

3.7.1 Automatic Tool Changer (ATC)

An automatic tool changer (ATC) is an important part of a machining centre. An ATC picks up a tool from the magazine and keeps it ready for swapping with the tool in the spindle which is presently cutting. The time for tool change varies between 3 to 7 seconds. The ATC plays a significant role in reducing idle time during tool change operations. There are a number of different designs for automatic tool changers.

Fig 3.19 shows the operation of a double-ended arm type ATC. The desired tool is collected from the magazine in one end of the special arm. At the moment of tool change, the empty end of the arm grips the tool in the spindle, removes it, indexes 180 deg, and inserts the new tool into the spindle. There are a number of variations on the double-ended arm. One is design of arm itself. The other variation is in the relative movement between arm and spindle during tool change. Quill-type spindles generally move out towards the stationary (after rotation) arm to accept a new tool or replace a used one. For non-quill-spindle machines, the double-end arm incorporates an in-out motion to insert or extract the tool from the spindle taper.

Not only does the magazine transport the tool during storage and keep it clean and free from damage but it also keeps track of which tools are where. This can be done by coding the tools physically either on the tool itself or in the magazine adjacent to the tool when the pocket is loaded.

The other way for keeping track of tools is to use the NC program itself. A tooling instruction sheet is sent to the operator with every tape and part setup sheet. With the manual data entry system this problem becomes easy by operator keying into the control both tool number and its corresponding pocket number. The NC does the data handling, and the

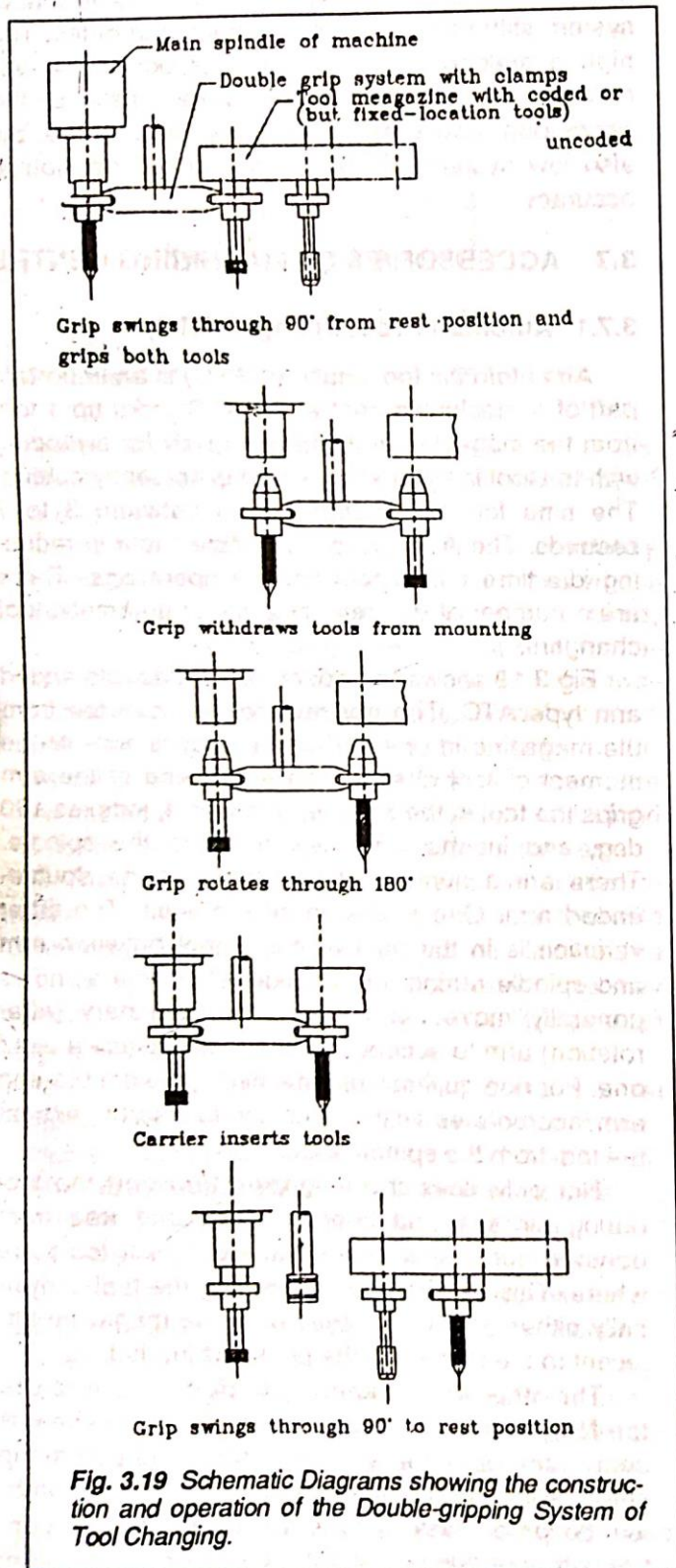
tool position can be reviewed from the control CRT at any time. When it is time for the tool to be selected and sent to the spindle, the control calculates whether it is shorter to send the directional magazine clockwise or counter clockwise to get the

proper pocket to its pick up point, and it instructs the magazine-drive motor.

3.7.1.1 Types Of ATC & Magazine

The concept of the ATC is that the range of tools for a specific job shall be made available for automatic selection and positioning. ATC can be :

Turret head type	Used on drilling machines; Strictly speaking, it is not on ATC.
Drum type	For holding small number of tools usually not more than 30. Stored on periphery of drum. Tool search speed is faster.
Chain type	For more number of tools (30-40 or more tools can be used). Tools search speed is less.



3.7.1.2 Characteristic Of Tool Magazines

Tool magazines should satisfy the following requirements:

- ◆ Tool magazine must be capable of holding enough tools needed for performing complete operations for some typical workpieces on the machining centres.
- ◆ As the magazine gets larger, the space needed is more and more expensive and hence the magazine has to be compact and as simple as possible.
- ◆ Interchange of tools should not interfere with the workpiece space and tool space. This means that the tool magazines should be located outside the working space of the machine tool.
- ◆ Easier and safer manual exchange of tools in the tool magazine during loading and unloading, should be facilitated.
- ◆ All preparatory works for tool exchange should be made during machining.

3.7.1.3 Classification Of ATC

ATC's can be classified in several ways :

According to the kind of cutting tools

- ◆ For single tool.
- ◆ For multi tool heads.
- ◆ Special tools such as microbores.

According to the system tool exchange:

- ◆ Without tool change arm.
- ◆ With tool change arm.
- ◆ With tool parking position.