Section-5 Q.1 Ans →

Working of Abrasive Water Jet Machining :-

- Abrasive water Jet machining, (AWJM) is a non-conventional machining process.
- In this process, the mechanical energy of water & abrasive phases is used to achieve material removal or machining.
- Additives in the form of suspended grit or other abrasives, such as garnet & aluminium oxide can assist in this process.

- An abrasive jet starts out the same as a pure water jet.
- As the thin stream of water leaves the nozzles, abrasive is added to the stream & mixed.
- The beam of water accelerates abrasives particles to speed fast enough to cut through much harder materials.

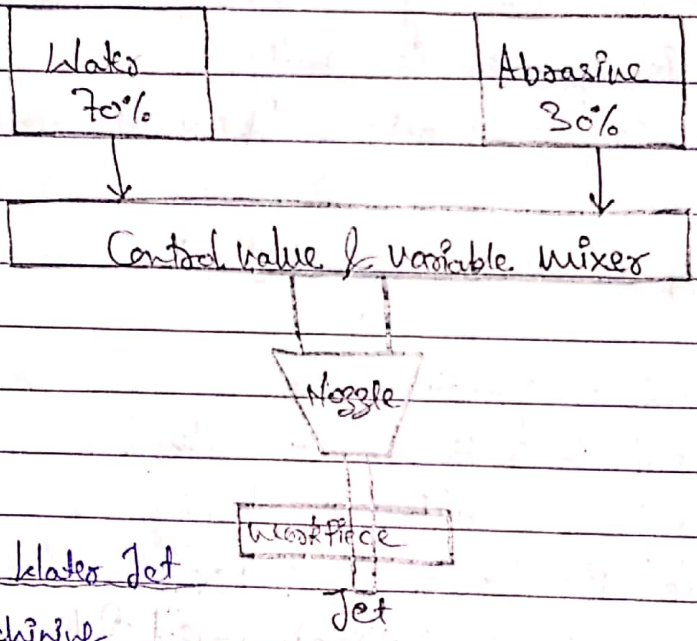

Fig :- Abrasive Water Jet Machining

⇒ Ultrasonic Machining :- (USM)

It is a mechanical non-traditional machining process.

- It is employed to machine hard and/or brittle materials (both electrically conductive & non-conductive) having hardness greater than 40RC.

* Principle :- In ultrasonic machining process, the high frequency electrical signal is converted into the high frequency mechanical motion.

*> Components of USM :-

- Acoustic head.
- Feeding unit.
- Abrasive slurry & feed Pump unit.
- work table (fixture)

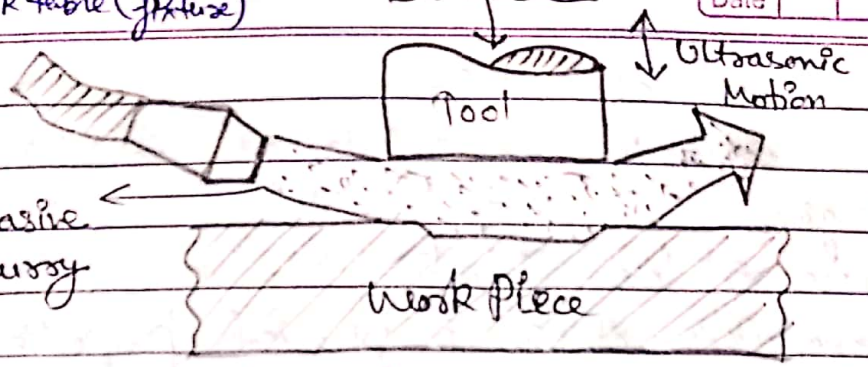

fig :- Principle of Ultrasonic Machining.

*> Working :-

- In ultrasonic machine, the abrasive slurry (contain of water & abrasive particles) is filled btw the vibrating tool & w/p.
- Material removal take place when the abrasive particles suspended in the slurry is struck by the vibrating tool.
- This struck cause the cutting action in the w/p, hence the w/p is machined.

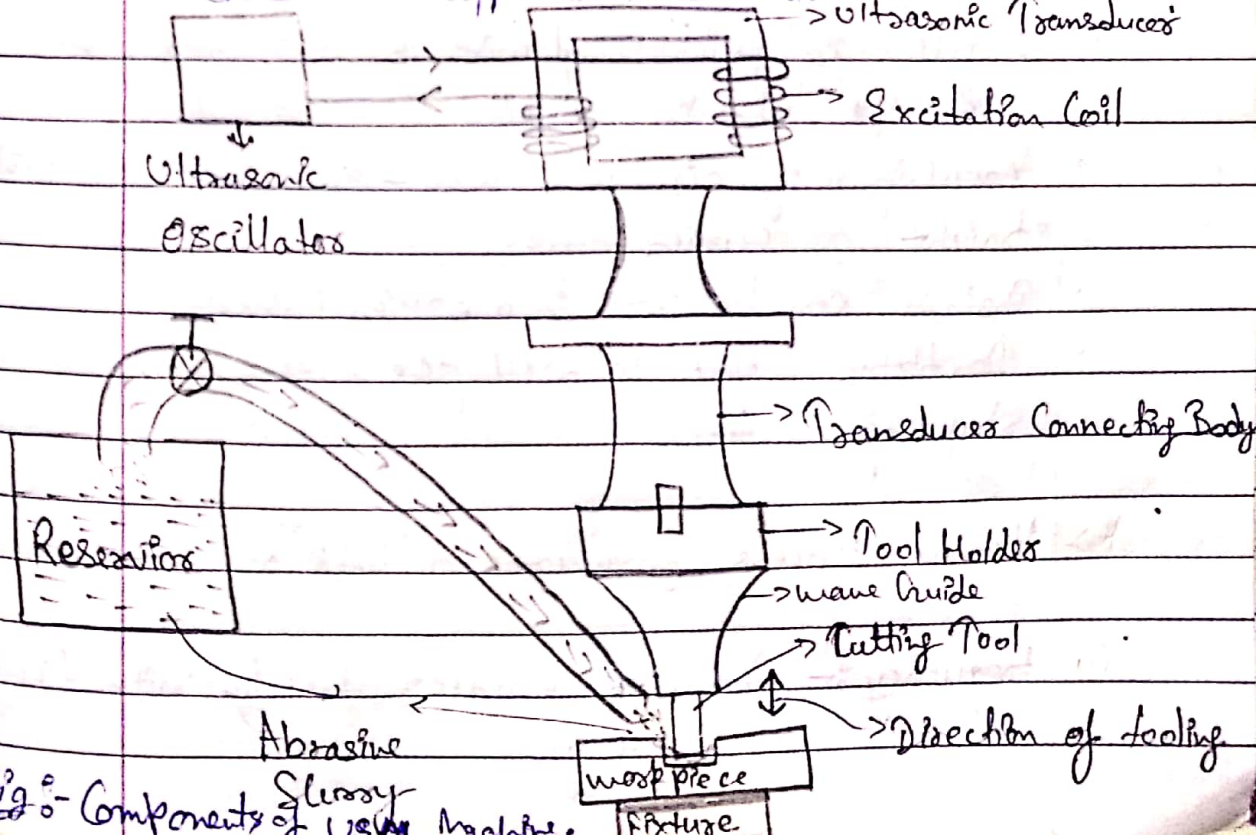

fig :- Components of USM machine.

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* Advantages of USM :-
- There are no thermal effects on machining.
- It gives good surface finish.
- There is less distortion.
- There is no change in physical properties of w/p.
- This process is free of unpleasant sound.
- It can m/c non-conductive materials.

* Disadvantages of USM :-
- High tool wear.
- It has low material removal rate.
- It has high power consumption.
- It is not economical for soft materials.
- Difficulty in tool designing.

* Applications of USM :-
- It can be used for coining, lapping, deburring, & broaching.
- Drilling & finishing of wire drawing dies made of tungsten carbide & diamond.
- Machining of circular & non-circular holes with straight or curved axes.
- Threads can be cut in a drilled holes.
- Dentistry work to drill fine holes of desired shape in teeth.

* Various Process parameters of "USM" are :-

(i) Frequency :- The MRR increases linearly with the frequency.

(iii) Amplitude :- When the amplitude of vibration is increased, the MRR is also increased.

(iii) Static Loading (Feed Force) :- With as Inc(ses) in static loading (i.e, also the feed force), the MRR tends to Inc(ses).

(iv) Grain Size :- MRR Inc(ses) with the Inc(ses) in the grain size.

(v) Concentration of Abrasive in the Slurry :- It does not have much effect on MRR, Concentration of abrasive in the slurry slightly Inc(ses) the MRR.

⇒ EDM (Electrical Discharge Machining) Principle :-

- This process involves a thermal process that uses spark discharges to erode electrically conductive material.
- When a discharge takes place b/w anode & cathode, the heat is generated near the zone which melts & evaporates the material in the sparking zone.

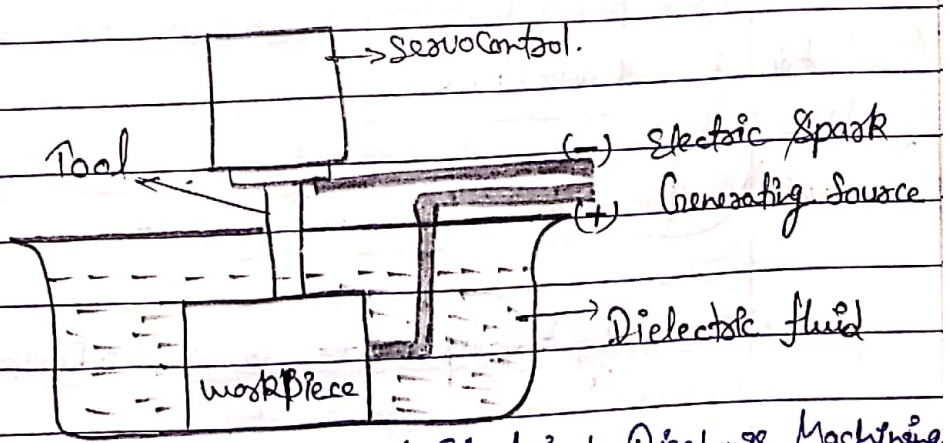

Fig :- Basic scheme of Electrical Discharge Machining

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Working of EDM:-

- In electrical Discharge Machining (EDM) process, machining is done by melting a large no. of very small particles of metal by bombarding of spark from electrode to the metal w/p.

- The electrode & w/p are connected in an electric circuit utilizing DC voltage up to 45 V & current varying from 5A to 60A or more depending upon area of electrode.

- When electrode & w/p come close to each other, the sparks generate which have temp. up to 5500°C. This spark melts & vaporize a spot in the metal & the same process will give a finish to w/p metal.

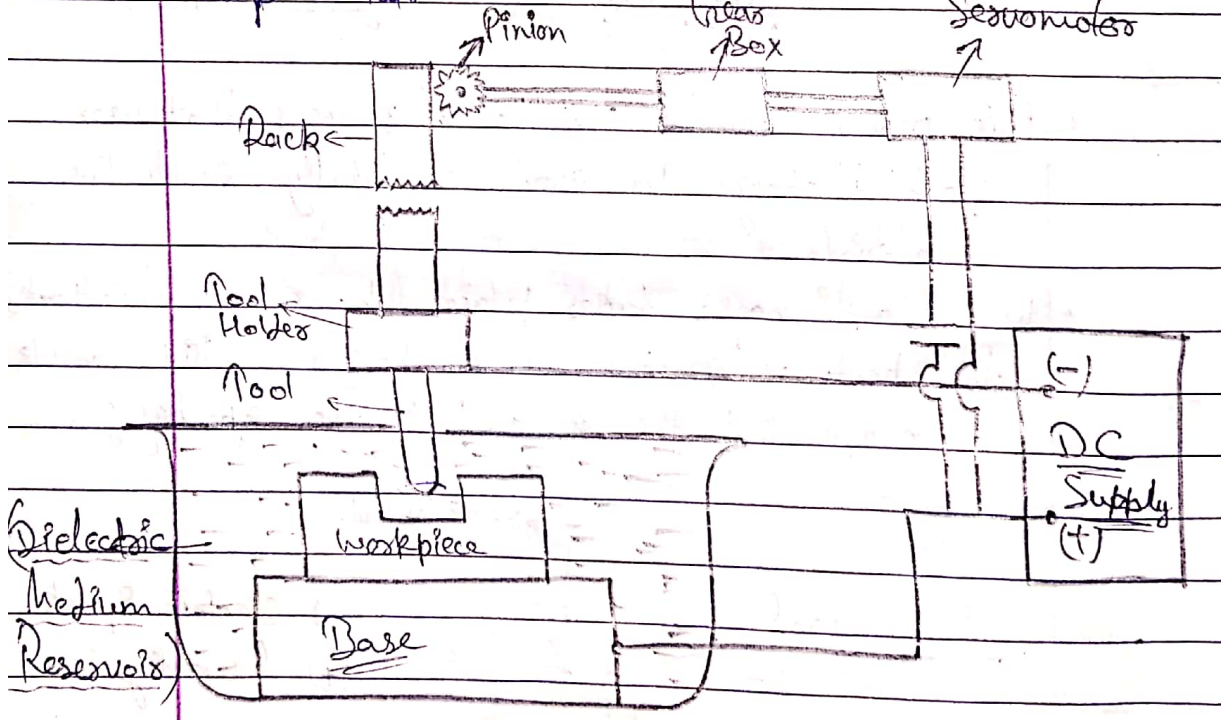

Fig:- Components of an EDM system.