

# Fixed Automation

L-4

# Automated flow lines

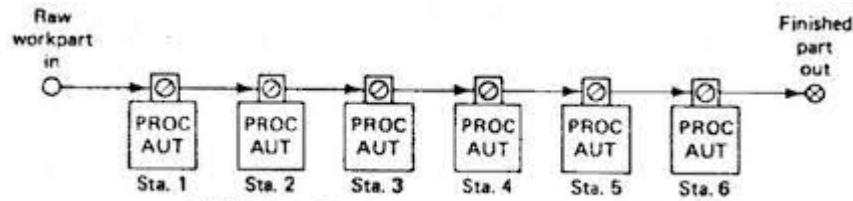


FIGURE 4.1 Configuration of an automated flow line.

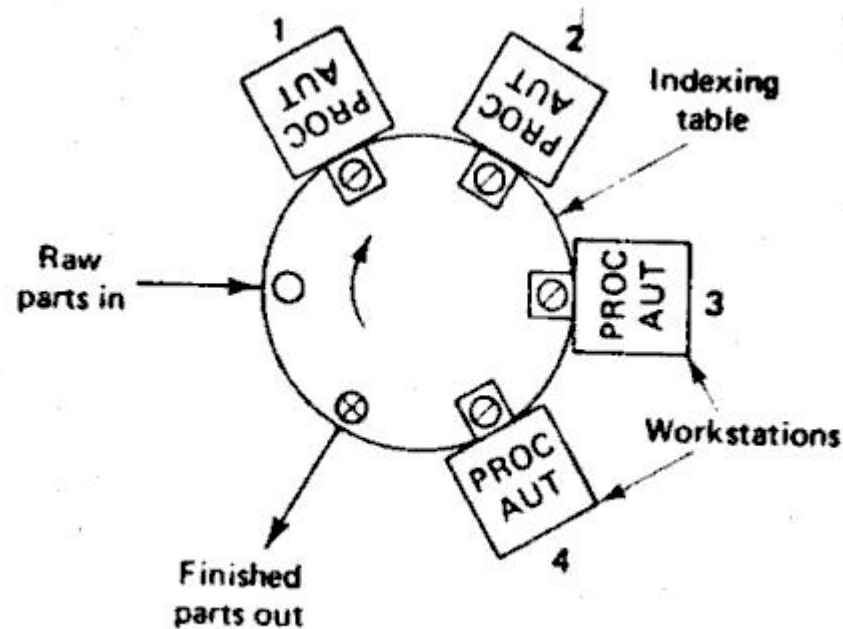
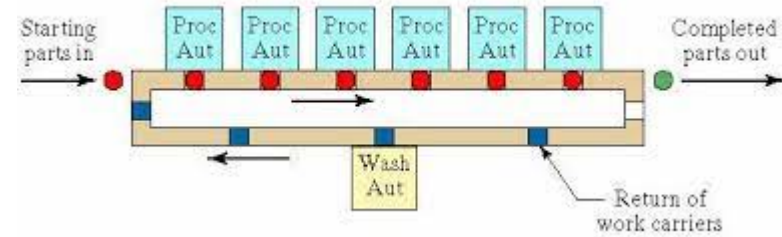


FIGURE 4.3 Configuration of a rotary indexing machine.

# Methods of Work Part Transport

- 1) Continuous transfer
- 2) Intermittent or synchronous transfer
- 3) Asynchronous or power and free transfer

The most appropriate type of transport system for given application depends on

- a) The types of operation to be performed
- b) The number of stations on the line
- c) The weight and size of the work parts
- d) Whether manual stations are included on the line
- e) Production rate requirements
- f) Balancing the various process times on the line

# Contd.

## TRANSFER SYSTEMS

### Rotary Indexing Machine

- To achieve higher rates of production, the rotary indexing machine performs a sequence of machining operations on several workparts simultaneously.
- Parts are fixed on a horizontal circular table or dial, and indexed between successive stations.



# Contd.

## TRUNNION MACHINE

- This machine uses a vertical drum mounted on a horizontal axis. The vertical drum is called a trunnion.
- Several fixtures are mounted on it which hold the workparts during processing.



# Contd.

## CENTRE COLUMN MACHINE

- Another version of the dial indexing arrangement.
- In addition to the radial machining heads located around the periphery of the horizontal table, vertical units are mounted on the center column of the machine.
- The center column machine is considered to be a high-production machine which makes efficient use of floor space.

# Control functions of automation in machining

## PROGRAM SEQUENCE CONTROL

- The sequence of motions and switching is controlled by relays, timers, switches, perforated tape, plug boards and other controllers.
- Each line presents a different movement or switch. It has to be printed correctly.
- There is no error control.

## NUMERICAL CONTROL (NC)

- Numerical control is a form of programmable automation in which a machine is controlled by numbers (and other symbols) that have been coded on an alternative storage medium.
- A position feedback control system is used in most NC machines to verify that the coded instructions have been correctly performed.
- Computer Numerical Control, or CNC.
- Direct Numerical Control, or DNC.

# Automation in Machining Operation

- 1) Single Station machine
- 2) Rotary indexing machine
- 3) Trunnion machine
- 4) Centre column machine
- 5) Transfer machine



# Current trends in automation in manufacturing or

## Key automation technologies

- 1) Industrial robots or cobots
- 2) Computer aided design and manufacturing (CAD/CAM)
- 3) Programmable logic controllers
- 4) Machine Vision system
- 5) Artificial Intelligence and machine learning
- 6) Internet of things and Industry 4.0
- 7) Additive manufacturing
- 8) Enterprise Resource Planning
- 9) Predictive Maintenance
- 10) Supply chain technology

# Designing and fabrication considerations

When a manufacturing firm decides that some form of automated flow line represents the best method of producing a particular work part or assembly, there are then a series of specifications that must be decided. In designing and building an automated flow line, some of the details to consider are the following :

- Whether the flow line is to be engineered in-house or by a machine tool builder
- Size, weight, geometry, and material if a processed work part
- Size, weights, and number of components if an assembly
- Tolerance requirements
- Type and sequence of operations
- Production-rate requirements
- Type of transfer system
- Methods of fixturing and locating work parts
- Methods of orienting and feeding components in the case of assemblies
- Reliability of individual stations and transfer mechanisms, as well as overall reliability of the line
- Buffer storage capability
- Ease of maintenance
- Control features desired
- Floor space available
- Flexibility of line in terms of possible future changes in product design
- Flexibility of line to accommodate more than a single work part
- Initial cost of the line
- Operational and tooling cost for the line

# Standard rotary table component

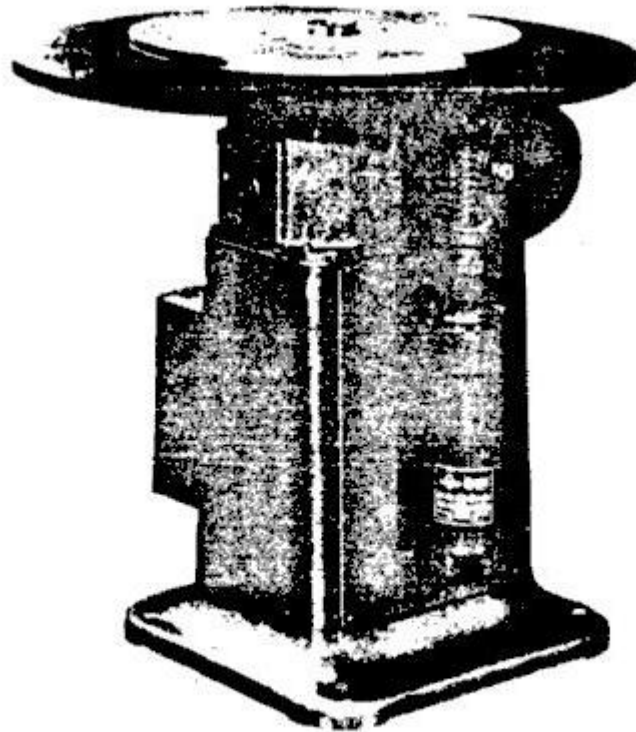


FIGURE 4.16 Standard rotary table component used on dial indexing machines.  
(Courtesy of Ferguson Machine Co.)

# Standard power feed unit

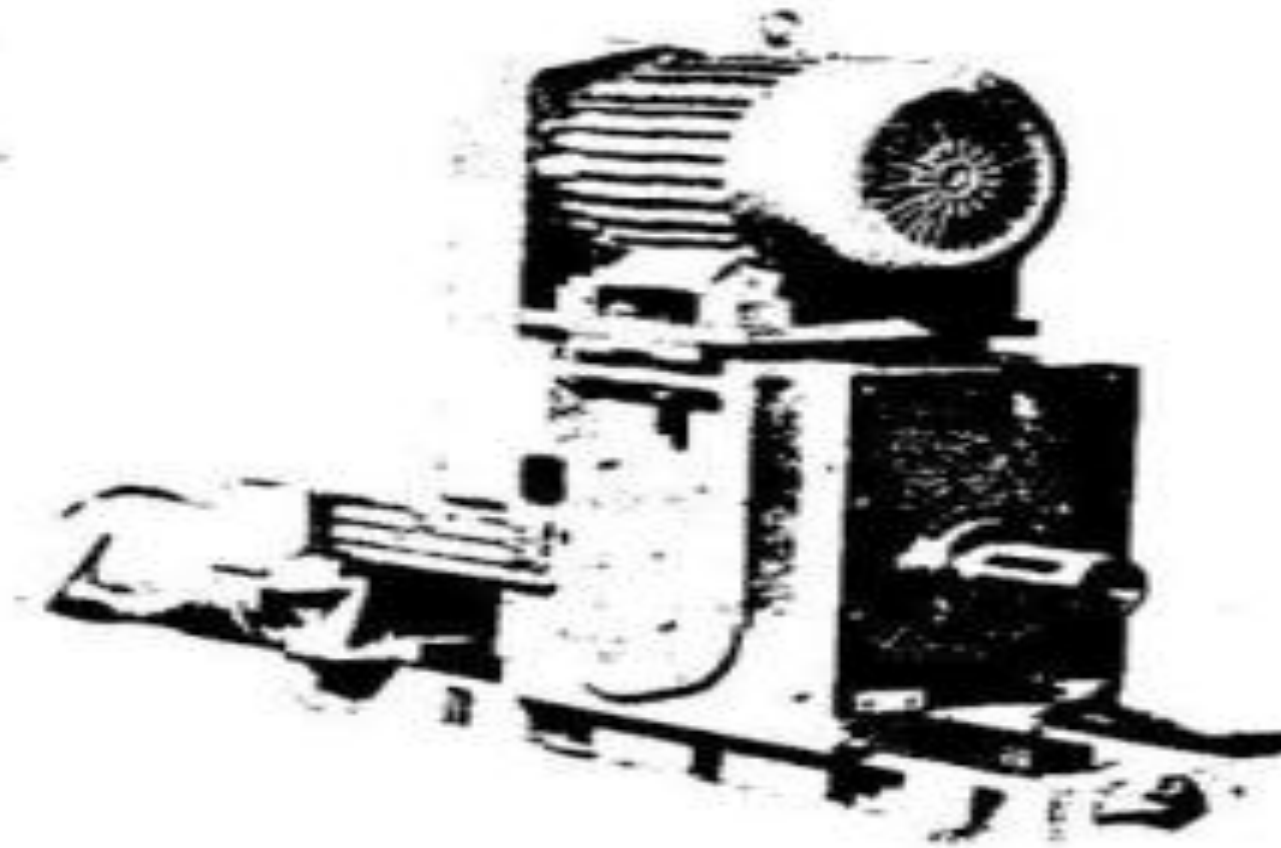


FIGURE 4.17 Standard power feed unit used on machining transfer lines. (Courtesy of Ferguson Machine Co.)