May 26, 1931. F. S. LOCKHART 1,807,042

COOLING INTAKE FOR INTERNAL COMBUSTION ENGINES

Filed June 13, 1927 3 Sheets-Sheet 1

FIG. 1

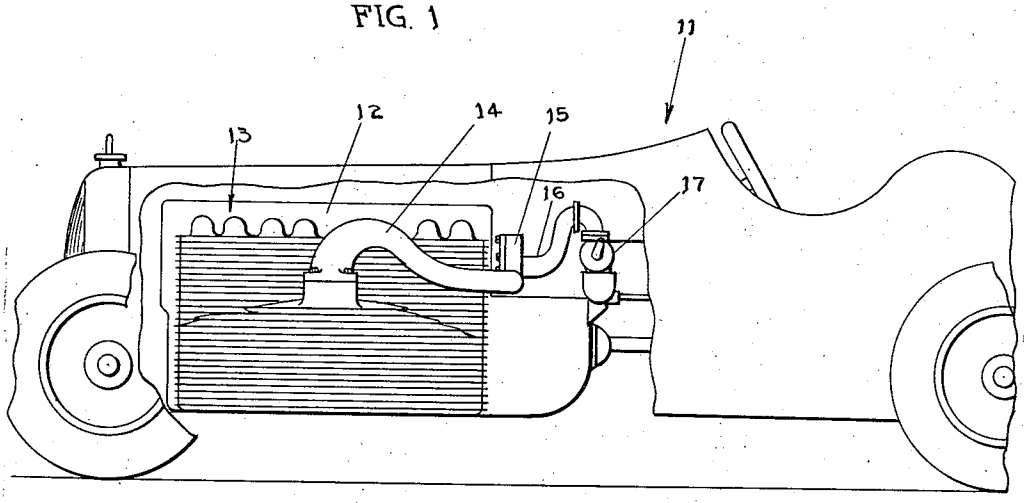

FIG. 2

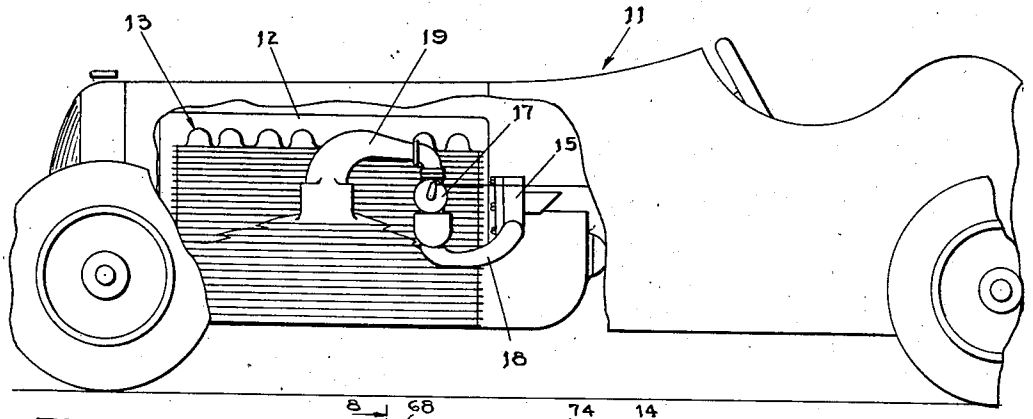

FIG. 8

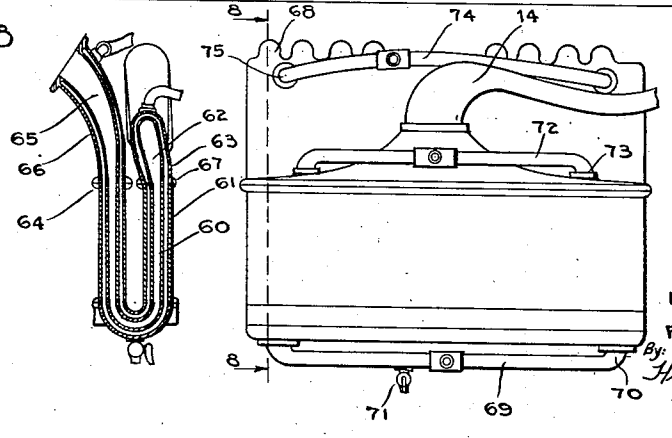

FIG. 7

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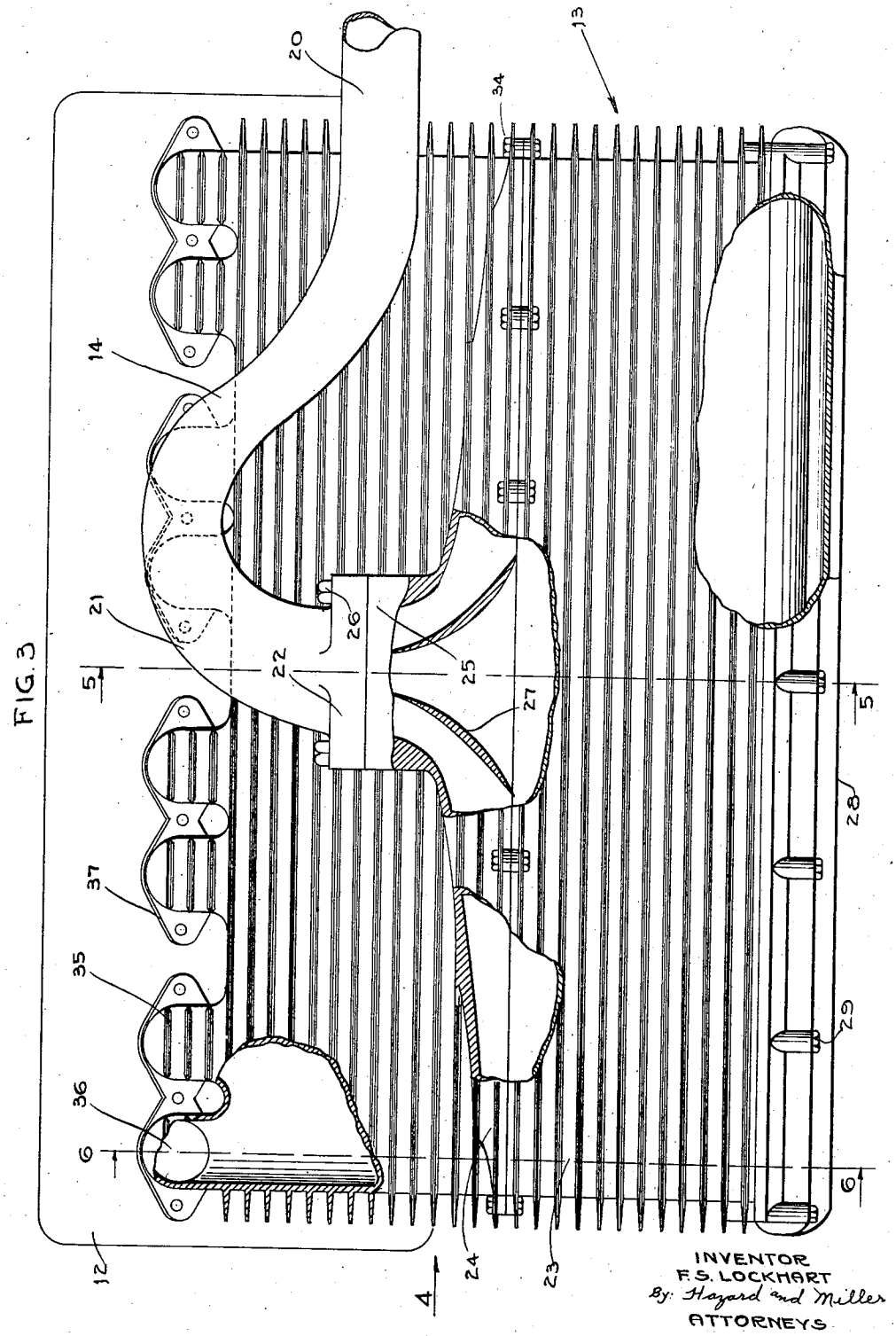

FIG. 3

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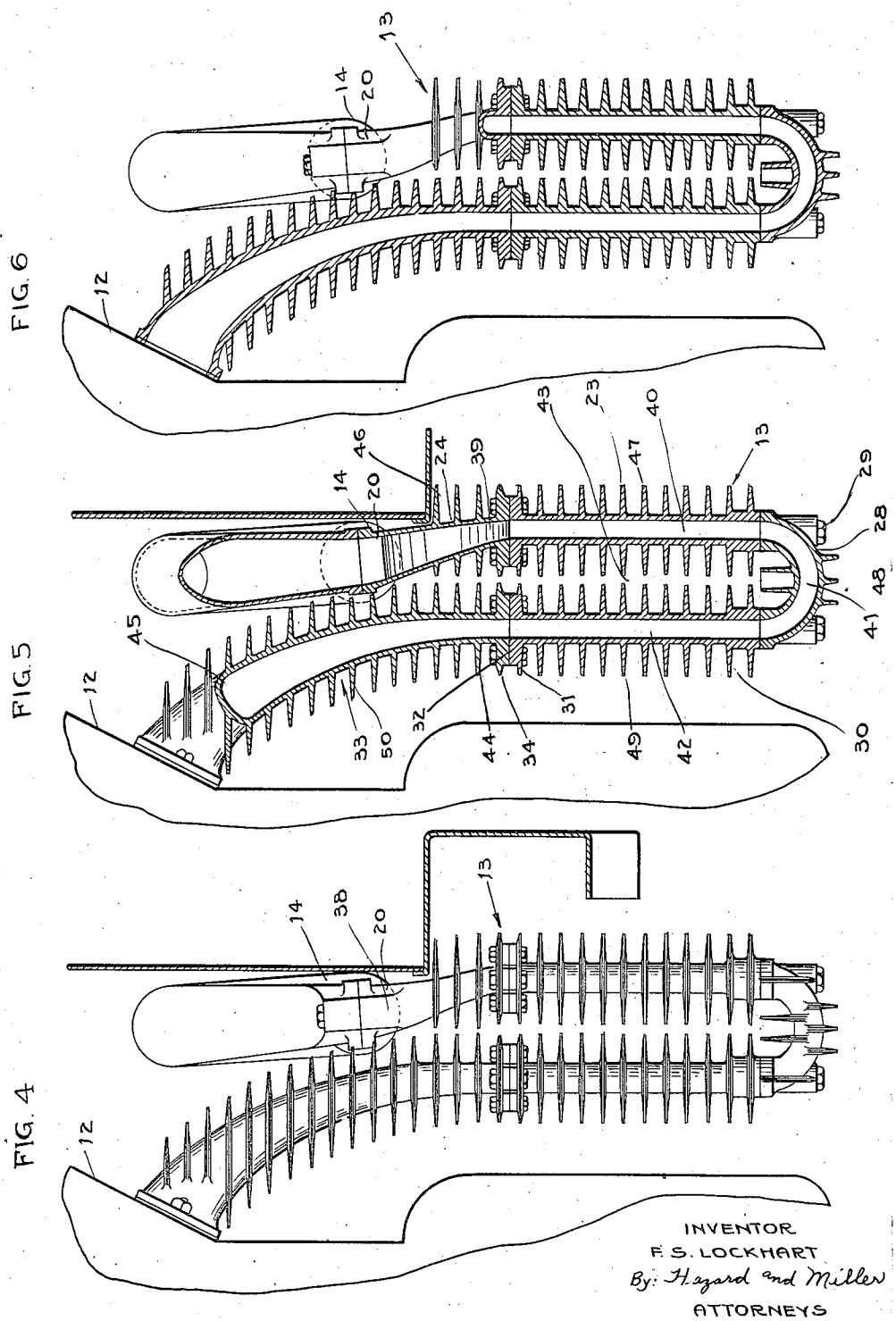

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UNITED STATES PATENT OFFICE

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COOLING INTAKE FOR INTERNAL COMBUSTION ENGINES

Application filed June 13, 1927. Serial No. 198,676.

My invention is a cooling intake for internal combustion engines, adapted to cool the gas before such gas enters the explosive chamber of the engine.

In internal combustion engines it has been a common practice to preheat the gas in the intake of an internal combustion engine, especially when the gas is formed by so called carbureting of air with liquid. The main reason for this preheating is to properly gasify the volatile liquid from which the gas is derived. When supercharged engines are used, that is when the gas is compressed before being drawn into the explosive chambers of the engine, the preheating has a disadvantage as it raises the temperature of the intake gas to too high a degree compared with the ultimate heating which may be developed in the engine.

As an internal combustion engine is a heat engine and its efficiency depends on the difference between the intake gas before its explosion and the temperatures which may be developed in the engine, and in practical operation as it is impossible to have the heat of the engine on the explosion and, therefore, the general heat at too high a degree, the engine operates more efficiently when the intake gas can be at a comparatively low temperature. The superchargers which force the gas into the combustion chambers under pressure heat the gas due to the heat of compression, therefore, unless this heat of compression temperature can be reduced, the engine will operate at less than its maximum efficiency.

My invention, therefore, comprehends cooling the intake gas for engines, especially when such gas is fed to the engine under pressure by a supercharger.

Another object of my invention is to introduce as much fuel per cubic measurement of gas as is possible and if the gas is at a high temperature due to initial heating or the heat of compression by a supercharger, it will be seen that the gas is necessarily expanded and the amount of actual fuel per unit of cubic measurement is less than if the same fuel gas is at a lower temperature. Therefore by precooling the intake gas I increase the amount of actual fuel per unit volume which may be taken into the engine and thereby increase the horsepower which may be developed from a specific size of engine operating at various speeds.

With these and other objects in view I have devised a cooling intake for internal combustion engines which cools the gas, preferably gas which has been developed from a carburetor, before it is drawn into the engine and where a supercharger for forcing the gas in under pressure is used I cool the gas after it has been compressed and thus reduce the temperature of the gas after it is forced into the combustion chambers.

In one form of my invention I utilize what may be considered as an elongated intake manifold which has a thin flat passage for gas, this manifold extending preferably the whole length of a multiple engine. The gas after leaving the supercharger is forced into this manifold by the pressure developed in the supercharger and in this intake manifold is subjected to cooling influence, which may be a draft of air for blowing over and around these thin narrow passages.

One form of my invention is illustrated in the accompanying drawings, in which:

Figure 1 is a side elevation, partly broken away, of an automobile showing my cooling intake coupled with a supercharger, the supercharger receiving the gas from a carburetor.

Figure 2 is a similar view showing a hook-up in which the supercharger forces air under pressure to a carburetor and hence to my cooling intake.

Figure 3 is a side elevation, partly broken away, of my cooling intake, of an air cooled type, attached to the side of a multicylinder engine.

Figure 4 is an end view taken in the direction of the arrow 4 of Fig. 3.

Figure 5 is a central vertical transverse section on the line 5—5 of Fig. 3 in the direction of the arrows.

Figure 6 is a vertical transverse section on the line 6—6 of Fig. 3 in the direction of the arrows.

Figure 7 is a side elevation of an alter-

native form of my invention using water cooling.

Figure 8 is a vertical cross section on the line 8—8 of Fig. 7.

Reverting to the construction of Fig. 1, the automobile structure is designated generally by the numeral 11, having an engine 12 housed under the hood, and this engine has my cooling intake, designated generally by the numeral 13, attached thereto. An intake feed pipe 14 leads directly from the supercharger 15 which compresses the gas and forces it through the intake under pressure. As shown in this hook-up the supercharger draws the gas through a suitable pipe 16 from the carburetor 17, the air being drawn into the carburetor in the ordinary manner.

In the construction shown in Fig. 2 the supercharger 15 draws in air and forces this air under pressure through a pipe 18 to the carburetor 17, and from the carburetor the air and gas are conveyed through an intake feed pipe 19 to the cooling intake.

The above constructions illustrate two suitable hook-ups but it is to be understood that any suitable connection may be utilized in which gas is forced under pressure to the cooling intake and also that my invention comprehends the use of such cooling intake without having a supercharger, in which case the gas is drawn into the engine by the suction of the engine. It is to be understood that the intake feed pipes 14 and 19 are substantially equivalent but that in the illustration of Fig. 1 such intake may be longer than in the illustration of Fig. 2.

Reverting to the detail Figures 3 through 6, I illustrate the connection with the long type of intake feed pipe 14 which has a tubular section 20 of substantially constant diameter which is swelled at the end 21, being materially enlarged and narrowed, this end being connected to a coupling 22. The cooling intake, designated generally by the numeral 13, has an outer section 23 which has a cap 24. This section 23 preferably extends from one end of the engine to the other and the cap 24 is drawn inwardly at the center, having coupling lugs 25 at the top to be secured to the coupling 22 by bolts 26 or the like. This cap has diverting vanes 27 to direct the flow of the gas towards the front and the rear of the outer section 23. A U shaped bottom section 28 is connected at the base of the outer section 23 by means of bolts 29 or the like and is connected to a main inner section 30, which is parallel to the outer section 23 and spaced inwardly therefrom. This section has a longitudinal joint coupling 31 at the top, which is connected to the under face of a coupling 32 of the upper inner section 33, the connection being by bolts 34 or the like. This upper inner section has a series of molded outlets 35, which are connected to the intake ports 36 of the engine, there being flanges 37 to allow bolting of this upper inner section on the engine block.

It will be noted that the cap section in a transverse direction, that is considered from the engine to the outside, tapers downwardly from a wide upper part 38, where it is connected to the couplings 25 and 22, to a comparatively narrow cross section 39. The transverse section of the outer part 23 of the cooler is substantially uniform, as indicated by the numeral 40. The internal passage 41 of the U shaped part 28 is also substantially uniform but may, if desired, be slightly increased in width over that of the part 40 to allow free flow of gas without retarding the flow. The internal passage 42 of the inner lower section 30 is also practically uniform from bottom to top and extends from the front to the rear end of the engine. The front section 23 and the rear section 30 are also substantially parallel, being spaced a constant distance apart, as indicated by the numeral 43. The upper inner section 33 has less internal width at the lower part 44 than at the upper part 45 adjacent the outlet parts 35 which connect onto the engine block, thus taking care of the continued velocity of the gas in the reduced cooled sections 35.

In order to more adequately cool the various sections of my cooling intake, I utilize fins or flanges 46 on the cap part 24 and also another series of fins or flanges 47 on the outer section 23. Vertical flanges 48 are provided on the U shaped section 28, these extending downwardly and upwardly. The inner lower section 30 is also provided with fins 49 and the upper inner section 33 has fins 50.

The manner of operation and functioning of my cooling intake is substantially as follows:

In the installation indicated in Figs. 1 and 2, the gas passing through the intake feed pipe 14 is under pressure due to the supercharger. This gas has an easy and free flow through this pipe and when it enters the cap structure 24, part of the gas is deflected towards the front and part towards the rear by the vanes 27, some of the gas passing directly downwardly between said vanes and filling the central part of the cooler. The gas is thus spread in an even flow from the front to the back of the outer cooling section 23, passes around the U shaped section 28, and flows upwardly through the lower inner section 30 and is conducted by the upper inner section 33 to the intake ports of the engine. When the automobile is traveling forwardly, there is a rush of air along the side of the engine, this air coming in direct contact with the walls of the cooling units and in addition extracting heat from the fins or flanges extending outwardly from such walls. This materially re-

duces the temperature of the gas and allows the gas to enter the engine at a decidedly lower temperature than that at which it enters the cooler.

In Figs. 7 and 8 I show my invention adapted for water cooling and in this case I preferably have a channel or U shaped cooling manifold 60 with a water jacket 61 thereabouts. This channel or U shaped section has a hollow cap structure 62 connected thereto, with a water jacket 63 surrounding same. This cap structure is connected to the intake pipe 14. At the inner side 64 of the U shaped manifold section there is an outlet end 65, which also has a water jacket 66. These sections are secured together by flanges 67 or the like having water tight gaskets and being bolted together in the ordinary manner. There are molded sections 68 securing directly over the intake ports of the engine.

The water circulation is provided by an intake pipe 69 at the bottom leading to opposite ends 70 of the base of the U shaped section 60 and there is preferably a drain cock 71 provided in this pipe. A pipe 72 is connected at opposite ends 73 of the cap structure and conducts the hot water therefrom and there is also a pipe 74 connected to opposite ends 75 of the discharge water jacket section, also conducting the hot water from this section. In the operation of the water cooling the cold water enters the bottom of the U shaped water jackets and rises upwardly on both branches of the U shaped section having its outlet through the pipes 72 and 74. As the water cooled structure is placed along-side of the engine, it is subjected to a considerable draft without undue resistance to the air and in addition the water is cooled in a suitable radiator which may be installed in any desirable place in regard to the engine. This, however, should be a radiator separate from the radiator cooling the engine water.

I have illustrated my invention in the air cooled and water cooled type of cooling intake as installed on an automobile, such as a racing type of vehicle but it is to be understood that my invention may be applied to any type of internal combustion engine and that it is particularly adapted for aeroplane engines which frequently operate with a super-charger, and in such latter installation the cooling manifold has comparatively little head on resistance, and therefore does not affect materially the drift of the aeroplane having an engine with my cooling intake installed thereon.

Various changes may be made in the principles of my invention without departing from the spirit thereof, as set forth in the description, drawings and claims.

I claim:

1. A cooling intake for an internal combustion engine comprising a U shaped structure having an internal passage, said passage in width being substantially the length of a multi-cylinder engine, in transverse measurement being materially less than the width, the inner section of the U shaped structure being adapted for location adjacent the cylinders of a multi-cylinder engine but spaced laterally therefrom, having a plurality of fins thereon, the outer section having a plurality of fins, the structure providing a clear, substantially unobstructive air passage between same and an engine, also between the two branches of the U shaped structure, and on the outside thereof, to allow air to flow in the direction of the width of the intake.

2. A cooling intake for an internal combustion engine constructed substantially U-shaped in cross section, one branch of the U-shaped cross section having means for connection to a plurality of cylinders of an engine arranged in alignment, the other branch having means to connect same to a source of gas supply, the transverse thicknesses of the said branches being much less than their measurement in the direction of the row of cylinders, the branch for connection to the engine being adapted to be spaced from the row of cylinders to allow a flow of air therebetween, the two branches being spaced from each other to allow a flow of air between such branches, and the branch connected to the source of supply being adapted to allow a flow of air thereover.

3. A cooling intake for an internal combustion engine comprising a U-shaped structure having an internal passage, said passage in width being substantially the length of a multi-cylinder engine and in transverse measurement each branch of the U-shaped structure being materially less than the width, the inner branch of the U-shaped structure being adapted for location substantially parallel to a row of cylinders, the outer branch of the U-shaped structure being spaced from the branch connected to the engine, means to connect the branch remote from the engine to a source of gas supply, and deflecting vanes in the branch connected to such supply to deflect the gas towards the front and rear portions of the said passage considered in the direction of the length of the engine, the said branches of the U-shaped structure being positioned to allow a flow of air between said branches and along the outside surface of said branches considered in the direction of the length of the engine.

4. A cooling intake for internal combustion engines comprising a structure having a narrow elongated passage, the passage in one direction extending substantially the length of a row of cylinders of an engine and in a transverse direction being of much smaller dimensions, an intake at substantially the central portion of the structure, means in said structure to divert the gas forwardly and

rearwardly considered in regard to the row of cylinders and a plurality of discharge outlets adapted to connect to cylinders, such structure being adapted for positioning spaced from the row of cylinders of the engine except for the connection at the discharge and thereby providing a free and substantially unobstructed passage for air between the cooling intake and the row of cylinders.

5. A cooling intake for an internal combustion engine comprising in combination a structure having a narrow elongated passage in one direction extending substantially the length of a row of cylinders in alinement and in a transverse direction being of much smaller dimensions, a plurality of discharge outlets adapted for connection to the cylinders of the engine, a second structure connected to the bottom of the intake structure, adapted to convey gas thereto substantially the whole length of the first mentioned structure considered longitudinally of the row of cylinders, the said structure being adapted to be spaced laterally from the engine with substantially no connection therewith except the discharge outlets providing a substantially free and unobstructed passage for air between the said structures and the row of cylinders.

6. A cooling intake for an internal combustion engine comprising in combination a structure substantially U-shaped in cross section, the two branches of the U each being a narrow elongated passage extending substantially the length of a row of cylinders of the engine and each in a transverse direction being of much smaller dimensions, a plurality of discharge outlets from one of the branches of the U adapted for connection to the cylinders, said discharge outlets being adapted to space the said structure from the row of cylinders, whereby a free unobstructed passage for air is provided, the branches of the U being spaced apart to allow passage of air and a gas intake to the branch of the U remote from the branch having the discharge outlets.

7. A cooling intake as claimed in claim 6, the branch of the U having the gas intake being of less height than the branch having the discharge outlets and means in the branch of the U having the intake to divert the gas to opposite ends of said branch.

8. A cooling intake for internal combustion engines comprising in combination a hollow structure U-shaped in cross section and having a narrow elongated passage in one direction to extend substantially the length of a row of cylinders in alinement, and in a transverse direction being of much smaller dimensions, the two branches of the U being connected by a return bend at the bottom, said return bend being secured to the branches to be disconnectible, a discharge connection from one of the branches of the U adapted for connection to a plurality of cylinders of the engine, the other branch of the U having an intake for gas connected thereto, the discharge outlet and the intake being disconnectible from their respective branches, the structure being adapted to be spaced from a row of cylinders and the branches from each other to allow a substantially free and unobstructed flow of air considered along the row of cylinders.

9. A cooling intake as claimed in claim 8, there being vanes in the intake to divert the gas to opposite ends of the outside branch of the U.

In testimony whereof I have signed my name to this specification.

FRANK S. LOCKHART.