

FMS

Refer to “Incorporation of Processing of Base Plates for Piston Motors into FMS Lines” (page 13)

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What is FMS?

FMS is the acronym for “Flexible Manufacturing System” and refers to a highly flexible production system that can efficiently produce batches of many different parts. The main features of FMS include systematic interfacing among parallel processing equipment and various devices including stockers, and efficient production of a variety of products by leveraging unattended operation.

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Examples of Configuration

Based on an example of configuration of FMS systems (Fig. 1) manufactured by Makino Milling Machine Co., Ltd., the following introduces the functions:

[1] System PC

A personal computer (PC) for controlling the FMS system. The PC is linked to individual equipment units via communication lines. The system PC issues production commands, based on which instructions are sent to equipment units. The operator can view the operating status of equipment units and work instructions to the set-up station, etc., on the PC screen (Fig. 2).

[2] Stocker

Several types of jig can be stored in a stocker so as to produce many different parts that cannot share the same jig. For a set-up change, the system PC can call the relevant jig to complete the set-up. The stocker capacity is decided by the types of parts, the number of lots, the time zones of unattended operation, and other factors. The stocker can house jigs with their work installed.

[3] Machining center (MC)

In many cases, parallel type machining centers are introduced. The number of machining centers is decided by the work processing time and production volume.

[4] Guided vehicle

A vehicle used to automatically transfer materials to equipment units. Stacker cranes, loaders, and robots are

used as guided vehicles.

[5] Set-up station

An area used to attach or detach workpieces. Work, after being attached or detached, is automatically transferred to equipment units for processing with a command from the system PC. Unattended operation is enabled by supplying work waiting for processing to the stocker.

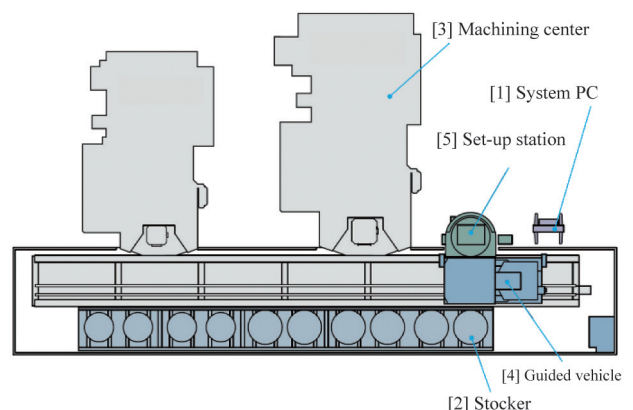


Fig. 1 Example of FMS configuration

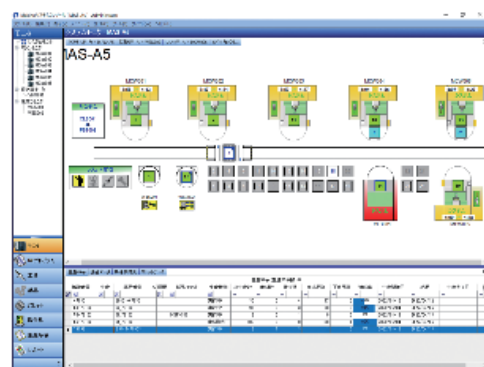


Fig. 2 System PC screen

Reference

1) Pallet Transfer System, MODULE MMC 2

<https://www.makino.co.jp/ja-jp/machine-technology/automation/pallet-system>

Counterbalance Valve

Refer to “Development of Anti-cavitation Vane for Travel Motor of 7-ton Hydraulics Excavator” (page 28)

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What are Counterbalance Valves?

Counterbalance valves are used to prevent hydraulic actuators installed in construction machinery or machine tools from dropping with their own weight or to maintain the descending speed of such actuators. The counterbalance valve limits the flow rate in one direction and lets fluid flow freely in the other direction. Actuator controls speed by generating back pressure so that it does not exceed the control speed.

Fig. 1 shows a structural drawing of a counterbalance valve. When the inlet pressure in the valve is not more than the pressure setting of the spring, the spool is kept pressed down. When the inlet pressure is higher than the pressure setting, the spool is pushed up to open the outlet port, releasing oil. If it is necessary to let pressured oil flow from the outlet port side to the inlet port side, a check valve should be installed in the circuit.

For example, the counterbalance valve can be used to prevent a vertical press machine from dropping with its own weight. Another example of an application is a drilling machine using a cylinder where the counterbalance valve is installed in a hydraulic circuit designed to prevent the piston rod from abruptly sticking out when the load resistance suddenly decreases upon completion of a drilling process.

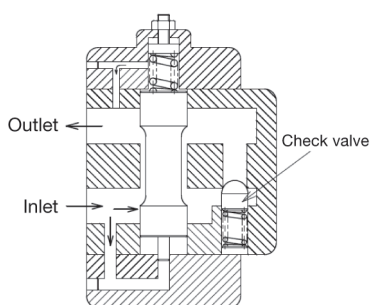


Fig. 1 Counterbalance valve

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Counterbalance Valves for Travel Motors

Travel motors for hydraulic excavators or other open circuit applications are equipped with counterbalance valves. Fig. 2 shows a circuit diagram of a travel motor. The counterbalance valve for travel motors has the following two functions:

[1] Motor braking

The counterbalance valve is combined with a relief valve or an anti-cavitation valve to constitute a braking circuit that can apply a braking force to the piston motor so as to bring the motor gradually down to a stop.

[2] Overrun prevention

Where a piston motor is forced by an external load to be rotated at a speed higher than the rpm decided by the supply flow rate (pumping effect), the counterbalance valve is used to control the motor speed to a level suitable for the supply flow rate.

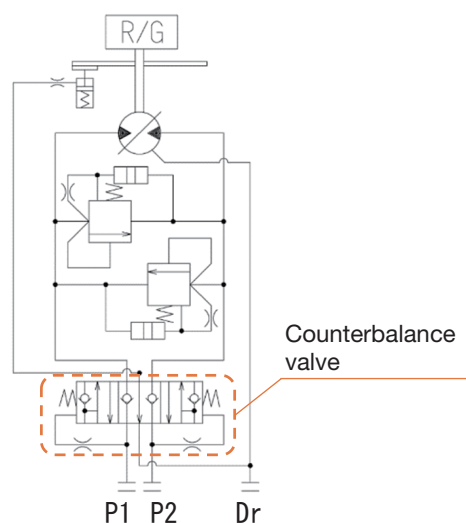


Fig. 2 Hydraulic circuit diagram of counterbalance valve for travel motor (relief valve type)