both intake chambers in the same manner, the flow from one intake chamber only will be described in detail. For the purpose of illustration, it will be assumed that the firing order is as follows I, V, IV, VIII, VI, III, VII, II, but it is to be understood that certain changes may be made in the firing order without altering the manifold. It will be obvious that with a firing order of the above character, no two successively firing cylinders are drawing fuel mixture from either one of the inlet chambers. Thus in a cycle of operation cylinder I will draw first from chamber 90 and then cylinder V will draw from chamber 91. Cylinder IV will then draw from chamber 90 followed by cylinder VIII drawing from chamber 91. Cylinder VI will then draw from chamber 90, cylinder III from chamber 91, and then cylinder VII from chamber 90 and cylinder II from chamber 91.

Referring then to chamber 90 as illustrated in Fig. 2 of the drawings, fuel will first be supplied to inlet I by virtue of the fact that the cylinder connected to this inlet will be on the suction stroke while the intake valves will be closed to the other cylinders supplied from chamber 90. It will not noted by reference to Figs. 2, 3, 5 and 6 that the portion 92 of the member 40, which portion forms the floor of the chamber 90, is provided with the downwardly inclined surface 94, which surface starts at the line 95 which is spaced slightly beyond the carburetor throat as viewed in Fig. 2 or in other words, toward the front of the manifold from the carburetor throat. It will be noted further that the portion 40 has the rib or raised portion 96 which constitutes the side wall of the inlet chamber 90 and that this surface is extended downwardly along the inclined portion 94 to direct any wet mixture in the general direction of the arrow designated by the reference character A in Fig. 2.

Thus when fuel is sucked into the motor through intake opening I the vaporized gasoline and the wet gasoline pass through the tunnel 56 provided by the bridge adjacent the intake I. The shoulder or abutment 96 imparts such a direction of travel to the mixture that there is no tendency for it at this time to pass into the intake port VI, it being, of course, understood that at this time this intake port is closed.

The next cylinder which draws from chamber 90 is cylinder IV which is also on the opposite

side of the manifold from this chamber. In this connection it should be noted that the bridge has a projecting portion 100 which fits against a shoulder 101 formed on the part 40, the two parts fitting together to form a continuous surface as indicated in Fig. 6 of the drawings. Thus when the explosive material is being drawn into cylinder IV the mixture flows in the direction of the arrow marked B in Fig. 2, the travel being along the trough 57 and down to the cylinder IV. During this travel of the mixture, wet gasoline is prevented from flowing to the cylinder VII first by virtue of the fact that the intake to this cylinder is closed and secondly by virtue of the fact that the shoulder or abutment 96 has an extension 105 which is so shaped as to urge the wet gas in the direction of intake IV.

The next cylinder which draws from chamber 90 is cylinder VI and it will be apparent that the mixture will flow down the incline 94 until it passes the end of rib 96 and then be drawn into the intake VI in the direction indicated by the arrow C in Fig. 2 of the drawings. Obviously at this time there is no danger of the wet mixture passing to the intake I by virtue of the fact that the valve between this intake and its respective cylinder is closed.

The final intake which draws from chamber 90 is intake VII and when this intake is drawing the mixture, the mixture flows in the direction indicated by the arrow D in Fig. 2, it being noted that the mixture flows down beyond the end of the shoulder or abutment 105 and then downwardly into the intake VII.

Thus it will be apparent that the abutments or shoulders 96 and 105 curtail the flow of wet mixture from the inlet chamber or main duct 90 to the adjacent intakes VI and VII and tend to direct the wet mixture to the remote intakes I and IV with the result that the four intakes supplied from the chamber 90 are equally supplied with both the wet mixture and the fully vaporized mixture. In other words the wet mixture supplied to the main duct 90 is initially directed in such a direction that it is started toward the remote cylinders I and IV with the result that it will be drawn into these cylinders if suction is present in the intakes I and IV whereas if suction is not present in these intakes the wet mixture will be drawn either into cylinder VI or VII.

It might be noted further that the part 40 is provided with projections 110 which partially define the side walls of the passages leading to intakes I and VIII with the result that the fuel flowing to these intakes is substantially vaporized.

Also these portions of the heating chamber are separated from the passages leading to intakes II and VII only by the adjacent wall of the bridge so that these latter passages will also be heated. In other words, the heating chamber 41 is so constructed that the walls thereof define substantial portions of the walls of the inlet chambers and fuel supply passages, thus furnishing the necessary inlet chamber and passage temperature for proper engine performance.

As previously mentioned, the flow of fuel from chamber 91 will be the same as that from chamber 90 and by again referring to Fig. 2 it will be noted that the fuel from one inlet chamber flows to one end port over top of the tunnel passage leading from the other inlet chamber to the opposite end inlet port. Thus from chamber 90 the fuel flows to port IV over the tunnel passage leading from chamber 91 to port VIII.

It is an important feature of this manifold that in addition to the fact that the floors of the inlet chambers 90 and 91 are on the same horizontal plane, the manifold is so constructed that there are no raised portions or obstacles over which the fuel must flow in its travel from the inlet chambers to the cylinders of the engine. In substance the flow is continuously down hill from the inlet chambers to the engine cylinders. In this connection it might be noted that the present practice is to mount the motor in the automobile chassis at an angle to the horizontal, the forward end being slightly elevated with reference to the rear end of the motor. While the angle of inclination of the motor may be as great as desired, it averages approximately 2½° and under the teachings of this invention the manifold is designed to compensate for this angle of inclination of the motor.

If reference be made to Fig. 6, it will be noted that the floor 92 slants toward the front of the manifold and thus toward the front of the vehicle with which the manifold is to be associated. The degree of inclination of this floor is such that when the manifold is secured to the engine block and thus is tilted to the angle of the engine block with reference to the theoretically horizontal, the floor 92 is actually horizontal.

It is appreciated that when the floor 92 is inclined in the manner illustrated, the passages leading toward the front of the manifold are of somewhat larger cross sectional area than the passages leading toward the rear of the manifold. This however, is compensated for by moving the throats 77 of the carburetors slightly rearwardly from the direct center of the manifold and also by the fact that the butterfly valves 79 in the carburetor throats tend to direct the mixture discharged into the intake chambers somewhat rearwardly. Thus despite the fact that for a portion of their lengths the passages in the manifold leading forwardly from the carburetor throats are slightly larger than those leading rearwardly, nevertheless the cylinders supplied by the rear half of the manifold receive the same amount of explosive mixture as the cylinders supplied by the front half of the manifold. It might be noted that the inclination of the floor 92 extends rearwardly beyond the open discharge ends of the carburetor throats so that under no circumstances will the explosive mixture be discharged directly into the rear passages of the manifold.

While in the preferred embodiment of the construction the floor 92 has been shown as inclined as above described, it is apparent that if the motor is to be mounted in a horizontal plane with the result that the manifold is also horizontally positioned, the floors of the inlet chambers need not be inclined. Such a modification is shown in Fig. 14 wherein it will be noted that the floor 92a of the inlet chambers is parallel to the base 20a of the manifold and thus wholly horizontal. Under these conditions the discharge throats 77a of the carburetors are preferably located centrally of the manifold since there are no larger passages leading forwardly for which compensation need be made.

From the above it is believed apparent that the invention provides a manifold which will effect an even and equal distribution of the explosive mixture to the cylinders of an eight-cylinder motor. The manifold provides two inlet chambers disposed on the same horizontal plane and fuel

supply passages leading from these chambers to the intakes of the cylinders, which passages are symmetrical and substantially uniform in cross sectional shape. The passages taper gradually from the inlet chambers to the intakes of the cylinders with the result that the velocity of the mixture flowing to the cylinders is increased. Additionally there are no raised portions or obtacles over which the explosive mixture must flow in its travel from the inlet chambers to the cylinders. This latter feature facilitates rapid starting of the motor in cold weather since it insured that all cylinders will receive an equal amount of wet and vaporized mixture and that no cylinder will be unduly flooded.

It is of importance also to note that the invention provides ribs or abutments in the fuel passages which tend to so direct the wet mixture that it will be readily drawn into the remote end intake ports when the latter are drawing mixture. Additionally, it is a feature of this invention that the manifold may be formed of pressed steel or like metal parts, these parts being fixed together mainly by clinching to thus eliminate the use of welded or soldered joints. In fact it is to be noted that in the construction illustrated, the only welded connections are those between the plate **27** and the base of the manifold, those between the plate **75** and the top of the manifold and those between the end members **52** and the mid-portion of the bridge of the manifold.

The parts of the manifold are so secured together that double thicknesses of metal are provided to deaden the sound waves from the valve chamber of the engine and to also deaden the sound waves which might issue from the heating chamber of the manifold with the result that the manifold is extremely quiet. The manifold has been described as being associated with an eight-cylinder V-type engine, but it will be apparent that certain of the inventive principles may be embodied in a manifold adapted for association with an engine having four or more cylinders either arranged in separate banks as described or arranged in any other desired manner. Still further it will be apparent that within limits the firing order of the cylinders of the engine may be varied without modifying the essential features of the construction.

While the invention has been described with some detail, it is to be understood that the description is illustrative only and is not definitive of the limits of the inventive idea. The right is reserved to make such changes in the details of construction and arrangement of parts as will fall within the purview of the attached claims.

What I claim as my invention is:

1. The combination with an eight-cylinder V-type engine having four cylinders in each block of a manifold disposed between the blocks and having two main ducts extending longitudinally of the blocks, said main ducts being arranged side by side whereby one is adjacent one block while the other is adjacent the other block, said manifold also having passages arranged to conduct fuel from each main duct to the center cylinders of the block to which it is adjacent and to the end cylinders of the other block, the floors of said main ducts being inclined downwardly away from the tops of said main ducts and in a direction toward the front of the manifold to compensate for the angle at which the engine is positioned with reference to the horizontal, and carburetor throats communicating with said main ducts for supplying fuel to the same, said carburetor throats being located slightly to the rear of the mid-points of said main ducts.

2. A pressed sheet metal manifold comprising a base plate having an up-turned marginal flange and having openings adapted to register with cylinder intake ports, said openings being surrounded by up-turned marginal flanges, a second plate fitted within the marginal flange of the base plate and clinched thereto by the flanges surrounding the openings in the base plate, the major portion of said second plate lying flush against the upper surface of the base plate but said second plate having an upwardly pressed portion cooperating with the base plate to form a chamber adapted to receive a heating medium, a cover plate having portions lying flush against said second plate and having an upwardly pressed portion enclosing and spaced from the upwardly pressed portion of the second plate to provide a fuel receiving chamber, said cover plate being clinched to said base plate by the marginal flange of the latter, and the means disposed between the raised portion of the second plate and the raised portion of the cover plate dividing the interior of the fuel receiving chamber into a plurality of passages.

3. A pressed sheet metal manifold comprising a base plate having openings adapted to register with cylinder intake ports, a second plate having a portion lying flush against the base plate and having a second upwardly pressed portion which cooperates with the base plate to provide a chamber adapted to receive a heating medium, a third plate of substantially the contour of the upwardly pressed portion of the second plate secured to the upper face of the base plate and constituting a floor for the heating chamber, a cover plate having portions lying flush against the second plate and having a raised portion surrounding but spaced from the raised portion of the second plate, and a bridge member spanning the raised portion of the second plate and having end portions providing tunnels, said bridge member cooperating with the raised portions of said second plate and cover to provide passages adapted to supply fuel to the cylinder intake ports.

4. An intake manifold structure for an internal combustion engine which is mounted at an inclination to the horizontal with the forward end of the engine slightly above the rear end thereof, said manifold structure including a main duct and passages connecting the ends of said main duct to the cylinder intake ports of the engine, and a carburetor throat communicating with said main duct for supplying fuel to the same, said carburetor throat being located slightly to the rear of the mid-point of the main duct.

HARRY F. SMITH.