Chapter 9
One-piece Production in Practice

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CONTENTS

9.1 REQUIREMENT FOR ONE-PIECE PRODUCTION

- In the JIT system, *one-piece production* or *single-unit production* is the concept of having things flow smoothly through the factory one by one, like water, without any holdups.

- The workers must be multi-skilled operators.

9.1 REQUIREMENT FOR ONE-PIECE PRODUCTION

- There are three essential requirements for one-piece flow.
  - working standing up
  - multi-process handling by multi-skilled workers
  - autonomation
- Do not try to achieve perfection at once.

9.2 RESISTANCE TO WORKING STANDING UP

- Managers should explain why it is necessary to work standing up.

Necessity No. 1:

- On an assembly line, it is difficult to share the workload equally among the workers.
- An overlap zone can be established between neighboring operators.
- When the workers are working standing up, they can move in and out of this overlap zone freely.

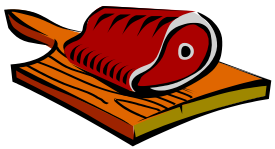
9.2 RESISTANCE TO WORKING STANDING UP

Necessity No. 2:

- Working standing up is a fundamental prerequisite at the heart of TPS. Take cooking in kitchens as an example.








9.2 RESISTANCE TO WORKING STANDING UP

Necessity No. 3:

- Practice shows that working standing up can eliminate the waste and strain in individual workloads.

- It can bring a better productivity, which is the quantity that each operator can produce during normal working hours in one day.

9.2 RESISTANCE TO WORKING STANDING UP

Benefits of working standing up

- Moving around more is good exercise and makes workers feel healthier.
- The posture of workers can improve.
- Neighboring workers can help each other out, so they can match their work rate to the pace of the line.

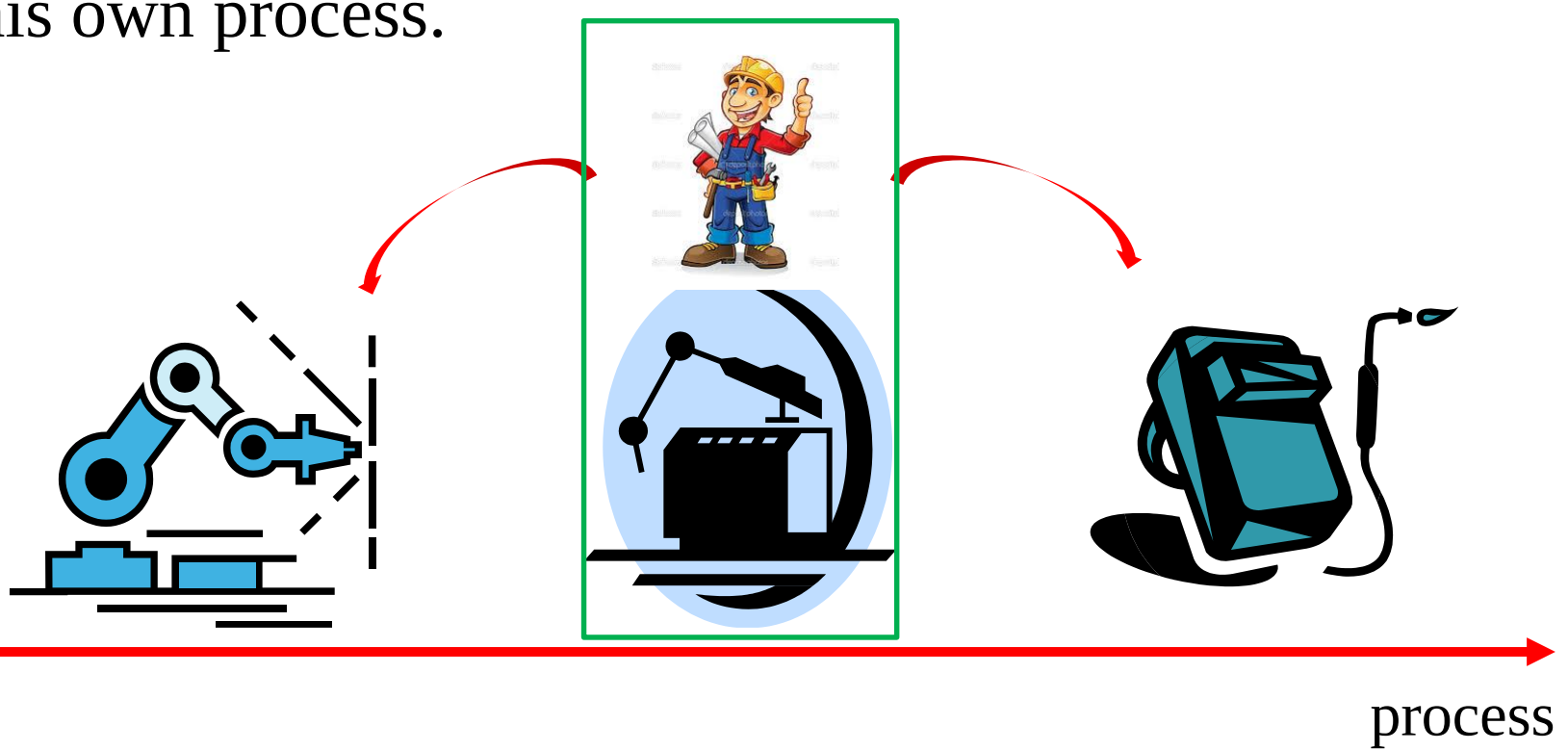
9.2 RESISTANCE TO WORKING STANDING UP

- Many companies failed to introduce TPS because their employees refused to accept working standing up.

- Managers should explain the necessities and benefits of working standing up to the workers or union representatives.

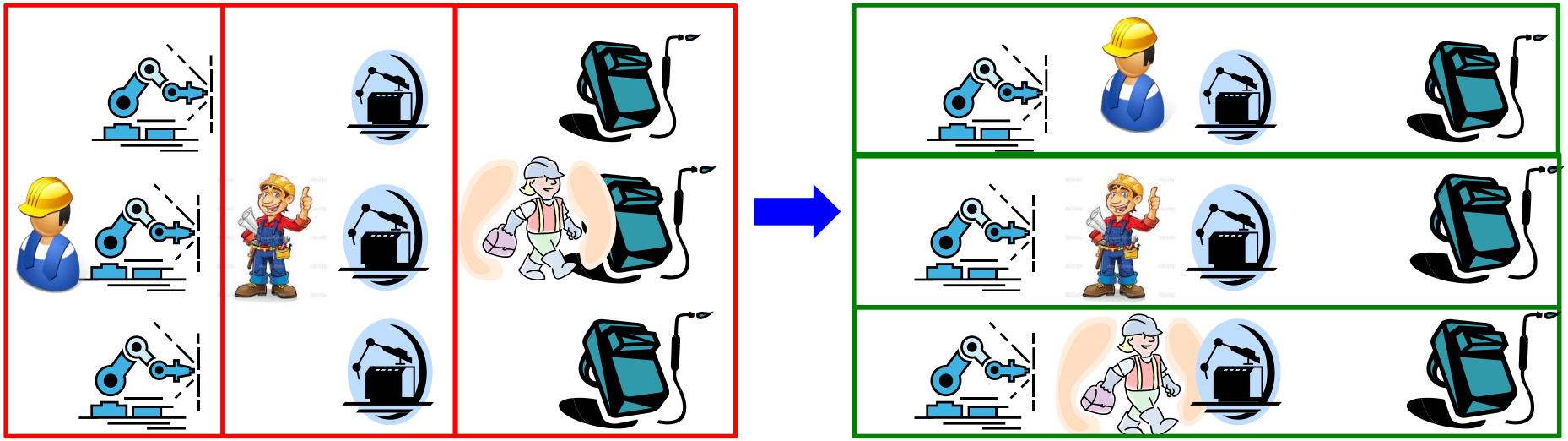
9.3 RESISTANCE TO MULTI-SKILLING

- The first step is that each worker learns how to do some of the tasks in the processes immediately after or after his own process.



9.3 RESISTANCE TO MULTI-SKILLING

- The second step is to have the workers learn to operate different machines little by little.



- Resistance exists due to the workers who have pride and confidence in their professional skills in particular operations.

9.3 RESISTANCE TO MULTI-SKILLING

- The third step is to explain the need for multi-process handling.

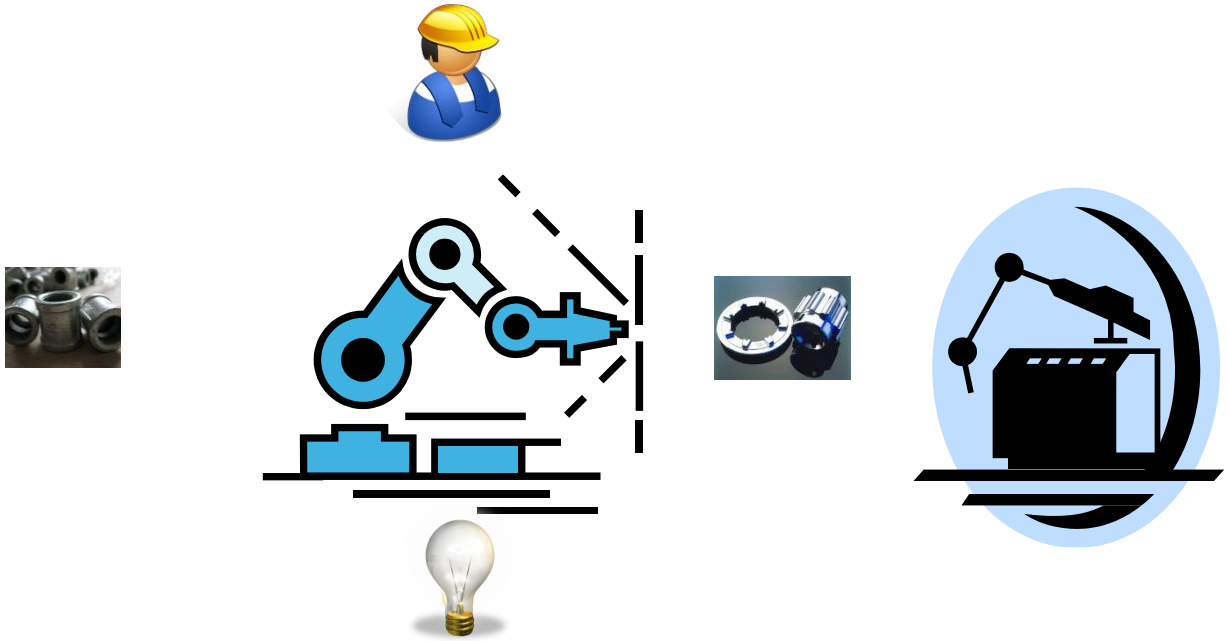
  - In current market, a large variety of products in small quantities are the customers' needs.

  - A system in which a fixed quantity of items is made every month no longer meets these needs.

  - One-piece production, achieved by means of multi-process handling can do it.

9.4 BARRIERS TO AUTONOMATION

- Under multi-process handling, machines have to be able to carry out their processing tasks automatically and switch themselves off when they finish the tasks.



9.4 BARRIERS TO AUTONOMATION

- In Toyota, this type of automation is called *autonomation* or *automation with human intelligence*.
- It is indispensable for multi-process handling which requires the improvement of machines.
- The production engineering department plays an important role in TPS.

9.4 BARRIERS TO AUTONOMATION

- The production engineering department needs to devise mechanisms for two things.

  - First, make the machines stop automatically when they finished each processing task.

  - Second, make the machines stop automatically when anything goes wrong during tasks.

9.4 BARRIERS TO AUTONOMATION

- Take an electric hole-punching machine as an example.

- This machine is used to make two holes in the left-hand side of a stack of documents in order to file them in a binder.

9.4 BARRIERS TO AUTONOMATION

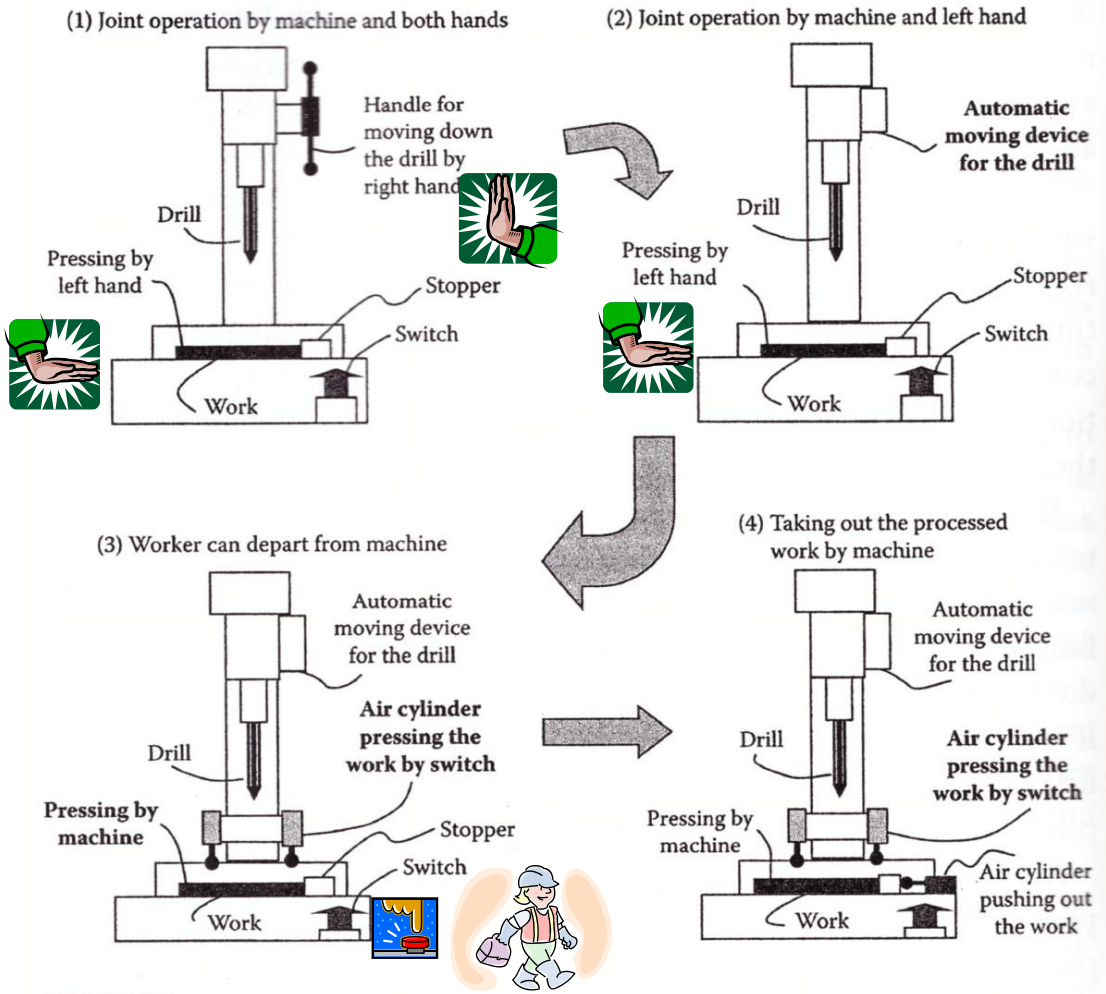


FIGURE 9.1
Separation of human operation from machine. (Adapted from Hirano, H. 1989. *100 Q&A for JIT Introduction*, Nikkan Kogyo Shinbun, p. 69, with partial revision.)

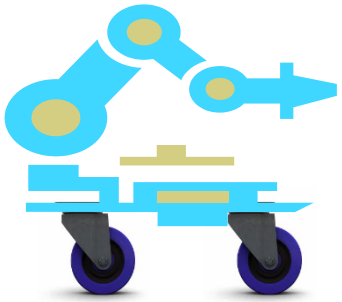
9.4 BARRIERS TO AUTONOMATION

- To take the automation a stage further, the following additional improvements would be added.

  - Automate the removal of the work piece after processing.
  - Automate the setting of the work piece on the machine.
  - Autonomate the machine so that it stops whenever a defective product is produced.

9.5 ATTACHING CASTORS

- With the castors attached to the bases, machines are movable at any time in response to requirements.
- This is a prerequisite for changing the layout of the machines.
- This is the first thing that ought to be done for one-piece flow.



9.5 ATTACHING CASTORS

- Machine modifications are needed to achieve the autonomation that allows the workers to leave their machines.
- The production engineering department plays an important role.
- These hardware improvements require a certain amount of additional expenditure.

9.6 SMOOTHED PRODUCTION

- Process-sequenced production implies multi-process handling.

- Set up separate lines (*cell lines* or *cell*) each of which makes a particular item.

  - The whole system is called *cellular manufacturing.*

9.6 SMOOTHED PRODUCTION

- When a large variety of models is being made, the number of cells for particular items can be large.
- The final assembly line should be a mixed-model line and the production must be smoothed.
- This minimizes the number of production lines and improves the investment efficiency.

9.6 SMOOTHED PRODUCTION

- There are three stages of mixed–model assembly.
  - Produce in sequence, lumping the total quantity of each model needed each month together.
  - Produce in sequence, lumping the average quantity of each model needed each day together.
  - Produce each model one unit at a time, matching the pace to the takt time of each model.

9.7 AN EXAMPLE

- Take a factory producing cabinets for use as flat-screen television stands as an example.

- When the factory used the *job-shop layout* (group and lay out the machines of the same type), there was a considerable amount of work-in-process.

- The factory switched to an arrangement of U-shaped lines and turned the final assembly line into a one-piece flow line.

9.7 AN EXAMPLE

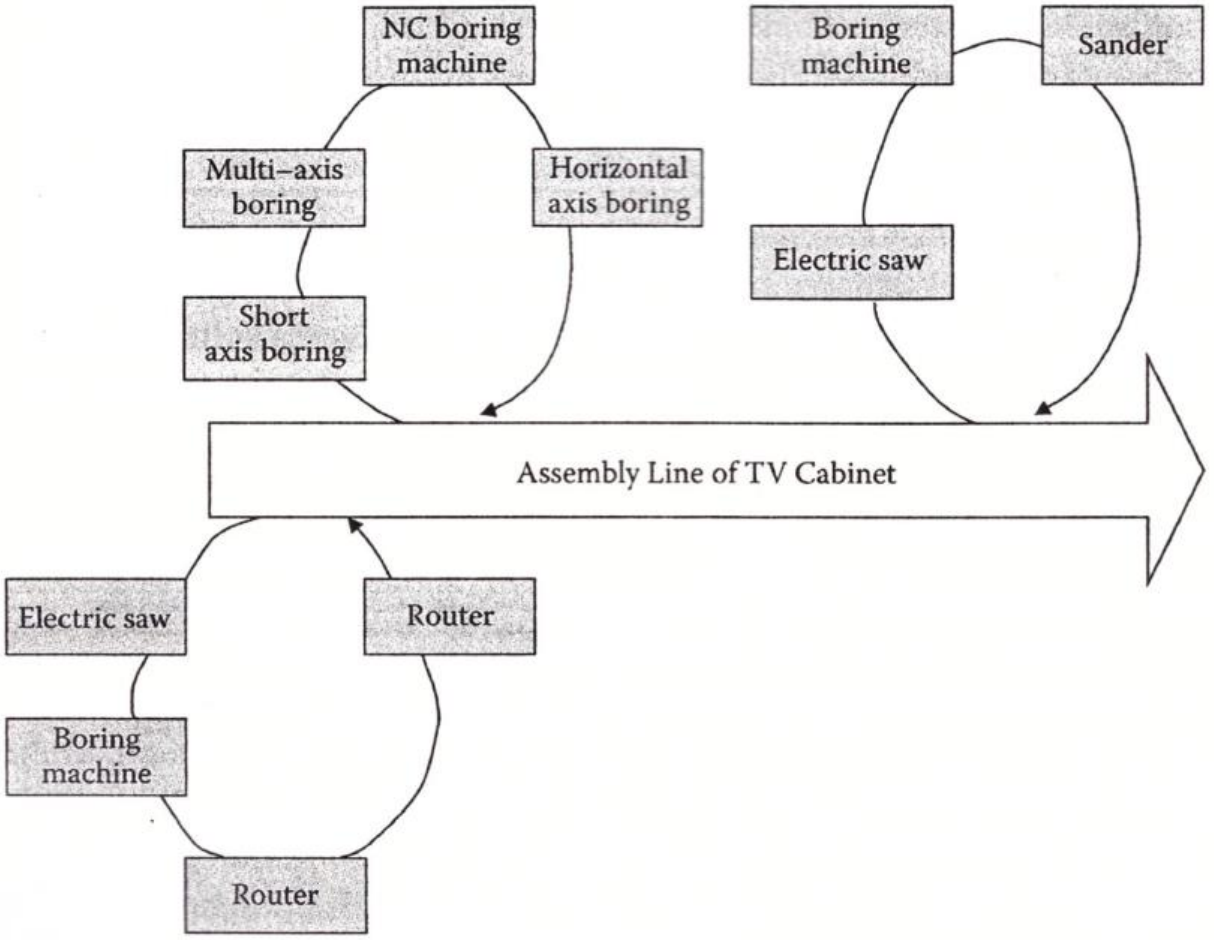


FIGURE 9.2
Example of improved layout: U-shaped multi-process handling in TV cabinet plant.