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**DOMESTIC APPLIANCES  
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## CHAPTER - I

### REFRIGERATORS AND AIR CONDITIONERS

#### 1.0 BRIEF HISTORY OF REFRIGERATION:

In olden days, natural ice was used for refrigeration purposes which was quite inconvenient and inadequate for large requirements. The different techniques are developed in the last hundred years and now there are numerous applications of refrigeration in our daily life as well as in many industries. In different types of the refrigeration systems, some physical property of matter is used for producing cold.

All the foods which are used by the human being are drawn from the plants, and animal kingdom. The foods which grow at one place may be used by the people faraway from the growing place. With the advancement of industrialisation, people are living far away from the food production areas and are thickly populating in to the industrial areas. This dislocation of population requires proper means for food preservation and distribution with out spoilage.

The standard living of the people has gone up with the advancement of Science and Technology, and the people are demanding better and fresh quality of food for all the time. Which is possible to provide with the use of modern methods of preservation.

The food preserving Technology has developed sufficiently to preserve the wide variety of foods for a considerable long time as near the point of freshness as possible. Refrigeration Technology plays a very important role from the last two decades in food preservation Technology.

#### 1.1. FUNDAMENTALS OF REFRIGERATION :

Refrigeration : " Refrigeration is defined as an art of producing and maintaining the temperature below the atmospheric or surrounding temperature. "

(OR)

" Refrigeration is the removal of heat from a space at a temperature lower than the surrounding temperature ."

In order to maintain the temperature below the surrounding atmosphere, it is essential that what ever amount of heat gets in to the refrigerated space, must be extracted out to maintain the desired temperature.

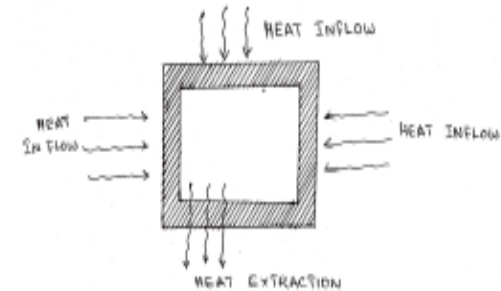


fig. 1.1

Refrigeration thus amounts to pumping of heat from lower to higher temperature. Heat has natural tendency to flow from higher to lower temperature. Hence input of work is essential, according to 'Second Law of Thermo Dynamics' in Refrigeration System.

#### 1.2 UNIT OF REFRIGERATION:

The power of capacity of Mechanical equipment is generally given in H.P. similarly the capacities of Electrical equipment are generally gives in KW or MW.

## 1.4. VAPOUR COMPRESSION REFRIGERATION SYSTEM

### 1.4.1 BRIEF ABOUT VAPOUR COMPRESSION

#### REFRIGERATION SYSTEM:

It is the most common method of refrigeration, which is usually termed as mechanical refrigeration. The vapour compression Refrigeration system (V.C.R.S.) nowadays are universally for all purpose refrigeration.

It is generally used for all industrial purposes from a small domestic units of 0.5 ton capacity to air conditioning plant of cinema halls of 200 ton capacity.

In V.C.R.S. the refrigerant alternately undergoes a change of phase from vapour to liquid and liquid to vapour during the completion of cycle. When the refrigerant's (Froen gas) temperature increases it changes its phase from liquid to vapour and vapour to liquid when the temperature decreases.

The substance or refrigerant used does not leave the plant but it is circulated through the system alternately after condensing and re-evaporation.

The diagramatic view of the system is shown in fig. All the Principal parts are shown on the diagram and parts of the refrigerant flow is also shown on the diagram.

The compression cycle is given this name because it is the compressor of the refrigerant by the compressor which permits the transfer of heat energy. The refrigerant picks up heat from the space to be cooled and releases it to another place. Most of the modern refrigerators and air-conditioners work on this cycle.

### 1.4.2. VAPOUR COMPRESSION REFRIGERATION CYCLE :

There are four fundamental operations required to complete one cycle.

- (1) Compression
- (2) Condensation
- (3) Expansion
- (4) Vaporization (or) Evaporation

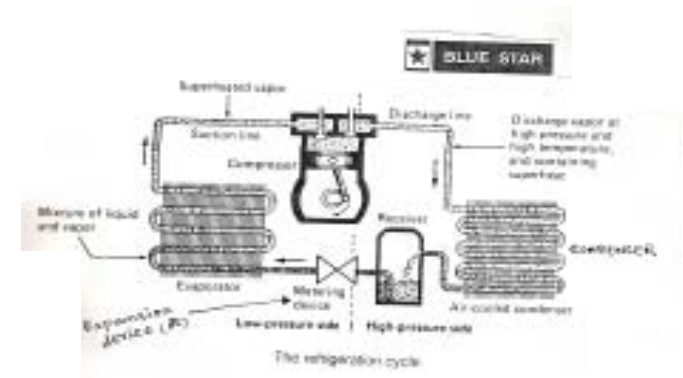


Fig 1.3

(1) Compression : The low pressure vapour refrigerant in dry state is drawn from the evaporator during the section stroke of the compressor. During compression stroke the pressure and temprature of the refrigerant increases.

(2) Condensation : The high pressure and high temperature vapour refrigerant enters in to the condenser through the discharge line. Heat will be rejected in to the cooling medium ( Air or water ) and the refrigerent changes its state from vapour to liquid.

1.5.2. Condenser: Condenser is also called as a heat exchanger. It collects the heat from the refrigerant and conveys the same to the cooling medium ( air or water ). There are different types of condensers and selection of condenser depends upon the capacity of the system, refrigerant used and medium of cooling available.

Types of cooling medium : The cooling medium available by nature or air water. Condensers are broadly divided as follows :

- (I) Air cooled Condensers : (a) Natural air cooled Condensers.
- (b) Forced air cooled Condensers.

(a) Natural air cooled Condensers : These condensers are cooled by natural air or atmospheric air. This type of condensers are commonly used for domestic refrigerators. This condensers are provided at the back of the refrigerator.

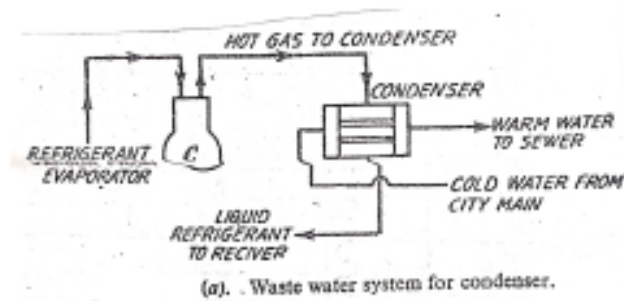
(b) Forced air cooled condensers: These condensers are cooled by external fan motors. This type of condensers are commonly used for water coolers, bottle coolers and air conditioners.

(II) Water Cooled Condensers : Water cooled condensers are always preferred where adequate supply of clean and inexpensive means of water disposal are available. These condensers are used in large capacity refrigerating plant such as, cold storages, ice plants and central air - conditioners.

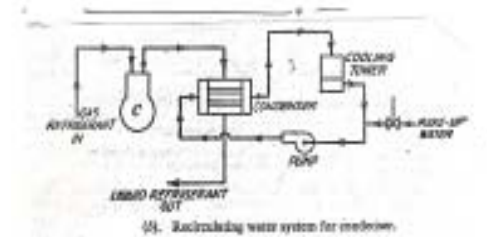
This category of condenser is divided into two kinds :

- (a) Water waste system.
  - (b) Re- circulated system.
- (a) Water waste system :

In water waste system, the water is taken from the mains made to allow and circulate in the condenser and then disposed off in the sewer or in side canals. This system is adopted only where the supply of water is adequate, cheap and disposal is not objectionable .



(b) Re - Circulated System :



When in - adequate and expensive supply of water is available then, the water is used in the condenser is circulated and used again and again in the condenser with the help of a cooling tower.

1.5.3. Cooling Towers :

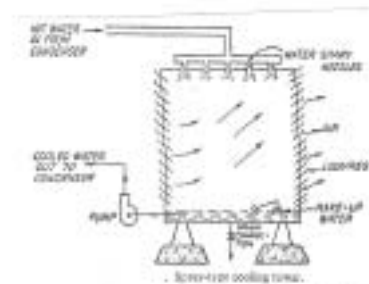
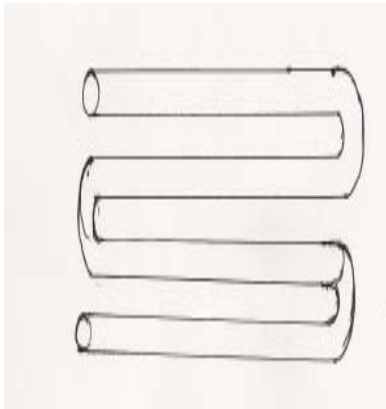


Fig 1-5



## 1.6 AIR - CONDITIONING

### 1.6.1. MEANING OF AIR - CONDITIONING :

The history behind the air-conditioning is more than hundred years old. The human life is becoming more un comfortable in rapidly developing countries like New York and Tokyo due to the increase in population and industrial growth. It was the feeling of ASHRAE ( American Society of Heating, Refrigerating and Air conditioning Engineers ) That uncomfot may be due to the inadequate supply of oxygen or unbearable temperature. ASHRAE had conducted lot of experiments changing oxygen supply and temperature on different kinds of people like old, young, childrens, women and it was found that the oxygen level and temperature were not the only factors for the comfort feeling of the human beings. The humidity of air was to be responsible factor for the human comfort and number of experiments were conducted with variable humidity and temperature and it was found that a particular temperature and humidity of air was comfortable for large percentage of people.

Full air-conditioning signifies the automatic control of an atmospheric environment either for comfort of human beings or animals or for the proper performance of some industrial or scientific process. The purpose of air conditioning is to supply sufficient volume of clean air containing a specific amount of water vapour and at a temperature capable of maintaining predetermined atmospheric conditions with in a selected space. The space may be a small compartment, such as research test cabinet or a cinema hall. Properly conditioned air results in greater comfort to occupapnts when applied to peblic places, offices and factories. Industrially it has many benefits, including better control of product quality and uniformity.

### 2. Plate Tube Evaporator :

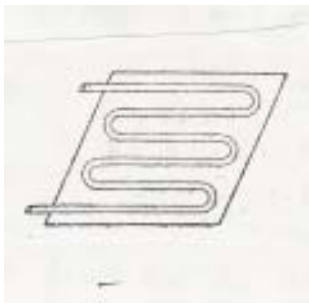


Fig 1.6 ( ii )

To increase the area of contact the tubes of the evaporator coils are welded on one side of a plate as shown in fig. This type of evaporator is commonly used in domestic refrigerator, Ice cream plants, home freezers etc.

## 1.7. House hold refrigerators :

### 5. Dew point temperature :

When atmospheric air saturated with water vapour is cooled, vapour pressure decreases and air has less capacity to absorb moisture, condensing excess moisture to water droplets. The saturation temperature corresponding to the partial pressure of the water vapour is known as dew point temperature.

### 6. Humidity:

Moisture present in air is called humidity. Humidity in psychrometry are specific humidity (S.H) and relative humidity (R.H)

#### (a) Specific Humidity (S.H):

It is the ratio of mass of water vapour to the mass of dry air at the temperature of the air .

#### (b) Relative Humidity (R.H)

It is the ratio of water vapour pressure to the saturated water vapour pressure at the temperature of the air.

### 7. Sensible heat :-

It is any heat that raises the temperature but not the moisture content of the substance.

### 8. Latent heat :

It is that heat required to transform a liquid to vapour . the latent heat of vaporisation in this instance is the heat required to change water from liquid at 100°C to vapour at the same temperature.

Human beings generate latent heat by way of moisture (perspiration )on their skin.

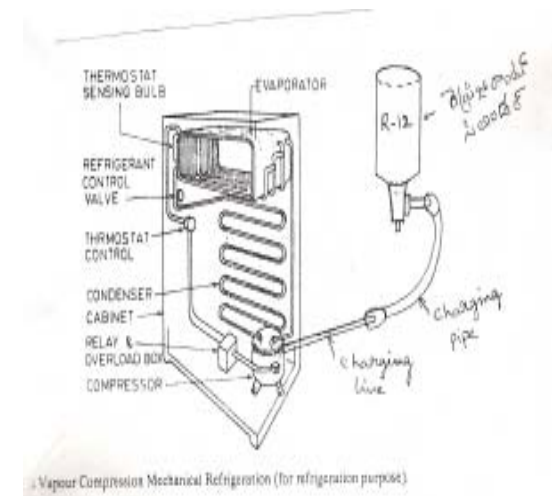


figure 1.6.2

### Principle of working of refrigerator :

As we switch on the refrigerator , the compressor compresses the refrigerant gas (R12) this gas after being compressed gets heated at high temperature and pressure and it flows through the delivery of discharge line.

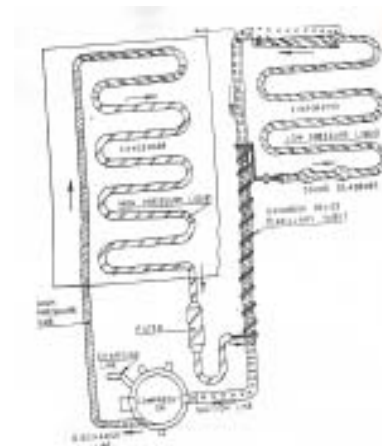


Figure 1.6.3.

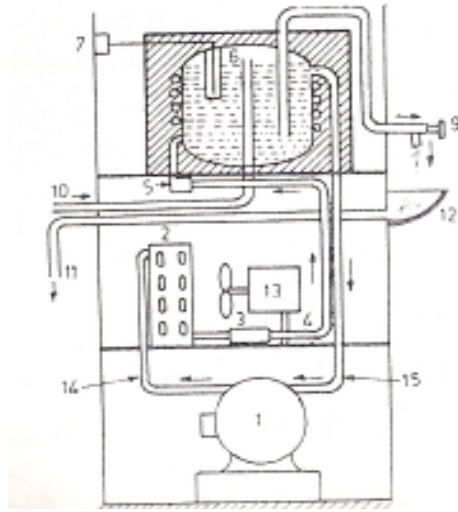


Figure 1.6.4.

A water cooler consists of the following main parts such as compressor, condenser, fan with motor, water storage tank, expansion device, evaporator, (cooling coil) and, filter. A thermostatic switch is provided to control temperature range of cold water between 10° to 20°

Water storage tank in which cold water is stored is made from non-corrosive material such as G.I. sheets so that it does not get corroded in a small span of valve which automatically maintains a certain level of water in it.

Working principle:

As we switch on the water cooler, the compressor starts working and the compressor piston compresses the refrigerant gas and pushes it through the discharge line into the condenser. This refrigerant gas which has high temperature and pressure. In the condenser (which is a fin and tube type)

this process is known as forced air cooling of the refrigerant gas in the condenser. As the compressor continues to work the refrigerant liquid at high pressure is pushed in to the receiver. From receiver the liquid refrigerant enters into the filter where it is filtered for any unwanted particles (such as carbon particles, metallic chips etc.)

As the compressor goes on working, the liquid refrigerant is pushed through the filter and the filtered liquid refrigerant enters the expansion device. From the expansion device the liquid refrigerant in very small quantity enters the evaporator coil. The evaporator coil is a copper tube of 10mm Diameter and 10 to 15 metres length. The evaporator coil is fitted around the water tank. From the outlet of the evaporator the refrigerant gas is pushed in to the accumulator which is usually a tube of about 30mm dia and 25-30 cm length. This accumulator is placed in such a position that at its outlet only refrigerant gas is pushed into the suction line of the compressor. This completes one cycle of the refrigeration cycle. As the compressor goes on working the cycle is repeated again and again till the thermostatic switch cuts off the supply to the compressor as this thermostat is preset for certain temperature range (usually between 10° to 20° c) which is installed in electric circuit in series with compressor motor winding, the electric supply will also cut off with an overload protector which operates when the motor is overloaded. The bimetallic overload gets heated and disconnects the power supply.

Cold water is stored in water tank which is provided with insulation material all around it so that the cold water does not get heated because of the heat penetrations from the surroundings.

1.9 window Air conditioning:

During the good old days, we did not have so much industrialisation in our country. We lived in a clean and fresh atmosphere. Cities had more trees and plants. These plants during the day, due to photosynthesis action, produced oxygen and dust in the atmosphere was filtered by the vegetation/plants. Now, as the cities/towns are becoming more congested due to increase in number of houses, the atmosphere is not

1.10 REFRIGERATION AND AIR-CONDITIONER TROUBLE SHOOTING:

Problems	Causes		
For the entire system			
1) In does not run and there is no humming	1) Fuse wire is blown out 2) Main overload relay tripped 3) Overload cut out tripped opr burnt out 4) Loose connections or broken wire 5) Faulty Wiring 6) Disconnecting Switch is open	4) The system is very noisy	7) Undersized unit 8) Oil entrapped in the coil 9) Control contacts overloaded 1) Undersized refrigerant line 2) Compressor completely burnt out 3) Refrigerant has been over charged 4) Vibration in the system 5) High head pressure 6) Load on evaporator not proper
2) The system runs but for a short time	1) Refrigerant Shortage 2) Refrigerant's control device faulty or wrongly adjusted or completely burnt out. 3) Load on evaporator is not correct 4) Low suction pressure 5) High head refrigerant pressure 6) Oil entrapped in the coil 7) Plugged liquid line 8) Refrigerant control device wrongly adjusted or completely burnt out	5) Evaporator temperture is very high	1) Low head pressure 2) Low ambient temperature 3) Refrigerator Shortage 4) Load on evaporator not proper 5) Oil logged coil 6) Undersized refrigerant line 7) Undersized Unit 8) Refrigerant pressure reducing device wrongly adjusted or completely burnt out.
3) The system runs continuously	1) Refrigerant shortage 2) Refrigerant pressure reducing device faulty or wrongly adjusted, or completely burnt out 3) Wiring not proper 4) Load on evaporator not proper 5) Low ambient temperature 6) High head pressure	6) Evaporator Temperature very low	1) Refrigerant Shortage 2) Refrigerant pressure reducing device wrongly adjusted or completely burnt out. 3) Oil logged coil 4) Control contacts over loaded 5) Wiring not correct 6) Faulty locationof the unit
		7) System suction line ices up	1) Refrigerant pressure reducing device

blow pump.

8. Close the hand shut off valve and stop the vacuum pump and disconnect it from the charging unit/line .
9. Connect the compound pressure gauge with charging line.
10. Open the hand shut off valve and note down the vacuum pressure. It should be around 68 cm of Hg.
11. Check the weight and pressure after about 24hours  
(it should be same).
12. Check the weight and pressure of the gas cylinder.
13. Connect the charging line with the gas cylinder.
14. Open the gas cylinder valve and purge the air from the charging line by loosening the flare nut fitted before the hand shut off valve.
15. Tighten the flare nut before opening the hand shut off valve.
16. Now, charge the system by opening the hand shut off valve for about one or two seconds ,so that very little quantity of refrigerant gas is charged into the system.
17. Start the compressor and run it for about 3 to 4 minutes, again open the hand shut off valve for about 3 to 4 seconds and run the compressor for about 3 to 4 minutes. Repeat the charging of the refrigerant till the section pressure of 0.70 to 0.85 kg/cm is achieved. To check the pressure, remove the gas cylinder after closing the cylinder valve and fit a compound pressure gauge to note the suction pressure.
18. Check cooling in the evaporator and adjust the thermostat at mark  
1. Note whether cut off takes place after the thermostat has been set at various marks, i.e.,1,2,3,4, etc. and check the cooling effect by noting down the achieved.

## CHAPTER - 1 QUESTIONS

### Short Answer Type Questions :

1. Define Refrigeration ?
2. What is the unit of refrigeration ?
3. What are the various methods of refrigeration ?
4. Write any two applications of refrigeration ?
5. Define air - conditioning ?
6. Define psychrometry ?
7. What is dry air ?
8. What are the parts of a refrigerator ?

### Essay Type Questions :

1. Explain vapour compression Refrigeration cycle ?
2. Write a short note on compressor ?
3. Write a short note on condenser ?
4. Write a short note on cooling tower ?
5. What are the psychrometric properties and explain ?

## 2.2 MAIN FEATURES OF AIR COOLER:

### i) Sturdy Design:

Totally indigenously designed. It is an Air Cooler made of thermoplastic material having excellent aesthetic appeal and corrosion free life.

### ii) Four Way Air Deflection System:

This feature enables uniform circulation of air by manual and motorised louvers to maintain same cool temperature through the room.

### iii) Uniform WATER Distribution on Pads:

Water is distributed to wet the wood wool through a pump and valve arrangement that delivers water to the shower pipes. Independent humidifier control is provided which controls quantity of water released on the wood wool pads.

### iv) Speed Control:

Independent Controls for three different air speeds. LED indicator for power "ON".

### v) Special Wood Wool Pads:

Wood Wool is provided for odourless and fresh cool air.

### vi) Auto Water Level Controller:

The Air Cooler when connected by the water inlet to the overhead tank maintains the required water level in the tank by the float valve arrangement.

### vii) Water Level Indicator:

An easy to view water level indicator on the front panel lets you keep a check on the water level in the tank.

### viii) Safety:

The body is electrical shock proof plastic material and earthing is provided on the fan motor.

## 2.3 SAFETY PRECAUTIONS:

To prevent shock.

\* Do not open any panel or cover when the unit is in operation.

Always

disconnect the mains cord before opening the unit.

\* Do not try to fill water manually into the cooler while the unit is in operation. Fill water in the cooler only when it is in the power 'OFF' mode.

\* Do not overfill the water tank.

## 2.4 OPERATIONS OF AIR COOLER:

### 1. INSTALLATION:

Location:

(a) For obtaining best results from the Air Cooler, mount the unit on a window, exposing the back and sides of the cooler outside, preferably away from the direct sunlight. Ensure that the unit is placed on a sturdy structure like a support from angular frames.

## 2.5 Applications of air cooler:

1. Living Room
2. Large Hall
3. Hotel Room
4. Bed Room
5. Office
6. Restaurant
7. Study Room
8. Clinic
9. Shop

## Important (or) Hint:

For efficient operation of air cooler, place the cooler near an open window for intake of fresh air. also leave a door or window open in the opposite side of the room to expel air.

## 2.6 TROUBLE SHOOTING:

If your Air Cooler fails to operate check the following before calling service centre.

- \* Check that the Power Point is switched “ON” and that the plug is in the place
- \* Check that there is electric supply at the Power Point
- \* Check that the controls are properly set

## 2.7 MAINTENANCE:

\* Periodic maintenance helps to keep your Air Cooler in good condition

\* It is recommended to drain the unit and clean the wood wool pads every month.

\* Replace the wood wool pads every year.

\* After a season of using the cooler ensure to drain the water from the tank completely.

\* To clean the wood wool pads.

1) Step the cooler and disconnect the plug from the main socket.

2) Remove the back and side panels by pushing the thumb locks down and pulling out the panel.

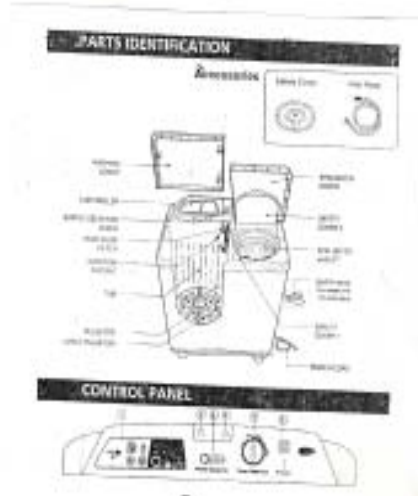
3) Clean the Wood Wool pads using house spray until the dust is removed, that would otherwise decrease the effectiveness of the cooler.

4) To drain the cooler, remove the drain plug provided inside the tank at the rear side. Place a bucket under the tank to collect drain water.

5) To remove the wood wool pads from the panel, disassemble retaining grill.

## CHAPTER –3 WASHING MACHINE

Schematic diagram of washing machine and brief description of the main parts



1. Controller :-  
Provides total control of washing as per need .
2. Hot water inlet :  
Select this inlet when opting for hot water wash .
3. Cold water inlet:  
Select this inlet when opting for cold water wash
4. Drain selector:-  
Select wash/rinse for washing and rinsing. And “drain” to drain water out of tub.
5. Power s/w:  
Press this s/w for connecting or disconnecting your machine from mains .
6. Water selector :  
Select “wash” to supply water for washing and rinsing and “spin” for spin shower rinse.

### HOW WASHING MACHINES WORK. TUB ON A VERTICAL AXIS.

The tub (or inner tub) , is where you put the clothes. In most washing machine brands , this tub has hundreds of small holes that allow the water to flow through to an outer tub. The outer tub is solid and holds the water. At the centre of the inner tub is an agitator .

#### Central agitator

The agitator clock wise and counter clock wise about three fourth of a revolution plunging the clothes through the water to wash them. The clothes keep moving from the top of the tub down to the bottom and back again. The motion allows the detergent and water to reach every part of the clothing and loosens the soil.

#### Motor and pump.

The motor drives the agitator during the wash cycle and spins the clothes during the damp dry or spin cycle. The pump removes the water from the tub and lifts its out to the drain.

On many machines the motor is reversing so it can run both clock wise and counter clock wise.

- i) In one direction , the motor works through a clutch and or a transmission to spin the inner tub at speeds from 400 to 800 r. p. m. this causes the water , by centrifugal force, to be forced out of the clothes in to the outer tub where it is pumped out of the clothes in to the outer tub where it is pumped to the out of the machine.
- ii) In the opposite direction , the motor works through the same clutch and transmission to move the agitator back and forth during the wash cycle.

#### Fill valve:

The fill valve which is about the size of a coffee cup is sometimes also called a water “ inlet valve”. It controls the entry of hot and cold water in to machine .the valve has three major components.

- i) A hot water solenoid.
  - ii) A cold water solenoid.
  - iii) A mixing valve body.
- The inlet valve has three hoses connected to it ,for .
- i) The hot water from the house.
  - ii) The cold water from the house.
  - iii) The water directed in to the washing machine inner tub leather

Some machines have adjustable leveling legs in the rear also, and you can adjust them in the same way. Keep the machine as close to the floor as possible the lower it is, the less likely it is to vibrate.

## II) Surface cleaning:

Your washer has either a painted steel or porcelain-coated steel cabinet. It's perfectly safe to use a little dish detergent and a damp rag to clean all of its surfaces. If the surface is Porcelain, you can ever use a little non-abrasive cleaner for stubborn stains.

## IV) Lint Disposal

Most washing machines contact lint during the wash cycle and send it down the drain during the drain cycle. You need to lift out that tube and clean it periodically. Other Machines have a lint filter near the top of the tub, which you need slide out, clean off, and reinsert

Answer to common questions about washing machines.

1. Does washer really need to be level?

A; Yes, It is very important for washing machines to be level for proper operation.

2. How much detergent need for each load?

A; This depends on the hardness of your water and the sort in your clothing. Softened water requires quite a bit less detergent than hard water. Yet the more sorted the clothes, the more detergent you need to clean them. If soap suds remains at the end of the cycle, you are probably using too much detergent.

3. Which detergent is best?

A: All modern detergents work quite well. However, some have been tested.

4. Where does the lint go from washer?

A: If your washer doesn't have a lint filter that you manually clean, the lint goes down the drain. This is usually safe for both city sewers and septic systems.

5. How delicate is the "delicate" cycle?

A: The systems used for delicate cycles vary widely. Units with at least a two speed motor. One speed for regular and another for delicate are usually more gentle than units with only one speed.

6. Why do items sometimes tear in the washer?

A: During the wash cycle, the agitator in the centre of a top-loading washer rotates back and forth rapidly. If the unit is too full, or if the agitator in the centre of a top-loading washer rotates back and forth rapidly. If the unit is too full, or if the agitator happens to catch a piece of clothing in an unfortunate way, it may tear certain clothes. When washing fragile things, put them into a net laundry bag, before

7. How to know how many clothes to put into the washer?

A: For a top loader. A general rule of thumb is to clothes loosely inside the washer until they reach the top of the agitator. For a front loader, fill it until it's full, with minimal compression of the clothes.

8. Is it bad to let the machine run with an unbalanced load?

A: Yes, washing machines are complex and have many functional components. It is always best to stop an unbalanced load, re-arrange it, and restart the washer.

9. Is it true a nail, accidentally put in the washer, can break it?

A: Absolutely, so can a small chain or any other small metal object. That's why it is important to always empty all pockets before laundering.

10. How can you get rid of residual soapsuds at the end of a cycle?

A: This is usually an indication that you are using too much detergent

## CHAPTER – 4 WET GRINDER AND MIXER

### INTRODUCTION

Among electrical domestic appliances, the wet grinder is one of the most popular and essential items for house wives. It is used to grind wet grains.

Wet grinder

There are three types of wet grinders

- \* Stone rotating type wet grinder
- \* Container rotating type wet grinder
- \* Tilting type, both stone and container rotary type wet grinder.

The most common wet grinder used in houses in the container rotating type wet grinder.

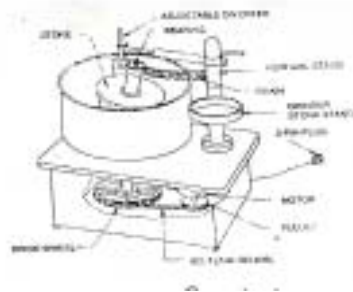
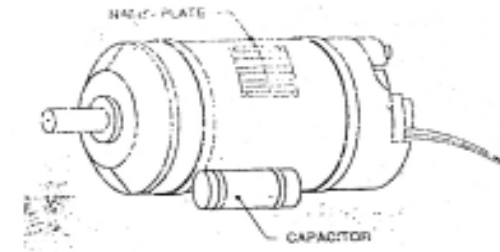


Fig .4.1

The important parts of a wet grinder are

- Motor
- Grinding Stone
- Container
- Pulley
- Belt
- Frame and Stand



Motor :~

The motor used in the wet grinders is usually the capacitor start induction motor. ( Fig 4.2 ). It has two windings. Both the start and run windings are energized to start the motor, and after 70 to 80 % of the rated speed is reached, The starting is switched off by the motor then operates only on running winding.

Stone :~

The grinder stone consists of two parts. One male and one female. The male part actually grinds the grinding material during its rotation. The hallow stone ( female ) actually keeps the grinding material inside. This female part is actually attached to the stainless steel container ( drawn ) which rotates when the motor is energized. The above stones are manufactured with hard granite which is usually whitish black in colour.

Pulley :~

The drum speed is lower than the motor speed, normally 500 to 600 r.p.m.. The motor speed is normally 1450 r.p.m and the speed of the drum is reduced by using a larger diameter pulley than the 1:3. The transmission of force between the driver pulley and the driven pulley is through a v-belt ( V-32 ).

Frame and Sand :~

These are all housed in a rectangular frame with Sun Mica or Stainless Steel covering or plastic moulding for decoration as well as safety. A separate vertical stand is provided on one side of the grinder for holding the male grinding stone in an idle running condition.

	3) Benf Shaft	3) Straighten or replace the shaft
	4) Un balanced rotor	4) Banance rotor
	5) Burns on Shaft	5) Remove burns
	6) Loose Parts	6) Tighten the parts
	7) Worn out belts	7) jReplace the belts
	8) Misalignment	8) Align Puley
	9) Warn out centri-fugal switch	9) Replace centrifugal switch
9. The usar gets a shock	1) Contact between live parts and body of the motor	1) Rectify isolation between body and the live parts of the motor.
	2) Broken ground strap	2) Replace ground strap
	3) Poor grond ane-ction	3) Inspect and repair ground connection
10. Reduction is power motor gets too hot.	1) Short circuited or grounded windings	1) Rectify or rewind the windings
	2) Sticky or light bearings	2) Clean and re-tubricate the bearings.
	3) Interference between stator and rotor	3) Install new bearings
11. Motor fuse blows	1) Grounded or short circuited windings	1) Rectify or rewind the windings
	2) Low capacity of fuses	2) Replace with proper capacity of fuses
	3) Grounded near the switch end of the winding	3) Repair or rewind the winding
12. Smoke from motor (motor burnt out)	1) Over load	1) Reduce the load
	2) Shorted windings	2) Rewind the windings
	3) Faulty centrifugal switch	3) Repair or replace the centrifugal switch
	4) Frozen bearing	4) Clean and lubricate or replace the bearing.

13. Rotor tubs stator	1) Shorted capacitor	1) Replace the capacitor
	2) Dirty in motor	2) Clean the motor
	3) Burrs on rotor or states	3) Repair or replace
	4) Worn out bearings	4) Replace the bearings
	5) Bent Shaft	5) Straighten or replace the shaft
14. Excessive bearing wear	1) Belt too tight	1) Correct the mechanical condition.
	2) Dirty Bearings	2) Clean and lubricate or replace the bearing.
	3) Insufficient lubrication	3) Lubricate with appropriate lubricant
	4) Thrust over load	4) Reduce thrust load
	5) Bent Shaft	5) Straighten or replace the shaft.
15. Radio Interference	1) Faulty ground	1) Rectify poor ground connections
	2) Loose connections	2) Tighten loose connections
	3) Defective suppression	3) Check Filler, capacitors, chokes if possible or replace the complete filter unit.

CAUSES OF FAILURE IN DRIVE BELTS:

Appearance	Cause of Failure
1) Worn Outsides	1) Normal wear, misalignment, grit or dust.
2) Underside, cracked belt hardened	2) High temparature
3) Narrow Spots	3) Broken cords from prying or running belt on the sheaves.

This machine is used for crushing the “masalla” and taking out juice from fruits , or making milk shake or mango shake etc., In this machine also, a Universal , motor is fitted and controlled with a push button. Different types of attachments are available to take different work from the machine. The construction is fig 4.3

i. MOTOR :-

Motor is with a rating of about 120 watts which operates on 220 Volts. The motor whirls while working at a speed of 12000 r.p.m. It is a series motor called universal motor.

ii. BLADES :-

Blades are made of good quality stainless and will, therefore, give high life.

i. BLENDER :-

Blender is made up of transparent plastic. This can make milk shakes, Lassi or other drinks or cocktails . It is also used for blending and stirring . The extent to which the blender is to be fitted depends on the substance. Liquids can be filled up to 3/4 th of the blender capacity. The heavier the substance to be placed in the blender, the less it should be filled. If the substance is not being circulated, add a small quantity of suitable liquid or water.

ii. GRINDER :-

Grinder is a designed to grind small quantities of dry substances, such as coffee, condiments, curry powder, nuts, black peeper etc., It is necessary that all dry substances are broken down to size of peas and roasted or dried to a crisp in order that the grinder is not over loaded.

iii. CLEANING OF GRINDER :-

The grinder unit should be cleaned with a soft dry brush. Never use water.

OPERATING INSTRUCTIONS :-

1. Place the rubber sealing ring on the base of the blade assembly. Screw the plastic blender into this assembly until tight.
2. Place the ingredients in the bladder.

3. Place the lid on the blender. When the motor is running , only the centre stopper should be removed.
4. Switch on the motor by pressing the switch.
5. When the operation is complete, switch “ off “ the mixer. Wait till the motor stops completely and remove the blender.

CAUTION :-

1. Motor should not be used continuously for more than two minutes in small mixy and 15 minute in heavy duty. There should be a gap of 15 seconds between each operation.
2. Do not insert any metal part from centre stapper when the motor is in motion.
3. Do not put big ice pieces while making cold drinks. Crush the ice and then put into the blender.

## CHAPTER 5 GAS STOVES

Installation and operations of gas stoves.

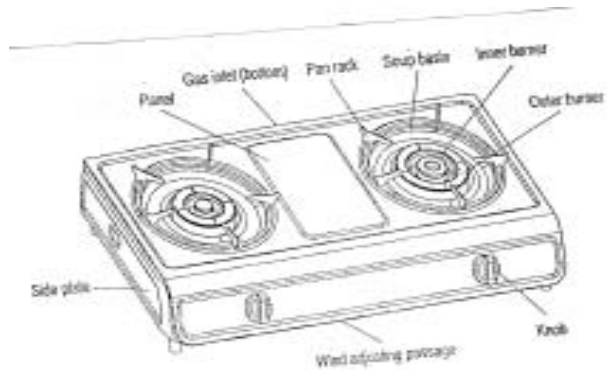


Figure 5.1

To install the gas stoves:-

1. Put it to the ventilated place in using .
2. the edge distance around the gas stove should not be less than .15em and there should be 100cm space to the top. But if the ventilating hood is installed, this space should set according to the requirements of the ventilating hoods.

Requirements and methods of installation:-

1. Check the kind and pressure of the gas on the rating label.
2. Check the fixing bolts and connection of the components to avoid the influence in transit.

To install the gas inlet hole:-

After cleaning the gas inlet end , fit the rubber hole to the slot which is near the splice, then light it with the clamp. Never use the defect hole or the aged hole to avoid the gas leakage.

GAS STOVE OPERATIONS :-

1. Confirm that all the knobs have on the “off” then open the gas.
2. Press down the knob and turn it anti-clock wise to the “on” , it will ignite automatically .
3. If it can't be ignited ,please repeat the above steps.
4. You can adjust the fire by slowly turning the knob according to indication.
5. If you need to fire the central ring only , turn the knob anti -clock wise to the limit.
6. Turn the knob clock wise to the “off” it will close automatically.
7. You should adjust the wind plate at the bottom to stable the flame when the off-flame ,flame with yellow colour or uneven flame happens.

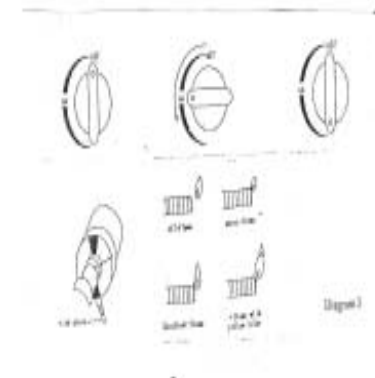


Figure 5.2

TROUBLE SHOOTING CHART:

Trouble	Reason	Trouble - Shooting
1) Ineffective to ignite	1) The gas switch is closed	1) Open the switch
	2) The rubber hose is bended or blocked	2) Straight the hose or remove the block age or replace the hose.

## CHAPTER 5 QUESTIONS

### SHORT ANSWER TYPE QUESTIONS:-

1. What are the requirements for installation of a gas stove?
2. Write the parts of a gas stove?
3. What is the reason for gas leakage in gas stoves?
4. If the flame is abnormal in a gas stove, what steps do you take?

### ESSAY TYPE QUESTIONS:

1. Write the operations of a gas stove with the help of a neat sketch?
2. Explain the installation methods of a gas stove with the help of a neat sketch?
3. Write the troubleshooting chart of a gas stove?
4. Explain the maintenance of a gas stove?
5. What are the cautions for operating a gas stove?

## CHAPTER - 6

### PETROMAX LIGHT AND GAS LIGHT

#### INTRODUCTION:

The first lanterns developed, named petromax, were used by the German armies before and during the second world war. The military significance of a lantern that would burn all liquid fuels from diesel oil to gasoline made the lantern very useful. Also developed were heaters and stoves for the individual soldier and up to whole companies. These three items gave the German army the benefit of heat, light and a way to prepare food with the use of any liquid fuel available.

The German army and many other military services including the NATO forces still use the same product line of the original company. Making use of parts quality and ability of interchange going back to 1900s.

All the lanterns, stoves and heaters used today by the general public worldwide, are known to be reliable and easy to repair, with the same use of kerosene as the fuel of choice, this lantern has a problem-free life of decades if a little tender loving care is bestowed upon it.

Designed by the Germans since the early 1900's, these pressurised, multi-fueled lanterns were invented to be the most reliable, consist to use, and capable of operating on a wide variety of fuels (i.e., kerosene, diesel, gasoline, biodiesel, mineral, spirits, lamp oils etc.,)

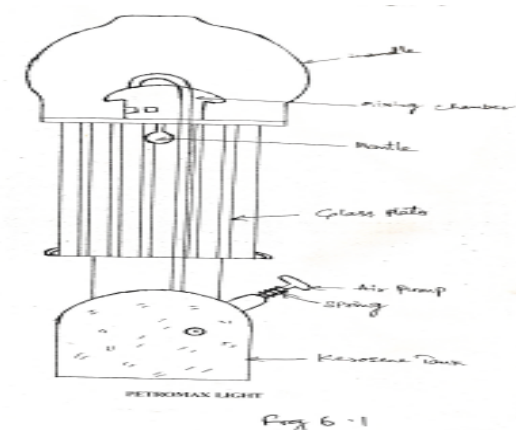


Fig. 6.1

ii) **REPLACING THE LEATHER WASHER:**

Remove pump piston unscrew pump piston nut and remove old leather washer. Grease and spread new washer for optimal function.

iii) **REPLACING THE NIPPLE AND NEEDLE:**

Loosen screws on frame. Remove hood, inner casing and glass chimney. Set inner casing and glass chimney to protect the porous mantle. Holding of vaporizer with one hand and unscrew nipple with spanner. Remove needle key. Replace nipple and needle and assemble again.

iv) **REPLACING THE PUMP VALVE:**

Drain the container. Remove pump piston. Unscrew valve with long screw driver. Tip lantern side wards and let valve fall out of necessary, remove valve washer from pump base. Assemble new valve with washer and screw it light.

v) **REPLACING THE CHECK PACKING:**

Open screw of fitting cap/gauge to release pressure. Open tip of preheater. Loosen screw on top with screwdriver. Replace the check packing and assemble again.

vi) **REPLACING THE CONNECTING PIPES:**

Release pressure, remove hood, inner casing, glass chimney, flame protecting tube, frame. Unscrew nipple for preheater and nut for nipple with the spanner. Remove the complete tip. Unscrew connecting piece with spanner and review lead washer.

vii) **REPLACING THE MIXING TUBE, MIXING CHAMBER AND NOZZLE:**

Remove hood and inner casing screw off nozzle from mixing chamber unscrew mixing chamber from mixing tube loosen screw and remove mixing tube. Replace the defective part.

**HINTS FOR THE CARE OF PETROMAX LIGHT (OR) SAFETY MEASURES:**

- 1) Damaged gas mantles have to be replaced immediately.
- 2) Even little tears can trigger blast flames which cause heavy damage of lantern.
- 3) Damaged leather washers have to be replaced immediately.
- 4) Damaged glass plates have to be replaced immediately.
- 5) Fitting cap must be lightened during operation.
- 6) Kerosene should not fill more than 3/4 full.
- 7) Pumping up air should be limited.
- 8) Frequently the nipple must be cleaned.

**GAS LIGHT:**

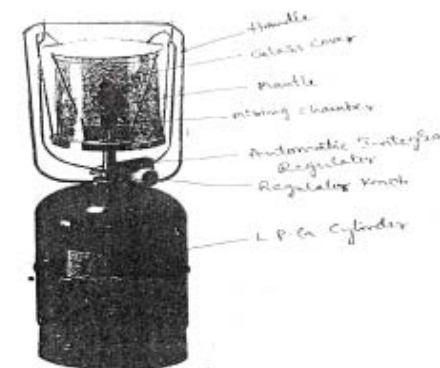


Fig. 6.2

The use of gas light is similar to the Petromax light. In the gas light, L.P.G. gas cylinder will be used instead of kerosene tank. In gas lighting system no liquid fuels will be used. Fixing of the gas mantle is similar to the petromax light. Integral regulator is provided in this gas lighting system. Integral regulator works as automatic lighter as well as gas controller.

## CHAPTER 7 BICYCLE

### INTRODUCTION:

Bicycle is an easily available machine and riding it is also easy. It is a poor man's vehicle to travel quickly. A bicycle is a two wheeler. Two wheels with rims are fixed to a frame, one in the front and the other is the rear. And axle is arranged to the bottom of the triangular frame. Two crank levers are fixed to the axle the right crank lever is fixed to a toothed wheel. A free wheel is there at the centre of the back wheel. The free wheel and the toothed wheel near the crank are connected by a chain. Two pedals are fixed to the two cranks. One seat is fixed above the back wheel and a handle is fixed above the front wheel.

A bicycle is within the reach of a common man, and it is easier to handle. It can be lifted by a single person and can be kept safely inside the house. It does not occupy much space. One can ride it in a narrow lane or along streets and also on field tracks and on mud roads. It is lighter than motor cycle. Unlike motor cycle it does not need any special training to ride it. Maintenance of bicycle is cheap and without petrol, it can run. The bicycle will solve the pollution problems also.

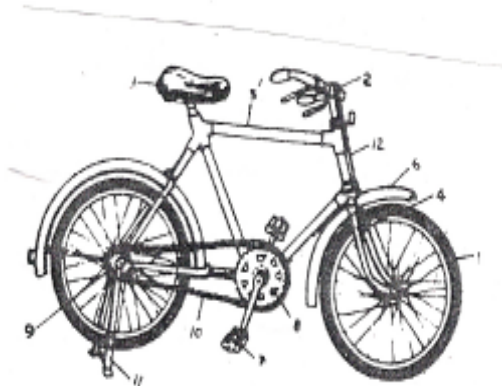


Figure 7.1

1.seat; 2 handle; 3; frame ; 4 fork ; 5 wheel; 6 mudguard; 7pedal; 8 gear wheel; 9 free wheel ;10 chain; 11 stand; 12 ;brake.

1.seat:-  
figure 7.2

The purpose of the seat is to sit the person comfortably and ride the bicycle. The material used for making the seat is leather. A high tensioned spring is provided beneath the seat to avoid shock absorbers.

2. Handle:-  
figure 7.3

The handle of a bicycle helps in keeping a proper balance of the vehicle while riding. We hold to the handle with our hands and it in different directions to maintain the balance. There is a bell fixed to the handle. At each end there are plastic or rubber handle grips to hold the handle firmly.

b) Brake:-

Brake levers are provided near the handle. Brake is used to control the bicycle speed. Right hand brake controls the front wheel speed and left hand brake controls the rear wheel speed. You have to slow down the vehicle while taking a sharp turn or stop it completely to get down from it go slow, the brakes are applied first to the rear wheel and then front wheel.

c) bell: -

Cyclist uses a bell to make the way clear.

3)frame :-  
figure 7.4

The frame is made up of a hollow tube and is triangular in shape. It connects the two wheels, handle, seat and the gear wheel.

4 forks :-

There are two forks, connecting the two wheels with the frame. The front fork connects the handle with the front wheel, while back fork connects the seat and the back wheel.

5. Gear – wheel, free- wheel and chain:-  
figure 7.5

The gear wheel is of a longer diameter is a toothed wheel which is fixed to the bottom of the frame while the free wheel is fixed at the centre of the back wheel, and is of smaller size. These two wheels are connected by

## QUESTIONS

### CHAPTER 7

1. What is the use of handle ion a bicycle ?
2. What is the use of frame In a bicycle?
3. Explain about gear –wheel and free wheel in a bicycle?
4. Write about bicycle tyre?

Essay type question:-

1. Explain the construction and working of a bicycle ?
2. Write briefly about over hauling of a bicycle?