Nov. 7, 1967 L. E. W. POMEROY 3,351,044

INTERNAL COMBUSTION ENGINES

Filed April 5, 1965 4 Sheets-Sheet 1

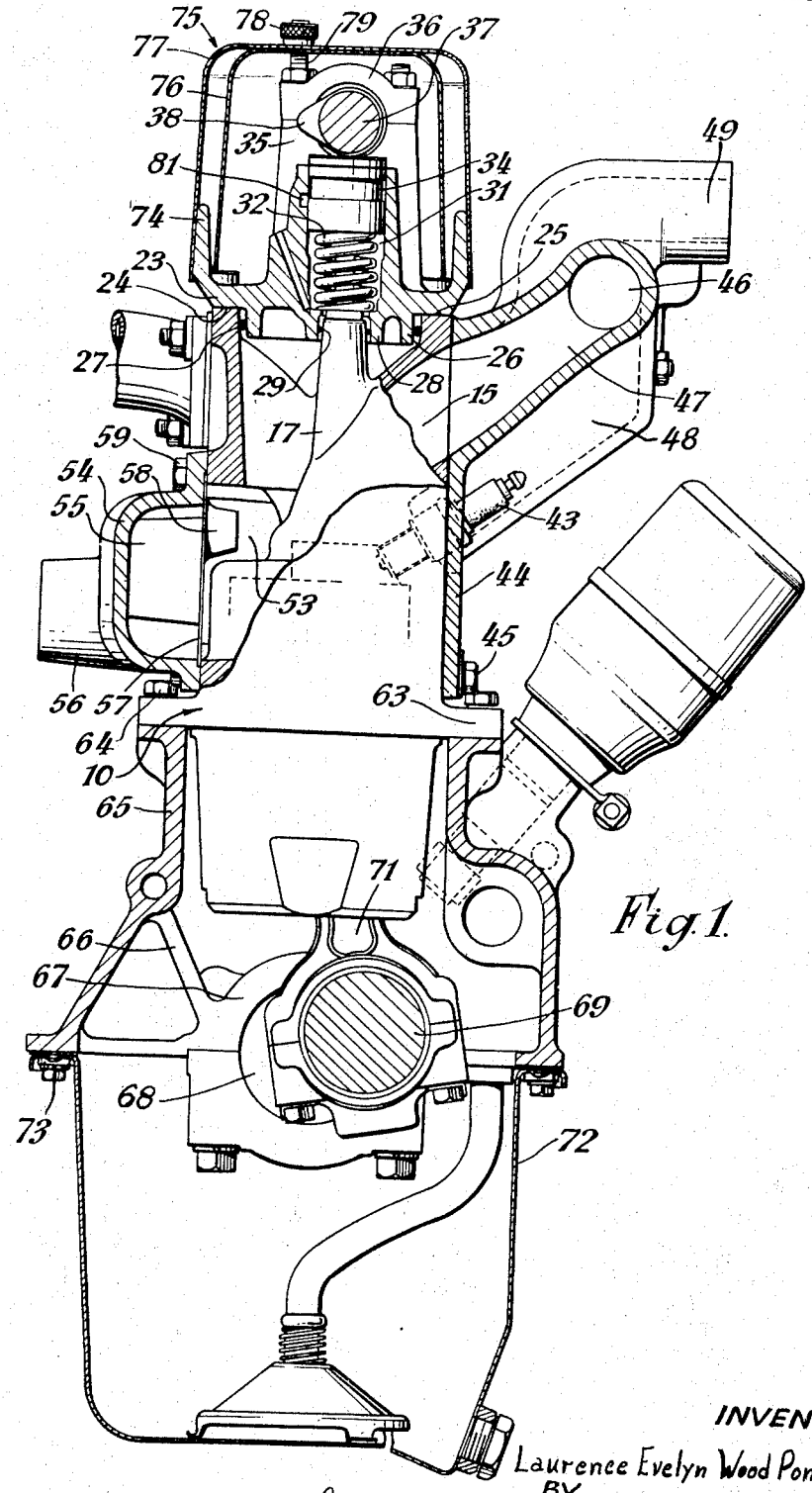


Fig. 1.

INVENTOR
Laurence Evelyn Wood Pomeroy
BY
Stevens, Davis, Miller & Mosher
ATTORNEYS

Nov. 7, 1967 L. E. W. POMEROY 3,351,044

INTERNAL COMBUSTION ENGINES

Filed April 5, 1965 4 Sheets-Sheet 2

Fig. 2.

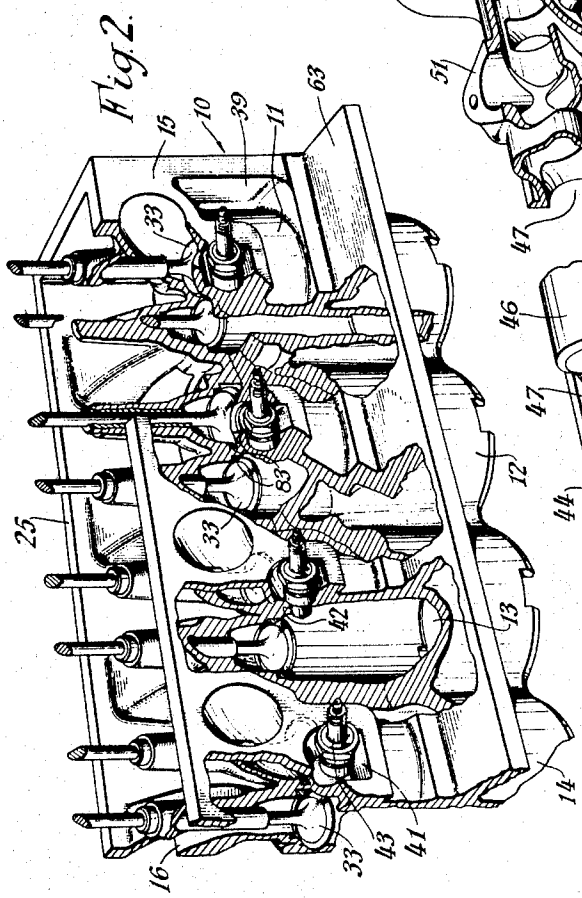
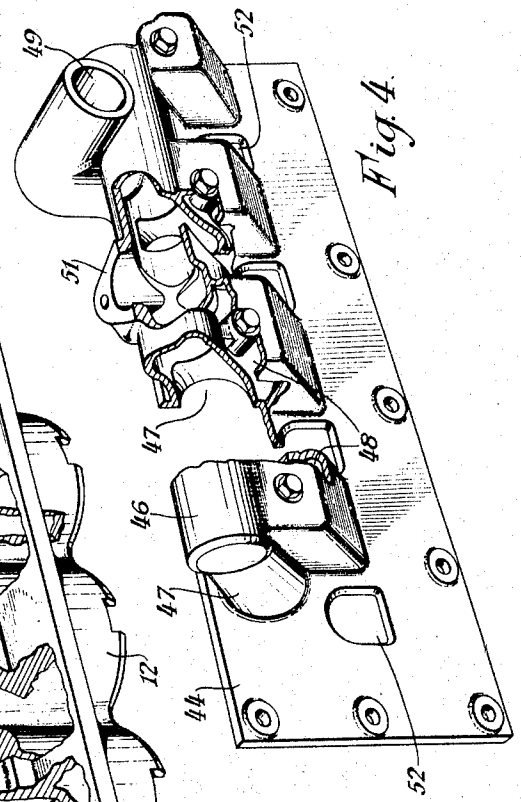


Fig. 4.



INVENTOR
Laurence Evelyn Wood Pomeroy
BY
Stevens, Davis, Miller & Mosher
ATTORNEYS

Nov. 7, 1967 L. E. W. POMEROY 3,351,044

INTERNAL COMBUSTION ENGINES

Filed April 5, 1965 4 Sheets-Sheet 3

Fig. 8

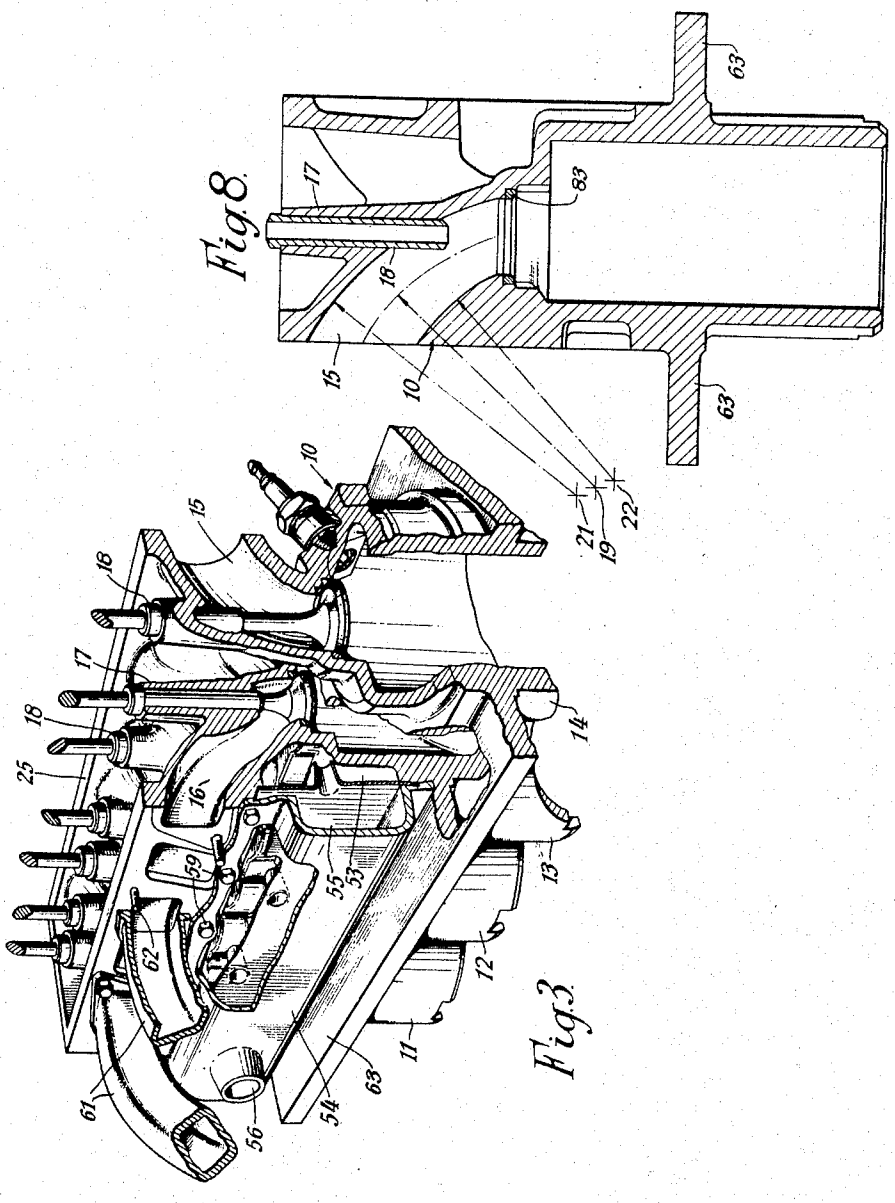


Fig. 3

INVENTOR
Laurence Evelyn Wood Pomeroy
BY
Stevens, Davis, Miller & Mosher
ATTORNEYS

Nov. 7, 1967 L. E. W. POMEROY 3,351,044

INTERNAL COMBUSTION ENGINES

Filed April 5, 1965 4 Sheets-Sheet 4

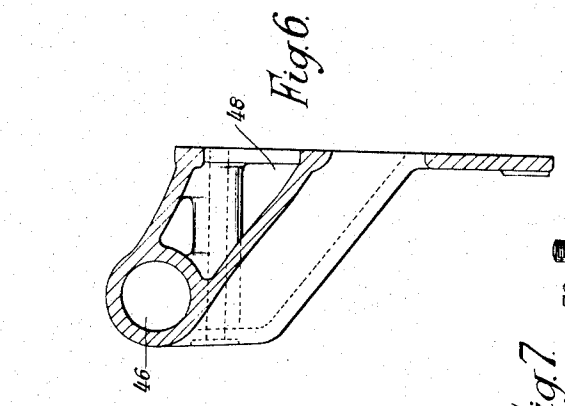


Fig. 6.

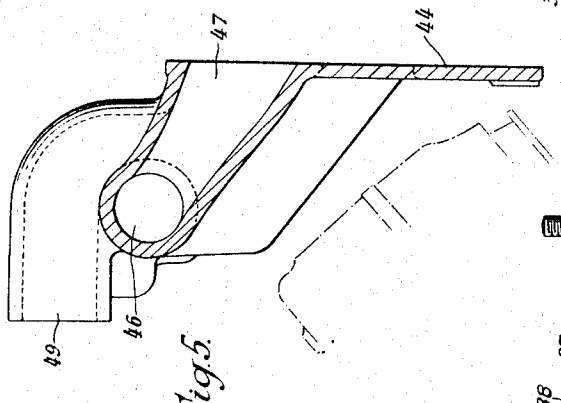


Fig. 5.

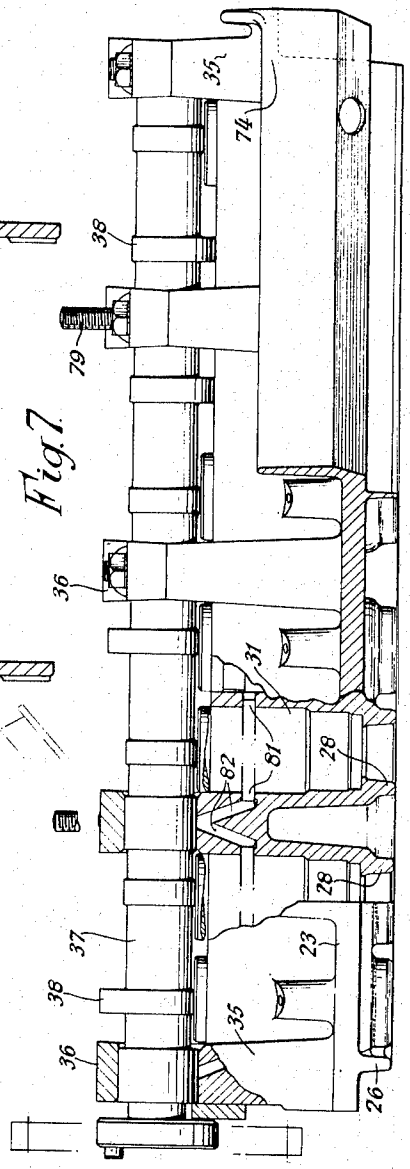


Fig. 7.

INVENTOR
Laurence Evelyn Wood Pomeroy
BY
Stevens, Davis, Miller & Mosher
ATTORNEYS

United States Patent Office 3,351,044 Patented Nov. 7, 1967

3,351,044

INTERNAL COMBUSTION ENGINES

Laurence Evelyn Wood Pomeroy, London, England, assignor of one-half to The British Aluminium Company Limited, London, England, a British company, and one-fourth to Technical Relations Limited, London, England, a British company

Filed Apr. 5, 1965, Ser. No. 445,532
Claims priority, application Great Britain, Apr. 10, 1964, 14,952/64
3 Claims. (Cl. 123—41.28)

ABSTRACT OF THE DISCLOSURE

A cylinder block and head unit in an internal combustion engine having an integral casting of non-ferrous alloy with a plurality of cooling water cavities and a plurality of inlet and exhaust passages, in addition to the cylinder bores. The cavities and passages are covered by a top plate and two side plates, one of the side plates being adapted to enclose a portion of the water cavities opening adjacent the corresponding side surface of said unit, being provided with an inlet manifold integral therewith, and having a plurality of passages registering with the inlet manifold and the inlet passages.

This invention relates to internal combustion engines, and has for its object to provide improvements in the construction of such engines.

It has previously been proposed to employ aluminium or non-ferrous alloy die-casting in the making of internal combustion engine structures, but so far there has not been produced a practically satisfactory engine at a cost which makes it an economic proposition.

According to the present invention, in a cylinder and cylinder-head unit for an internal combustion engine the cylinder or cylinders and the cylinder head or heads comprise an integral casting of aluminium or non-ferrous alloy having cavities and passages other than the cylinder bores formed in it by draw members associated with the die in which the casting is formed, all of which cavities and passages are closed by cover parts including structures having a function other than the mere closing of said cavities and passages.

Further, according to the invention, an internal combustion engine comprises a cylinder and cylinder-head unit as set forth in the last preceding paragraph, combined with a crank-case which is an iron casting carrying the bearings for the engine crankshaft.

The invention is hereinafter described with reference to the accompanying drawings which show, by way of example, one form of internal combustion engine embodying the invention. The engine shown in the drawings has four cylinders, and is of the overhead-camshaft type, but it will be understood that the invention may be applied to engines having any number of cylinders and having other arrangements of valve-operating mechanism, such as push rods and rockers.

In the drawings:

FIGURE 1 is a transverse section through an internal-combustion engine embodying the present invention;

FIGURE 2 is a perspective view of the cylinder and cylinder-head unit, with parts broken away, looking from the right-hand side of FIGURE 1;

FIGURE 3 is a perspective view of the cylinder and cylinder-head unit, with some of the cover parts attached to it, looking from the left-hand side in FIGURE 1, both the unit and the cover parts being partially broken away;

FIGURE 4 is a perspective view, partly broken away, of a cover part for the side of the unit shown in FIGURE 2;

FIGURES 5 and 6 are sectional elevations, on a larger scale, of the cover part shown in FIGURE 4;

FIGURE 7 is a side elevation, partly in section, of the top cover part shown in FIGURE 1; and

FIGURE 8 is a transverse section of the cylinder and cylinder-head unit illustrating the formation of the inlet and exhaust passages in the said unit.

Referring to the drawings, the engine shown therein is of the four-cylinder type with overhead valves operated by cams on an overhead camshaft, and has inlet passages opening on one side of the engine and exhaust passages opening on the other side thereof. A cylinder and cylinder-head unit **10**, consisting of a die casting of aluminium or light alloy, includes the four cylinders **11**, **12**, **13** and **14**, and has generally flat side and top surfaces. Curved inlet passages **15** have open ends in one side wall of the unit **10**, whilst similar exhaust passages **16** have open ends in the other side wall thereof. Cavities extending inwardly from the side and top surfaces of the body open one into another to provide a continuous coolant space or water jacket surrounding the upper ends of the engine cylinders, the inlet and exhaust passages and supports **17** for valve guides **18**, which supports are cast integral with the unit **10**.

The various cavities are formed by draw members forming parts of the die in which the unit **10** is cast, and the inlet and exhaust passages **15** and **16** are similarly formed by draw members which are withdrawn along arcuate paths about centres such as that shown at **19** in FIGURE 8, the curvature of the sides of the said passages being in the form of arcs struck from centres **21** and **22** so positioned with relation to the centre **19** as to provide the equivalent of a taper symmetrical about the curved line along which the draw members move.

The valve-guide supports **17** are in the form of vertical tubular ports extending upwardly from the walls of the inlet and exhaust passages **15** and **16** to the top of the unit **10**, and the valve guides **18** are a force fit in said tubular ports.

A top cover **23** which is also a die casting of aluminium or light alloy has a flat under-surface **24** extending round its perimeter to rest on the flat top surface **25** around the perimeter of the unit **10**, and a downwardly-extending flange **26** which lies inside the unit **10**, a sealing ring **27** being provided around the flange **26** to provide a water-tight joint. Tubular bosses **28** on the underside of the top cover **23** receive the upper ends of the valve-guide supports **17**, the joints between said bosses and the supports **17** being sealed by sealing rings **29**, the said tubular bosses **28** opening into cavities **31** in the top cover in which are mounted valve springs **32** for the valves **33**, and hydraulic tappets **34** through which the valves **33** are operated. Pillars **35** integral with the top cover **23**, together with bearing caps **36** mounted on the said pillars, provide bearings for an overhead camshaft **37** formed with cams **38** acting on the hydraulic tappets.

The top cover **23** is secured to the unit **10** by studs or bolts (not shown) screwed into the said unit.

On the side of the unit **10** in which the inlet passages open there is a continuous cavity **39** extending longitudinally below the said inlet passage openings, from end to end of the unit, and four smaller cavities **41** from which screw-threaded holes **42** lead into the cylinders to receive the sparking plug **43**. A single cover member **44** secured to this side of the unit **10** by bolts such as those shown at **45** in FIGURE 1 is also a casting of aluminium or light alloy and includes a tubular inlet manifold **46**, passages **47** (FIGURES 4 and 5) leading from the said manifold **46** to the inlet passages **15**, water cavities **48** (FIGURES 4 and 6) below and between the passages **47** which communicate with the cavity **39** in the unit **10**, a water-outlet connection **49** communicating with the cavi-

ties 48, and a carburettor-receiving flange 51 (FIGURE 4) surrounding an opening leading into the inlet manifold 46. The cover member 44 has openings 52 registering with the cavities 41 for the sparking plugs. Thus the cover member 44 constitutes both the inlet manifold and part of the water jacket of the engine.

On the exhaust side of the engine, as shown in FIGURES 1 and 3, there is a cavity 53 corresponding to the cavity 39 on the other side, the two cavities communicating one with the other above and around the inlet and exhaust passages. The exhaust passages 16 open in the side wall of the unit 10 above the cavity 53. The cavity 53 is covered by a cover member 54 channelled at 55 to provide a water-distributing duct and having a water-inlet connection at 56, a thin metal plate 57 interposed between the duct 55 and the cavity 53 having openings surrounded by nozzles 58 to direct water from the duct 55 onto the valve-seat regions of the unit 10. The cover member 54, which is secured to the unit 10 by bolts 59, thus also serves as a water-inlet duct.

Separate exhaust pipes 61 are secured to the unit 10 so as to register with the individual exhaust passages 16, and are secured by studs 62.

The unit 10 is formed with a mounting flange 63 intermediate the ends of the engine cylinders, and is secured by bolts 64 (FIGURE 1) passing through the said flange to a cast-iron unit 65 (FIGURE 1) constituting the engine crankcase, the said unit being formed with transverse webs 66 to support the main bearings 67 for the engine crankshaft 68. One of the crank throws of the crankshaft is shown at 69 and the connecting rod associated therewith is shown at 71. The usual pressed sheet-metal sump, indicated by the reference 72, is secured to a flange on the unit 65 by bolts 73. The engine crankcase instead of being secured to the unit 10 by bolts may be secured to the said unit by mounting it in the die in which the unit 10 is cast and causing the metal of the said unit to form an interlocking engagement therewith.

The top cover 23, as shown in FIGURE 1, is formed with an upwardly extending flange 74 around its edge, and a cover 75 (FIGURE 1) for the cam mechanism comprises inner and outer sheet-metal members 76 and 77 lying one on each side of the flange 74 and secured by nuts 78 on extended studs 79 which also receive two of the bearing caps 36 of the camshaft bearings.

Grooves 81 around the cavities 31 in the top cover, which grooves may be eccentric as shown in FIGURE 1, are connected one to another in the pillars 35 by pairs of inclined passages 82 (FIGURE 7), a connection from the engine oil pump (not shown) being made to one set of passages 82. The passages 83 open into the camshaft bearings. Thus, oil is supplied through the grooves 81 to the hydraulic tappets, and through the passages 82 to the camshaft bearings.

The inlet and exhaust passages 15 and 16 may be formed wholly by draw members in the die in which the unit 10 is cast, or a relatively thin wall of metal may

be left at their inner ends, and subsequently removed by machining. A hard metal insert is provided in each passage, as shown at 83, to provide a valve seat.

Whilst liners may be used in the engine cylinders if desired, it is not considered necessary to use them, and preferably the pistons work directly in the aluminium bores.

I claim:

1. A cylinder block and head unit for use in an internal combustion engine, said unit comprising an integral head and cylinder casting having a plurality of aligned cylinder bores, a plurality of cooling liquid cavities extending through the top and both sides of said casting, and a plurality of oppositely directed inlet and exhaust passages in addition to the cylinder bores, and a plurality of cover members extending the length of the engine, having flat mounting surfaces, and covering said cavities and said inlet passages, said cover members including a top plate and two side plates, said top plate enclosing the cavities in the top of said casting and carrying the valve tappet means for said engine, the first of said side plates enclosing and interconnecting the cavities opening adjacent the corresponding side surface of said unit, said first side plate being provided with an inlet manifold integral therewith, said manifold having a plurality of passages registering with said inlet passages, and the other of said side plates providing a channel interconnecting the cavities on the other side of said unit, said first side plate including outlet means for said liquid, and said other side plate including inlet means for said liquid.

2. The unit of claim 1, in which said first side plate is further provided with a plurality of additional cavities communicating with said liquid cavities.

3. The unit of claim 1, in which said channel is adapted to receive the cooling liquid and direct same to said cavities.

References Cited

UNITED STATES PATENTS

1,345,684	7/1920	Maire	123—41.81
1,372,897	3/1921	Nelson	123—41.81
1,822,857	9/1931	McCuen	123—41.73 X
2,049,596	8/1936	Timian	123—52 X
2,227,247	12/1940	Conover.	
2,227,500	1/1941	Johnson et al.	
2,700,964	2/1955	Nallinger	123—193 X
2,763,254	9/1956	Klug	123—191
2,767,694	10/1956	Boghossian	123—41.82 X
2,769,438	11/1956	Witzky	123—193
2,974,654	3/1961	Bouvy	123—195 X
3,022,775	2/1962	Bouvy	123—41.82
3,168,081	2/1965	Bauer	123—195
3,168,083	2/1965	Buchanan	123—191 X
3,186,387	6/1965	Kolbe et al.	123—41.82 X

AL LAWRENCE SMITH, *Primary Examiner.*

CARLTON R. CROYLE, *Assistant Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,351,044 November 7, 1967

Laurence Evelyn Wood Pomeroy

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

In the heading to the printed specification, line 10, after "14,952/64" insert --, July 23, 1964, 29,682/64 --.

Signed and sealed this 25th day of February 1969.

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents