Applications of EDM

EDM is used for following purposes.

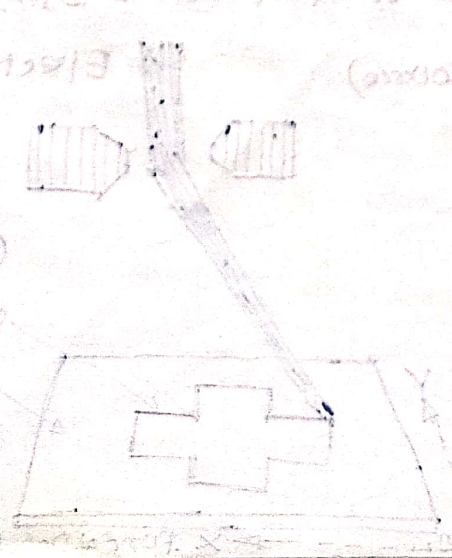
1. In tool making, particularly in the manufacture press tools, extrusion dies, forging dies, and molds.
2. The oil retention property of the surfaces produced by EDM makes the process suitable for finishing plain bearings and bores of internal combustion engine cylinders.
3. EDM has been successfully used to drill very small diameter holes in such hardened parts as nozzles for diesel engine fuel injectors.

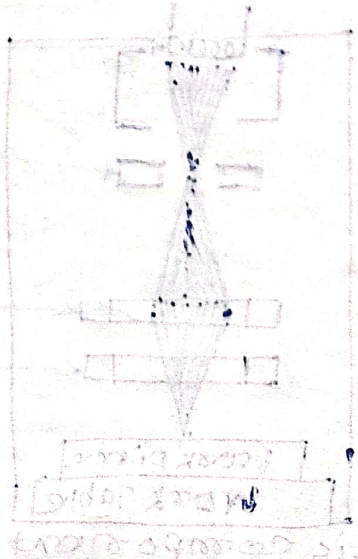
Advantages :-

1. Any material, regardless of hardness or strength can be machined provided it can conduct electricity.
2. Any shape that can be produced in a tool can be duplicated in the workpiece.
3. Any delicate material can be machined without distortion since no mechanical force is required.
4. Tools and dies can be spark machined after they are hardened and hence great accuracy can be achieved.

Disadvantages :-

1. The work piece and tool both conduct electricity
2. EDM is a slow machining process.
3. Because of the intense heat, thermal distortion is a problem.





ELECTRICAL DISCHARGE MACHINING :—

Principle of operation :—

When electrical accidents occurred an arc is produced which causes pitting on work piece material.

An electrical discharge machine is composed of following components.

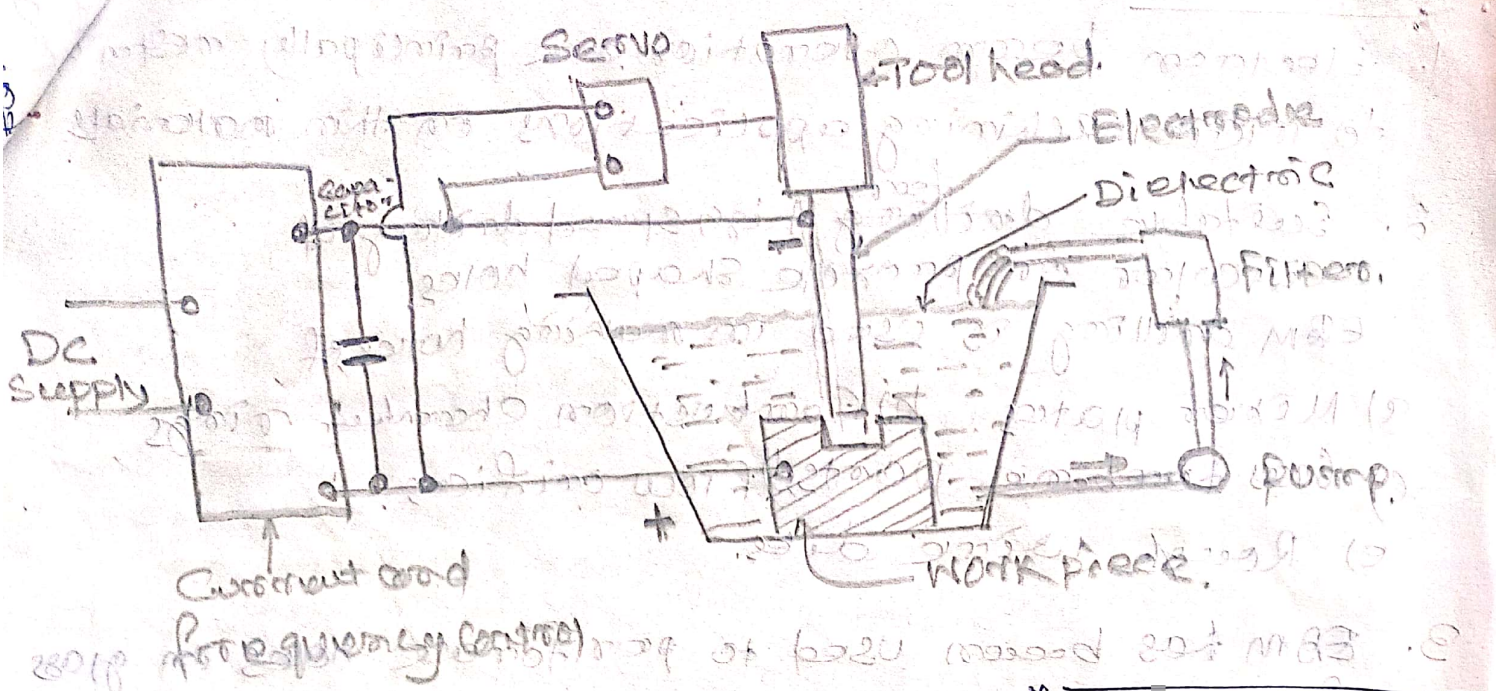
1. A source of D.C. supply and a method to control voltage and frequency. (current 0.5 - 400 Amps and voltage 40 - 300 V d.c.)
2. Tool head

   Tool head is made up of copper, tungsten and graphite alloy which holds the electrode. The electrode is used as cutting tool. The shape of electrode is same as the shape of cavity to be made on the work piece.
3. Servo Mechanism : The function of servo mechanism is to control the movement of electrode to maintain a correct gap (about 0.025 mm) between work piece and electrode as the machining progresses.
4. Coolant : coolant usually a mineral oil that forms a dielectric (non-conducting) barrier between the electrode and the work at the arc gap.

- The electrode and workpiece are submerged in the dielectric fluid. When voltage reaches a point sufficient to cause the dielectric to breakdown, a spark occurs. High pressure and temperature are created for each spark. Each spark erodes a minute piece of metal from the work piece. About 20,000 to 30,000 spark occurs per second as a result appreciable quantities of metal are removed.

- Function of dielectric :- Dielectric serves to,
  - flush particles from the gap.
  - keep the electrode and work cool.
  - prevent fusion of electrode with workpiece.

A filter removes the particles (corrosion products) from the dielectric fluid.



Advantages of EBM :-

1. Suitability for automatic machining.
2. Absence of mechanical contact between work piece and tool.
3. Capability of making very small holes and slots with high precision, in a short time, on any material.

Disadvantages of EBM :-

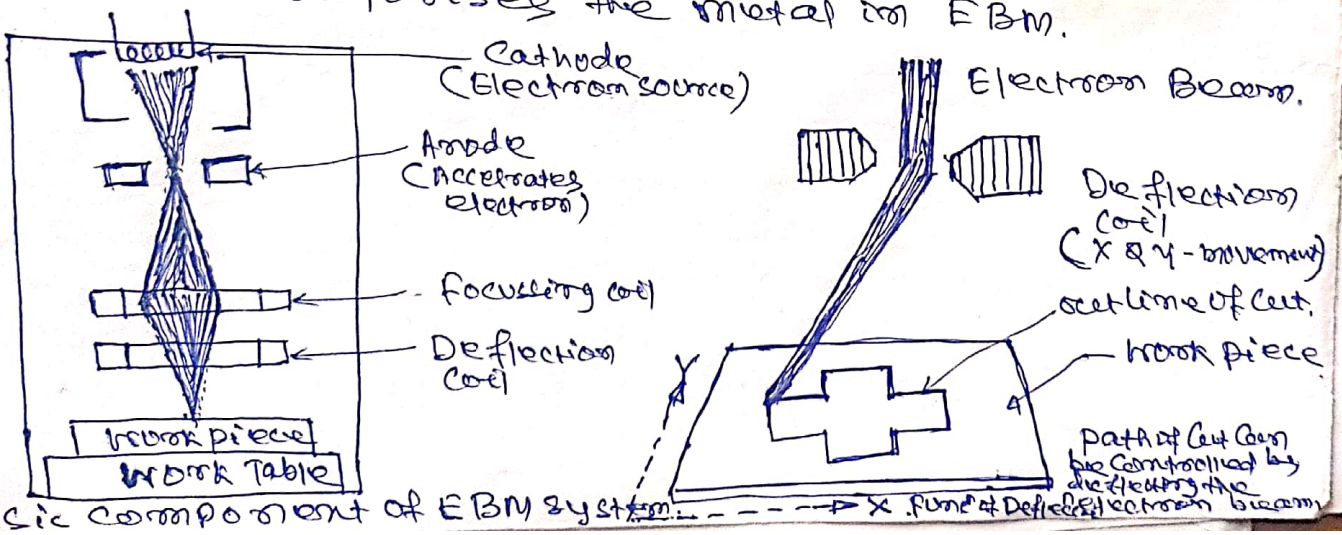
i) High cost of equipment.
ii) Slow production rate, because of metal removal rate and time required to evacuate the chamber.
iii) Non uniformity of holes and slots.
iv) Limited applicability due to,
   - Depth of cut being 6mm.
   - Small metal removal rate.
   - Vacuum chamber limits the size of work piece to be machined.
v) Skilled operators are required.

→

ELECTRON BEAM MACHINING "EBM"

Principle of operation :-

- An electron beam is a stream of electrons moving with same velocity and same direction.
- Electron beam machining is a thermo electric process in which electrons are emitted from a tungsten filament (cathode) heated to 2500°C in a vacuum of about 10^{-5} mm of mercury. The electrons are directed through the hole in the anode without colliding with the anode itself. The stream of electrons is accelerated towards the anode by a potential difference of 50 to 150 kV between filament (cathode) and anode. The electrons attains the maximum velocity as they leave the anode and with same velocity they strike the work piece. The deflection coil deflects the electron beam and controls the path of cut.
- Electrons beam moving with a velocity half of the velocity of light and strikes the work piece surface. The electron energy is converted in to heat energy which sufficient to vaporize any known material.
- Careful control is essential over the heating and cooling cycle locally at the cut to prevent welding the corresponding metal.
- The difference between electron beam machining (EBM) and electron beam welding (EBW) is that in machining the beam energy is higher, the focusing sharper and the pulse duration shorter.
- Instead of melting the metal as in (EBW), electron beam vaporises the metal in EBM.



Basic component of EBM system.

—: अमित पुरोहित :—

LASER BEAM MACHINING :- (LBM)

LASER → Light Amplication by Stimulated Emission of Radiation.

Principle: Laser beam machining is a method of cutting in which the work material is melted and vapourized by a narrow beam of intense monochromatic light. When the beam strikes the work piece, the heat produced melts and vapourizes even the most refractory work materials.

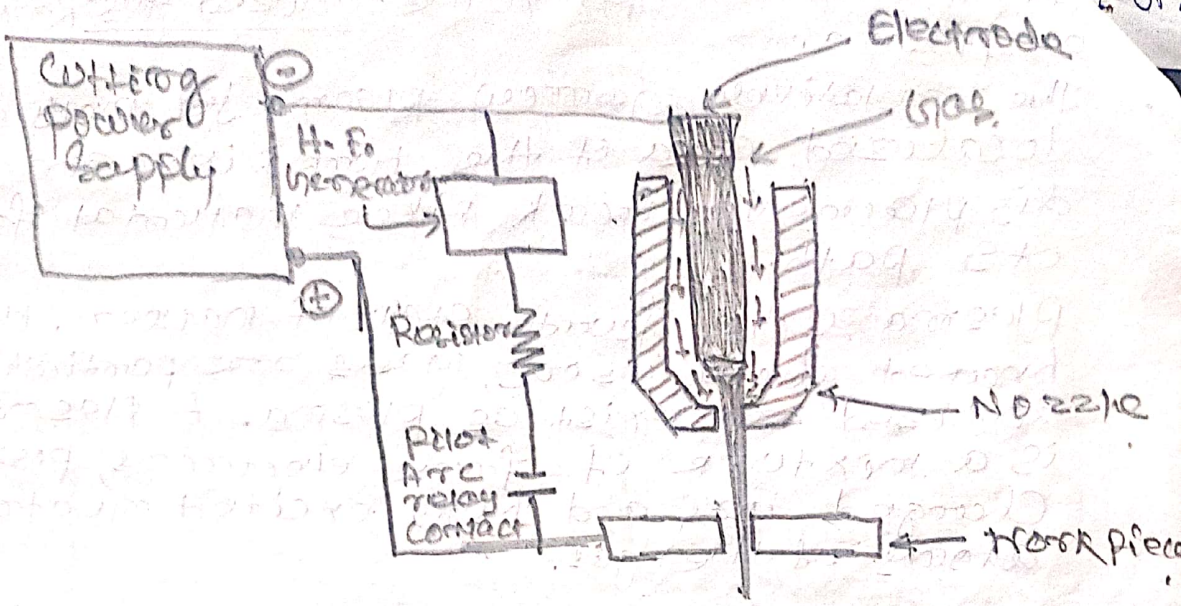
Types of LASER: There are two types of lasers are now in common use.

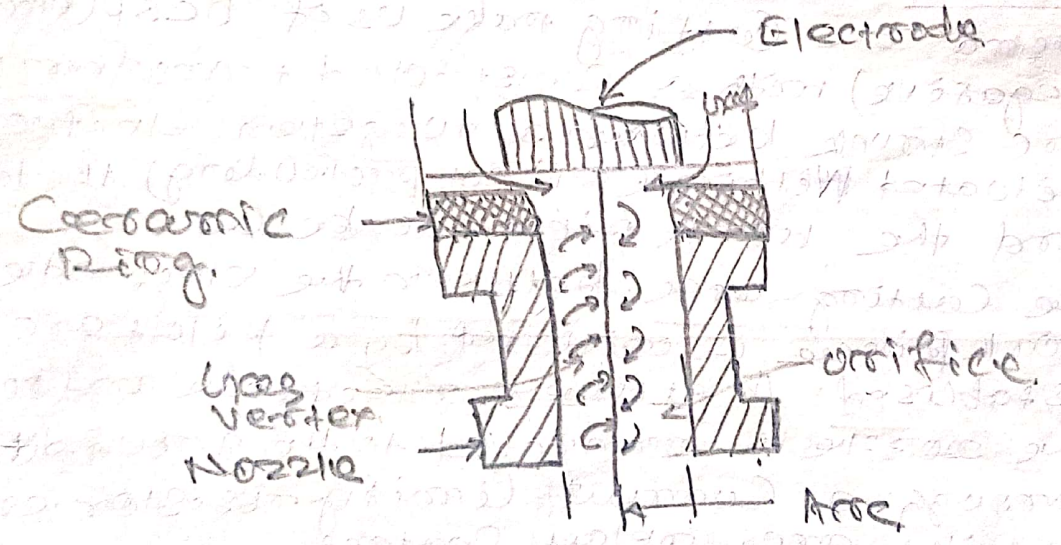
a) ~~Solid~~ solid laser.

b) Gas laser.

Solid lasers are capable of providing short bursts of power, where as gas lasers produce a continuous laser beam.

- Solid lasers best suited to produce a neodymium-doped glass rod as the lasing medium. The rod ends are finished as optical surfaces with reflective coatings one end has a partially reflective coating to permit escape of the laser beam when it has reached the required intensity. The laser rod is optically excited by a high intensity flash lamp. Mirrors located inside the optical oscillators are used to reflect and to focus the light on the laser medium inside the discharge tube or optical oscillators.
- At present CO2 lasers are most efficient for converting em to laser power. Gas lasers operate in basically the same manner as solid lasers, except that.





Plasma Arc Cutting