

## Development of Complete Gravity Die Casting Production System for Aluminum Castings

Yukiyoshi Funakoshi<sup>1</sup>, Keishiro Kaneda<sup>1</sup>  
<sup>1</sup> SINTOKOGIO,LTD. Toyokawa, Aichi, 442-8505, Japan

According to the world population explosion, it is expected the demand for automobile will still go up at least until 2050. It is required for manufacturing equipment to improve the productivity and quality under above-mentioned situation. Especially, the improvement of the aluminum casting equipment is required greater since aluminum castings are important components in order to reduce weight of automotive parts. To meet this demand, it is very important to optimize into complete system as well as improving each device in each process.

Gravity die casting method is popularly utilized for light metal castings especially to get high strength and pressure tightness. Authors have developed a completely new gravity die casting machine, which achieves energy saving and downsizing and also allows producing quality castings with above mentioned advantages. The authors also offer the complete system from melting to finishing in order to deliver the following benefits for foundries with this completely new gravity die casting machine as core device.

**Keywords:** gravity die casting, high strength, pressure tightness, energy saving, downsizing,

### 1. Introduction

The developed gravity die casting machine has construction and feature which could produce high quality castings besides low energy, downsized and also improves maintenance. Figure 1 shows the outside of equipment.

### 2. Feature

#### 2.1 Producing high quality castings

The developed machine enables to pour molten metal into cavities without turbulence since the center of matching-die rotating axis is about the same, it reduces ladle tilting distance.

Application of the servo motor for die tilting mechanism allows molten metal flow without turbulence since shock and oscillation are reduced.

Additionally, pouring movements is up to each type of dimensional shape cavity and pouring condition is managing by patterned. When flame exchanging actualized pouring high reproducibility and quality stabilization by pattern choosing. Figure 2 shows structural drawing.



Fig.1 Development machine

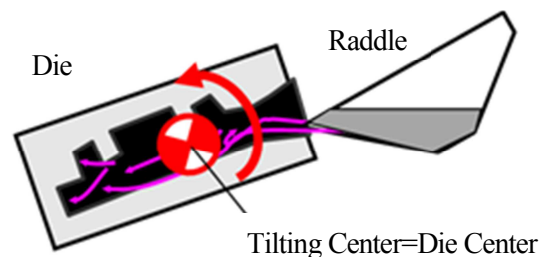


Fig.2 Tilting method

#### 2.2 Energy saving

Figure 3 shows the comparison of the electric power consumption taking conventional machine as a base of 100.

As shown in this figure, the developed machine saved energy 80% compared to the conventional machine. The main reasons are following: (1) the number of actuators was reduced because one actuator operates multiple actions (2) Actuators power was reduced because the rotation center is set near the die center.(3) The machine weight is reduced. (4)

Optimizing the hydraulic unit control. These features reduced the machine running cost.

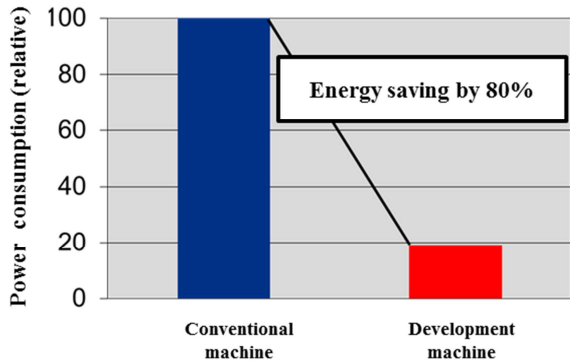
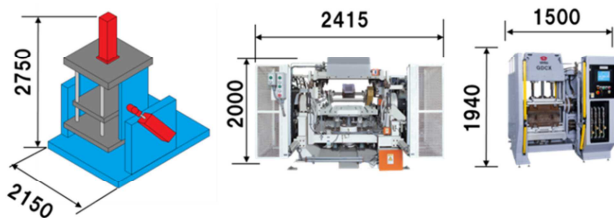


Fig.3 Effective save energy

### 2.3 Downsizing

Figure 4 shows the machine size comparison with (a) cope up-and-down method, (b) cope flip-up method and (c) developed machine taking (a) cope up-and-down method as a base of 100.

This comparison shows that new die casting machine realized the significant downsizing with new die opening system. The developed machine reduced the size 40% compared to up-and-down method and 50% to core flip-up method.



(a) Cope up-and-down method (b) Cope flip-up method (c) Development machine  
 (a) 100 : (b) 85 : (c) 52

Fig.4 Comparison of machine size

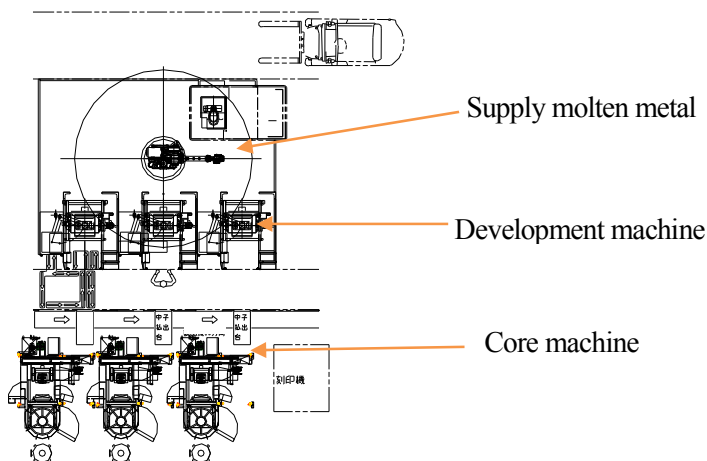


Fig.5 Total traceability(ex.)

Therefore the developed machine is easy to upgrade from the existing machine and install more machines thanks to the flexibility of the layout.

### 2.4 Total traceability

This developed machine monitors various data such as die temperature, cooling flow, tilting pattern, cycle time, etc to utilize them for total traceability. In addition, production data in entire die casting system are monitored and integrated as a database with combining with core making machine or pouring machine.

Figure 5. shows the example of total traceability in entire system. This system is able to clarify the points to be improved for quality aluminium casting and it leads to reduce the casting defects.

### 3. Conclusion

Authors have developed a completely new gravity die casting machine, which achieves energy saving and downsizing and also allows producing quality castings with reconsidering the conventional die casting machine. Moreover, application of the servo motor for die tilting mechanism improves the casting quality.

Authors believe that this developed die casting machine contributes to produce higher quality die casting.

