Wh 42 3rd Oct.

INSTRUCTION MANUAL
FOR
INSTALLATION • OPERATION • MAINTENANCE

Pump Shaft Speed Tachometer
1st Stage 2nd Stage.

0 Low.	100 RPM.	330 RPM
6 Med	150	510
12 High	250	860.

Mr ~~Foster~~ Stephens
Mr Day.

BV6.

CLARKE-BUILT

Britannic

RANGE OF CONTINUOUS FREEZERS

Variable Drive Belt
Reeves Dayco 1A.
No. RC - 312 - 27.

MACHINERY WORLD

Your Machine is Model No.

CLARKE-BUILT LIMITED

Power Road, Chiswick, London, W4, England. Telegrams: Clarkbilt, London, W.4. Telephone: Chiswick 7631

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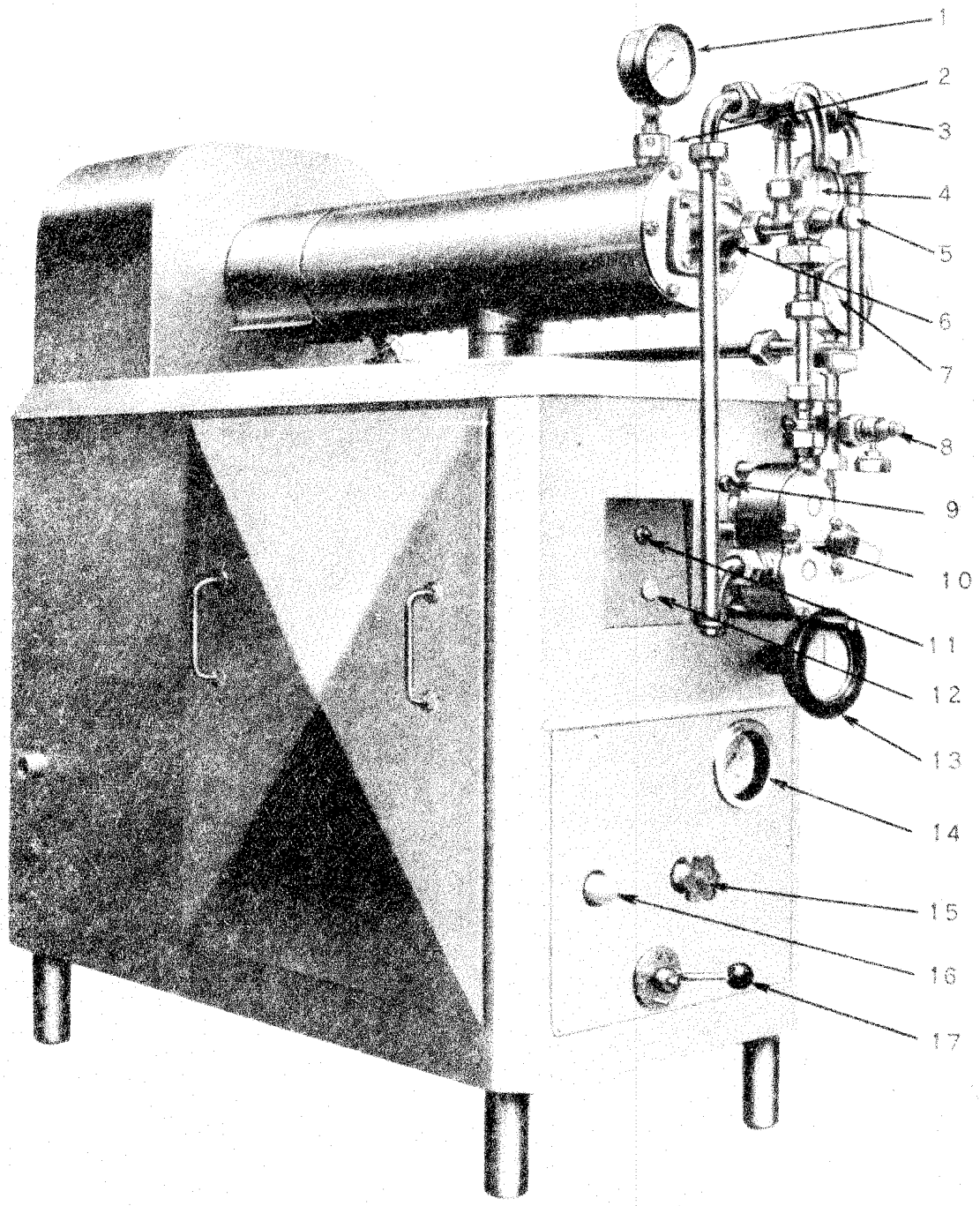


FIG. 1. FRONT VIEW OF BV8 FREEZER

1. Refrigerant Back Pressure Gauge.
2. Refrigerant Back Pressure Gauge Valve.
3. Three-way Valve.
4. Mix Pressure Gauge.
5. Barrel Hold-back Valve.
6. Mix Outlet.
7. Vacuum Gauge.
8. Air Control Valve.
9. 2nd Stage Mix Pump Adjustment.
10. Duplex Mix Pump.
11. Indicator light.
12. Stop Button.
13. Mix Pump Speed Control Handle.
14. Ejector Pressure Gauge.
15. Refrigerant Stop Valve.
16. Expansion Valve Adjustment.
17. Ejector Quick Shut-off Valve.

		BV8	BV1	BV2	BV6	2BV8	2BV1	2BV6	3BV8	3BV1	3BV6
Nominal Output	Gall.p.h. Lits.p.h.	30/70 140/330	60/125 280/600	120/250 560/1200	120/250 560/1200	60/140 280/660	120/250 560/1200	240/500 1120/2400	90/210 420/990	180/375 840/1800	360/750 1680/3600
Overall Length	ins. mets.	61 1.55	64 1.60	72 1.83	71 1.80	61 1.55	64 1.60	71 1.80	61 1.55	66 1.68	71 1.80
Overall Width	ins. mets.	29 0.74	32 0.81	32 0.81	34 0.86	43 1.09	50 1.27	55 1.40	58 1.47	78 1.98	77 1.96
Overail Height	ins. mets.	61 1.55	69 1.76	76 1.92	74 1.88	61 1.55	69 1.76	74 1.88	61 1.55	69 1.76	74 1.88
Case Length	ins. mets.	68 1.73	71 1.80	79 2.00	78 1.98	68 1.73	71 1.80	78 1.98	68 1.73	74 1.88	78 1.98
Case Width	ins. mets.	35 0.89	38 0.96	38 0.96	40 1.20	49 1.25	56 1.42	61 1.55	64 1.60	84 2.14	83 2.11
Case Height	ins. mets.	67 1.70	75 1.92	82 2.08	84 2.14	67 1.70	65 1.65	80 2.03	67 1.70	75 1.92	80 2.03
Nett Weight	lbs. kgs.	1803 820	2437 1110	3404 1550	2687 1225	3233 1470	4029 1830	4529 2030	4660 2120	5621 2550	6371 2900
Gross Weight	lbs. kgs.	2211 1015	2863 1300	3764 1710	3013 1370	3771 1715	4682 2130	5182 2360	5331 2420	6501 2950	7251 3300
Refign. Required	T.R. K.Cal.H.	3.5 10,500	6.0 18,000	12.0 36,000	13.5 40,000	7.0 21,000	12.0 36,000	27.0 80,000	10.5 31,500	18.0 54,000	40.0 120,000
Motor Size	H.P.	7½	15	20	20	7½	15	20	7½	15	20
Liquid Connects	ins. m.m.	1 25.4	1½ 38.1	1½ 38.1	1½ 38.1	1 25.4	1½ 38.1	1½ 38.1	1 25.4	1½ 38.1	1½ 38.1
Suction Connects	ins. m.m.	1 25.4	1½ 38.1	1½ 38.1	2 50.8	1 25.4	1½ 38.1	2 50.8	1 25.4	1½ 38.1	2 50.8
Mix Inlet	ins. m.m.	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4	1 25.4
Ice Cream Outlet	ins. m.m.	1 25.4	1½ 38.1	1½ 38.1	1½ 38.1	1 25.4	1½ 38.1	1½ 38.1	1 25.4	1½ 38.1	1½ 38.1

GENERAL INFORMATION

The BRITANNIC range of ice cream freezers is made in three basic sizes with different rated capacities, as follows:-

BV8 -	70	Imp.	Gal.	per	hour	(330	litres	per	hr. -	95	U.S.	Gal.	per	hr.)
BV1 -	124	"	"	"	"	(560	"	"	" -	150	"	"	"	")
BV6 -	250	"	"	"	"	(1120	"	"	" -	300	"	"	"	")
BV2 -	250	"	"	"	"	(1120	"	"	" -	300	"	"	"	")

The above ratings are based on firm extruded ice cream, and represent maximum capacities on this type of product with 100% overrun. Output is correspondingly higher with soft ice cream. ALL BRITANNIC freezers have a steplessly variable output control from about 40% up to 100% of their rated capacity.

The BV8, BV1 and BV6 sizes can be supplied as single, double or triple units, for simultaneous production of one, two or three flavours. The number of independent units housed in a single base is indicated by a numerical prefix; thus 3BV8 indicates three units of BV8 size, and 2BV1 - two units of BV1 size.

The following instructions apply to all freezers in the BRITANNIC range, but figures which vary for each model are to be taken from Table 1.

BRITANNIC freezers, unless otherwise specified, are arranged for Ammonia refrigeration, which is recommended. Models can be supplied for Freon 12 or 22 (Arcton 6 or 4) refrigeration, against specific orders. Normally liquid Ammonia should be fed to the freezer at condenser pressure, i.e. approximately 10 kg/cm^2 (140 p.s.i.g.) *Sub-cooled Ammonia* is not recommended, and if used at the factory this fact *must be stated at the time of ordering*. If liquid pressures below 8.5 kg/cm^2 (120 p.s.i.g.) prevail, this should be advised at the time of ordering to enable the makers to make suitable alterations to the basic design.

READ THIS BOOKLET CAREFULLY BEFORE INSTALLING THE FREEZER, AND REFER TO IT UNTIL YOU ARE FULLY FAMILIAR WITH THE MACHINE.

In case of doubt ask the maker's advice. You may find minor constructional details on your machine different from the description in this booklet. This would be due to the makers' policy of continual improvements of design features. However, the basic principles apply equally to all BRITANNIC MACHINES.

INSTALLATION

INSPECTION

1. Unpack the Freezer. All tools, loose and extra parts are in a box attached to the case. Check and inspect them against the packing slip. Shortages and damage must be reported promptly to the makers and insurance company.

CAUTION

Do not permit anyone to turn the handwheel of the variable speed transmission while the freezer is idle. This can cause jamming or breakage of the transmission.

FOUNDATION

2. Prepare firm and level foundation to avoid vibration. Allow 24 inches (610 mm.) from the rear and the sides of the base, and 48 inches (1200 mm.) in front, for easy access.

INSTALLATION

3. Level the Freezer accurately by packing. Use the front edge of the Freezer as the transverse reference plane and the inside of the freezing cylinder for longitudinal reference.

4. Make sure all piping used is clear and free from scale or rust. Keep the liquid refrigerant supply from the liquid receiver as short and direct as possible. If it is necessary to connect the freezer to the main liquid line which supplies hardening rooms, the take-off line to the Freezer(s) must be connected between the liquid receiver and expansion valves controlling the hardening rooms at the lowest point. The liquid receiver must be at least 1/3 to 1/2 full when operating the Freezer, and the line must be amply proportioned to ensure plentiful and gas-free supply to the machine(s). The first fitting to be installed behind the freezer inlet is a 1/2" (12.5 mm.) liquid refrigerant stop valve.

5. The suction line from the freezer should be made direct to the low side of the compressor, or to the main suction line running to the compressor, if it carries uniformly low pressure and is amply proportioned, so that the additional load from the freezer will not raise the back pressure normally carried.

6. Do not run suction lines from the Freezer through hardening rooms; this may cause recondensation of the gas and carry-over of liquid to the compressor. Do not connect suction lines from the Freezer to suction lines from a brine tank; widely varying loads on brine tanks may result in erratic performance of the Freezer if so connected. The pressure relief valve on the suction line set at 14 kg/cm^2 (200 p.s.i.g.) should be piped to atmosphere, never pipe this into the suction main.

7. The first fitting to be installed in the suction side after the Freezer back pressure valve is a stop valve.

8. If multiple Freezers, two or more single Freezers are operated from one compressor installation, liquid and suction headers of ample proportions should be provided. For distances up to 50 feet (15 m.) liquid and suction lines to and from Freezer can be of the same size as the respective connections on the Freezer; for greater distances they should be one size larger.

9. Line up Refrigerant lines to and from Freezer carefully. Do not spring them, as this puts unnecessary strain on the pipe joints.

10. Provide draining cocks at the lowest points of the lines, to enable purging of oil from the system when necessary.

11. When electrical connection is made start and stop the motor momentarily to check the direction of rotation. The dasher drive shaft should rotate clockwise, when facing the front of the Freezer. Dasher should not be installed for this test.

12. Always slide the dasher handling trough under a dasher before removing it from a freezing tube to prevent damage to the tube surface.

13. There is an emergency stop button and a red light in a panel at the front of the base. The red light can be wired to the starter either as an overload warning light which should only come on when the motor is being overloaded and before overload releases cut out, or as a pilot light, which is 'on' when the motor is running and 'off' when the motor stops.

14. All electrical connections on the Freezer have been made at the factory, all that is neceesary is to wire in the three phase connections from the starter to the Freezer and from the mains to the starter. All connections to the Freezer can be made in the junction box. A wiring diagram will be found in this box.

15. It is essential that the back pressure valve is fitted in the suction line, as close to the Freezer as possible.

16. Check that main drive and pump drive belts and pulley have not moved in transit causing misalignment.

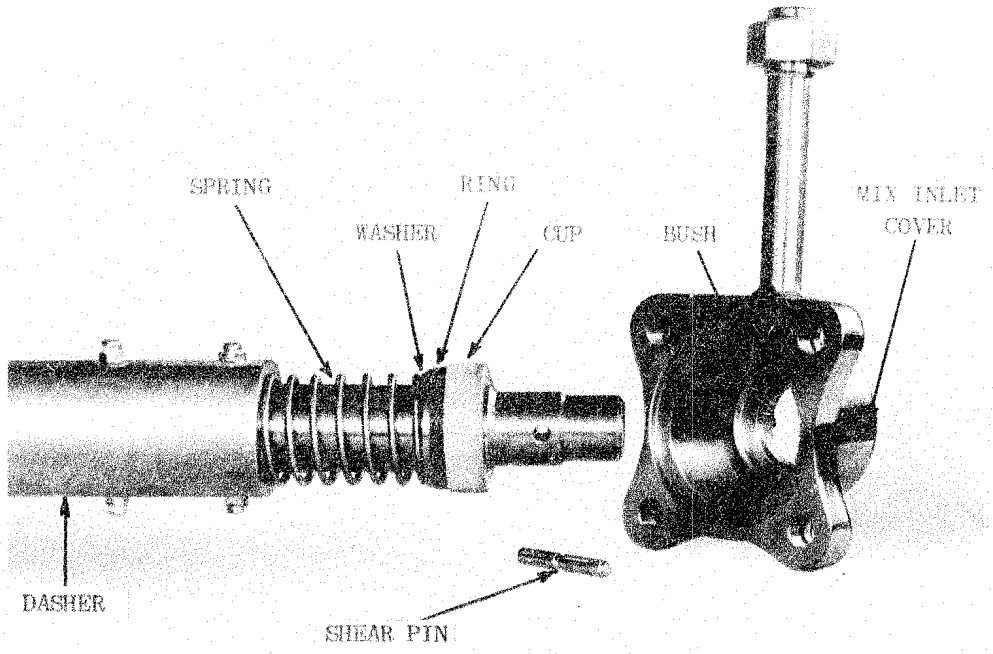


FIG. 2. ROTARY SEAL ASSEMBLY

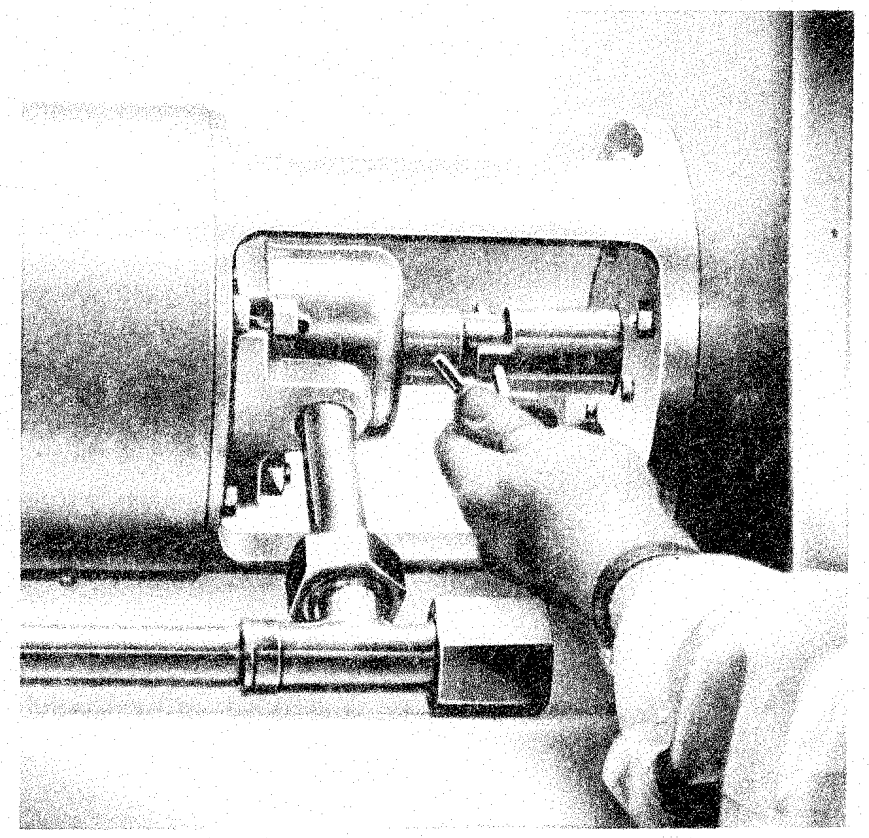


FIG. 3. SHEAR PIN LOCATION

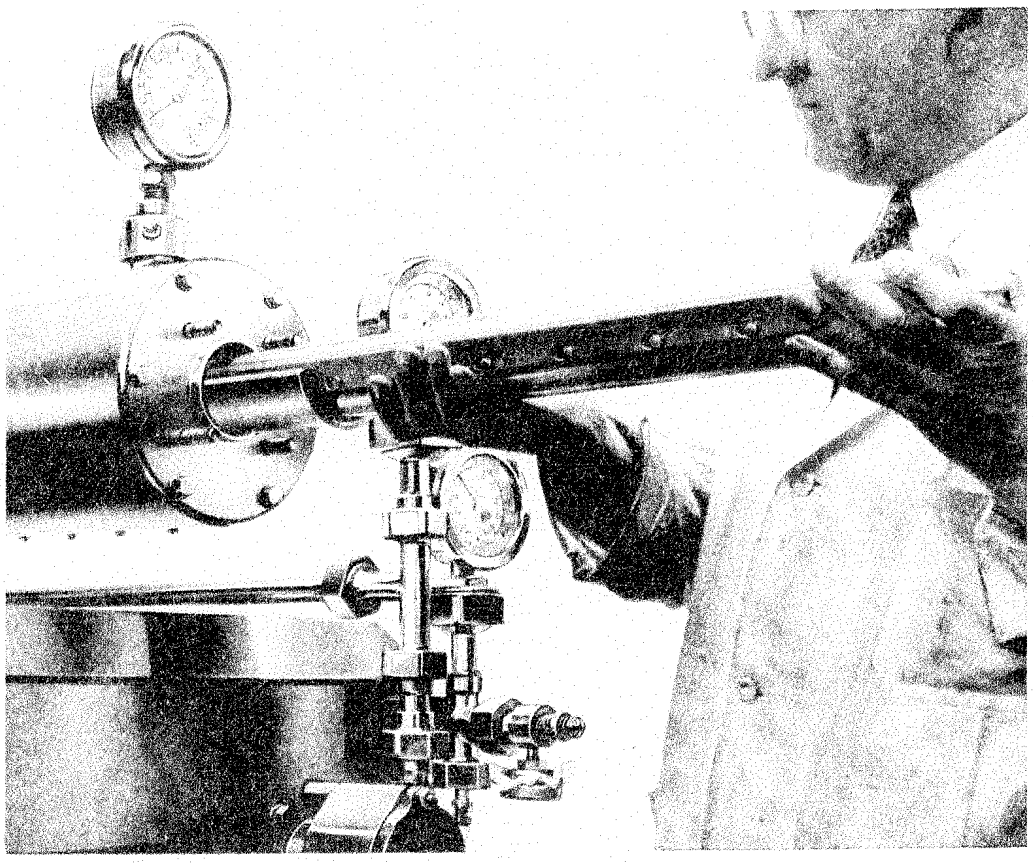


FIG. 4. SHOWING DASHER & TROUGH

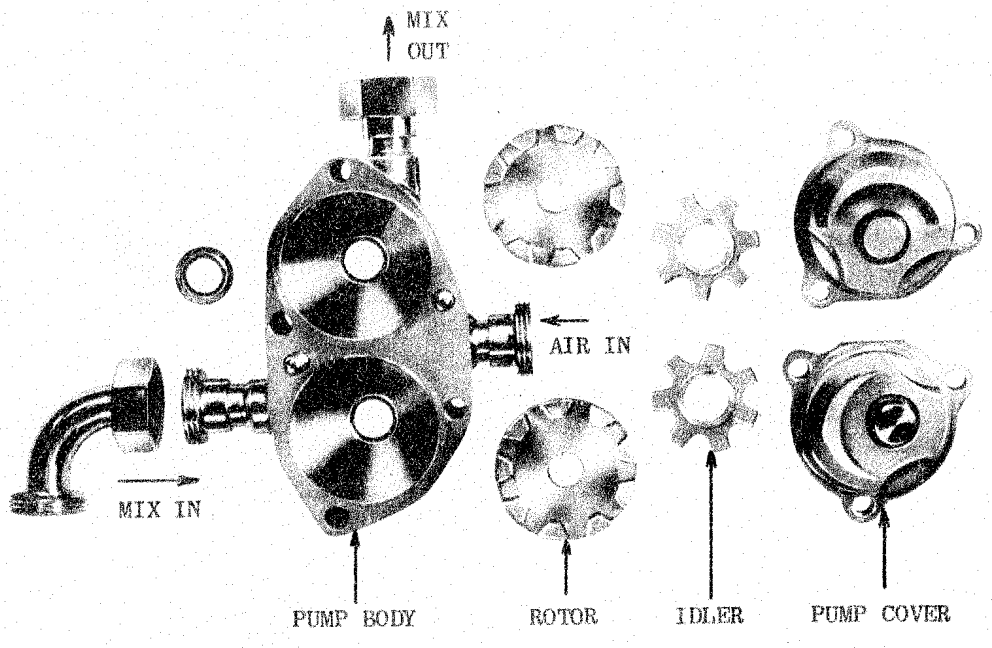


FIG. 5. DUPLEX PUMP ASSEMBLY

PRE-OPERATION

Before starting, remove all sanitary lines and fittings, dismantle the adjustable discharge valve at the outlet by removing the sanitary nut on the front of the tee, dismantle the mix outlet and front bearing and remove the shear pin at the rear of the dasher with the tool provided.

Lift the front of the dasher slightly and insert the trough under the dasher and withdraw dasher and trough together and take apart the rotary seal. See figures 2 & 4.

Remove the mix inlet at the rear of the cylinder. Remove the Duplex pump by undoing the nuts holding the cover, lift the cover carefully over the studs, ensuring that no parts fall to the ground, remove the housing. Take the air valve apart by:

(a) Screwing the adjusting nut back against the body.

(b) While holding the valve stem from turning with a thumb against the valve stem head, remove the spring by shifting and turning the lock end away from the hole in the valve stem.

(c) Remove the valve stem.

Sanitary Gauges. Wash these by hand, do not submerge in water, place in a safe place to dry.

OPERATION

Familiarise yourself with the position of all operating controls before touching them. See figure 1.

NEVER TURN THE SPEED CONTROL HANDLE WHEN THE MOTOR IS STOPPED.

1. Clean the Freezer and all dismantled parts thoroughly. Remove all traces of oil left from factory tests.

2. Re-assemble the Freezer by reversing the procedure outlined above.

3. Before fitting in the dasher make sure all rotary seal parts at the rear are assembled in their proper order and that the seal faces are perfectly clean. See figure 2.

4. Insert the dasher into the tube by sliding it on the dasher trough. Push the dasher back until the shear-pin hole is in line with its corresponding holes in the driving spindle. Lock it in position with the shear-pin tool provided. See figures 3 & 4.

5. Lift slightly the front of the dasher, remove the dasher trough from the tube and assemble the front bearing, gasket and outlet on the Freezer.

6. Remove the shear-pin tool following it with a shear-pin. Locate the shear-pin so that the lock snaps into place. If Shear-pin tool is not followed out by inserting the shear-pin, dasher will slide forward out of line.

7. When assembling the pump note that the internal parts are numbered. They are not interchangeable between first (lower) and second (upper) stages. Take particular care not to force pump parts against one another, not to damage finely machined surfaces and not to pinch or distort the rubber sealing rings. The order of assembly is: 'O' ring, housing, rotor, idler, cover. See figure 5.

8. Tighten all nuts, using only the spanners provided for each. Do not use excessive force or leverage.

9. Purge Freezer of oil in refrigeration system before starting, this is done by closing the stop valve in the suction line, opening the purge cock in the bottom of the refrigerant accumulator and admitting a small amount of liquid refrigerant to give about 0.3 kg/cm^2 (5 p.s.i.g.) of pressure, sufficient to expel any oil and moisture that may have accumulated.

10. Close the purge cock and open the suction stop valve.

Before starting check the Freezer for the following points:-

(a) That it is completely assembled.

(b) That the front heads and all sanitary connections are tight.

(c) That the refrigerant system has been thoroughly drained of oil at the accumulator.

(d) That any stop valves between the compressor and the Freezer are open.

(e) That the compressor is working at the correct back pressure.

(f) That there is an ample supply of liquid in the receiver.

STARTING THE FREEZER

1. Where fitted, close the freezing cylinder quick drawn valve by moving the handle to the 'ON' position.

2. Open the liquid refrigerant supply valve inside the cabinet. Open the liquid refrigerant supply valve to the float valve so that the accumulator fills to half way up the level eye.

3. Open the mix line to the pump. Make sure that the pump inlet is flooded.

4. Turn the dasher two or three times with the special wrench provided to make sure it is free. Place a can under one of the ice cream discharge pipes, set the two way valve and start the motor.

5. Wind the speed control handle clockwise to a low speed position and as soon as mix starts to discharge from the outlet, open the quick action valve to the ejector; this is low down at the front of the machine. See Figure 1.

   This will start the refrigerant circulating in the freezing cylinder and freezing will begin.

6. Check the ejector pressure which should be between 2.5 to 3.5 kg/cm^2 (35 and 50 p.s.i.g.)

   If the pressure is outside this range adjust the automatic expansion valve.

   To do this remove the cap facing the front of the Freezer. See Figure 10. Turn the adjusting screw in for higher, out for lower pressure. Replace the cap tightly to keep out moisture.

7. Set refrigerant back pressure to between 0.7 to 0.8 kg/cm^2 (10 and 12 p.s.i.g.) for safe starting up. The back pressure is regulated by turning the hand wheel of the back pressure valve at the back of the Freezer, the actual back pressure being read on the gauge mounted on top of the freezing cylinder.

8. WATCH THE MIX PRESSURE GAUGE. AS THE PRESSURE RISES GRADUALLY INCREASE THE PUMP SPEED.

9. Do not open the back pressure regulating valve too wide or keep the speed of the pump too low in order to get stiff ice cream too quickly. Overfreezing can result in ice formation on the dasher and puts an excessive load on scraper blades.

10. When the desired pump speed for a given output has been reached adjust back pressure regulating valve to lower pressure which will result in desired stiffness of ice cream. The back pressure regulating valve is not a stop valve and must never be used as such. The optimum setting for a specific type of ice cream depends on many factors, and can only be found by experience.

    Back pressure of 0 to 0.33 kg/cm^2 (0 to 5 p.s.i.g.) are usually employed for hard extrusion.

11. The pressure in the main suction line leading to the compressor must always be a few pounds lower than the back pressure required in the freezer jacket to enable the back pressure valves to operate properly under slight variations in suction conditions. Therefore the back pressure valve should not be operated in a fully open position.

    Maximum back pressure obtainable is 1.35 kg/cm^2 (20 p.s.i.g.)

ADJUSTMENT DURING OPERATION

Maintenance of desired mix pressure and back pressure

In order to maintain a steady mix pressure with consequently uniform stiffness and overrun it is necessary to:

(a) Have a uniform temperature of incoming mix.

(b) Have a steady, uniform supply of liquid refrigerant free from any appreciable amount of oil or water.

(c) Have a steady, uniform back pressure at the Freezer.

Factors which would demand a change in pump speed or operating back pressures are:

(a) Change in type of mix frozen.

(b) Change in temperature of the mix. The cooler the mix as it enters the Freezer, the less the refrigeration required, since there are less heating units to be removed in a given time. Mix temperatures should be 40°F. (4°C) or lower and temperatures higher than this should be avoided.

(c) Chilling of the freezing tubes and discharge pipes shortly after starting. It will be noted that after the Freezer has been started up and the back pressure set, the mix pressure will slowly increase due to the freezing cylinder becoming more thoroughly chilled. This is compensated for either by a gradual increase in pump speed, holding the pressure desired, or raising the refrigerant temperature by means of the back pressure regulating valve.

CONTROL OF MIX PRESSURES AND OVERRUN

1. **Mix Pressures**

As the freezing process is essentially a pressure process the mix pressure is directly indicative of the degree of stiffness to which the ice cream is being frozen in the tubes.

Mix Pressure is dependent upon the following factors assuming that the mix supply is constant:

(a) Speed of the pumps i.e. the rate at which the mix is being pumped through the freezing tubes. The faster the mix is being pumped the lower the pressure, and vice versa.

(b) Refrigerant back pressure. The temperature of the refrigerant in the freezing jacket surrounding the tubes is dependent upon the back pressure. The lower the back pressure, the lower the temperature and consequently the more completely and stiffer the ice cream will be frozen, with a consequently higher mix pressure. Excessive mix pressures and over freezing often result in accumulation of ice particles in the freezing tubes, particularly under the dasher blades.

2. **Overrun or amount of air pumped into the mix.**

The rotary pumps consist of a first stage mix pump and a second stage air and mix pump which receives the mix pumped to it by the mix pump, and due to its higher speed draws in air by suction through a controlled air valve on the line between the two pumps. This air valve is controlled by a hand nut which regulates the compression on the valve spring. Turning the nut out increases the compression on the spring and decreases the amount of air taken in. This valve control furnishes a quick and accurate means of controlling the amount of air pumped into the mix. The vacuum gauge on this valve indicates the amount of air being taken in. As the amount of air taken in is decreased the gauge readings are higher and vice versa. For ordinary mixes 100% overrun will be obtained at vacuum gauge readings somewhere between 7 and 12.

3. **Should the overrun be slightly lower than the point desired, it may be increased as follows:**

(a) Open air intake valve wider permitting more air to be pumped into mix by the second stage or air pump. (Indicated by a lower reading on the vacuum gauge).

(b) If the discharged ice cream is too soft to hold air, lower the back pressure to freeze more stiffly.

(c) Increasing the pressure in the Freezer, by increasing the spring tension on the DISCHARGE REGULATING VALVE. This valve provides a way to raise the ice cream pressure INDEPENDENT OF TEMPERATURE. This method is particularly effective on mixes easy to stiffen as chocolate or high fat mixes.

(d) A worn second-stage or air pump will cause low overrun because of its inability to pump air. This is corrected by replacing worn parts and adjusting properly. (See section on pumps, page 31.

4. **Should the overrun be slightly higher than desired, it may be decreased as follows:**

(a) Reduce the opening of the air intake valve, thus pumping less air into the mix. (Indicated by a higher reading on the vacuum gauge).

(b) If there is any looseness of the sanitary fittings between the first and second stage pumps, an excess of air will be pumped into the mix with a consequent increase in overrun.

CONTROL VARIATION

The mix pressure should be observed during the run and the back pressure regulating valve adjusted so that a uniform mix pressure will be maintained. Variations of a few pounds in the mix pressure caused by filling operations such as the can filler being operated in an up or down position cause no particular variation in stiffness and should not be confused with mix pressure variations that may be caused by ice accumulations. Marked fluctuations in mix pressure that continue and do not automatically correct themselves, are usually due to a decided change in temperature of the mix or the refrigerant.

OVERRUN VARIATIONS MAY BE CAUSED BY A NUMBER OF FACTORS WHICH ARE:

1. **Variation in Back Pressure due to Rapid Fluctuations in the Refrigeration Load.**

   This may be eliminated by proper use of the back pressure regulating valve.

2. **Variation in amount of air being pumped**

   (As indicated by the vacuum gauge). This is usually caused by:

   (a) The air intake valve sticking. The valve should be kept clean and free from mix so that it will work freely.

   (b) Air pump worn.

3. **Insufficient or Improper Processing of the Mix**

The mix must be thoroughly homogeonised in order to obtain best results and sufficient pressure used to obtain a thorough emulsion. The valves of the homogeoniser must be in good condition to ensure thorough homogeonisation.

4. **Dull Dasher Blades**

If the dasher blades are allowed to become dull the scraping action in the tubes is impaired and variable results are often obtained. Blades should be kept sharp and contacting the tubes at all times.
See page 33.

MULTIPLE TUBE OPERATION

Each cylinder on the Freezer is independently controlled. Start each one and control each one as separate machines. *When running different flavours*, the controls should be adjusted so that the flow of ice cream is at the same rate from each cylinder and that a good stiff ice cream is produced on each cylinder. *When running on one flavour* the controls should be adjusted so that overrun is similar on each cylinder and that the ice cream is frozen to about the same stiffness, *unless a mixer is used some colour difference may be noticed* if accurate control is not obtained.

FREEZE - UPS

1. A combination of low refrigerant back pressure with low pump speed may result in a freeze-up.

2. Rapidly increasing current (as shown on the freezer motor ammeter) accompanied by rising mix (Barrel) pressures or the red light coming on the control panel if so wired are early indications of the danger. Watch out for them and increase refrigerant back pressure and pump speed immediately.

3. When a freeze-up occurs two things may happen: The motor cuts out or the shear-pin breaks.

4. If the shear-pin breaks do not restart the Freezer after thawing out until freezing tube and scraper blades have been carefully examined.

   A broken shear-pin may be the result of the blade catching on a rough spot in the tube, due to ice accumulation.

   If a scraper blade is nicked or otherwise damaged it should be smoothed off.

5. To thaw out the Freezer.

   Close the quick action valve to the ejector. Close the main liquid refrigerant stop valve.

6. Remove the front outlet.

7. Flush out the freezing tube with warm water.

8. Remove and examine the dasher and scraper blades. Examine the interior of the freezing tube.

9. When all ice has been removed from the freezing tube re-insert the dasher and renew the broken shear-pin, using the shear-pin tool. See Figure 3.

10. Remember to use the dasher trough when removing and replacing the dasher.

11. Replace the Freezer outlet and start up the motor.

12. Circulate warm mix for one minute before resuming freezing.

13. Use only shear-pins provided by the makers. These will break before any damage can be done to the motor and transmission.

SHUTTING DOWN THE FREEZER

As soon as the mix disappears from the bottom of the supply tank but before the supply to the mix pump runs out:

Close the quick action valve to the ejector.

Close the liquid refrigerant supply valve to the float valve.

Close the liquid refrigerant stop valve inside the cabinet.

Shut off the motor when the mix pressure drops to zero.

WASHING AND CLEANING FREEZER

1. Remove the two discharge pipes, discharge pressure regulating valve and dismantle all sanitary pipes and fittings.

2. Remove the pump and dismantle internal parts keeping the parts from the first stage and second stage separate. Push out shear-pin, remove the front outlet and bearing and remove dasher using the dasher trough. Remove mix inlet from the back of the freezing tube and dismantle Rotary Seal.

3. Rinse and brush the Freezing tube, wash the dasher and all pipes, fittings and pump parts. Start with luke warm water and finish with hot water. Use hot water and approved detergent to remove all traces of food.

4. Reassemble the mix inlet and rotary seal, re-insert dasher and replace the front outlet and bearing.

5. Steam the freezing tube and dasher to sterilize and also to remove any oil which may have congealed in the jacket.

6. Loosen front outlet to drain condensation from freezing tube.

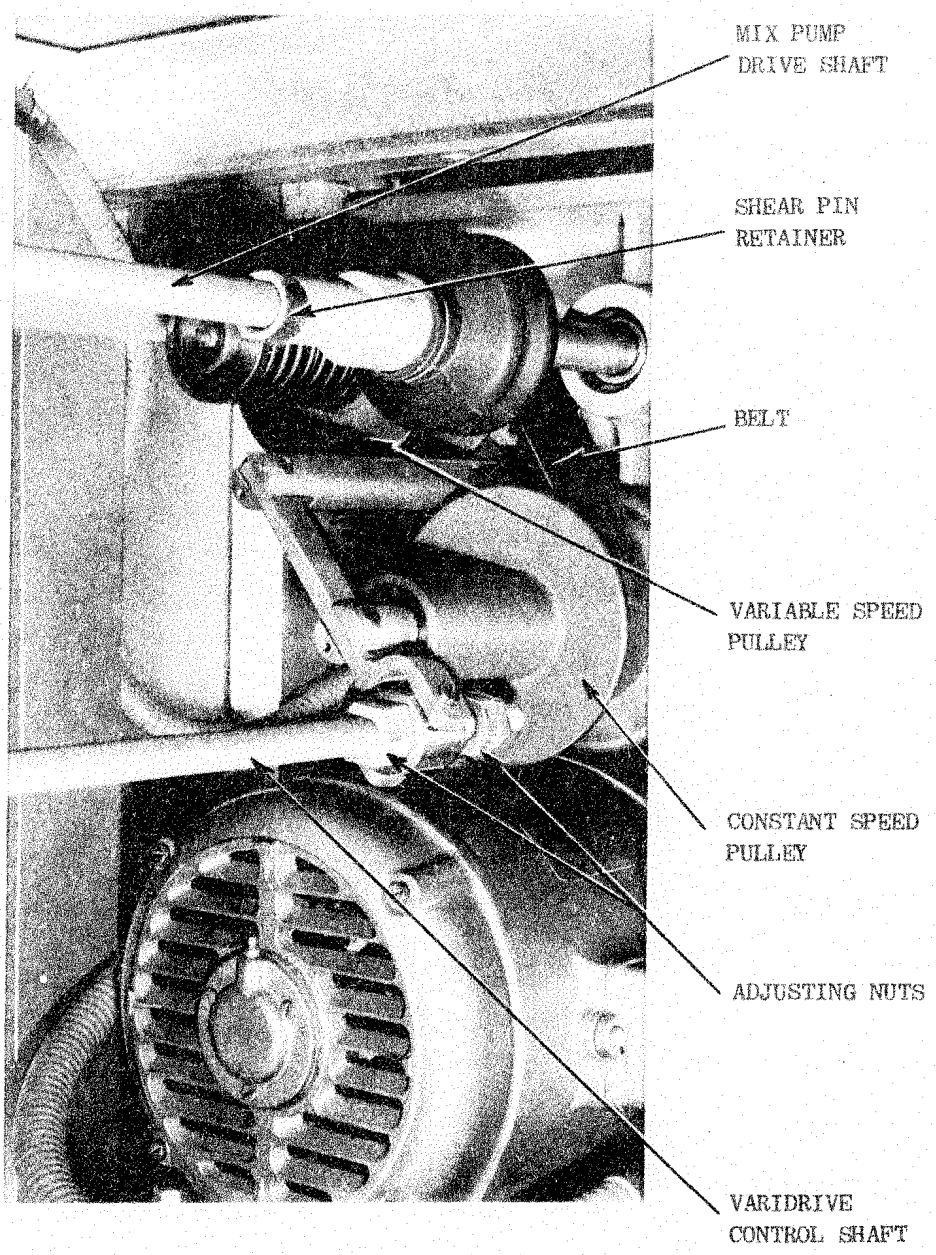


FIG.6. VARIABLE SPEED UNIT

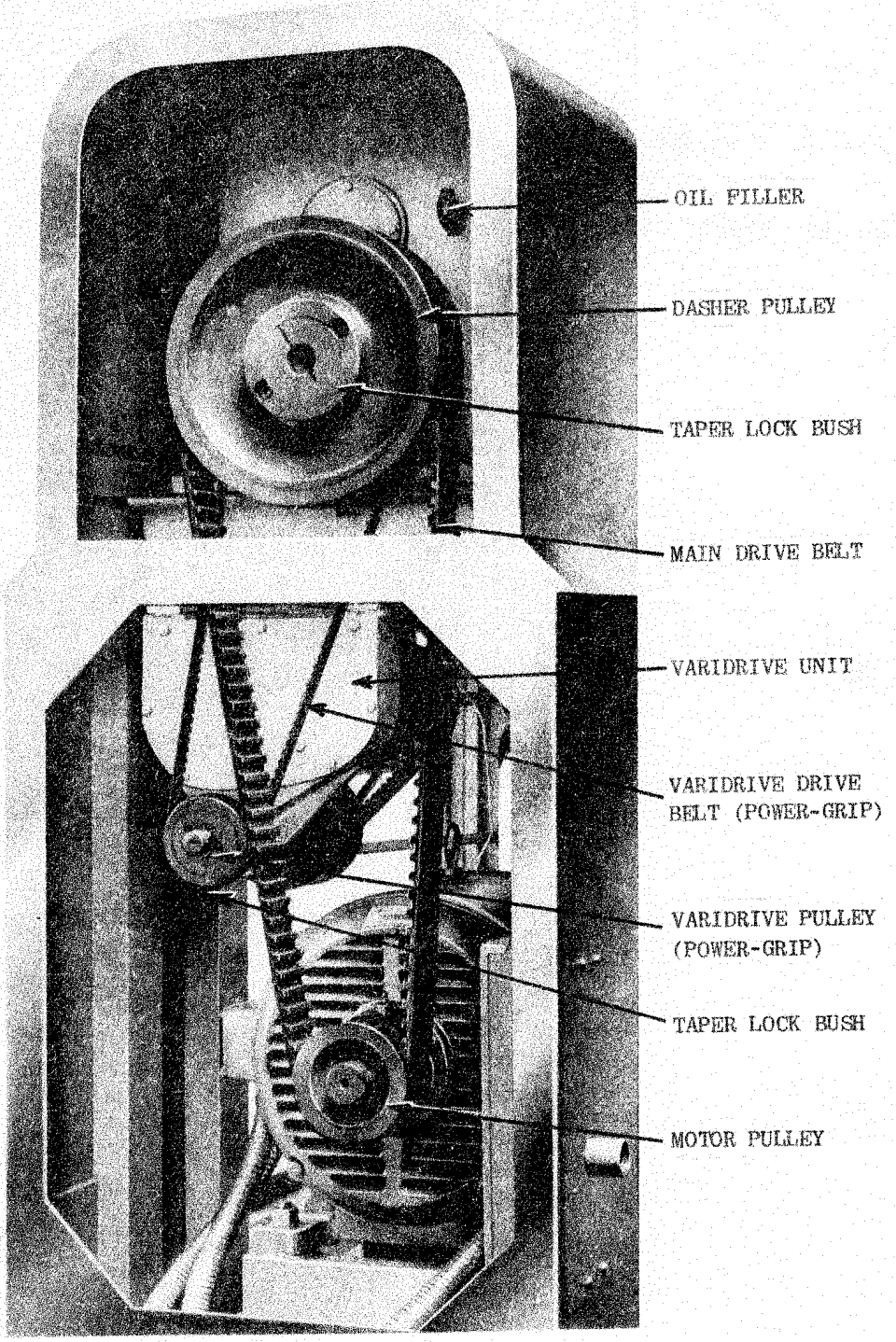


FIG.7. REAR VIEW OF MODEL BV2

7. Steam sterilize pipes fittings and pump parts separately. This should be done as soon as freezing is completed.

8. Re-assemble, taking care that first and second stage pump parts are not mixed up.

9. Where in-place cleaning is employed, care must be taken to rinse the Freezer very thoroughly with warm water to remove all traces of alkali and acids. Sterilize by circulating very hot water at about 200°F (95°C) for 20 minutes.

10. The Freezer pumps should not be used for this duty, as small clearances necessary for cold working can lead to seizures if hot liquid is pumped.

LUBRICATION

Proper lubrication is of the utmost importance.

Use only good quality ball bearing grease and good clean oil.

INSTRUCTIONS

Variable Speed Unit for Pump. See Figures 6 & 7.

There are three grease nipples requiring attention.

Do not overgrease so that grease is forced out of the bosses on the belt driving cones. There are also two points where oil should be applied regularly. These are the adjusting lever pivot points.

The oil level for the chain should be topped up as required through the filling plug at the rear of the unit, taking care to keep oil off the belts, pulleys and motor.

Change oil every six months.

Pump transmission Assembly. See Figure 8.

Sealed bearings are used on this assembly and no greasing is required. Check occasionally that there is no fault in the seal allowing water to enter the bearings.

Occasionally smear grease on the transmission gears and the brass adjustment gears.

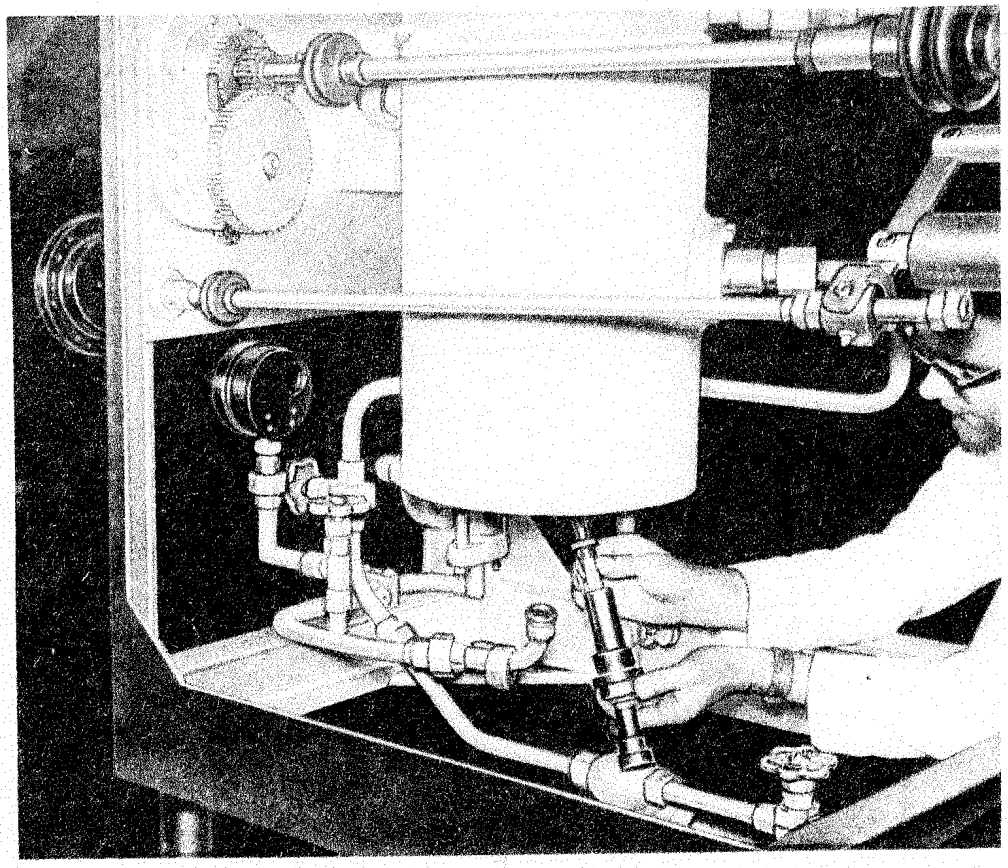


FIG. 8. SHOWING EJECTOR ASSEMBLY AND PUMP TRANSMISSION ASSEMBLY

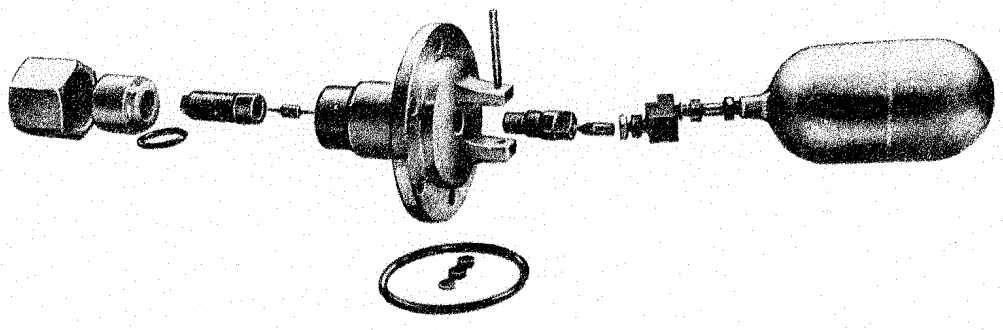


FIG. 9. EXPLODED VIEW OF FLOAT VALVE

Pump Drive and Pump Adjustment Shaft. See Figure 6.

There are 3 Universal joints on these shafts, covered by rubber shrouds. These are pre-packed with grease and should be inspected regularly and re-packed as necessary.

Driving Motor. See Figure 7.

There are 2 grease points on the motor, these are pre-packed when new and should need no attention for six months. Do not over grease.

Dasher Drive Shaft Assembly. BV8 - BV1 and BV6 Machines.

There is one Stauffer grease cup requiring attention. Keep well filled with grease.

BV2 Model Dasher Drive Shaft Assembly. See Figure 7.

This unit runs in oil. Top up level as required, first having removed the oil level plug, until oil issues from here, and then replace plug tightly. Change the oil every six months.

REFRIGERATION

Before opening any part of the refrigeration system to atmosphere make sure that all refrigerant has been pumped out.

Refrigerant can be boiled out of the accumulator as follows:

Close the main liquid supply valve to the Freezer.

Open the quick action valve to the ejector.

Open the liquid supply to the float valve.

Open the stop valve in the suction line.

Open back pressure control valve.

Boil the refrigerant out of the accumulator by running warm water down the side.

Care should be taken to keep water off the motor.

When all the refrigerant has been boiled out of the accumulator to zero pressure:-

Close the stop valve on the suction line. Do not attempt to use the *back pressure control valve as a stop valve.*

Open the oil purge valve at the bottom of the accumulator carefully.

It may be necessary to repeat above procedure.

Refrigerant Strainers

Before removing strainers make sure all refrigerant has been pumped out.

There are strainers at the following points of the Freezer liquid refrigerant lines:-

1. On the liquid line after the stop valve in the cabinet.

2. On the ejector.

3. On the float valve.

4. On the automatic expansion valve.

These strainers should be cleaned thoroughly by washing in petrol two or three days after the freezer is installed, to remove initial rust, scale etc. from the pipe lines.

Thereafter cleaning every month or two should be sufficient.

INSTRUCTIONS FOR SERVICING PHILLIPS 250WCB AND 300WCB FLOAT VALVE

See Figure 9.

Do not try to adjust the float side of the valve unless absolutely necessary. The adjustments are made in the factory and are locked with locknuts and washers. Periodic cleaning of the filter screen position of the cartridge will be necessary. When performance indicates that the needle and seat inside the cartridge are worn, a new cartridge should be installed.

Remove the cartridge in the following way:-

1. Make sure that all refrigerant has been pumped out of the system and close all refrigerant lines.

2. Unscrew the union nut on the liquid line to the float valve.

3. Unscrew the connecting nut and pull out the connector together with the bend up to the union.

4. Use a 3/8" Hexagon Socket Wrench to unscrew the cartridge and remove it from the valve.

5. Install the new cartridge. Gradually tighten and then loosen again to ensure a good seating before finally tightening up.

6. Check the '0' ring on the connector to make sure it is in good condition and will seal properly.

7. Install the bend with connector and connecting unit and tighten securely.

8. Tighten the union nut on the liquid line.

9. Admit a small amount of refrigerant to the system and test the float valve connection for leakage at approximately 0.35 kg/cm^2 (5 p.s.i.g.) If no leak occurs test again at 4.2 kg/cm^2 (60 p.s.i.g.)

10. Open the suction and liquid line valves to check the operation of the float. The level should be half way up the level eye on the accumulator.

In the event of the Float or Pusher needing replacement, proceed as follows:-

1. Make sure that all refrigerant has been pumped out of the system and close all refrigerant lines.

2. Unscrew the union nut on the liquid line to the float valve.

3. Unscrew the connecting nut and pull out the connector together with the bend up to the union.

4. Remove the six socket head cap screws from the valve body.

5. Pull out the entire body and float assembly.

6. Note how the parts are assembled, take apart and fit new parts, re-assemble in the correct order. (If extensive repairs are necessary it is recommended that a spare unit be purchased).

7. Before re-installing the assembly carefully inspect the '0' ring on the body. If there is any doubt about it sealing, replace the '0' ring.

8. After installing the complete assembly and tightening all joints, check for gasket leakage at 0.35 kg/cm^2 (5 p.s.i.g.) and again at 4.2 kg/cm^2 (60 p.s.i.g.)

BACK PRESSURE REGULATING VALVE

The back pressure regulating valve is of simple construction and accurate in operation. There is only one point of caution to remember in the operation of this valve, it is NOT A STOP VALVE. Any attempt to screw up on the adjustment handle in order to stop the flow of refrigerant gas through this valve will result in either bent diaphragms or possibly a broken cylinder. If the valve becomes sluggish due to the presence of oil in the system, it is an easy matter to dismantle and clean by carefully following these instructions:

INSTRUCTIONS FOR SERVICING BACK PRESSURE CONTROL VALVES

Before proceeding make certain that all refrigerant has been pumped out of system and stop valves are shut.

To Dismantle

It is not necessary to remove the valve from the line. Back off on the handwheel adjustment to relieve all tension on the diaphragm spring. Remove flange bolts and nuts. This will permit lifting the spring chamber from the valve body.

After removing the larger spring pressure plate, as well as the diaphragms, the working unit is readily accessible. Gasket should remain untouched unless it is to be renewed.

The cylinder can now be lifted out. It is not advisable to remove the piston unless necessary. The cylinder can be washed in petrol or any cleaning fluid, then doused and worked up and down over the piston to clean it.

IMPORTANT. Both the piston and cylinder should be well oiled and the surplus wiped off and made certain to work absolutely freely and smoothly. A good grade, low temperature (-30^{o}) refrigerant compressor oil will serve this purpose satisfactorily.

Ordinary oils will congeal and make the valve stick so that it will not function.

To Assemble. The small spring is placed on top of the piston, followed by the cylinder. At this stage, the cylinder will protrude above the valve body. Replace the diaphragms, pressure plate, diaphragm spring and spring button. Put on the spring chamber, and draw it down until there is a gap of about ¼" between the flanges. Screw down on the handwheel to compress the small spring and force the cylinder down. In this way, it can be seen that the diaphragms are resting in the body recess. As the flange bolts and nuts are drawn down, tension should again be relieved from the diaphragm spring.

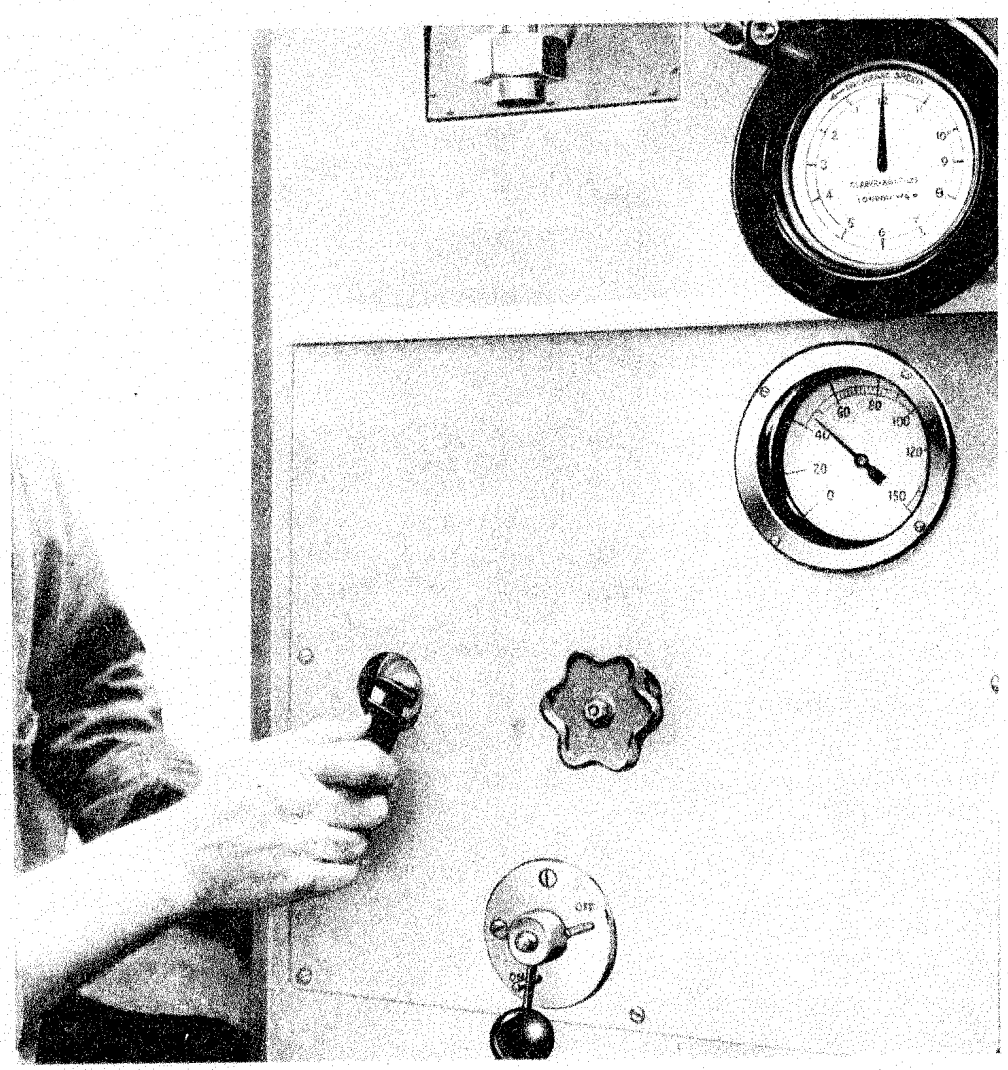


FIG. 10. ADJUSTING JET PRESSURE

CAUTION. It should be made absolutely certain that the diaphragms rest down in the recess with the gasket. If they should cock out on one side of the recess, breakage of the spring chamber flange may result.

After properly bolting on the spring chamber, compression is applied to the diaphragm spring by the handwheel until the desired back pressure in the Freezer is being maintained.

OPERATION AND CARE OF THE AUTOMATIC EXPANSION VALVE

The low pressure liquid refrigerant in the accumulator is circulated around the freezing tube by means of a jet or nozzle. The usual operating pressure, as indicated by the refrigerant gauge between the jet and the pressure reducing valve, is between 35 and 50 pounds.

An automatic expansion valve is used to reduce the high pressure liquid refrigerant to the pressure at which the jet is operated. This valve will automatically maintain a constant jet pressure with varying high side pressures.

The jet pressure can be adjusted by removing the adjusting screw cap and turning the adjusting screw - in for higher pressures - out for lower pressures. See Figure 10

After adjustment is made, be sure screw cap is replaced tightly. Failure to do this will mean that moisture will filter into the valve head, condense and freeze. This will render the valve inoperative.

This valve has a capacity range sufficient to meet all ordinary operating conditions.

If slow starting of the Freezer is experienced it is usually due to too low a jet pressure. This is indicated by a pressure gauge and if pressure drops to 30 lbs. slower starting will be noticeable.

To obtain satisfactory circulation the jet and entrance to combining tube must be submerged below the liquid refrigerant level in the accumulator.

In starting the Freezer the liquid level in the accumulator should be halfway up the level eye.

A lower liquid level may give slower starting. As the liquid is raised from accumulator to freezing jacket the level in the accumulator may drop below the combining tube and temporarily stop circulation.

CLEANING THE EJECTOR NOZZLE See Figure 8

The ejector nozzle is normally protected from scale by a strainer but if it becomes blocked it can be cleaned as follows.

Before proceeding make certain that all refrigerant has been pumped out of the system and liquid and suction line stop valves shut.

Unscrew the two union nuts on the liquid line nearest to the nozzle, and remove this section of piping.

Unscrew the ejector body and when this is out the ejector nozzle will be seen, screwed into the top end of the ejector body, unscrew this also.

Clean the nozzle by blowing out with air, never interfere with the smooth surface of the hole. Wash the strainer in petrol.

Replace by reversing procedure given above and make sure the gasket is in good condition on the ejector body.

OIL IN REFRIGERATION SYSTEM

Difficulties can be encountered in refrigeration plants, due to oil in the system. Oil is a very effective insulator and if it reaches the outer wall of the freezing tube the efficiency of the Freezer will be lost.

Oil can be carried into the system by various means, such as worn pistons in the compressor, oil levels too high in splash system etc.

Oil difficulties will be minimised by the following:

1. Use the correct grade of oil; ice machine oil only, should be used as recommended by the machine manufacturers. Oil which solidifies or gets stiff at minus 25°F. (minus 32°C) will not drain from the freezing surfaces. Test your ice machine oil in a hardening room at these temperatures before use.

2. Check and drain oil regularly from oil separators, oil legs or pots in the plant.

3. Check and regularly overhaul the compressor and maintain correct oil levels.

Air and water in the system can also cause trouble

The following will help to keep these troubles to a minimum.

1. Purge regularly for air wherever provision is made.

2. Keep sufficient water flowing through the condenser and keep the condenser clean.

3. Keep all valve stems well greased to keep the packings soft and helping to prevent air from being sucked in.

4. Keep all stuffing boxes well packed for the same reason.

CLEANING THE FREEZER OF OIL

When sufficient oil has collected round the freezing cylinder to decrease the efficiency of the Freezer, the freezing tube can be cleaned. Before doing this attend to the primary refrigerant plant to prevent further trouble as far as possible, then proceed as follows:

1. Make sure that all refrigerant has been pumped out of the system and that all stop valves are shut.

2. Open the oil purge valve at the bottom of the accumulator.

3. Remove the mix outlet and front bearing, use the tool and remove the shear pin, use the trough and remove the dasher, remove the mix inlet.

4. Unscrew the 4 - 3/8" Hex. Head Set Screws holding the 'O' ring flange at the rear of the freezing tube, and carefully remove the 'O' ring flange. If the 'O' ring flange does not easily slide out, do not use force or any leverage behind the flange as this may cause damage to the flange or the freezing tube. In the spares supplied with the machine there are 2 - 1/4" BSF x 1.1/2" long Hex. Head Set Screws. Screw these into the tapped holes in the 'O' ring flange; use these jack screws to give an even pull on the 'O' ring flange.

5. Unscrew the 6 Hex. Head Set Screws securing the front flange of the freezing tube. Carefully remove the freezing tube with a steady pull. If the freezing tube does not slide out easily, do not use any force or leverage on the flange or on the tube itself as this may cause damage to the tube. Place a block of wood across the rear of the tube and apply pressure to this block to push the tube forward, then remove the tube with a steady pull from the front.

6. Clean the outside of the freezing tube and the refrigerant jacket with paraffin, followed by a detergent solution, then thoroughly dry.

7. Fit a new '0' ring on the front flange and smear with grease.

8. Re-assemble the freezing tube, fit a new '0' ring at the rear end and smear with grease and loosely fit the '0' ring flange.

9. Tighten the 6 Hex. Head Screws on the front flange first as hard as they will go, then tighten the '0' ring flange sufficiently to prevent leakage only DO NOT OVER TIGHTEN.

10. Clean all strainers and re-fit.

11. Close the oil purge valve at the bottom of the accumulator.

12. Make sure that all parts are correctly assembled and test for ammonia leaks.

FRONT DASHER BEARINGS

Attention should be paid to the wear of the front bearings. If wear is permitted to become too great it allows the dasher to drop so that the dasher pins, which support the blade, drag on the freezing tube. This not only scores the cylinder, but often causes burrs. It is then very easy for the blade to catch in these burrs and cause a gouge or do other serious damage to the dasher or freezing tube.

With proper use one should expect normally about a year's wear out of these front bearings or approximately 2,000 hours. The bushing in the front bearing spider is replacable. It can be pressed out of the spider and a new one pressed in.

SHEAR PINS

The coupling connecting the dasher and drive shaft is equipped with a shear pin designed to break and protect the dasher blades and freezing tube, should a freeze-up occur in the tube or the mix become frozen to extreme stiffness, throwing a heavy load on the dasher. Extra shear pins are furnished with the Freezer. Should a pin shear, it should be replaced with one of the standard pins designed to break at the proper overload.

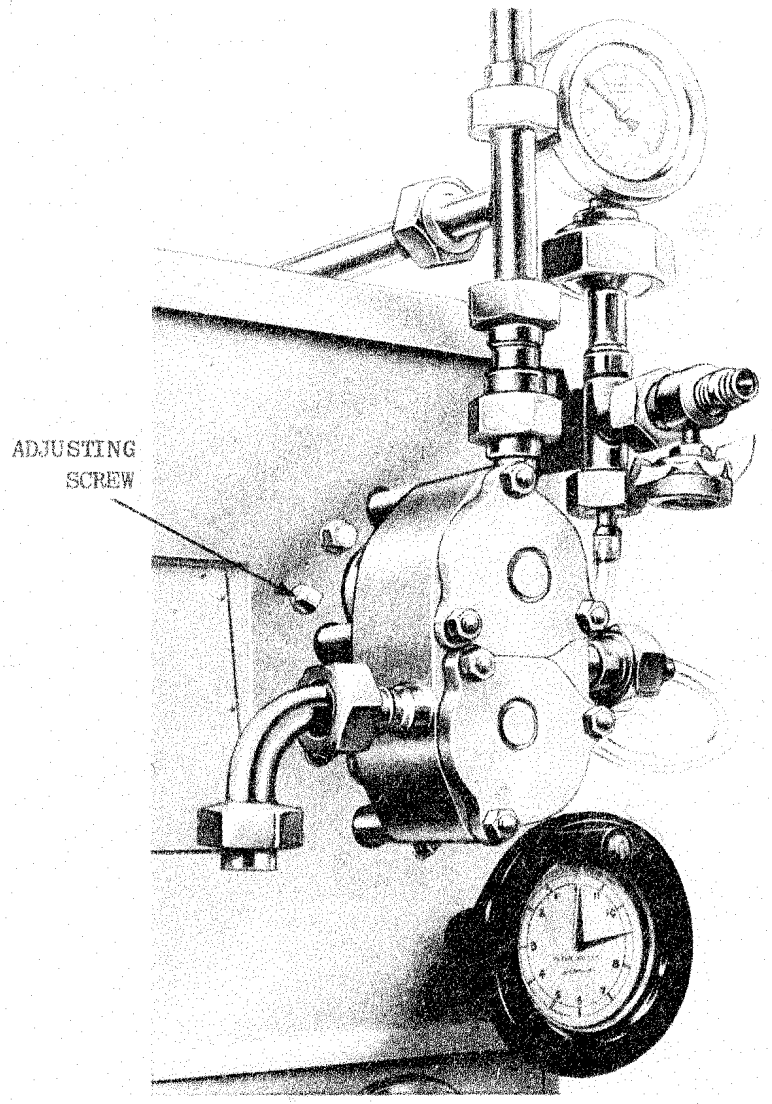


FIG. 11. FRONT VIEW OF PUMP

ROTARY SEALS

When replacing rotary seal rubbers, they might require some fitting as the effectiveness of the seal depends largely on this fit.

The rubber ring should fit into the flanged cups without any cramping or compression. When in the cups, they should slide on to the shaft with a noticeable drag, but not so much that the spring will not push them back after it is well compressed.

The effectiveness of the seal depends also on the finely lapped surface of the cup flange. If this is damaged, leakage will result. Small burrs can be removed with a fine file. The rubber rings deteriorate with use and should be replaced from time to time.

ADJUSTMENT OF PUMP CLEARANCES

See Figure 11.

Adjustment may only be made whilst the freezer is not running. The pump stages are adjustable for correct running clearance between flat surfaces of the covers, rotors and idlers, by means of a micrometric screw. They are set at the factory for approximately 0.003" endwise clearance which should be maintained for efficient operation.

At the base of the Duplex pump there are two square headed adjusting screws - on the right of the first stage (lower) and on the left of the second stage (upper).

To adjust either stage turn the square headed screw clockwise with the box spanner provided as far as it will go. Do not use excessive force or extra leverage. You will feel and hear the ratchet clicking as each screw is being turned. Having tightened the screw as far as it will go, turn it back or anti-clockwise, by two clicks. Each stage is now in adjustment.

You will find that the second stage needs adjusting about three times as often as the first.

The intervals between adjustments depend on the fat content of the mix, its purity and presence of undissolved solids.

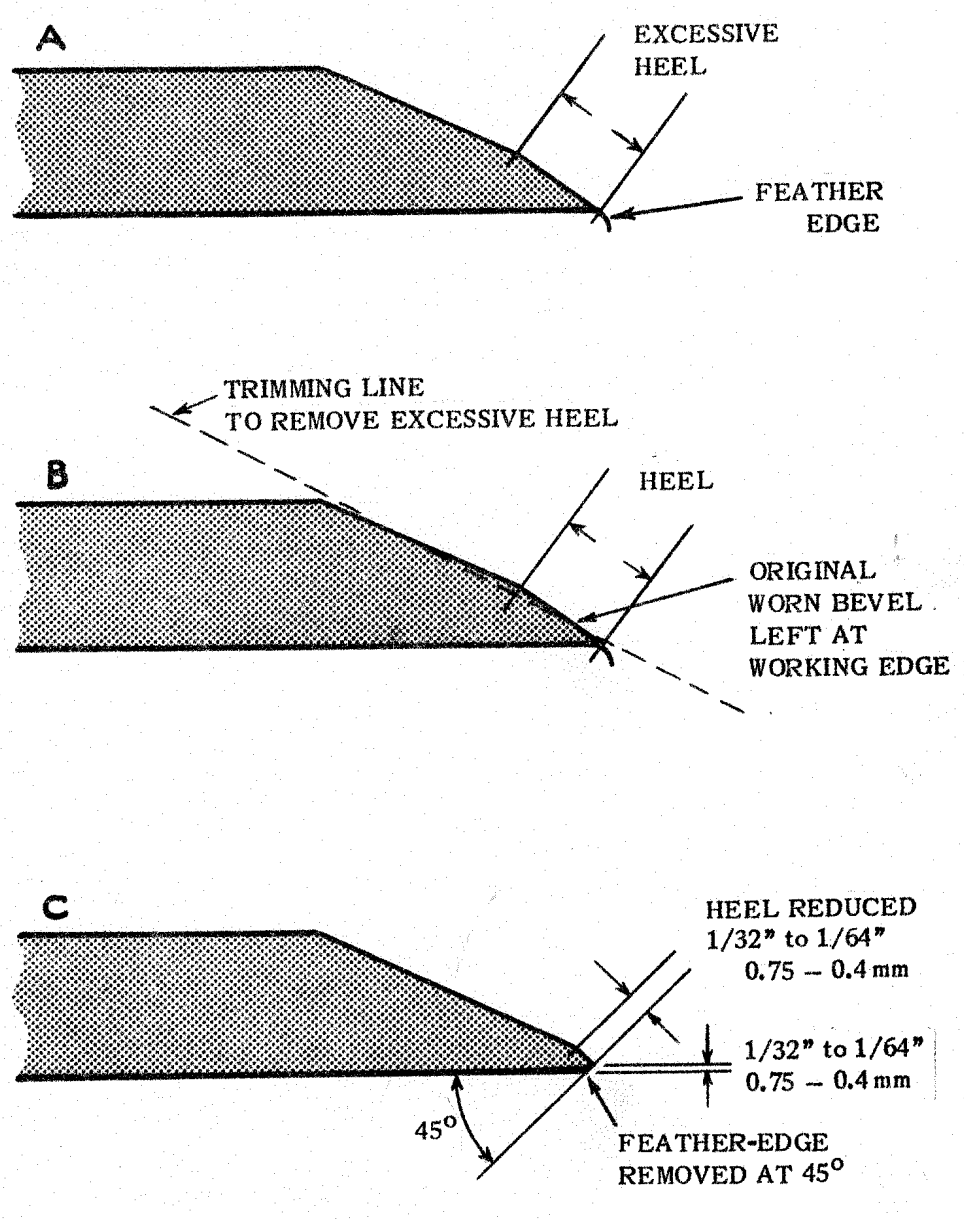

A
EXCESSIVE
HEEL
FEATHER
EDGE
TRIMMING LINE
TO REMOVE EXCESSIVE HEEL
B
HEEL
ORIGINAL
WORN BEVEL
LEFT AT
WORKING EDGE
C
HEEL REDUCED
1/32" to 1/64"
0.75 – 0.4 mm
1/32" to 1/64"
0.75 – 0.4 mm
45°
FEATHER-EDGE
REMOVED AT 45°

FIG. 12

DASHER SCRAPER BLADES

Removing and Replacing Dasher Blades

To remove the blades, lift at the rear until disengaged from the locking pin and push forward to disengage the slots. To replace, place the blade in the slots and press rearward from the front with the left hand. Give three or four quick glancing blows to the blade just ahead of the locking pin at the rear which will cause the blade to snap into place.

As the blades scrape against the freezing tube, wear occurs at the scraping edge to form a heel. A blade is in good condition when a heel of uniform width between 1/32" and 1/64" extends the length of the blade. Diagram A shows a blade in poor condition. Blades should be checked after each day's operation. To remove feather edges and recondition a blade, proceed as follows:-

1. Set the dasher in the rack and insert several small wooden wedges between the blade and dasher.

2. Hold a piece of cardboard or metal under the wedges to protect the dasher and remove the feather edge with a fine Swiss file or a medium grade India pike stone. Remove the feather edge along the blade as shown in diagram C.

3. When the heel width is greater than 1/32" file the blade along its length to remove the excessive heel as shown in diagram B, until the width of the heel along the whole blade is approx. 1/64" wide or just apparent. Do not file away all of the heel at any point along the length of the edge. It is important that the wear pattern is preserved so that best scraping maintained and a visible heel of 1 64" is an assurance that the blade has been worn into its cylinder.

4. Diagram C shows a blade in good condition. When blades are badly worn they should be returned to the manufacturers for regrinding, where special jigs are used to ensure correct angles and edges.

INSTRUCTIONS FOR CHANGING BELTS ON VARIABLE SPEED DRIVE

1. With the motor running, turn the speed control handle on the front of the Freezer clockwise to the lowest speed position. Shut off the motor.

2. Remove the two hinge pins and carefully lower the adjustment shaft complete with nut and the locking nuts. Do not disturb the setting of these parts.

3. The belt will now be at the top of the spring loaded pulley. Remove the adjusting nut and spring. Place one hand under the female flange, with the other hand remove the collar. This will allow the retaining pin to fall into the hand underneath. Remove the female flange.

4. The belt can now be removed, the top end first. Place the new belt in position.

5. Re-assemble by reversing the procedure given above; do not forget to replace the retaining pin and collar.

QUESTIONS AND ANSWERS

TOO MUCH OVERRUN

1. Not enough compression on the air valve spring.

   REMEDY: Turn the thumb nut to increase compression on the spring.

2. Air valve not seating.

   REMEDY: Clean thoroughly and, if necessary, regrind.

3. Pumps running too slow, dasher shaft over-whipping the mix.

   REMEDY: Run the pumps faster by speeding them up with the variable drive at the same time lower the refrigerant back pressure, if necessary.

4. Occasionally the cover on the second stage pump has been burred and does not fit the pump casing tightly. This will prevent a proper seal being made and air may leak into the pump since there is a suction and not a pressure if the leak is near the suction inlet.

   REMEDY: Remove the cover plate and with a fine file true up the surfaces on both the cover plate and the pump casing.

5. Excessive amounts of partly frozen ice cream being put in the mix tank to be re-run through the Freezer.

REMEDY: Thoroughly melt down and agitate the mix to be re-run, and add in small quantities.

NOT ENOUGH OVERRUN

1. Too much compression on the air valve spring.

REMEDY: Turn the thumb nut to decrease compression in the spring.

2. Air valve stuck, closed or sluggish in action.

REMEDY: Remove the air valve from the valve body and thoroughly clean both, making sure that the valve stem works freely in the valve guide.

3. Adjustment on second stage pump thrust bearing.

REMEDY: (See Adjustment of Pumps, page 31).

4. Second stage or air pump worn, indicated by vacuum gauge reading low or at zero, and no air breaking out of the ice cream.

REMEDY: Replace worn parts within pump as necessary.

5. Mix not properly balanced or processed.

REMEDY: Write for information pertaining to mixes, quoting details of mix and procedure.

6. Mix pressure too low, unable to build pressure to normal.

(a) Lack of refrigerant.

REMEDY: See Refrigeration Troubles and Remedy. See page 37.

(b) Oil in the refrigeration system.

REMEDY: See Oil Troubles under Refrigeration. See page 27.

(c) Dull dasher blades.

REMEDY: Resharpen or install new set. See page 33.

(d) Mix temperatures to high - above $50^{o}F$.

REMEDY: Cool to lower temperature for best results between $30^{o}F$ and $40^{o}F$.

(e) Mix too thick or viscous.

REMEDY: Process the mix so that less viscosity will be obtained.

This may be found to be due to any one of a number of factors such as homogeonising pressure or temperature, type of serum solids used or type or quantity of gelatin used. Write for information, quoting full details of present processing.

(f) Blades on backwards.

REMEDY: Replace so that bevel edge is pointing in the direction of rotation.

(g) Freezing with too high a refrigerant back pressure.

REMEDY: Lower the back pressure by means of the back pressure regulating valve.

(h) Barrels may be badly scored or rough from use.

REMEDY: Barrels should be removed and returned to the manufacturers.

(i) Freezer being operated at too great a capacity.

REMEDY: Slow down the pump so as to freeze the mix slower and permit it to receive a greater amount of whipping.

(j) Dasher blades not flexible on the pins due to damaged dasher.

REMEDY: Examine for bent heads on the pins. If necessary replace dasher.

7. Improper use of adjustable discharge valve.

REMEDY: See section on adjustable discharge valve. See page 13.

REFRIGERATION TROUBLES

1. Common causes for failure of liquid refrigerant to reach the accumulator in sufficient quantity.

(a) Lack of refrigerant in the system causing the liquid seal in the receiver to be broken and discharge only gas to the low side.

REMEDY: See that the proper liquid seal is maintained in the receiver and if necessary add additional refrigerant to the system.

(b) Too many expansion valves open to other parts of the plant on the same line feeding the float valve on the Freezer; or the valve open too wide, robbing the Freezer of its refrigerant supply.

REMEDY: Close some of the valves or close others partially, or increase the size of the line supplying liquid from the receiver. An excellent plan where this type of trouble arises is to run a liquid supply line direct from the receiver to the Freezer.

(c) Choked Strainer.

REMEDY: Remove the strainers and wash thoroughly in petrol.

(d) Pre-cooled liquid refrigerant which is delivered to the Freezer at reduced pressures. A pressure below 7.5 kg/cm^2 (102 p.s.i.g.) will give insufficient nozzle pressure at the ejector.

REMEDY: Advise makers and request change parts.

2. Insufficient nozzle pressure at the ejector. This pressure should be 2.5 kg/cm^2 (34 p.s.i.g.) although it is well to throttle when necessary to hold it to this figure. Variation of five pounds pressure above or below this figure is permissible.

REMEDY: Clean the strainer of the expansion valve. Clean the 'Piston' in the expansion valve if necessary. 'Remove the bonnet to get at the 'Piston').

3. Common cause of flooding the accumulator with refrigerant.

(a) Dirt or scale under the float valve seat making it impossible to close and shut off the flow of refrigerant.

REMEDY: Pump out the refrigerant, take the valve apart, clean and replace.

(b) Oil congealing around the float valve needle holding the valve open.

REMEDY: Dismantle and clean - use the proper grade of oil.

(c) Valve seat worn or pitted.

REMEDY: Replace parts.

(d) Punctured float - rare.

REMEDY: Renew. The utmost care should be taken with suspect floats. Heating, even ambient temperature changes can cause a faulty float to explode with serious risk of personal injury.

(e) Liquid refrigerant backing up through the suction line to the accumulator from another operation which causes flooding. This happens most frequently when another operation is on hand expansion.

REMEDY: More frequent checking of hand expansion valves. The Freezer suction line should be direct to compressor.

(f) Operating jet at too high a pressure.

REMEDY: Reduce pressure.

4. Impure refrigerant can cause considerable trouble at the Freezer.

REMEDY: Make the usual evaporating tests of purity.

IF IN ANY DOUBT ABOUT ANY POINT CONCERNING OPERATION AND MAINTENANCE, CONSULT THE MAKERS.

REMEMBER THAT YOUR FREEZER IS AN EXPENSIVE PIECE OF PRECISION MACHINERY. TREAT IT WITH RESPECT, ATTEND TO NORMAL MAINTENANCE ROUTINE, AND IT WILL GIVE YOU YEARS OF EFFICIENT AND TROUBLE FREE SERVICE.

IF THE QUALITY OF YOUR PRODUCT IS NOT SATISFACTORY, DO NOT BLAME THE FREEZER IMMEDIATELY. THERE ARE MANY FACTORS WHICH CAN EFFECT PERFORMANCE, SUCH AS REFRIGERATION, HOMOGENISATION OR COMPOSITION OF THE MIX, MIX TEMPERATURE, ETC. CHECK THAT THESE, AND ANY OTHER POINTS, ARE CORRECT BEFORE BLAMING THE FREEZER. EVEN THEN, SEE THAT THE MACHINE IS ADJUSTED TO SUIT THE PRODUCT AND THE CIRCUMSTANCES. ESTABLISH STABLE AND CORRECT CONDITIONS AND REFRAIN FROM FREQUENT AND PURPOSELESS EXPERIMENT.

OBSERVE CAREFULLY THE RESULT OF EACH ADJUSTMENT OF THE FREEZER CONTROLS AND RECORD THE GAUGE, TEMPERATURE AND AMMETER READINGS CAREFULLY, SO THAT CONDITIONS CAN BE REPEATED READILY TO ENSURE CONSTANT AND RELIABLE RESULTS.

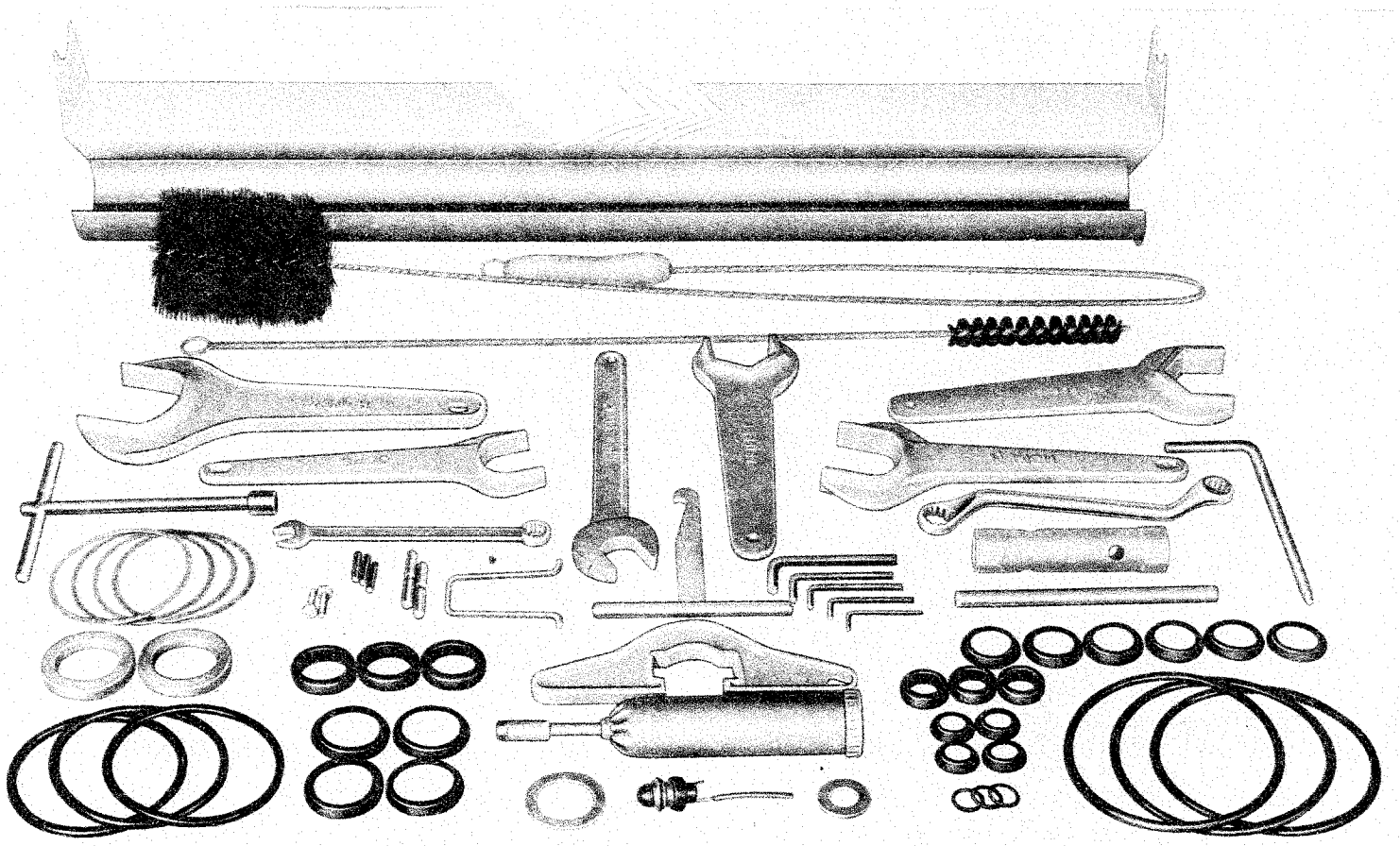


FIG. 13. SPARE PARTS SET

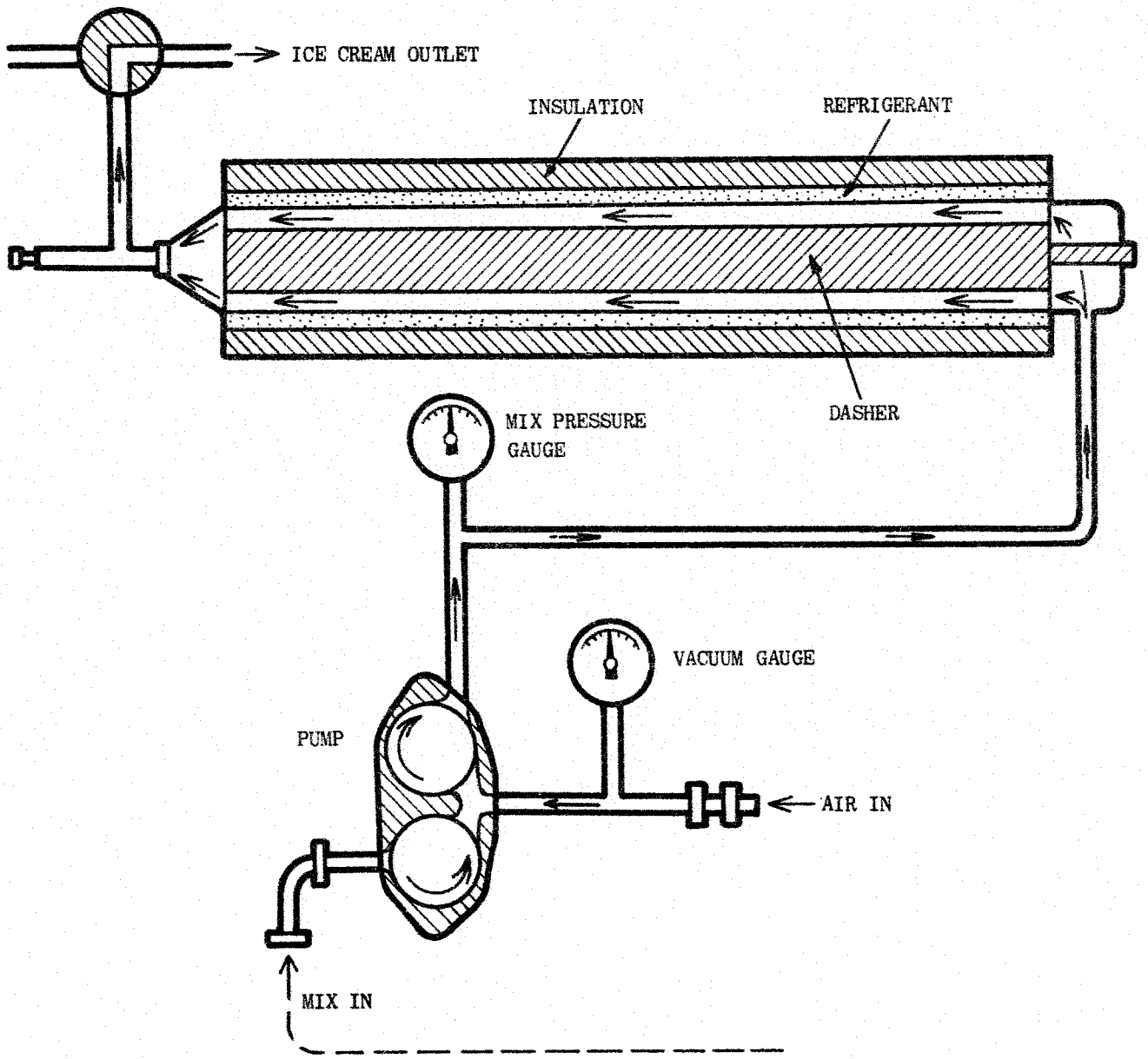
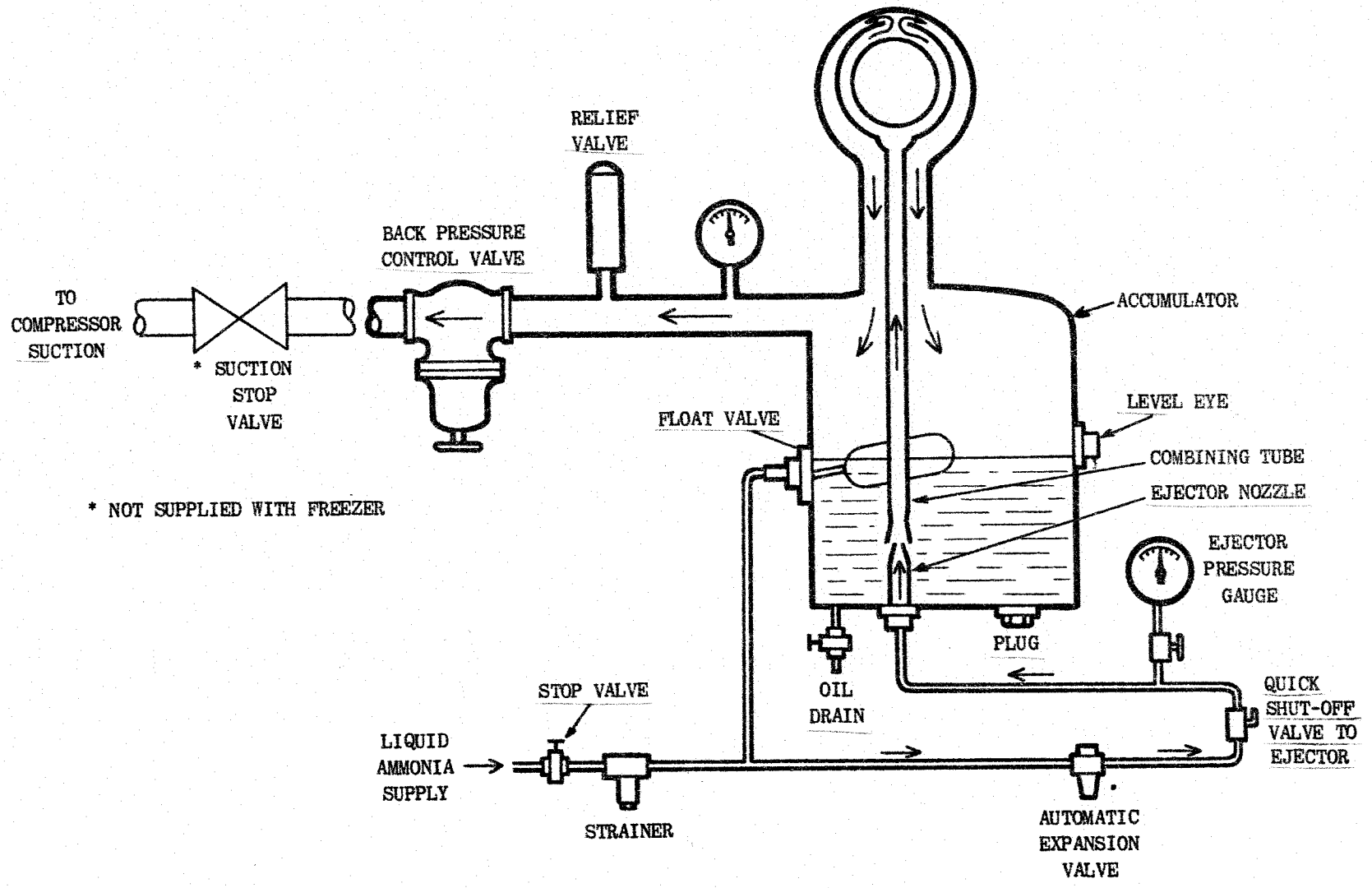


FIG. 14. MIX FLOW DIAGRAM



* NOT SUPPLIED WITH FREEZER

FIG. 15. AMMONIA SYSTEM

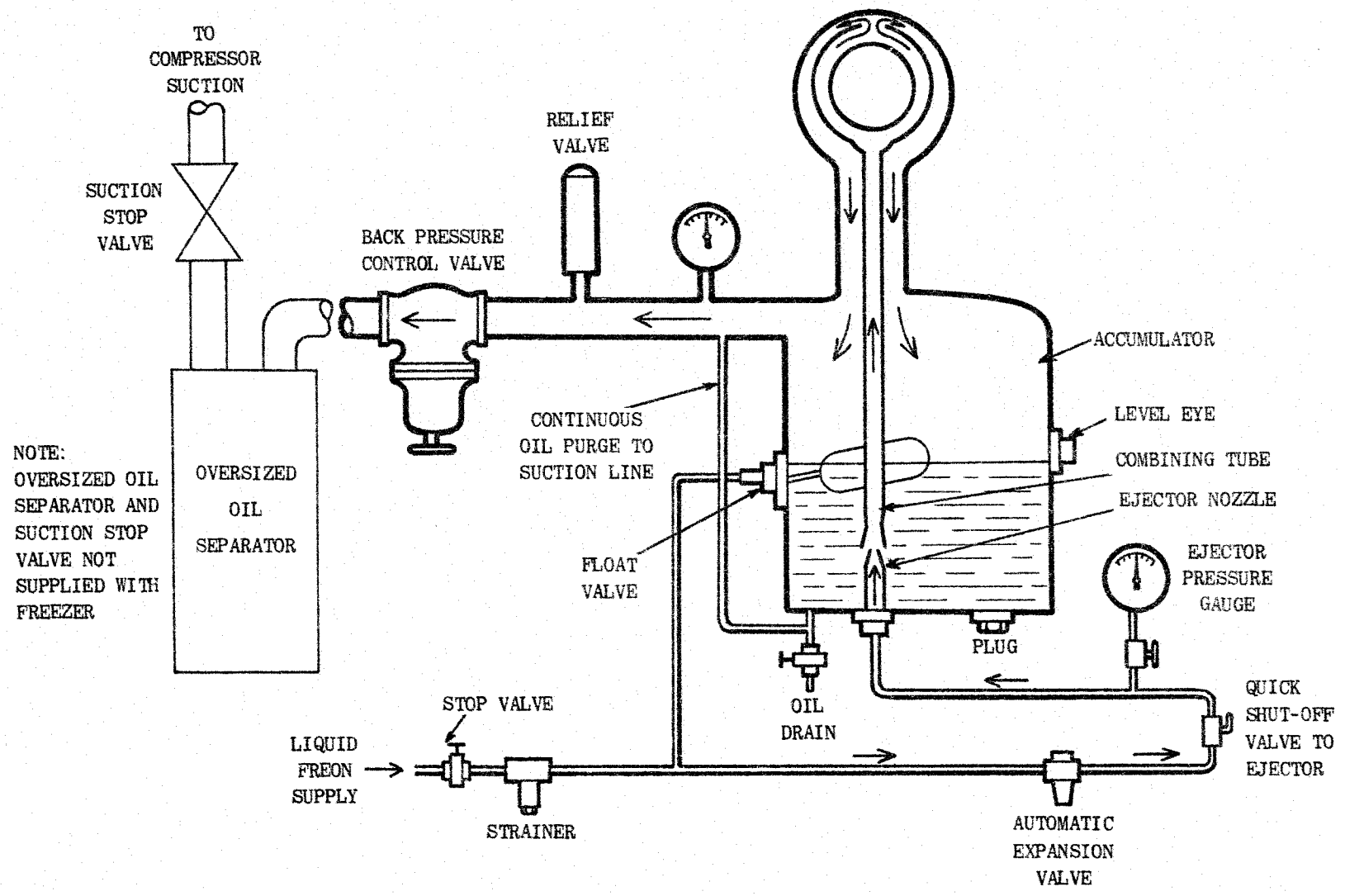


FIG. 16. FREON SYSTEM

TABLE 2 FLUID EQUIVALENT

Litres	British Gallons	U.S.A. Gallons	Litres	British Gallons	U.S.A. Gallons
0.568	1 (Pint)	1.2 (Pint)	182.84	40	48
1.136	1 (Quart)	1.2 (Quart)	227.3	50	60
2.272	0.5 (Gall)	0.6 (Gall)	272.76	60	72
4.546	1	1.2	318.22	70	84
9.192	2	2.4	363.68	80	96
13.738	3	3.6	409.14	90	108
18.284	4	4.8	454.5	100	120
22.73	5	6.0	909.2	200	240
27.276	6	7.2	1363.8	300	360
31.822	7	8.4	1818.4	400	480
36.368	8	9.6	2273.0	500	600
40.914	9	10.8	4546.0	1000	1200
45.46	10	12.0	5455.0	1200	1440
91.92	20	24.0	6819.0	1500	1800
137.38	30	36.0	9092.0	2000	2400

TABLE 2 COMPARISON OF THERMOMETERS

Cent.	Fahr.	Cent.	Fahr.	Cent.	Fahr.
− 40	−40.0	21	69.8	62	143.6
− 38	−36.4	22	71.6	63	145.4
− 36	−32.8	23	73.4	64	147.2
− 34	−29.2	24	75.2	65	149.0
− 32	−25.6	25	77.0	66	150.8
− 30	−22.0	26	78.8	67	152.6
− 28	−18.4	27	80.6	68	154.4
− 26	−14.8	28	82.4	69	156.2
− 24	−11.2	29	84.2	70	158.0
− 22	− 7.6	30	86.0	71	159.8
− 20	− 4.0	31	87.8	72	161.6
− 18	− 0.4	32	89.6	73	163.4
− 16	+ 3.2	33	91.4	74	165.2
− 14	6.8	34	93.2	75	167.0
− 12	10.4	35	95.0	76	168.8
− 10	14.0	36	96.8	77	170.6
− 8	17.6	37	98.6	78	172.4
− 6	21.2	38	100.4	79	174.2
− 4	24.8	39	102.2	80	176.0
− 2	28.4	40	104.0	81	177.8
0	32.0	41	105.8	82	179.6
+ 1	33.8	42	107.6	83	181.4
2	35.6	43	109.4	84	183.2
3	37.4	44	111.2	85	185.0
4	39.2	45	113.0	86	186.8
5	41.0	46	114.8	87	188.6
6	42.8	47	116.6	88	190.4
7	44.6	48	118.4	89	192.2
8	46.4	49	120.2	90	194.0
9	48.2	50	122.0	91	195.8
10	50.0	51	123.8	92	197.6
11	51.8	52	125.6	93	199.4
12	53.6	53	127.4	94	201.2
13	55.5	54	129.2	95	203.0
14	57.2	55	131.0	96	204.8
15	59.0	56	132.8	97	206.6
16	60.8	57	134.6	98	208.4
17	62.6	58	136.4	99	210.2
18	64.4	59	138.2	100	212.0
19	66.2	60	140.0		
20	68.0	61	141.8		

TABLE 3 METRIC UNITS

Pressure kg/□ cm. (ATO)	NH_3 Deg. Cent.	F_{22} Deg. Cent.	F_{12} Deg. Cent.	Pressure kg/□ cm. (ATO)	NH_3 Deg. Cent.	F_{22} Deg. Cent.	F_{12} Deg. Cent.
cm. Hg.				kg/□ cm.			
40	− 47	− 55.7	− 46	2.6	− 5	− 9.9	+ 4.5
38	− 46.2	− 54.6	− 45	2.7	− 4.2	− 9.1	5.5
36	− 45.2	− 53.3	− 43.9	2.8	− 3.5	− 8.3	6.2
34	− 44.3	− 52.2	− 42.8	2.9	− 3	− 7.6	7
32	− 43.7	− 51.1	− 41.7	3.0	− 2.2	− 7	8
30	− 42.9	− 50.8	− 40.8	3.1	− 1.5	− 6.2	9
28	− 42.1	− 50	− 39.9	3.2	− 1	− 5.6	9.9
26	− 41.4	− 49.2	− 39	3.3	− 0.2	− 5	10.6
24	− 40.6	− 48.5	− 38.2	3.4	+ 0.3	− 4	11.2
22	− 40	− 47.8	− 37.3	3.5	+ 1	− 3.4	12
20	− 39.3	− 47.1	− 36.5	3.6	1.6	− 2.9	12.8
18	− 38.7	− 46.5	− 35.7	3.7	2.1	− 2.1	13.5
16	− 38.1	− 46	− 35	3.8	2.8	− 1.5	14.1
14	− 37.4	− 45.2	− 34.2	3.9	3.2	− 1	14.9
12	− 36.8	− 44.4	− 33.5	4.0	3.8	− 0.3	15.3
10	− 36	− 43.8	− 32.8	4.1	4.2	+ 0.2	16
8	− 35.4	− 43	− 32	4.2	4.8	+ 0.9	16.8
6	− 34.9	− 42.4	− 31.5	4.3	5.2	1.3	17.4
4	− 34.4	− 41.9	− 31	4.4	5.9	2	18
2	− 33.9	− 41.2	− 30.2	4.5	6.3	2.6	18.8
0	− 33.2	− 40.5	− 29.7	4.6	6.9	3.1	19.2
kg/□ cm.				4.7	7.3	3.8	20
0.1	− 31.5	− 38.8	− 27.4	4.8	8	4.2	20.7
0.2	− 29.8	− 36.8	− 25.3	4.9	8.5	4.9	21.1
0.3	− 28.2	− 35	− 23.4	5.0	8.9	5.4	21.9
0.4	− 26.7	− 33.5	− 21.6	5.1	9.3	5.9	22.3
0.5	− 25.1	− 31.9	− 19.9	5.2	9.9	6.3	23
0.6	− 23.8	− 30.4	− 18.2	5.3	10.3	7	23.6
0.7	− 22.5	− 29	− 16.8	5.4	11	7.5	24
0.8	− 21.2	− 27.7	− 15.2	5.5	11.3	8	24.7
0.9	− 20	− 26.4	− 13.8	5.6	11.8	8.5	25.1
1.0	− 18.9	− 25.1	− 12.3	5.7	12.2	9	25.8
1.1	− 17.9	− 24	− 11.1	5.8	12.7	9.5	26.2
1.2	− 16.7	− 22.9	− 9.9	5.9	13	10	26.8
1.3	− 15.7	− 21.8	− 8.8	6.0	13.5	10.5	27.1
1.4	− 14.6	− 20.7	− 7.5	6.5	15.6	12.7	30
1.5	− 13.7	− 19.6	− 6.3	7.0	17.4	14.9	32.2
1.6	− 12.8	− 18.7	− 5.2	7.5	19.3	17	34.6
1.7	− 12	− 17.7	− 4.1	8.0	21	19	36.9
1.8	− 11	− 16.7	− 3.1	8.5	22.8	20.9	39
1.9	− 10.2	− 15.7	− 2.1	9.0	24.5	22.6	41.2
2.0	− 9.3	− 14.8	− 1.0	9.5	26	24.4	43.1
2.1	− 8.7	− 14	+ 0	10.0	27.5	26.1	45
2.2	− 7.9	− 13.1	+ 1	10.5	29	27.9	47
2.3	− 7.1	− 12.2	2	11.0	30.3	29.3	48.9
2.4	− 6.4	− 11.4	2.9	11.5	31.8	31	50.6
2.5	− 5.8	− 10.7	3.7				

TABLE 4 **ENGLISH UNITS**

Pressure lbs/□" (Gauge)	NH_3 Deg. Fah.	F_{22} Deg. Fah.	F_{12} Deg. Fah.	Pressure lbs/□" (Gauge)	NH_3 Deg. Fah.	F_{22} Deg. Fah.	F_{12} Deg. Fah.
Inches Vac				P.S.I.			
25	− 83.4	− 99.8	− 85.9	21	6.8	− 4	20
24	− 78.5	− 94.7	− 79.8	22	8	− 2.6	21.3
23	− 74.2	− 90	− 75	23	9.1	− 1.2	22.8
22	− 70.4	− 86.1	− 70.6	24	10.1	0	24.1
21	− 67	− 82.9	− 66.9	25	11.2	+ 1.1	25.4
20	− 63.9	− 79.3	− 63	26	12.4	2.2	26.9
19	− 61	− 76.2	− 60	27	13.5	3.4	28.1
18	− 58	− 73.9	− 57	28	14.6	4.6	29.4
17	− 55.9	− 71.1	− 54.2	29	15.6	5.8	30.8
16	− 53.6	− 68.8	− 51.6	30	16.6	6.7	31.9
15	− 51.4	− 66.3	− 49	31	17.3	8	33
14	− 49.4	− 64	− 46.7	32	18.2	9	34.2
13	− 47.4	− 62	− 44.3	33	19.2	10	35.5
12	− 45.6	− 60.1	− 42.2	34	20.2	11	36.8
11	− 43.8	− 58.3	− 40	35	21.2	12	37.9
10	− 42.1	− 56.5	− 38	36	22.1	13	39
9	− 40.4	− 54.9	− 36.2	37	23	14	40
8	− 38.9	− 53.1	− 34.3	38	24	15	41
7	− 37.3	− 51.6	− 32.8	39	25	16	42
6	− 35.9	− 50	− 31	40	26	17	43
5	− 34.5	− 48.4	− 29.2	41	26.8	18	44
4	− 33.1	− 47	− 27.7	42	27.4	18.9	45
3	− 31.8	− 45.5	− 26	43	28.2	19.6	46
2	− 30.5	− 44.1	− 24.5	44	29	20.4	47
1	− 29.2	− 42.8	− 23	45	29.8	21.2	48
0	− 28	− 41.4	− 21.5	46	30.5	22.2	49
P.S.I.				47	31.2	23.1	50
1	− 25.9	− 39	− 18.8	48	32	24	51
2	− 23.4	− 36.7	− 16.1	49	33	24.9	52
3	− 21.2	− 34.3	− 13.5	50	33.8	25.8	53
4	− 19.2	− 32	− 11.1	55	37.5	30	57.8
5	− 17.2	− 30	− 8.8	60	40.9	33.5	62
6	− 15.3	− 28	− 6.5	65	44.1	37.2	66
7	− 13.5	− 26	− 4.5	70	47.1	40.7	69.8
8	− 11.8	− 24.1	− 2.3	75	50.1	44	73.5
9	− 10.1	− 22.3	− 0.2	80	53.1	47.1	77.1
10	− 8.4	− 20.4	+ 1.8	85	55.9	50	80.6
11	− 6.9	− 18.8	3.6	90	58.6	53.1	83.9
12	− 5.3	− 17	5.3	95	61	56	87
13	− 3.8	− 15.5	7.1	100	63.3	58.8	90.2
14	− 2.4	− 14	8.9	110	68.1	63.9	96
15	− 1.0	− 12.3	10.7	120	72.4	68.9	101.5
16	− 0.4	− 10.9	12	130	76.8	73.4	107
17	1.7	− 9.4	13.9	140	80.6	77.8	112
18	3.0	− 8	15.2	150	84.3	82.1	116.7
19	4.3	− 6.7	17	160	88	86.1	121.1
20	5.5	− 5.3	18.6				

TABLE 5 PRESSURE EQUIVALENTS

lbs/□″ (Gauge)	Kg/□ cm² (atm)	lbs/□″ (Gauge)	Kg/□ cm² (atm)
Inches Vac	cm. Hg.	P.S.I.	Kg/□ cm.
19	48	28	1.97
18	46.1	29	2.03
17	43.8	30	2.09
16	40.9	31	2.15
15	38.2	32	2.21
14	36	33	2.29
13	34	34	2.36
12	31.5	35	2.42
11	28.7	36	2.5
10	26	37	2.59
9	23.7	38	2.66
8	21	39	2.7
7	18	40	2.78
6	16	42	2.9
5	13.5	44	3.03
4	10.5	46	3.18
3	8	48	3.31
2	6	50	3.45
1	3	52	3.6
0	0	54	3.75
P.S.I.	Kg/□ cm.	56	3.9
2	0.14	58	4.06
3	0.2	60	4.2
4	0.27	62	4.31
5	0.33	64	4.49
6	0.4	66	4.61
7	0.47	68	4.76
8	0.53	70	4.9
9	0.61	75	5.23
10	0.68	80	5.7
11	0.75	85	5.93
12	0.82	90	6.29
13	0.89	95	6.65
14	0.97	100	7.0
15	1.03	105	7.36
16	1.1	110	7.7
17	1.19	115	8.01
18	1.25	120	8.4
19	1.32	125	8.75
20	1.39	130	9.1
21	1.45	135	9.41
22	1.52	140	9.79
23	1.6	145	10.16
24	1.68	150	10.43
25	1.74	155	10.8
26	1.82	160	11.2
27	1.9		

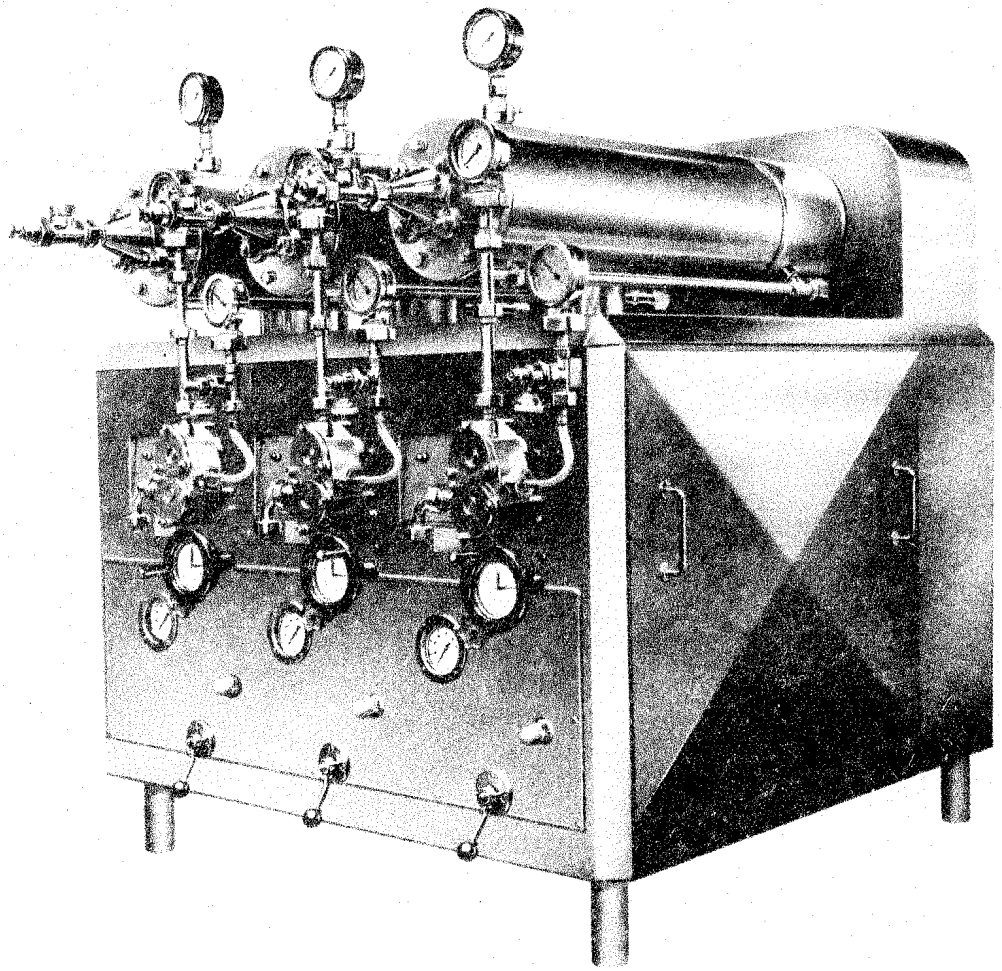
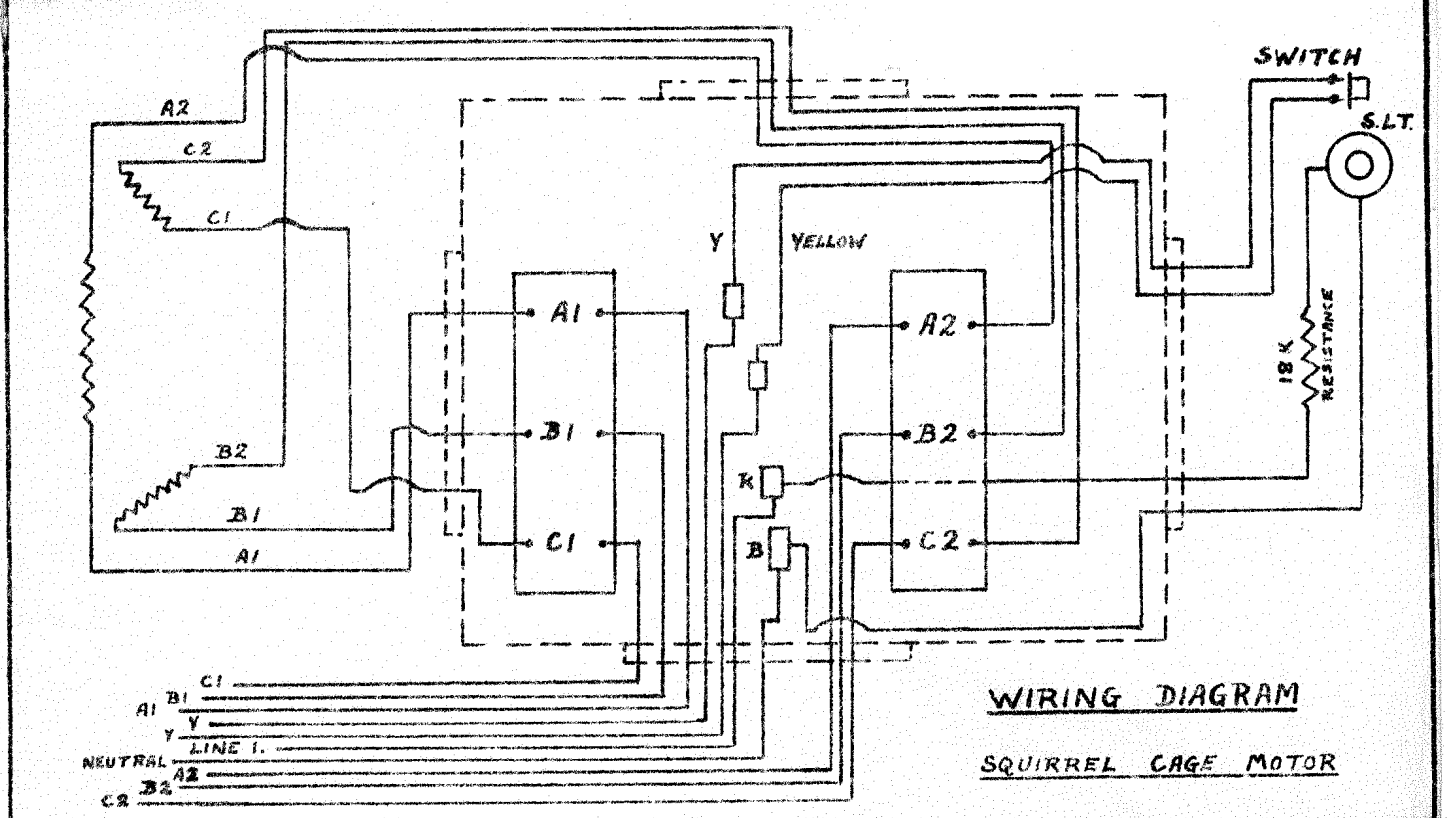
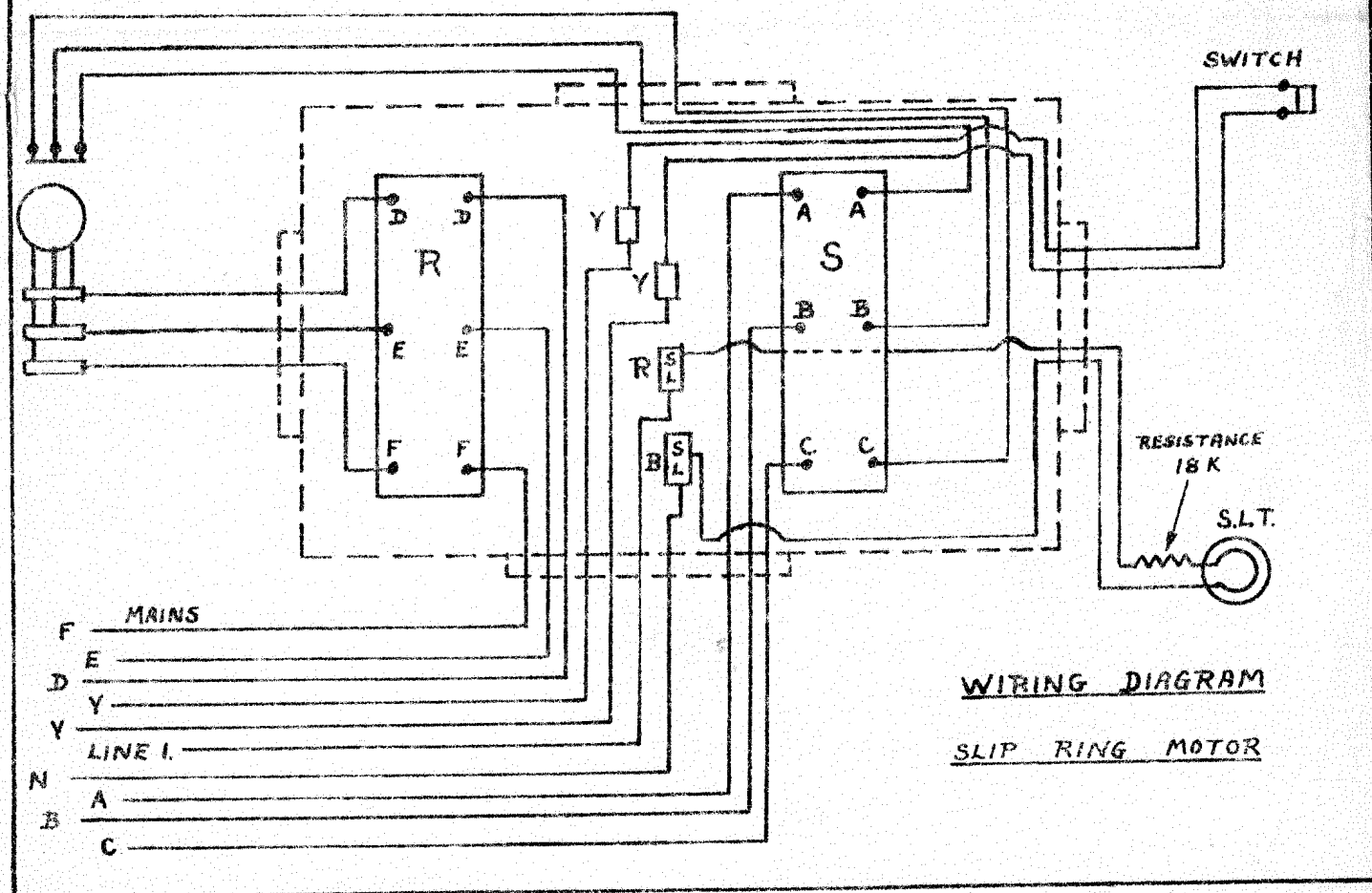


FIG. 17. 3BV1 FEEDER



WIRING DIAGRAM

SQUIRREL CAGE MOTOR



WIRING DIAGRAM

SLIP RING MOTOR