March 9, 1965 J. SCHMUCK 3,172,397

COOLING DUCT ARRANGEMENT

Filed June 7, 1962 3 Sheets-Sheet 1

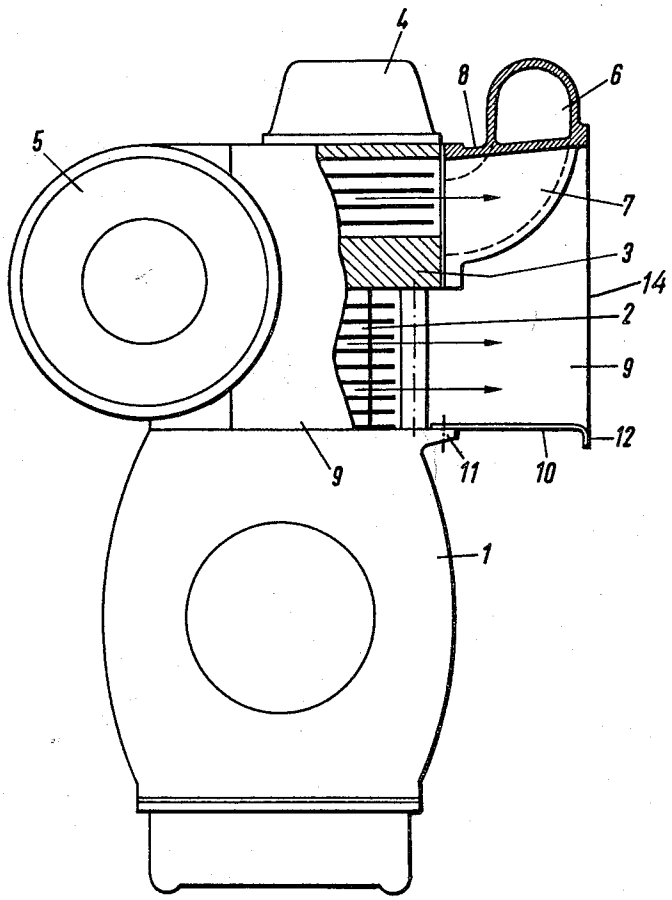


Fig. 1

Inventor

JOHAN SCHMUCK

By Toulmin & Toulmin

Attorneys

March 9, 1965 J. SCHMUCK 3,172,397

COOLING DUCT ARRANGEMENT

Filed June 7, 1962 3 Sheets-Sheet 2

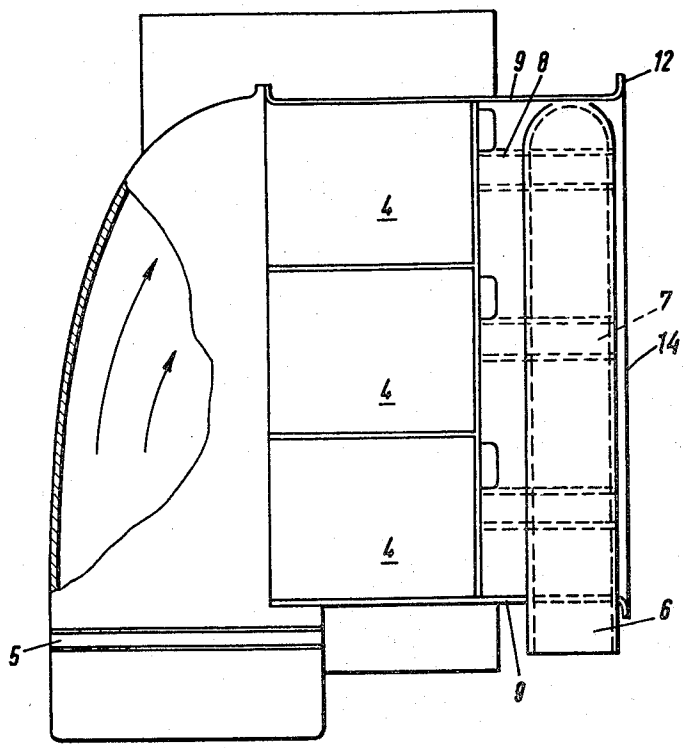


Fig. 2

Inventor
JOHAN SCHMUCK

By Toulmin & Toulmin
Attorneys

March 9, 1965 J. SCHMUCK 3,172,397

COOLING DUCT ARRANGEMENT

Filed June 7, 1962 3 Sheets-Sheet 3

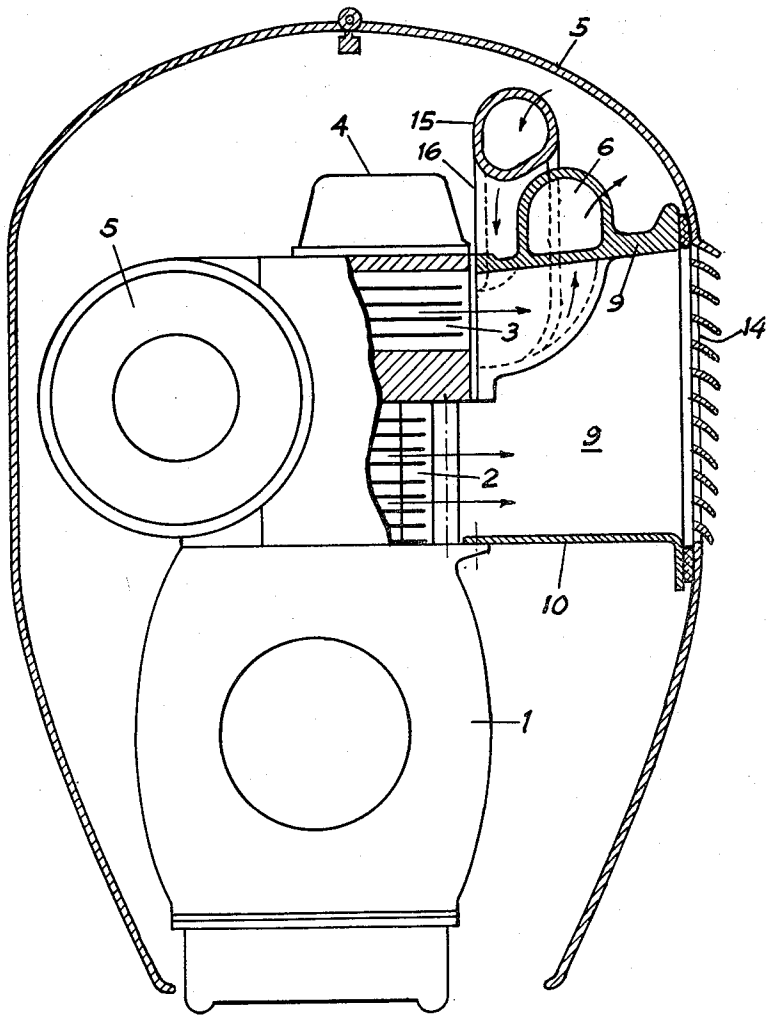


Fig.3

INVENTOR

JOHANN SCHMUCK

BY Toulmin & Toulmin

ATTORNEYS

United States Patent Office

3,172,397
Patented Mar. 9, 1965

3,172,397

COOLING DUCT ARRANGEMENT

Johann Schmuck, Germering, near Munich, Germany, assignor to Gesellschaft fur Linde's Eismaschinen Aktiengesellschaft, Wiesbaden, Germany

Filed June 7, 1962, Ser. No. 200,754
Claims priority, application Germany, June 9, 1961, G 32,452
5 Claims. (Cl. 123—41.62)

The present invention relates to a cooling duct arrangement for multi-cylinder reciprocating combustion engine, more particularly, to such a cooling duct arrangement wherein cooling air from a blower on one side of the engine is passed around cylinders and cylinder heads to be conducted away by a large conduit on the opposite side of the engine and formed in part by both the intake and exhaust ducts leading to the combustion chambers which are on the same side of the engine with these ducts being constructed so as to have a common wall.

Multi-cylinder reciprocating combustion engines have previously been provided with exhaust ducts which extend transversely from the engine for discharging the cooling air which has been circulated around the cylinder heads of the engine by a blower. The intake duct for the cooling air has usually been arranged on the same side of the engine on which the exhaust duct has been mounted. These cooling ducts are generally constructed from sheet material which is then attached to parts of the engine by various fastening arrangements. It has proved to be extremely difficult to connect these ducts to the engine in such a manner that spaces are not formed between the edges of the ducts and parts of the engine.

These spaces, which are between the cast block of the engine and the cylinder heads which are usually provided with cooling fins, provide undesired passages for the leakage of the cooling air and also cause objectionable noise by contacting the engine due to the vibrations of the engine when in operation. Not only is the noise objectionable, but this repeated contact of the ducts with the engine results in rapid wear of both these ducts and those portions of the engine being contacted thereby.

While it is possible to seal these spaces by elastic sealing compounds, this is not particularly desirable because the sealing compounds are not inexpensive and considerable amount of working time is required to properly apply the sealing compounds to these spaces. Further, the sealing compounds are rapidly fatigued as result of the high temperatures to which they are exposed because of their contact with the engine casing and therefore frequent replacement of the sealing material is necessary.

In those duct arrangements wherein the intake and/or the exhaust collecting lines are arranged on the same side of the engine as the exhaust duct, further difficulties are encountered when either of the intake duct or the exhaust lines must pass through a wall of the exhaust duct. This means an opening must be provided in the sheet material comprising the exhaust duct and the respective line run therethrough. Thus, whenever the exhaust duct must be removed, such as for maintenance purposes, the line running through the opening in the wall thereof must also be disconnected. Further, spaces and leaks are inevitably formed between the wall of the pipe and the opening in the exhaust duct which spaces are disadvantageous as discussed above.

In some cases the exhaust duct may be dispensed with and the cooling air circulating around these cylinder heads may be discharged into the atmosphere. However, it is frequently desirable and economical to utilize this heated cooling air by discharging the cooling air circulating from the cylinder heads into an exhaust duct. This heated air

may then be passed through various drying installations as may be encountered in agriculture operations or, when the engine is being run in a closed room, into an exhaust line for removing the air from the enclosure in which the engine is positioned.

It is therefore the principal object of the present invention to provide a novel and improved cooling air duct arrangement for multi-cylinder reciprocating combustion engines.

It is a further object of the present invention to provide a simple and inexpensive exhaust duct for a multi-cylinder reciprocating combustion engine.

The disadvantages of the prior art as discussed above are avoided and the foregoing objects are attained by the present invention. The duct arrangement of the present invention essentially comprises an exhaust duct for cooling air which is sufficiently wide to span the extreme outmost cylinder heads of an in-line reciprocating combustion engine. The exhaust duct extends transversely of the axis of the engine as represented by the crankshaft thereof and cooling air which is circulated through cooling channels around the cylinder heads and cylinders is discharged through this exhaust duct. An intake duct to the combustion chamber is provided which extends longitudinally of the engine and is arranged so that the bottom wall of the intake duct is common with the upper wall of the exhaust duct. A plurality of connecting passages extend from the bottom wall of the intake duct to the combustion chambers in the cylinder heads. The common wall between the intake ducts to the combustion chambers and the cooling air exhaust ducts is provided with suitable fastening means for mounting the exhaust duct onto the cylinder heads of the engine. The bottom wall of the exhaust duct is mounted upon a shoulder extending from the block or crankcase of the engine.

In another modification, the single line to the combustion chambers may be utilized to exhaust the gases of combustion from the cylinder heads. In a further modification both the intake and exhaust lines leading to the combustion chambers may be mounted on the wall of the exhaust duct.

Any of the foregoing structures will provide the results of the present invention since in all these structures the intake and/or exhaust line to and from the combustion chambers are constructed as a unit together with the exhaust duct for the cooling air. As a result the mounting of this duct arrangement is considerably facilitated since it is only necessary to mount the exhaust duct onto the cylinder heads.

Other objects and advantages of the present invention will be apparent upon reference to the accompanying description when taken in conjunction with the following drawings, wherein;

FIGURE 1 is an end view of an engine looking in the direction of the crankshaft with a portion of the duct arrangement being shown in section for purposes of clarity;

FIGURE 2 is a top plan view of the engine and duct arrangement illustrated in FIGURE 1; and

FIGURE 3 is a view similar to that of FIGURE 1 but showing a modified duct arrangement.

With respect to the drawings wherein like reference symbols indicate the same parts throughout the several views there is illustrated a conventional multi-cylinder reciprocating combustion engine having a crankcase 1 from which are upstanding a plurality of cylinders 2 having cooling fins thereon. Each cylinder comprises a cylinder head 3 and positioned on each of the cylinder heads is a cylinder-head cover 4 which encloses the necessary control elements such as the valve-rocker arms and springs therefor.

The cylinder heads are provided with cooling channels to circulate cooling air around, between, or through

the cylinder heads and cylinders. The exhaust line of a cooling channel may be seen at 13 in FIGURE 1.

A blower 5 circulates the cooling air through the cooling channels.

The intake duct or manifold to the combustion chamber in the cylinder heads is indicated at 6 and extends longitudinally of the engine and parallel to the crankshaft thereof. The intake duct 6 is connected with the cylinder heads by a plurality of elbow connections 7. As may be seen in FIGURE 1, the connections are 90° elbows and extend from the bottom wall 8 of the intake duct to the cylinder heads.

The bottom wall 8 of the intake duct 6 is extended to the cylinder heads as may be seen in FIGURE 1 so as to form the upper wall of a cooling air exhaust duct 14. The wall 8 is essentially a plane which is connected to the upper edge of the cooling air channels for circulating the cooling air in cooling relationship to the cylinder heads. Since the exhaust duct is fixedly connected with the cylinder heads, it can be appreciated that no special fastening members are necessary for connecting the upper wall 8 to the cylinder heads of the engine. This wall may be connected with the cylinder heads by machine screws or other suitable fastening means.

The exhaust duct 14 also comprises a pair of lateral walls 9, depending from the extreme ends of the upper wall 8 and attached to a lower wall 10. As may be seen in FIGURE 2, the lateral walls 9 are spaced sufficiently far apart so as to extend to the outermost portions of the extreme cylinder heads of the engine. In this way all of the exhaust lines leading from the cooling channels of the cylinder heads are spanned by the exhaust duct and communicate therewith.

A ledge or shoulder 11 is provided on the crankcase 1 or may extend from the block of the engine to support the lower wall 10. An external flange 12 is provided at the outer ends of the wall defining the exhaust duct to facilitate connection to an exhaust line.

The intake duct 6 is of such a length so as to extend the length of the block of the engine as may be seen in FIGURE 2 of the drawings. The intake duct 6 together with its connections 7 may be manufactured as an integral unit by casting or by welding the several conduits together. To this integral unit can then be attached to the lower and lateral walls to define the cooling air exhaust duct.

It is pointed out that with this arrangement no openings are necessary in the exhaust duct for the passage therethrough of the intake line and/or an exhaust line.

Depending on the location of the exhaust lines leading from the cylinder head cooling channels, the exhaust line for combustion gases may also be formed so that a wall thereof is common with a wall of the exhaust duct 14. The exhaust line may be formed in this manner either in addition to the above-described formation of the intake duct, as may be seen in FIGURE 3, or to replace the intake duct. In FIGURE 3, an intake duct

15 to the cylinder heads is mounted in addition to exhaust line 6 and is connected by elbows 16 to the cylinder heads.

Thus it can be seen that the cooling duct arrangement of the present invention provides for a close fit with the casing of the engine so as to eliminate any gaps or spaces between the duct arrangement and the engine casing. With the fabrication of the intake duct assembly, the remaining elements of the exhaust duct can be easily connected to the common wall of the intake duct to provide a simple yet effective cooling duct arrangement for combustion engines. The lower wall 10 of the exhaust duct may also be secured with the shoulder 11 by bolts or screws so as to rigidly secure the duct arrangement to the engine.

Not only is this duct arrangement relatively inexpensive to manufacture and install, but the installed duct arrangement closely fits the cooling channels of the engine so as to eliminate any leaks between the engine casing and the duct arrangement.

It will be understood that this invention is susceptible to modification in order to adapt it to different usages and conditions and, accordingly, it is desired to comprehend such modifications within this invention as may fall within the scope of the appended claims.

What is claimed is:

1. An air-cooled internal combustion engine comprising a series of cylinders mounted on a crankcase, cylinder heads on said cylinders, a conduit attached to the cylinder head for communication with the combustion chambers, and a cooling air exit conduit whose upper wall is integral with the first-mentioned conduits, said exit conduit being wide enough to extend across the entire series of cylinders and cylinder heads and of sufficient depth to extend vertically across the cylinder and cylinder heads.

2. The engine of claim 1, in which the first-mentioned conduit includes a manifold integral with the upper wall of the exit conduit, the lower wall of the manifold being coplanar with the upper wall of the exit conduit.

3. The engine of claim 1, in which the first-mentioned conduit includes elbows integral with the upper wall of the exit conduit and extending downwardly therefrom, the lower ends of said elbows being secured to the cylinder heads.

4. The engine of claim 1, in which the lower wall of the exit conduit is attached to the crankcase.

5. The engine of claim 1, in which the first-mentioned conduit is an intake conduit.

References Cited in the file of this patent

UNITED STATES PATENTS

1,264,281	Daugherty	Apr. 30, 1918
1,313,252	Brooke	Aug. 19, 1919
2,182,866	Gabrielson	Dec. 12, 1938
2,270,912	Theodorsen	Jan. 27, 1942