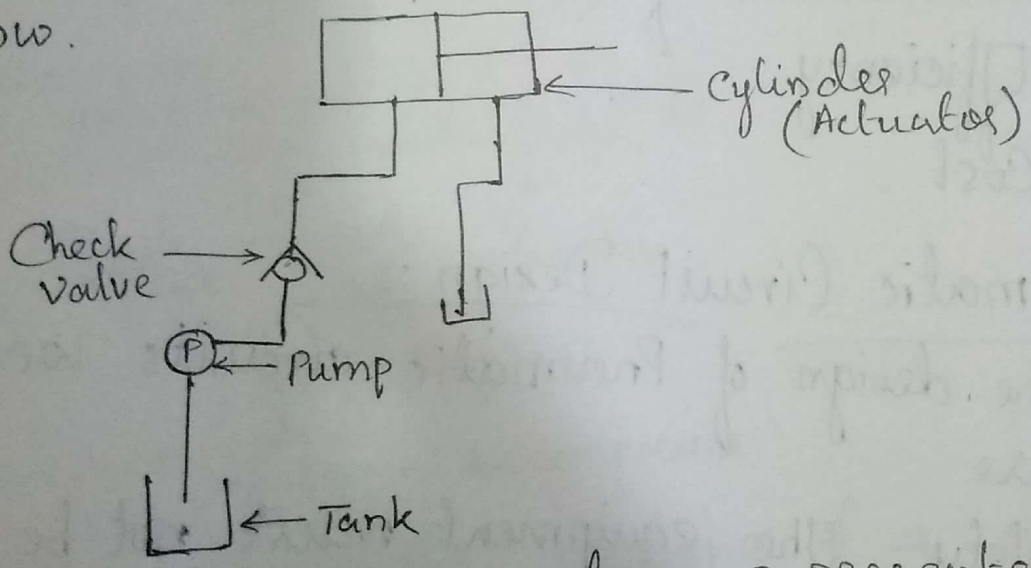
→① **Hydraulic Circuit Design:**

Hydraulic circuit design is a basic method to represent the ~~Hydraulic~~ connections between different hydraulic components.

It includes pumps, valves, actuators, motors etc. The connections are achieved by means of pipes & the working fluid might be water or hydraulic oils.

A simple design of an hydraulic circuit is shown below.



In the above figure we have represented the working of a single acting cylinder. Here ~~route~~ the fluid is drawn from the tank by the pump & supplied to various components through the pipes finally to the actuator. The fluid pushes the piston thus performing

the required work. A check valve is provided to ensure that the fluid doesn't flow back to the pump.

The designer of the circuit must be very skilled & needs to have proper knowledge about the various hydraulic components.

The factors to be considered while designing an hydraulic circuit are:

i) Safety to equipment & personnel operating.
ii) Minimisation of losses.
iii) Efficiency.
iv) Cost.

Pneumatic Circuit Design:

In the design of Pneumatic circuits we must ensure

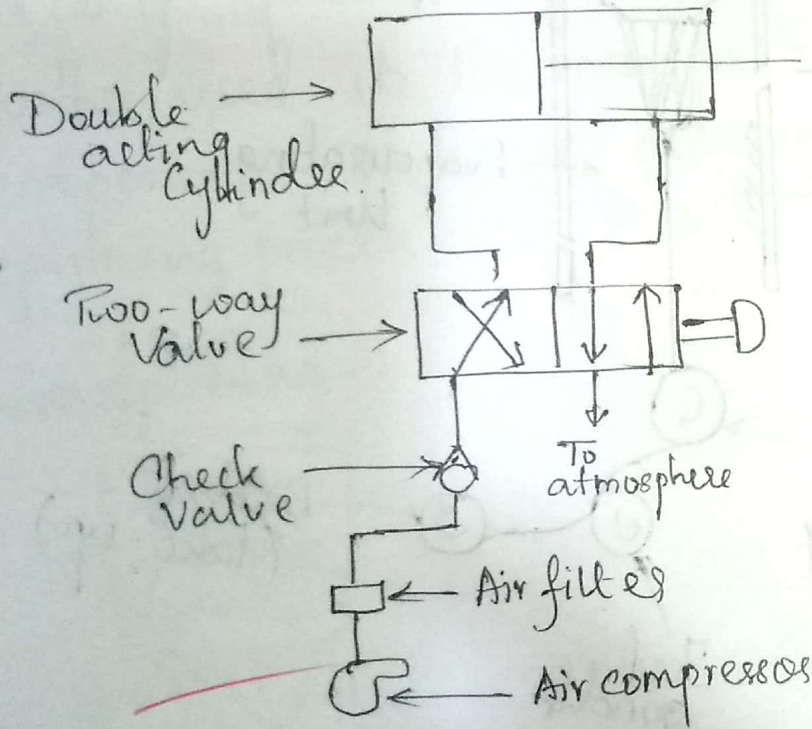
i) Safety: The equipment must not be damage The circuit must also ensure safety to the person operating.

ii) Efficiency: Pneumatic systems have very low efficiency as several losses occur in the pumps, valves as well as in the actuators. The aim must be to design

a circuit which minimizes these losses so as to increase the systems efficiency.

iii) Cost: The components used must not result in high initial cost.

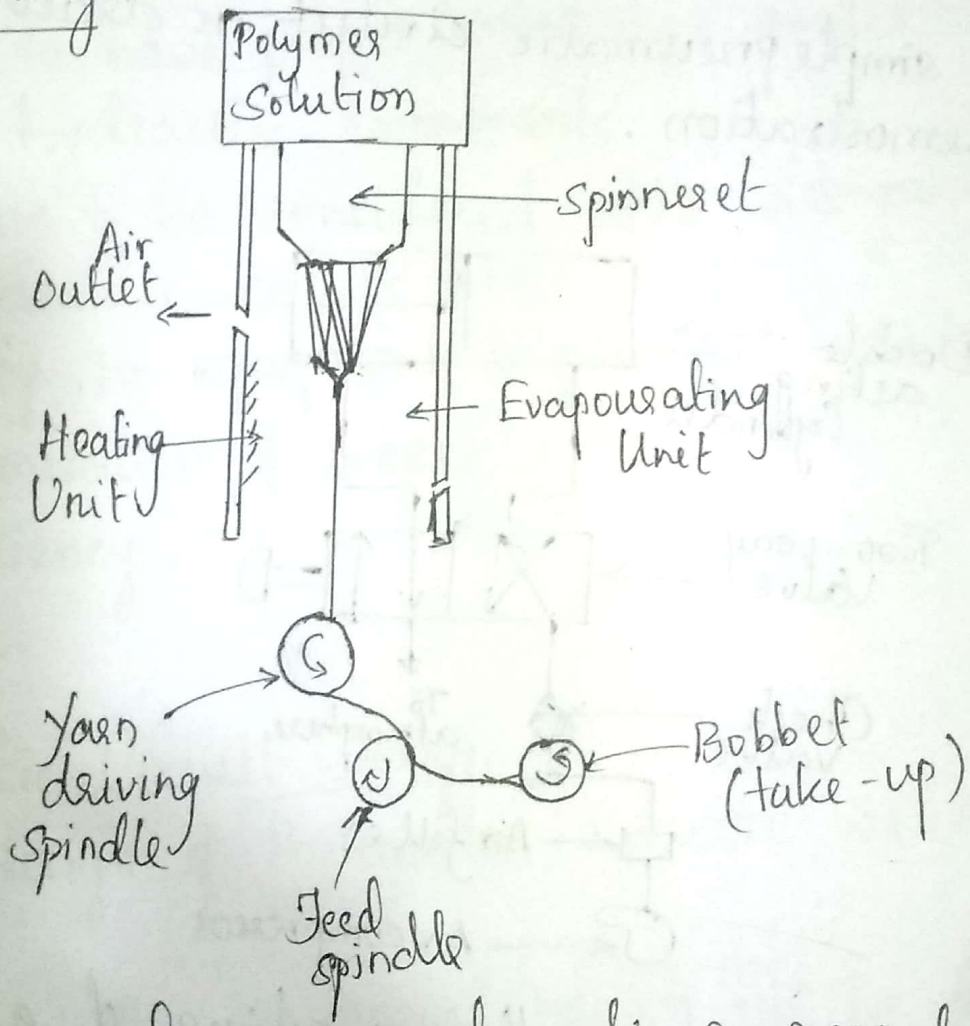
A simple pneumatic circuit is drawn for the demostration.



The figure shows the working of a double acting cylinder. Here the working fluid is the compressed air supplied through the air compressor. It is also passed through a filter inorder to eliminate the impurities present in the air.

A two way valve actuated by a push button & incorporated by a spring return mechanism is used to aitidate the cylinder.

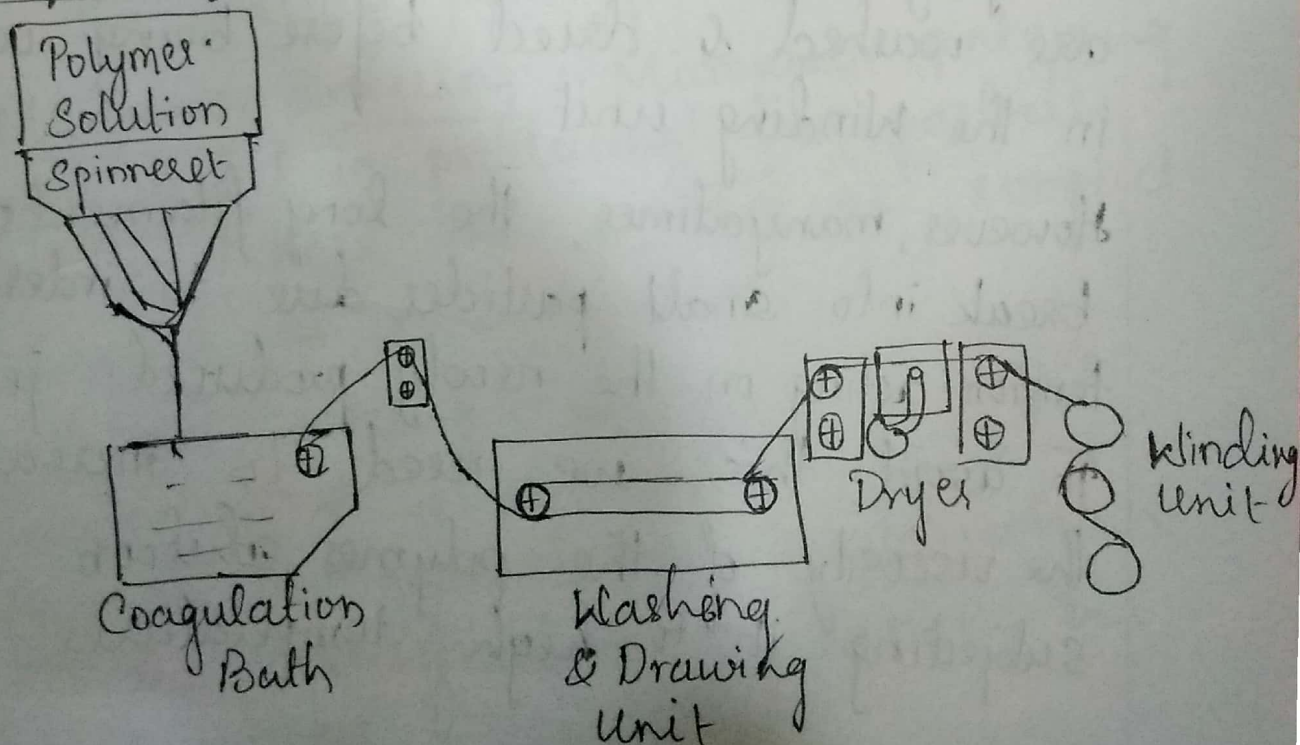
→ (8) Dry Spinning:



The figure shows a schematic representation of the dry-spinning process. In dry spinning process, the polymer compound is mixed with a suitable solvent to produce a high concentration polymer solution. The viscosity of the polymer solution can be increased

by increasing the temperature. The polymer solution is heated for softening & passed through the spinneret which produces continous jets of polymer. ~~This~~ The solvent is evaporated by passing a counter current of nitrogen gas. The polymer jets then are rolled by a no. of spindles into fibres which are further used in the manufacturing of various components. Nylon is an example of this spinning process.

Wet Spinning:



The above figure shows a schematic representation of. Wet spinning method

In this method, the polymer jets are produced similar to the dry spinning method i.e, intially the polymer powder is converted into a high concentration solution by dissolving it in a suitable solvent. This solution on passing through the spinneret with the application of heat, produces long jets of polymer which is then dipped in a coagulation bath consisting of a non-solvent which precipitates the polymers into continous filaments which are washed & dried before being wound in the winding unit.

However, many atimes, the long filaments might break into small particles due to interfacial tension acting on the newly produced jets. To avoid this we need to increase the viscosity of the polymer solution by subjecting it to high temperatures.

→(5) The Modern Sintering Techniques include:

i) Activated sintering: In this sintering technique we dope the powder or compact with an alloy so as to increase the densification.

ii) Reduction Sintering: It is a chemical process where in two reactants react to gethes to produce the reducing effect on the powder or the compact resulting in high amount of sintering.

iii) Rate-controlled Sintering: In Rate-controlled sintering we control the rate at which the powder or compact is subjected to a temperature below the melting point of the main constituents.

iv) Microwave Sintering: Microwave sintering is very useful in producing fine particles of powder. Here the powder or compact is heated in a microwave.

v) Spark-up Sintering: In this technique we make use of a cationic diode & microwaves to generate a spark which causes the densification & hence the sintering process.

→② Shape Memory Alloys :

Shape memory alloys are the materials which remembers it's shape & retains it when heated although it had undergone a minute deformation under the lowes temperatures.

The shape can be set by heat treatment process by varying the catastrophic structure of the material which occurs between the low temperature martenite stage & the high temperature austenite state.

Shape memory alloys can be used as actuators by converting them into wires. These fires have a large force withstanding capability due to it's high volume-force ratio. However it is one directional.

For instance if a shape memory alloy wire is compressed on cooling, it needs external force to reach its original state. Due to this reason we make use of bias mechanisms.

(6) Powder Metallurgy can be used in

i) Construction Industry : For manufacturing construction equipments.

ii) Automobile Industry : To manufacture various engine components.

iii) ~~Manu~~ Jewellery & Ornament manufacturing

iv) Medical Uses

v) Home appliances.