CANNING MACHINERIES AND EQUIPMENTS

Aim: To study various types of machineries and equipments used in canning

Introduction: Preservation of food materials in closed container by using heat as an agent to destroy microorganisms and other spoilage agents is termed as canning.

Definition of Canning Method:

"Canning is a process whereby selected raw materials are prepared as for the table, packed in tin or glass, or plastic containers capable of being sealed airtight, heated sufficiently to destroy spoilage and pathogenic agents within the container and cooled rapidly to prevent over cooking of the product."

Can Making Equipments:

1) **Can body Reformer:** The can bodies, in most of the cases are supplied to the distant canners in collapsed form. So as to reduce space and easy transportation the can bodies are shaped into cylindrical form using in a can body reformer.
2) **Flanger:** The cylindrical shaped can bodies are flanged in the can ends by the flanger. The flanging has two flanging dye which have flanging of grooves.
3) **Seaming Machine:** The Seaming machine helps in closing one end of the can. It has a base plate for keeping the can that can be raised when the can body is raised the upper end of the can on which lid is kept comes in contact with the top plate and simultaneously two seaming rollers of first and second operate. Thus closing the can.
4) **Can Leakage Tester:** The seamed cans are tested for leakage using this machine. The cans are immersed in water and pressures are noticed, then it is understood that seaming is not proper.
5) **Flange Rectifier:** Sometimes the cans subjected to flanging will be bent, deformed or crushed. These types of cans are rectified by flange rectifier machine.
6) **Can coding Machine (Embossing Machine):** The machine is used for embossing the code, which contain the name of the product, name of manufacture (code) and date of production.

7) **Transfer Car:** The car is used for transferring the cooker tray (basket/plate type) taken out of cooker / retort to the next position.

8) Packing table with conveyor:

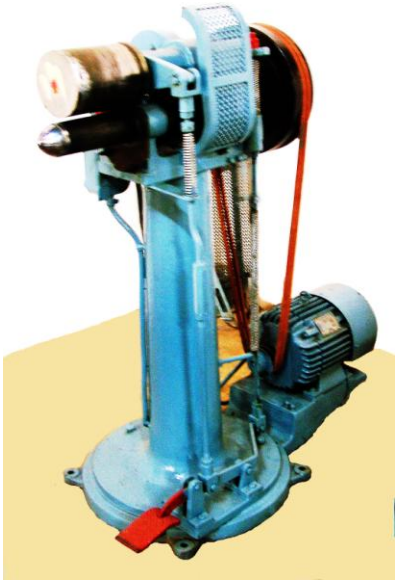
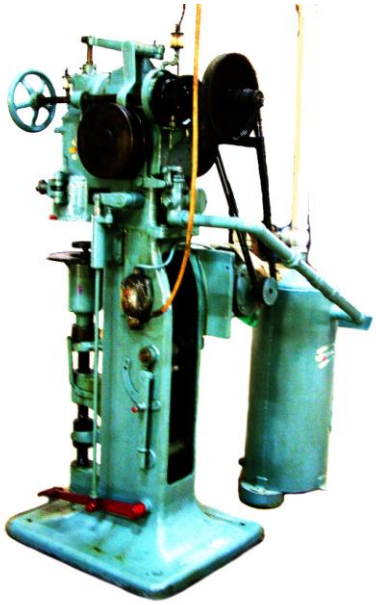
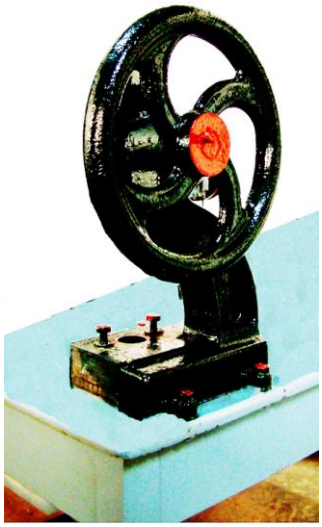
This equipment consists of a packing table and a conveyor belt. It rationalizes canning operation and greater production efficiency. The packing table is made of stainless steel to resist corrosion.

Double Seam Examination:

a) **Can Opener:** The special manual can opener is a heavy-duty unit commercially available from most container suppliers. It is adjustable to the can diameter and removes the center panel at the cover without damaging the seams or the body. The use of conventional house hold can opener should be discouraged because it leaves a double seam which is not only difficult to tear down, but may be distorted.

b) **Can Vacuum Tester:** This instrument is used for the measuring vacuum with in a closed can. The cushion of the tester is pressed hard on the lid, thus making its needle tip pierce the can. The measurement at vacuum appears on the dial of the instrument.

c) **Seam Micrometer:** The Seam micrometer has a standard micrometer barrel incorporated on to a suitable stem, which has been designed specifically for measurement of double seam dimensions. The micrometer is placed over the surface to be measured by balancing the micrometer with the index finger at 90-degree angle to the surface. The micrometer is lowered on to the surface touches the surface. The adjustment barrel of the micrometer should then be used to bring the stem in contact with other side of the surface without exerting excess pressure.

		
Can body Reformer	**Seaming Machine**	**Home Seamer (Hand operated)**
		
Semi automatic vacuum seamer	**Irregular can double seamer**	**Embossing machine**

d) **Countersink Gauge:** The dial indicator type counter sink gauge is probably the best. However, there are less expensive instruments available. All are used to measure the countersink depth from the top of the seam to the lowest point adjacent to the countersink wall.

e) **Nippers:** Standard no.5 nippers are available in most hardware stores. Nippers are used to tear off the strip of cover left by the can opener.

f) **Seam Saw:** A cross-section of the double seam can be cut with a fine metal saw.

g) **Seam Projector:** A seam projector is very effective for direct measurement of the seam overlap. A small cross section is first removed from the double seam area of the can. It is then clamped into position and calipers in the base of the projector permit direct measurement on the projected image of the overlap, cover hook, and body hook. The projector allows inspection of the total configuration of the seam at the same time. It should be understood that this unit is limited to observing a cross-section of the seam. It does not eliminate the need for seam teardown to make a full and complete evaluation.

h) **Seam Scope:** The seam scope is a pencil like magnifier with a attached light source. It contains a visible scale by which the length of the body hook, cover hook and overlap can be read directly in thousandths of an inch on the exposed cross-section of the double seam. Its uses and limitation are similar to that of the seam projector.

i) **Head Space Scale:** It is used for measuring of empty space left out in the filled canned products.

j) **Refractometer:** Used for testing the concentration of brine solution and brix concentration of syrup used as a filling medium of fish and fruits canned products respectively.

k) **Vernier Calipers:** This instrument is used for finding dimension of can.

K.H. Home Seamer (For Sanitary Round Cans)

I. Hand operated: Adjustable to different can sizes

This is manually operated closing machine for seaming open-top cans. It is portable and recommended for a laboratory or for small company.

Specifications:

1) Range and can size: 2 1/8″ - 4 1/16″ dia. or 2″ -5″ ht.
2) Capacity: cans per m^2.

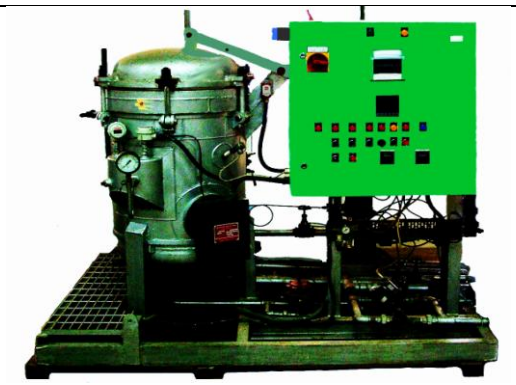
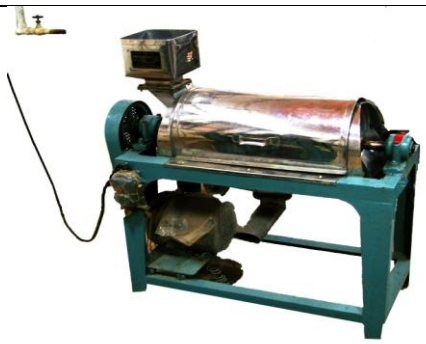
3) No. of Revolution of hand wheel to close one can: 30
4) Floor space: 21″ x 14″
5) Overall ht. : 53″
6) Gross Wt. : 300 lbs.
7) Cubic Measurements: 12 cft.

II. Type: Adriance, No.127 – Irregular can double Seamer:

(For oval, square, rectangular and other irregular shaped cans)

This is a semi-automatic all-round machine for closing oval, round, square, rectangular and other irregular shaped cans. The operator adjusts the seaming head, places on the lifter a filled can with a cover on and depresses the foot-pedal. The lifter spindle will ascend and fix the can in the seaming chuck. A further depression of the pedal will cause the seaming head revolve and by the alternating action of first and second rolls, seaming is affected. It is a belt driven machine, but motor driven is also available.

 **Jacketed steam kettle**	 **Can transfer car**

 **Over pressure retort**	 **Fruit juice extractor**
 **Flanger**	 **Horizontal retort**
 **No.1 Tall 8-Oz 1 lb Jam**	 **Can transfer car**

Specifications:

1) Range of can size: 3″-8″ dia. or 2″-10″ ht.
2) Speed: Cans per minutes: 10-15
3) No. of Revolution of driving pulley to seaming one can: 20

4) No. of Rev. of seaming head to seam one can: 10
5) Required horsepower: 1 H.P.
6) Floor space: 48″ x 28″
7) Size of base: 33″ x 23″
8) Over all ht. : 72″
9) Gross wt.: 1200 lbs
10) Cubic measurement: 68 cft.

III. Model-5-Automatic Sanitary Vacuum Seamer:

This is a fully automatic machine for closing round cans in a vacuum chamber. The machine has cover and can-feeds and No can-No cover mechanism. It has a superior seaming set-up capable of giving a perfect result with efficiency.

Specifications:

1) Range of can size: 202-401 mm dia., 107-500 mm ht.
2) Speed: Cans per min. 40-45.
3) No. of Rev. of driving pulley to seam one can: 15
4) No. of Rev. of Seaming head to seam one can: 18
5) Required power: 1.5 KW
6) Floor space: 1200 x 1450 mm
7) Size of base: 650 x 850 mm
8) Gross Wt.: 1480 Kg.
9) Crate Dimensions: 1300 x 1600 x 2000 mm
10) Cubic measurement: 4.2 m^3

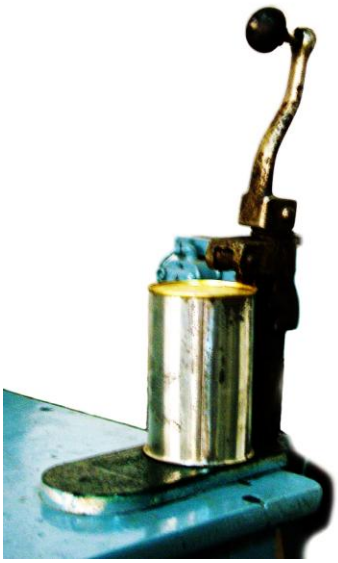
Principle of double seam: The double seam is made in two operations. To begin with, the first operation rolls the flange of the lid under the flange of the body of the can, and then the second operation rolls finish off the seams by tightly pressing together and rolling up all five layers of tin plate. In this machine, the seaming is made up with two or four grooved rollers, which are brought into operation by a can or eccentric arrangement fitted into the hand.

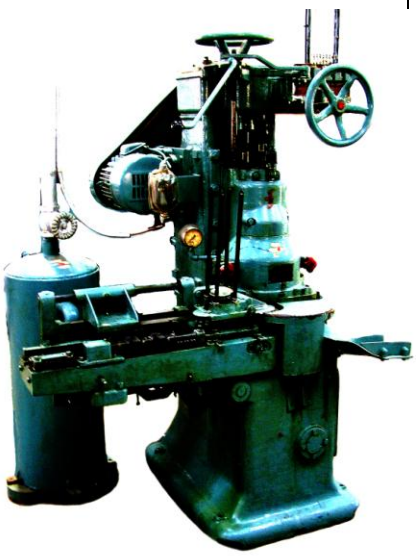
The first operation roller, which comes in contact with the cover, has a narrow groove, and the second operation, which follows the first, has a wide groove. Inside, the curl of the cover is a rubber compound which is applied in a liquid state and dried out, leaving sufficient rubber or compound for jointing. When the seam is complete, the edge of the body is pressed into this material. The first operation roller folds the cover and flange together and the second operation flatten out the metal and complete the seal.

The lid is seamed while one can is under vacuum

Setting for a correct seam: In setting up a double seaming machine, the first thing to do is to check the chuck and the seaming rollers to be sure they are in good condition. Next step is to bring the base plate up to the top position. The setting of this plate is the adjusting of the distance between the face of the base plate and the top edge of the chuck. This is done by placing a can on the base plate and adjusting up or down until the flange of the can is just level with the top edge of the chuck i.e. distance equals height of the can minus the thickness of the chuck.

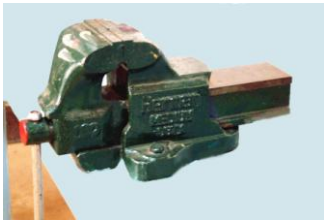
Now, turn the machine round slowly and bring in the first operation roller and make sure that the distance between the top edge of the chuck and flange of the roller is not less than 0.002 inch. Now, turn the machine further until the second operation roller is in contact and allow not less than 0.015 inch of clearance.

		
Pine apple slicer	**Can opener**	**Flange rectifier**



Automatic vacuum seamer

Pine apple corer



Wice

Can leakage tester

Packing table with conveyor

Refractometer, Vacuum tester, seam micrometer, Can cutter, Counter sink gauge, Tone tester

To facilitate the setting of the rollers, the canner is usually supplied with two wires, a thick one for the first operation and a thin one for the second operation. The machine is turned round until the first operation roller is in full operation and the roller is then adjusted to a point where the wire will pass firmly between the contour of the roller and the face of the chuck. The same process is repeated with the second operation rollers and the thin wire.

When the adjustments are all made, make sure that all locking nuts or bolts are tight and turn the machine one complete cycle by hand before seaming a test can under power. The seam should first be measured on the outside to check thickness and length. The hooks and double seam are measured with a micrometer. There are some standard limits of seam dimension.

Maintenance:

The machine should be kept well oiled and greased. The seaming rollers or seaming roller bearing should be greased not less than once per shift or hours. At the end of the shift, the machine should be thoroughly washed with hot water and then with steam and the setting of the rollers should be tested while the machine is still warm. After this is done, oil should be rubbed over the metal faces to prevent rusting.

Note: Not advised to exceed the speed specified by the manufacturer.

Pressure Process Retort:

a) **Horizontal Retort:** Two models such as No. 48 and 510 are available. This unit is used in a cannery with a steam. This equipment is fitted with Pressure Gauge, Thermometer and Safety Valves.

Model	**48 horizontal**	**510 horizontal**
Inner diameter	940mm / 291 /8 ″	910mm / 357 / 8″
Length of body plate	1220mm / 48″	1520mm / 60″
Thickness of body	6mm / ¼″	8mm / 5 / 16″
Thickness of lid and end	8mm/ 5 / 16″	9mm / 3 / 8″

Astoria type:

A retort is a steel tank in which crates containing filled cans are placed for processing and cooling. It is fitted with a cover without any pressure leak. For large-scale production and more efficiency, horizontal retorts are preferred than the vertical retort.

Retort Equipment:

1) **Indicating Mercury-in-glass Thermometer:** Use of two such thermometers on each retort is advised – one so placed as to serve as official guide to the operator in his control of temperature of processes and the other intended to serve as a check instrument located adjacent to temperature recorder bulb.

Each thermometer should have a temperature range of not more than 100^0F, For example: 170^0F to 270^0F. The thermometer should have a pressure scale corresponding to the temperature scale at the altitude above sea level at which the retort is located. The relation between the temperature and pressure scales at various altitudes is provided in a table. The pressure scale of all thermometers should be adjusted in correspondence with these data.

2) **Pressure Gauge:** It should be graduated in one pound division and have a range up to 30 lbs. The gauge should be connected to the retort by means of a gauge siphon.

3) **Valve Controlled Vents:** In general, the venting efficiency is better when the resistance to flow through the venting system is decreased. This resistance is minimized with the larger size fittings and gate-type valves rather than the globe valves. Vents should be controlled by quick opening gate or plug cock type valves, which permit

unrestricted discharge of air from the retort during the come-up period.

An air-steam mixture in the retort will cause a non-uniform heat distribution, and may cause a lowering of rate of heat transference to the containers. The specified time of process should not be considered as beginning, (even though the proper temperature has been reached) until temperature and pressure instrument on the retort corresponding readings.

Processing in open kettle:

Fruits, including tomatoes and other food with sufficient acidity, may be safely processed in open kettle at the temperature of boiling water.

Jacketed Steam Kettle:

Both rotating and stationary types are available. The inner kettle will be made of cast-Iron, stainless steel or gun metal according to the purpose for which the container is to be used. It's containing capacity ranges from 360 to 370 liters. Its other accessories are pressure gauge, safety valve, stop valve and drain cock.

Semi Automatic Corer and Sizer (For pineapples and apples):

This machine is used to core, peel and size pineapples or apples. The cutter, core-tube knives are made of non-corrosive acid resisting material. It is very easy to install and operate.

Specifications:

1) Range of can size: 80-105 mm dia.
2) Speed-Fruits per min.: 15-20
3) No. of Rev. of pulley: 550 - 600
4) Required power: 0.2 KW
5) Floor space: 1800 x 440 mm
6) Overall height: 1370 mm
7) Gross Wt.: 220kg (Approx).

8) Cubic measurement:1.65 m^3

Model "O" Sanitary Vacuum Seamer (With 5-p Vacuum Pump and Vacuum Tank): This is a semi automatic machine for seaming round cans in a vacuum chamber. As it is quite simple in operation and adjustment, it is recommended for use in a small cannery or a laboratory.

Accessories: Model 5-P Vacuum pump, vacuum tank and their pipes. The Seamer alone can be purchased without accessories. Normally this machine is operating by belt drive, but meter drive can be available on demand.

Specifications:

1) Range of can size: 21 / 8″-6 3/16″ dia. and 2″-62 / 16″ ht.
2) Speed Cans per min.: 10-15
3) No. of Rev. of driving pulley to seam one can: 18
4) No. of Rev. of Seaming head to seam one can: 18
5) Required horsepower: For Seamer-1 H.P; For Pump - 5 H.P.
6) Floor space: 38″ x 28″
7) Size of base: 32″ x 28″
8) Overall ht.: 80″
9) Gross Wt.: 1625 lbs. (approx.)
10) Cubic measurement: 80 cft.

Table giving the standard limits of seam dimensions (inches):

Can diameter	**Nominal substance**	**Dimension**		
(inch, 1/16″)	lb. (per base box)	Thickness (1/1000″)	Length (1/1000″)	Hooks (1/1000″)
211	85	55-57	117-125	75-85
300, 301	90	56-58	117-125	75-85
307	95	58-60	117-125	75-85
313, 401	100	60-62	117-125	75-85
401, 502	108	63-65	117-125	75-85
603	112	65-67	122-130	80-90

Note: Thickness measurement can only be considered in relation to the actual substance of the body and end examined. Allow 0.002 inch for each 10 lb. deviation in substance of body plate, and 0.003 inch for each 10 lb. in end plate.

Seams made from lacquered plate will be about 0.003 inch thicker than those made from plain plate.

BOILERS:

Classification of Boilers:

Boilers may be classified in different forms according to the service and construction

(a) Locomotive (b) Marine (c) Fire Tube (d) Water Tube

(e) Vertical (F) Horizontal (g) Inclined, etc.

Simple Vertical Boiler:

In its simplest form, a vertical boiler consists of a cylindrical shell surrounding a nearly cylindrical firebox. At the bottom of the firebox, a gate is provided to facilitate the burning of fuel. At the top of the firebox, an uptake tube is provided connecting the firebox with the exhaust chimney. To increase the heating area and thereby to increase the efficiency, cross water tubes are fixed in the firebox. The cross tubes are fixed slightly inclined to facilitate efficient circulation of water. Hand holes are provided in the axis of the cross tube for easy inspection and cleaning of the tubes.

The boiler is provided with ***"fire holes'*** and ***"man holes"*** to maintain the boiler and the charging of the fire. There is a pit provided at the bottom of the boiler to collect the ash produced during operation. The steam is collected at the top portion of boiler by means of steam delivery tubes. The boiler shell will be insulated from outside to reduce the radiation, heat loss and usually painted with white colour.

Normally, simple vertical boilers are of smaller capacity having about 4′ diameters, 10′ heights, with gate area of 8½ sq.ft. The cross tubes will be of 9″ dia. and total heating surface area will be of 80 sq.ft.

The drought required to suck sufficient air into the firebox is obtained by giving enough chimney height. Because of continuous flow of gases and due to atmospheric pressure difference between the top of the chimney and the firebox, sufficient air will be sucked into the boiler ensuring total and efficient combustion of the fuel. This is termed as ***"Natural Draught"***

Boiler Mountings: The important boiler mountings are,

1) Water level indicator
2) Pressure gauges
3) Safety valve
4) Top-valve or Air-junction valve
5) Feed check valves and
6) Blow off cock and air cock

The important boiler accessories are:

a) Feed water pumps
b) Water softeners
c) Fuel supply systems
d) Exhaust system

Feed Water:

Good water free from hardness is required to feed the boiler. Hard water leads to scale formation. It should be avoided because it acts as an insulator between water and shell of the boiler.

Many methods are employed for this purpose. The easiest method being the Zeolite process in which sodium Zeolite is used for this purpose. The term Zeolite is applied to a class of minerals that have the property of Base Exchange, i.e. Zeolite is a term applied to natural inorganic salts that undergo a reversible chemical reaction with hardness ions in water. Natural Zeolite is composed of hydrated silicates of Iron, Aluminium and Sodium. The Zeolite is first treated with brine and then the hard water can satisfactorily be softened using a bed of such material. The limit of hardness in feed water is about one gram per gallon.