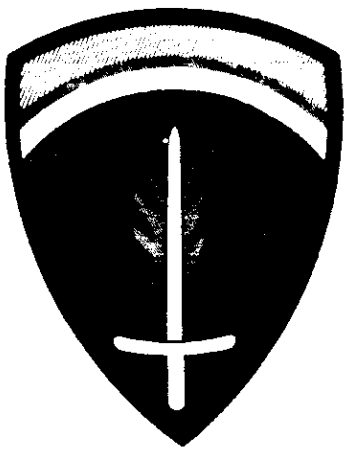
FIAT FINAL REPORT 1153

MAHLE HOT CHAMBER PRESSURE DIE CASTING MACHINE



OFFICE OF MILITARY GOVERNMENT
FOR GERMANY (US)

FIELD INFORMATION AGENCY, TECHNICAL

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MAHLE HOT CHAMBER PRESSURE DIE CASTING MACHINE

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A B S T R A C T

The value of the Mahle hot chamber die casting machine has been the subject of considerable controversy. It has been criticized as being too complicated and too dangerous to find application in the United States. This report explains the reasons for its development, namely, it was designed for casting alloys which are highly subject to oxidation, and which cannot be handled by ordinary cold chamber type of equipment.

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I N T R O D U C T I O N

Objective:

The purpose of this investigation was to determine, if possible, the basic reasons for the development by Mahle G.m.b.H. of a special hot chamber type of die casting machine and, to examine its advantages over the cold chamber type of equipment generally used in the United States.

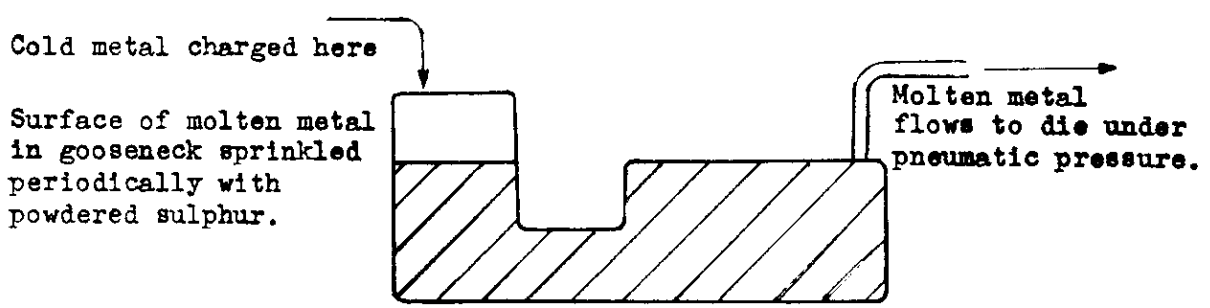
Evaluation:

This target has been repeatedly visited and a complete machine of the D type pneumatic Mahle design has been evacuated to Frankford Arsenal.

The Mahle type of hot chamber die casting machine was developed solely to permit a wider use of "Electron", a magnesium alloy of 9% aluminum, 1% zinc max. and the balance magnesium with contaminations of copper not to exceed .02%. For various applications this alloy has to be die cast, because it had been found impossible, at that time (as early as 1926), to satisfactorily forge and form material of this composition. The machine is extremely complex and somewhat dangerous to operate as all sorts of precautions are necessary to avoid squirting of the hot metal. It is fast (a ratio of 3 : 2 as compared with the cold chamber type). This equipment is of no interest for the casting of the usual aluminum-zinc compositions, but has a definite place for the die casting of alloys which are highly sensitive to oxidation.

DETAILS OF OBSERVATIONS AND DISCUSSIONS

The hot chamber machine was developed to prevent all surface oxidation of the liquid metal. The chamber has a gooseneck type or churning design charging end, which serves the purpose of keeping the metal from exposure to the air.



The machine is very complex, being operated hydraulically (H_2O for movement of dies) and pneumatically for the pressure on the liquid metal (this pressure is dependent on the type of machine and the size and section of the part to be cast) but ranges usually between 60 and 100 atmospheres. In view of its general arrangement and the possibility of leakage, a multiplicity of safety features has been included.

The die material used is of the following composition:

C	.40%	Si	.50% max.
Mn	.50% max.	Cr	1.2 to 1.6%
	W	8.00 to 10.00%	

The steel is received in the fully annealed condition and is then machined and hardened to C 40 to 42 Rockwell. No castings are ever made on an unhardened die. The dies are thoroughly preheated before use.

The advantages of pneumatic versus piston pressure application in hot chamber die casting are stated as:

(a) Elimination of all irregularities in pressures

(b) Avoidance of piston wear - and resulting pressure loss

(Since the above holds true only for the hot chamber type of machine it need not be considered with cold chamber equipment.)

The Mahle machine was built in four sizes, type C, D, E and F (the F machine was never completed). At present the available equipment consisted of five C-type machines, three D-type machines and one E-type machine. Ten Pollack cold chamber machines are available.

The hot chamber machines are operated by two men. The temperature for the magnesium alloy is carefully controlled at 650 to 660°C.

Actually, Mahle would not use this machine at all if it were not for the difficulties encountered in forming this particular magnesium alloy, or if oxidation could have been eliminated by some other means, such as by the addition of beryllium, had it been available.

A P P E N D I X 1

LIST OF TARGETS VISITED & GERMAN PERSONNEL INTERVIEWED

Name	Position	Location
Herr Gustav Lieby	Manager	Mahle G.m.b.H., Stuttgart-Fellbach.

APPENDIX 2

BIBLIOGRAPHY

Copies of the reports and microfilm listed below were transmitted to Washington, D.C. Inquiries should be addressed to:

Office of Publication Board,
U.S. Department of Commerce,
Washington 25, D.C.

1. Microfilm No. CC-295
   Drawings of Mahle Hot Chamber Die Casting Machine
   (12 drawings)

2. FIAT Technical Bulletin No. TB. 28, "The Mahle Die Casting Machine" by Gustav Nyselius (in process).

3. FIAT Final Report No. 89, "Mechanical and Industrial Developments in Magnesium" by J.D. Hanawalt. Located at FIAT Records Branch, File No. TA 480/P116.