Automated Production Lines/Transfer lines-

Sections:

1. Fundamentals of Automated Production Lines
2. Applications of Automated Production Lines
3. Analysis of Transfer Lines

1. Automated Production Lines

*High production of parts requiring multiple processing operations

*Fixed automation

Applications:

*Transfer lines used for machining

*Robotic spot welding lines in automotive final assembly

*Sheet metal stamping

*Electroplating of metals

Where to Use Automated Production Lines

*High product demand

Requires large production quantities

*Stable product design

Difficult to change the sequence and content of processing operations once the line is built

*Long product life

At least several years

*Multiple operations required on product

The different operations are assigned to different workstations in the line

Eg-cement industries/oil refineries/chemical industries/fertilizer industries etc.

Benefits of Automated Production Lines-

*Low direct labor content
*Low product cost
*High production rates
*Production lead time and work-in-process are minimized
*Factory floor space is minimized
*fewer operators are needed
*marching opns are speeded up
*the quantity of the products is quite improved
*the alignment of the wpc at each m/cg station is automized
*less number of opns are reqd
*chip conveyor can be used for removal of chips
*automized whole line except loading and unloading

Disadvantages of Automated Production Lines-

*initial cost of these is very high
*much time is reqd to change over the m/c to handle a difft shaped component.
*A break down of one m/c means stoppage of whole of production line
*The electrical sys is very complex
*this sys is justified only for high prodn of components.

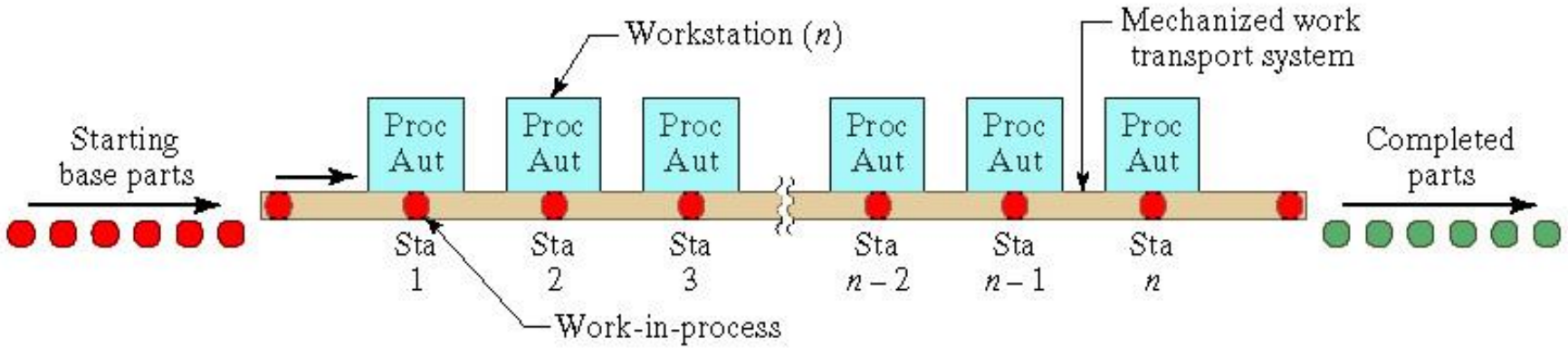
Automated Production Line or Transfer m/cs or SPM(special purpose m/cs)-

Defined:-

Fixed-routing manufacturing system that consists of multiple workstations linked together by a material handling system to transfer parts from one station to the next, Slowest workstation sets the pace of the line.

Work-part transfer:

- -Palletized transfer line
  - Uses pallet fixtures to hold and move work-parts between stations
- -Free transfer line
  - Part geometry allows transfer without pallet fixtures



General configuration of an automated production line consisting of *n* automated workstations that perform processing operations

System Configurations-

The transferring of wpces usually is carried out by the following methods-

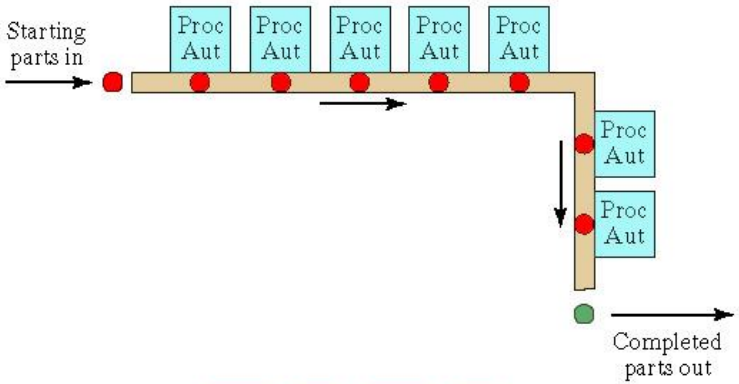
*In-line - straight line arrangement of workstations

*Segmented in-line – two or more straight line segments, usually perpendicular to each other

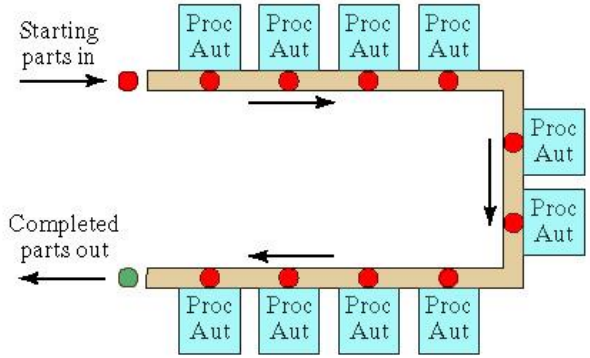
*Rotary indexing machine (e.g., dial indexing machine)

L-shaped layout

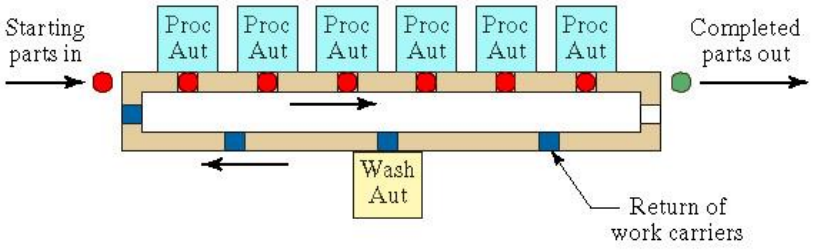
Straight line
L-type
U-type
Square type
Rectangular etc.



U-shaped layout

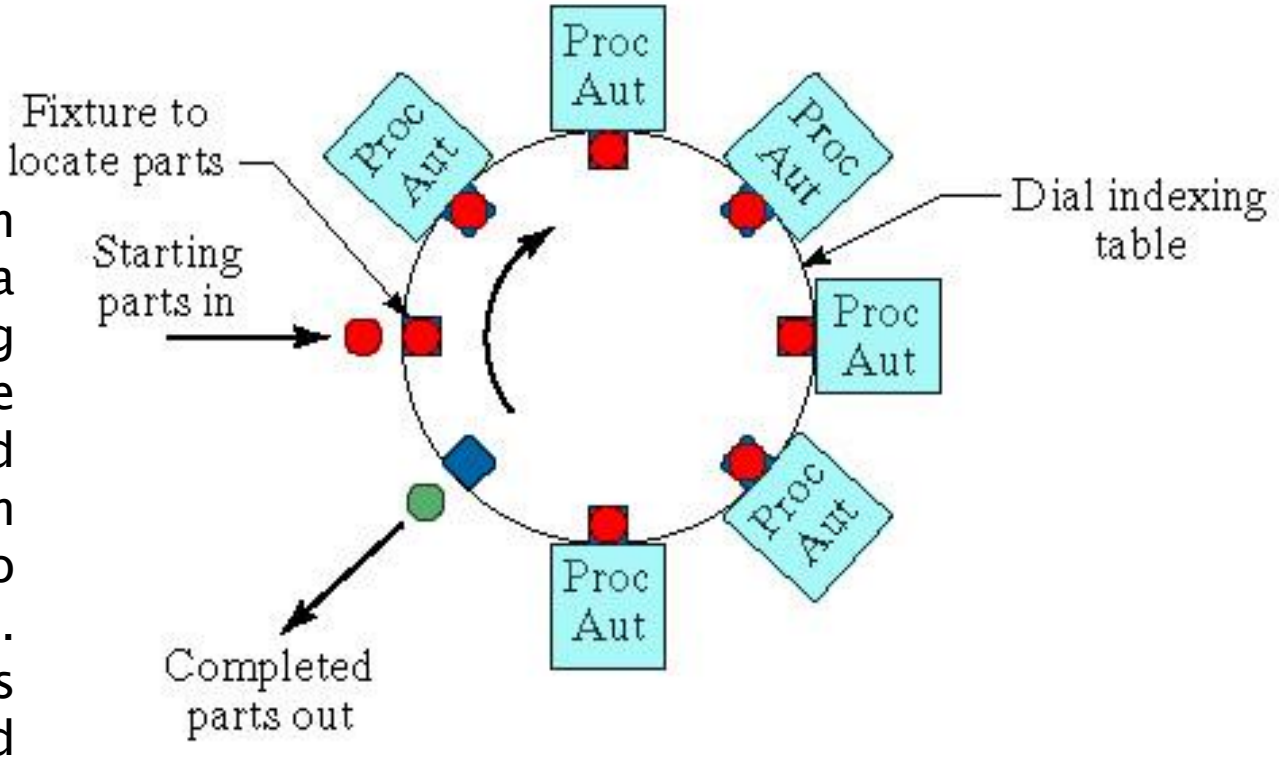


Rectangular configuration



Rotary Indexing Machine

The wpcs are held in fixtures in a continunous rorating table, wpcs to be loaded and unloaded at a single location without having to intrupt the m/cing. This type of sys is very compact and saving floor space.



Selection of wpc transferring sys depends upon the following factors-

- -shape of wpcs
- -weight of wpc
- -m/c tool layout
- -type of manufacturing

Workpart Transfer Mechanisms-

Linear transfer systems:

Continuous motion – not common for automated systems

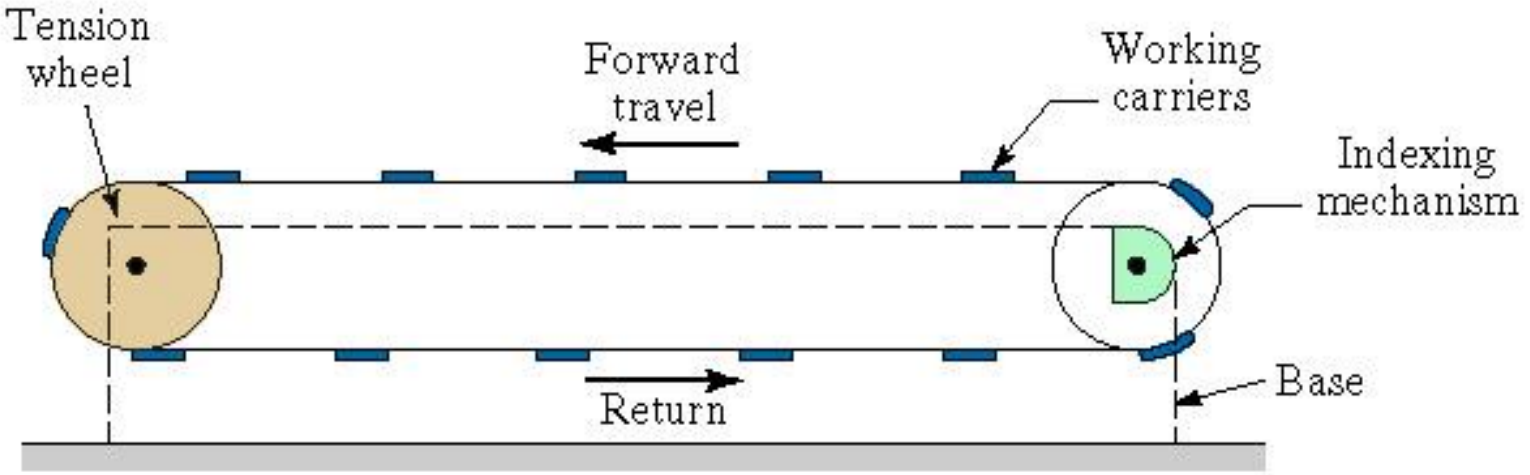
Synchronous motion – intermittent motion, all parts move simultaneously

Asynchronous motion – intermittent motion, parts move independently

Rotary indexing mechanisms:

Geneva mechanism

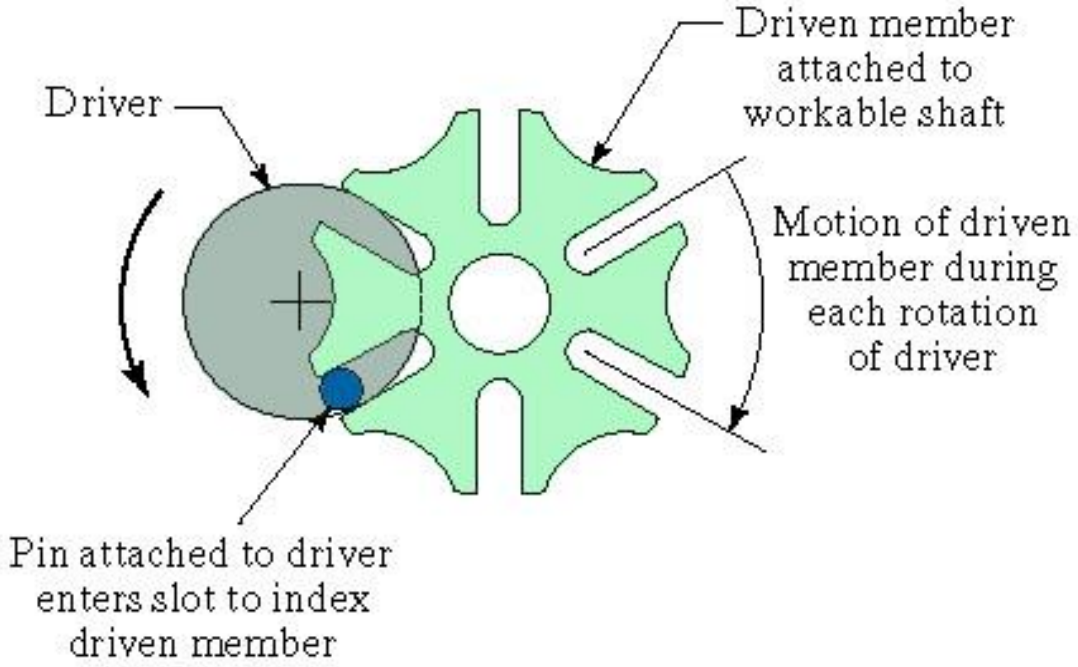
Others

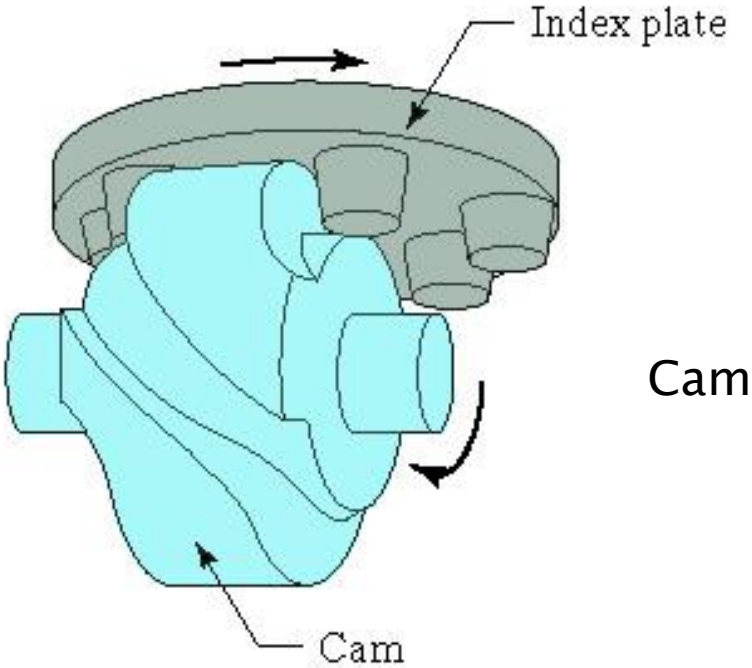


Belt-Driven Linear Transfer System-

Side view of chain or steel belt-driven conveyor (over and under type) for linear transfer using work carriers

Geneva Mechanism with Six Slots





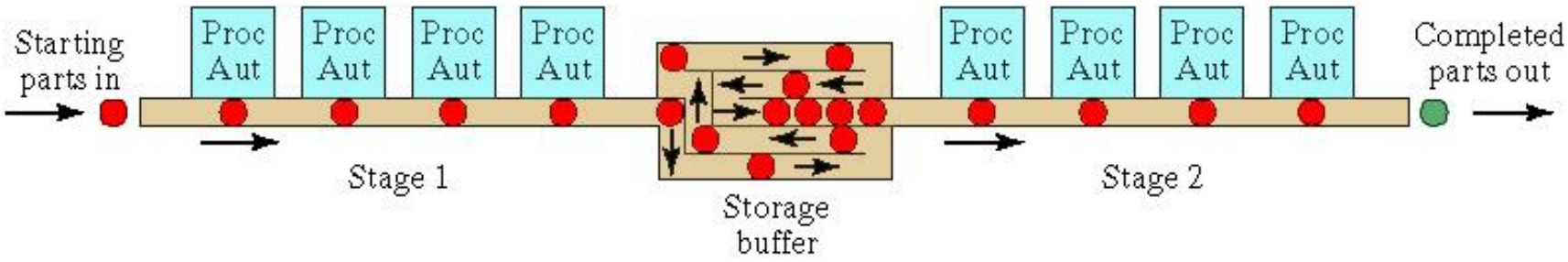
Cam Mechanism to Drive Dial Indexing Table

Storage Buffers in Lines-

A location in the sequence of workstations where parts can be collected and temporarily stored before proceeding to subsequent downstream stations.

Reasons for using storage buffers:

- To reduce effect of station breakdowns
- To provide a bank of parts to supply the line
- To provide a place to put the output of the line
- To allow curing time or other required delay
- To smooth cycle time variations
- To store parts between stages with different production rates



Storage buffer between two stages of a production line

Control Functions in an Automated Line-

-Sequence control
To coordinate the sequence of actions of the transfer system and workstations

-Safety monitoring
To avoid hazardous operation for workers and equipment

-Quality control
To detect and possibly reject defective work units produced on the line

System Design Considerations-

-**Building block approach**: machine tool companies specialize in transfer lines and indexing machines
*User contracts for custom-engineered line
*Standard modules such as workheads, feed units, transfer mechanisms, and bases
*Called a unitized production line

-**Link line**: uses standard machine tools connected by specialized handling system

-**Specialized** processes often engineered by the user company

Analysis of Transfer Lines-

Three problem areas must be considered:

1. **Line balancing**
   *To divide the total work load among workstations as evenly as possible
2. **Processing technology**
   *Theory and principles about the manufacturing or assembly processes used on the line
3. **System reliability - two cases**:
   *Transfer lines with no internal parts storage
   *Transfer lines with internal storage buffers