CAN HANDLING EQUIPMENT FOR
FOOD PROCESSING PLANTS

by

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CAN HANDLING EQUIPMENT FOR FOOD PROCESSING PLANTS

INTRODUCTION

Only through the use of the best methods and the most efficient equipment and arrangements is it possible for a canning firm to maintain both quality of product and low cost, high volume production over an extended period of time.

It is believed that management's greatest opportunity for increased volume of production at lower per unit cost lies in (1) an all-out search for, (2) an increased use of, and (3) better arrangements and operation of improved mechanical can handling equipment.

In this work the author has attempted to bring together and discuss some of the equipment and arrangements useable in performing the customary can handling operations in a fruit or vegetable canning plant.

The first section begins with the empty can supply and extends up to the closing operation. (Closing machines are not included in this work; these machines are generally furnished by can manufacturing companies on a leased basis and present an extensive study alone.)

The second section covers equipment and arrangements used for handling cans from the closing machines through
the processing and cooling operations. The third section includes the movement of cans to the warehouse and warehousing operations. The fourth section pertains to operations, maintenance, and lubrication of equipment. This is followed by a condensed coverage of pertinent legal considerations and recommendations.

The writing is based on work done while assigned to the canning section of a joint army and navy military government research staff and on reading, research, interviews, and experience in canning factories. The judgments formed are the result of working as an operator at some time at all of the principal operating jobs typical to a fruit and vegetable cannery, as a plant mechanic doing production speed-up work, and also are based on supervisory experience as a foreman and as a plant supervisor in charge of all canning operations.
CHAPTER I

MOVEMENT OF CANS TOWARD THE CLOSING MACHINES

Empty Can Supply

Empty cans are generally available to packers either in bulk in railroad cars or in bags. Sometimes, however, the can manufacturer ships cans to customers in shipping cases. If this kind of shipment is afforded, it is usually handled in one of two ways. First, the customer furnishes the shipping cases in the flat, and the can company makes them up and fills them, charging the customer for making up the cases. Second, the can company purchases the cases and bills the customer for them. This charge includes the cost of making up the cases.

If the plant is serviced with a spur track, the major part of the can supply may best come from direct feeding of the can lines from bulk loaded railroad cars. Auxiliary gravity-fed lines supplied from bags in dead storage in a loft above the level of the seamers will serve to keep operations going for short periods in case of trouble with the main can line. Such auxiliary lines, if made of considerable length, could all be fed at a central point. By locating someone in the area to do other necessary work, e.g., can straightening, there need not be any idle labor
accruing to this emergency supply. The feed-in from the spare supply should be arranged so that its use is automatic when the regular line is not functioning.

Conveyor-fed can supply systems generally make use of some type of merry-go-round arrangement to prevent can damage by conveyor pressure when the total conveyor capacity is not being used at the fillers. Such merry-go-round arrangements are placed near the filler end of the can line and feed into gravity drops above the fillers. When the supply of empties is too great, the system, by mechanical and electrical devices, shuts off the main conveyor, "pegs" the can flow, and sends a limited supply of empties around and around the system, keeping the filler drops supplied. As the merry-go-round supply becomes exhausted, the main conveyor is automatically switched on. Either cables or belts are used to move the cans along in conveyor can tracks when they are not gravity-fed. The use of belts is usually restricted to small operations and short distances. Empty can conveyor systems, can tracks, turns, etc., are usually plant built or custom made by can companies for each individual job or made to order by a can equipment manufacturer.

If the can track is fed from bags, the usual practice
Figure 1. Railroad cars being loaded with empty cans in bulk at the can factory. At the cannery loaded cars are spotted for unloading directly into the empty can supply system.
is for the worker to put his fingers into the open ends of the cans, grasping several at a time, and place the cans open end up on a circulating disc, on a converger, or directly into the track itself. Figure 2, below, shows can tracks being fed by hand.

![Figure 2. Can tracks being fed by hand.](image)

tracks being bed by hand from bags. Either a disc or a converger will put the cans in single file and send them down the track automatically and offer labor savings.

A mechanical device for removing a complete layer of cans at a time from bags and placing them on a converger would have economic possibilities in addition to being a more sanitary method of handling. Without giving any disclosure of the construction, Dawson (11) reports that he has recently developed such a device but is still testing
it prior to offering it on the market. It would seem that a suitable metal plate magnetized by an electro-magnet could be used to lift a complete layer of cans per trip and release them on end on a converger. One layer would, of course, always be wrong end to, but this layer could be released on a plate above the main converger and flow through a can righter or a return. A lifting device of this sort could be easily handled by having it hang from a counter-balanced boom, much as air hoses are sometimes mounted at service stations. The switch might be conveniently located on the handle of the device so that it could be controlled by the thumb. The use of conveyors in moving the bags up to the loading point of the can track should not be overlooked.

If empty cans are supplied in cases that are to be used subsequently for full cans, the empties may be removed with a lifter. Dawson (11) has developed a lifter for removing empties from cases a layer at a time. In use, one operator working at about half capacity was able to supply a can line at the rate of 420 cans per minute. The cases containing the empties were opened and moved up to the lifter operator on a conveyor and the empty cases conveyed away. The lifter removed 48 cans per trip.

Generally, from a time standpoint, the bulk of the
can supply should be fed from railroad car bulk shipments. Whether or not it is possible to do this with economical advantage is an individual plant problem. Such things as size of operations, variety of can sizes used, demurrage charges, and cost of truck transportation would be some of the determining factors.

Based on cost analysis investigations of thirty Indiana canning factories, Haverkamp and Hardin (15, p.2) summarize that it costs on an average only one-half the time to supply the can line with empty cans from bulk in railroad cars as it does to work from bags. Where empty cans must be provided from bags these investigators recommended that the can tracks be close together and of sufficient length so that fewer operators could fill all the lines during fluctuating light operations.

The can fork, and old tool but still generally used, serves to enable one person to remove a number of cans from bulk supply and place them into the can line. Although there are some patented and commercially manufactured can forks, they are all basically the same, and the packer often has a plant mechanic make them as desired. Figure 4 illustrates the operation of an automatic grip sanitary can fork. To insert the tines of the fork into cans the handles are squeezed together. Once inserted,
the grip on the handles is released, and the cans remain fastened to the fork at any angle without falling off. Can forks are made to handle any number of cans desired.

The ordinary multiple-tined can fork can be maneuvered better and with less effort if provided with a comfortable "D" grip on the end of the regular handle.

![Image of a woman using a can fork](image)

*Figure 3. An old time can fork still used today. This type of can fork is made to handle any desired number of cans.*

Tilting the can track slightly from the horizontal and constructing a back-guard on the far side of the can track
at which to aim makes the job easier as movements need not be so precise. In using a back-guard the cans are lined up as the loaded fork hits the back-plate, or guard. The fork is lowered and withdrawn, leaving all cans in line in the track ready to roll away.

![Figure 4: Automatic grip sanitary can fork.](image)

Courtesy Jos. Wolfinger & Sons

Figure 4. Automatic grip sanitary can fork. With the aid of this fork it is possible either to pick up or release cans in a vertical position.
Can Washers

Canners who pack products that move in interstate commerce are subject to certain federal laws in addition to the controlling laws of the state wherein the plant is located. Of important concern are the Federal Food, Drug, and Cosmetic Act and the state laws of similar nature. Practically all of the states have laws patterned upon the Federal, Food, Drug, and Cosmetic Act of 1938, or its predecessor the Food and Drugs Act of 1906 (16, p. 62).

Sanitary requirements make it necessary that cans be clean at the time they are filled. Under certain conditions of transportation or storage, cans may become
contaminated. In such cases, as an assurance that cans will be clean, can washers are used. Can washers may be introduced into the can track at any point desired, however, they are generally placed close to the filling machine.

The can washer shown in Figure 5 is adaptable to moderate-speed lines only. While rolling through the machine the cans are subjected to a series of jets of steam, cleansing the cans. The cans pass through the washer in a tilted position so that they will drain. The machine is adjustable for any size can from No. 1 to No. 10.

The Robins high-speed can washer, Figure 6, below, 

![Image of a high-speed can washer](https://example.com/robins-washer.png)

**Figure 6.** A high-speed can washer with positive feed.
provides for positive travel of cans through the entire length of the machine and will operate much faster than the gravity-fed machine. It is designed for installation in the can line ahead of the filler and is also adjustable as is the gravity-fed device shown in Figure 6. In going through this machine the cans pass over a series of special jets in a spinning motion.

Some manufacturers offer washers especially built to attach to their fillers. For example, CRCO-Ayars manufacture a can washer to be installed on CRCO-Ayars filling machines in place of the can feed. The device is adaptable to all CRCO-Ayars fillers (21, p.126). Such a device,
as shown in Figure 7, connected directly to the filler reasonably assures that foreign material will not get into the cans before being filled. The cans are washed while in the upright chute by three sprays. They then drain for a space of three cans and are righted for movement directly to the filler. The chute is provided with an adjustable plate to accommodate different size cans. Many types of can washers are manufactured, and still others are improvised by plant mechanics.

Filling Cans

Cans are filled by a great variety of methods involving all sorts of combinations ranging from manually handling and packing each can to entirely automatic operations. The method of filling depends to a great extent upon the product being packed. For example, cream style corn or juices are easily handled in mechanical fillers, while corn on the cob or asparagus presents a different problem.

For comparatively small operations where a number of grades and sizes of various products are packed, tray boards are the most common method of handling cans to be filled. The empties are placed on tray boards at a central point. The loaded tray boards are set on top of each
other in suitable size stacks and moved up to the various filling points, usually by hand truck. At these filling points it is common to slide a tray board of cans under a metal plate which has an opening over each can. The cans are filled by hand, the tray board and filled cans are removed, stacked, and then moved toward the exhaust box. Cans are there accumulated and subsequently fed into the exhaust box according to grades and sizes. Such a method presents a sanitation problem and easily tends toward un-sanitary conditions. Tray boards are restacked and reused. The wood is not sanitary, yet each tray board is supported by the open ends of the cans below it when stacked. Not only do the open ends of the cans come in contact with the boards, but the food product at the top of the cans often does, also. It will probably be only a matter of time until the tray board method of handling for the filling operation will be specifically forbidden by law.

Semi-automatic fillers are suitable for a variety of products. Several variations of this type of filler have been made. The use of such a machine tends toward a continuous line arrangement. The top plate of the filler rotates, taking in empties at one point and discharging filled cans at the other (See Figure 8). The speed of the filler is best set when the workers filling the cans can
"just keep up" while the filler runs continuously. If the filler workers get behind in filling, one of them stationed by a throw-out clutch can intermittently stop the machine. With the use of such a filling machine the can handling may be accomplished under quite satisfactory sanitary conditions.

Figure 8. Semi-automatic can filler. Occasionally a damaged can will come through the empty can chute. If the can chute is provided with a short hinged section either on the filler side or on the top side, dented cans that are observed can be removed easily by filler workers without affecting the filler feed. The hinged section should be within easy reach yet far enough up the chute so that removing the can will not affect the filler.

Courtesy Purdue Univ.
Sta. Bul. #528
If the product lends itself to automatic filling, such machines offer maximum labor savings and have tremendous possibility for speed in operations. Automatic fillers are easily fitted into a continuous-flow system. The empty can supply is mechanically delivered to such machines. Filled cans discharge to the adjoining seamer.

The liquid packing medium is almost always added to cans through the use of some type of mechanical dispensing arrangement. If syrupers are used, they may be connected just prior to the seamer, much as an automatic filler is often connected.

If an exhaust box is used for preheating, the liquid packing medium is added before the cans enter the exhauster. Common arrangements provide for a perforated pipe mounted over the can line just before it enters the exhauster. A slight bend in one guide rail at this point provides for tilting of the cans, draining them slightly, thereby giving the desired headspace. Excess packing liquid may be recirculated. Sometimes a plunger-type syruper is used at this point.

For brine packed products, plain water may be added at the feed end of the exhaust box, and tablets can be added by an automatic device mounted at the seamer. This arrangement saves the exhaust box from the destructive
attack of salt water. Also, a more uniform brine in cans day by day is assured.

Exhausting Operations

In modern canning, procedures provide for the greatest possible exclusion of air from the sealed container and for the removal of other gases from the raw product itself (5, p.72). For the removal of product gases and the exclusion of air, dependence is mainly placed upon exhausting or preheating operations or upon the use of a vacuum sealing machine.

The exhausting procedure is primarily a mechanical can handling operation performed under desired temperature conditions. The operation is accomplished by passing the open filled cans through a covered chamber in which hot water or steam is used. This expands the food by heat and expels the air and other gases contained in the food and in the head space of the can. The temperature in any exhaust box is easily regulated automatically while the exhaust time is variable within limits generally by changing the speed of the machine.

The exhausting operation is sometimes accomplished by passing the cans through a narrow, shallow, rectangular, trough-like container by means of a cable. Other
Types are walk-along, circular, and rotary boxes. The cans are moved through the walk-along box while standing on end. The floor is made of thin strips of steel on edge. One-half of them are raised up slightly and move ahead and lower, thereby moving the cans progressively toward the discharge end. The circular exhauster is round, as the name indicates. The cans move in circles while guided by guide rails. There is no transfer problem in this type.

One common type of exhauster makes use of guide rails and a series of revolving discs in moving the cans in the least direct route, thereby affording the cans the desired time in passing through the box. The cans are fed into one end of the box and discharged at the opposite end. The revolving discs are faced off at their perimeter,
making transfer from disc to disc less likely to cause jamming. Lubrication of the vertical bearings and disc hubs presents a special lubrication problem because of temperature, moisture, and often salt conditions. These hubs must be lubricated adequately. Excessive wear will at times permit tipping of the discs to the extent that the cans will not always transfer from disc to disc but will catch, causing a jam and possibly damage to the machine. Any stopping of the exhauster will make for non-uniform blanching operations. Most exhausters have sectional removable tops and bottoms. One of the main difficulties with the disc type is jamming due to worn bearings and improper adjustment in height and tilt of the discs.

The conveying trouble which in the disc type is both

![Diagram of Pivot Chain Exhauster](image)
inherent in the design and a result of inadequate lubrication is overcome by moving the cans through the box on a pivot chain. Steam spray pipes serve as guide rails in this box as they often do in the disc type.

To determine the capacity of these types of exhausters, first determine the holding capacity of the machine, allowing about one quarter inch space between cans, and divide this number by the number of minutes of exhaust time desired. For example, if a chain exhauster had a capacity of 198 cans of the size in question and 108 second exhaust were desired, 198 would be divided by 1.8, indicating a capacity of 110 cans per minute.

![Pivot chain exhauster](image)

Courtesy Berlin Chapman Co.

Figure 11. Pivot chain exhauster.

Arrangements should be made so that the box will stop
in case of jams in either the box or the seamer. Much delay and poor vacuum often result from badly jammed exhausters. Jamming of cans caused by stoppage at the discharge end could be prevented easily by installation of a safety arrangement. For example, a pressure switch located at the seamer could function through a solenoid to cut off the power to the exhauster. It is advantageous to have the control of the exhaust box within easy reach of the seamer operator.
CHAPTER II

CAN HANDLING THROUGH THE PROCESSING AND COOLING OPERATIONS

Continuous-type Cookers and Coolers

The disposition of cans at the point of discharge of the seamer depends mainly upon the type of processing equipment used. If processing is performed in a modern continuous-type cooker-cooler, the "handling" of cans is totally eliminated. However, if retort operations are used, the can handling job is enormous. If retorts are used, sealed cans must be placed into retort crates which are moved to and into the retort for processing and then moved again back out of the retort and unloaded.

Spin-coolers and walk-along boxes are often used for

![Continuous cooker and cooler.](image)

Courtesy Food Machinery Corp.

Figure 12. Continuous cooker and cooler.
processing and cooling high acid products. Such walk-along boxes operate much as the walk-along exhaust box mentioned in Chapter I. In a walk-along box for processing, the cans are moved forward while standing on end. The floor of the box is made of steel strips on edge. One-half of the strips are stationary while the other half rise and move forward and down by cam action. The cans are thereby lifted up and moved forward slightly by each revolution of the cam shaft. As the cans reach the discharge end, they are taken off in single file, or files, by cross chains.

Generally, spin coolers operate with the cans being moved forward while lying on their sides and at the same time being rotated by a belt running beneath them. A long trough arrangement is provided and is inclined toward the discharge end. A chain moves up each side of the trough. Cross bars spaced in the chain serve to move the cans along. Water is dripped or sprayed on the cans as desired from above. Such equipment has decided advantages of cooling efficiency but is unsuitable for products that damage easily by tumbling in the cans. The can flow through these machines is generally continuous. The seamer is fed into the processing box which connects into the cooler. The cooler discharges the cans in single file.
In the beginning most of the continuous cookers and coolers were rectangular in cross section; later many were designed cylindrical in form and of a circular cross section. This was followed by a trend toward making the bottom half of a half circle in cross section and the upper half rectangular (10, p.125). The design of a rectangular top makes easier entry for checking for and removing jammed cans.

Figure 13. Continuous cooker and cooler. This machine will handle approximately 200 cans per minute.

Continuous line cookers are fed directly from the seamer by means of a can track gravity flow connected to an elevator which raises the cans up to the intake entrance.
of the cooker. A common type of continuous cooker and cooler is an arrangement where the cans progress through the cooker by a spiral reel to the discharge point where they either flow by gravity or are elevated to a continuous cooler. The movement through the cooler is much the same as, if not identical to, that through the cooker. Cooled cans are discharged from the cooler to a can track from which arrangements are made for their disposition. Sometimes a continuous-flow system is set up taking the cans straight through the labeler, caser, case sealer, and marker, and on out to the dock for loading or to the warehouse area for stacking.

If the cooker, cooler, and cooker intake elevator are all operated by one drive and are positively connected together, a jam necessitating the stopping of any one of these will necessitate the stopping of all three. When such a hookup is stalled for any reason, the cans in the cooker are overcooked and those in the cooler subcooled. Overcooled cans may rust or cause labeler trouble, especially if the pickup being used will not work well on both "hot" and "cold" cans. Certainly the power hookup must be so that the cooker and elevator will shut off in case the cooler jams, and likewise the elevator must be stopped when the cooker jams. A power hookup whereby, in
case of trouble with only the elevator, the cooker and cooler stay running, or in case of cooker trouble, the cooler remains running serves to save much unnecessary overcooking and subcooling.

Ordinarily, if for any reason cans back up in the cooler discharge can track to the cooler port, the backed-up cans will actuate a safety device at this point and stop the cooker-cooler system, or they will cause a jam at this point. In either case, production is lost and quality of product endangered. The installation of an auxiliary can line to a local accumulating point connected by a gravity drop gate in the bottom of the regular can track, preferably close to the cooler discharge, would prevent jamming by providing an alternative outlet in case of failure of the regular line.

Often the regular can track backs up because of temporary elevator, labeler, or caser trouble. If the connection between the labeler and the cooler is rather short and does not provide for at least a minute or so backup, the cooker-cooler will have to be stopped and started for trouble stops of only a few seconds duration on down the line. Such inflexible arrangement tends toward see-sawing from one end of the line to the other and develops trouble that would never happen if the line
were kept running through the use of by-passes and/or accumulating points. A few minutes discharge down an auxiliary cooler discharge line could easily be accumulated or cased bright by hand. Entry of cans into the alternate track must be automatic when the cans back up to a certain point in the line.

In addition to having mercury switches located at the potential trouble spots on the cooker-cooler, the machines are equipped with shear pins and slip clutches. If the mercury switches are properly located and correctly adjusted, the other safety devices will seldom need to function.

Speed of movement of the cans through continuous-type machines is generally controlled by a variable speed drive or by changing the size of driving or driven pulleys.

Can trouble often occurs between the cooker intake and the seamer. In case the elevator to the cooker stops or the flow jams, cans will soon back up to the seamer discharge. A pressure gate safety device to prevent jamming is usually provided on the seamer. Before jamming the seamer, the cans press open a hinged section of a guide rail held closed by spring tension and drop out on the floor.

Excessive speed of the cans flowing down the gravity-type can track to the cooker elevator is easily prevented.
by hanging a suitable length of chain over the can track parallel to the can flow so that the cans rub on the chain in passing.

If the seamer discharge is so arranged that the cans roll down the track with the "open" ends visible to the seamer operator, cans on which a lid has been missed may often be picked out by the seamer operator.

The FMC One-Man Cook Room

The Food Machinery Corporation pressure cooker and cooler illustrated in Figure 14 completely eliminates manual handling of cans during the processing and cooling operations (14, p.1-18). In designing this huge piece of cannery equipment, recognition has been given to the many potential trouble spots that cause jamming, endanger quality, and cause high production costs.

The FMC cooker and cooler is often referred to as the "One-Man Cookroom." The machine has a convenient centralized control board wherein all gauges, control instruments, and the electric control cabinet are located. From this board the operator can tell at a glance how the entire machine is functioning. Automatic protective stops and signals are absolutely essential to mechanized handling. The "One-Man Cookroom" has a generous supply of
strategically placed automatic controls.

Automatic control begins at the very entrance to the feed elevator with the use of a mercury switch. Out-of-position cans will automatically stop the elevator and light an amber light over this point. Other protective stops are located at the top of the transfer valve, at the cooler discharge chute and at the top of the cooler discharge valve. High and low water levels give dual warning by sounding a vibrating horn and by red signal lights. Through the operation of the various protective stops, jamming of the machine is reduced to a minimum. The lighting of lights located high over the potential stoppage points makes it easy for the attendant to see immediately where the trouble is located, and he can then proceed directly to it. If the controls are in proper adjustment, usually all that needs to be done is to pick out or properly position the can that actuated the control. Thus the machine is protected and costly delays are prevented.

This machine uses a reel spiral that is so designed that the entire advance forward of cans endwise in the machine is accomplished in a very short distance. The entire advance of each rotation of the reel occurs in a short distance on one side while the can is in a free
Figure 14. The FMC "One-Man Cook Room."
rolling position. This arrangement saves much wear on the reel angles and cuts down the operating power considera-

bly.

The recognized advantages of high speed and continuous flow are combined in this fully automatic, continuous cooker and cooler. Cans automatically enter the cooker directly from the seamer, are cooked under pressure, cooled under pressure, if necessary, and discharged ready for labeling or storage.

The use of a continuous cooker and cooler saves repeated handling of cans and minimizes the possibility of losses from dented and damaged cans. The units may be built to give any desired ratio between the length of cook and cool.

Retort and Open Vat Operations

Retorts are of two general types, vertical and horizontal. Vats vary greatly in size and construction. They are sometimes improvised from wood, made of boiler plate, or are concrete lined pits in the ground.

Retort operations are common throughout the canning industry. Their use is flexible, but their operation is generally far from efficient. Due to the high initial cost of continuous cookers, especially the pressure type,
plants generally try to improve on their methods in using
the retorts they have and often plan for progressive modernization by gradually installing continuous line machinery where it can be justified.

Figure 15. Horizontal retort showing crate and truck.

Processing and cooling of cans in retorts is basically a batch operation. Cans are placed in crates which are moved about on trucks or are suspended by an overhead monorail. If horizontal retorts are used, the crates on trucks are pushed into the retort on rails or the bottom of the retort is provided with a bed of rollers making the use of a truck in the retort unnecessary.
Crates are lowered into vertical retorts from a hoist on a monorail. Whether retort or vat operations are used,

![Overhead monorail system for handling retort crates.](image)

Figure 16. Overhead monorail system for handling retort crates.

the loading and unloading of crates may be performed in about the same manner. When open vat cooling is performed on cans in retort crates, the movement of the crates through the vat is usually made continuous by suspending the crates from a moving chain or by resting the crates on a moving conveyor in the cooling water.

**Crate Loading by Hand**

If retort crates are loaded by hand, it is common practice to fit a table with a slightly slanted metal top
up to the discharge point of the seamer so that the sealed cans push each other out onto the table where they can be picked up. The tail-off man at this point usually wears some type of gloves for protection from the hot cans. The cans are manually picked up and positioned in the retort crate placed near by. Such handling is hard work, and the volume of cans that can be handled is quite limited. Sometimes the tail-off man uses a piece of belting.
One end is grasped in each hand, and the belt is flopped around a number of cans, encircling them. All the cans are lifted at once and placed in the crate on the tray. Using a belt in this way speeds the handling, especially when loading trays.

Dawson and Company manufacture several variations of a manually operated can lifter (11). Figure 19 pictures a Dawson double handled lifter being used to lift sealed cans from the seamer discharge runway and to place them in a retort crate. This device can be obtained to handle cans of all sizes and shapes. It is claimed that one man
Figure 19. A Dawson double-handled can lifter being used to tail off at seamer.

Figure 20. A Dawson single-handled can lifter. Tilted runway insures good straight line of cans.
easily can handle from one hundred and fifty to two hundred cans per minute with this lifter. In using the device, there is no squeezing necessary on the handles--just lift.

A single handled lifter being used for the same operation appears in Figure 20. The seamer discharge can track has a two-way slant, making compact straight rows of cans to be lifted. These lifters are built of Duralumin for light weight and strength. The use of some type of lifter does away with blisters on the hands of tail-off men and makes it unnecessary to wear gloves. It also speeds up handling. The single-handled lifter shown in Figure 20 may be used for either loading or unloading rectangular retort crates.

**Mechanical Loading of Retort Crates**

The canning division of the Rosenberg Elevator Company has developed machines to mechanize both the loading and unloading of retort crates (22).

The crate loader consists of a hydraulic lift to position the false bottom of the crate, an accumulating table, and a "U" shaped tool for use by the operator to push the cans into position in the crate. The crates may be positioned on a dolly or moved in while suspended by a
monorail system. A generous size accumulating table affords sufficient back-up space to allow for switching

![Figure 21. Retort crate loading lift and conveyor table.](image)

Crate when filled. The machine requires only one operator. The "U" shaped tool is used to push a group of cans off the accumulating table into position in the crate. When a layer is filled, the crate bottom is lowered for the next layer, and so on until filled.

Mechanization of retort crate loading and unloading
has been accomplished by W. F. and John Barnes Company through the development of a machine that handles a complete layer of cans or jars at a time through the use of a magnetic plate (4). This crate loader, shown in Figure 22, is automatic and rapid. In operation the cans enter a storage conveyor from the seamer. They are advanced to a gate where they are counted by a mechanical counter as they pass through to form a circular layer on the revolving loading disc of the machine. Cans accumulate on the
loading disc until the predetermined number has been reached, at which time the inlet gate closes, momentarily stopping the incoming flow. The magnet picks up and transports the complete layer into loading position over the crate. In moving into position with the cans the magnet pivots through an arc of about 145 degrees. As the unloading position is reached the magnet releases the layer of cans in position in the crate. The counting mechanism automatically stops the machine when the crate is loaded with the desired number of layers. It is then necessary for someone to move out the loaded crate and position an empty one. The cycle is repeated. A special ejector automatically ejects for inspection cans that for any reason are lying on their side before they arrive at the counter.

Special applications are available to suit individual

Figure 23. Hydro-magnetic crate loader handling two converging can lines.

Courtesy W. F. & John Barnes Co.
plant requirements. For example, in Figure 23 is shown an adaption for handling cans converging from two seamers. The two lines are advanced in double file to the gate where they are counted and formed into a single layer. The magnet picks up the layer and transports it to a crate which has been automatically registered into position and deposits it. Successive trips are made by the magnet until the crate has received its predetermined load. All operations of this arrangement are entirely automatic. No attendant is required. As the magnet deposits the final layer in the crate and returns to its starting position, the loaded crate is automatically positioned to unloading position. For safety, the crate is held at this position when the machine’s operation is completed. An operator takes charge of loaded crates at this point and ejects them hydraulically by push button control.

**Mechanical Unloading of Retort Crates**

After retort crates have been processed and cooled, the unloading operation must be performed. Cans are often removed from crates by hand and stacked on tray boards, cased, or sent down a can track for labeling or stacking. However, several types of machines are available for effectively doing this job.
mechanically.

The counter-part to Rosenberg's crate loader, shown previously, is the crate unloader illustrated in Figure 24 (22). This unloader functions only with remodeled crates. In order to push up the layers of cans with the hydraulic lift the bottom of the crate must be false and moveable upwards.

Mechanical unloading of retort crates is accomplished by this machine by the use of a strip-off device which is hand controlled and hydraulically operated. It is claimed that two operators can unload crates as fast as any case packer and labeler can take the cans.

Both of the loading and unloading units made by Rosenberg & Co. are built in several types to meet specific requirements. Special crates and crate dollies and other accessories can be obtained from the manufacturer or the existing crates of the plant may be remodeled to function with this system.

In Figure 25 is shown a considerably different type of basket or crate unloader which provides for dumping the cans into water as the first step of the unloading operation (21, p.194). This unscrambler is operated by first placing and locking the full container on a tilting device. The crate is then tilted by the operator into the
Figure 24. Retort crate unloading lift and conveyor table.

Courtesy F. Rosenberg Elevator Co.

PATENTED AND PATENTS PENDING
receiving tank of the unscrambler which contains water. The water acts as a cushion and prevents damage to the cans when dumped.

From the water the cans are raised by a short conveyor to the top of the receiving tank from where they slide down one of a number of troughs in horizontal position to the first of two conveyor belts. While on the first conveyor belt the cans are kept in line in a horizontal position. At the end of the first conveyor belt they gently tumble over into upright or vertical position onto a second conveyor belt where they are transferred to the discharge plate, through a can twister, and on to the labeler or other disposition. Two persons are required to operate the machine. This unscrambler has a rated capacity of about two hundred cans per minute.

In Figure 26 is pictured a Food Machinery Corporation can unscrambler or can aligner (13, p.165). This is a high production machine designed to speed up the flow of cans to the labeling machine. It consists of a crate dump, can unscrambler, aligner, and elevator. Loaded crates direct from the cooler are placed on the dump platform and from there on no manual handling of cans takes place. The jumbled mass of cans dumped from the crate slide down the aligning troughs, drop onto an
Figure 25. Can unscrambler. Crates are dumped into water to cushion cans against damage. The cans are elevated out of the vat and are aligned as they slide down troughs. Cans are in line and horizontal on the first conveyor at the end of which cans tumble gently into upright position. From the second conveyor, cans are transferred to the discharge plate, and are discharged in single file through a can twist.
elevator, and are then on their way to the labeler. Two models of this machine are made. One handles round crates, the other square crates. Either machine also may be used for warehouse operations. Cases of unlabeled cans can be emptied directly into the unscrambling section. From the view shown, it can be seen how the blockade of looped rods cause rolling cans to flip endwise so that they slide on down the chute in that position.

Much the same as for loading, mechanical crate
unloading may also be accomplished by the use of a magnetic plate. Figure 28 illustrates a crate unloader which

![Crate Unloader](image)

*Courtesy W. F. & John Barnes Co.*

**Figure 27.** Hydro-magnetic crate unloader.

**Figure 28.** Crate unloader shown in combination with a Single Filer. The magnet deposits the cans a layer at a time onto the conveyor from which they are discharged in single file.

is the counter-part to the hydro-magnetic loader described
Figure 29. Tray inverter and feed table with straight away discharge.

Figure 30. Hand operated tray inverter and feed table with left-hand discharge.
previously. To function, the loaded crate is rolled into position beneath the magnet, and is locked into place. The operator starts the unloading operation by depressing the "cycle start" button on the machine. From then on the machine functions automatically until the crate has been emptied. The magnet picks up successive layers of cans, raises them to clear the crate, moves them to and releases them on a special conveyor table where they are formed into single file for entrance to a labeler or other disposition.

A number of canners use retort trays instead of crates for holding cans during the processing and cooling operations. The problem of rapidly unloading and draining trays used in horizontal retorts may be accomplished by using a machine as in Figure 29.

The loaded tray is placed on the feed table and rolled into the machine, rotated one-half revolution in the drum, and discharged upside down in the position shown. The tray is merely lifted off. The cans flow on feed rollers to a rotating disc at the discharge end. As the cans pass onto the disc, they are automatically arranged into single file.

After cans have been removed from crates or trays, if they are formed into lines, they are sometimes passed
over a steam heated can dryer, or they may be allowed to roll through considerable trackage to dry sufficiently.
CHAPTER III

MOVEMENT OF CANS TO THE WAREHOUSE AND WAREHOUSE OPERATIONS

Cans either mechanically dumped from retort crates or cooled in continuous coolers may be conveyed to the warehouse area in much the same manner. Cable tracks, belt conveyors, and gravity-flow can tracks either separately or in combination usually serve for the conveyance.

Can Separators

Under certain layout conditions it may be necessary to convey a number of sizes of cans for a considerable distance from the cookroom to some rather remote warehouse point. Under such conditions the distance involved, space requirements, and other reasons may make it necessary to use a common conveyor for all can sizes being used. With the use of a common conveyor it may be desired to branch off with certain sizes along the line and, of course, all remaining cans must be sorted at the end of the line. This can be done progressively by mechanical or combination mechanical and electrical devices. Cans of the largest diameter may be removed first, followed by the next largest, and on down to the smallest in diameter. Sorting may also be done according to the height of cans,
the tallest being sorted out first, followed by the next tallest, and so on down to the shortest in height.

Blakey (6, p.1 Sec.11 & p.1 Sec.12) suggests two devices for separating cans by size. One device is electrically operated and sorts by diameter. See Figure 31. The other, a non-moving brush-off device, sorts by height. See Figure 32. Either device may be located anywhere along a conveyor where it is desired to guide out the largest in diameter or tallest can size on the conveyor. Cans must be conveyed on end for these separators to function.

The operation of the electrical device requires that the cans be guided into a uniform single file prior to passing by the sorter. This is done very simply by locating a piece of spring steel along the conveyor just ahead of the separator, pressing all cans to the opposite side of the conveyor.

In setting up the electrically operated separator, contactors are located alongside the conveyor and adjusted so as to contact only the largest can size passing at that point. All but the largest diameter cans pass straight through without making contact.

The contactor for each separator is connected to a solenoid through a time delay. A divertor gate is actuated by the solenoid guiding the selected can size out of the line.
Figure 31. Electric can separator. This device separates cans by diameter.
The time delay is to compensate for the time necessary for the cans to travel from the contact point to the diverting point. The conveyor should be run fast enough that the cans are spaced a few inches apart. A spring is not used to return the diverting gate to its original position as the next can which is not to be guided out will push the gate back open. This arrangement reduces the number of times the solenoid and gate must move. A string of cans of the same diameter would cause the gate to move only once. The gate is not held open by the solenoid. It functions only when the contactor has selected a can to be guided out.

Figure 32 shows the second type separator which is designed to sort by can height. It is a brush-off arrangement made up, as shown in the drawing, to sort 603 X 700 cans from those of lesser height. Each successive brush-off device can be made to guide out the tallest can size remaining on the conveyor. The brush-off device is very simple in operation and can be plant-made. It consists of a shear which contacts the tallest can size at a height which will permit the shorter cans to pass through underneath. The shear should be set at such an angle that the cans are not guided out too abruptly. A top guide is provided to prevent the cans from tipping.
Figure 32. Brush-off type can sorter.

Courtesy American Can Co.
over. Excellent results are reported for this device (6, p.1 Sec.11).

**Photo-electric Can Sorter**

The extent to which systematic procedure can be obtained in handling cans through the various canning operations is often dependent upon the number of different grades and sizes of a product that must be handled. Even where the same can size and same equipment is used for all the sizes and grades, the problem of delivering marked cans to the proper filler point, the keeping of grades and sizes separate, and getting the marked lids on the corresponding grades and sizes is time consuming and subject to error. Such batch processing necessitates tray-board stacking and accumulating and lengthens the time between filling and processing.

Automatic marking of cans delivered to the filling points and automatic sorting after cooling would make it possible to elevate operations to more sanitary and systematic procedures. Tray boards could be eliminated and the filled cans would move directly on to the next operation.

Blakey (6, p.1 Sec.17) reports on an idea for automatic code marking of empty cans as they enter filler
points and automatic sorting of full cans for quality and size grade by the use of photo-electric cells connected with diverting mechanisms. Filling tables would be fed from a common empty can supply through gravity drops to each filling point. The cans supplied to each filling point would be automatically marked corresponding to the grade and/or size being packed at the point. Full cans from all filling points would converge and go through processing and cooling together. The code marks for size could be placed near the base of the can and the grade marks at the top as desired. The distance the mark was placed from the end of the can would be the code to the grade or size. After cooling, all the cans would be passed by a photo-electric cell device which would sort the cans according to the code marks.

This type of sorter has been built and is being used on an experimental basis but is still subject to error. Sorting has reportedly been accomplished from 98 percent to 99 percent perfect (6, p.1 Sec.17). The remaining difficulty is in obtaining a good code mark. It is thought that the ink manufacturers may be successful in developing a marking ink more suited for the purpose.

Industrial electronic engineers of a Los Angeles firm are reportedly now working on this can sorting
from a different approach (7).

**Empty Can Extractor**

Of course, it is undesirable to label and case occasional empty cans that may come through a line. In addition to this, empty cans often cause can track and conveyor trouble in a fast line. Due to lack of weight, empty cans do not go around the system the same as full cans do and cause stoppages that would never occur with only full cans in the line. Completely empty cans or near empties can be effectively removed while riding on end on a conveyor. One easy way to do this is to cut out a section of the side rail of the conveyor. Slightly up the line from the cut and on the opposite side, a piece of spring steel rod may be mounted in such a manner that it will brush or flick the empties out the side cut. Due to lack of weight of the empties, they guide out or tap out rather than flex the rod. A rod of about 3/16" diameter and about 3' in length works quite well. The cut-out section of the side of the conveyor need not be more than about twelve inches. In mounting the rod, one should provide for adjustment in angle and in length of the effective brush-off section. Ordinary welding rod works satisfactorily as a temporary rod for an empty can.
extractor with this arrangement, but after approximately one hundred thousand cans have flexed this type of rod, it will have become hardened and will break at the fulcrum point. A small diameter spring steel rod arranged in the manner explained above will flip out empty cans passing by even in close formation. All that is necessary as far as spacing is concerned is that cans are not pressing against each other. When cans pass with very little spacing, the spring steel rod does not function much as a brush-off device; it works, instead, by flicking out the empty cans. As each can moves beyond the end of the rod, the next can in line is tapped by the spring tension.

Floatation or weighing machines could function for sorting, but commercially manufactured ones are too expensive to be practical for ordinary individual canning lines.

**Warehousing Operations**

The major warehouse operations include labeling, casing, stacking, and shipping. Arrangements providing for the performance of these operations depend primarily on the disposition to be made of the pack.

If immediate shipment is possible the cooled cans
may be fed into a labeler, discharged to a caser, the cases conveyed through an automatic case sealer and marker and conveyed to the loading dock. A thoroughly mechanized continuous flow of cans from the unloading platform for the empties through to the loading dock for the cased product affords maximum possibility for systematic, non-strenuous, fast, efficient production.

Upon being discharged from a continuous cooler or after being unloaded from retort crates the cans must, of course, be warehoused or shipped out.

Cans to be stacked bright uncased, may be conveyed to the stacking area, or, if on tray boards, they may be wheeled into the area by hand truck.

The more common practice of handling unlabeled cans for stacking is to case them bright and fold the flaps of the case. The cases are then stacked solid or palletized until it is desired to label and load them out. Under these circumstances when the labeling job is performed, the cases can be dumped onto a converger or the cans may be removed with some type of lifter. Sometimes cans are lifted from the cases manually and placed in the labeler feed track, but this takes considerable labor and is slow.

A vacuum lifter, a plant-made device, is sometimes used for removing a complete layer of cans from the case
per trip. The device is merely a battery of small pipes rigidly spaced so that one pipe centers over each can of the layer. A special rubber suction cup is attached to each pipe. Cases are rolled up to the operator by conveyor. The device, suspended by a counter boom, is lowered over the open case, the vacuum valve switched on and a complete layer of cans is lifted and released on the labeler feed. Although this system is used quite widely in some areas, apparently the lifter is not commercially manufactured. Food Machinery Corporation reports that it has supplied several packers with vacuum pumps for this type of lifter.

Labeling

Cans are labeled by portable automatic machines. By any one of a number of arrangements cans are fed into the labeler and disposed of at the discharge end. The specific setup or layout for this operation, as for almost all other canning operations, is as varied as canning plants themselves. If operators are competent and the equipment is in good operating condition, it is ideal to put all operations possible in sequence. To have maximum results in using a connected arrangement, either accumulating points or by-passes must be afforded between each operation.
otherwise, the flow will tend to see-saw. Continuous in-line operations generally are more efficient if the units are not too close together. Making the line too "tight"

![High-speed can labeler](image)

 Courtesy Food Machinery Corp.

Figure 33. High-speed can labeler.

or inflexible will cause unnecessary see-saw tendencies. It should be realized that at least some minor stoppages and little troubles are inevitable in each piece of equipment. These momentary fluctuations should be allowed for so as not to have any effect on the general can flow.

The immediate entrance to a labeler is gravity-fed, but once into the machine, cans are positively fed onto
the discharge end. Pick-up is spotted onto each can as it is rolled through the machine. (The glue that is spotted on the cans by the labeling machine is commonly called pick-up.) The pick-up spotted on the can attaches to a label which has had paste applied to the flap end. As the can rolls the label forms around it. The belts or rollers tend to press the label firmly to the can as it is moved on out of the machine. Labeling machines operate up to and over three hundred cans per minute. The high-speed machines are more sensitive to adjustment than the slow machines. A well-trained, qualified labeling machine operator in a continuous line arrangement is much more of a necessity for low production cost than is often realized.

In a continuous or semi-continuous flow arrangement the temperature of cans may vary to a great extent. Due to cooler breakdown, for example, a batch of cans may come through that are comparatively cold. Some pick-up will not function on both "cold" and "hot" cans. However, there is pick-up available that will function equally well on cans of varied temperatures. The proper choice of pick-up will generally eliminate the stoppages that would be expected when the temperature of the cans varies.
Cans that have been stacked bright may be lifted and fed into the labeler in rows by the use of a Dawson can lifter. Figure 34 shows a Dawson lifter being used to lift eighteen cans per trip. A labeler runway that receives cans on an angle and twists into a horizontal position before entering the labeler works best in connection with this lifter. The lifter shown is built to handle the full width of a stack per trip in any size of can. The usual stack widths are 12, 14, 16, 18, and 20 (in).

**Casing**

Casing of cans is usually accomplished by feeding the
cans into a power operated mechanical caser. Cans flow from one row through diverters and form into the number of rows that the case holds. Cases are manually held in

![Image of CRGO accumulating feed table.](image)

**Figure 35.** CRGO accumulating feed table.

position at the caser discharge. Release of a trip permits the machine to push a complete layer or a complete case of cans into the case at a time, depending on the type of caser. Filled cases of labeled cans are usually conveyed directly to a case sealer.

Most important for the operation of a connected mechanized continuous can handling arrangement is that adequate provisions be made for minor troubles so that a stoppage of short duration will not be felt in the overall
system. From the first machine to the end of the line each successive machine should be timed a little faster

than the one feeding it. Sufficient distance should be allowed between machines for flexibility, allowing some backup of cans. By-passes or accumulating points can also be used to good advantage in keeping the lines going.

Figure 36. Casing by hand direct from retort crates.
Figure 37. Accumulating feed table, labeler, and caser connected in line.
Where a labeler and caser or either of these is connected into a continuous line, neither of these machines should be permitted in any way to affect the free flow of cans from coolers. Any shutdown of equipment back up the line from the labeler because of labeler or caser trouble cannot be justified.

Installation of a "zig-zag" lowersator or use of an accumulating table will provide for sufficient back-up space for minor labeler stoppages. An automatic gravity drop located up the line from the accumulating point will serve to by-pass the can flow into an auxiliary track that can be fed into the caser for casing bright or fed into a

Courtesy Purdue Univ. Sta. Bul. #528

Figure 38. Manually-operated caser.
hand casing table. By casing bright during longer periods of labeler trouble, plant production can be kept going. Those cases containing brights can be diverted for labeling at a later date but can probably be fed into the labeler during slack times during the shift or at the beginning or close of the shift when idle labor is often present.

An accumulating device and a by-pass between the labeler and caser will serve to prevent shutdowns in case of caser trouble. Labeled cans could be automatically diverted to a hand casing table by a gravity drop in the track ahead of the accumulating point much as the arrangement ahead of the labeler. Any arrangement that can be provided for the line that will always permit disposition of the cans at the labeler and caser point is all that is needed.

The importance of preventing stoppages by labelers or casers when they are part of a system cannot be over-emphasized. A small amount of shutdown time because of trouble at these points may become magnified many times as its effects are felt throughout the plant. All possible effort should be made to prevent see-sawing in the can flow if efficient operations throughout the plant are to be obtained.
Electronic Can Ejector

For any one of a great number of reasons cans are sometimes discharged from the labeling machine imperfectly labeled or not labeled at all. The job of picking out all such cans so that they will not be cased is very difficult and consumes many man-hours. If the line is running up around three hundred cans per minute, it is impossible for checkers to "pick out" all the unlabeled or improperly labeled cans. Attempts to do so result in compounded trouble and confusion with many cans being missed. The labeler may at times discharge a stream of unlabeled cans. If checkers miss any of them, the cases they are believed to be in must be set aside. If the flow is pegged by the checkers before the labeler operator is able to shut down the labeler, jams will occur. A trip operated by-pass track through the bottom of the regular can track would provide for separation of the cans so that they would not be cased and would minimize the possibility of jams. However, the success of such an arrangement depends both upon the observer being able to spot the cans and on his being able to drop them out, neither of which can be done with good results in a fast system.

To perform this sorting problem an electronic can
Figure 39. Electronic Can Ejector. Unlabeled or imperfectly labeled cans are electronically selected and dropped into the diverting can shoot below.

A. Cans may be touching bead to bead.
B. Flags, Shiners, Dog Ears, and Crooked Labels detected.
C. Beam and feeler assembly both at top and hinged.
D. Adjustable to all sizes. 211 X 304 to 404 X 708.
E. Track gates always free and in operating condition.
F. Motor driven blower.
G. Solenoids open track gates below point of inspection.
H. Perfect labeled cans continue on line.
I. Imperfect labeled cans ejected through chute.
J. Adjustable for desired height and for any cans, 8 oz. up to and including 46 oz.
ejector has been developed (17). See Figure 39. The device is made to be connected directly onto the discharge end of any labeler. This automatic ejection system "scans" the cans with a photo electric eye as they pass, and in addition a feeler finger system contacts the cans.

The photo-electric eye detects anything that sticks up from the can such as flapping labels, dog ears (corners), etc. The feeler fingers determine whether or not the can is labeled and if the label is on the can straight and in the proper place. Any can that is unlabeled or improperly labeled is instantly and automatically ejected by being dropped out of the line to a diverting can track below. Perfectly labeled cans flow on through the machine undisturbed.

An ordinary head light bulb is used for a light source for the electric eye. The feeler fingers are adjustable to ride any desired distance from the edge of the can. Spacing of the cans is not necessary as the ejector will operate with the cans flowing solidly, bead to bead. The machine is adjustable for any can size ranging from 8 oz. up to and including 46 oz. and will function at any speed that cans can be fed to it.
Figure 40. Electric Eye and Feeler Assembly.

Figure 41. Exchangeable plug-in electronic unit.

Figure 42. Shiner being dropped out.
Case Sealers

Cased labeled cans are often fed by conveyor directly from the caser into a case sealer. Although manually operated sealers are sometimes used for small operations, this job is generally performed by a fully automatic machine.

![Manually operated case sealer](image)

*Figure 45. Manually operated case sealer.*

In Figure 44 is shown a fully automatic case sealer (13, p.177). This machine simultaneously seals both top and bottom flaps of fiber shipping cases. The machine is composed of a sealing unit and a compression unit. Adhesive is applied to the inner flaps of the cases. In the compression unit the cases are held compact end to end and from top to bottom. This machine is adjustable to a wide range of case sizes. Sealed cases are discharged onto a
Another case gluer is shown in Figure 45 (21, p.203). This is a belt compression sealer and is fully automatic. It does not require an attendant. Full cases are received from a conveyor. The machine opens the top and bottom outer flaps while the inner flaps are closed and the cans held in place. Adhesive is spread on the inner surface of the outer flaps which are then closed. The closed cases proceed through the rest of the machine under compression and are discharged tightly sealed. This unit is adjustable to handle different size cases. Cases proceed through
Packomatic Automatic Model D Case Gluer

WITH BELT COMPRESSION SEALER

Courtesy A. K. Robins & Co., Inc.

Figure 45. Automatic Case Gluer.
the compression section intermittently, i.e., they are moved only far enough at a time to admit the incoming case into the compression section.

**Stacking and Shipping**

After canned goods have been cased, the cases are usually handled either individually by conveyor or palletized and handled by lift truck.

![Figure 46. Cased goods being loaded on a pallet. Loaded pallets can easily be moved out of the way without the use of a lift truck.](image-url)

*Courtesy Food Packer Magazine*
The use of pallets can cut down labor costs considerably, but whether or not palletizing has sufficient immediate economical advantages to be justifiable is an individual plant problem. Many factors such as loading dock area, volume of pack, warehouse arrangement, and general construction must be considered. Equipment costs and cost of pallets may perhaps be easily justified, other conditions being favorable, providing sufficient volume of cases are to be handled.

Mr. Carpi (8, p.58), representative of the Pennsylvania Railroad, speaking at the 1949 Materials Handling Show in Philadelphia, brought out that palletization of car load shipments would not lead to faster turn-around of cars. He emphasized that switching was done on a schedule basis and that even if a car were unloaded in two hours instead of eight that this did not mean that the car would move any faster unless the railroad provided special switching at additional expense. It was also stated by Mr. Carpi that experienced loss and damage people are of the opinion that pallet use may increase rather than reduce damage. It was brought out at this meeting that carriers have been reporting considerable damage to the floors of freight cars caused by the operation of mechanical loading equipment. This railroad
executive pleaded that proper precautions (for example, the insertion of a portable floor plate in the doorway sections) would eliminate this damage.

![Figure 47. Booster elevator being used in stacking individual cases.](image)

In that freight cars are generally loaded to capacity under existing government regulations, it was said that palletized loading tends to decrease the average net load of product per car.

Although palletizing of canned goods may be by far the best handling method for stacking and shipping at the canning plant, it must be remembered that there are a great number of outmoded terminals and receiving docks which may necessitate reloading and extra handling
because the load is on pallets.

Experiments are being carried on with expendable types of pallets. A satisfactory "throw-away" pallet could quite probably be practical for handling cased canned goods.

If filled cases are palletized, they are easily handled by lift truck. The loaded pallets are generally

Figure 48. Individual cases being stacked.
stacked on top of each other in designated areas allowing for isle traffic and maneuvering.

Figure 49. Loaded Pallets being stacked.

Numerous conveyor arrangements can be provided for stacking of individual cases. Some type of booster or elevator is used to elevate the cases as the stacks build up in height. No doubt the most economical and the easiest method of loading is to connect a conveyor to the discharge end of the case sealer and feed the cases right into the box car spotted at the loading dock.
CHAPTER IV

THE IMPORTANCE OF PROPER OPERATION, MAINTENANCE, AND LUBRICATION OF EQUIPMENT

The best equipment in any canning line can be ruined in the first few days of operation by poor operators and lack of proper lubrication. While in theory equipment manufacturers, plant management, and mechanics may turn out a nearly perfect line, the operating efficiency and life of the line actually rest in the hands of the operating and maintenance personnel. Production costs are high when operators are incompetent and inexperienced and the machinery is not cared for properly. Therefore, it is essential that plant management realizes the necessity of ensuring that equipment is in the hands of qualified operators and that machines are afforded proper lubrication and maintenance. On this, the success or failure of a food processing plant may well depend.

Operation

Often operators are switched to new, complicated machines with absolutely no instruction and with no knowledge of what they are doing. The author is aware of the arguments pro and con pertaining to the economies of training operators in a seasonal industry such as the
canning industry. However, instruction need not be considered in the terms of the conventional classroom type. Such instruction to temporary employees would, of course, be of slight immediate practical value to a canner. This, however, can be no reason for not selecting more systematically and intelligently and for not training the permanent and supervisory personnel. A new employee under competent supervision would more rapidly become acquainted with his machine and would be better equipped to discharge his duties. Furthermore, there can be no false reasoning in subsequently preparing a good operator for the running of other machines so he can be switched about without notice and without being an immediate potential stoppage in the line. If it is expected that a plant operate near its theoretical maximum, it should be made certain that machine operators know their equipment and know danger signals so as to prevent stoppages, damage, poor quality, or loss before it becomes too great.

There may be no easy answer to the problem of obtaining qualified temporary employees. For most food packers the processing time is of short duration. Making the tremendous investment on equipment pay maximum dividends is of utmost importance. Certainly for equipment to pay dividends it must function, and the best way to be
sure good equipment will function is to put it in the hands of fit operators and have it cared for by qualified maintenance personnel. To obtain such employees, they must be selected; to keep them they must be well paid, developed, and respected in their work. Although most operating jobs are seasonal, a little effort on the part of the plant management would bring a surprisingly larger number of the selected operators back to the plant year after year.

In those plants where the management takes steps to ensure that the machine operators are qualified and trained, the plant foremen and supervisors often feel the need for some more effective means of leading employees to handle their machinery in a more intelligent manner. Operators sometimes handle their machines very unwisely. Certainly this may be attributed to many causes, but a quite frequent cause is lack of appreciation of the mechanisms that are being controlled. In the majority of the jobs involving the use of machinery in food processing plants, the author has found that the greatest part of the attention is centered strictly on the operation of the machine and on the product. Little or no attention is given to the understanding of the machine itself. Often equipment operators are shown only how to start and stop their machines.
This may appear to be logical; however, if the employee is given an insight into the workings of the internal mechanisms of his machine, this may serve as a stimulus to greater interest in all machinery and may be a basis for the development of greater ability to master new operating and mechanical jobs about the plant as they arise.

It is not suggested that time out need be taken for such instruction of an employee, but that it be a development of the employee by the foreman or other supervisory personnel during normal operations. Such employee development will benefit both the employee and management. The employee will feel more secure with an increased feeling of competence, and he will subsequently do better work; the management will benefit from the economies in better operation of the equipment.

Maintenance

If a maintenance mechanic is confronted with a new machine or an old one that fails to function and if he is experienced in tracing out the lines of power through machines; he will soon be able to understand a new machine or find the trouble with an old one. Such ability is in great demand, and canners should take steps toward developing it in their employees.
Managers often feel that since their work involving canning is seasonal, they cannot afford to train a man who probably will not return the following season. They often accept high production costs at the beginning of the season, expecting low production costs toward the close of the season. (It is generally observed that the equipment works better toward the close of the season. Much of this is due, however, to the fact that the employees are more experienced by then.) The author has known of canning organizations which were doomed for insolvency by their first season's operation. The organizers complained in retrospect that although the lines were apparently well set up, the machinery, nevertheless, would not function properly. In these cases it was finally concluded that the trouble did not lie with the machinery or the layout but was mainly due to inexperienced and untrained operators and mechanics.

Havenkamp and Hardin (15, p.7), in their recent study on canning factory operations, found some canneries operating with a labor cost of nearly two and one-half times more than others in the same general area. In these cases, such factors as equipment, costs, and quality of product were not found to be appreciably different. The study revealed that breakdowns accounted for much of the
inefficiency.

Just how soon obsolescence sets in for many of the cannery machines depends to a great extent upon the care and diligence of the operating and maintenance personnel. Ignorance on the part of these employees of the structural and mechanical make-up of their machines can only result in unnecessary stoppages, machine damage, shutdowns, extra costs, and often loss of earnings to other cannery employees.

Lubrication

The value of lubrication as a preventative measure is often overlooked or little realized in canneries. Lines are sometimes "rigged up" for just a few weeks with the realization that they will soon be torn down or rearranged for another product to be packed later on in the season. Because of the constant putting up and tearing down of lines and of the temporary nature of many arrangements, the necessity of "oiling and greasing" may tend to seem rather unimportant. Although wear is something that can be guarded against only in a measure, excessive wear can usually be prevented. For insuring continuous operation of cannery equipment, it is very necessary that lubrication be adequate and that preventative
maintenance be of the best.

In spite of the obvious and basic need for proper lubrication of equipment, in many plants, year after year, it is almost traditional that the "greasing job" be given to someone who has shown incompetence or apathy in a series of jobs but is continued on the payroll, sometimes for nepotic reasons.

Some of the most qualified mechanics in the plant could well be assigned to the job of lubricating the equipment during peak operation and in doing this job be given the additional responsibility of checking the equipment for adjustment and need for repair. A great deal of trouble that causes stoppage is foreseeable and preventable. Much of the repair can be timed so as to be done during rest periods, lunch periods, and between shifts.

Good relations between shifts also are very necessary for an exchange of information regarding the condition of equipment at the close of a shift. A good practice would be for each departing shift to stay on whenever necessary to leave the line in good repair before checking out. Competition between shifts should not be allowed to develop to the extent that one shift "keeps things going at any cost," leaving preventative maintenance and necessary repairs for the following shift.
The average cannery is composed of thousands of mechanisms. Every mechanism must be handled and adjusted properly and every bearing in each of these mechanisms must be lubricated adequately; these requirements, if disregarded, will sometime result in stoppages, shutdowns, accidents, and increased production costs.
CHAPTER V

LEGAL CONSIDERATIONS

In supervision and operation of equipment, cannery personnel often conceive new ideas for machine improvements. As a result of visiting other plants and observing their operations, employers may want to copy some of the observed equipment and arrangements. New employees bring new knowledge to a plant. Under supervision or on their own employees often actually make the desired improvements.

Questions arise. For example, can a firm legally be prevented from making whatever equipment it desires if said equipment is for its sole use: Who is the owner of a plant-developed invention—the employer, the head of the department, or the person who actually performed the work? Will a patent be issued to a firm? Can lessors of special patented equipment require a lessee canner to purchase other services or supplies as a part of the leasing contract?

Patents

The United States patent system was established pursuant to a provision of the United States Constitution empowering Congress to grant patents for limited times
to inventors for the purpose of promoting the progress of useful arts and sciences.

A patent is a document granted to an inventor, which confers upon him the right to exclude others from the practice of a specified invention for a limited time and teaches the principles of the invention to others (19, p.3027-3029). Fundamentally, a patent is a contract between the government and the inventor. The government in accordance with constitutional provision obtains from the inventor a disclosure of the invention which is turned over to the public and after a limited time may be used by anyone. The government, in return for the disclosure, gives to the inventor the right to prevent others from utilizing the invention for a period of seventeen years (1, p.5).

Many people believe that the patent owner's consent is not necessary for a firm or individual to make patented articles and use them strictly for their own use. This is not true. A patent gives the exclusive right to the patentee to prevent others from making the patented article. If a plant buys a patented part incorporating it in a plant-built machine and uses the machine, this is not an infringement; but making such a part without the patent owner's permission and using it most certainly is. Of
course, when a patent expires, all the rights granted by it vanish. Its owner ceases to have any power over users, makers, or sellers of specimens of the invention (5, p.40-42).

A large number of disputes arise from the failure of employers to provide by contract for the ownership of inventions that may be made by their employees. Few business relations are so simple that they may be left unwritten. There are several sides to the employer-employee relationship. For instance, if a workman develops an invention on his employer's time, using his employer's materials and tools, an indirect contract relationship of employment exists which pledges the workman to give the employer the right to use the invention in his shop. This is known as a shop right. The employer, however, has no right to use the invention anywhere except in his own shop in the absence of a contract unless the workman was employed to invent (24, p.99-106). Before an employer is entitled to take the inventions of an inventor-employee, it must be shown that the employment related to the subject matter of the invention involved.

The mere employment of a person does not entitle the employer to the inventions made by him. An employee-workman has the right to his inventions and owns them,
subject to any shop right the company might have where there is no express contract on the subject. This is not necessarily true in the case of an executive. An executive is hired to make a business successful and to make improvements. His position is unlike that of a simple employee. It has been held that an executive holds a position of trust with the employer and should in equity turn over his improvements to the employer.

In order to tie up a simple employee so that his ideas and inventions will be turned over to the employer, either a special contract is necessary or the employee must be hired as an inventor. However, even if an employee is hired as an inventor, anything he develops that is not in the line of his employer is not the property of the employer.

If an invention has been developed by group effort in a plant, it may be difficult to determine the right man whose name should appear on the patent papers as the inventor. If the head of a department signs the papers, and it is discovered after the patent application is filed or the patent is issued that one of his mechanics, for example, actually made the invention, the whole thing becomes invalid. Only the person or persons who are actually the inventors can sign the papers (24, p.106-108).
The only exception to this is that the executor of a deceased inventor's estate or the guardian of an insane inventor may sign the papers in place of the actual inventor.

**Exclusive Dealing Arrangements and Tying Contracts**

Occasionally some specific types of patented cannery equipment are available to firms only on a leased basis. The lessee may then be confronted with a lessor-vendor who hopes to build additional business by making tie-in agreements.

Briefly, a tying contract is a condition whereby a lessee or purchaser of a certain article is compelled to purchase other articles of the lessor-vendor or seller in order to obtain the particular item desired (12, p.431). Tie-in sales or tie-in contracts usually take the form of an agreement whereby a seller or lessor-vendor agrees to sell or lease a machine only on the condition that goods be purchased to be used with the machine. This type of contract has generally come about when a seller has a patented machine which calls for the use of non-patented supplies (18, p.482-484). Exclusive dealing arrangements are those wherein the seller or lessor-vendor requires that the lessee or purchaser does not use the machine or
deal in goods in the same plant in which competitors' goods or machines are used. Thus, it becomes necessary for the purchaser or lessee to deal in nothing in the seller's field but the seller's wares. Through contracts of this type the seller or lessor attempts to eliminate competition in his specific field by denying a market to competitors.

Under the Clayton Act, 1914, tying contracts or exclusive leases are declared to be illegal if the effect is substantially to lessen competition or tend toward monopoly (20, p.531-532). In that the Federal Trade Commission Act, 1914, requires only a hindrance to competition and not necessarily a substantial lessening of competition in a line of commerce as required by the Clayton Act (18, p.483), the Trade Commission has often combined the two in administering the Clayton Act. The proof of illegality has rested on "the effect." The laws have been subject to court decision and "reason."

The government has had many failures in applying these prohibitions. A major difficulty lies in proving that the leasing contracts caused a substantial lessening of competition. Agency arrangements do not come under the prohibitions of the law. Hence, tying arrangements can circumvent the law by resorting to agency contracts.
(18, p.484). Additional avoidance may be had where the contracts do not substantially reduce competition, or the lessor-vendors or sellers concerned may not represent a sufficiently large proportion of a trade so as to endanger the general working of competition.
RECOMMENDATIONS

1. Ensure that all filler points are afforded an uninterrupted supply of empty cans.

2. Build toward systematic, continuous line operations.

3. Label, case, and ship direct from the cooler whenever possible.

4. Provide potential trouble spots with safety cut-out devices and by-passes or accumulating tables so that the over-all flow through the line is unaffected by momentary troubles.

5. Select qualified maintenance and operating employees and develop them in their work.
BIBLIOGRAPHY


APPENDICES
APPENDIX A

CAN SIZES
(3, p.213-216)

The dimensions of the cans ordinarily used in packing canned foods are determined by a number of variables. The characteristics of the food to be canned, the amount of food desired by different consumer units, and the packing method are the most important of these factors.

The natural size and shape of the food may determine the shape of the container. For example, foods such as sliced pineapple, corn on the cob, or asparagus spears have rather definite dimensions, and the sizes of the cans in which they are packed are to a great extent limited by this physical property of the food itself. Only one dimension of the container can be changed to any great amount in such cases. Cans of low height are most suitable for vacuum packed foods as this shape gives required structural strength necessary for high internal vacuum.

Juice products and semi-solids allow a rather wide range of freedom in the selection of all dimensions of the can.

In the following table some of the commonly used can sizes are described.

Actual dimension of cans within the same "size" will vary slightly within manufacturing tolerances. The canner's designation is derived from the nominal dimensions. The first
part of the designation represents can diameter. Can height is represented by the last part of the designation. The first digit in each case represents inches while the next two represent the extra fraction expressed in sixteenths of an inch, e.g., the canner's designation 603 X 700 represents a can of six and three sixteenths inches in diameter and seven inches tall. Weight cited is that of foods of medium weight per unit volume.

**COMMON CAN SIZES**

<table>
<thead>
<tr>
<th>CAN NAME</th>
<th>DIMENSIONS</th>
<th>CANNER'S DESIGNATION</th>
<th>APPROX. NET WEIGHT</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 ** **</td>
<td>2 1/8&quot;</td>
<td>2 7/8&quot;</td>
<td>4 3/4 oz.</td>
</tr>
<tr>
<td>6Z</td>
<td>2 1/8&quot;</td>
<td>3 1/2&quot;</td>
<td>5 3/4 oz.</td>
</tr>
<tr>
<td>8Z Tall</td>
<td>2 11/16&quot;</td>
<td>3 1/4&quot;</td>
<td>8 1/2 oz.</td>
</tr>
<tr>
<td>No. 1 Picnic</td>
<td>2 11/16&quot;</td>
<td>4&quot;</td>
<td>10 1/2 oz.</td>
</tr>
<tr>
<td>No. 211 Cylinder</td>
<td>2 11/16&quot;</td>
<td>4 7/8&quot;</td>
<td>(juice can) 12 fl. oz.</td>
</tr>
<tr>
<td>No. 300</td>
<td>3&quot;</td>
<td>4 7/16&quot;</td>
<td>14 1/2 oz.</td>
</tr>
<tr>
<td>No. 1 Tall</td>
<td>3 1/16&quot;</td>
<td>4 11/16&quot;</td>
<td>1 lb.</td>
</tr>
<tr>
<td>No. 303</td>
<td>3 3/16&quot;</td>
<td>4 3/8&quot;</td>
<td>1 lb.</td>
</tr>
<tr>
<td>No. 303 Cylinder</td>
<td>3 3/16&quot;</td>
<td>5 9/16&quot;</td>
<td>1 lb. 5 oz.</td>
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<tr>
<td>No. 2 Vacuum</td>
<td>3 7/16&quot;</td>
<td>3 3/8&quot;</td>
<td>12 oz.</td>
</tr>
<tr>
<td>No. 2</td>
<td>3 7/16&quot;</td>
<td>4 9/16&quot;</td>
<td>1 lb. 4 oz.</td>
</tr>
<tr>
<td>No. 2 Cylinder</td>
<td>3 7/16&quot;</td>
<td>5 3/4&quot;</td>
<td>1 lb. 9 oz.</td>
</tr>
<tr>
<td>No. 2 1/2</td>
<td>4 1/16&quot;</td>
<td>4 11/16&quot;</td>
<td>1 lb. 13 oz.</td>
</tr>
<tr>
<td>No. 3 Cylinder</td>
<td>4 1/4&quot;</td>
<td>7&quot;</td>
<td>(juice can) 1 qt. 14 fl. oz.</td>
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<td>CAN NAME</td>
<td>DIMENSIONS</td>
<td>CANNER'S DESIGNATION</td>
<td>APPROX. NET WEIGHT</td>
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<td>-------------------</td>
</tr>
<tr>
<td>No. 5</td>
<td>5 1/8&quot;</td>
<td>502 X 510</td>
<td>3 lbs. 9 oz.</td>
</tr>
<tr>
<td>No. 10</td>
<td>6 3/16&quot;</td>
<td>603 X 700</td>
<td>6 lbs. 10 oz.</td>
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### CASE CAPACITIES FOR COMMON CAN SIZES

(3, p. 481-482)

<table>
<thead>
<tr>
<th>CAN SIZE</th>
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<tr>
<td>4**</td>
<td>202 X 214</td>
<td>12-24-48</td>
</tr>
<tr>
<td>6Z</td>
<td>202 X 308</td>
<td>24-48</td>
</tr>
<tr>
<td>8Z Tall</td>
<td>211 X 304</td>
<td>24-36-48-72</td>
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<td>301 X 411</td>
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<td>303 X 406</td>
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<td>No. 3 Cylinder</td>
<td>404 X 700</td>
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<tr>
<td>No. 5</td>
<td>502 X 510</td>
<td>12</td>
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<tr>
<td>No. 10</td>
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