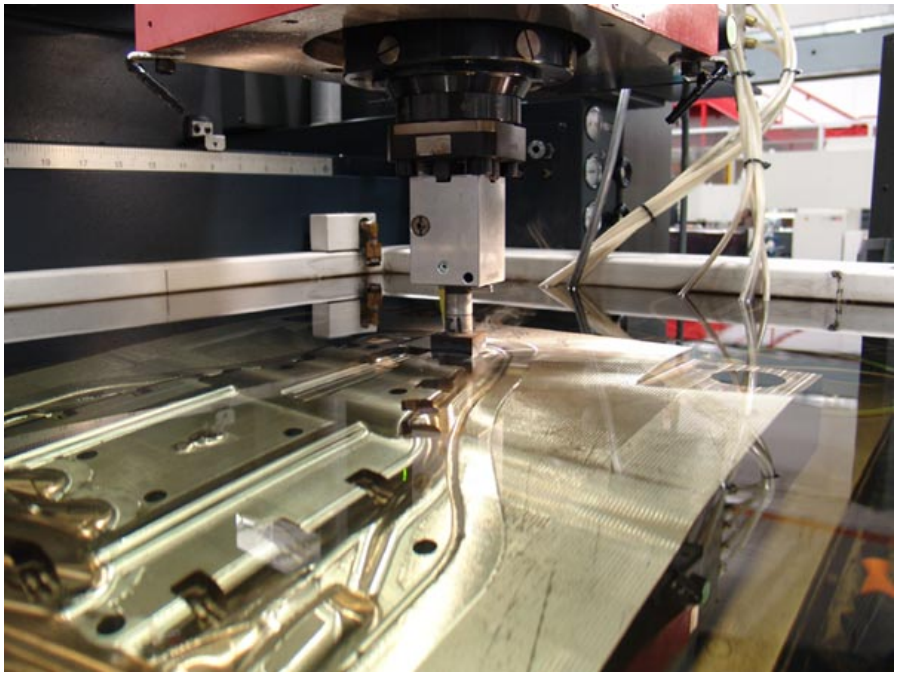
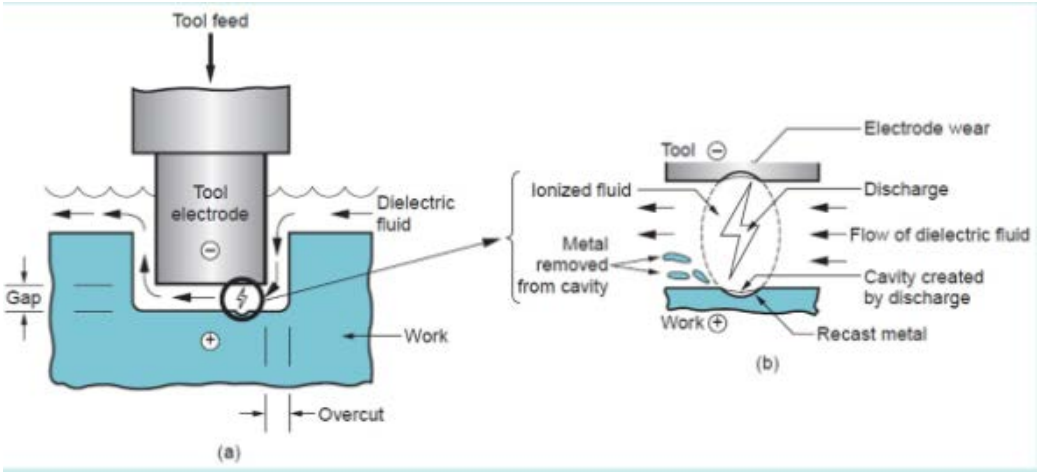
ELECTRICAL DISCHARGE MACHINING (EDM)

Principle and Working : Refer to Fig.





The **Electrical Discharge Machining (EDM)** *process involves controlled erosion of electrically conducting materials by the initiation of rapid and reptitive electrical discharge between the tool (cathode) and workpiece (anode) separated by a dielectric fluid medium.* A suitable gap

between the tool and workpiece is maintained to cause the spark discharge. The gap can be varied to match the machining conditions such as metal removal rate.

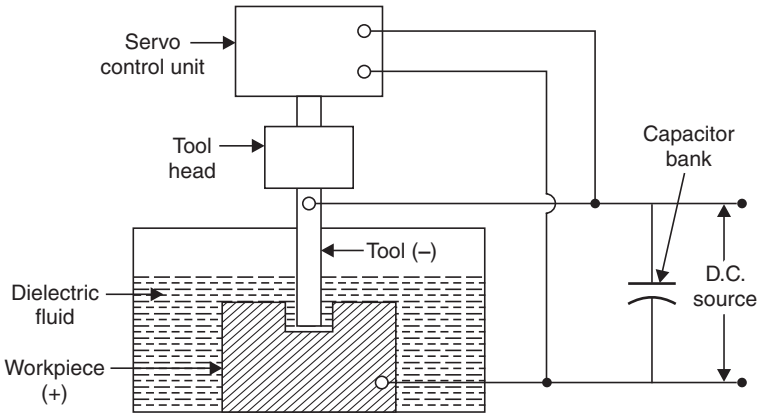


Fig. 12.1. Electric Discharge Machining (EDM).

As soon as the voltage gradient set up between the tool and the workpiece is sufficient enough to breakdown the dielectric medium, a conducting electrical path is developed for spark discharge owing to ionization of the fluid medium and thereby causes the current to flow. The temperature of the spot hit by the spark may rise upto 10000°C causing the work surface to melt and vaporize and ultimately to take the form of a sphere as it is quenched by the surrounding fluid.

If the tool is fed downwards, maintaining the predetermined gap, *the tool shape/profile will be reproduced on the workpiece.*

The spark gap, generally 0.01 to 0.1 mm, is adjusted so that the gap voltage is around 70 percent of the supply voltage for charging the capacitor bank. Higher gap although increases the discharge energy but it decreases the spark frequency due to increase in charging time of the capacitor.

The **'servocontrol unit'** is provided to *maintain the predetermined gap.* It senses the gap voltage and compares it with the preset value and the difference in voltage is then used to control the movement of servomotor to adjust the gap.

Important characteristics of EDM :

- *Tool materials* : Copper, brass and graphite.
- *Workpiece materials* : Conducting metals and alloys.
- *Process parameters* : Voltage, capacitance, spark gap and melting temperature of workpiece.
- *Material removal* : Melting and vaporisation.

Advantages :

1. Machining time is *less* than conventional machining processes.
2. *Any complicated shape* that can be made on the tool can be reproduced on the workpiece.
3. The process can be applied to *all electrically conducting metals and alloys* irrespective of their melting points, toughness, hardness or brittleness.
4. Can be employed for *extremely hardened workpiece.*
5. Fragile and slender workpieces can be machined without distortion.
6. *Considerably easier and more economical polishing* can be done on the cratering type surfaces developed by EDM.

7. *Fine holes* can be easily drilled.
8. Enables high accuracy on tools and dies, because they can be machined in '*as hard*' condition.

Disadvantages :

1. Compared to conventional processes, *power required is very high.*
2. In some materials, *surface cracking* may take place.
3. Sharp corners *cannot* be produced.
4. Material removal rate is low.
5. Surface tends to be rough for larger removal rates.
6. It cannot be applied to non-conducting materials.

Applications :

1. Very useful in *tool manufacturing* due to ease with which hard metals and alloyed can be machined.
2. Resharpening of cutting tools and broaches, trepanning of holes with straight or curved axes.
3. Machining of cavities for dies and remachining of die cavities without annealing.
   - This process can be *used to preform almost all conventional machining operations.*