LINE ALLOCATION OF WORKPIECE CARRIERS IN A MODULAR ASSEMBLY SYSTEM

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LINE ALLOCATION OF WORKPIECE CARRIERS IN A MODULAR ASSEMBLY SYSTEM

Technical task:
This idea describes a method of how the workpiece carriers are assigned to a particular line, but cannot block others.

Initial situation:
In a modular assembly system, workpieces are conveyed in the assembly process from one station required for the process to the next via a driverless transport system. The route corresponds to the work plan, i.e. the required assembly sequence and the capabilities of the individual stations, e.g. press-fitting, screwing, etc. If the capacity of such a system is not sufficient, it can be expanded as required if the corresponding production areas are available. In this case, the expansion is even possible in such a way that the already existing systems are not disturbed and can continue to produce. As soon as the extension is completed, the new stations can be included in the work plan. If these are individual stations, they can be arranged as alternatives to the existing ones and it can be decided at runtime which station is more suitable.

It is also possible that the capacity increase includes almost all stations and that it is a new assembly line and you want to separate the complete new line from the old line (for reasons of operation, employee assignment, shift models, and so on). It is also possible that only parts of the line are affected and other parts are used together again. These can be, for example, particularly expensive resources such as test benches or stations that have to be redundant due to setup times or reliability.

Furthermore, it may be necessary, also for operational and organizational reasons, to assign the workpiece carriers directly to the individual lines. However, this brings with it the danger that the lines can block each other. Assuming there are three lines A, B and C. on one section that is shared by all three lines. If the workpiece pallets of the three lines are one behind the other, the workpiece pallet of line A can be picked up next and would have to be fed back into a segment of line A. If in this case line A is not ready for pick-up, the workpiece carrier is not picked up and would block lines B and C.

Solution:
For the sake of simplicity, we will consider only two lines below. But the procedure can be extended to n lines.

For this purpose the workpiece carriers are divided into 2 pools. If, for example, there are 70 workpiece pallets and the ratio is 30:40, for example, the WTs 1001 to 1030 belong to line 1 and the workpiece pallets 1031 to 1070 belong to line 2. This allocation is fixed as long as this allocation does not lead to a standstill of the assembly.

Even then, the fixed allocation is not dissolved.

Assuming the case, the two lines run strictly separated at the beginning of the assembly process. This would mean that a workpiece carrier from the range 1001-1030 is always started on line 1 and vice versa 1031-1070 always on line 2. Now the following case occurs. Workpiece carrier, e.g. 1005 delivers its finished component to shipping and is available for the next cycle (next order) and would have to be started on line 1. However, this line is blocked. Then you start this workpiece carrier exceptionally, normally once on line 2, so that the workpiece carriers following it are not blocked. In the following pass, it is started again on the line to which it belongs. This means that the temporary change to the wrong line is automatically corrected.
If a workpiece carrier is requested by the rework, the next one that becomes free is used. This can also cause this workpiece carrier to run on the line that does not belong to it (chance 50:50) until it reaches the last station again. This change is also only temporary.

If one of the two lines is blocked longer due to a malfunction, this can lead to a temporary increase in the number of workpiece carriers in the line still running. It is important to ensure that the line does not become so full that the workpiece carriers block each other. In this case, organizational intervention is required.

The workpiece pallets can be assigned to the lines via an input mask and the result can be stored in a database.

The problem of lines blocking each other also occurs if the workpiece pallets are not permanently assigned, but are started on both lines in a ratio of 1:1 in order to keep the ratio equal. This would mean that a workpiece carrier coming from the shipping department is started alternately on one of the two lines. If it is not possible to start on the next alternating line because it is not receptive, a temporary deviation from this would be necessary. As soon as both lines run evenly, the 1:1 ratio is automatically reset after a certain time. In this case, too, it can happen that one line picks up a large number of workpiece carriers if the other line is disturbed for a longer period of time and has to be counteracted.

If a corresponding buffer belt for workpiece carriers is available, countermeasures can be taken automatically in this case and also in the upper case, in which the too many workpiece carriers are stored on the buffer belt, until the fault is eliminated. Afterwards they can be automatically fed back into the process.

**Advantages:**
Uniform or desired distribution of the workpiece carriers in an assembly system without blocking several lines with each other, blocking would mean loss of production.