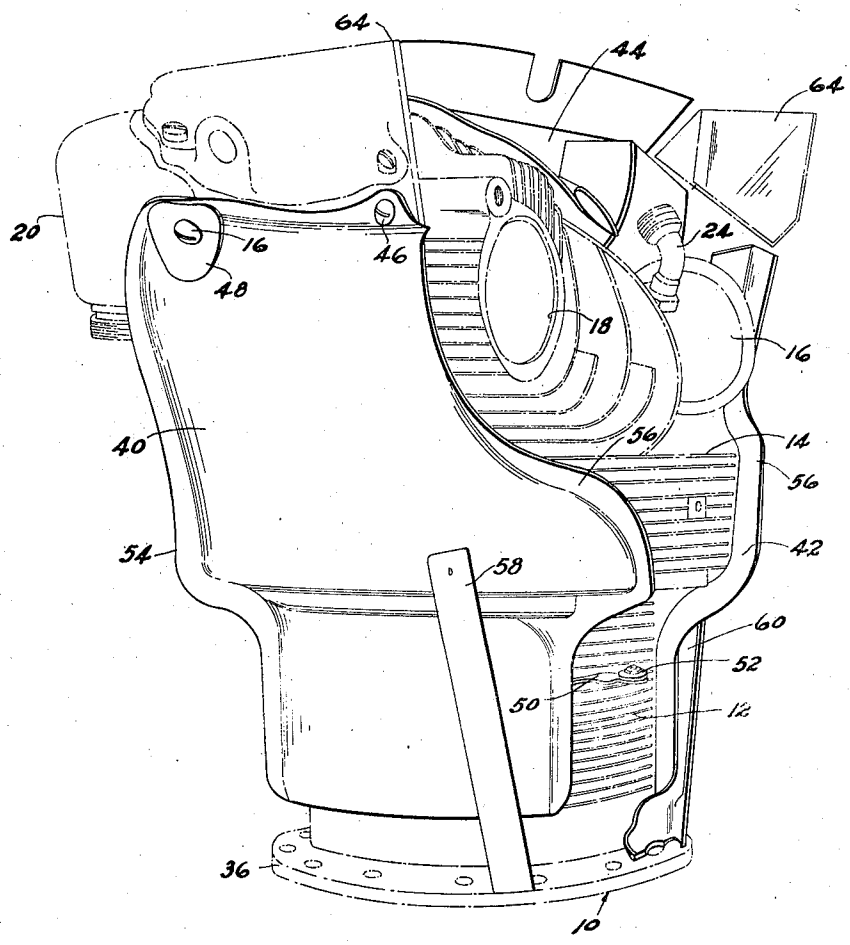
April 12, 1938. E. H. GRANVILLE 2,113,939

BAFFLE

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Fig. 1



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Fig. 2

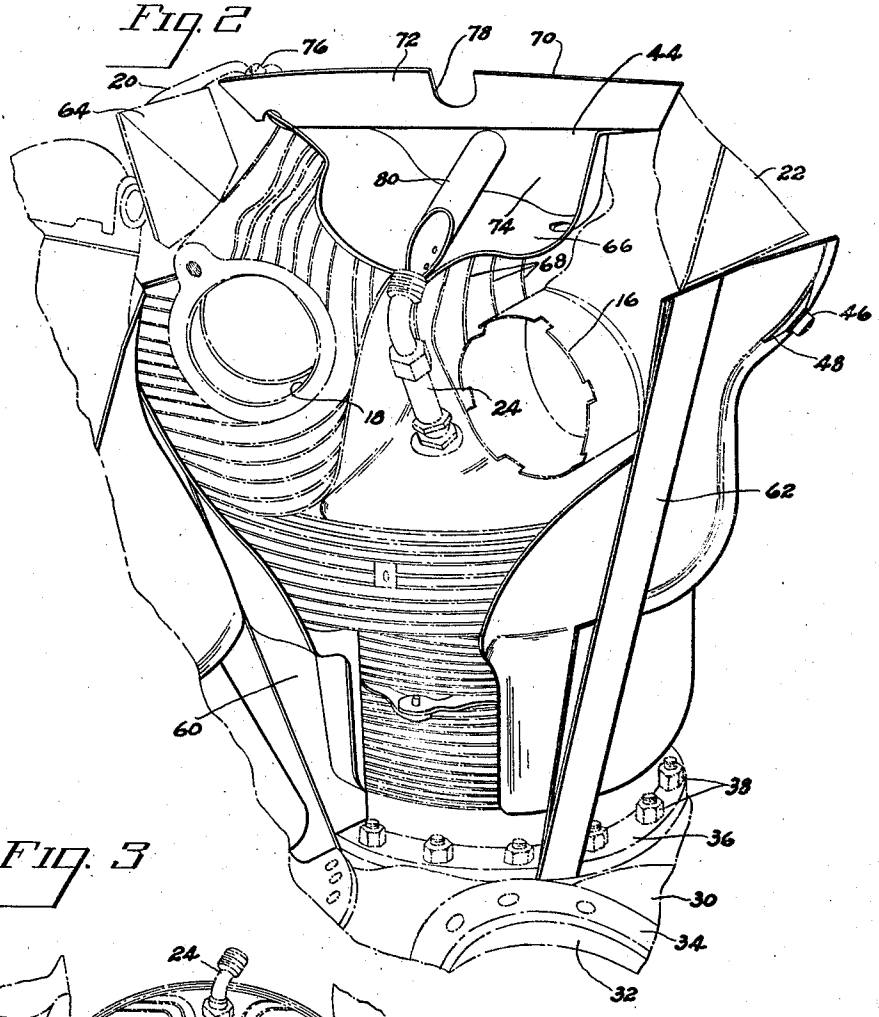
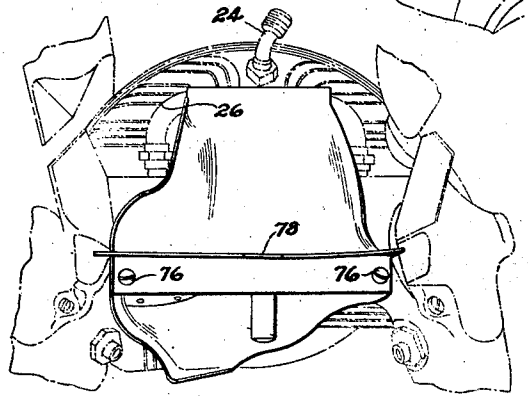


Fig. 3



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Fig. 4

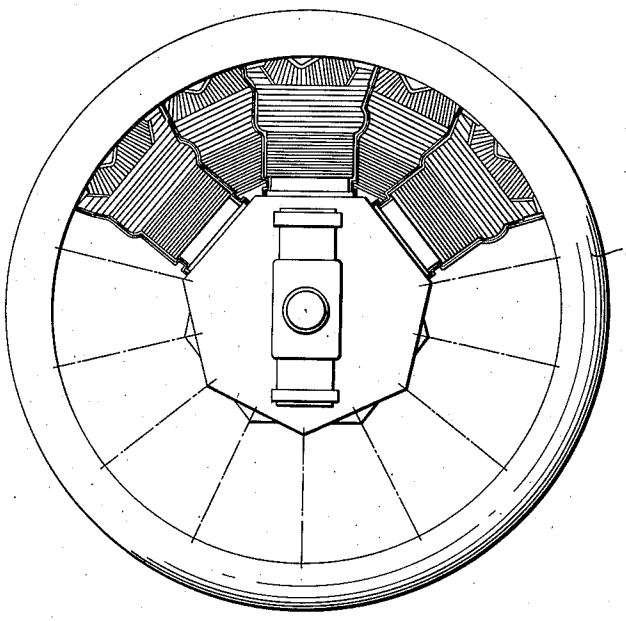
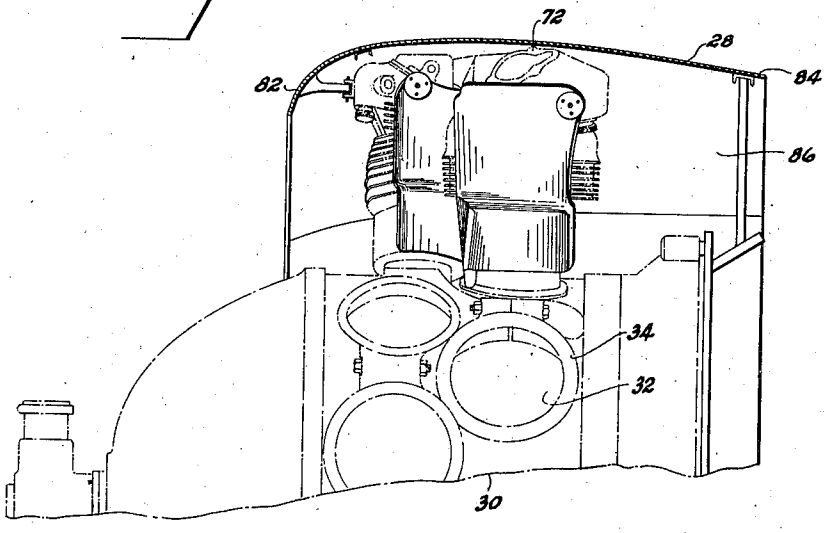


Fig. 5



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UNITED STATES PATENT OFFICE

2,113,939

BAFFLE

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Application February 24, 1936, Serial No. 65,336

9 Claims. (Cl. 123—171)

This invention relates to improvements in cooling means for internal combustion engines and has particular reference to the application of pressure baffles to the finned cylinders of a radial internal combustion engine of the kind in common use for the propulsion of aircraft.

An object of the invention resides in the provision of cooling means in the form of baffles constructed in sections which may be attached to the individual engine cylinders in such a manner that the baffle sections are supported entirely by the respective cylinders and are removable from the engine with the cylinders without interfering with any other cylinders or baffles and without the necessity of disconnecting any holding means other than the means for holding the respective cylinder on the engine.

A further object resides in the provision of a system of baffles of the character described which will effectively close all of the space between the cylinders and the cowl of a cowled engine except the spaces between the individual cooling fins of each cylinder, and in the provision of means for eliminating any tendency of the various baffle sections to rattle, and for preventing chafing between the contacting surfaces of the various sections.

Other objects and advantages will be more particularly pointed out hereinafter, or will become apparent as the description proceeds.

In the accompanying drawings in which like reference numerals are used to designate similar parts throughout, there is illustrated a suitable mechanical embodiment of what is now considered to be the preferred form of the invention. The drawings, however, are for the purpose of illustration only and are not to be taken as limiting the invention, the scope of which is to be measured entirely by the scope of the appended claims.

In the drawings, Fig. 1 is a perspective view of an engine cylinder with a complete group of baffle sections applied thereto.

Fig. 2 is a perspective view of a fragmentary portion of a baffled engine particularly illustrating a joint between baffle sections on adjacent engine cylinders.

Fig. 3 is a top plan view of a cylinder showing the application of a head baffle section thereto.

Fig. 4 is a front elevational view of a cowled engine showing the application of the pressure baffles and cowl to the engine cylinders.

Fig. 5 is a side elevational view of a fragmentary portion of a cowled engine having a portion of the cowl broken away and a number of engine cylinders removed to illustrate the application of the cowl and baffles to the engine.

Referring to the drawings in detail, the numeral 10 generally indicates one of the cylinders of a radial air cooled internal combustion engine. This cylinder has a finned barrel portion 12, an enlarged finned head portion 14, inlet and exhaust ports 16 and 18, and rocker boxes 20 and 22 for enclosing and supporting the valve operating mechanism. The cylinder is also provided with one or more spark plugs as indicated at 24 and may have an oil drain connection 26 in the form of a generally U shaped tubular member extending between the rocker boxes.

The form of engine illustrated in the drawings is a two-row air cooled radial engine having a crankcase and a plurality of radially disposed cylinders arranged in staggered relation in two parallel planes about the crankcase. The entire engine is surrounded by a stream lined or drag reducing ring cowl 28. Such an engine depends for cooling upon a stream of cooling air entering the open end of the ring cowl and flowing between the cylinders and along the tops thereof in contact with the finned cooling surfaces of the cylinders and out through the open rear end of the cowl, thus picking up and carrying away the excess heat of the cylinders. While a two-row radial engine of the character indicated has been illustrated in the drawings and the description will, for the sake of convenience, be drawn in general to the application of the improved pressure baffles to this particular type of engine, it is to be understood that the improved baffles are not limited in their application to the particular type of engine illustrated, but may be applied to any air cooled engine having independently demountable cylinders.

In the type of engine illustrated, the cylinders are mounted in their radial staggered relation upon a crankcase 30 provided with suitable apertures 32 surrounded by cylinder supporting pads or bosses 34. Each cylinder is provided at its crankcase joining end with an outwardly extending flange 36 provided with suitable spaced apertures through which extend the hold down bolts 38 for attaching the individual cylinders to the engine crankcase.

According to the idea of this invention, each cylinder is provided with a pair of intercylinder baffle sections 40 and 42, and a head baffle section 44. Each of the intercylinder baffle sections is attached at its upper end to the cylinder by means of a plurality of screws 46 which extend through apertures in the baffle section and are

screw threaded into tapped wells provided in the material of the cylinder head; the apertures through the baffle may be suitably reinforced by means of an apertured plate or washer 48, if desired, which may be permanently secured to the baffle by suitable means such as welding or riveting. At their lower ends the two intercylinder baffle sections are secured together and supported upon the cylinder by means of a suitable clamp ring or girdle 50 which is made in two halves, each half being permanently attached to one of the baffle sections. The two halves encircle the barrel portion of the cylinder as a continuous ring, being secured together by suitable means such as the eye and pin connection 52. These intercylinder baffle sections are shaped to conform closely to the contour of the outer surface of the finned cylinder and together overlie substantially one-half of the cylinder surface providing an air intake space upon the front side of the cylinder, and a smaller air outlet space upon the rear side of the cylinder. Each baffle section is preferably provided along its opposite edges with outwardly flaring flange portions as indicated at 54 and 56.

In order to provide a substantially air tight joint between the intercylinder baffle sections on adjacent cylinders, each baffle section is provided with a straight contact strip 58 permanently secured upon the outer side of the baffle in such a position that when the baffles are applied to the cylinders and the cylinders mounted upon the engine, the contact strips on adjacent baffle sections coincide with each other. These contact strips 58 may, if desired, extend the entire length of the baffle section to provide a straight radial contact surface, but it has been found in practice that the upper portion of the baffle section is usually sufficiently straight and near enough to a straight radial direction to render the extension of the strip for the entire length of the baffle unnecessary. The strips 58 have, therefore, been illustrated as extending only a short distance above the barrel enclosing portion of the baffle section. Between each contact strip 58 and the contoured baffle surface immediately adjacent thereto, there is provided a closure member 60 having its outer edge either formed integral with, or permanently attached to, the contact strip and its inner edge shaped to conform to the contour of the baffle, as particularly illustrated in Fig. 2. Preferably these closure members are also permanently attached to the surface of the baffle section by suitable means such as by providing a flange upon the baffle contacting edge of the member and riveting or welding the flange upon the outer surface of the baffle section. This construction provides a rigid and durable connection between the associated contact strip 58 and the baffle section to which it is attached.

As particularly illustrated in Figs. 1 and 2, the contact strips 58 extend below the bottom edge of the baffles to which they are attached to a position in which they substantially contact the outer surface of the crankcase. Each closure member 60 is also provided with a downwardly extending portion which is contoured to fit into the space between the lower portion of the contact strip, the lower portion of the cylinder, and around the cylinder supporting flange 36 to substantially completely close the space between the cylinders from the crankcase to the head end of the cylinder.

The intercylinder baffle sections are so designed that when all of the cylinders with the baffle sections attached are mounted upon the engine, a slight spacing is left between all of the adjacent contact strips 58. A chafing strip 62, preferably formed of fiber or some similar resilient and durable material is then interposed between each pair of adjacent contact strips 58 and extends upwardly above the contact strips between the upper portions of the adjacent baffle sections to provide an air seal between the adjacent baffle sections and at the same time eliminate rubbing or vibration of the baffle sections.

From the above description it will be observed that the intercylinder baffle sections are independently secured in complementary pairs upon each of the engine cylinders and are so constructed that when the cylinders are mounted upon the engine, the baffle sections upon adjacent cylinders automatically come together to provide substantially air tight partitions across all of the spaces between adjacent cylinders. The chafing strips 62 may be, and preferably are, permanently secured to alternate baffle sections so that they are always in place between the adjacent sections when the cylinders are mounted upon the engine. Thus it will be seen that any one of the various engine cylinders may be demounted from the engine by removing the nuts of the hold-down bolts 38 and simply drawing the cylinder out in a radial direction, and that the baffle sections mounted upon the particular cylinder will be withdrawn with the cylinder and will remain securely attached thereto during the process of demounting the cylinder from the engine or mounting it upon the engine and that none of the other cylinders or baffles will be disturbed by the removal or application of any one cylinder. After the cylinder has been removed from the engine, the baffle sections may be readily detached from the cylinder and remounted thereon if desired.

In the form of the invention illustrated, the intercylinder baffle sections terminate somewhat short of the inner surface of the cowl and are extended, in effect, to the inner surface of the cowl by means of partition portions, or "tails" 64 cast upon the ends of the rocker boxes 20 opposite the push rod receiving ends thereof. While it has been found practical and desirable to cast these extensions or tails integrally upon the rocker box covers, it is obvious that such extensions could be provided either by separate members secured to the cylinders, or by extensions upon the respective intercylinder baffle sections 40 and 42, or upon the head baffle section 44.

With the construction illustrated in which the contact strips 58 and the closure members 60 extend from the lower ends of the baffles to the crankcase and the extension 64 extends from the upper ends of the baffle sections to the inner surface of the cowl, it is obvious that the spaces between the cylinders will be completely blocked from the crankcase to the cowl except for the air passages provided between the respective baffle sections and the adjacent surface of the cylinders upon which they are mounted.

Between the rocker box extensions or tails 64, each cylinder is provided with a head baffle section 44 particularly illustrated in Figs. 2 and 3. Each of these sections comprise a contoured portion 66 overlying the upper edges of the head fins 68, a flanged ring section 70 extending across between the upper portions of the rocker box covers and provided with an upwardly extending flange 72 provided with a curved upper edge which cooperates with the adjacent inner surface of the

cowl 28 as particularly illustrated in Fig. 5 to form a substantially air tight seal between the baffle section and the cowl, and a wall or partition member 74 between the member 70 and the member 66. If desired, the member 74 may be formed integrally with the member 70 or the member 66. The head baffle sections are detachably secured to the respective cylinders by suitable means such as the screws 76 extending through apertured lugs or ears provided on the baffle sections and into tapped wells provided in the material of the cylinder head. They may also be additionally supported upon the cylinder head by having a portion coiled about the oil tube 26 as particularly illustrated in Fig. 3, if the engine happens to be of the type provided with an oil tube as illustrated.

Each of the head baffle sections is provided in the flange portion 72 with a notch 78 to accommodate the ignition wire for the rear spark plug 24, the wire being preferably held in the notch by a rubber grommet or other suitable packing device, and is provided in the wall portion 74 thereof, with a blast tube 80 which extends through the wall portion and to a position adjacent to the end of the spark plug 24 for directing a blast of cold air from the high pressure side of the baffles onto the spark plug elbow to carry away excess heat generated in the ignition wire and the spark plug and maintain the ignition wires and spark plugs in a cool condition.

From this description it will be observed that the head baffle sections block all of the spaces between the head portions of the cylinders and the inner surface of the cowl between the extensions 64 except the spaces between the head fins 60, and since the cooperating intercylinder baffle sections 40 and 42 block the spaces between the cylinders except between the barrel cooling fins it follows that all of the engine cooling air flowing through the engine is constrained to flow substantially through the spaces between the individual engine cooling fins, and that all of the air is thus forced to come into intimate contact with the engine cooling surfaces so that the engine may be adequately cooled by a relatively small amount of cooling air.

It will also be observed that any engine cylinder and its associated baffles may be removed from, or attached to, the engine as a complete unit without in any way disturbing any of the other cylinders or their associated baffles.

In the two-row type of radial engine illustrated, the intercylinder baffle sections on a cylinder in one row engage with corresponding baffle sections on the two adjacent cylinders in the other row, also the extensions or "tails" on the rocker box covers on a cylinder in one row extend into close proximity to the extensions on the adjacent rocker boxes on the two nearest cylinders in the other row. Thus the intercylinder baffles extend from row to row and all of the cylinders of both rows are directly exposed to the blast of cooling air flowing through the engine.

The cowl 28 is preferably made in a plurality of elements which include a continuous ring shaped nose element 82, a continuous ring shaped rear portion 84, and an intermediate portion made up of a plurality of longitudinal panels 86 so that it is not even necessary to remove the entire cowl in order to remove a cylinder from the engine for purposes of inspection or repair, but is necessary only to remove the particular cowl panel 86 overlying the cylinder which it is desired to remove. This type of construction leads to exceptional convenience and economy in the maintenance of engines of the type described.

This application is in some respects an improvement upon, or a special adaptation of the pressure baffle construction illustrated and described in Patent No. 2,031,541 by Albert Lewis MacClain, issued February 18, 1936.

For a more complete description of a suitable form of cowl to be used in connection with the engine and baffles described above, reference may be had to application Serial No. 26,878 of Rex B. Beisel, filed June 15, 1935.

While there has been illustrated and described a particular mechanical embodiment constructed according to the idea of the invention, it is to be understood that the invention is not limited to the specific construction so illustrated and described, but that such changes in the size, shape, and arrangement of parts may be resorted to as come within the scope of the appended claims.

Having now described the invention so that others skilled in the art may clearly understand the same, what it is desired to secure by Letters Patent is as follows:

1. In an air-cooled internal combustion engine having a plurality of independently demountable cylinders arranged in spaced relation with respect to each other to provide passages for the flow of engine cooling air therebetween, a system of baffles for constraining the engine cooling air to flow along the surfaces of said cylinders comprising, a plurality of baffle sections carried independently by each cylinder and provided with interengaging surfaces in the spaces between respective cylinders, said sections being supported solely by said cylinders and removable as a unit therewith without the necessity of removing adjacent units.

2. In an air cooled internal combustion engine having a plurality of independently demountable cylinders, a pair of intercylinder baffle sections and a head baffle section attached to each cylinder and supported entirely thereby, whereby each respective cylinder and its baffle sections is removable from said engine as a unit without disturbing adjacent units, said intercylinder baffle sections having surfaces engaging between said cylinders with surfaces of similar baffle sections supported on adjacent cylinders.

3. In an air cooled internal combustion engine having a plurality of independently demountable cylinders, a group of baffle sections including a pair of intercylinder baffle sections and a head baffle section supported on each cylinder, whereby each cylinder and its respective group of baffle sections is individually removable from the engine as a unit without disturbing any other unit, said intercylinder baffle sections being disposed on opposite sides of said cylinder and having portions interengaging with similar baffle sections on adjacent cylinders to block the passage of air through the spaces between said cylinders, a cowl surrounding said engine, and an air obstructing portion on each of said head baffle sections closing the space between the end of the respective cylinder and the inner surface of said cowl.

4. In combination with an air cooled internal combustion engine having a plurality of independently demountable cylinders, a pair of baffle sections attached to each cylinder and supported entirely thereby, whereby each cylinder and its respective baffle sections constitutes a unitary portion of said engine individually removable therefrom without disturbing any other unit, said

baffle sections having juxtaposed surfaces between said cylinders.

5. A set of cooling baffles for an engine having a plurality of independently demountable cylinders comprising, a group of fractional baffle portions independently supported on each cylinder and provided with contact surfaces which cooperate with contact surfaces on similar baffle portions mounted on adjacent cylinders to provide complete air baffles across all the spaces between said cylinders, each unit being removable from said engine without disturbing adjacent units.

6. In an air-cooled, multi-cylinder engine, cylinder and baffle units, each comprising a cylinder with at least one baffle secured thereto, each unit being removable from the engine as a unit without the necessity of removing any part of any other unit and each unit co-acting with the adjacent unit to form a close joint therebetween.

7. In combination with an air-cooled internal combustion engine having a plurality of independently demountable cylinders, a pair of baffle sections attached to each cylinder and supported entirely thereby and removable therewith as a unit, said baffle sections having surfaces in juxtaposition between said cylinders with surfaces of similar baffle sections supported on adjacent cylinders, and a chafing strip between each pair of juxtaposed surfaces of said baffle sections, each cylinder and its baffle sections being removable as a unit without removing or disassembling any of the other cylinders and baffles.

8. In combination with an air-cooled internal combustion engine having a plurality of independently demountable cylinders, a pair of baffle sections shaped to the contour of said cylinders attached to each cylinder and supported entirely thereby, and removable therewith as a unit, a contact strip attached to each baffle section to provide a straight contact surface along the side of said section, and a closure member between each contact strip and the surface of the corresponding baffle section, the contact strips on complementary baffle sections on adjacent cylinders engaging between said cylinders, each cylinder and its baffle sections being removable as a unit without removing or disassembling any of the other cylinder and baffle units.

9. In a radial engine having a plurality of independently demountable cylinders and an open ended ring cowl, a set of cooling baffles for said engine comprising, a pair of inter-cylinder baffle sections independently supported on each cylinder, said sections cooperating between adjacent cylinders to close the spaces between said cylinders from the base ends of said cylinders to the head portions thereof, and a head baffle section independently supported on each cylinder and extending from the head of said cylinder to said cowl, each cylinder and its baffle sections being removable as a unit without disassembling any other cylinder from the engine or from its associated baffles.

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