DOMINION OF CANADA
DEPARTMENT OF AGRICULTURE
HEALTH OF ANIMALS BRANCH

MEAT AND CANNED FOODS DIVISION

EVAPORATED APPLES

BY

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Chief Travelling Inspector, Fruit and Vegetable Canneries.

BULLETIN No. 24

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APRIL 24, 1917.

The Hon. MARTIN BURRELL,
Minister of Agriculture,
Ottawa.

SIR,—I have the honour to submit to you a report on evaporated apples, prepared by Mr. C. S. McGillivray, Chief Travelling Inspector of Fruit and Vegetable Canneries; and I would recommend that it be printed as Bulletin No. 24.

I have the honour to be, sir,

Your obedient servant,

F. TORRANCE,
Veterinary Director General.

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OTTAWA, April 11, 1917.

Dr. F. TORRANCE,
Veterinary Director General,
Ottawa.

SIR,—I have the honour to submit herewith for your approval a report on the Evaporated Apple Industry in Canada.

In this report no attempt has been made at literary style or scientific explanation. It is simply a statement of facts as I find them, together with information gathered from other reliable sources.

I have received very valuable assistance from many sources, but I wish particularly to acknowledge the help given me by Messrs. R. J. Graham, of Belleville, L. K. Shourds of Wellington and J. Foley of Ingersoll; also from the heads of the chemical laboratories of the Departments of Inland Revenue and of Agriculture I have received most valuable help.

I need scarcely say that the compilation of this report has entailed a great deal of study; still, I am sure that the information received through that study has been of great value to me as an officer of this branch.

If my efforts, though humble, have the effect of in any way improving this important industry I shall feel amply repaid.

I have the honour to be, sir,

Your obedient servant,

C. S. McGILLIVRAY,

Chief Travelling Inspector of Fruit and Vegetable Canneries.

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THE EVAPORATED APPLE INDUSTRY IN CANADA.

PART I.

Apple growing is one of the many important industries of Canada. The fruit is grown in many of the provinces, but principally in Nova Scotia, Ontario and British Columbia.

The apple is the most abundant, as well as the most valuable, of fruits. The cost of its production is less than that of any other fruit, and its food value is superior to any. Notwithstanding, however, its cheapness as a food and its dietetic value, it is to be feared that the apple is not appreciated by many people as it should be. With proper care it can be made one of the staple articles of food the year around.

Nature teaches the animal which foods may, and which may not be put away for winter use. We call this "instinct;" but "science" has come to the aid of man so that he may preserve for future use practically any article of food that he so desires.

During the autumn and early winter the apple may be marketed in its natural state, but later on in the year, refrigeration, sterilization, or dessication must be resorted to.

Both refrigeration, or cold storage, and sterilization, or canning, have many good features, but it is with the system of dessication, or drying, that this article has to deal.

The "dried" or "evaporated" apple industry, like many other industries whose aim is the preservation of food for future use, has made wonderful strides towards perfection during the past few years. Still, while great advancement has been made, there is room for improvement, both in the methods of manufacture of the product and in the marketing of the same.

Many readers of this article will recall the old time "apple cut" when the young people of the neighbourhood would gather at some home at the close of the day, to pare apples and to spend a social evening. The fruit would be pared, quartered, and cored by hand, then, either threaded on strings, or placed on wooden trays. These strings and trays would be suspended from the kitchen ceiling or rafters, or placed outside in the sun to dry. To-day, in the kitchens of many of the old farm homes, may still be seen the hooks in the ceiling from which were suspended the poles that supported the strings or trays of apples.

Later, as the industry grew in importance, machinery was invented to do part of the work. At first the machine removed only the skin of the fruit, leaving the core to be cut out by hand. Ultimately a machine was invented to remove both skin and core at one operation.

When the apples were dried they were either sold or put away for future use. Outside of what was used in the home, lumber camps and railway construction camps furnished the principal market.

Commercially speaking, dessicated apples are divided into two classes; "dried apples" and "evaporated apples."

The term "dried apples," or, as is sometimes used, "sun-dried" apples, is applied to that product which is made in quarters, etc. They are unbleached and are generally the product of the home drier.

The term "evaporated apples" is applied to that product which is made in rings instead of quarters, is bleached, and is generally the manufactured output of a regularly equipped evaporator.

As nearly as we can ascertain, it was in the year 1882 that the first evaporator was started in Canada. The growth of the industry has been rather erratic since then. At present we have about 175 establishments operating through the Dominion, with a capacity for handling about 40,000 bushels of apples per day, and giving direct employment to about 1,200 males and 2,000 females. The period of operation is during the months of October, November, and December, and the number of working days will average about fifty.

THE DIFFERENT TYPES OF EVAPORATORS.

There are several types of evaporators in use, but as 96 per cent of the establishments in Canada use either the "tower" system or the "kiln" system, we will confine our remarks to these two.

THE TOWER SYSTEM OF EVAPORATORS.

There are two kinds of "tower" evaporators, the hot-air drier and the steam drier. With both these systems the fruit is placed in trays to be dried. These trays are made of wood having wooden slats or wire bottoms. They each hold about a bushel of sliced apples.

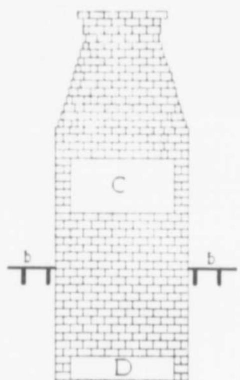


FIG 1.
Plan of hot air tower.

Fig. 1 represents a "hot-air tower." It is built of brick, and its dimensions are 4 feet 2 inches square on the inside and about 30 feet high.

A represents the furnace opening.

B represents an opening 4 feet 2 inches wide by 15 inches high, and through this opening the trays of prepared fruit are placed on an iron frame G.

C represents an opening where the trays are removed when the fruit is dried.

D represents an opening for observation purposes, where the fruit may be examined from time to time.

E E represents two iron pawls, placed in the walls of the tower, so adjusted that they will allow the trays of fruit to pass upwards, but not downwards.

F represents a sprocket with crank attached, which in turn operates G.

G is an iron frame in the form of a T, the perpendicular bar of which is fitted with sprocket teeth, which mesh into sprocket wheel F.

The tray of prepared fruit is placed through opening B on frame G and the crank F is given one turn. This raises frame G with the tray of fruit above the pawls E E. The crank F is then released allowing frame G to fall back into its original position, while pawls E E hold the tray in place till another tray is inserted. This operation is repeated as often as there are fresh trays ready. The trays are separated by blocks, two inches thick, nailed on the centre of each of the top sides, thus securing a two-inch opening between trays. It will be noted that as each fresh tray of fruit is placed into opening B the previous tray is forced upward. When about thirty trays have been placed in opening B the first one should have arrived at opening C. The operation should be so timed that the fruit on the tray when it arrives at C should be dry enough to remove. If it is not dry enough, more time must be allowed, but if too dry the operation must be hurried somewhat. This may be accomplished by using some empty trays, as fillers, instead of waiting for full ones.

At the bottom of the tower, on each side, are two ventilators, H. Each ventilator is one foot square. The current of fresh air, as it passes through these four ventilators circulates around and over the furnace, becomes hot, and ascends toward the top of the tower. To get out it has to pass through the trays of apples, thus evaporating the moisture from them. A separate flue is provided in the back of the tower to allow the smoke to pass out. Iron doors are provided for openings B, C and D, and these are kept closed except when the fruit is being put in or taken out.

A tower similar to the one just described has a capacity of about one hundred bushel of apples per day. If desirable, several towers could be built side by side, or back to back, always taking care that there is plenty of intake air at the bottom of each one.

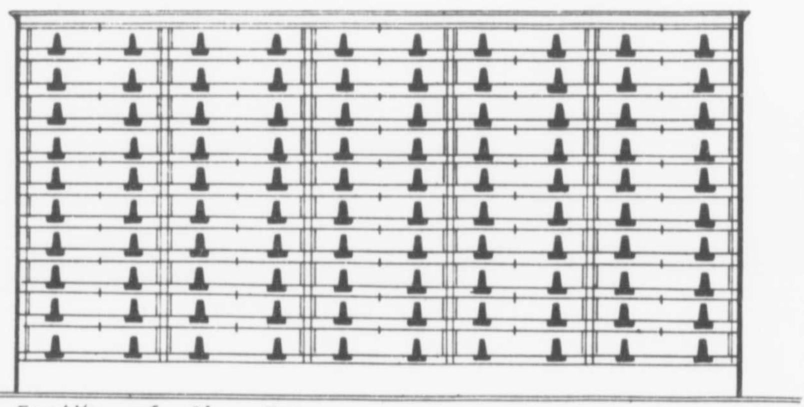


Fig 2

Front View of a Steam Drier

Fig. 2 represents a front view of a steam drier. The drier shown here is 23 feet long, 8½ feet wide, and 10 feet high, with a cupola 15 feet high fitted on the top. The interior is composed of five tiers of steam pipes, arranged at equal distance above one another. Each tier is made up of twenty-four coils, and each coil is 22 feet long and 20 inches wide. These coils are suspended on cross-pipes, and when in position should be about 4 inches apart.

Fig. 3 gives a view of the drier with part of the end removed. This shows the pipe arrangement. It also shows the edges of some of the trays in position in the drier.

Fig. 4 gives a view of part of the front of the drier with two trays of fruit partly withdrawn. The back of the drier is similar to the front.

It will be noted that there are fifty trap doors opening into the drier, each 4 feet 2 inches wide, to permit the entry of trays 4 feet square. As the compartment is 8 feet wide it allows for two trays to be placed, end to end, in it. The tray of fruit is put through the door in front which is so arranged that the trays are in position over the rows of pipes. When the first tray is partly dried it is pushed to the back and a tray of fresh fruit takes its place. The trays of dried fruit are removed from the back of the drier. This drier, having fifty compartments of two trays each, or a total of one hundred trays, has a capacity for about one hundred bushels of apples at one time. Each tray of fruit is dried independently of any other. Steam valves are used on each series of coils to control the steam supply so that there will be no waste of heat when the drier is only partly filled. Space about a foot high along the bottom provides plenty of ventilation below, while the cupola on the top carries off the moisture-laden atmosphere.

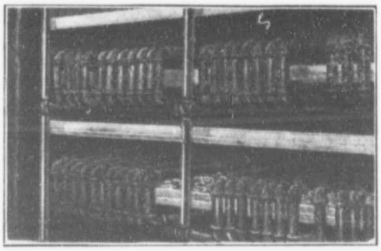


Fig. 3.
End of Steam drier.

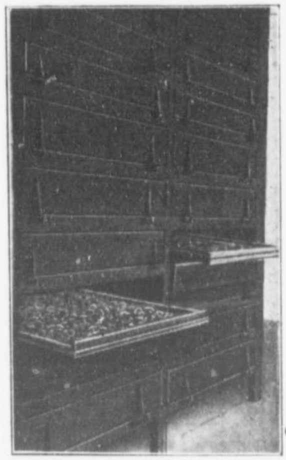


Fig. 4.
View of part of side of steam drier.

Fig. 5 shows a roof view of a steam drier with cupola.

THE KILN SYSTEM OF EVAPORATORS.

A kiln might be properly described as a room especially designed for drying purposes. On the ground floor is situated the furnace or other heating apparatus, while

Fig. 5.
Shewing view of roof of Steam Drier.

above is the drying floor, which resembles a large stationary rack, covering the whole surface of the room.

Fig. 6 gives a view of a section of a kiln-drying floor. The joists are laid as for an ordinary floor, and on them are nailed the slats. These slats are made from basswood, if possible, but sometimes poplar or soft maple is used if basswood cannot be secured. They are cut from inch lumber, dressed on all sides. They are an inch wide on top, and bevelled off on the sides to half an inch on the bottom. They are nailed on the joists about three-sixteenths of an inch apart on the top edge, thus allowing a free circulation of air between them, and still retaining the fruit from dropping through.

Kilns are of various sizes and shapes, owing largely to the fact that many evaporators were formerly churches, schools, factories, or other buildings, and the kilns were arranged to conform with the dimensions of the rooms as they were originally designed. However, in designing a building for a modern evaporator the size of kiln —20 feet by 20 feet—is found to be the most satisfactory.

In constructing a kiln one must bear in mind that heat is not the only essential in evaporating apples or other fruit. A free circulation of air is equally necessary to produce good stock. Lack of air circulation, both above and below the drying floor, causes the fruit to become baked, as in an oven. Plenty of air below and lack of outlet above, produces cooked stock, as in a steam cooker; while an unlimited supply of air both above and below, without proper control, would result in a waste of fuel. Therefore, when constructing a kiln, it will be necessary to consider the heat supply and the air control as well as the drying floor.

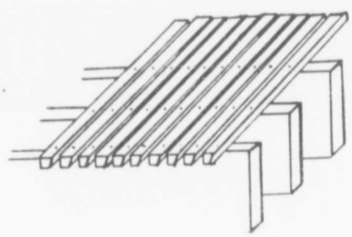


Fig. 6.
View of Section of kiln floor.

The heat supply may be from air heated by a furnace or by steam pipes. When a furnace is used the drying floor should be about twelve feet above the ground floor on which the furnace stands. Near to the ground, through the foundation walls, must be ventilators or openings to allow for the intake air supply. Provision should be made for, at least, 1 square foot of intake supply for every 40 square feet of drying surface. The sides of the drying room, between the studding, should be filled in with brick or cement, at least as high as the drying floor; or, better still, about three feet above it. The outlet for the air, or, as it is termed, the top ventilator, should be as nearly as possible over the centre of the kiln. It should be somewhat larger in capacity than the intake opening, and should be built to a sufficient height to secure good draught. Both intake and outlet ventilators should be fitted with doors to regulate their draught. The intake supply door should hinge from the top and open upwards and inwards, the outlet door should hinge from the bottom and open outwards. For the outlet some people use slats arranged as a window shutter, while others use a cowl.

Later in this article a couple of models of kiln type of evaporators will be shown to illustrate the system more fully.

The Equipment of an Evaporator.

The equipment of an evaporator consists of tables, paring machines, bleacher, slicer, press, and sundry smaller articles. When motor power is used, a motor, elevator, and shafting will be needed.

Tables for use in paring and trimming the fruit are of various designs. We will consider but two of them, the table for hand work and the one for motor power.

The table for hand-power machines should be built on a slight incline, receding from the machine. The operators of the paring machines stand on one side of the table, the trimmers on the opposite side. Through the table top, under the end of the paring machine, is a hole to allow the skins and cores to pass into a receptacle provided for them. On the trimmer's side of the table is a trough, so inclined that the trimmed apples will roll to the lower end where they may be removed to the bleacher. In a plant operated by motor power the table may be either flat or slightly inclined. An endless belt carries the skins and cores to their destination, while another belt carries the trimmed apples to the bleacher. Tables are generally built so as to allow about four feet in length for each machine and its operator. Crates, or bins, of unpared apples are placed at a convenient distance to each operator.

The first operation is to pare and core the fruit. This is done by means of a machine.

The Paring Machine.

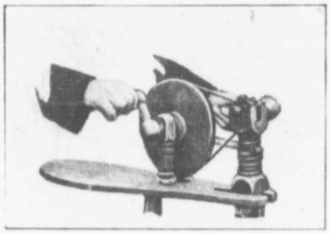


Fig. 7.
View of one of the first paring machines.

Fig. 7 shows a paring machine used a hundred years ago. It removed the skin only. The fruit had to be quartered before the core could be removed. This was done by hand. This machine resembles a small spinning wheel. The operator turns the large wheel with his left hand. This wheel by means of a belt drives the spindle to which the fork is attached. The apple is placed on the fork, and while the spindle revolves rapidly, the operator, with the right hand, places the knife on the fruit and with a dexterous movement removes the skin. This knife resembles a paddle to which the cutter from a spoke shave has been attached.

Fig. 8 shows a modern paring machine for hand work, while fig. 9 shows an up-to-date power parer.

With the parers shown in figs. 8 and 9 the apple is placed on fork A. Care should be taken to place it evenly on the fork, stem end first. The movement of the machine brings the fruit into contact with the knife B, which is adjusted by a spring so as to pare small apples as well as large ones. The apple revolves with the fork, and beginning at the "blossom" end and working towards the stem, the knife removes a thin skin. When this operation is completed the corer C pierces the centre of the apple, while one revolution of the fork removes the core and an adjustment on the back of the machine presses off the fruit and leaves the fork ready for another apple. The pared apple rolls down an inclined table to where it is examined by the trimmer, who removes any skin or other defect that may remain on it. It is then sent on to the bleacher. It may be noted in fig. 9 that the parer is provided with a reel of three forks. In this way the operator can be placing an apple on one fork while another is being pared.

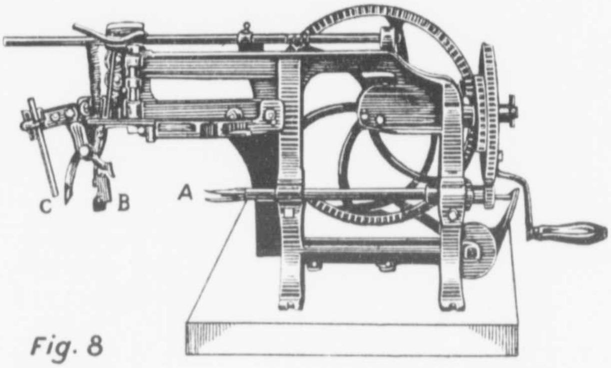


Fig. 8.
View of Hand Paring machine.

An expert operator can pare about fifty bushels of average apples in ten hours with the machine as shown in fig. 8, while as high as sixty to seventy bushels have been pared in the same time with the machine as shown in fig. 9.

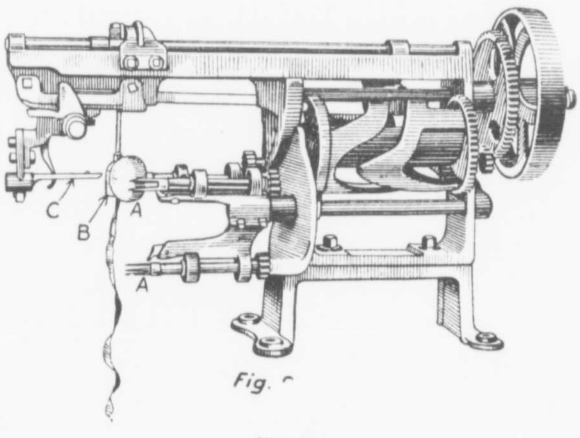


Fig. 9.
A modern power parer.

When the cut portion of an apple is exposed to the air for any length of time it becomes brown, and thus, in the natural course of drying, the fruit is brown. The consumer wants a white product, and what the consumer wants the manufacturer must produce. To obtain this white product artificial means must be resorted to; or, in other words, the fruit must be bleached. This is done by subjecting the pared fruit to the action of sulphur fumes for a short time, and for this purpose a bleacher is used.

The Bleacher.

Bleachers are built in either horizontal or in upright positions. They are constructed like an oblong box, and provision is made for carrying the fruit from end to end. Their length depends on the amount of work required of them, the faster the fruit has to travel the longer the bleacher must be. Fumes of burning sulphur are directed into the bleacher at the bottom side at the same end where the fruit enters; they make their escape through an opening provided on the upper side at the opposite end.

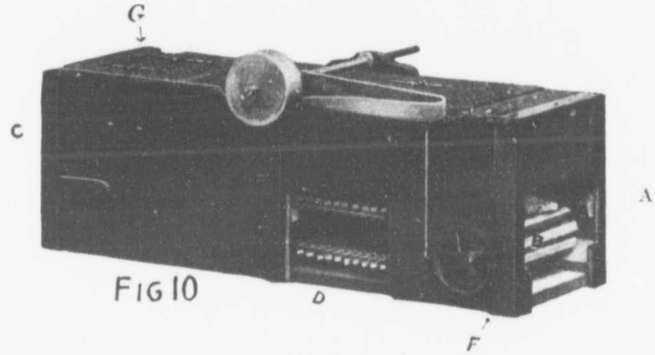


Fig. 10.
Horizontal Bleacher.

Fig. 10 shows a horizontal bleacher. The fruit, either loose or in trays, is inserted at A. The endless belt B carries it through the bleacher to the opposite end C where it is removed and sent to the slicer. D shows a part of the side of the bleacher removed showing the endless belt B. A vessel with burning sulphur is placed at F, while provision for the escape of the sulphur is made at G.

Fig. 11 shows an upright bleacher. Tray A filled with apples, is inserted at opening B where it rests on a movable frame which is attached to rods C on each side. These rods go to the top of the bleacher, where they make connection with lever D. To operate this bleacher, lever D is pulled down, thus lifting the frame with tray of apples past a pair of pawls on the inside. These pawls prevent the trays of fruit from falling back when the lever is released. When the lever is released the frame falls into its original position ready for another tray of fruit. This operation is repeated as often as there are trays of fruit ready and the bleached fruit is removed at opening F. Underneath the bleacher, at E, a place is provided where sulphur is burned. The fumes find their exit through a pipe provided at the top. As a rule this bleacher is constructed so that the lower half is in the work room, while the upper portion is in the slicing room. This answers, not only as a bleacher, but it does duty as an elevator to get the fruit to the slicing room. The sulphur or brimstone is generally burned in an iron pot at a point near the intake end of the bleacher, but sometimes it is burned in a specially designed stove, which may be placed at a point at a lower level than the bleacher, and at a considerable distance away. With this latter plan, the fumes are conveyed to the bleacher through pipes.

There is a difference of opinion among scientists, manufacturers, dealers, and consumers whether the practice of bleaching with sulphur should be allowed, but it is certain that the fruit should not be subjected to the action of the sulphur for any greater length of time than is really necessary to accomplish its purpose. Any longer time tends to give an evidence of sulphurous acid, which is not desirable.

The Slicer.

The slicer, as the name implies, is used to cut the apples into slices. There are several types of these machines in use, some good and some no good. A slicer, to be of any use, should be strong and simple in its construction, positive in its feed and true in its cut. It should be so constructed as to be easily cleaned and simply adjusted. The knives should always be kept sharp and true so that the apple is cut in whole slices, not broken ones. As soon as a slicer shows that it will not do first-class work it should be sold for old iron. We have known of many instances where from one-quarter of a cent to three-quarters of a cent per pound was deducted from the

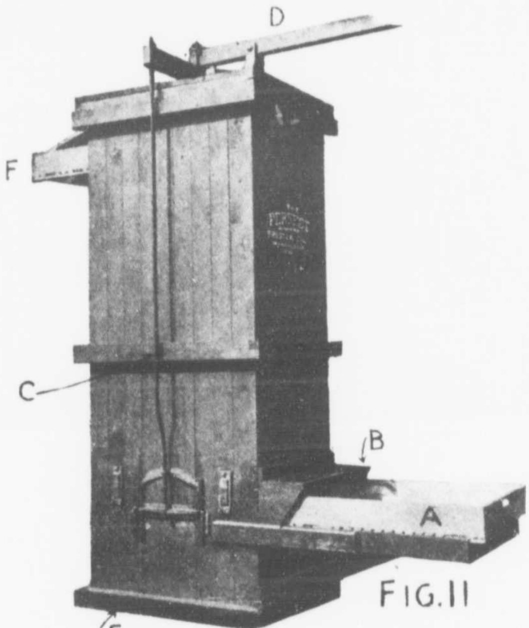


Fig. 11.
Upright bleacher.

price of otherwise good stock on account of broken slices due to the work of an inferior slicer. We know of one instance during the past season where half a cent per pound was lost on 3,000 cases (150,000 pounds) due to the poor work of an old slicer. This loss of $750 could have been saved had they thrown away the old slicer and put in a new one at a cost ranging from $25 to $100. A slicer that breaks more than 5 per cent of the slices of an ordinary apple is no good, and had better be sent to the scrap heap.

Fig. 12 shows a foot-power slicer, and fig. 13 a motor-power machine. In either slicer the apple is forced through a gang of knives which cuts it into slices about a quarter of an inch thick. The sliced fruit falls into boxes and is carried away to the drier. If a tower is used, the sliced apples are put on trays, slightly less than a bushel on a tray 4 feet square. If they are to be dried on a kiln they are placed on the drying floor and spread evenly over the surface of the floor at whatever depth is found necessary, but not more than 6 inches deep, or in the case of an extra good working kiln, 8 inches deep. The working of a tower has already been explained, the manner of operating a kiln is somewhat different.

In kiln drying the first operation is to spread the fruit evenly over the drying floor, then it is ready for the warm air. At first too strong a current of hot air should not be applied as it is apt to bake those slices next the slats, but as soon as the warm air has worked its way freely through the fruit the furnace may be driven to its capacity till the stock is fairly well dried, though it will be necessary to turn the fruit from time to time. The number of turnings will be governed largely by the depth of fruit on the drying floor. The turning is done with a flat shovel. The operator inserts the shovel under the fruit, lifts it loaded and turns it upside down, thus the part that was on top is now underneath. This operation is continued till the whole lot has been turned. The turning is repeated from time to time till the fruit is dry.

The writer has applied the experience gained in the drying of hops to the kiln drying of evaporated apples, and it has given very satisfactory results especially the

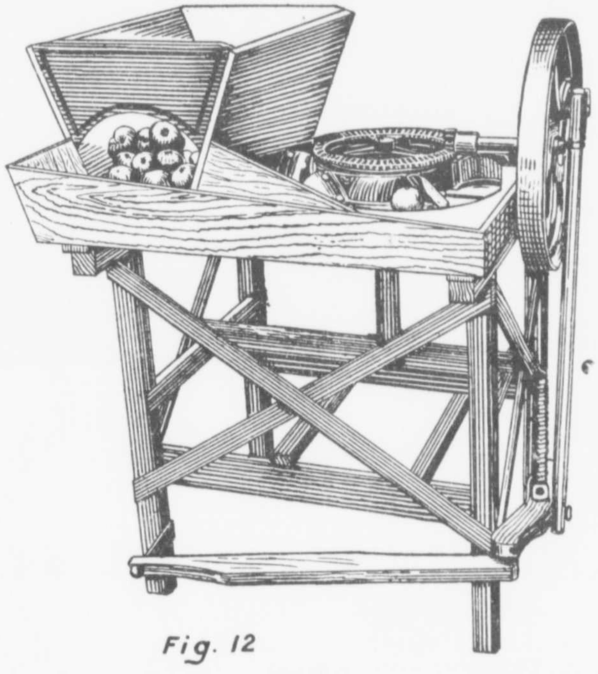


Fig. 12

Fig. 12.
View of foot slicer.

following method: When the fruit, through the regular process, has become about seven-eighths dry the furnace fire is allowed to slacken somewhat and the fruit is "stacked" or piled in the centre of the drying floor. To properly "stack" the apples start at the centre and work outward, turning each shovelfull upside down on the top of the pile. This will mix the green and the dry fruit thoroughly. Allow the apples to remain thus in the pile from three-quarters of an hour to an hour. This will allow them to "sweat" or "neutralize," or, in other words, the dry slices will absorb the moisture from the green ones. A canvas to cover the whole pile will hasten the process somewhat. When the moisture throughout the pile is thoroughly distributed the fruit will have a damp, wilted appearance and is ready to re-spread on the drying floor. A slow fire will soon complete the necessary drying.

It must be admitted that this process appears to take considerable time, but it gives the satisfactory results, as well as really saving time in the end, because the moisture in a kiln of evaporated apples can be better equalized in an hour in a pile in the warm drying room than in four days when spread on the floor of a cooling room and turned daily. The fruit should be turned every day or two till boxed, or given at least five or six turnings.

FIG. 13

Fig. 13.
Power Slicer.

Grading the Stock.

There is no legal standard for grading. As a rule our goods are sold by sample, but this is not always satisfactory, as disputes arise and adjustments are not always satisfactory. New York dealers recognize four grades, namely, prime, choice, fancy and extra fancy.

"Prime" goods must be good stock, well cured, comparatively white, mostly free from pieces of skin, cores or spots.

"Choice" is an intermediate grade between "fancy" and "prime." It is not clear of defects enough to be called "fancy" but still somewhat better than "prime."

"Fancy" is very white, clean stock, free from skins, cores, spots, or other objectionable portions, and is composed to a large extent of whole rings.

"Extra fancy" is a fancy grade that is exceptionally fine and made up almost altogether of whole rings.

It is to be regretted that the dishonest packer sometimes brands his "prime" goods as "extra fancy." A legal standard for grading might do much towards getting more uniform pack. It might also enable the dealer, as well as the retailer, to buy the grade of goods his trade demands.

The writer has interviewed several of the largest dealers in the United States, as well as scores of dealers in Canada, and in almost every instance, one of the greatest complaints against Canadian evaporated apples is their lack of uniformity in size, colour, cut, and trim. More concerning this difficulty will be considered later.

The Package.

Evaporated apples are generally packed in wooden boxes containing either 50 pounds or 25 pounds net. The former contains about 2,540 cubic inches, while the latter holds about 1,450 cubic inches. Pasteboard cartons are sometimes used. They are usually made to hold about three pounds net, and when filled are packed in wooden boxes containing from one to three dozen cartons. This is one of the most satisfactory ways of packing evaporated apples for domestic consumption. The first cost is considerably more than with cased goods, but the saving to both the dealer and the consumer more than evens this up. Export trade, however, demands cased goods. It also requires that these cases be "faced." In casing evaporated apples the bottom side of the box as it rests on the table to be filled becomes the "face" of a case. A board is fitted so as to slip easily inside of the case. On this "facing board" the "facers" are placed. They are the choice of the perfect rings selected from the stock, and are arranged so as to overlap one another. They are placed in rows side by side and covered with parafin paper the full size of the board. To place the "facers" in position, support the case open side downwards, between the body and a wall or post, steadying the case by placing one hand on the outside bottom. With the other hand gently lift the board with the "facers" till it touches the inside of the bottom, press the two hands towards one another and reverse the box. Remove the facing board and the "facers" will be found in position ready to receive the balance of the apples. A good way to fill the case is to provide a box of sufficient size to hold the amount of fruit to go in the case, i.e., 25 pounds or 50 pounds as the case may be. Set the weight on the scales to balance the weight of the box and the amount of apples required, but deducting the average weight of the "facers." This will give the correct weight to go in every case. A moveable riser slips over the top of the case to be filled. Into this, empty the weighed fruit, pack down with the press, remove the riser and nail on the cover.

Fig. 14 gives a view of a press used for this purpose. Some manufacturers do not face their goods, but the Old Country trade demands it. The writer's attention was drawn to an instance a short time ago, where an Old Country Arbitration Board awarded the purchaser one shilling and six pence per hundredweight damages because the cases were not faced. The same Board awarded another dealer two shillings per hundredweight damages because the apples, though dry and of good colour, were made up largely of broken slices, evidently the fault of a poor slicer.

Some manufacturers line their cases with paper. It gives a much better appearance to the goods when opened. It also helps to protect them from the dampness.

In operating an evaporator there are two other products obtained in addition to evaporated apples; viz., chops and waste, and they might be called the by-products.

During the day all the small, irregular and otherwise defective apples are thrown out as unfit for paring. At the end of the day these are generally put through a chopper and cut into slices. They are neither pared nor cored, and are generally put on one corner of the waste drying floor to dry. This product is called "chops." The skins and cores from the apples when pared make what is known as "waste." This is put on the drying floor and dried in the usual way. Chops and waste, however, are not put through the bleacher, but receive their bleaching from fumes of sulphur burned on the furnace.

Chops are packed in barrels. A market is found for this product in Europe, where it is used in the manufacture of vinegar, cheap wines, etc.

Waste is rich in pectin, or the jelly portion of the fruit, and is valuable in jam making. It is used extensively in Canada, United States and Europe, the latter taking the bulk of the amount produced.

The chops and waste of an evaporator should always sell for enough to pay for all the fuel used in drying the various products, some years it brings considerably more.

The product of a bushel of apples, when dried, will weigh about ten pounds, and with extra good fruit possibly a pound or two more. Whether the "white" stock average is four, five, six or more pounds per bushel depends largely on the class of fruit handled, as well as on the work done by the machinery and help. Except in the case of early fall apples, one is safe in concluding that what is short in an average yield of white stock will be apt to be over in the yield of chops and waste. A season's average for white stock at six pounds per bushel would be considered good.

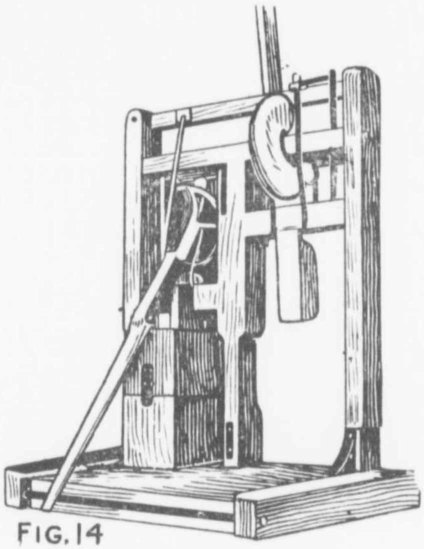


FIG. 14

Fig. 14.
Apple press.

The Furnace.

The furnace is a very important item in the equipment of an evaporator. There are a number of different furnaces on the market, but they are all pretty much alike in action. The essential parts of a furnace are,—a large fire-pot, good dumping arranagements, ample ash pit and large radiating surface.

Fig. 15 shows a general type of furnace. A is the furnace door through which the fuel is fed. B is a door where the ashes are removed. C shows the ends of six shaker bars which form the base of the fire pot. By rocking these bars the ashes and clinkers are removed from the fire. D is the fire pot where the fuel is burned. In some evaporators the whole top of the furnace above F is removed and the furnace is operated without the use of either pipes or chimney. This is a more rapid way of drying but it does not produce such clean white stock. It is also hard on the respiratory organs of the operator. When this system is used a "deflector" about eight feet square is suspended directly over the furnace, at a distance of about four feet from the drying floor. This helps to distribute the heated air evenly over the whole kiln.

The Fuel.

The fuel used in a furnace may be either coke, coal, or wood. We have, in Canada, a couple of evaporators where the fruit is dried with heat developed from natural gas. Coal and coke, however, are the standard fuels. The quantity used will vary with the evaporator arrangement, the weather, the class of fruit, and last, but not by any means the least, the fireman.

From 1,500 to 2,000 pounds of coal should be sufficient to produce a ton of dried fruit (that is white fruit, chops, and waste), 1,800 pounds is a fair average. If a good fireman uses more than 1,800 pounds of coal, with average fruit, in fair weather, there is almost sure to be something wrong with the drying system of the kiln, and it had better be thoroughly examined. About 1,600 pounds of coke should produce a ton of dried fruit, while if an open furnace is used, a ton of coke should dry 2,600 to 2,800 pounds of fruit.

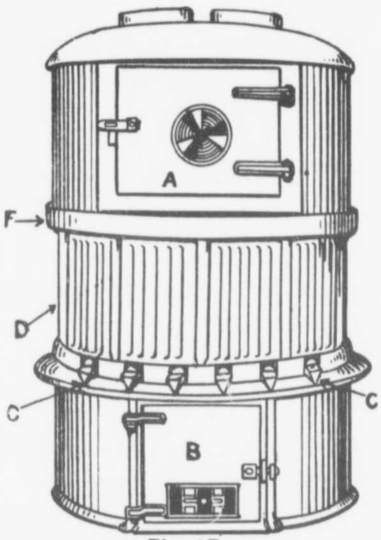
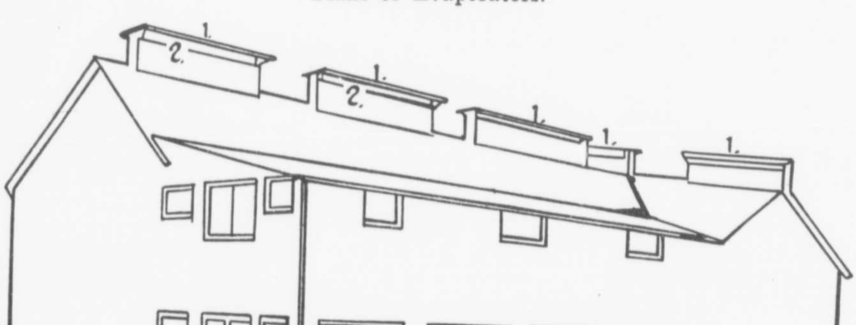


Fig. 15

View of a furnace.

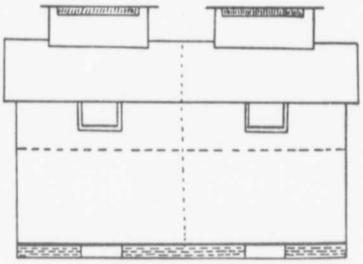
In the foregoing, we have touched on the systems of evaporators in use, their general equipment, method of operation and product manufactured. We will now illustrate this more fully by reference to a couple of models of evaporators which we herewith submit. These plans are partly the writer's own design and partly adapted from evaporators already in operation.

Plans of Evaporators.



Perspective 80×40
Plan I Fig I
C.S.McG.

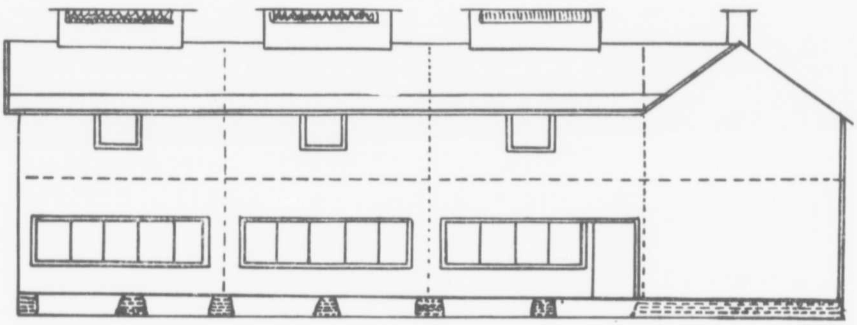
Plan I, fig. I. This gives a view, in perspective, of an evaporator 80 feet long and 40 feet wide. It includes five kilns, each 20 feet square, an office and work room down stairs, and a slicing room and curing room upstairs.



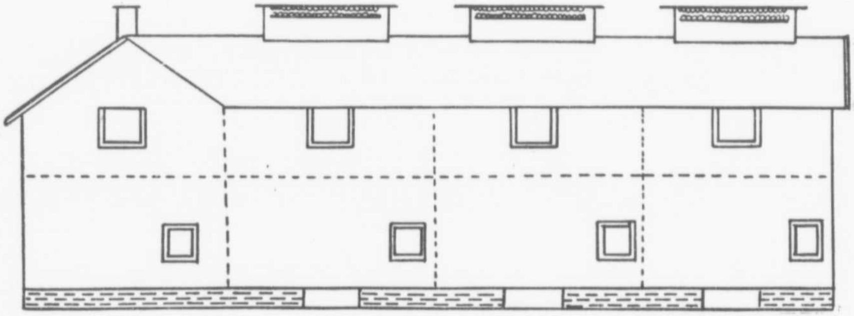
Rear End 80×40
Plan I Fig II
C.S.McG.

Front End 80×40
Plan I Fig III
C.S.McG.

Plan I, figs. 2, 3, 4, and 5 give the outlines of the rear end, front end, front side, and rear side, respectively.

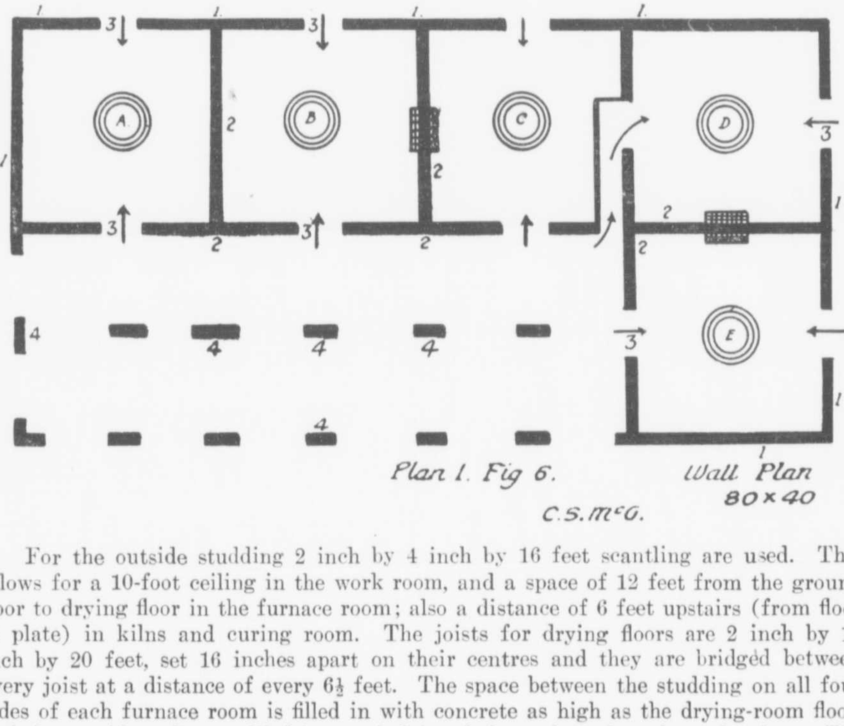


Front Side 80×40
Plan I Fig 4
C.S.McG.



Rear Side 80×40
Plan I. Fig 5.
C.S.McG.

Plan I, fig. 6, gives a plan of the wall on which the evaporator is built. That portion of the building comprising the kilns is built on solid walls, the rest of the building is supported on piers. Both walls and piers are constructed of cement and go far enough below the top ground to secure a solid base. The walls 1, 1, 1, around the outside, are 22 inches above the ground level. The walls 2, 2, 2, on the inside are 12 inches above the ground level. They are all 12 inches thick. Openings are provided in the opposite sides of two walls of each kiln. These openings are 5 feet long and 1 foot high, are situated at the centre of the sides of the kiln and next to the ground. They are intended to provide for an ample supply of air for the kiln. Each opening is provided with a trap door, and arranged to open from the bottom inward to any extent desired. In kiln D, the building construction prevented the direct intake of air, so an air conductor was built along the ground in the corner of kiln C. This is 2½ feet wide and 2 feet high and is made of galvanized iron. The piers 4, 4, 4, are 15 inches long, 10 inches thick, and 8 inches above the ground. On the top of the wall 2 inch by 8 inch planks are laid, while on the piers 6 inch by 8 inch timbers are placed. The joists under the work room are 2 inch by 10 inch, thus bringing the work room floor 2 feet higher than the furnace room floor. Chimneys with double flues are built between kilns D and E, B and C, and A and work room. The base of the last chimney is constructed around the air intake 3.

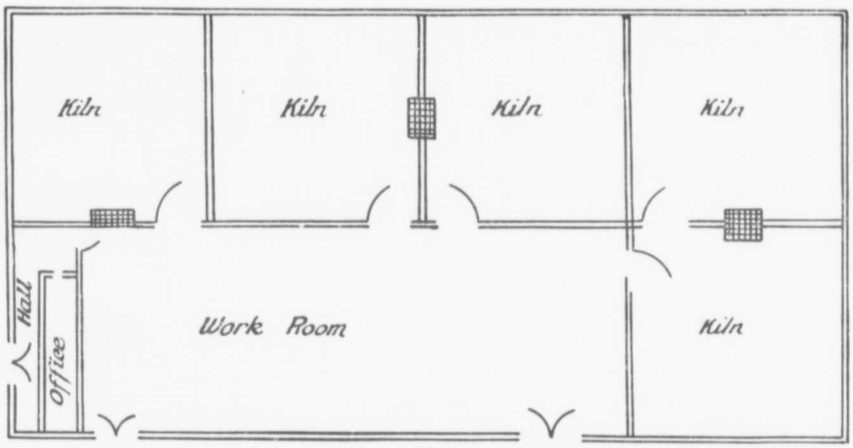


Plan I. Fig 6. Wall Plan 80 x 40

C.S. McO.

For the outside studding 2 inch by 4 inch by 16 feet scantling are used. This allows for a 10-foot ceiling in the work room, and a space of 12 feet from the ground floor to drying floor in the furnace room; also a distance of 6 feet upstairs (from floor to plate) in kilns and curing room. The joists for drying floors are 2 inch by 10 inch by 20 feet, set 16 inches apart on their centres and they are bridged between every joist at a distance of every 6½ feet. The space between the studding on all four sides of each furnace room is filled in with concrete as high as the drying-room floor, and the outside walls are filled in to a height of about three feet above the slats. The kiln slats are inch thick, inch wide on the top, and bevelled on two sides to half an inch wide on the bottom. They are laid three-sixteenths to one-quarter of an inch apart on top edge, and are nailed with 2-inch wire finishing nails well set in. The sides of the building are covered with corrugated galvanized iron, well nailed, the nail heads being soldered. The roof is of asbestos. A ventilator, 12 feet long, 15 inches wide, and 4 feet high, is arranged through the roof over the centre of each kiln (see plan 1, fig. 1, No. 1). The roof of the ventilator is 30 inches wide with a raise of 2 inches to the centre. On each side of the ventilator, and near to the top, are two trap doors, each 6 feet long and 10 inches wide. These doors are hinged on the bottom edge, and open outwards and downwards. Each one is operated from the inside of the kiln by means of a rope and pulley.

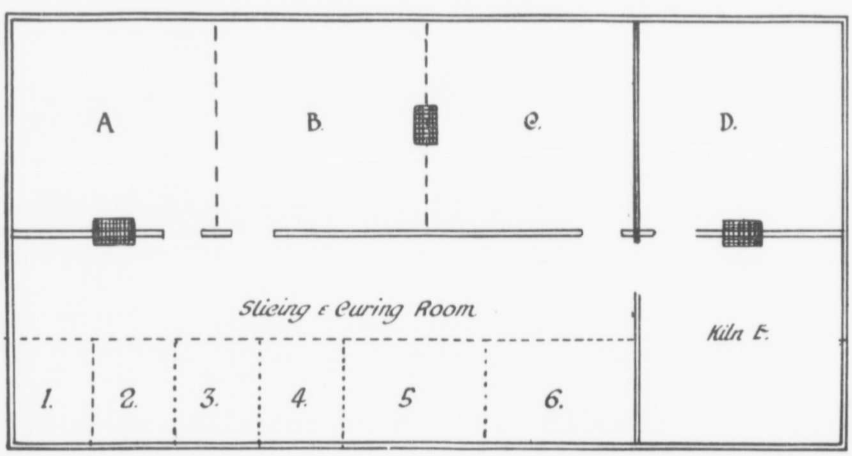
Plan I, figs. 3 and 4 show the arrangements for doors and windows for the end and side of work room and curing room. Plan I, fig. 5, shows the openings where the fuel is delivered to the furnace room.



Plan I. Fig 7. Main Floor 80 × 40
C.S McG.

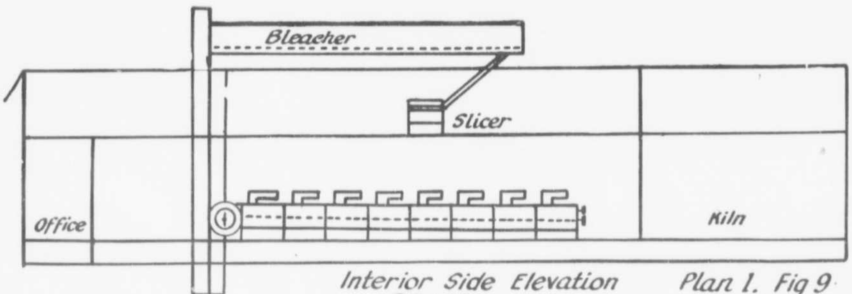
Plan I, fig. 7, shows location of office and doors on main floor.

Plan I, fig. 8, shows second floor plan of the evaporator. Plan I, fig. 9, gives the interior view of the evaporator, showing the relative position of paring table and elevator on main floor, bleacher on the roof, and slicer on second floor; also kilns at the end.



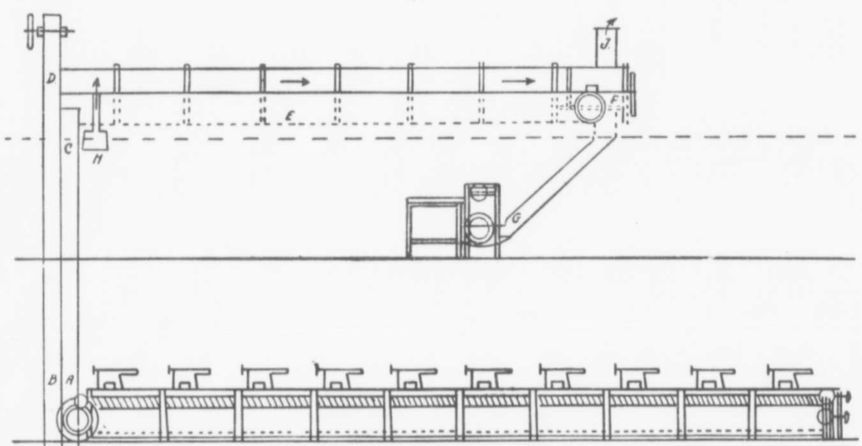
Plan I. Fig. 8. 2nd. Floor 80 × 40.
C.S. McG.

Plan I, fig. 10, shows an enlarged interior view of the work room. The paring table, with 10 paring machines, is shown here. The skins and cores fall from the paring



Interior Side Elevation 80×40 Plan I. Fig 9 C.S. McG.

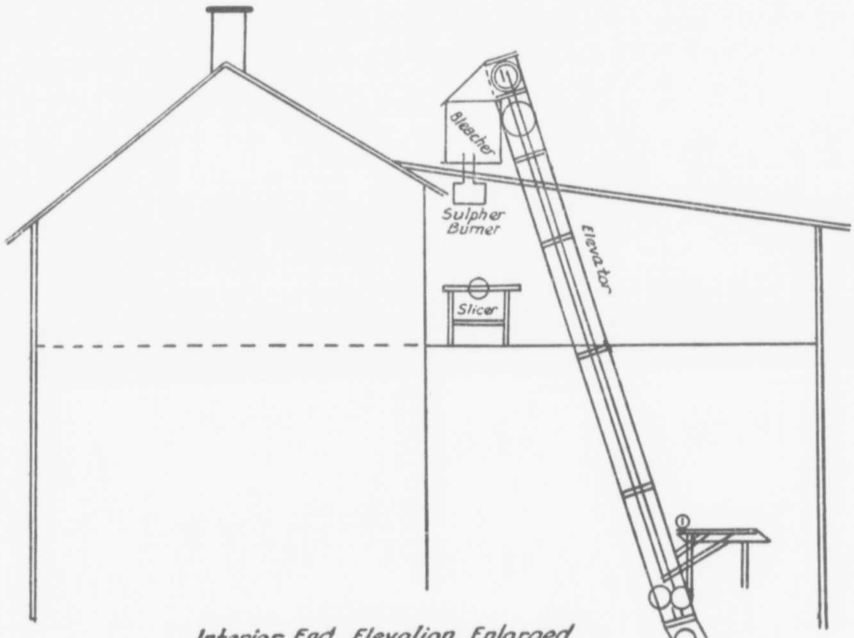
machine on an endless belt and are carried into one side of the elevator at A, whence they are carried up to the next floor and discharged at C. Arrangements are here made to remove this product in barrels to the waste kiln to be dried. The fruit, after having been pared and trimmed, falls on another endless belt which carries it to the opposite side of the elevator at B, whence in turn it is conveyed to the bleacher



Enlarged Interior Side Work Room Elevation Plan I Fig 10. ¼" To 1' C.S. McG.

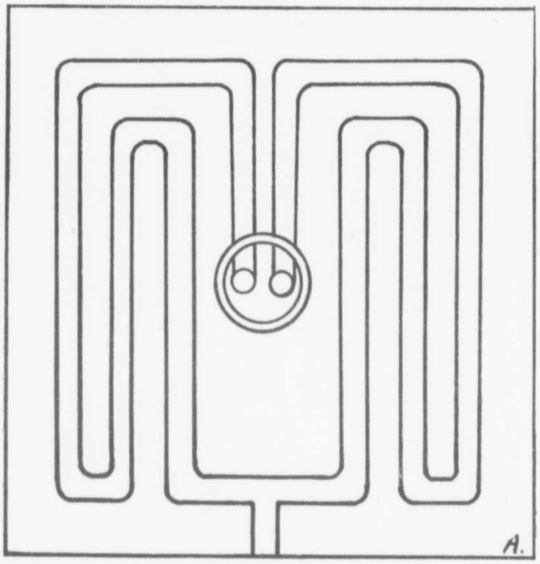
at D. An endless slat belt carries the apples through the bleacher from D to F, where they fall down a spout to the slicer. When they are sliced they are carried to the kilns and are ready for drying.

Plan I, fig. 11, shows an interior end view of the elevator and the slicer. It may be noted that in this plan the bleacher is placed on the roof of the work room. This arrangement gives more room inside, and also prevents any chance for annoyance from sulphur fumes. However, if the owner so desires, the bleacher may be placed under the roof and next to it, but when so placed, the head-room going in and out the kiln is reduced. A sulphur burner is placed at H. The fumes travel from H to the opposite end of the bleacher, and escape at J. (Fig. 10.)

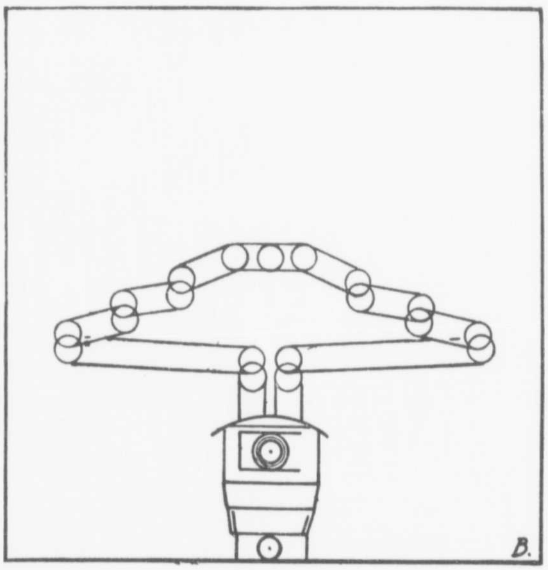


Interior End Elevation Enlarged
80×40 Plan I Fig II.
C.S.McO. 1/4"=1'

Plan I, fig. 12, shows the piping arrangement made for the furnace. A shows plan of circulation, while B shows their elevation. The pipes rise from the furnace, perpendicular, to a height of about six and a half feet from the ground, then they take an almost horizontal direction towards the front of the kiln, to a distance of about 3 feet from the wall. Here they turn and follow the wall along the front to the side, on to the back, keeping the 3 feet away. From the back the space is so divided that after forming a letter U the lines of pipes from the two sides join at the back and by means of a T connection enter the chimney at a point about 9 feet from the ground floor. This arrangement of the pipes carries the hot smoke and gas to the outside of the furnace room, the point farthest away from the heat, and as the smoke cools it works its way back to the centre and out through the flue. One may note the gradual rising of the pipe line from 6½ feet to 9 feet, thus securing the "upward" draught, so much to be desired in a good working furnace system.



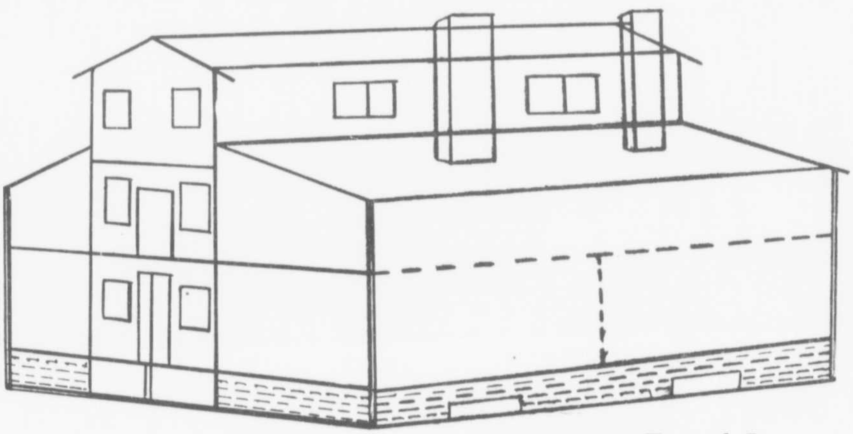
20×20
1/4" 1.1'



Piping Plan Furnace Room
Plan 1. Fig 12.
C.S.McO

PLAN II.

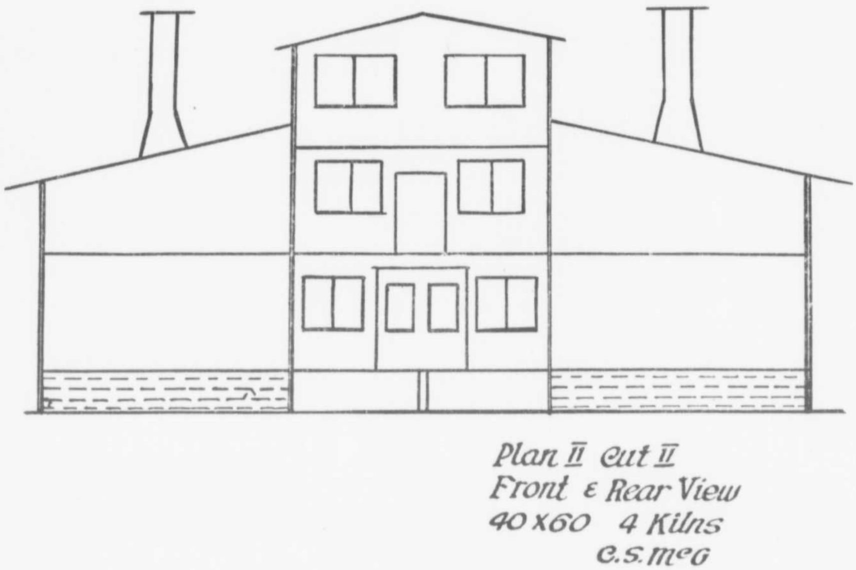
Plan II, cut I, shows a view, in perspective, of an evaporator 40 feet wide by 60 feet long, having 4 kilns, each 20 feet square and a central part 20 feet wide and 40 feet long. The outside walls supporting the kilns are 24 inches high from the ground level. The inside walls are 14 inches high. Through the centre, from end to end, is a supporting wall 14 inches high. All the walls are 10 inches thick, built of concrete and are far enough underground to secure solid base. Each kiln is provided with ventilators in the base wall similar to those shown in plan I. Each opening is 5 feet long, and 1 foot high. Planks 2 inches thick are laid on the walls to support the studding and joists. The work room floor is built on joists 2 inch by 10 inch and may be spliced on the centres. The outside kiln wall studding is 2 inch by 4 inch



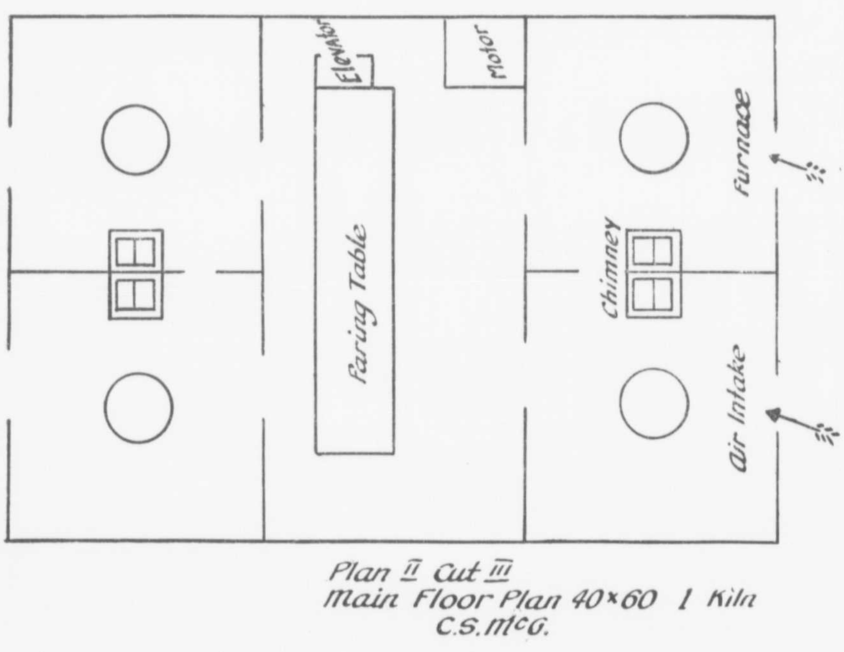
Plan II Cut I
Perspective View
40 x 60 – 4 Kilns
C.S McG.

by 15 feet. The furnace room is 12 feet high from ground to drying floors. It is 5 feet from drying floor to plate on the outside and 9 feet from drying room floor to where the kiln roof joins the main part of the building. The studding that is used between the kilns and the curing room is 15 feet long, thus giving 9 feet from floor to kiln roof and 6 feet extension to the plate of the main part. This arrangement provides for a work room on the first floor, a curing room on the second floor, and a bleacher and slicer room on the top floor. Each room is 20 feet wide and 40 feet long. The ceiling of the work room is 10 feet high, the curing room 8 feet high, and the slicer room 7 feet to the plate. A feature of this plan worthy of special notice is the liberal provision for light on all the floors at both ends of the main part of the building, while additional light and ventilation is provided for on the sides of the top story.

The ventilators over these kilns are of somewhat different construction to those shown in plan I, inasmuch as while the ventilators in plan I set on the apex of the roof, these in plan II set on practically a flat roof, thus requiring a stronger "drawing" power. With this plan, in the centre of the roof, over each kiln, the sheeting is left off a space 5 feet long and 5 feet wide, and over this space a ventilator is built, rising to a height of 12 feet from the roof. The size of this ventilator is 5 feet long and 5 feet wide at the bottom, drawing in to 5 feet long and 2½ feet wide at the top. The roof arrangement of this ventilator is similar to that in plan I, only this roof is 50 inches wide on top and rises to 4 inches in the centre. The trap doors on the sides are similarly arranged but are 20 inches wide.

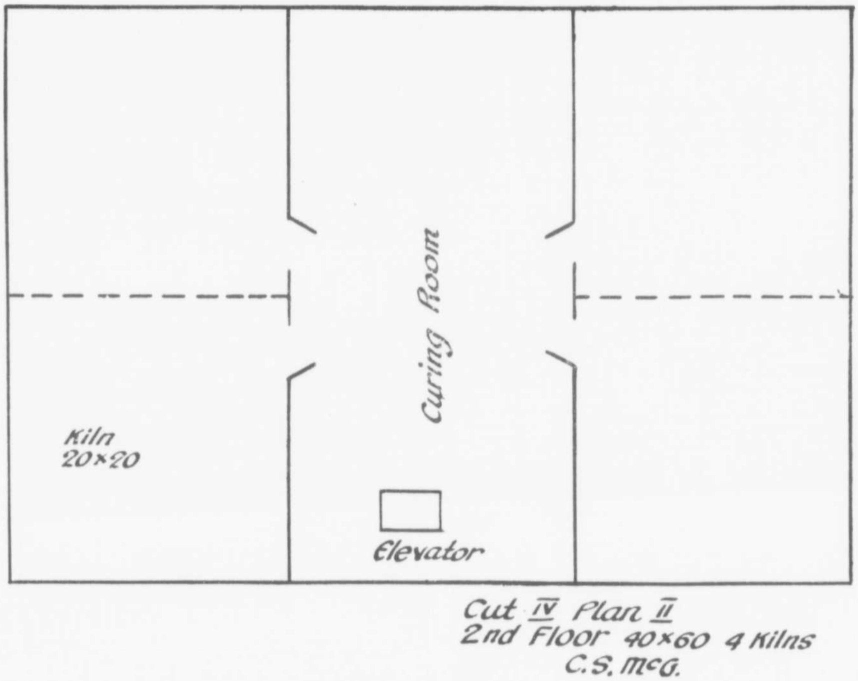


PLAN II—CUT II.

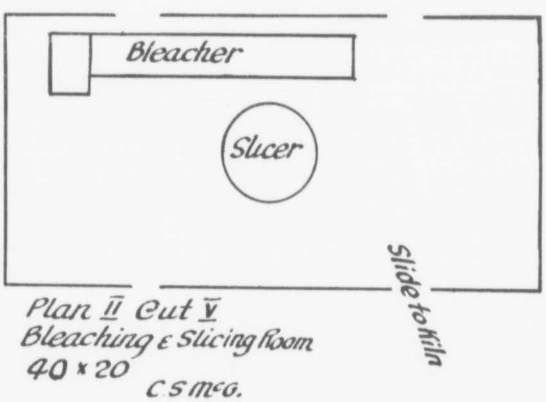


PLAN II—CUT III.

Five cuts are shown with plan II, viz.: cut I, a view of the building in perspective; cut II, front and rear view; cut III, main floor plan showing position of work table, elevator, office, and kiln arrangements; cut IV second floor plan; cut V showing bleacher and slicer arrangements.



PLAN II—CUT IV.



The fruit is pared on the main floor, the skins and cores are elevated on one side of the elevator, and the apples are elevated up the other side through the curing room to the bleaching room. The skins and cores empty on a slide which conveys them direct to the waste kiln. The apples are deposited into the bleacher just under the roof. When the apples are bleached they fall into a short conveyor, connecting the bleacher and slicer, and when sliced, they are emptied into a slide which conveys them to the drying kilns. When the fruit is dried it is removed to the curing room, which owing to its size and isolation from the other rooms is one of the best features of the whole plan. Plan II works out very nicely where motor power is not used, the fruit being elevated through an upright bleacher, the skins and cores raised by rope and pulley.

In addition to the foregoing plans of kilns there is still another plan lately introduced. Most of the parties who have tried this plan are very well satisfied with the results obtained. It differs from other plans mainly in the furnace room. Its construction is as follows:—

In the centre of the furnace room is built a brick or cement "well" about 8 feet square and about 5½ feet high. Allowance must be made in the construction of this "well" for openings at the bottom of each of three sides, each opening to be 4 feet long and 1 foot high. On the fourth side, or front, an opening 4 feet long and 4½ feet high should be left. This latter opening should be provided with an iron door to close to within a foot of the ground.

The distance from the drying floor to the ground floor should be 16 feet.

Joists are laid from the top of the "well" wall to the sides of the kiln walls at a line 3½ feet below the drying floor. These joists are set in 2 feet apart, and when in place the structure resembles a square, or cottage, roof inverted. On the top of these joists, as also on the 3½-foot space below the drying floor, steel lathing is nailed, and the whole surface covered with a heavy coat of asbestos, thus making a fireproof hopper under the drying floor.

The furnace is placed in the centre of the well. The iron door on the front of the well opens to allow the fuel to be fed into the furnace, and also to allow the ashes to be removed.

The four openings at the bottom provide an abundant air supply for the proper working of the kiln.

The drying floor and plan of kiln above it is the same as in an ordinary kiln.

The advantage claimed for this style of furnace room is that all the air has to come into direct contact with the furnace, and thus is heated evenly; also that the sloping sides, or hopper arrangement gives a more equal distribution of heated air to the drying floor, thus allowing the fruit to dry more evenly.

The place between the ground floor and where the joists join the kiln walls need not be enclosed, as the more air there is around the "well" the better the results.

Curing Room.

It must be understood that the curing room space provided for in both these plans is by no means sufficient for the capacity of the plants. In connection with every evaporator there should be a storehouse of sufficient capacity to hold all the dried stock till it is packed and shipped. Where possible, this storehouse should be in an isolated position, thus reducing the insurance risk.

Let us take as an illustration the curing room as shown in plan I, fig. 8. This room is 60 feet long and 20 feet wide. It will be necessary to provide for room to work around the slicer, as well as to have space to cure the fruit. Through the centre, from end to end, let us put a partition about 2 feet high. Let us use that half next to the kilns for stairway, slicer and other working space. The part next to the windows we will use for curing space, for which purpose we will divide it into, say six divisions, four of which will be 8 feet wide and the other two 14 feet wide. Let us use spaces 1, 2, 3 and 4 for white fruit, and spaces 5 and 6 for chops and waste, respectively. Let us assign kiln E and possibly part of kiln D for the chops and waste, while we will keep kilns A, B, C and part of D for the white stock. When the fruit on the kilns becomes dry it will be stored in space 1. The next day it will be turned over in space 2, the next into space 3, the next into space 4, and the next day it should be transferred to the storehouse. In this way there will be only the fruit from four days operations in the evaporator at any one time, the rest having been taken to the curing or storeroom.

The chop and waste may be stored in their respective places and turned every alternate day for a week, then either pack in barrels or remove to other storage.

PART II.

It was in the autumn of 1908 that this branch first undertook the duties of inspecting the evaporators of Canada.

At first the efforts of the inspectors were directed almost entirely towards securing better sanitary conditions and methods of operation, and along that line they had plenty to do. Owing to the large number of evaporators operating, many of them in out-of-the-way places, and the short duration of the season for working at the business, it was found that the two inspectors, then comprising the field staff, in addition to looking after the canning factories, could not give the evaporators the attention that they should have. For this reason, in 1912, temporary inspectors were appointed to act during the canning and evaporating season only, and from that date forward every evaporator has been visited regularly, most of them several times during each season. Unsanitary conditions were remedied, as far as possible, at once, while a reasonable time was given the manufacturers to meet all the sanitary requirements of the "Meat and Canned Foods Act." On account of the absolute unfitness of some of the buildings, or the unwillingness of the owners to properly operate them, three or four of the plants have ceased to be evaporators. Of all the others, those which were the best eight years ago are at least 25 per cent better now than they were then, while many are showing an improvement of 100 per cent or more.

In 1913 this branch decided to give some practical aid to the manufacturers of, and dealers in evaporated apples, and for this purpose undertook to collect samples, make tests, try experiments, and collect any information of interest in connection with the industry. For this purpose samples were obtained at most of the plants then in operation. These samples were taken by inspectors at the different plants, placed in air-tight cans of the type known as "Penny Lever." A label setting forth the information concerning the sample was placed on the can and the package sent to Ottawa for examination. Under the direction of Dr. F. T. Shutt, Dominion Chemist for the Department of Agriculture, a portion of each sample was examined for moisture. The balance of the sample was examined and classified along the following lines, viz., colour, cut, uniformity, trim, and general remarks.

Samples were taken from 102 evaporators, in all amounting to 136 samples of evaporated apples, and 64 samples of chop and waste. Of these, all but six samples were from packages ready for sale. A table showing moisture-content of these samples of apples ready for shipment will be given later in this article.

Uniformity.

In judging for uniformity, the even size of slice, the equal distribution of moisture, and the general appearance were the points taken into consideration.

The following was the classification decided upon:—

Good..	47 samples or	35 per cent.
Fair..	73 "	54 "
Poor..	16 "	11 "

Colour.

As practically all evaporated apples are bleached, this point was noted but the results not tabulated.

Cut.

In judging for cut the evenly cut, whole rings were classed as "good," the somewhat broken and uneven rings were counted "fair," while the badly broken and choppy pieces were classed as "poor."

The following was the classification decided upon for "cut":—

Good..	65 samples or	48 per cent.
Fair..	52 "	38 "
Poor..	19 "	14 "

Trim.

In judging for "trim," those slices which were free from skin or core were classed as "good," those which had small pieces of skin or core were classed as "fair," while those which had considerable skin or core were classed as "poor."

The following was the classification decided upon for "trim":—

Good..	45 samples or	33 per cent.
Fair..	65 "	48 "
Poor..	26 "	19 "

Remarks.

The principal remarks made were concerning fermentation and 42 samples out of the 136 examined, or 31 per cent, showed fermentation. Out of these, 16 samples were unfit for food. When one notices that 40 per cent of these samples contained 27 per cent or more of moisture, and that 42 of them were fermented within six weeks from the time they were packed it certainly proves that the packer should be kept within the legal moisture limit.

A circular setting forth the information gained by this examination was prepared. In it the samples were designated by numbers. Every packer from whom a sample had been taken was furnished with a marked copy of the circular, having the record of his own sample underlined with red ink. Other manufacturers were furnished with an unmarked copy. In this way every packer had a chance to see how his own goods tested as well as to see how they averaged with the pack of other manufacturers.

The appreciation of this circular, as expressed by a large number of the manufacturers, has been very encouraging to the officers of this branch.

In 1914, samples were taken in a manner similar to the method followed in 1913, except that in no case was a sample to be taken other than from a case or barrel ready for shipment. Samples were taken from 114 evaporators, in all amounting to 151 samples of evaporated apples, and 18 samples of chop and waste. The examination for moisture-content was made for 1914 under the direction of Dr. A. McGill, Chief Analyst for the Department of Inland Revenue. A table showing the moisture-content of this season's pack will follow later in this article.

As soon as the analyst advised this branch that the sample had shown moisture-content in excess of the (then) legal limit, an inspector was sent to detain all the pack of the manufacturer which was still in his possession, and hold for further testing. Samples were drawn from a number of packages throughout the different piles, enough to satisfy both the packer and the inspector that the mixture made from these samples would show a fair representation of the lot. From this mixture a sample was taken and sent to Ottawa for examination. If this test showed the sample to be within the legal moisture limit the goods were released, but if the second sample showed an excessive moisture-content, the manufacturer was required to re-cure the lot till it came within the legal moisture limit before he was allowed to dispose of it.

Owing to the lapse of time between the taking of the samples by the inspectors and the report of the test from the analyst, it is to be regretted that several of these extra moist lots were shipped out of the country before this branch could take action.

During the season of 1915, owing to the very few canning factories operating that season, the inspectors had more time to devote to the evaporating industry. It was decided that the inspectors should endeavour to take samples from each evaporator as often as possible. These samples were to be sent in to Ottawa to the laboratory of the Department of Agriculture promptly so that the tests could be made and the results reported as soon as possible.

There were 103 evaporators operating, and from these were taken 423 samples of evaporated apples and 243 samples of chop and waste. Of the 423 samples of evaporated apples taken, 353 were said to be ready for shipment, the balance were taken from piles for information to the packer only.

The manner of taking the sample was similar to that followed in 1914, and similar action was taken when a sample from a package was found to contain excessive moisture. Samples taken from piles were detained for further testing. A table showing the moisture-content of this season's pack will be shown later in this article.

There were 100 evaporators operating during 1916, and from the pack of these 185 samples of evaporated apples and 178 samples of chop and waste were taken. Any goods which showed a moisture-content exceeding the present legal limit of 25 per cent were detained for further curing. Of the 185 samples of evaporated apples taken, 174 were said to be ready for shipment.

The following table shows the moisture-content of the various samples for the years 1913, 1914, 1915, and 1916:—

	Years in which samples was taken.			
Per centage of Moisture in samples.	1913 Samples.	1914 Samples.	1915 Samples.	1916 Samples.
20 per cent or Less than 20.0 per cent..	8	13	32	48
20.1 per cent—22.5 per cent.. ..	15	22	65	45
22.6 " —25.0 "	22	41	109	52
25.1 " —27.0 "	31	30	71	15
27.1 " —28.5 "	12	15	35	11
28.6 " —30.0 "	16	6	13	2
30.1 " —32.5 "	12	10	14	1
32.6 " —35.0 "	8	8	10	—
35.1 " —37.5 "	6	3	3	—
37.6 " —40.0 "	—	3	1	—
	130	151	353	174

We think the foregoing table speaks volumes for the improvement made, and it is only fair to say that the good showing is largely due to the hearty co-operation of the packers of Canada, most of whom are anxious to do anything which will be of benefit to the industry.

An extra close study of the methods of work followed by the different manufacturers has convinced the writer that while some of the establishments are not properly equipped to profitably carry on the work, others are either incompetent to do good, work, or insincere in their desire to meet the requirements of the law.

There can be no excuse for any manufacturer packing goods which contain an excessive amount of moisture. The method for testing is so simple that any intelligent person can easily ascertain whether his goods are within the legal limit of moisture. Moreover, inspectors from this branch have visited the evaporators every week or two during the packing season, and have ever been ready to send in samples for information.

This branch has been making some experiments in connection with the packing and storing of evaporated apples.

Twelve boxes were procured, each box to hold 48 ounces net, of evaporated apples. Their construction resembled as nearly as possible that of an ordinary evaporated apple box, but smaller. Six of these boxes were lined with ordinary tissue or butter paper, the other six were unlined. Each box was carefully filled and marked. The fruit that was used with this experiment showed by test exactly 27 per cent moisture. The results derived from the experiment were as follows:—

The tissue-lined boxes were numbered 1, 2, 3, 4, 5, 6, while the unlined ones were numbered 7, 8, 9, 10, 11, 12.

On March 10, 1914, 48 ounces net was placed into each of the boxes, and all but numbers 4 and 5 were sealed up.

Boxes numbers 1, 2, 3, 7, 8, 10 and 11 were placed on an open shelf in the inspector's room in the Canadian Building, Ottawa. Here they were exposed to conditions similar to those to which they would be subjected were they on the shelves of an ordinary grocery store.

On the same date, boxes numbers 6 and 12 were placed in the cold room of a cold storage where they were left suspended from a hook on the ceiling till July 8, 1915, when they were removed and examined.

Box No. 4 was left open to the air from March 10, 1914, to March 16, 1914, when, upon re-weighing, its contents showed a loss of 5.3 ounces, or at this time the moisture-content would be 17.9 per cent. Into this sample was now carefully sprinkled and thoroughly mixed, 5.3 ounces of water, thus bringing weight up to 48 ounces, and its moisture back to 27 per cent. It was again packed into a tissue-lined box and put on the shelf with the other boxes where it was left till July 10, 1914, when it was again examined. This examination showed a loss in weight of 8.7 ounces, as well as a sample badly fermented. The sample was again sealed up and left till July 8, 1915, when on examination it was found to be a mass of dry rot.

Box No. 5 was exposed to the air from March 10, 1914, till March 18, 1914. On this later date the contents weighed 41 ounces, thus showing a loss of 7 ounces, and a moisture-content of 14.5 per cent. At this period, 7 ounces of boiled water was carefully mixed through the lot, thus bringing it back to its original weight of 48 ounces, and to its original moisture-content of 27 per cent. The sample was put on the shelf till July 2, 1914, when on examination it was found to be practically rotten. It was then repacked and left till July 8, 1915 when it was found to be a mass of dry rot.

Box No. 9 weighed 48 ounces net on March 10, 1914, when it was put into cold storage. On July 8, 1915, when taken from cold storage, it weighed 52.9 ounces, thus showing a gain of 4.9 ounces and a moisture-content of 33.5 per cent. The colour was fair, especially in the centre of the package. There was a small quantity of white mould on the outside, but the lot was perfectly free from any trace of fermentation at the time of examination. On this date a portion of the sample was put into an air-tight can and left in a warm room till July 19, 1915, when, on examination, it was found that fermentation had set in.

Box No. 12 weighed on March 10, 1914, 48 ounces net when it was put into cold storage. On July 8, 1915, it weighed 53.3 ounces net, a gain of 5.3 ounces and a gain of 7·3 per cent moisture. Examination of this showed some rot on the corners and edges of the package, but was generally free from fermentation. However, when the greater portion of this sample was put back into the box and left in a warm room for eleven days it was decidedly fermented.

It is interesting to know that while all the samples which were on the shelves of the office cupboard lost weight, those which were tissue lined lost on an average 2 ounces less than did those which were not lined, while the tissue-lined box at the cold storage took up 0.4 ounces less moisture than did the unlined one. This would lead us to believe that it would be profitable to tissue-line all boxes.

Again, it may be noted that those samples which had water added to them fermented and rotted, although their actual moisture-content did not exceed 27 per cent.

This experiment, together with scores of other instances which we have had brought to our notice, leads us to the conclusion that water, it matters not whether boiled or unboiled, cannot be added to evaporated apples, chops or waste, no matter how dry they may be, without causing the stock to spoil, sooner or later.

Earlier in this article we stated that there was no legal standard for quality for evaporated apples. There is, however, a legal limit of moisture.

The present legal limit of moisture permitted in evaporated apples, etc., is that fixed by order of His Royal Highness the Governor General in Council, dated the 16th day of March, 1916, which states: "4. Evaporated apples shall not contain more than (25) twenty-five per cent of moisture." Prior to this time the legal limit was that fixed by Order in Council under date of October 17, 1912, which fixed it at 27 per cent.

The old standard of 27 per cent undoubtedly has been of great value to the trade, but there is no doubt in the minds of most of the manufacturers, as well as the dealers, that 27 per cent is too liberal. Experience has taught them that apples containing as much as 27 per cent moisture are not safe to carry under ordinary conditions, let alone for overseas shipment, nor for ordinary storage during the summer months. Some manufacturers consider the legal limit the degree of moisture necessary to attain, but these are few. We have the assurance of most of the dealers, as well as of the makers of 75 per cent of the evaporated apples in Canada, that they consider 27 per cent as too liberal a limit, and that they are not only willing but anxious to have the legal limit of evaporated apples, chops and waste, 25 per cent instead of 27 per cent of residual moisture.

One of the largest manufacturers of, and dealers in, evaporated apples in Canada sent out a circular to the trade in the spring of 1914 asking them to co-operate with him in getting the Government to reduce the moisture standard from 27 per cent to 25 per cent. About 65 per cent of the manufacturers replied to his circular letter, and the writer has read these replies. Of the total number who answered, only one manufacturer objected. He did not think that there should be any legal limit set; he thought that the manufacturer ought to be his own judge as to when his stock was dry enough. It is interesting to note that this man's idea of properly dried apples, as shown from a sample taken from part of his pack in boxes at the railway station ready for shipment to England, showed a moisture content of 39 per cent, and he was not at all pleased when he was required to return his stock to the evaporator and re-cure it.

Not only have the majority of the manufacturers and dealers expressed their desire to have the legal moisture limit reduced, but officers of the Government who have made a scientific study of the matter have recommended it. Dr. A. McGill, Chief Analyst for the Department of Inland Revenue, and Chairman of the Advisory Board of that Department, in his Bulletin No. 293, dated September 14, 1914, says in part: "I am convinced that evaporated apples need not, perhaps I should say, ought not, to contain more than 20 per cent of water." Again referring to evaporated apples as food for our troops in the field, he says: "The excellent keeping qualities of properly dried apples, together with their ready portability, make this food peculiarly suited for the purpose suggested; and with such an object in view it might be well to reduce the residual moisture considerably below even 20 per cent," while in conclusion he says: "I am strongly of the opinion that 25 per cent should be made a legal maximum, and that evaporated apples containing no more than 20 per cent of moisture should be preferred."

In considering the subject of legal limit of moisture it might be well to explain what 25 per cent limit of moisture refers to. In the minds of some packers it means not more than 25 pounds of water in 100 pounds of evaporated apples, chops or waste, as determined by a specially designed drying oven such as is used in practically all laboratories. They consider that if they dry their fruit to such an extent as to contain not more than, say 15 pounds of water to 100 pounds of fruit, they are perfectly justified, when they are ready to pack this product in boxes or barrels for shipment, in adding sufficient water to raise the moisture content of the lot to 25 per cent. This is a mistaken idea, as the moisture limit named means the residual or natural moisture of the fruit, not added moisture.

There can be no doubt in the mind of anyone who cares to investigate the subject, that the addition of water to evaporated apples, chops and waste, no matter how small the quantity of water, or how dry the stock may be, constitutes an adulteration, inasmuch as it "reduces, lowers, and injuriously affects the quality," and invariably causes fermentation to start, and ultimately spoils the goods.

Thousands of dollars are lost every year by dealers through having bought stock which, though apparently dry when purchased, fermented and spoiled by the time it reached the consumer, while the cause, if traced back, would be found to be that the manufacturer had sprinkled his stock before packing it. The writer has in mind a case where the manufacturer was cramped for room and did not have sufficient curing space for his waste, therefore he dried it very dry so it would keep without turning.

At the end of the season when he started to barrel it he dampened it with water so that it would "pack good." When the waste was packed in barrels ready for shipment a sample drawn from the lot showed a moisture-content of only 18 per cent. The goods were held in good storage till spring, then shipped to Europe. On their arrival at destination the lot was found to be fermented and unfit for food, and had to be destroyed. The dealer lost $835 while all the packer gained by the addition of the water did not exceed in value $10.

This form of adulteration is particularly objectionable, inasmuch as it is almost impossible for scientists, let alone dealers, to detect it before the goods are spoiled, nor is the gain to the one man in any way equal to the loss to the other. The only proper action for a government officer to take when he finds a case of this kind would be to confiscate the goods and destroy them.

The principal market for evaporated apples is found in the central western provinces of Canada, and in Europe, although a few go to other countries. That this industry could be greatly increased is beyond question. To augment this trade, however, to any great extent, several conditions now existing must be remedied. A better class of raw fruit must be used, and improved methods of manufacturing, grading and packing, marketing, storing, retailing, and even cooking must be observed.

In too many establishments the class of fruit used is what is known as "wind falls." There is no reason why, if a good apple should fall from the tree during a wind storm or through other accident, it should not be used up at once. On the other hand, apples which have fallen from the tree through defect, or have laid on the ground till they have spoiled, are not fit for use. Some growers sell, and some manufacturers buy, apples that are only fit for hog feed.

There has been a great deal said about shipping out of the country the lower grades of apples, especially the No. 3 grade. Many shippers claim that these should not be allowed to be shipped even from province to province, let alone out of the country. We do not think it is at all profitable to ship a No. 3 apple. It costs just as much for barrel, freight, and delivery for a barrel of No. 3 apples as it does for a barrel of No. 1's.

Let us consider what this means: No. 3 grade of apples is made from "culls" which have been rejected from the lots out of which the No. 1's and No. 2's were selected. They include "fruit that is either small for the variety or immature, or the skin of which is broken so as to expose the tissue beneath, or that is so injured by insects, fungi, abnormal growths or other causes, as to render it unmerchantable." A large percentage of these culls have bruised or broken skins and this causes them to rot in a very short time, thus, not only being worthless in themselves, they cause decomposition in, and loss of flavour to the balance of the lot. As a rule, from four to six weeks from the time a barrel of No. 3 apples is packed will find it at least half spoiled. It would take a good part of this length of time to get the apples from the orchard to the store of the retailer in the Middle West, and when it has reached there the purchaser has, at best, a very inferior product which has to be disposed of within a few days, or loss will ensue.

Suppose the barrel of No. 3 apples had been evaporated, the bruises and spots would have been trimmed off and it would have produced about 16 pounds of first-class stock. Allowing an average retail price of 12½ cents per pound for these evaporated apples, the consumer could have bought the product of a barrel of No. 3 apples for $2. This is less than the average price for barrel, freight and cartage from Nova Scotia and Ontario points to Central West points, let alone the first cost of the fruit and packing, together with provision for two or more middlemen's profits, which will add in the neighbourhood of two dollars more. Then the consumer would have had an article of food, if properly prepared, just as palatable as the inferior green stock, and available twelve months in the year.

If the grower would give the cider-mill its just portion of the crop he would be able to get better prices for his "peelers" from the evaporator. On the other hand, it will avail the manufacturer little to get good raw stock if his methods of manufacturing are not correct.

To give an illustration of some of the mistaken methods in manufacture we will cite an instance which came under the personal observation of the writer during a visit to one of the evaporators. Entry was made at the storehouse where the first thing noticed was the finished stock. It was, without any exception, the most inferior lot of evaporated apples that we ever looked at. They were spotted all through with burned pieces, nearly every slice was broken, the majority of the slices had pieces of skin or core attached, while the lot had a "cooked" appearance. Just across the hallway was stored the raw fruit from which this stock was produced. There were about 1,000 barels there, and we are safe in saying that we never saw so fine a lot of apples in any evaporator; in fact, we believe that about 750 barrels of No. 1's and No. 2's could have been packed from the lot. With such good raw material to start with naturally we were led to seek the causes which led up to the poor finished product. They were not hard to find. On entering the work room we found that the paring machines were not doing good work, some knives were dull and some not properly adjusted. The operators did not give their whole attention to their work, little attention was given to the manner in which the apple was placed on the fork, with the result that the fruit was neither properly pared nor cored. The work of the trimmers was no better. We dropped an apple on the table of the slicer (one of the over-cut type) and it went three times around the circle before the knives caught it, and when it did pass through the gang of knives, five out of the seven slices were broken. On entry into the drying room upstairs one might easily imagine oneself in the steam room of a Turkish bath, while the heat in the furnace room down stairs was so intense that one could scarcely get one's breath. An examination of the ventilating system showed that all the provision made for intake air supply down stairs was through two small intake openings each 10 inches long and 6 inches wide (one of these was covered with boxes) while the air outlet upstairs was through an opening 6 inches by 14 inches. Instead of evaporating the moisture from his apples this manufacturer was baking the under ones and cooking the upper ones. He claimed it took from 2,500 to 2,800 pounds of coal to dry a ton of fruit. There is little wonder that he complained that there was little money in the business. We pointed out a few plain facts and left him, we trust, a wiser man.

Of course this is an extreme case; still, nine out of ten evaporators have one or more of these troubles to contend with, and each one adds to the cost of production, as well as deducts from the quality of the goods they manufacture.

The question of grading and packing the fruit is a very important one.

In the absence of legal standards it would be well for the manufacturer's own protection to divide his pack into three classes, viz., stock from early apples, stock from first-grade peelers, and stock from second-grade peelers.

The stock from early apples should never be mixed with the stock made from winter fruit. The stock from early fruit is practically as good in every way as that made from the later fruit except that it soon looses its colour, and when mixed with the winter fruit gives a "speckled" appearance to the lot. Again, the stock made from first-grade peelers should not be mixed with the stock made from second-grade peelers, because the former does not materially increase the value of the latter when mixed together. We believe that just as good price can be obtained from the "Early" and "Seconds" stock when kept separate, as is now obtained from the mixed lots, whereas a much better price could be obtained for the "Firsts." We are quite aware that some of the manufacturers will not agree with this statement, but we have the assurance of several of the largest manufacturers, dealers, wholesalers, retailers, and exporters in Canada, as well as those of four of the largest exporters in New York city that such is the fact.

For home consumption, the smaller cases and cartons seem to give the best satisfaction, but for export the larger cases and barrels are generally demanded.

The storing of evaporated apples is very important, whether they be in the possession of the manufacturer, the wholesaler, or the retailer.

A manufacturer should never be held responsible for goods that meet all the requirements of the law when delivered by him.

If a dealer, wholesaler or retailer, stores his goods where they take on moisture and spoil, or where they are subjected to extreme heat and dry out so as to appear short weight, that is his fault and no fault of the manufacturer.

A cool, dry, airy storehouse is the best for ordinary storage. During the warm summer months, cold storage is often resorted to. In selecting a cold storage one needs to investigate carefully the system of refrigeration used. A cold storage wherein the fruit takes on moisture is worse than no cold storage, as the goods will ferment almost immediately they come in contact with the warm air in the retailers store.

There are no definite statistics to show just how much of the dried product of the apple is used in Canada. Some of the largest dealers give an estimate that an amount equal to about three-quarters of the evaporated apples (white stock), one-quarter of the waste, and a very small quantity of the chops goes into home consumption. However, a close study of imports and exports of evaporated apples (including sun-dried apples, chop and waste), together with the knowledge gained through investigating the stocks of the various wholesale houses throughout Canada, convinces the writer that the manufacturers of this country do not produce as much white stock as the consumers use; that while the tables of imports and exports show a large balance in favour of exports, still the bulk of these exports is in the form of chop, waste, and sun-dried, while practically all the imports are in the form of white stock, or in reality, the imports of evaporated apples in the form of white stock is more than the exports of the same.

In conclusion, we would say that while the evaporated apple business is already an industry of no small importance, still it is, as yet, only in its infancy in Canada. Taking into consideration the number of apple trees which we have under cultivation, there is no doubt but what this country should be able to furnish a large portion of the markets of the world with evaporated apples, but to do this, intelligence in the manufacture and honesty in the packing must be observed.