Chapter 11
Reduction of Setup Time – Concepts and Techniques

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CONTENTS

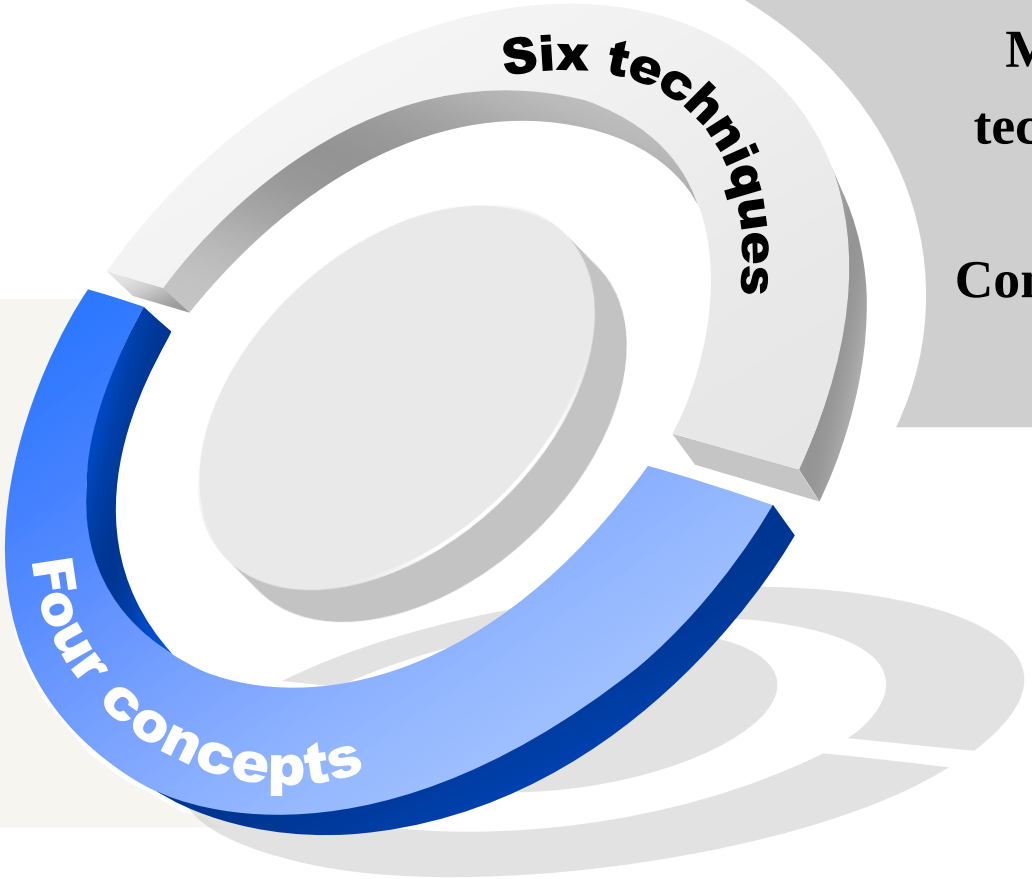
11.1 EFFECTS OF SHORTENING THE SETUP TIME

- A *single setup* means that the setup time has a single-digit number of minutes.
  - within 9 minutes, 59 seconds
- A *one-touch setup* means that the setup time is less than one minute.

11.1 EFFECTS OF SHORTENING THE SETUP TIME

- Advantages of a single setup.
  - minimization of stocks
  - job-order oriented production
  - prompt adaptability to demand change
- This concept is invented by ***Shigeo Shingo***.

11.2 SETUP CONCEPTS



Most of these techniques were devised for Concepts 2 and 3.

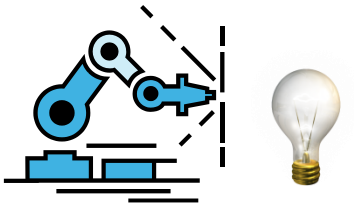
The setup actions for punch press operation will be an example.

11.2 SETUP CONCEPTS

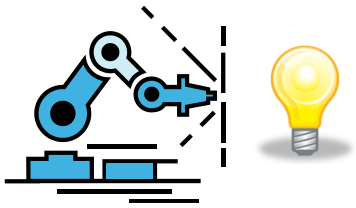
❖ Concept 1.

Separate the *internal setup* from the *external setup*.

- Internal setup refers to those setup actions that inevitably require the machine to be stopped.



- External setup refers to actions that can be taken while the machine is operating.



11.2 SETUP CONCEPTS

- Once the machine is stopped (internal setup is triggered), the worker should never do the external setup.
- In the external setup, the dies, tools, and materials must be perfectly prepared beside the machine.
- In the internal setup, only the removal and setting of dies must be done.

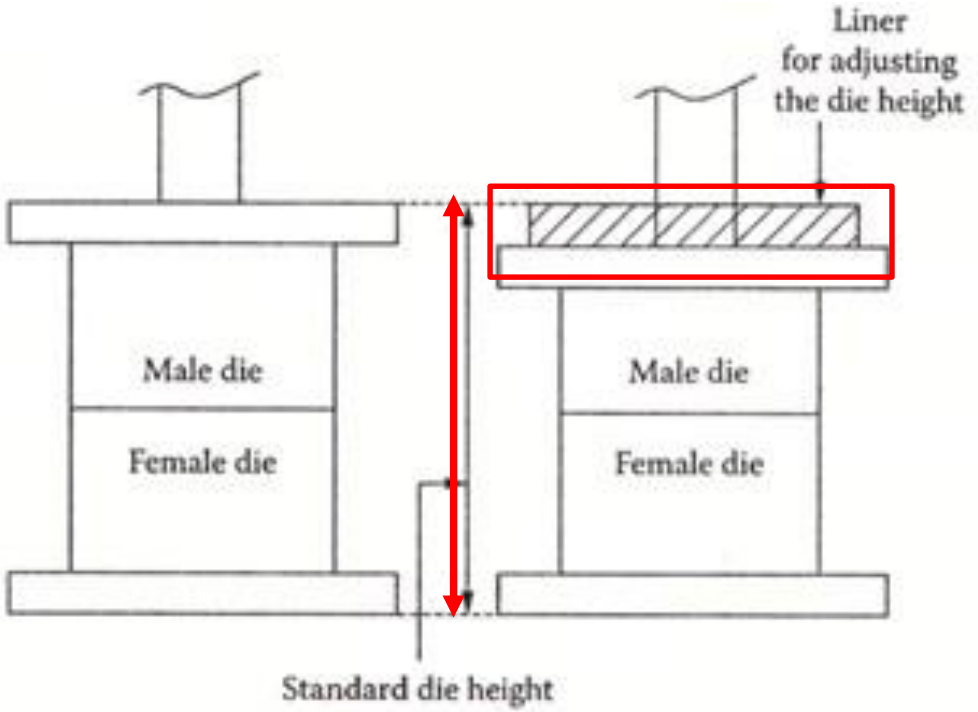
11.2 SETUP CONCEPTS

❖ Concept 2.

Convert as much as possible of the internal setup to the external setup.

- This is the most important concept for the single setup.
- Look at an example.

11.2 SETUP CONCEPTS



- Standardize the die heights of a punch press by using the liner
  - stroke adjustment will be unnecessary.
- Preheat the machine by using its waste heat
  - the trial shot to warm up the metal mold can be eliminated.

11.2 SETUP CONCEPTS

- Concept 3.

  Eliminate the adjustment process.

- Adjustment usually takes 50% to 70% of the total internal setup time.

- It is an incorrect notion that adjustment is essential and requires highly developed skills.

11.2 SETUP CONCEPTS

- Setting is a concept that should be independent of adjustment.

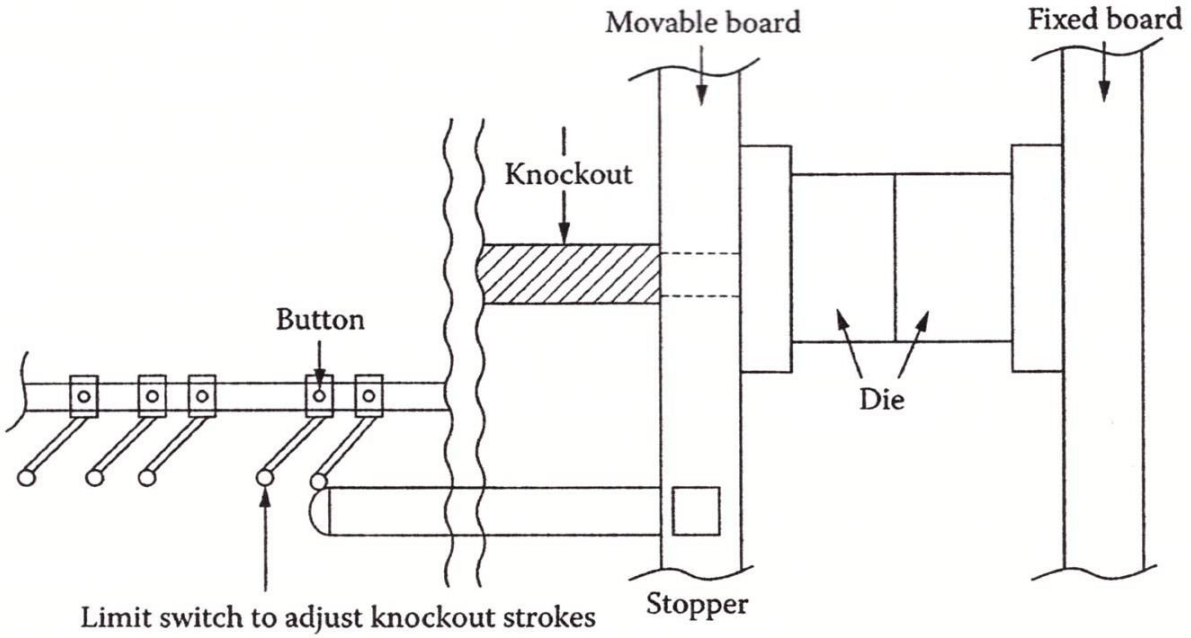


FIGURE 11.2
Installing limit switches at all required positions speeds knockout stroke adjustment.

11.2 SETUP CONCEPTS

- The company could standardize the die height at a certain size.
  - The stroking adjustment can be omitted.

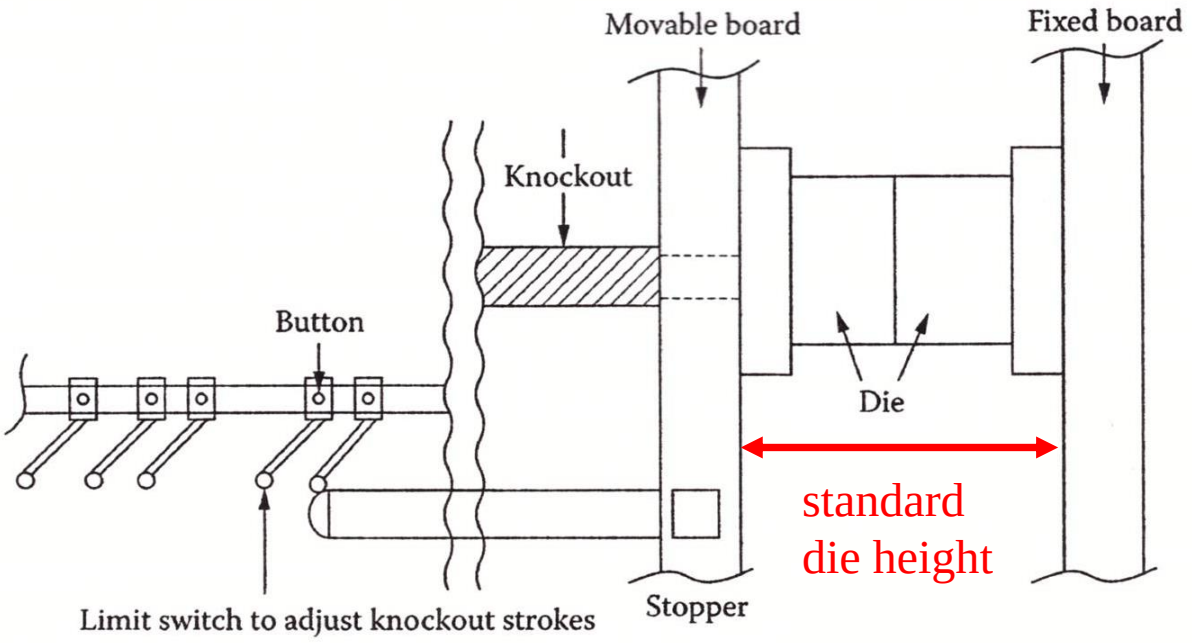


FIGURE 11.2
Installing limit switches at all required positions speeds knockout stroke adjustment.

11.2 SETUP CONCEPTS

- When the position of the limit switch needs changing to adjust the stroke, several switches can be installed at required positions.

One push on the button can finish the adjustment.

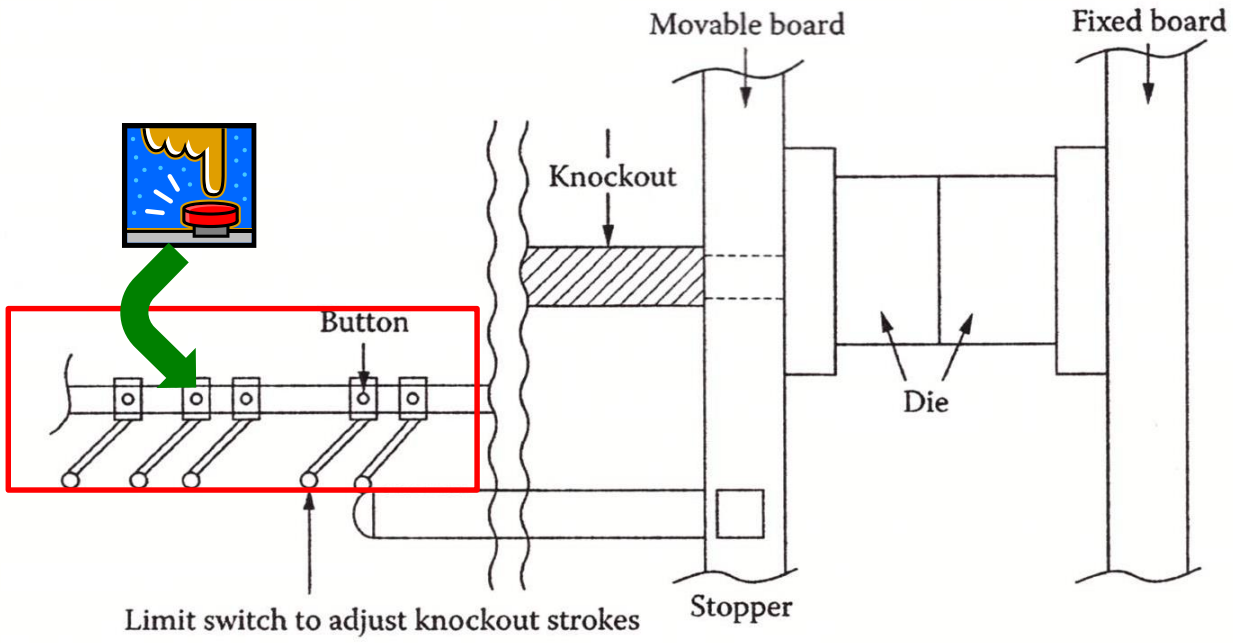


FIGURE 11.2
Installing limit switches at all required positions speeds knockout stroke adjustment.

11.2 SETUP CONCEPTS

- In the real world, only a few stepwise positions are needed.
- Such a system can be described as the *finite-settings built-in system*.
- This system enables one-touch setup.

11.2 SETUP CONCEPTS

- To exchange the dies on the stamping machine, a revolving table car is prepared.

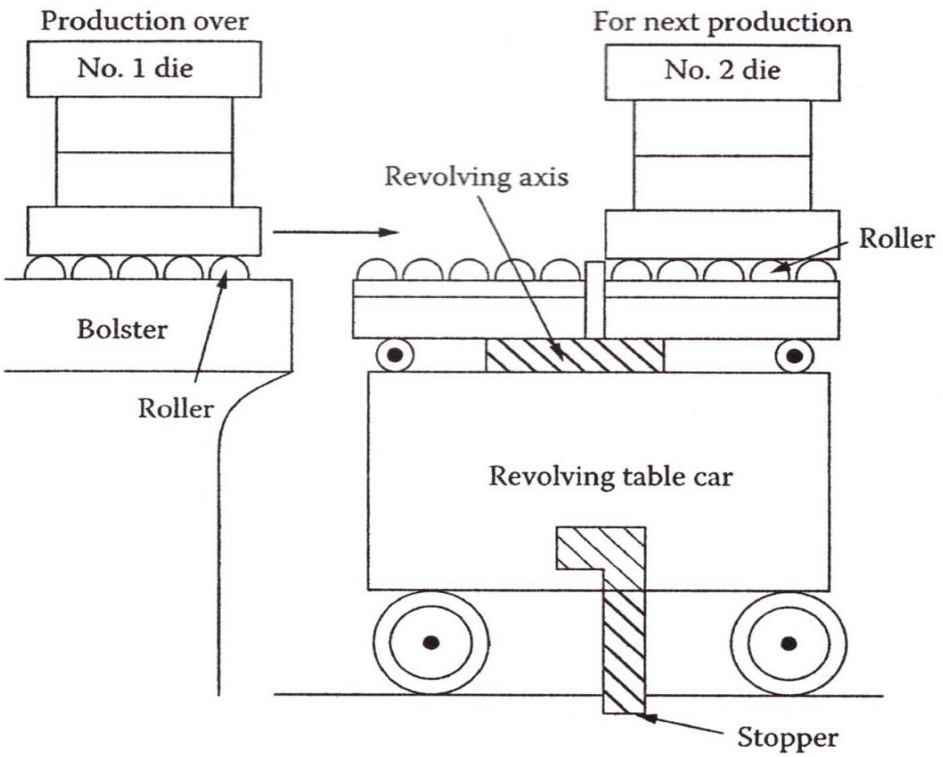


FIGURE 11.3
Revolving table car.

11.2 SETUP CONCEPTS

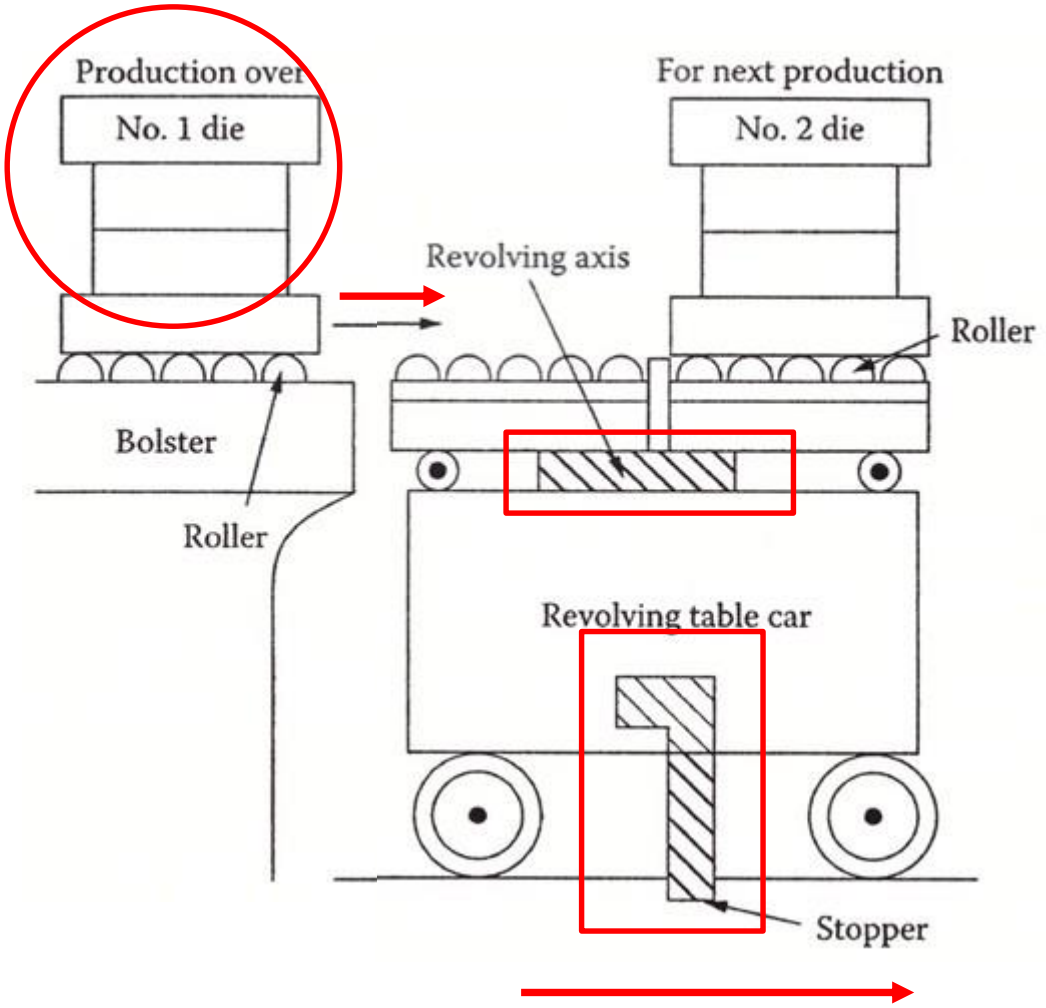
1. Detach no.1 die from the holder.

2. Push the table car to approach the press and then fix the stopper.

3. Put no.1 die on the table car.

4. Revolve the upper part of the car to set no.2 die onto the bolster.

5. Detach the stopper, pull the car far from the press and set no.2 die on the press.



11.2 SETUP CONCEPTS

❖ Concept 4.

Abolish the setup step itself.

- Use uniform product design and use the same part for various products.
- Produce the various parts at the same time.

11.3 CONCEPT APPLICATION

- Technique 1.

  Standardize the external setup actions.

- The operations for preparing the dies, tools, and materials should be made into routines and standardized.

- Such standardized operations should be mastered by the workers through training.

11.3 CONCEPT APPLICATION

❖ Technique 2.

Standardize only the necessary portions of the machine.

- It could be very costly to standardize everything.
- Standardize only the portion of the function necessary for setups.
  - such as the liner for standardizing the die height

11.3 CONCEPT APPLICATION

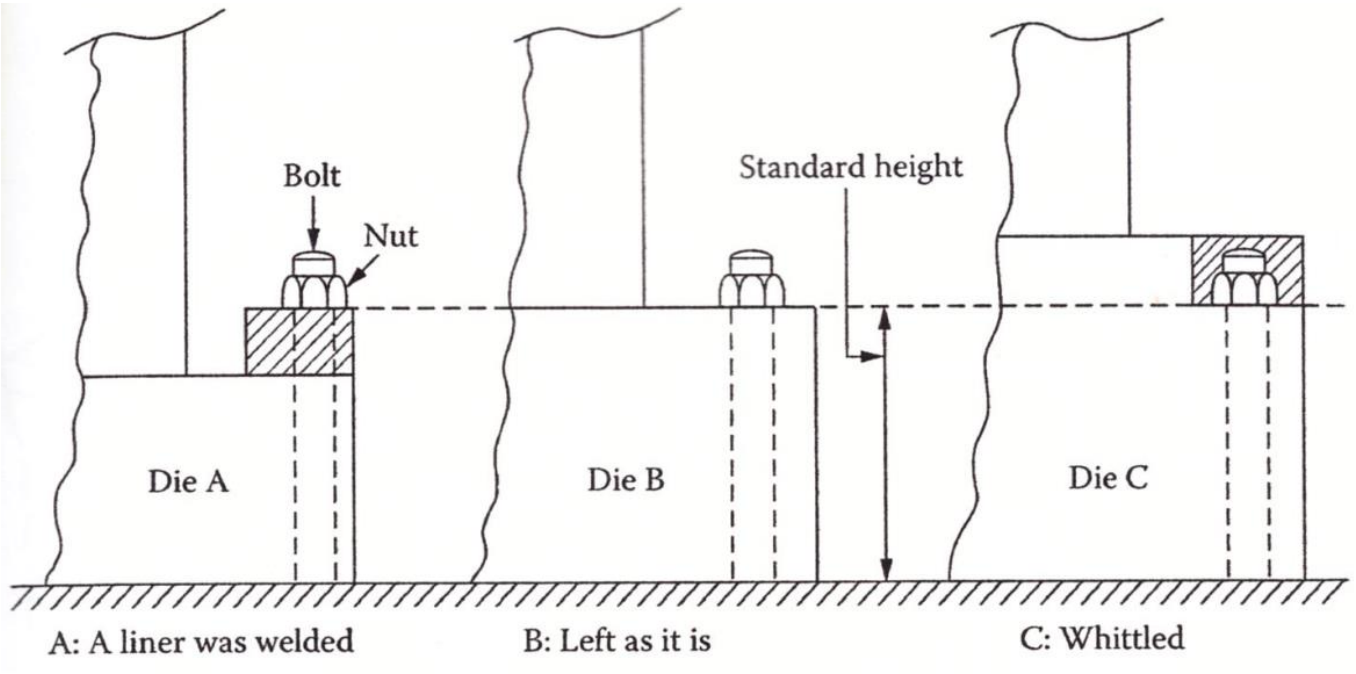


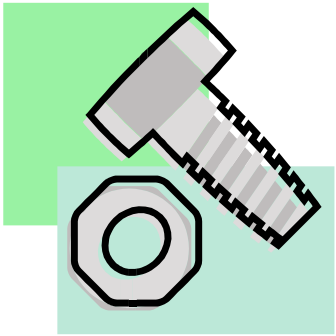
FIGURE 11.4
Standardizing die-holder height reduces the need to exchange fastening tools.

- Standardize die-holder height can reduce the need to exchange fastening tools.

11.3 CONCEPT APPLICATION

- Technique 3.

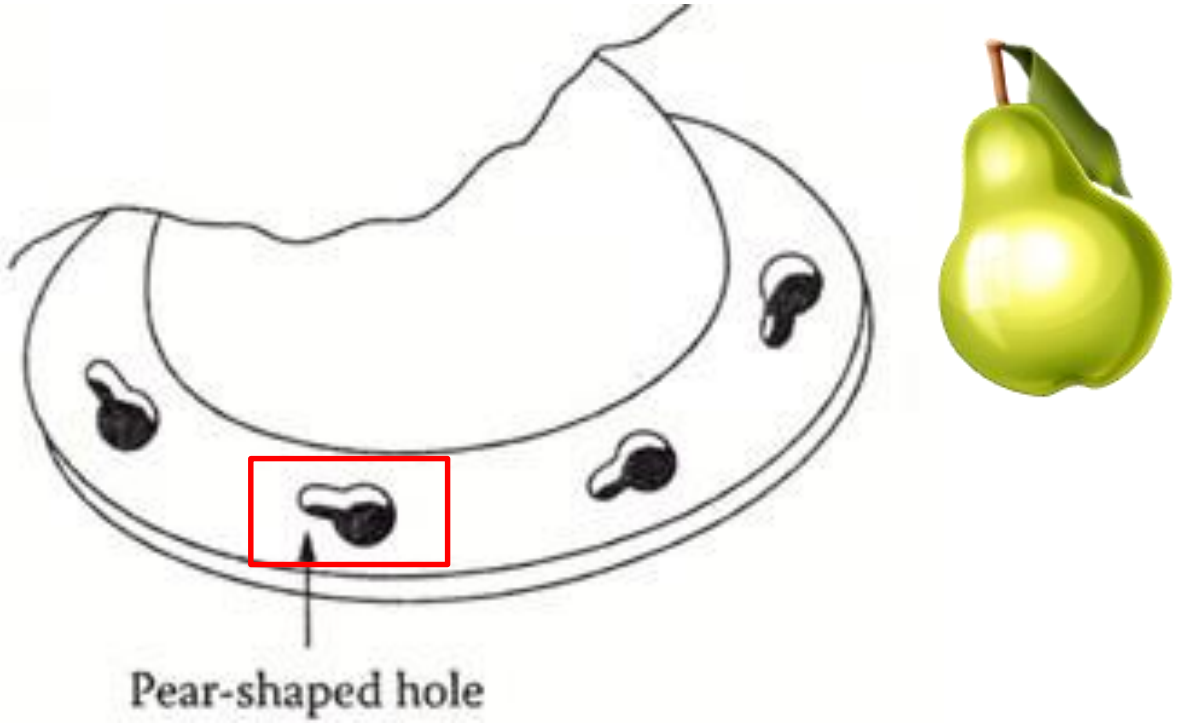
  Use a quick fastener.



- A bolt is usually the most popular fastening tool.
- A bolt fastens at the final turning of the nut and can loosen at the first turn.
- Devise a fastening tool that allows only a single turning of the nut.

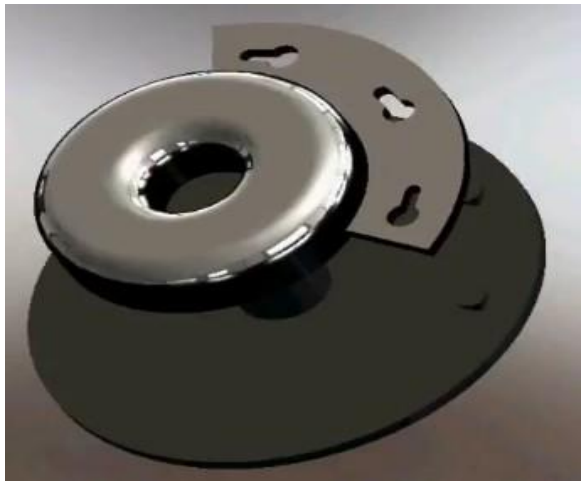
11.3 CONCEPT APPLICATION

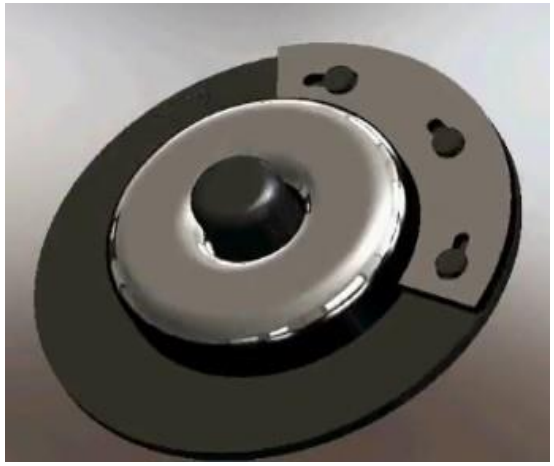
- Pear-shaped hole

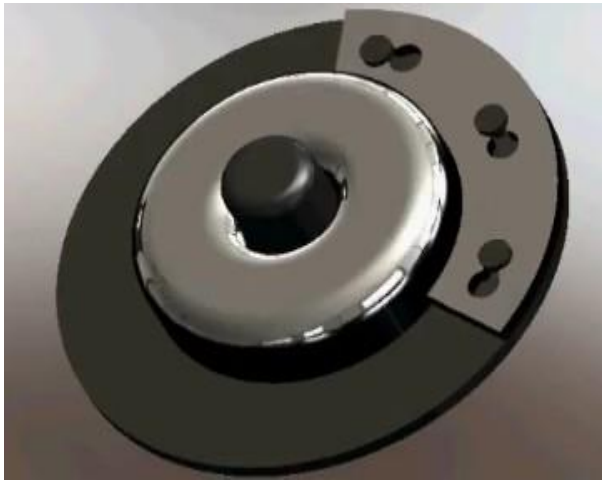


11.3 CONCEPT APPLICATION

- Pear-shaped hole



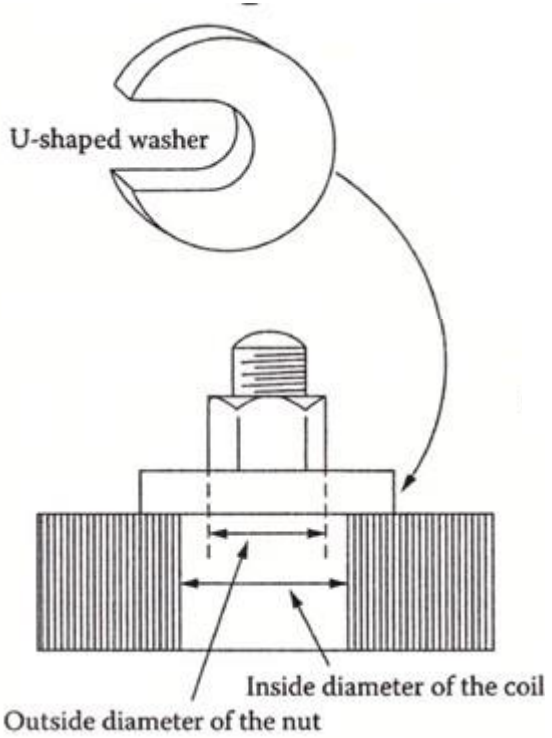




http://www.youtube.com/watch?v=74alvAJe5rM

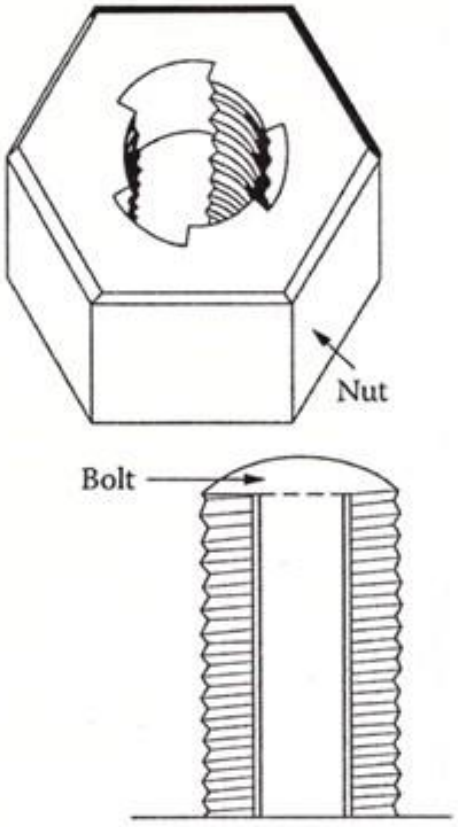
11.3 CONCEPT APPLICATION

- U-shaped washer



11.3 CONCEPT APPLICATION

- Nut and bolt with corresponding portions chipped off



11.3 CONCEPT APPLICATION

- Technique 4.

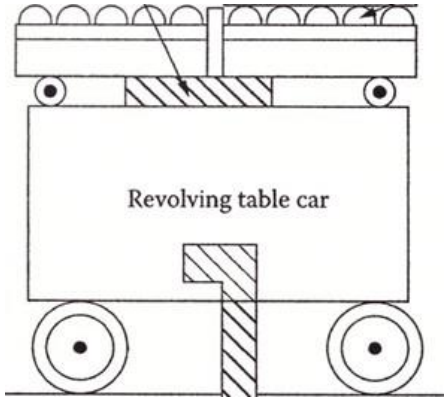
  Use a supplementary tool.

- The die or bites can be attached to the supplementary tool in the external setup phase.

- In the internal setup phase, this tool can be set at one touch.

- The supplementary tools must be standardized.

  such as the revolving table car



11.3 CONCEPT APPLICATION

- Technique 5.

  Use parallel operations.

- The setup actions for a machine with many attachment positions takes one worker a long time.
- If parallel operations by two workers are applied, the setup time can be reduced.
- The total effective operating hours of the machine can be increased.

11.3 CONCEPT APPLICATION

- Technique 6.

  Use a mechanical setup system.

- Oil pressure or air pressure can be used for fastening at several positions at a time by the one-touch method.
- The die heights can be adjusted by an electrically operated mechanism.
- Be careful of the investment.

11.3 CONCEPT APPLICATION

- Toyota's shortened time is the internal setup time.
- The external setup still requires half an hour or one hour.
- Reducing the setup times of machines can be an easy way to introduce TPS in other companies.

Two methods

- The first method is the set system.
  - Two different shapes of parts A and B are carved as a set.
  - These two part are separated after continuously punching both shapes at the same time.
- The second method is to press the multiple parts in parallel using less expensive multiple machines.