METHOD OF WELDING CYLINDER TO HEAD

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1 Claim. (Cl. 29—156.4)

It has long been common practice, in fabricating an internal combustion engine of relatively large size, to form the cylinder block by casting and to provide said block with cylindrical recesses for the reception of cylinders which have been separately formed. It is also frequently found to be desirable to assemble together and unite into one integral structure, prior to emplace-

ment upon the cylinder block, the head and barrel of an individual cylinder assembly. Various procedures for the assembly in one integral structure of a cylinder head and barrel have heretofore been proposed and made use of in actual engine construction.

It is the purpose of the present invention to provide a head and barrel assembly of novel and improved character shown in my copending application Serial No. 157,762 filed April 24, 1950, now abandoned and par-
ticularly in this divisional application thereof to provide a novel and improved process or method by means of which the assembly of a cylinder head and associated barrel may be effectuated, to the end that one integral structure, ready for assembly with the engine block, is real-
ized.

By separately forming the head and barrel of a cylinder it becomes easily possible for a manufacturer to em-
ploy casting procedures in the formation of the head and barrel and also to use metals for these two parts which vary somewhat in chemical composition and physical char-
acteristics. Conveniently the head and barrel of such an assembly may be united by welding and the present invention relates particularly to a cylinder head and barrel assembly in which these parts have been so united, and to a method for effecting the welding opera-

tion in a manner superior to methods and procedures which have heretofore been suggested or utilized.

In the practice of the method the head and barrel are separately formed by methods chosen by the manufac-
turer to be most suitable. The head is provided with a peripheral flange with a cylindrical inner face and an annular end surface. The barrel is provided, at one end, with an annular end surface and an axially projecting portion which is adapted to alidably engage the cylin-
drical inner surface formed on the peripheral flange of the head. The arrangement is such that, when the projection portion of the barrel is caused to telescope with the peripheral flange of the head, the head and barrel will be precisely in desired co-axial relationship, the annular end surfaces of the flange of the head and the end of the barrel are in mutually facing and equi-
distantly spaced relationship throughout, the projection from the barrel comprising a stop for limiting the move-
ment of approach of head and barrel and likewise comprising means defining a cylindrical bottom for the groove

or annular space intermediate the mutually facing end surfaces of head and barrel and into which space the weld metal by any acceptable process of welding so that the head and barrel are rigidly united in desired rela-
tionship. The projection which extends axially from the barrel end, which has served as means for guiding and

maintaining the head and barrel of the cylinder into desired relationship as a pre-welding operation, and which has also served to confine the molten weld metal during the welding operation, may then be cut away since it is no longer of utility and, as a matter of fact, would interfere with or limit the movement of the piston unless removed. After removal of this barrel projec-
tion the interior of the assembly comprises a smooth cylindrical surface extending from end to end of the cylinder space, the inner face of the annular bond of weld metal having been rendered truly cylindrical during the final machining operation involved in the removal of the barrel projection and being continuous with the surfaces of the barrel below it and the inner cylindrical surface of the peripheral flange above it. The weld is so located that it cannot be reached by any piston ring when the piston is working in the barrel is at the top of its stroke, although the piston stroke may be of such length that its upper end will pass beyond the weld. The resulting assembly is of great strength, and by the method above briefly described it is possible to eco-
nomically construct light weight but high quality cylinder head and barrel assemblies quite rapidly and, where the practice as described is employed, a high quality low cost unit may be produced.

Minor variations in the procedure are permissible, without departure from the invention. The process or method may best be understood by reference to the accompanying drawings in which are shown, rather diagrammatically, a cylinder head and barrel in the several positions which they relatively occupy as the process is practiced.

In the drawings:

Figure 1 shows, in axial section and co-axial relation-
ship, portion of a cylinder head and the adjacent end of the cylinder barrel, these parts having been joined so as to have mutually telescoping portions and being shown in the relative positions which they occupy just prior to assembly;

Figure 2 shows a portion of the cylinder head and a portion of the barrel just after assembly of these mem-
bers.

Figure 3 is a similar view showing the assembled parts just after completion of the welding operation;

Figure 4 is a further view of the same character, showing the same portions of the assembly after removal of the barrel projection, which projection has completed its function; and

Figure 5 is an axial section through a completed cylinder barrel and head assembly, showing also small portions of the cylinder block upon which this assembly is mounted.

The head 10 of the cylinder may vary widely in de-
tails of construction and may be fabricated in various ways provided, however, that it includes a peripheral flange such as indicated at 10a, this flange being gen-

erally cylindrical, having a cylindrical inner surface 10b

the diameter of which is equal to the diameter of the finished cylinder, and an annular end surface 10c, the

inner portion of which is frusto-conical. The cylinder

barrel 11 is in the nature of a shell the wall of which is preferably thin and of high quality metal. At that

detail of the barrel which is to be attached to the cylinder head 10 it is provided with a frusto-conical end surface 11b

and an inwardly offset projection 11c which is pref-

erably in the nature of a cylindrical extension of the barrel with a cylindrical outer surface 11d of sub-
stantially the same diameter as the cylindrical inner surface

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of the head 10, surface 11d being described about the axis of the inner cylindrical surface of cylinder 11 and being adapted to engage with a close sliding fit the cylindrical inner surface 10b of the head 10 when the peripheral flange 10c of the head and the cylindrical projection 11c of the barrel are telescoped. The telescoping operation will proceed until the parts occupy the relative positions in which they are shown in Figure 2, the projection 11c of the barrel being of such length as to limit the approaching movement of head and cylinder when the mutually facing annular surfaces 10c and 11b of the head and cylinder occupy the relative positions in which they are shown in Figure 2. A groove being formed by the frusto-conical surfaces 10c; 11b and the exposed short portion or band of the outer cylindrical surface 11d of the projection 11c which lies between these surfaces. In cross section the groove is V-shaped and is of such dimension as to facilitate welding.

Weld metal is then deposited in the resulting groove until a continuous band of weld metal 12 has been formed, rigidly uniting the mutually facing ends of flange 10b and barrel 11 and thus forming one integral structure of head and barrel. The barrel projection 11c is then removed by suitable machining operations, preferably followed by grinding until the cylindrical inner surfaces of the flange 10c of the head, the cylindrical inner surface of the band 12 of weld metal, and the cylindrical inner surface of the barrel 11 form one continuous smooth cylindrical surface. The assembled head and barrel are then ready for assembly with the block and may be so assembled, in the manner shown in Figure 5 or in any other suitable manner. The resulting structure is extremely strong and durable and the weld metal band 12, which comprises the sole connection between head and skirt, is, if the welding operation is properly carried out, at least as durable and long lasting as the members which it unites.

The operation just described may be practiced repeatedly with absolute uniformity of result, the resulting product is of the highest quality and the cost of production lower than comparable procedures heretofore or now practiced.

As previously explained the weld is so located, in the practice of the invention, that it may not be reached by any piston ring mounted upon the piston which is to work in the completed cylinder assembly, a piston in its uppermost position being indicated diagrammatically at 14 and piston ring at 14a. The barrel, over the surface of which the piston rings constantly move, is fabricated of metal best suited to resist wear and is processed to provide maximum wear resisting properties, a nitralloy steel being particularly well suited for such use. The depth of the weld is equal to the width of the cylinder wall, a condition which ensures maximum strength. It will be understood that a step might be machined into the flange 10a and that the end of the flange 11c might omit this step instead of the under-surface of the head, without departure from the invention.

I claim:

The method of fabricating a one piece cylinder assembly defining a closed dome at one end of the combustion chamber for an internal combustion engine, which comprises the steps of forming upon the cylinder head an integral peripheral flange having an annular end surface spaced apart from the inside surface of the dome and having a cylindrical inner face disposed between the two said surfaces, forming a barrel with a cylindrical flange of predetermined length at one end offset inwardly from the inner wall of the body of the barrel and a transversely extending intermediate wall portion joining the barrel body and the cylindrical flange integrally together at that end, the wall portion presenting an annular end surface included between the respective junctures of the wall portion and each of the body of the barrel and the cylindrical flange thereof and maintaining the coaxial stepped relationship whereby the inner wall of the barrel body and the outer wall of the cylindrical flange are substantially longitudinally aligned, said cylindrical flange closely engaging the inwardly facing cylindrical surface of the flange of the head when it is inserted within said encircling flange to establish coaxial relationship between said head and the body of the barrel with the predetermined length to which the cylindrical flange is formed being such that when it is inserted into the encircling peripheral flange of the head it will, by abutting the dome in said head function as a stop limiting the extent of such insertion and accurately locating the mutual facing annular end surfaces of head and barrel in desired spaced relationship, filling the space between said annular end surfaces with weld metal to permanently unite the head and barrel, and thereafter cutting away the said cylindrical flange and the stepped transversely extending wall portion to provide a continuous cylindrical inner surface extending from the body of the barrel beyond the weld.

References Cited in the file of this patent

UNITED STATES PATENTS

1,665,468 Murray Apr. 10, 1928
2,226,496 Jacobs Dec. 24, 1940
2,258,913 Stone Oct. 14, 1941