Construction of an Oil Pump Rotor Production Line with High Productivity

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Abstract

New product line with additional secondary operation of oil pump rotor was built in necessity of increasing ca pacity. This new line includes steam treatment process after sizing. The new line achieved 1.6 times higher perfo rmance compared with a conventional line.

Keywords : Oil Pump Rotor, Hydraulic-Knuckle Joint Press, AGV, High Productivity

1. Introduction

Fig. 1 Oil Pump Rotor

Newly designed oil pump rotor for automobile engines was produced since 1981 in Japan. One special product line was introduced and the line had 3 powder compaction presses, 1 sintering furnace, and 3 sizing presses. Since sintering furnace in this line had more capacity than 3 compaction presses and 3 sizing presses, additional 1 compaction press and 1 sizing press were introduced according to the increasing amount of engine oil pump rotors production. In these 20 years application is expand to AT (Automatic Transmission) and CVT (Continuously Vriable Transmission) and due to recent volumetric increasing demand. Construction of another line became necessary for increasing capacity.

A new line has 2 powder compaction presses, 1 sintering furnace, 2 sizing presses, and 2 steam treatment (ST) furnaces, and its expected productivity is 1.6 times of an old line.

2. Results

All products of a new line have processes, compacting - sintering – sizing, and ST. Compacting press with hydraulic / knuckle joint combined mechanism was chosen from the points of initial price and running cost. The merit of hydraulic press is “possible to change stroke depend on tools”. And the merit of knuckle joint press is “high speed”. The new press has both merits of these two types of presses.

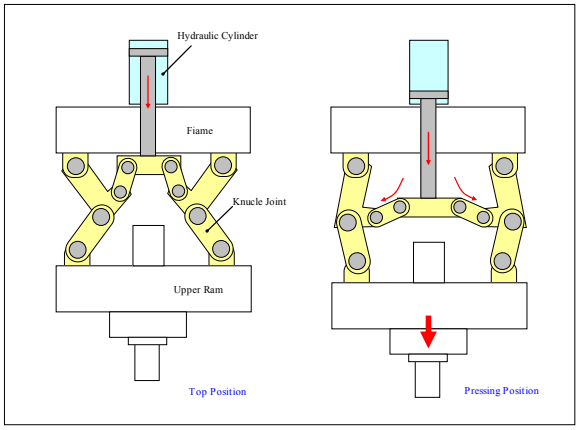

Fig.2 Hydraulic / Knuckle joint combination press

The structure of this press is simple compared with conventional mechanical press, because this press does not have complicated rotation system in its drive unit (Fig.2). However, there was not such a powder compacting press and this press was developed for the first time in cooperation with a press maker.

In addition, the press has a lower ram with hydraulic servo drive and a servomotor driver filling device. These numerical control systems could give special filling method that has been developed for a long time. By this system, better uniform density products could be obtained in shorter filling time, compared with conventional presses. And it gives products better parallelism of over all length. Relation between filling time and a product parallelism is shown in Fig.3.

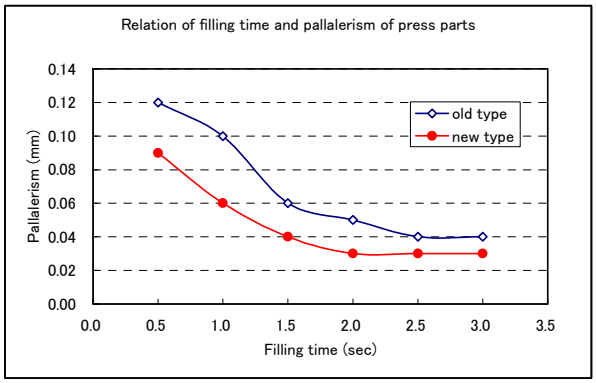

Fig. 3 Filling time and product parallelism

Another installed powder compacting press is conventional mechanical press, but filling device has been substituted for one with servomotor drive. All green parts compacted by these two presses are automatically collected on the screen with tray. The trays are stacked up 10 layers, and then each layer is automatically transported to a sintering furnace by Auto Guided Vehicle (AGV). Each screen with products is supplied into the furnace by a loading system automatically.

The furnace is remodeled idle furnace for oil pump rotor by our maintenance section.

The AGV transports screens from an exit of a furnace to sizing press also. At an exit of the furnace, 2 kind of different parts are distinguished and those screens are separated and collected on the designated tray. And they are transported to the designated press, and sintered parts are supplied to the press. The sizing presses has also Hydraulic / Knuckle joint upper ram system same as powder compacting press. And it is cheaper than conventional mechanical press, but realizes high-speed operation. The lubricant for sizing and it requires no de-oil process before ST. And after sizing products are directly arranged in steel case for ST by the robot.

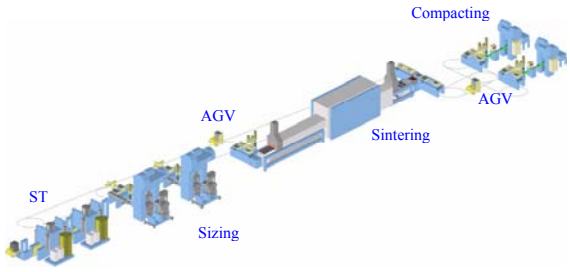

Fig. 4 A New Production Line

As ST process is in batch operation, 50 layers are stocked after sizing. After ST process they are shipped to machining shop. This line succeeded in raising productivity and achieved target of 1.6 times higher than the old line. Because of the lack of capacity of the old line, oil pump rotor production amount out of this line was 54%, but after introducing this new line only 11% rotor products are out of these two automated lines (Fig.5).

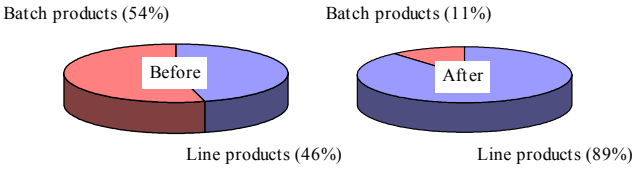

Fig. 5 Rate of products in Line and Batch

3. Summary

New line has introduced for 1.5 years. This new line has already achieved target productivity of 1.6 times higher than the old line. But improvement of further productivity and reduction of a production cost will be expected in this line.

4. References

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