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A HISTORY OF REFRIGERATION TECHNOLOGY IN THE WEST COAST FISHING INDUSTRY.

by Duncan Stacey

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Development of Cold Storage for Fish

Non Mechanical Systems

The first practical device for the freezing and subsequent cold storage of fish was invented by Enoch Piper of Camden, Maine, to whom a patent was issued in 1861[1]. His process was based on the well-known principle that a composition of ice and salt produces a much lower temperature than ice alone, a fact which had already been used in the production of ice cream, etc. The following is a description of Piper's apparatus and its applications.

> The fish were placed on a rack, in a box or room having double sides filled with charcoal or other nonconducting material. Metallic pans containing ice and salt were set over the fish and the whole enclosed. The temperature in the room would soon fall to several degrees below the freezing point of water, and in about 24 hours (the mixture being changed once in 12 hours) the fish would be thoroughly frozen. The fish were then covered with a coating of ice by immersing them a few times in ice-cold water or by applying the water with a brush, forming a coating about one-eighth of an inch in thickness. After the coating of ice was formed the fish were sometimes wrapped in cloth and a second coating of ice applied. In some instances they were covered with a material somewhat like gutta percha, concerning which much secrecy was exercised. The fish were then packed closely in another room, well insulated against the entrance of warmth, by means of double walls filled with some nonconducting material. Fixed perpendicularly in the second room were a number of metallic tubes, several inches in diameter, filled with a mixture of ice and salt to keep the temperature below the freezing point[2].

Piper also patented this process in the Dominion of Canada. A plant was established near Bathurst, New Brunswick in 1865. Its output consisted almost entirely of salmon, a large proportion of which were exported to the United States[3].

The Piper process was a distinct class of refrigeration technology based on non-mechanical chemical refrigeration or a freezing mixture which worked as follows:

> That a low temperature could be produced by the combination of two solid bodies uniting chemically to form a liquid has probably been known by scientists for centuries. In 1762 a mixture of crushed ice or snow and salt was employed by Fahrenheit when he obtained his zero temperature and placed the freezing point of water at 32. The action of the frigorific mixture is due to the absorption of latent heat. When, for instance, certain solid substances, such as ice and salt, are brought together, the tendency to combine and melt is so great that heat absorbed in the action cannot be supplied from external sources as quickly as it is required by the two substances. Consequently, the internal heat of the two substances themselves is drawn upon, they become chilled, and the temperature drops until the heat drawn from the two sources--external and internal—is sufficient to keep pace with the rate of melting[4].

The principal limitation of Piper's process was that the fish were not in contact with, the freezing mixture during the freezing operation and consequently too much time was required for them to become thoroughly frozen. This problem was solved by the pan process, patented in 1868 by W. Davis of Detroit, Michigan, which involved the use of two thin metal sheet pans so that the fish came in direct contact with the freezing mixture[5]. The above process was used without any great modification until the development of mechanical methods of freezing and the introduction of ammonia compression freezers in the fish industry in 1892.[6]

Mechanical Systems

Further discussion of the non-mechanical freezing process is not within the scope of this study as only mechanical freezers were used in relation to the

Gulf of Georgia site and in the British Columbia fisheries in general. With regard to systems of mechanical refrigeration, it is important to note that all are based on the principle that when a liquid (e.g. ammonia) passes into a gaseous state, it carries away a certain amount of heat from the objects surrounding it.

There are two types of mechanical refrigeration. The first utilizes a gas which is compressed, partly cooled, and then reduced to a low temperature by expansion while doing work, using the low temperature produced to abstract heat from the substance to be cooled. The second type produces its refrigerating effect by the evaporation of some volatile liquid having a low boiling point. Until the early 1890s the most commercially successful method of producing low temperatures by mechanical means was the first type of machinery described above; machines using gas or cold air were invented in the 1840s. By the early 1890s, however, the second type of machine became more important because of its greater economic efficiency.

The forerunner of the modern compression machine was invented in 1834 by Jacob Perkins, using sulphuric ether as the agent. This machine, however, never got beyond the experimental stage. It was not until 1857 that James Harrison of Geelong, Victoria, Australia, improved the compression machine and, using sulphuric ether as the agent, brought it into practical use in breweries and in the refrigeration of meat, paving the way for the enormous development of the frozen meat industry in Australia.[8] However, there were several problems with using sulphuric ether as an agent. It was very flammable, it required machinery much larger than that using ammonia or carbon dioxide as an agent and, as both the forward and back pressures were below that of the atmosphere, there was trouble in keeping air from leaking in at the compressor glands.[9] With the introduction of the ammonia compression machine by Professor Linde in 1873 the need to use sulphuric ether, the major drawback of the Harrison compressor, was eliminated.

The compression system consists of three operations which follow each other in rotation, and which are practically the same in all refrigerating machines. By means of a large compression pump, anhydrous ammonia, which is the gas usually employed, is compressed to a pressure varying from 880 to 1230 kilopascals (125-175 lb/in.^{2}). During this operation heat is developed according to the amount of the pressure exerted upon the gas or to the relative volume to which it is reduced, and this heat is withdrawn from the compressed gas by forcing it through coils of pipe in contact with cold water, the heat being transferred to the water. The gas is now ready to assume a liquid state, and in so doing transfers additional heat to the water surrounding the pipes. The liquid "gas" thus obtained is allowed to enter coils of circulating pipe at a pressure much lower than that required for retaining the gas in a liquid state, whereupon it reexpands and extracts from the pipes and the substances surrounding them a quantity of heat equal to that which was previously given up by the gas during the period of condensation and liquefaction. The gas is then drawn from the expansion coils by the pumps at a pressure of 70 to 105 kilopascals above that of the atmosphere, is again compressed in the condensing coils at a pressure of 880 to 1230 kilopascals, and the same cycle of operations is repeated. Various modifications of the above, as well as auxilliary processes, have been introduced, but the principles are the same in all compression machines, the differences being in their application.[10]

Early Development of Pacific Coast Mechanical Systems

A market for fresh and frozen fish products was developed on the Pacific Coast only because of the introduction of mechanical refrigeration which produced the chilling medium either in the form of ice for preserving fresh fish and/or freezer units for freezing fish. This made possible storage and shipment to distant markets. Refrigeration technology revolutionized and expanded the industry's capacity for industrial preservation beyond canning technology, the only type available since the 1870s.

Cold storage had a number of important effects on the fishing industry. It broadened the range of species available, making possible the utilization of salmon considered unsuitable for canning. It also led to the development of the halibut and groundfish fishery, and of a herring bait fishery for the halibut and groundfish fishery.

Before the advent of refrigeration technology generally only the oily, red-fleshed salmon such as sockeye were used, as canned salmon had to have a high oil content. With the introduction of cold storage other species of salmon became marketable because the best freezer fish are those with a low oil content; a high oil content is conducive to rancidity in frozen fish.

With the introduction of chilling and freezing the system of "highgrading" came in. Under this, salmon were sorted according to their suitability for various markets—fresh, frozen, or canned (the market value being generally in that order). Being able to use this grading system gave a fishing company a competitive edge. It could pay a higher price per pound for salmon as the margin on non-cannery grades of fish was great enough to permit a substantial increase on the price of sockeye, the basic species used in canneries before the early 1900s.[11] Ice and refrigeration also gave a company the ability to hold its fish longer, not having to process them immediately. Before refrigeration was available, a company might have to throw away fish it could not process within a certain time span.

Refrigeration technology not only revolutionized the salmon industry but also created the modern halibut and groundfish fishery. Without ice and/or freezers, transporting fish from the fishing grounds to the processing plant and then to the major market (eastern North America) was impossible. In addition, it was possible to produce the major groundfish bait (herring) much more cheaply by freezing than by the traditional salting method.

Early Mechanical Refrigeration in the British Columbia Fishery

Mechanical refrigeration was first introduced into the British Columbia fishery in the late 1880's as a direct result of the completion of the C.P.R. transcontinental railway in 1885. This rail link provided direct access to eastern markets for fresh (packed in ice) and frozen B.C. fish.[12] Prior to the 1890's this was steelhead trout and spring salmon; after that date halibut and groundfish also made their way to eastern markets. The first B.C. fish freezer was constructed in either 1886 or 1887 at New Westminster on the Fraser River and had a 22,860 kg (50,000 lb) storage capacity.[13] Unfortunately its method of refrigeration is unknown but presumably it employed a mechanical system. In 1895 four fish freezers were operating in B.C. and exporting 566,350 kg (1,250,000 lbs) of fresh and frozen salmon and 906,000 kg (2,000,000 lbs) of fresh (in ice) halibut. Canning technology still dominated the salmon fishery, however, as export of this product exceeded 13 million kg (28 million lbs).[14] In 1906, with the establishment of the Canadian Fishing Company's Home Plant in Vancouver, exports of fresh and frozen salmon had reached 2,235,885 kg (5,156,480 lbs) and halibut 5,171,765 kg (11,416,700 lbs).[15]

Evolution of Home Plant, CFC, Refrigeration System: the "Triumph Ice Machine", 1906 - 1980s

Introduction

For the period between the establishment of the Gulf of Georgia cannery in 1894 and the plant's aquisition by the Canadian Fishing Company in 1926, no documents have come to light regarding the use of refrigeration technology. In addition, there is no structural evidence that the site ever contained a freezer unit. Since 1926 all its fresh and frozen fish operations have been supplied by the Home Plant located at the foot of Gore Avenue in Vancouver. To understand these operations it is therefore necessary to study the Home Plant's fresh and frozen fish operations.

Between 1906 and the construction of the present freezer plant in 1911 Home Plant served merely as a transshipment point for halibut.[16] Company vessels unloaded dressed halibut which was graded, boxed in ice, and then packed into refrigerator cars. As the plant had no freezer, fish could be held for no more than a few days in ice. This ice was provided by the International Ice and Cold Storage Company which was just across the C.P.R. tracks at Gore Avenue[17] (see Figure 1).

This Home Plant operation began in 1906 with the formation of the Canadian Fishing Company and construction of a fresh fish operation. Unlike other major fishing companies at the turn of the century (such as the Gulf of Georgia) the Canadian Fishing Company and its parent company (from 1910 to 1978), the New England Fishing Company, did not use canning technology; they were originally established solely for the fresh and frozen fish trade based on freezing technology. The C.F.C. did not venture into salmon canning until 1917 when a fire destroyed much of the plant and even then this cannery was only an adjunct to the fresh and frozen fish operations (see photos 1 and 2).[18]

The Home Plant is located directly on the C.P.R.'s Vancouver waterfront line. The choice of this location was not accidental as fresh and frozen fish operations relied solely on eastern markets to which the C.P.R. provided the only direct access. Direct access to markets was essential for fresh fish packed in ice due to their short preservation period compared to frozen fish. Fresh fish was more sought after than frozen, however, and commanded a premium price. The company's reliance on fresh fish resulted in its being taken over in 1910 by the New England Fishing Company (Nefco) which controlled the eastern markets for this product.[19]

Nefco had entered the British Columbia fresh fish trade in 1894 and by 1898 controlled this sector of the industry.[20] This control derived not only from its position in the eastern markets but also because it was the only company in British Columbia allowed to ship its fish in bond to eastern U.S. markets. This bonding privilege was first issued in 1898 by an Order-in-Council and was reissued annually.[21] The Order-in-Council gave the New England Fishing Company control of the fresh and frozen fish export market as all other B.C. companies had to pay a 1¢ per pound import duty on fish entering the U.S. and thus they could not compete. The privilege was strenuously supported both by the C.P.R.'s Special Traffic division and, until 1907, by the Vancouver Board of Trade due to the volume of supplies and of employment associated with Nefco's Vancouver operations. After 1906 the Vancouver Board of Trade reversed its support of the company's privilege under pressure from other B.C. fishing companies, especially B.C. Packers: "We hereby beg to make an application to be put upon the same terms, as regards the use and privileges granted the American registered boats belonging to the New England Fish Company as that Company enjoy".[22] The C.P.R., however, continued to support Nefco's privileges because, "This halibut is one of the best paying freight the C.P.R. has. It is all carried by express".[23] The C.P.R. argued that if it did not support Nefco's privileges, the carrier trade would fall to American carriers south of the border, specifically out of Seattle, "and I take it for granted that you [the Minister of Fisheries] would prefer to have us get any benefits resulting from the shipment of this fish, rather than have them go to the transportation lines south of the International boundary".[24]

As previously mentioned, the C.F.C. was formed in 1906, but its reliance on the fresh fish trade meant that it had to export by means of the New England Fish Company which controlled that trade both through its bonding privilege and its control of the major distribution market area, the eastern

United States. Prior to 1907 Nefco could not enter the smaller eastern Canadian market as under its bonding privilege it could only ship its fish to the United States. The U.S. market, however, only wanted medium sized fish, from 5 to 36 kilograms (12 to 80 pounds). Smaller or larger fish could not stand the carriage as well as fish of medium size.[25] Thus most large or small fish were culled during the fishing operation and thrown back as scrap or sold on the local market.[26] This culling was a waste of fishing effort as well as damaging to the fish stock; many died as a result. Although the small fish commanded the highest price, they were saleable only to the limited local markets to which Nefco did not have access without paying the bonding charge. To relieve this problem and to increase profit, Nefco offered these small and large fish for consumption in Canada, paying duty on them and disposing of such fish through C.F.C.[27] As C.F.C. was a Canadian owned company it had the direct access to the Canadian marked which Nefco lacked. In 1910 Nefco gained a controlling interest in the C.F.C.'s Home Plant as a subsidiary, thus ensuring itself direct access to both the American and Canadian markets.

With the purchase of the C.F.C. plant Nefco integrated its building and that of C.F.C., both located on the same dock at the foot of Gore Avenue (see Figure 2), into the original Home Plant of the present C.F.C. The present (1985) Home Plant dates from 1916, except for the freezing plant, which dates from c. 1906-1910. In 1916 a fire virtually destroyed the original Home Plant, leaving only the freezing and ice making plant at the east end of the cold storage fish warehouse.[28] This area was actually the major part of the original (1906) C.F.C. plant.

In October of 1910 construction began on Home Plant's freezing and ice making facilities.[29] Prior to this, ice for the fresh fish operations was obtained from Vancouver Ice and Cold Storage and the International Ice Company. The power of the New England Fishing Company in the Vancouver ice buying market is illustrated by the fact that in 1907 the contract price of ice from the Vancouver Ice and Cold Storage Company was $4.00 per ton to the C.P.R. but only $3.50 to Nefco.[30]

On its completion in 1911, this new Home Plant contained the largest cold storage and refrigeration plant on the Pacific Coast. It had a cold storage capacity of 8400 m^3 (300,000 cubic feet) or room for 2,720,000 kg (6,000,000 lbs) of fish and an ice-making plant capable of producing 45 tonnes (50 tons) a day.[31] It held this distinction until 1912 and the construction of the Canadian Fish and Cold Storage Company's[32] plant in Prince Rupert which had a storage capacity of 21,868 m^3 (781,000 cubic feet), and which had the distinction of being the biggest fish freezer in the British Empire for many years.[33]

Compression System

The Home Plant refrigeration system may be described as a heat pump for the simple reason that its main function was the abstraction of heat from one body (either cooled fish or water), then the continuous and automatic transfer of that heat to the refrigerating or cooler agent, ammonia. The method of refrigeration employed is called the compression system whereby the abstraction of heat is effected by the evaporation of a separate refrigeration agent, of a more or less volatile nature, which agent is subsequently restored to its original physical condition by mechanical compression and cooling.

In this system, the process of refrigeration is a continuous cycle divided into three stages: compression, condensation or liquefaction and direct expansion or evaporation. The refrigeration plant is made up of three basic units: 1) the compressors, located in the engine room, where the ammonia gas is compressed, 2) the condenser, where the compressed warm gas imparts its heat to cold water and liquifies, and 3) the direct expansion coils located in the freezers where the liquid re-expands to its original gaseous state, thereby absorbing heat and performing the refrigeration work. In order to make the operation continuous the three parts are connected; the charge of gas originally put into the machine being used over and over again, going progressively through the process of compression, condensation, and evaporation. Thus only a small quantity of gas is required to replace any losses. The compressor draws the gas from the expansion coils, compressing it to the liquefying pressure (which depends upon the temperature of the cooling water in the condenser). The compressed gas is discharged into the condenser where it imparts its heat to the water in the condenser and becomes a liquid. The liquid is then returned to the expansion or cooling coils, expanding through the coils and thereby absorbing heat. The surface of the cooling coils is so proportioned that all of the liquid evaporates as it passes through. From there the gas again returns to the compressor to resume the cycle of operation. The pressure of the gas in the coils is controlled by means of a valve.

Direct Expansion System

In the direct expansion system extra heavy wrought iron pipe coils are placed in the rooms to be cooled, either on the ceiling, the walls or in lofts built for this purpose. Connections are made between the coils and the liquid receiver at the outlet of the condenser. An expansion or regulating valve is placed between the small liquid pipe and the large expansion coils. The liquid is fed through the coil to a gaseous state. During its evaporation the carbonic anhydride or ammonia absorbs heat from the surrounding atmosphere and then returns to the compressor. For general cold storage plants, breweries, packing houses, candy factories and similar plants, the direct expansion system is preferable to the compression. It is the simpler system, requires less machinery, is more efficient, needs less attention and for these reasons is used wherever possible. With carbonic anhydride the direct expansion system can be used in many places where it would not be advisable with ammonia. In case of a leak in the expansion coils with the carbonic anhydride system no damage can result, while with the ammonia system the result might be disastrous.

Triumph Ice Machine

The basic machinery of the plant's refrigeration unit was a pair of 42 H.P. Triumph ammonia compressors, manufactured by the Triumph Ice Company[34] (see photo 3). One of these original compressor units was acquired by Parks Canada in 1985 for the Gulf of Georgia site. These compressors were driven by two 150 H.P. Canadian General Electric Company electric motors, using a rope drive (see photos 4 and 5). The components and specifications of the compressor unit are as follows:[35]

C.F. Co. Ltd.	Cold Storage Building	F.O.B. Plant Installation Cost Added 1924		F.O.B. Plant Installation Cost Added 1927		F.O.B. Plant Installation Cost Add 1928	
	<u>Machine #2, Ice Machine</u>						
1	12x20" Twin ice machine #213 and 214 with 15'x19' flywheel grooved for 12 - 1" ropes; Mfd. by Triumph Ice Machine Co., Cincinnati, O., f.o.b. Vancouver		19,075.00		19,075.00		19,075.00
	Installation		750.00		750.00		750.00
	<u>Foundation</u>						
48	Cu. yds. concrete in piers and footing slab laid on bed rock	27.00	1,296.00	27.00	1,296.00	27.00	1,296.00
	<u>Transmission</u>						
1,210'	1" Manila transmission rope	.07 1/2	90.75	.07 1/2	90.75	.07 1/2	90.75
1	48" single groove idler sheave for 1" rope		62.50		62.50		62.50
5'	2 15/16" Shafting	1.96	9.80	1.81	9.05	1.81	9.05
2	2 15/16" x 24" Collar oiling adjustable drop hangers	27.40	54.80	24.50	49.00	24.50	49.00
2	2 15/16" Set Collars	1.62	3.24	1.50	3.00	1.50	3.00
1	48" Single groove sheave on tension carriage on 32 lin. ft. 3" channel track with 10 - 1 1/2x30" pipe hangers and braces and counterweight and cable and sheave		235.00		235.00		235.00

C.F. Co. Ltd.	Cold Storage Building	F.O.B. Plant Installation Cost Added 1924		F.O.B. Plant Installation Cost Added 1927		F.O.B. Plant Installation Cost Add 1928	
	<u>Section #2, Motor, Drives Ice Machine #2</u>						
1	130 H.P., 360 R.P.M., 2300 volt, form P, 37A, 3 phase, 60 cycle, type I, wound rotor Canadian General Electric induction motor with adjustable sliding base, with attached outboard bearing, 36" sheave with 12 grooves for 1" rope and T 20 B General Electric drum controller, #5023 with starting resistor, f.o.b. Vancouver		4,180.00		4,420.00		4,420.00
	Cartage and Installation		150.00		150.00		150.00
	<u>Millwrighting</u>						
	Timber supports		80.00		80.00		80.00
17	Lin. ft. 1" pipe guard rail	.35	5.95	.35	5.95	.35	5.95
1	Wood cover		7.50		7.50		7.50
	<u>Wiring</u>						
2	3" Type FE condulets	18.00	36.00	15.18	30.36	15.18	30.36
161'	3" conduit	1.62	260.82	1.47	236.67	1.47	236.67
195'	#4/0 Rubber covered wire	.34	66.30	.32	62.40	.32	62.40
20'	#1 Rubber covered wire	.17	34.17	.15	3.00	.15	3.00
	Total Section #2		4,820.74		4,995.88		4,995.88

This Triumph compressor unit was technologically advanced for its time as it employed an electric power motor. Electric power was a crucial innovation in freezing technology introduced at the turn of the century. Originally mechanized refrigeration plants were steam powered, but this power source was extremely bulky and expensive to operate due to manpower needs. With the application of electric motors to refrigeration units and with the resulting diminuation of ice and cold storage compressor units in size and the lower manpower input compared to steam machine operations, there was a rapid adoption of freezer operations in the Pacific fishery's shore operations.[36] In addition, with ammonia refrigeration units based on compression (like the one being studied) electric power was preferred over steam for their operation.[37]

The first industrial application of the Triumph ice machine system was at the meat (beef, veal, and mutton) refrigeration plant of Jacob Schlachter and Sons at Cincinnati, Ohio, circa 1893.[38]

In the early 1900's there were two general types of compressors: the vertical single acting and the horizontal double acting. The Triumph was the latter type. Unlike vertical compressors, horizontal were always made double acting. While North American compressor manufacturers generally produced horizontal models, Europeans produced vertical models. Although the single acting vertical compressor was more economical in operation than the usual horizontal double acting type, frequently the latter was preferable when a cheaper initial cost or lack of headroom was the deciding factor.

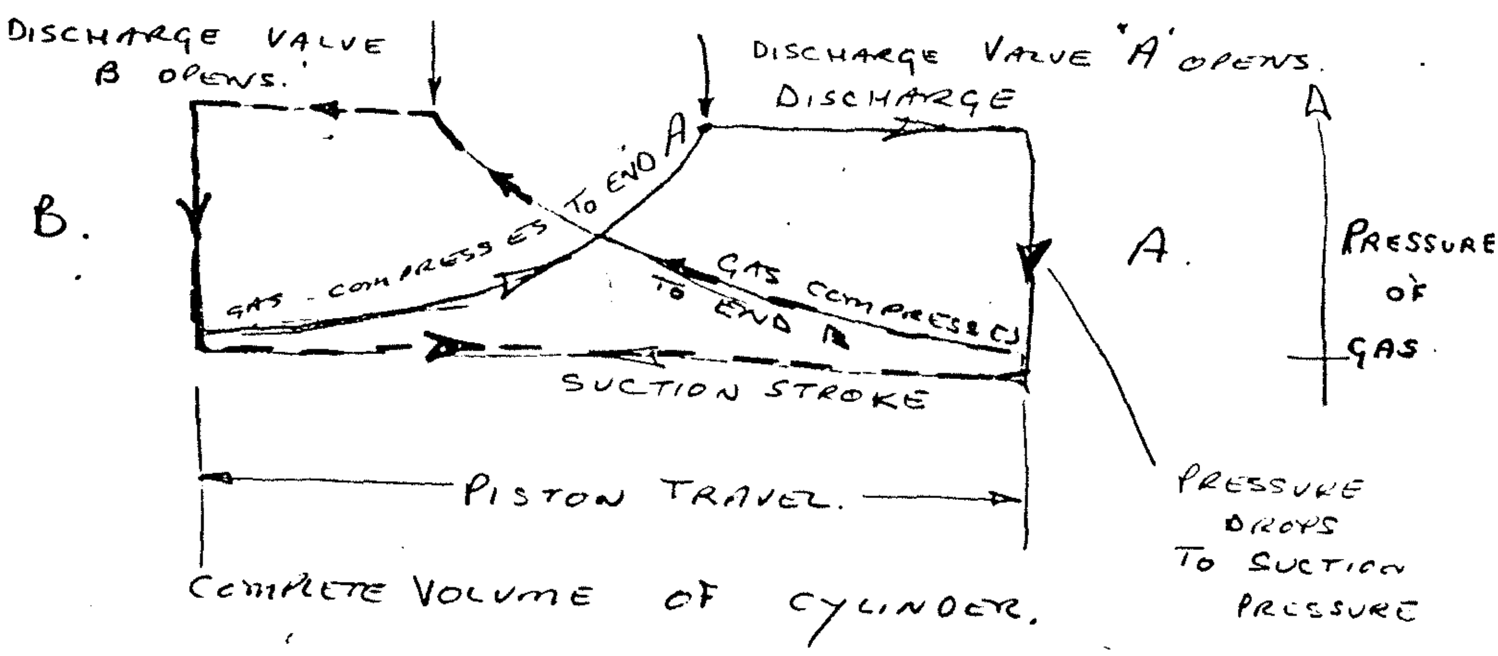
An understanding of the operation and merits of the Triumph ice machine can best be accomplished by explaining its construction and double acting reciprocating compression system.[39] The machine is constructed by the two cylinders being displaced one each side of the flywheel which is cut with 10 "U" shaped pulley grooves (see photos 6 and 7) and driven by a separate electric motor (see photo 8). By placing the flywheel in the centre of the foundation (see photo 9), only two main bearings are required, and the crankpins may be overhung (cantilever off) the crank discs at the end of the shaft. This reduces the cost of construction and also places the running gear on the outside of the machine making maintenance tasks easier. The drive was by endless rope between the electric motor and flywheel with a takeup and circulating pulley situated overhead between the two. The rotary motion of the flywheel was converted to reciprocating motion to the piston by the overhung cranks, connecting rods, crossheads, and piston rods.

Double acting refrigeration compressors (and indeed air compressors as well as diesel engines) perform a working stroke as the piston moves in each direction, hence the fitting of suction and discharge (delivery) valves on each end of the cylinder. The best way to understand this is to examine the operation of the compressor through one complete revolution of the flywheel and consider only one cylinder. At any point in time the other cylinder is doing exactly the opposite i.e. the cranks are situated at 90° to each other.

As the piston travels to the right it approaches the cylinder head compressing the gas into the volume "A". When the gas pressure in volume "A" overcomes the load on the discharge valve spring, the gas is discharged through the discharge valve to the condenser. After the piston passes top dead centre on the crank pin (sometimes called outer dead centre on horizontal machines) the piston now moves to the left. Any gas left in volume "A" re-expands with the increasing volume until its pressure drops below the pressure in the suction pipe coming from the evaporator; gas now flows from the evaporator into the cylinder and will continue to do so as long as the piston is moving to the left.

During this movement to the left the other side of the piston is compressing the gas into volume "B", reducing the volume and discharging the gas to the condenser via discharge valve "B". When the piston reaches its bottom dead centre (or inner dead centre) it again reverses direction and commences a suction stroke on end "B" and a discharge stroke on end "A".

Graphically the two strokes are represented below.



Arguments over advantages and disadvantages of horizontal as opposed to vertical machines have been pressed by manufacturers over the years.

The main disadvantage of the horizontal machine is the piston acting as a cantilevered weight inside the cylinder. The piston tends to wear the bottom of the cylinder and produce a leaky piston. This leads to lower efficiency as high pressure gas escapes past the piston rings to the low pressure side of the piston, resulting in less gas pumped per stroke.

Its main advantage is its lower centre of gravity. The machine foundation can be smaller. This also enables the cross heads to be incorporated into the bed plate so reducing total weight of castings. It also means the compressor can be fitted into a lower building and places the running gear within easy sight and touch of the operating engineer. This ensures that the machine is "tended" more often which in itself guarantees less breakdowns and repairs: hence a claim by horizontal manufactures of lower maintenance costs.

As the purpose of the compressor is to pump gas through the system any reduction in the quantity of gas pumped per stroke means a loss of efficiency in the system.

As explained earlier the gas remaining in volume A (and volume B) at the end of the stroke re-expands. To reduce this volume to a minimum, the piston and cylinder head are made spherical and as nearly matching as possible (a small clearance must be left to prevent mechanical contact). However, when this gas re-expands, the pressure drops slowly, allowing the suction valve to open slowly. This opening tends to slow down the rate of gas flow into the cylinder, wire drawing occurs, creating a drop in pressure through the valve and hence the cylinder does not fill to capacity. Modern compressors are built with valves as light as possible to reduce the inertia of the valves and thus encourage rapid opening.

The Triumph compressor also has distinctive features in valve construction and in the number of valves. An essential characteristic, and in fact that feature demanding the most extreme care in designing a thoroughly efficient compressor, is the construction of the suction and discharge valves. According to its advertising pamphlet,

> The Triumph Ice Machine Co. has succeeded in perfecting a valve which is adapted to every condition which

can arise in the operation of an ammonia compressor. Certain companies contend that we have sacrificed simplicity and that the Triumph valve is so intricate as to become a hindrance. Such an argument in comparing a Slide Valve and a Corliss engine would sound most ridiculous, for the reader can fully appreciate those distinctive features of the Corliss type of engine, which permit an accuracy of adjustment which is impossible with an engine of the Slide Valve type. The same principle applies to compressor construction and from the following description the reader will understand why the parts added to the Triumph valve produce economy of operation which would otherwise be impossible. The Triumph valve is ground to a seat in the cage, after which the cage is inserted in the cylinder head, which in turn is also ground to a perfect seat; the complete head with valves and cages is then placed in the lathe and turned to the proper radius. All pockets are thereby eliminated and a full discharge of gas is insured.

Many other types of compressor valves are retained in the valve ports by means of the valve bonnet, requiring this bonnet not only to make an absolute joint between itself and the head, but also a joint between the bonnet and cage, and the cage seat and the cylinder head. It is mechanically impossible for the valve bonnets to maintain a tight joint at these three points under all conditions, and eventually serious leaks will occur. Many times the valve will work loose from its seat in the head and permit the discharged gas to leak back on the return stroke into the cylinder. This causes re-expansion of compressed gas and materially reduces the capacity of the cylinder.

The main stem of the suction valve is provided with an adjusting nut or collar which regulates the tension of the cushion spring; on this inner collar is arranged a secondary collar with which the working spring is adjusted. These two collars are maintained in their correct position by keepers which absolutely prevent them from working loose. The safety collar in the suction valve is of the split pattern arranged in a stationary position between the valve seat and valve cage. This collar in no way interferes with the action of the valve stem, and therefore is not subject to wear; owing to its position however it will absolutely prevent any portion of the valve from falling into the cylinder in the event of any part becoming accidently disarranged. The openings in this valve are much larger than the area of the suction pipe, thus preventing wire drawing gas.

The valve cages are held in position upon a ground joint by means of a retaining collar screwed into the housing or port. This retaining collar is fitted with set screws in such a manner that by tightening them, an exceedingly heavy pressure is exerted on the valve cage, forcing it upon the ground joint, and preventing the leakage of gas. This arrangement also relieves the bonnets of the discharge pressure.

We invite your comparison of this feature in the Triumph with those machines in which a lead gasket is used between the cage and seat. It will be noted that where a lead gasket is employed, the gasket will frequently become heated to fusion point, inducing leakage of gas from the discharge back into the cylinder, with a consequent reduction in compressor efficiency.

By means of the regulating device, the engineer may make such adjustments as will exactly conform to the pressures to which the valves are subjected. This advantage is peculiar to the Triumph construction. As a result of the safety features contained in these valves, in addition to the regulating device, they are recognized as the most reliable cylinder valves on the market. So well known is their success that we are constantly in receipt of orders to supply the Triumph valve on machines of other makes.

An additional advantage of the Triumph construction is the fact that the valve ports are so arranged in the cylinder heads as to permit the removal of the entire valve at a moment's notice.[40]

The Triumph's utilization of five valves (three suction and two discharge) is of key importance to the machine's efficiency (see Illustration 3). The third, or auxiliary, suction valve is much lighter than the main valves and perfectly balanced; the machine's economy is due largely to its use. The main suction valves must of necessity be sufficiently large to admit the charge quickly at the beginning of each stroke; the springs controlling them must, therefore, have appreciable tension, and it can readily be seen that in consequence the pressure of the gas in the cylinder, during admission, must necessarily be less than in the suction pipe by just the tension of these springs. The above is true of all machines, but by the use of the auxiliary suction valve, which is comparatively light, and operated with a very light spring, the "Triumph" machine equalizes these pressures, obtains a larger charge at each stroke, and in consequence operates with a materially greater efficiency.[41]

As with virtually all American produced ammonia compressors this machine is based on a horizontal cylinder system (European compressors are based on vertical cylinders). According to its producers, the advantages of the horizontal design were twofold.[42] The machine's direct connection to its engine with the flywheel resting on the crankshaft, at equal distance from both engine and compressor cranks, assures the proper distribution of power. The second advantage is the ease with which a horizontal machine can be operated, the valves regulated, and all the moving parts adjusted while the machinery is in operation, lessening the danger of accidents that so easily occur when the attendant is compelled to climb numerous stairways to handle the machinery, as with vertical compressors. One other advertising feature of Triumph machine is its aesthetic appeal: "while at the same time graceful curves replace abrupt angles, adding a beauty seldom found in this class of machinery".[43]

Virtually all the Home Plant's original refrigeration equipment (with the exception of the compressors' General Electric Company electric motors was supplied by the Triumph Ice Machine Company.

Originally the refrigeration process was a single stage system; today it is a two stage system (see Illustration 6). A single stage system uses only the main compressor while a two stage system uses a main compressor and a booster compressor. The function of the booster compressor is to compress the ammonia gas, in the Home Plant's case to 11 kg (25 lbs) before it enters the main compressor. In the two stage system the booster creates the vacuum; in the single stage system the vacuum is created by the suction side of the main compressor. The Home Plant system was converted from a single stage to a two stage system between 1931 and 1937 by the addition of two booster compressors produced by the York Company.[44] The components and specifications of these compressors are as follows.

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #16, Booster Compressor			
1	Model D6 York 15"x10" double cylinder vertical single acting, special booster compressor, Shop #67678, complete with Manzel 6 run oil pump, built in oil pump and splash oiling base, water cooled heads, enclosed by-pass, complete with V belt drive: Mfd. by York Mfg. Co., York, Pa.			
	F.O.B. Plant		6,825.00	6,143.50
	Installation		100.00	100.00
	Foundation			
1	Concrete block 7 1/2"x8', 10' deep to top of floor, with 1 1/2'x3' projection and moulded top for machine base		416.00	416.00
	Total Machine #16		7,341.00	6,659.50

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #17, Booster Compressor			
1	Model D6 York 11 1/4"x8" double cylinder vertical single acting, special booster compressor, Shop #67677, complete with Manzel 6 run oil pump, built in oil pump and splash oiling base, water cooled heads and enclosed by-pass, complete with V belt drive; Mfd. by York Mfg. Co., York, Pa.			
	F.O.B. Plant		3,995.00	3,555.00
	Installation		95.00	80.00
	Foundation			
1	Concrete block 5 1/2'x6 1/2', 10' deep to top of floor, with 1 1/2'x3' projection and moulded top for machine base		256.00	256.00
	Total Machine #17		4,346.00	3,891.00

Description of Home Plant Freezer Fish Processes

Introduction

Canfisco's refrigeration and freezing plant consists of two major processing operations, the first, fresh and frozen fish, and the second, ice making. From the time of the plant's original construction in 1910 and its reconstruction in 1917, little has changed in its basic technology and operation; apart from palletization, totes, forklifts, synthetic packaging, and the replacement of the original compressors by more modern units, the process in the 1980s is basically the same as in the early years of the century. Thus a study of the present operation will provide the best means of understanding fresh and frozen technology, especially as virtually no records have been located on the plant's early operation and it is doubtful that such records exist.[46] As Fernand Braudel notes: "Economists and more particularly historians will of course caution us against the procedure of extrapolating from the present to understand the past", but no alternative appears possible considering the lack of information available.[47]

Fresh and Frozen Fish

Fresh and frozen fish production lines consist of the same processes in the initial stages; after the second or internal grading process fresh fish are cooled in ice (but never frozen) and frozen fish enter the freezing process.[48] The fish arrive at the cannery uncleaned ("in the round") by boat or truck. Traditionally they were packed in ice but today they more often arrive in refrigerated salt water (R.S.W.) or champagne chilled salt water (C.S.W.) systems. Halibut have always been packed in ice. They must be cleaned and "de-nutted" (have their sex organs removed) aboard the fishing vessel or they taint and are unmarketable and R.S.W. and C.S.W. are not suitable for transporting cleaned or dressed fish. Originally the fish were unloaded by Chinese unloading gangs, but now marine pumps and conveyors do the work except for halibut, which are still unloaded manually. After unloading, salmon are weighed and sorted by species and graded for size and quality. The grades are #1 export (based on less than 20% scale loss and no scars over 12 mm long), #2 domestic (scars over 12 mm long), and #3 cannery. Scale loss results from the fish coming into contact with the fishnet, and especially gillnets. Scale loss makes a fish unsuitable for the frozen market as it has lost eye appeal. The market value of frozen versus canned salmon depends on the species. With sockeye, #2 and #3 grades are worth the same frozen or canned. With springs, coho, and chums, #2 grade is worth more frozen than canned.

After being graded the fish are dressed, or gutted, (see photos 10, 11, 12) and the head may or may not be cut off. Only 10% of salmon are dressed with the head on. This is referred to as "princess cut" and is produced solely for the Japanese. It is the most expensive due to the large labour input in the process of dressing. If the market price makes it worthwhile, the salmon eggs are removed and salted during the dressing process. If, however, the egg market price is low and/or there is a large volume of fish, the eggs are thrown away with the guts and offal.

On the "head off" line one man heads, one guts, one reams, and one bloods. With a "head on" line one man places the fish, one slits from the anus, two gill, two gut, and two blood. Once dressed the fish pass through a washing machine and then are hand washed. This washing removes any blood left on the backbone which would cause rapid deterioration of the product's quality if not removed. After being washed the fish are re-graded into #1, #2, and cannery based on the internal quality of the chest cavity. The grader looks especially for bellyburn which occurs when the bones protrude through the lining of the chest cavity. Bellyburn automatically makes a fish cannery grade.

Once graded internally, the fish progress to the freezing process or the fresh fish or canning line. Due to the difference in market value based on the processing technique used, the key to the grading process is self evidence. The grader is the key person on any line but is especially important on the freezer line as once a fish is frozen it is impossible to tell its grade until it is thawed by the consumer. Thus quality control is essential not only in the grading process but also in the freezer to ensure that #1 fish are not shipped as #2 fish or vice versa, a procedure which could result in the loss of major buyers.

After grading, fresh fish are merely packed in ice and either shipped directly to the market or held in a cooler room for a day or two and then shipped.

Freezer fish, once dressed and graded, enter the freezing system as follows. They are placed in freezer trucks and pushed to the tally station where the truck is weighed (see photo 13). This weight, the species, and the grade are marked on a tally sheet and on the truck. The marking system is essential so that the grades do not get mixed up in the sharp freezer to which they go next (see photo 14). A sharp freezer is a small room which can be filled and left undisturbed until the charge is frozen. In large room the temperature is more stable because of the large reserve of brine in the refrigeration coils, but this advantage is offset by the frequent opening and closing of the doors to put in and take out small lots of fish. The typical side by side arrangement of these sharp freezers (five in number) at Home Plant reduces the necessity for heavy insulation except on the outside walls (see photo 15). Also typical of other freezer units, Home Plant's storage rooms, glazing rooms, and chill rooms are adjacent to the sharp freezers, insulating them from warm rooms and the outside wall of the freezer plant (see photo 16).[49] To insulate the sharp freezers at Home Plant further, access to them from the main entrance is gained through a narrow corridor into which all these freezers open.

The freezing system in these sharp freezers is provided by a bank of refrigeration coils made of 38 mm or 50 mm (1 1/2" or 2") iron pipe, arranged to make shelves on vertical centres (see photo 17). Direct expansion ammonia or calcium-chloride brine from the refrigeration system circulates in these coils providing a temperature of around -40°C. On top of these coils are laid galvanized iron sheets or in more modern units, aluminum sheets, to form solid shelves. On entering the sharp freezer the fish are laid on these sheets in a specific order. On the right hand side of the freezer fish are laid with their backs to the wall, belly to belly (see photo 18); on the left hand side they are laid with their bellies to the wall, back to back (see photo 19). This order is used because all the fish are frozen on the same side of their bodies and this results in a better looking product. In addition, once frozen they are easier to pile and pack. Fish remain in these freezers for 24 hours to ensure that they are properly frozen although freezing actually occurs between 18 and 20 hours (see photo 20). After the 24 hour period the charge is removed from the sharp freezer and the fish are then glazed in the glazing room (see photo 21), so called because it holds the glazing tank (see photo 22). This room's temperature is -14°C, the same as the freezer's storage rooms. Fish are glazed, or covered with a thin layer of ice, by dipping them into the glazing tank containing fresh water at 2°C with salt or sugar added. The salt or sugar gives a better glaze as the glaze doesn't crack and the additives allow the water to be taken down to a lower temperature before it freezes. Glazing is done to protect fish from exposure to the air while they are being stored in a freezer. If they are not so protected the oxygen in the air will act on the fats, turning them rancid, and the moisture (and odour and flavour) will evaporate. This deterioration of the product is commonly known as "freezer burn". The glazing tank at C.F.C. is technically described as follows:

> 20'x3'x 24" Glazing tank on 6 - 4"x4" legs of 2" stock, bolted, with a 36" return conveyor rotating on 3 -4' shafts and 21 1/2"x 8"x 1 3/4" spur gears on head end and 4 - 1 1/2"x6" sprockets on tail end, conveyor of 2 lines of #H60 chain with attachments and 1"x 2"x3" spaced 14" apart; driven by 1 - 20"x3" spur gear, 1 - 4"x3" miter gear and 1 - 16"x4" iron pulley with 8' - 3" belt to countershaft, connected to tank by 4' - 1 11/16" shaft, 2 boxes, 1 - 4"x4" steel split pulley, and 6' - 3" rubber belt to 3 H.P., 1200 R.P.M., 220 volt, 3 phase, 60 cycle motor, with pulley, magnetic switch CR7006-D140D and push button control.[50]

Today once the fish are glazed they are placed in fish totes lined with poly and are sealed like a big plastic bag. They are then moved into a storage freezer room by forklift. The use of the sealed poly liners is a further protection against freezer burn. Before the introduction of the fish tote and forklift in the 1950's the glazed fish were manually piled on skids in 2.4m x 4.8m (8 x 16 ft) piles and covered with a tarp to protect them against dehydration and "snow" (ice falling from the freezer's ceiling - see photos 23, 24, 25). To further decrease dehydration the exposed side of the piles of fish were sprayed with water. Before the beginning of the freezer season the walls of the freezer were sprayed as well to decrease the amount of air that could enter from outside the freezer. As in the netlofts, the introduction of the forklift and tote system for moving and storing freezer fish drastically reduced the labour force of the freezer unit. In the late 1950s, 20 year round employees were needed, thirty years later six men could run the unit.

If they are in demand (e.g. special orders) the frozen fish are shipped directly to the buyer without further processing. If they are to be held in storage for six months or more, however, they must be reglazed prior to shipment. Glazing is not only a procedure to preserve the quality and appearance of the fish—it also increases the value of the original product. Each time a fish is glazed it gains weight and as frozen fish are sold by the pound, the heavier the glaze the more expensive the product. In the past glazing could account for 6% of the frozen fish's total weight and sometimes fish were glazed merely to increase their weight. Today, however, due to tighter marketing controls of fishery products both by the government and by the industry itself glazing accounts for about 3-4% of the frozen product's weight.

Since the 1960's the weight of fish delivered to the processing plant has increased by about 5% over its weight when captured if it is transported in R.S.W. or C.S.W. (as is the case with most salmon and all herring transport). This phenomenon is known as "plus shrinkage". When fish were transported in ice they lost approximately 5% of their weight. Fish transported in R.S.W. or C.S.W. do not lose weight and their condition, when delivered, is far superior to those transported in ice. The water in which they are carried acts as a cushion and the product is less bruised and crushed than that carried in ice. Iced fish are bruised and crushed either by their own weight or by crewmen stepping on them in the process of icing them down. A greater percentage of the catch transported in water can be sold as non-cannery fish ("highgrading"), thus obtaining a better market price.

Ice Making

As with any fishery plant, Canfisco's second major refrigeration processing operation is ice making.[51] The ice is used for icing down fish when they have to be held overnight in the cannery for processing, for fresh fish operations, and for the company's fishing fleet. Prior to the introduction of the R.S.W. and C.S.W. systems in fishing and packing vessels, the production of ice was of paramount importance to the fresh and frozen sector of the industry. It was also very im ortant for the canning sector if the fishing grounds were far removed fro the processing plant. Today, with the use of R.S.W. and C.S.W. the import of ice making is not as crucial in the primary sector (fishing) of the salmor d herring industries, but it retains its importance in the halibut and ground fisheries and in the secondary (processing) sector. Due to the perishabili f fish, ice production is a major key to the success of a fish company. failure in this system, especially during the fishing season, can have disas s effects on a company. Competing companies will, if possible, supply this duct, but only after their own ice supply needs have been met.

The i making operation at Home Plant employs a system known as the "can syste , its components supplied by the Triumph Ice Company (see photo 31). The other major ice making system in the fishery is the "plate system". The can system derives its name from the fact that it produces ice in molds or rectangula ns", originally constructed of galvanized iron but now made of aluminum Illustration 4, photo 32), which produce 250 pound blocks of ice. Once fille fresh water, the cans are immersed in a tank which holds 240 cans (see p 33). The tank is filled with "frozen" brine still in a liquid state; brine does reeze at 0°C. Cooling coils are submerged in this tank through which the onia gas, provided by the compressors, absorbing the heat from the brine a brings it down to the required temperature, -9 to -11°C. The brine in the free tank is agitated, causing an even temperature throughout and slowly free the water in the cans. After the ice is frozen solid (about 36 hours) the hoisted out of the tank by a moveable hoist (see photos 34, 35) and convey the thawing dump (see photo 36). Initially the can is placed vertically dump and then the dump is placed on a sloping downward position (se to 37), facing an ice slide which leads into the freezer. At this time the c sprayed automatically with hot water by the thawing dump which resul the block of ice slipping from its can down the slide into the freezer (se tos 38, 39). Once the ice slides out of the dump, the dump automatica returns to the vertical position, ready to receive the next can.

Blocks of ice thus produced cannot be used immediately; they are "green ice". Green ice also clogs up the ice hoses and ice augers used to load the fishing vessels with ice, thereby slowing down production. To avoid these problems green ice is stored in the freezer for a minimum of three or four days to age it (see photos 40, 41). Prior to the fishing season a large quantity of ice is made and stored in the freezers. As this ice is used up during the season its freezer space is occupied by fish.

The cans at Home Plant are filled and dumped in the following sequence. The brine tank is divided into two 120 can sections. One day the first section is dumped and refilled. The following day the other section is dumped and refilled. By employing this alternating system the cans remain immersed in brine for at least 36 hours.

The final processing stage for block ice is the crushing stage where the blocks are removed from the freezer and fed into a crusher as needed for icing down functions.

Little change has occurred in the technology of this ice making plant since its installation in 1910-1911. The mechanical hoist has been replaced by a hydraulic hoist and the galvanized cans by aluminum ones. The major change has been the removal of the brine tanks' original permanent can holding framework and its replacement by a temporary unit, a change made in the early 1980s. This was done to facilitate multiple use of the brine tank. It is now used July to September to produce ice for the salmon season and in February and March to hold roe herring prior to the removal of the roe. If roe herring is held in brine prior to processing, a better quality of roe is obtained because the fish and its roe are firmed up and a longer undamaged roe can be extracted. As length is a major factor in the grading of top quality herring roe, the advantages of the brine firming process are evident in relation to market value.

Refrigeration Technology and Processes at the Gulf of Georgia Site, 1900's to 1980's

No records exist concerning refrigeration activities at the Gulf prior to its acquisition by the C.F.C. in 1926. Such activities were probably not conducted at the site prior to the mid-1920's as existing evidence points to the fact that the site's technology was based strictly on canning and mild cure. After 1926, however, a fresh fish operation definitely operated at the site in conjunction with the salmon cannery[52]. With the closure of the cannery in 1930, fresh fish operations became the only salmon processing method used at the Gulf of Georgia plant.

In 1931 the demands on the site's fresh fish operation increased because C.F.C. closed its other fresh fish operation on the Fraser River, above the Gulf of Georgia site at New Westminster. Previously the New Westminster plant had processed the company's upper Fraser River fish, but when it closed the Gulf started handling this fish[53].

Originally (1927) this fresh fish operation was based on red and white spring salmon, ling cod, and sturgeon delivered to the site by the company's fishboats or collectors[54]. These fish were packed in ice at the site and then trucked to Home Plant for processing[55]. The area or building in which this 1927 fresh fish operation was conducted has not been positively identified, but as a roadway to provide vehicular access to the front dock was constructed in 1927 down the west side of the main building and through the original 1894 west wing gutting shed, in all probability the fresh fish operation was conducted in the area of the front dock[56]. Prior to 1927 the old west wing of the cannery was used as the fish wharf, but in 1928 this area was converted into a net room[57]. Thus after 1927 fresh fish operations had to be conducted on the front dock, presumably in a fish bin structure.

Between 1933 and 1937 a specific fish bin was constructed on the front dock, just west of the main cannery building (see photos 43, 44 and illustration 4)[58]. It was a 3 m x 12 m x 5.5 m (10' x 40' x 18') elevated bin, with a 4.2 x 6.7 m

(14' x 22') extension for a hoistway[59]. This fish bin structure contained no mechanical cooler refrigeration system. The fish were merely iced down with ice from Home Plant, while awaiting transshipment to Home Plant for processing. This fish bin was torn down in 1939 to accommodate construction of the site's seine loft[60].

Between 1930 and 1939 the fresh fish operation employed on average five men; a tallyman, a wharf boss, a watchman, and two or three labourers[61]. The wharf boss and watchman were hired year round and performed other functions in addition to their fresh fish operation jobs. The tallyman and labourers were hired for the fresh fish season, usually four months, June to September. The tallyman weighed, counted, and sorted the salmon by species and colour (red or white in the case of spring salmon), and the labourers iced, boxed, and loaded fish onto trucks, unloaded ice delivered from Home Plant, and operated the fish bin.

In 1943 the existing cooler plant (see photos 45, 46, and illustration 5) was constructed as follows:

> A 27'x40' gable roof frame building, 16' walls; 44x16' planking on west side, 5x45' planking on east side and 5' to 12'x27' planking at front. All set on piles, 12x12" caps, 3x12" joists,, 3" decking, 2x6" frame, 1x6" drop siding and shingle roof. 10x40' set fish bins; 18x28' double walled cold room with 12x18" crusher room and 12x40' engine room.[62]

Unlike any previous fresh fish structure at the site, this 1943 ice house contained its own mechanical cooler system located in a 3.6 m x 12 m (12' x 40') engine room on the ground floor of the building. It was an ammonia compression system and comprised a

> 4 1/2" x 4 1/2" two cylinder compressor unit, splash oil system, outboard bearing and 4 strand V belt drive with 1" circulating pump, 1 - 8 x 12" watercooled condensor and 1 8" x 10'6" ammonia receiver, both set in angle iron frame, 2 sets of 14 - 24' runs of 1 1/4" coils in Cold Room U bends and fittings; unit complete with pipe, fittings, gauges and temperature control.[63]

The function of the refrigeration unit was solely to refrigerate the cold room, not to produce ice. The ice for this plant was block ice produced at the Home Plant "can system" (see photos 31 to 40) and trucked out to the Gulf site.

To facilitate the loading of the cold room a budget hoist on a rail system was used. This rail system ran from the upper storey loading doors (see photos 47, 48) to the cold room through the crusher room. When crushed ice was needed for icing down, the blocks were removed from the cold room and fed into the crusher using the budget hoist and rail system[64]. Once crushed, the ice was gravity fed from the bottom of the crusher into ice carts on the main floor. Initially these carts were used not only to ice fish down in the cooler plant but also to load vessels with ice (see photo 49). These carts were manhandled out to the wharf and lowered into the vessel's hold with a crane located on the southeast corner of the front dock. Once in the hold the carts were tipped by use of their handle[65]. In the 1950s this laborious system of loading a vessel with ice was replaced by a screw feed conveyor system and gravity feed metal ice chute suspended on the same level as the second floor by a wooden framework. The framework extended from the south side of the cooler plant over the ice loading berth. This enabled a vessel to place its hold directly under the gravity feed ice chute to facilitate icing up (see photo 50).

As crushed block ice was utilized at the site only a screw feed ice delivery system could be used. Crushed ice, unlike flake ice which uses a blower delivery system, clogs up in a blower system but not in a screw feed system[66].

Although the cooler plant had fish bins and a conveyor system to load these bins, it appears they were hardly used because it was more efficient to hold fish iced in boxes or totes or to simply load them directly onto the truck from Home Plant[67].

Conclusion

The introduction of mechanical refrigeration technology to the British Columbia fisheries in the late 19th century revolutionized and expanded the industry's capacity for industrial preservation beyond that of its original canning technology. It broadened the range of fish species available for exploitation, specifically non-sockeye salmon species, which were considered unsuitable for canning prior to the turn of the century. It also was instrumental in the development of the halibut and groundfish fishery and a frozen herring bait fishery to supply this halibut and groundfish fishery.

With the advent of chilling and freezing systems salmon were sorted according to their suitability for various markets—fresh, frozen, or canned (the market values being generally in that order). This process is commonly known as highgrading. Highgrading enabled the canning companies to pay a higher price per pound for salmon to their fishermen as the margin on non-cannery grades of fish was great enough to permit a substantial increase on the price of sockeye, the basic species used in canneries prior to the early 1900's.

The application of refrigeration aboard fishing vessels and tenders diminished the perishability of fish. This allowed the fishing fleet to travel further afield for unexploited fishing grounds and eventually led, with the introduction of refrigerated and chilled saltwater systems in the 1960's and 1970's, to the final centralization of the processing sector in the north (the Skeena area) and the south (the Fraser River area).

The Canadian Fishing Company, unlike other major British Columbia fishing companies at the turn of the century (such as the Gulf of Georgia), did not use canning technology but only employed refrigeration technology for fresh and frozen fish. This accounts for the fact that the Gulf of Georgia site never had a shore installation to produce ice, nor a freezer unit. This function was provided by the Home Plant. From the time of the original installation of the Home Plant's refrigeration units little has changed in its basic technology and operation apart from the use of palletization, totes, forklifts, synthetic packaging, and the replacement of the original compressors by more modern units. The process in the 1980's is basically the same as that in the early years of the century.

The predominant refrigeration technology used in the early British Columbia fishery was based on the ammonia compression system whereby a compressor abstracts heat from one body (either cooled fish or water) by a continuous system which automatically transfers the heat to the refrigerating or cooler agent, ammonia. Under this system the process of refrigeration is a continuous cycle divided into three stages: compression, condensation (or liquefaction), and direct expansion (or evaporation). The basic machinery includes a compressor (which compresses the refrigerant), the condenser (where the compressed refrigerant imparts its heat to cold water and liquefies), and the direct expansion coils (where the refrigerant re-expands into its original gaseous state, thereby absorbing heat and performing the refrigeration work). Because the machinery and technology for these systems were imported from either eastern North America or Europe, the British Columbia fishery was not a leader in refrigeration technology except for chilled salt water systems aboard vessels which was perfected locally.

Refrigeration was never a major technology at the Gulf of Georgia site because the Gulf was basically a transshipment station for fresh fish. The ice needed for this function was provided by the Home Plant. However, due to the importance of refrigeration technology to the fishery's economic development it must be portrayed at the Gulf of Georgia site since fresh fish processing was an important part of the Gulf's function as evidenced by its fish bins and ice house unit.

APPENDIX A

HOME PLANTS REFRIGERATION UNIT 1930's

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HOME PLANTS REFRIGERATION UNIT 1930's

MACHINERY

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value		5-39 New Replacement Value	
	Machine #20, Pump and Tank for Can Spray					
	Tank					
1	3'10"x5' Tank, 3' deep, 2" planking, rodded, with heat coils					
	Installed			16.00		16.00
	Pump to Can Spray					
1	Centrifugal pump, 1 1/2" suction, 1 1/4" discharge; Mfd. by Pumps & Power Ltd. Vancouver, B.C.					
	Installed			69.00		65.00
	Transmission					
8'	2" - 3 Ply rubber belt		.21	1.68	.18	1.44
	Total Machine #20			86.68		82.44

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #21, Pumping Unit			
1	3/4" Turbine 'Paramount' pump, with extended base, 1/3 H.P., 1800 R.P.M., 110/220 volt, 1 phase, 60 cycle motor, direct connected to pump, Serial #3513473; Sold by Pumps & Power Ltd., Vancouver, B.C.			
	F.O.B. Plant		130.00	121.00
	Installation and Wiring		10.00	10.00
	Total Machine #21		140.00	131.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value		5-39 New Replacement Value	
	Machines #22 and #23, Condensers					
2	Vertical shell and tube condensers, open bottom type, 42" diameter, 13'9" high, outside shell 5/8" hammer welded, fitted with 180 - 2" - #10 gauge charcoal iron tubes 13'11 7/8" long, polished ends, rolled into 1 3/8" end sheets, flared and rolled into sheet grooves, each condenser fitted with 3 1/2" discharge, 1 1/4" liquid, 3/4" purge, 3/4" air blow-off, 1/2" safety and 1/2" oil ammonia valves and 2 - 3" valves, painted, tested to 500# hydrostatic pressure					
	F.O.B. Plant		1,825.00	3,650.00	1,679.00	3,358.00
	Installation		60.00	120.00	60.00	120.00
	Foundation					
19.5	Cu. yds. reinforced concrete in 12'x22'x6' concrete tank, 8" walls and bottom, open top, including base		18.00	351.00	16.00	312.00
	Total Machines #22 and #23			4,121.00		3.790.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #24, Receiver			
1	3'x18' Horizontal ammonia receiver with stands, gauge glass, relief and connecting valves			
	F.O.B. Plant		1,460.00	720.00
	Installation		40.00	35.00
	Total Machine #24		1,500.00	755.00
	Machine #24A, Receiver			
1	3'x18' Horizontal ammonia receiver with stands, gauge glass, relief and connecting valves			
	F.O.B. Plant			720.00
	Installation			35.00
	Total Machine #24A			755.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	<u>Machine #25, Purifier</u>			
1	12"x8' Lap welded steel purifier with 18"x3' water jacket, 3 outlet headers, liquid and pressure gauge			
	Installed		240.00	221.00
	<u>Machine #26, Intercooler</u>			
1	16"x12' - 3 Pass intercooler for high pressure, with 2 - 6", 1 - 4" and 2 - 2" connections			
	Installed		600.00	552.00
	<u>Machine #27, Gas Separator</u>			
1	York thermostatic non-condensable gas separator, complete with connections and piping			
	Installed		387.00	356.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #28, Gas and Liquid Cooler			
1	30"x10' Combined direct expansion gas and liquid cooler with 150' - 1" expansion pipe coils inside, liquid level indicator, injector, drain valve and stand, complete with necessary connections			
	F.O.B. Plant		817.00	752.00
	Installation		35.00	35.00
	Total Machine #28		852.00	787.00

Vancouver	Cold Storage Building	New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Machine #29, Ice Tanks						
2	Double ice tanks, 16'6" wide, 48' long, 5'6" deep, sides, bottom and ends of 8" timber, center partition of 6" timber, caulked and rodded, removable top of 3" rabbeted plank, 10 longitundinal can partitions of 2" plank, tanks lined with 1/4" steel plated, welded, and have 30"x15' electric welded steel shell coolers with liquor and gas connections, capacity of each tank 264 - 300# cans						
	Installed			5,210.00	10,420.00	4,890.00	9,780.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	<u>Machine #30, Water Tank for Ice Cans</u>			
1	10'x24'6"x7'8" Wood tank, constructed of double 1" shiplap, insulated walls and 4" main walls, rodded, complete with 240' - 1 1/4" tank pipe in 24' single coils of 10 pipes each			
	Installed		560.00	520.00
	<u>Machine #31, Separator</u>			
1	18"x8' Steel tank separator			
	Installed		192.00	192.00

Vancouver	Cold Storage Building	New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	Machine #33, Band Saw			
1	14" Delta band saw on 3'x5' stand, complete with 1 H.P., 1800 R.P.M., 440 volt, 3 phase, 60 cycle General Electric motor, with base, pulley, CR1038 switch and connecting cord			
	Installed		280.00	175.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
2	5" Flanged elbows	36.96	73.92	34.50	69.00	36.50	73.00
	<u>Vent Line</u>						
54'	3/4" Pipe	.20	10.80	.15	8.10	.15	8.10
1	3/4" Flanged Valve		9.50		9.85	12.90	12.90
	<u>Liquid Ammonia to Receiver</u>						
86'	2" Flanged Pipe	1.34	115.24	.58	49.88	.46	39.56
1	2" Elbow		1.96		1.80		3.05
2	2" Flanged Elbows	13.20	26.40	6.35	12.70	9.25	18.50
1	2" Flanged Valve		19.42		21.60		22.65
	<u>Shell and Tube Condensers</u>						
2	Vertical shell and tube condensers, open bottom type, 42" diameter x 13'9" high, outside, 5/8" shell, hammer welded. Fitted with 180 - 2" - #10 gauge charcoal iron tubes, 13' - 11 7/8" long, polished ends rolled into 1 3/8" end sheets and flared out and rolled into sheet grooves. Each condenser fitted with a 3 1/2" discharge, 1 1/4" liquid, 3/4" purge, 3/4" air blow-off, 1/2" safety and 1/2" oil ammonia valves and 2 - 3" valves. Tested to 500# hydrostatic pressure and painted, with 1 - 36" diameter x 18' horizontal liquid ammonia receiver complete with stands, valves, gauge glass and						

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
8	5" Nipples	1.73	13.84	1.70	13.60	1.60	12.80
1	2" Flanged angle valve		34.00		21.60		22.65
1	5" Flanged valve, cork covered		60.60		120.30		106.50
	Ice Tanks						
2	16'6"x48' long, 5'6" deep, double ice tanks, sides, bottom and ends of 8" timber, center partition of 6" timber, all caulked, bolted and rodded together, removable top of 3" rabbeted plank, 10 longitudinal can partitions of 2" plank, 30"x15' electric welded steel shell coolers with liquor and brine connections, capacity of each tank 264 - 300# cans						
	Installed	3,021.00	6,042.00		Relisted		Relisted
	Cans						
528	300# Galvanized ice cans	7.70	4,065.60		Relisted		Relisted
150	300# Galvanized ice cans (spare)	7.70	1,155.00		Relisted		Relisted
	Sprayers						
8	Sprayers consisting of 7 - 7' lengths 1/2" galvanized pipe with 19 - 3/8" outlets, complete with fittings and 12'x7' drip pan on wood shelf	32.00	256.00	32.00	256.00	28.50	228.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Steam Lines</u>						
	<u>To Jap Dressing Room</u>						
16'	1/2" Pipe	.11	1.76	.11	1.76	.09	1.44
3	1/2" Elbows	.22	.66	.30	.90	.48	1.44
2	1/2" Unions	.45	.90	.49	.98	.62	1.24
3'	3/8" Pipe	.09	.27	.10	.30	.08	.24
1	3/8" Globe valve		.78		.56		1.25
3	3/8" Elbows	.18	.54	.28	.84	.47	1.41
32'	1 1/4" Pipe in coil	.24	7.68	.18	5.76	.18	5.76
7	1 1/4" Return Bends	.67	4.69	1.03	7.21	.80	5.60
22'	3/8" Pipe overflow	.09	1.98	.10	2.20	.08	1.76
1	3/8" Globe valve		.78		.56		1.25
1	3/8" Elbow		.18		.28		.47
	<u>Heating Coils, First Floor</u>						
300'	1 1/4" Pipe in 3 coils	.24	72.00	.18	54.00	.18	54.00
15	1 1/4" Return bends	.67	10.05	1.03	15.45	.80	12.00
4	1 1/4" Elbows	.41	1.64	.55	2.20	.70	2.80
6	1 1/4" Bushings	.14	.84	.19	1.14	.28	1.68

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Brine Tank, Overflow						
13'	2" Pipe	.40	5.20	.33	4.29	.29	3.77
1	2" Union		1.46		1.27		1.42
1	2" Tee		.92		1.35		1.03
1	2" Elbow		.68		.90		.98
1	2" Bushing		.23		.28		.40
29'	1 1/2" Pipe	.30	8.70	.22	6.38	.21	6.09
1	1 1/2" Gate Valve		5.05		3.68		5.20
3	1 1/2" Elbows	.49	1.47	.66	1.98	.78	2.34
	Brine Pump Discharge to Brine Tank						
20'	1 1/2" Pipe	.30	6.00	.22	4.40	.21	4.20
5'	1 1/4" Pipe	.24	1.20	.18	.90	.18	.90
1	1 1/4" Elbow		.41		.55		.70
1	1 1/4" Nipple		.18		.18		.20
1	1 1/4" Globe valve		2.28		1.50		3.40
1	1 1/2" Angle valve		3.10		2.03		4.40
1	1 1/2" Union		1.18		1.01		1.10
1	2" Bushing		.23		.28		.40
1	2" Tee		.92		1.35		1.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Brine Pump Suction</u>						
29'	2" Pipe	.40	11.60	.33	9.57	.29	8.41
1	2" Union		1.46		1.27		1.42
3	2" Elbows	.68	2.04	.90	2.70	.95	2.85
	Total Fresh Water Lines		2,308.69		3,198.76		3,241.39
	<u>Air Lines</u>						
	<u>Blower Suction</u>						
3'	2 1/2" Pipe	.58	1.74	.47	1.41	.45	1.35
1	3" Bushing		.39		.63		.55
1	3" Strainer cap		6.50		6.50		4.50
70'	3" Pipe			.61	42.70	.69	48.30
1	3" Tee				2.78		1.86
	<u>Discharge</u>						
6'	2 1/2" Pipe	.58	3.48	.47	2.82	.45	2.70
1	2 1/2" Union		2.27		2.14		2.30
1	3" Bushing		.39		.63		.55
3	3" Elbows	1.11	3.33	1.92	5.76	1.66	4.98
40'	3" Pipe	.75	30.00	.61	24.40	.69	27.60
1	Heater of 4 runs 2" and 3" double pipe, 10' long, with necessary connections				105.00		105.00

DESCRIPTION OF COLD STORAGE BUILDING

General Description --- The Main Building is a low pitched hip roof building, 80' wide, 180' long, four stories high. First story 11'4" high, second story 11'4" high, third story 11'6" high, fourth story 8'6" high at eaves. Included with this building are the following Additions: Fuel Shed on south end 20' wide, 80' long, first story 22' high with mezzanine floor 20'x34'. Loading Platform on west side of irregular shape containing approximately 4000 sq. ft. with shed roof. Pipe Fitting Storehouse, Office and Ice Lowerator stand upon this platform. Connecting Addition between Warehouse and Cold Storage Building of irregular shape containing 1344 sq. ft. Elevator and Stairwell Shaft 8' wide, 18'5" long, 32'6" high, extending from roof of Warehouse with Pent House above Cold Storage Building roof.

Foundation --- Main Building consists of concrete footings with pile cores and piling under Additions.

Floors --- Cold Storage Rooms are insulated with shavings enclosed with shiplap and paper, other sections have plank and T & G floors.

Frame --- Consists of timber posts and girders.

Walls --- Cold Storage Sections have insulated walls with corrugated galvanized iron on exterior, other sections sheathed with corrugated galvanized iron over shiplap.

Roof --- Consists of composition roofing.

Vancouver	Cold Storage Building		12-30 New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	<u>Cooling Tower on Roof</u> 47'x64' Open platform, 14' side walls with 1"x6" louver, platform covered with 3 ply composition roofing, 6' 8' sloping balcony around sides.				
256'	12 Posts 8"x8" - 4' average	G			
27'	3 Posts 6"x6" - 3' average	G			
1,408'	8 Beams 8"x12" - 22'	G			
96'	4 Beams 8"x12" - 3'	G			
128'	4 Corbels 8"x8" - 6'	G			
43'	8 Braces 4"x8" - 2'	D			
128'	8 Braces 4"x8" - 6'	D			
792'	132 Lin. ft. 6"x12" drain sides	G			
396'	132 Lin. ft. 3"x12" drain bottom	D			
3,564'	1188 Lin. ft. 3"x12" joist	D			
6,000'	2" Plank on platform	P			
3,098'	1" T & G on platform	B			
288'	216 Lin. ft. 2"x8" sides	D			
660'	220 Lin. ft. 3"x12" girts	D			
168'	4 Corner posts 6"x6" - 14'	G		Removed	Removed
1,064'	38 Side posts 4"x6" - 14'	D		Removed	Removed
928'	1392 Lin. ft. 2"x4" balcony joist	D			
3,024'	42 Creosoted posts 6"x6" - 24'	CG			

Vancouver	Cold Storage Building		12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Summary							
62,241'	Heavy Sills	TT	34.00	2,116.19	41.00	2,551.88	33.00	2,053.95
184,388'	Heavy Posts, Beams and Joists	GG	44.00	8,113.07	48.00	8,850.62	42.50	7,836.49
8,160'	Sills and Caps	T	30.00	244.80	41.00	334.56	31.00	252.96
38,215'	Posts and Beams	G	38.00	1,357.53	51.50	1,968.07	40.50	1,547.71
154,820'	Plank Floors and Joists	P	28.00	4,324.66	41.00	6,347.62	32.00	4,954.24
73,250'	Dimension Framing	D	40.00	3,055.12	46.00	3,369.50	42.50	3,113.13
76,651'	1" Boards and Shiplap	B	32.00	2,435.23	39.00	2,989.39	37.00	2,836.09
3,300'	2" T & G Flooring, Common	A	36.00	118.80	41.00	135.30	38.00	125.40
10,450'	Siding, S.G. Flooring, Outside Trim	S	50.00	522.50	62.00	647.90	61.50	642.68
3,410'	Creosoted Lumber	CD			78.00	265.98	75.00	255.75
3,024'	Creosoted Posts	CG			83.50	252.50	80.00	241.92
	Total Wood Construction			22,387.90		27,739.72		23,886.72

Cold Storage Insulation

First Floor

Vancouver	Description	12-30		3-37		5-39	
11,200	Sq. ft. insulated flooring constructed of 2 courses of shiplap ceiling with 1 course paper between and 1 course of shiplap under 1 course T & G flooring with 1 course paper between, 12" space between joists filled with shavings, joists included with frame	.19	2,128.00	.23	2,576.00	.23	2,576.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
80	Lin. ft. 18" partition between Machine Room and Room #8, constructed 4 courses shiplap, 2 courses paper on 2"x12" studding, 18" centers, space filled with shavings (all 18" interior walls of similar construction)	3.25	260.00	3.90	312.00	3.40	272.00
280	Lin. ft. 18" outside wall, constructed 5 courses shiplap, 3 courses paper on 2"x14" joists, 18" centers, space filled with shavings (all 18" outside walls of similar construction)	3.50	980.00	4.20	1,176.00	4.05	1,134.00
80	Lin. ft. 12"x12' partition between Rooms #7 and #8, constructed 4 courses shiplap, 2 courses paper, 2"x8" studding, 18" centers, space filled with sawdust	2.15	172.00	2.60	208.00	2.90	232.00
90	Lin. ft. 12"x12' wall as above between Rooms #6 and #7	2.15	193.50	2.60	234.00	2.90	261.00
63	Lin. ft. 14"x12' wall surrounding Elevator and Stairwell	2.60	163.80	3.10	195.30	3.10	195.30
80	Lin. ft. 18"x12' wall as above between Room #6 and Rooms #1 to #5	3.25	260.00	3.90	312.00	3.40	272.00
160	Lin. ft. 18"x12' wall in 4 sections separating Rooms #1 to #5	3.25	520.00	3.90	624.00	3.40	544.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
80	Lin. ft. 18"x12' wall between Rooms #1 to #5 and Hall	3.25	260.00	3.90	312.00	3.40	272.00
	Addition						
112	Lin. ft. 18" outside wall	3.50	392.00	3.90	436.80	3.40	380.80
32	Lin. ft. 14"x12' partition walls	2.60	83.20	3.10	99.20	3.10	99.20
1,280	Sq. ft. insulated coiled			.23	294.40	.23	294.40

EQUIPMENT

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #1, Motor, Drives Ice Machine #1</u>						
1	130 H.P., 360 R.P.M., 2300 volts, Form P, 37A, 3 phase, 60 cycles, Type 1, wound rotor, Canadian General Electric induction motor, #10562, with adjustable sliding base with attached outboard bearing, 36" sheave with 12 grooves for 1" rope and T20B General Electric drum controller, #5023 with starting resistor						
	F.O.B. Plant		3,757.00		3,589.00		3,300.00
	Cartage and Installation		150.00		65.00		65.00
	<u>Millwrighting</u>						
1	Lot timber supports		60.00		60.00		45.00
17	Lin. ft. 1" pipe guard rail	.35	5.95	.35	5.95	.35	5.95
1	Wood cover		7.00		Removed		Removed
	<u>Wiring</u>						
2	3" Type FE condulets	17.28	34.56	12.19	24.38	11.50	23.00
133'	3" Conduit	1.76	234.08	1.44	191.52	1.16	154.28
1	6"x6"x12" Junction box		2.20		2.20		2.20
210'	#1 Rubber covered wire	.18	37.80	.19	39.90	.16	33.60

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #2, Motor, Drives Ice Machine #2</u>						
1	130 H.P., 360 R.P.M., 2300 volts, Form P, 37A, 3 phase, 60 cycles, Type 1, wound rotor, Canadian General Electric induction motor, #12149, with adjustable sliding base, with attached outboard bearing, 36" sheave with 12 grooves for 1" rope and T20B General Electric drum controller, #5023 with starting resistor						
	F.O.B. Plant		3,757.00		3,589.00		3,300.00
	Cartage and Installation		150.00		65.00		65.00
	<u>Millwrighting</u>						
1	Lot timber supports		60.00		60.00		45.00
17	Lin. ft. 1" pipe guard rail	.35	5.95	.35	5.95	.35	5.95
1	Wood cover		7.00		Removed		Removed
	<u>Wiring</u>						
2	3" Type FE condulets	17.28	34.56	12.19	24.38	11.50	23.00
161'	3" Conduit	1.76	283.36	1.44	231.84	1.16	186.75
195'	#0000 Rubber covered wire	.37	72.15	.41	79.95	.35	68.25
20'	#1 Rubber covered wire	.18	3.60	.19	3.80	.16	3.20
	Total Section #2		4,373.62		4,059.92		3,697.16

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value	5-39 New Replacement Value
	<u>Section #5, Spare Motor</u>				
1	130 H.P., 360 R.P.M., 2300 volts, 3 phase, 60 cycles, Canadian General Electric induction motor, #1056, complete with 36" 12'1" grooved sheave, pulley and adjustable base with attached outboard bearing				
	F.O.B. Vancouver		3,757.00	Removed	Removed
	Cartage		25.00		
	<u>Millwrighting</u>				
1	Wood cover		7.00		
	<u>Test Wiring</u>				
54	Lin. ft. #00 rubber covered wire	.26	14.04		
1	100 Amp, 250 volt triple pole, single throw fused knife switch		22.66		
62'	3/4" Galvanized conduit	.39	24.18		
2	3/4" Type LB condulets	1.48	2.96		
190'	#14 Rubber covered wire	.02	3.80		
	Total Section #5		3,856.64		

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value	5-39 New Replacement Value
	<u>Section #6, Motor, Drives Blower</u>				
1	3 H.P., 1800 R.P.M., 220 volts, 3 phase, 60 cycles, Type KT, Canadian General Electric induction motor with base, pulley and starting switch, Serial #11221				
	F.O.B. Plant		85.00	Removed	Removed
	Installation		11.00		
	<u>Millwrighting</u>				
10'	2 Pieces 2"x10" - 3'	70.00	.70		
	<u>Wiring</u>				
44'	1/2" Conduit	.33	14.52		
1	1/2" Type LB condulet		1.27		
140'	#12 Rubber covered wire	.03	4.20		
1	60 Amp, 250 volt, triple pole, single throw fused knife switch in Crane cabinet		16.50		
	Total Section #6		133.19		

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #7, Motor, Drives Agitator</u>						
1	5 H.P., 1200 R.P.M., 220 volts, 3 phase, 60 cycles, induction motor with base, pulley and starting switch						
	F.O.B. Plant		131.00		144.50		132.70
	Installation		11.00		6.00		11.00
	<u>Millwrighting</u>						
64'	1 Piece 16"x16" - 3'	70.00	4.48	65.00	4.16	50.00	3.20
	<u>Wiring</u>						
26'	3/4" 1/2" Conduit	.33	8.58	.29	7.54	.19	4.94
85'	#10 Rubber covered wire	.05	4.25	.04	3.40	.03	2.55
	Total Section #7		159.31		165.60		154.39

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Section #12, Motor, Drives Hoist						
1	5 H.P., 1800 R.P.M., 220 volts, 3 phase, 60 cycles, induction motor with base, pulley and magnetic starting switch						
	F.O.B. Plant		113.85		111.00		116.00
	Installation		11.00		6.00		7.00
	Millwrighting						
1	Plant platform		4.00		4.00		3.50
	Wiring						
104'	3/4" Galvanized conduit	.39	40.56	.29	30.16	.19	19.76
1	3/4" Type A condulet		1.43		.90		.84
320'	#10 Rubber covered wire	.05	16.00	.04	12.80	.03	9.60
	Total Section #12		186.84		164.86		156.70

Vancouver	Cold Storage Building		12-30 New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	<u>Section #13, Motor, Drives Condenser Circulating Pump</u>				
1	20 H.P., Type 1 induction motor, 3 phase, 60 cycles, 220 volts, 1800 R.P.M., Serial #33096, with base and pulleys; Mfd. by Canadian General Electric Co.		441.00	Removed	Removed
1	Canadian Westinghouse 20 H.P. automatic starter, cast iron case		23.00		
	Installation		24.00		
	<u>Millwrighting</u>				
96'	2 Joists 3"x12" - 16'				
96'	48 Lin. ft. 2"x12" decking				
16'	1 Sill 4"x16" - 3'				
208'	Lumber, average per M	60.00	12.48		
	<u>Wiring</u>				
270'	#4 Rubber covered copper wire	.10	27.00		
90'	1 1/2" Conduit	.82	73.80		
1	1 1/2" Corner box		.90		

Vancouver	Cold Storage Building	12-30 New Replacement Value	3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #14, Motor, Drives</u> <u>Booster</u>					
1	50 H.P., 1200 R.P.M., 440 volt, 3 phase, 60 cycle, Type KG motor, Serial #279614, with base, CR7006D7B magnetic switch, relay heaters and 2 push button control stations; Mfd. by Canadian General Electric Co.					
	F.O.B. Plant			560.50		582.00
	Installation			25.00		25.00
	<u>Wiring</u>					
3'	1 1/2" Flexible conduit		.61	1.83	.48	1.44
10'	1 1/2" Galvanized conduit		.58	5.80	.46	4.60
40'	2" Galvanized conduit		.76	30.40	.61	24.40
195'	#2 Rubber covered wire		.14	27.30	.12	23.40
1	6"x8"x36" Wiring gutter			6.00		4.50
50'	1/2" Galvanized conduit		.23	11.50	.15	7.50
120'	#12 Rubber covered wire to push buttons		.03	3.60	.03	3.60
1	200 Amp, 3 pole single throw fused switch			59.55		57.55
	Total Section #14			731.48		733.99

<u>Note:</u> Foundation listed with compressor

Vancouver	Cold Storage Building	12-30 New Replacement Value	3-37	3-37 New Replacement Value	5-39	5-39 New Replacement Value
	<u>Section #15, Motor, Drives</u> <u>Booster</u>					
1	30 H.P., 1200 R.P.M., 440 volt, 3 phase, 60 cycle, Type KG motor, Serial #280725, with base, CR7006D7B magnetic switch and 2 station push button control; Mfd. by General Electric					
	F.O.B. Plant			435.00		448.00
	Installation			20.00		20.00
	<u>Wiring</u>					
2'	1 1/4" Flexible conduit		.51	1.02	.41	.82
26'	1 1/4" Galvanized conduit		.49	12.74	.39	10.14
240'	#6 Rubber covered wire		.08	19.20	.061/2	15.60
58'	1/2" Galvanized conduit		.23	13.34	.15	8.70
122'	#12 Rubber covered wire to push buttons		.03	3.66	.03	3.66
1	100 Amp, 3 pole single throw fused switch			31.65		34.20
	Total Section #15			536.61		541.12

<u>Note:</u> Foundation listed with compressor

Vancouver	Cold Storage Building	12-30 New Replacement Value	3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #16, Motor, Drives Circulati-g Pump</u>					
1	20 H.P., 1800 R.P.M., 440 volt, 3 phase, 50 cycle, Type HS motor, Serial #264623, with 11-200-Z.B.2 line starters and push button control; Mfd. by Westinghouse					
	F.O.B. Plant			252.50		233.00
	Installation			15.00		15.00
	<u>Wiring</u>					
12'	1 1/4" Galvanized conduit		.49	5.88	.39	4.68
40'	1 1/2" Galvanized conduit		.58	23.20	.46	18.40
186'	#6 Rubber covered wire		.08	14.88	.061/2	12.09
52'	1/2" Galvanized conduit		.23	11.96	.15	7.80
118'	#12 Rubber covered wire		.03	3.54	.03	3.54
1	100 Amp, 3 pole single throw fused switch			31.65		34.20
	Total Section #16			358.61		328.71

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #17, Motor, Drives Circulating Pump</u>						
1	20 H.P., 1800 R.P.M., 440 volt, 3 phase, 60 cycle, Type HS motor, Serial #264337, with 11-200-Z.B.2 line starters and push button control; Mfd. by Westinghouse						
	F.O.B. Plant				252.50		233.00
	Installation				15.00		15.00
	<u>Wiring</u>						
24'	1 1/4" Galvanized conduit			.49	11.76	.39	9.36
258'	#6 Rubber covered wire			.08	20.64	.061/2	16.77
52'	1/2" Galvanized conduit			.23	11.96	.15	7.80
118'	#12 Rubber covered wire			.03	3.54	.03	3.54
1	100 Amp, 3 pole single throw fused switch				31.65		34.20
	Total Section #17				347.05		319.67

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Section #18, Motor, Drives Blowers</u>						
1	3 H.P., 1800 R.P.M., 220 volt, 3 phase, 60 cycle, Type KT motor, Serial #11221, with base, pulley, magnetic switch and push button control; Mfd. by Canadian General Electric						
	F.O.B. Plant				110.00		99.00
	Installation				5.00		8.00
	<u>Wiring</u>						
50'	1/2" Galvanized conduit			.23	11.50	.15	7.50
160'	#12 Rubber covered wire			.03	4.80	.03	4.80
	Total Section #18				131.30		119.30

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Section #19, Motor, Drives Pump to Can Spray						
1	2 H.P., 1200 R.P.M., 220 volt, 3 phase, 60 cycle motor, Serial #80245, with base, pulley, 30 amp, 3 pole single throw fused switch; Mfd. by Fairbanks-Morse						
	F.O.B. Plant				99.30		88.70
	Installation				4.00		8.00
	Wiring						
2'	1/2" Flexible conduit			.22	.44	.16	.32
65'	1/2" Galvanized conduit			.23	14.95	.15	9.75
204'	#12 Rubber covered wire			.03	6.12	.03	6.12
	Total Section #19				124.81		112.89

Vancouver	Cold Storage Building	12-30 New Replacement Value	3-37 New Replacement Value	5-39 New Replacement Value
	<u>Section #20, Transformer Room</u>			
	<u>Master Switch</u>			
1	300 Amp, 2300 volt, Type SA4 oil circuit breaker; Mfd. by Crompton-Parkinson; with 1 time limit overload relay, 5 amp, Type P.Q.; Mfd. by General Electric; 1 inverse time limit overload relay, 5 amp Type P.Q.: Mfd. by General Electric; 2-5 amp tripping reactors for use with trip coil with transformers, complete with 2 potential tranformers on mains; Mfd. by General Electric; all mounted on pipe frame, complete with disconnect switches and wiring			
	Installed		356.00	356.00
1	Unit of 4 - 300 amp, 12,500 volt oil circuit breakers, Type S.A.4; Mfd. by Crompton-Parkinson; with 3 time relays and transformers on breakers, 7 potential transformers, 60 amps on mains and 2 potential transformers, 2300/115, 200 amp on feeders tie in, mounted on pipe frame, complete with wiring to switches and board inside Power House			
	Installed		1,259.00	1,205.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Machine #1, Ice Machine						
1	12"x20" Twin ice machine #711 and #712 with 15'x19" flywheel grooved for 12 - 1" ropes; Mfd. by Triumph Ice Machine Co. Cincinnati, Ohio						
	F.O.B. Vancouver		17,017.50		12,500.00		12,000.00
	Installation		750.00		600.00		600.00
	Foundation						
48	Cu. yds. concrete in piers and footing slab laid on bed rock, reinforced	20.00	960.00	16.00	768.00	12.00	576.00
	Transmission						
1,210'	1" Manila transmission rope	.11	133.10	.13	157.30	.11	133.10
1	48" Single groove idler sheave for 1" rope		62.50		67.50		52.00
5'	2 15/16" Shafting	1.73	8.65	1.76	8.80	2.18	10.90
2	2 15/16"x24" Collar oiling adjustable drop hangers	22.69	45.38	26.85	53.70	32.90	65.80
2	2 15/16" Safety set collars	1.20	2.40	1.55	3.10	1.55	3.10
1	48" Single groove sheave on tension carriage on 32 lin. ft. 3" channel track with 10 - 1 1/2"x 30" pipe hangers and braces and counter-weight with cable and sheave		235.00		254.00		213.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Machine #2, Ice Machine</u>						
1	12"x20" Twin ice machine #213 and #214 with 15'x19" flywheel grooved for 12 - 1" ropes; Mfd. by Triumph Ice Machine Co. Cincinnati, Ohio						
	F.O.B. Vancouver		17,017.50		12,500.00		12,000.00
	Installation		750.00		600.00		600.00
	<u>Foundation</u>						
48	Cu. yds. concrete in piers and footing slab laid on bed rock, reinforced	20.00	960.00	16.00	768.00	12.00	576.00
	<u>Transmission</u>						
1,210'	1" Manila transmission rope	.11	133.10	.13	157.30	.11	133.10
1	48" Single groove idler sheave for 1" rope		62.50		67.50		52.50
5'	2 15/16" Shafting	1.73	8.65	1.76	8.80	2.18	10.90
2	2 15/16"x24" Collar oiling adjustable drop hangers	22.69	45.38	26.85	53.70	32.90	65.80
2	2 15/16" Safety set collars	1.20	2.40	1.55	3.10	1.55	3.10
1	48" single groove sheave on tension carriage on 32 lin. ft. 3" channel track with 10 - 1 1/2"x30" pipe hangers and braces and counterweights and cable and sheave		235.00		254.00		213.00

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Machine #3 and #4, Ice Tank Cranes</u>						
1	10"x18' Single I travelling cranes, 2 wheeled end travellers, complete with 1/2 ton Sprague electric hoist on 4 wheel trolley for 2 cans, complete with 2 - #4 lateral trolley wires and 50' - 3 wire #0 longitudinal trolley, 2 - 20#x58' travelling rails, carried on 6"x12" timber girders with 4"x6" brackets, 16" centers						
	F.O.B. Vancouver	990.00	1,980.00	1,012.00	2,024.00	982.00	1,964.00
	Installation	65.00	130.00	65.00	130.00	65.00	130.00
	<u>Wiring (Two Cranes)</u>						
32'	1/2" Galvanized conduit	.33	10.56	.23	7.36	.15	4.80
2	1/2" Type LB condulets	1.27	2.54	.89	1.78	.77	1.54
1	20"x36"x7" Steel cabinet		13.25		10.25		10.25
2	30/250 Triple pole single throw fused knife switches	8.61	17.22	8.60	17.20	16.50	33.00
	<u>Note</u>: Remainder of switches included with motors.						
	Total Machines #3 and #4		2,153.57		2,190.59		2,143.59

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Machine #5 and #6, Can Dumpers</u>						
2	Can dumpers for 2 - 300# cans; wood frames; Mfr. Unknown						
	Installed	345.00	690.00	98.00	196.00	98.00	196.00
	Installation	20.00	40.00				
	<u>Ice Slides</u>						
37	Lin. ft. 28" double ice slides, constructed 2" bottom, 2"x4" sides, L partition with 4 - 1 1/4" quarter round steel slides	.95	35.15	.95	35.15	.95	35.15
	Total Machines #5 and #6		765.15		231.15		231.15

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Machine #7, Ice Hoist						
1	Ice hoist for 1 - 300# block, steel and wood frame carrier, total travel 44' with 3/8" single cable haul line with sheaves, 6"x8" timber guides (shaft listed under construction)		160.00		92.00		92.00
	Hoist						
1	Single drum hoist, 15"x8" drum, 26"x5" friction drive, 2 3/16" and 1 15/16" bearings, 18"x4" steel split drive pulley on timber frame with 28" single groove lead sheaves and 3/8" wire rope						
	Installed		300.00		286.00		248.00
	Transmission						
36'	3 1/2" - 3 Ply rubber belt, to motor	.33	11.88	.30	10.80	.26	9.36
	Total Machine #7		471.88		388.80		349.36

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	Machine #8, Blower						
1	2 1/2" Belt driven rotary blower; Mfd. by Globe Iron Works, Vancouver, B.C.						
	F.O.B. Plant		76.00		82.00		72.00
	Installation		10.00		10.00		8.00
	Transmission						
23'	3 1/2" Single leather belt	.80	18.40	.76	17.48	.68	15.64
	Total Machine #8		104.40		109.48		95.64

Vancouver	Cold Storage Building	12-30 New Replacement Value		3-37 New Replacement Value		5-39 New Replacement Value	
	<u>Machine #9, #10, #11, and #12, Agitators</u>						
2	18" Single propeller agitators on 4' of 1 15/16" shaft with bearings, 48"x4" cast iron drive pulleys	200.00	400.00	162.00	324.00	135.00	270.00
2	18" Single propeller agitators on 4' of 1 15/16" shaft with bearings, 24"x4" drive pulleys	180.00	360.00	146.00	292.00	105.00	210.00
	<u>Transmission</u>						
30'	2 1/2" Single leather belt	.49	14.70	.54	16.20	.49	14.70
27'	2 1/2" Single leather belt	.35	9.45	.54	14.58	.49	13.23
30'	2 1/2" Single leather belt	.49	14.70	.54	16.20	.49	14.70
27'	2 1/2" Single leather belt	.35	9.45	.54	14.58	.49	13.23
	Total Machines #9, #10, #11 and #12		808.30		677.56		535.86

APPENDIX B

GULF OF GEORGIA FISH BINS
1930's

GULF OF GEORGIA

FISH BINS

G. of G. C.	Construction	12-37 New Replacement Value	5-39 New Replacement Value	New Replacement Value
	<u>General Description</u> - A 10'x40'x18' elevated bin, with 14'x22' extension for hoistway. Set on Platform A.			
	<u>Wood Construction</u>			
480'	80 Lin. ft. 6"x12" sills			
540'	10 Posts 6"x6" - 18'			
189'	9 Posts 6"x6" - 7'			
270'	9 Posts 6"x6" - 10'			
960'	320 Lin. ft. 6"x6" plate and sills			
149'	16 Studs 4"x4" - 7'			
1,152'	24 Joists 6"x8" - 12'			
80'	8 Ties 2"x6" - 10'			
128'	8 Braces 2"x8" - 12'			
1,120'	2"x6" T & G Bottom in bins			
720'	2" Plank bin walls			
360'	3" Plank bin partitions			
322'	23 Rafters 2"x6" - 14'			
564'	1"x8" Shiplap on roof			
64'	8 Braces 4"x6" - 4'			
160'	80 Lin. ft. 2"x12" header			
420'	21 Pieces 4"x6" - 10' floor joist			
800'	2" Decking			
360'	1"x6" T & G on ice room floors			
2,170'	1"x8" Shiplap on ice room walls			
341'	4 Pieces 8"x8" - 16' posts			
299'	4 Pieces 8"x8" - 14' joist			
149'	4 Pieces 4"x8" - 14' joist			
37'	1 Piece 4"x8" - 14' post			
560'	2" Decking on extension			
220'	2" Lumber in stairs			
390'	2"x4" In extension house frame			

FISH BINS

G. of G. C.	Construction	12-37 New Replacement Value		5-39 New Replacement Value		New Replacement Value
900'	Shiplap in extension house frame					
400'	2" Lumber in chutes					
14,304'	Lumber, average per M	45.00	643.68	42.00	600.77	

G. of G. C.	Construction	12-37 New Replacement Value		5-39 New Replacement Value		New Replacement Value
	<u>Iron Construction</u>					
375#	Rods and bolts	.11	41.25	.11	41.25	
	<u>Doors and Windows</u>					
2	3'x6' Insulated doors 6" thick, double shiplap, with galvanized heavy hinges and C.S. latch	28.00	84.00	28.00	56.00	
5	Single sash, 9 - 12"x14" lights	4.00	16.00	4.00	20.00	
1	3'x6' Singly ply door				5.50	
	Total Doors and Windows		100.00		81.50	
	<u>Painting</u>					
1	Job of mineral painting		34.00		34.00	
	<u>Sheet Metal Work</u>					
120	Sq. ft. galvanized sheet iron in chutes	.12	14.40	.12	14.40	
	<u>Roofing</u>					
10	Squares 3 ply composition roofing	5.00	50.00	4.50	45.00	
	Total Construction Fish Bins		883.33		816.92	

EQUIPMENT

FISH BINS

G. of G. C.	Machinery	12-37 New Replacement Value		5-39 New Replacement Value		New Replacement Value
	Machine #1, Fish Hoist					
1	Double drum motor driven winch, 8"x16" drums, double geared to 5 H.P., 1200 R.P.M., 3 phase, 60 cycle, 220 volt Canadian General Electric motor, with starter		480.00		445.00	
2	3'x4'x2' Sloping side buckets, 2" plank lined with galvanized sheet iron, carried in frames of 3"x3" angle iron	84.00	168.00	84.00	168.00	
	Transmission					
4	12"x1/2" Wire rope sheaves on 1 11/16"x2' shafts	12.00	48.00	12.00	48.00	
200	1/2" Wire rope	.10	20.00	.10	20.00	
	Iron Construction					
220#	Rods and bolts	.11	24.20	.11	24.20	
	Millwrighting					
640'	480 Lin. ft. 4"x4"					
187'	140 Lin. ft. 2"x8"					
120'	Miscellaneous braces					
264'	264 Lin. ft. 2"x6"					
1,211'	Lumber, average per M	90.00	108.99	80.00	96.88	
	Total Machinery #1		849.19		802.08	

G. of G. C.	Machinery	New Replacement Value	5-39 New Replacement Value		New Replacement Value
	<u>Machine #2, Pump</u>				
1	4" Single stage belt driven Smart-Turner centrifugal pump				
	F.O.B. Plant			125.00	
	Installation			6.00	
	<u>Transmission</u>				
20'	6" - 5 Ply balata belt		1.07	21.40	
	<u>Millwrighting</u>				
60'	1 Sill 10"x12" - 6'		40.00	2.40	
	<u>Pipe and Fittings</u>				
	<u>Suction</u>				
20'	5" Pipe		1.20	24.00	
1	5" Foot valve			13.45	
1	5" Elbow			5.36	
1	5" Nipple			1.60	

G. of G. C.	Machinery	New Replacement Value	5-39 New Replacement Value		New Replacement Value
	Connections to Buildings				
1	4" Elbow, 2" side outlet			3.32	
4'	4" Pipe		.80	3.20	
1	4" Reducing tee			5.41	
1	4" Nipple			1.19	
3'	2" Galvanized pipe		.31	.93	
2	2" Galvanized elbows		.72	1.44	
1	2" Globe valve			11.40	
1	40 Gallon iron drum on stand			6.00	
116'	2" Galvanized pipe		.31	35.96	
3	2" Galvanized tees		1.03	3.09	
5	2" Galvanized elbows		.72	3.60	
2	2" Galvanized unions		.86	1.72	
2	2" Globe valves		11.40	22.80	
1	6" Pressure gauge			7.20	
	Total Machine #2			306.47	

G. of G. C.	Machinery	New Replacement Value	5-39 New Replacement Value		New Replacement Value
	<u>Machine #3, Motor, Drives Pump</u>				
1	20 H.P., 1200 R.P.M., 220 volt, 3 phase, 60 cycle, Type K, General Electric Co. induction motor, with base, pulley and starting compensator with overload relays				
	F.O.B. Plant			418.00	
	Installation			32.00	
	<u>Wiring</u>				
8'	1 1/4" Flexible conduit		.41	3.28	
22'	1 1/4" Conduit		.39	8.58	
90'	#4 Rubber covered copper wire		.08	7.20	
1	100 Amp 250 volt 3 pole fused safety switch			26.40	
	Total Machine #3			495.46	
	Total Machinery			1,604.01	

APPENDIX C

GULF OF GEORGIA COOLER PLANT
1940's

COOLER PLANT

A 27'x40' gable roof frame building, 16' walls; 44x16' planking on west side, 5x45' planking on east side and 5' to 12'x27' planking at front. All set on piles, 12x12" caps, 3x12" joists, 3" decking, 2x6" frame, 1x6" drop siding and shingle roof. 10x40' set fish bins; 18x28' double walled cold room with 12x18" crusher room and 12x40' engine room.

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction		Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Piling						
25	40' Piles			13.50	337.50	21.00	525.00
					337.50		525.00
	Timber Construction						
1920'	4 top caps 12x12" - 40'	G					
3600'	6 creosoted caps 12x12" - 50'	GC					
4590'	34 creosoted joists 3x12" - 45'	JC					
6594'	3" decking	J					
1088'	68 studs 2x6" - 16'	S					
972'	972 lin. ft. 2x6" plate	S					
320'	320 lin. ft. 2x6" plate	S					
2679'	1x6" drop siding	W					
790'	1x6" lumber	L					
144'	6 posts 6x6" - 8'	GC					
1152'	48 rafters 2x8" - 18'	R					
324'	6 ceiling joists 2x12" - 27'	J					
1200'	60 roof strips 1x6" - 40'	L					
427'	80 lin. ft. 8x8" creosoted bull rail	GC					

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Timber Construction</u>					
	Cold Room:					
1440'	2" caulked flooring	JJ				
629'	1x4" T&G ceiling	W				
1158'	Shiplap	L				
629'	T&G Ceiling	W				
579'	Shiplap ceiling	L				
480'	16 Ceiling joists 2x10" - 18'	J				
579'	Shiplap top ceiling	L				
1012'	1" shiplap walls	L				
1012'	1" shiplap walls	L				
1100'	1x6" T&G walls	W				
307'	46 studs 2x4" - 10'	S				
720'	16 joists 3x10" - 18'	J				
	Fish Bins"					
168'	14 posts 6x6" - 4'	G				
84'	14 posts 6x6" - 2'	G				
1344'	28 joists 4x12" - 12'	J				
800'	2" bottom	J				
80'	8 braces 2x6" - 10'	B				
1000'	2" siding	J				
240'	10 posts 6x6" - 8'	G				
240'	2 beams 6x6" - 40'	G				
575'	1" lining on sides	L				
525'	1" lumber in partition	L				
133'	200 lin. ft. 2x4" partition frame	S				
160'	80 lin. ft. 2x12" walk	J				
250'	Lumber in stairs	M				
4	18x24" sliding galvanized iron doors		10.00	40.00	14.40	57.60

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Timber Construction</u>					
10	Squares Scutan paper		1.25	12.50	1.60	16.00
1286	Cu. ft. shavings		.12	154.32	.15	192.90
80	Lin. ft. 4" wood gutter		.25	20.00	.34	27.20
	Summary:					
2652'	Caps, Beams & Posts	G	57.50	152.49	73.00	193.60
4171'	Caps, Beams & Posts, Creosoted	GC	61.50	256.52	123.00	513.03
11422'	Joists & Plank	J	58.50	668.19	91.50	1045.11
4590'	Joists & Plank, Creosoted	JC	62.50	286.88	141.50	649.49
2820'	Stud Frame	S	68.10	192.04	100.00	282.00
7430'	1" Boards & Shiplap	L	56.70	421.28	77.00	572.11
5037'	Siding & Ceiling	W	94.00	473.48	155.00	780.74
1152'	Roof Frame	R	73.50	84.67	108.00	124.42
1440'	2" Caulked Floor	JJ	65.00	93.60	103.50	149.04
80'	Braces	B	94.75	7.58	120.00	9.60
250'	Stairs	M	94.25	23.56	137.50	34.38
				2887.11		4647.22

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Doors & Windows					
1	4x7' refrigerator door			70.00		120.00
1	Panel door			12.00		18.50
7	Double sash windows 6 - 10x12" lights		8.50	59.50	16.30	114.10
1	10x8' sliding V-joint door on square track			23.00		36.00
1	Pair 3x12' hinged batten doors			16.00		18.00
				180.50		306.60
	Lighting					
20	Conduit wired outlets		10.00	200.00	12.10	242.00
				200.00		242.00

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Painting					
330	Sq. yds. lead and oil painting		.40	132.00	.70	231.00
160	Sq. yds. roof painting		.25	40.00	.40	64.00
				172.00		295.00
	Roofing					
15	Squares shingle roofing		7.00	105.00	8.25	123.75
				105.00		123.75
	Plans & Supervision - 6%			232.92		
				232.92		
	Total Construction Cooler Plant			4115.03		

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Construction	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Contractor's Profit & Overhead - 10%					613.96
	Plans - 5%					337.68
	Supervision - 3%					202.61
	Total Construction Cooler Plant					7293.82

EQUIPMENT

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Item No. 1</u> - Refrigeration Unit					
1	4 1/2x4 1/2" two cylinder compressor unit, splash oil system, outboard bearing and 4 strand V belt drive with 1" circulating pump, 1 - 8x12" water-cooled condenser and 1 - 8"x10'6" ammonia receiver, both set in angle iron frame, 2 sets of 14 - 24' runs of 1 1/4" coils in Cold Room U bends and fittings; unit complete with pipe, fittings, gauges and temperature control					
	Installed			2400.00		2885.00
				2400.00		2885.00

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 1M - Motor					
1	5 H.P. 1710 R.P.M. 440 volt 3 phase 60 cycle motor with base, magnetic switch					
	F.O.B. Plant			120.50		143.55
	Installation			10.50		13.25
	Wiring:					
50'	1/2" conduit wired		.27	13.50	.35	17.50
				144.50		174.30

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Item No. 2</u> - Water Pump					
1	3x3" single stage centrifugal pump with outboard bearing and flexible coupling					
	Mfd. by Pumps & Power					
	F.O.B. Plant			180.00		207.25
	Installation			10.00		15.00
1	6 strand 5/8" V belt drive 36" centers, 1 - 6" pulley and 1 - 12" pulley			52.44		52.44
				242.44		274.69

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 2M - Motor					
1	20 H.P. 900 R.P.M. 220/440 volt 3 phase 60 cycle motor with base and magnetic switch					
	F.O.B. Plant			387.60		488.80
	Installation			15.00		19.25
	Wiring:					
30'	1" conduit wired		.53	15.90	.64	19.20
				418.50		527.25

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Item No. 3</u> - Elevator					
1	2x45' 2-line chain fish elevator 12" deep, 2x12" lumber and 3x18" sides in return, 2x4" braces spaced 4', 2 lines No. 448 riveted chain with Cl attachments, 1x2" wood slats to each link and wood flights spaced 18", 4 - 12" No. 448 sprockets on 1 15/16" shafts and 2 flat boxes and 2 take-up boxes					
	Installed			460.00		555.00
1	5x10' galvanized lined receiving hopper, flared side			60.00		75.00
1	10x35' - 4 log float			70.00		97.00
	Transmission					
1	6" RC100 sprocket			13.91		13.15
1	10" RC100 sprocket			18.19		18.20
6'	RC100 chain		2.32	13.92	2.65	15.90

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 3					
1	Galvanized lined fish hopper and weighing box			25.00		33.00
1	800# capacity Toledo dial platform scale, Type 31-2821, Serial No. 717788, 500# with double beam 300#			550.00		550.00
				1211.02		1357.25

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 3M - Motor					
1	5 H.P. 1750 R.P.M. geared head motor, Type K, with 19:1 reduction gear, magnetic switch and push button control					
	Installed			330.00		561.15
	Wiring:					
20'	1/2" conduit wired		.27	5.40	.35	7.00
				335.40		568.15

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 4 - Conveyor to Bins					
1	40' belt conveyor, 2" bottom, 2x8" sides, 4 gates, 2 - 12x12" steel split pulleys, 2 - 1 15/16" stub shafts, 2 flat boxes and 2 take-up boxes; complete with 3x8" posts and braces and 86' 12" - 5 ply rubber belt					
	Installed			260.00		348.90
	Transmission:					
30'	No. 77 pin chain		.71	21.30	.52	15.60
2	10" No. 77 sprockets		7.95	15.90	12.75	25.50
				297.20		390.00

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G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 5 - Conveyor from Bins					
1	40' belt conveyor, 2x10" sides, 2" bottom, 2 - 12x12" steel split pulleys on 1 15/16" shafts, 2 flat boxes and 2 take-up boxes, 1 line 12" - 5 ply rubber belt					
	Installed			260.00		348.90
	Transmission:					
10'	1 15/16" shafting		1.00	10.00	1.13	11.30
3	1 15/16" flat boxes		4.55	13.65	6.45	19.35
1	1 15/16" flanged coupling			16.70		18.20
2	1 15/16" set collars		1.10	2.20	1.35	2.70
2	6" RC80 sprockets		12.35	24.70	12.20	24.40
5'	RC80 chain		1.88	9.40	2.10	10.50
				336.65		435.35

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 5M - Motor					
1	2 H.P. 1800 R.P.M. motor on I beam base, with flexible coupling, magnetic switch and push button control					
	F.O.B. Plant			105.70		124.65
	Installation			10.00		10.00
	Reduction Gear:					
1	2 H.P. 60:1 Western reduction gear			252.00		275.00
	Wiring:					
40'	1/2" conduit wired		.27	10.80	.35	14.00
				378.50		423.65

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Item No. 6</u> - Truck Elevator					
1	24x2' chain elevator, 2 lines of No. 488 riveted chain with metal flights spaced 2' and galvanized rods 2" centers, 2x24" sides, 2" bottom, 4 - 10" No. 448 sprockets on 1 15/16" shafts and 2 flat boxes and 2 take-up boxes; complete with counterbalanced raising winch and grooved pulleys					
	Installed			260.00		315.00
	Transmission:					
2	8" RC60 sprockets		14.12	28.24	11.95	23.90
5'	RC60 chain		1.23	6.15	1.25	6.25
				294.39		345.15

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 6M - Motor					
1	3 H.P. 1800 R.P.M. 220 volt 3 phase 60 cycle geared head motor, with 17:1 reduction gear, magnetic switch and push button control					
	F.O.B. Plant			260.00		280.00
	Installation			10.00		10.00
	Wiring:					
20'	1/2" conduit wired		.27	5.40	.35	7.00
	Millwrighting:					
1	Metal cover			6.00		7.50
				281.40		304.50

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 7 - Ice Hoist					
1	500# capacity Torpedo electric hoist, 110 volt, single phase, 60 cycle, No. 2862, on 30' - 6" T beam and trolley					
	Installed			300.00		384.00
				300.00		384.00

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 8 - Ice Crusher					
1	30x16" steel plate ice crusher with 5 strand V belt drive, 14" pulley and 24" pulley, 7 1/2 H.P. 1750 R.P.M. 3 phase 60 cycle 440 volt motor with magnetic switch and push button control					
	Installed			1018.00		1215.00
	Wiring:					
14'	3/4" conduit wired		.40	5.60	.48	6.72
	Millwrighting:					
1	30"x6' table of 2" lumber			10.00		17.00
				1033.60		1238.72

G. of G. C	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	<u>Item No. 9</u> - Sprial Conveyor					
1	10' - 12" spiral conveyor, 2 1/2" shaft, metal trough, open top, plain ends					
	Installed			112.00		162.50
	Transmission:					
4'	RC60 chain		1.23	4.92	1.25	5.00
1	4" RC60 sprocket			9.60		9.25
1	6" RC60 sprocket			11.53		13.05
	Pipe:					
8'	10" pipe		1.30	10.40	1.50	12.00
				148.45		201.80

G. of G. C.	Machinery	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Item No. 9M - Motor					
1	1 H.P. 220 volt 3 phase 60 cycle 1750 R.P.M. geared head motor, reduced to 96 R.P.M., with magnetic switch					
	Installed			224.00		247.00
				224.00		247.00
	Total Machinery			8046.05		9756.81

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Power Wiring	Unit Value	Unit Value	9--1943	Unit Value	1--1948
80'	1 1/4" conduit wired		.68	54.40	.81	64.80
1	8"x12"x7' gutter bos, 9 openings			48.00		118.80
1	200 amp 3 pole single throw switch, 220 volt			51.55		61.90
8	30 amp 220 volt 3 pole single throw switches		16.50	132.00	19.80	158.40
1	100 amp 220 volt 3 pole single throw switch			34.20		41.00
	Total Power Wiring			320.15		444.90

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Pipe & Fittings	Unit Value	Unit Value	9--1943	Unit Value	1--1948
	Water					
40'	3" pipe to Main		.75	30.00	.90	36.00
1	3" L			1.78		2.15
1	3" foot valve			8.95		10.70
20'	3" pipe		.75	15.00	.90	18.00
1	3" gate valve			17.45		33.15
1	3" companion flange			3.25		3.50
4	3" T's		2.64	10.56	3.25	13.00
1	3" plug			.69		.80
40'	1 1/2" pipe		.31	12.40	.35	14.00
4	1 1/2" fittings		.66	2.64	.80	3.20
12'	1 1/4" pipe to Bins		.27	3.24	.31	3.72
6	1 1/4" fittings		.57	3.42	.60	3.60
1	1 1/4" globe valve			3.25		4.30
40'	3/4" pipe and fittings		.20	8.00	.32	12.80
1	3/4" globe valve			2.00		2.50
	Total Pipe & Fittings			122.63		161.42

NEW REPLACEMENT VALUES

COOLER PLANT

G. of G. C.	Miscellaneous Equipment	Unit Value	Unit Value	9--1943	Unit Value	1--1948
1	Toledo scaffold type, 1# graduation dial scale, Style 312812, No. T9582, 3250# capacity					1225.00
1	9 key Sundstrand adding machine					345.00
1	Shovel					2.25
						1572.25
	Total Equipment Cooler Plant					11935.38

APPENDIX D

REPORT OF PLANT SURVEY
GULF OF GEORGIA PLANT
NOVEMBER 1953

DEPARTMENT OF FISHERIES
CANADA

Report No. BC 28

in conjunction with

FISHERIES RESEARCH BOARD OF CANADA

REPORT OF PLANT SURVEY

FRESH, FROZEN AND CURED FISH OPERATIONS

Date: Nov. 18, 1953

Time of Day: 11:00 a.m.

(A) General Details - Owner, Employees, Operations, Markets, etc.

1. Owner Canadian Fishing Co.
2. Name of Plant Gulf of Georgia
3. Address Steveston B.C.
4. Name of Plant Manager Mr. Lloyd Monk
5. Name and Title of person interviewed Same
6. Nature of operation - List of products, and quantity produced annually, indicating whether fresh, frozen or cured; dressed or fillets, and also whether sold in bulk, or, if packaged, what package sizes?

Product and Details	Quantity
Lands, holds and tranships	
whole round fish -	4,000,000 pounds.

7. What are the principal markets? Export____ Inter-Provincial____ Local____ (Use check mark) / All fish transported to Home Plant for processing.
8. What is the maximum daily production?
9. Maximum number of employees? Male 10 Female
10. What is the production on day of survey?
11. During what period of the year does the plant operate? During salmon season.
12. If closed down, date when plant last operated.
13. Is fish delivered to the plant from company packers, cash buyers, other wholesalers, or individual fishermen?

Company packers and collector boats.

(A) - continued - 2 - Report No. BC 28

14. Approximate processing area of plant See #56 sq. ft.

15. Ice-making capacity (24 hr. day)

16. Ice storage capacity 16 tons.

17. What other source of ice is used? Supplied from Vancouver.

18. What is the plant's annual consumption of ice? Not available.

19. Source and adequacy of fresh water supply

No fresh water used.

20. Is it chlorinated or otherwise treated?

21. Is it tested, and by whom and how often?

22. Is any sea water or secondary water supply used? Yes.

23. If so, for what purpose? Describe the source and any treatment.

River water used for washing down.

24. If a secondary water supply is used, is it connected with the primary fresh water system?

25. Is the plant subject to inspection by municipal or provincial authorities?

26. If so, by what authority? No.

27. What is the nature of such inspection?

28. How frequent is it?

29. Are employees subject to periodic medical examination?

30. Remarks:-

This plant lands, holds and tranships fish, but does not do any dressing or filleting.

(B) Building: - 3 - Report No. BC 28

31. Location: Over water Yes On Waterfront ______ Inland ______

32. Character of waterfront in immediate vicinity River basin.

33. Is the immediately adjoining area occupied by other buildings? If so, what are the other buildings used for?

Reduction plant.

34. Does this plant occupy one building completely, or more than one building completely?

One building.

35. If the plant shares a building, what is the rest of the building used for? ______

36. Does the building occupied consist of more than one storey? 2 storeys.

37. Is there a basement? If so, what is it used for? No.

38. What type of foundation? Piling.

39. What materials are used in construction? Wood.

40. What is the age of the building? ?

41. What is the state of repair of the building? Fair.

42. Type of ceiling? (If sheeted, with what material? - joists with single flooring - joists with double flooring - open rafters). Open rafters.

43. Is ceiling area painted? No.

44. Condition of paint? ______

45. Type of walls in detail Open studding, not painted.

46. Condition of paint on walls? Fair.

47. Construction of floors Wood planking.

48. Condition of floors Good.

49. Drainage of floors -

50. Type and construction of drains ______

(B) - continued - 4 - Report No. BC 28

51. Disposal of drainage

52. Is the plant adequately ventilated? Yes.

53. Are fly screens used on doors and windows? No.

54. Is the plant adequately lighted? Yes.

55. In what respects is the plant layout unsatisfactory?

56. Remarks:-

Facilities consist of elevator belt to six wooden bins, and conveyor belt from bins to deliver to transport trucks. Stores ice in same building and is equipped with a crusher and conveyor for delivering crushed ice to the holding bins.

(C) Equipment:

57. How are fish stored before processing? Wooden bin.

58. What are fish holding bins or icing boxes made of? Wood.

59. Are mechanical washers or slimers used? No.

60. What materials are the tables made of? Not used.

61. If a conveyor system is used, what materials is it constructed of? Metal with wood frame.

62. Materials in containers or carts used for moving fish within plant.

63. List other mechanical equipment used on production line ______ None

64. What is dip tank constructed of? ______ Not used.

65. Materials used for cutting boards? ______ Not used.

66. What type of freezers and their capacity? ______ None.

67. Cold storage capacity ______ None.

68. Temperature of cold storage rooms? ______

69. Remarks:-

(D) Sanitation:

70. Is fish kept or stored on the floor? ______ No.

ø 71. Adequacy of icing, if held ______ Not using any.

ø 72. Cleanliness of equipment and working area ______ Fair.

73. What cleaning, disinfecting, or insecticidal materials are used? ______

74. Are there any signs of vermin or other pests? ______

75. Is hot water or steam used in cleaning? ______ No.

76. What type of container is used for offal? ______

77. How is offal disposed of? ______

78. Are offal containers removed frequently and cleaned before re-use? ______

(b) Sanitation - continued - 4 - Report No. MG 25

79. Are cutting boards replaced frequently? ____

80. Condition of cutting boards? ____

81. Are areas under tables and other equipment readily accessible for cleaning? ____

82. Are knives, trays, etc., kept clean and rust-free? ____

83. Number and type of toilets In reduction plant close by.

84. If privies are used, how far are these from the plant? ____

85. Are washbasins with hot and cold running water, soap or soap substitute, clean towels, and toilet tissue provided at places convenient to the toilets and also to the working areas?

In reduction plant close by.

86. Cleanliness of toilets and washrooms Not seen.

87. What protective clothing, including gloves and head gear, is provided or insisted upon by the management? ____

88. Is this clothing laundered or washed by employees or by the management? ____

89. Does it appear clean? ____

90. Is smoking permitted in the working area? Yes.

91. Are "No Smoking" signs displayed? No.

92. Are lunch room and rest period facilities for employees provided? ____

93. If so, give details ____

94. State of cleanliness of such facilities ____

95. Personal tidiness and cleanliness of employees in dress, appearance, and otherwise ____

96. Remarks:

(E) General Observations:-

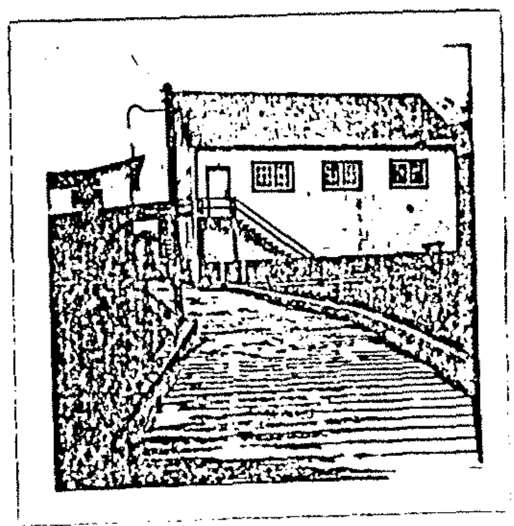
There was some difficulty in surveying this plant, as the manager wished to be present. Three visits were made to the plant, but the manager was only available for a few minutes on the third visit.

R. S. Bolton

Signed:
Chief Chemist, Canned Fish Inspection Laboratory,
Vancouver, B. C.

S. W. Roach

Signed:
Senior Technologist,
Pacific Fisheries Experimental Station,
Vancouver, B. C.



Endnotes

1 United States, Patent Lists, Washington, Government Printing Office, 1861, no. 31736, dated March 19 1861.

2 United States, Fisheries Commission, Bulletin Vol. XVIII, C.H. Stevenson, "The Preservation of Fishery Products for Food", Washington, 1898, p. 371.

3 ibid.

4 Hal Williams, Mechanical Refrigeration (London: Sir Isaac Ritman and Sons Ltd., 1924), pp. 51-52.

5 U.S. Fisheries Commission, Bulletin XVIII, op. cit., p. 371.

6 ibid, p. 373.

7 Williams, p. 51.

8 ibid, p. 61.

9 ibid, p. 61.

10 U.S. Fisheries Commission Bulletin XVIII, op. cit., p. 374.

11 U.B.C. Special Collections, Doyle Papers, "B.C. Packers Report, November 1902", box 11, file 12. See Skeena River notes #4.

12 Canada, Sessional Papers 1888, no. 6, p. 242.

13 Canada, Sessional Papers 1887, no. 16, p. 251.

14 Canada, Sessional Papers 1896, p. 192.

15 Canada, Sessional Papers 1907-1908, p. 230.

16 Pacific Fisherman, August 1911, Vol. IX, p. 13.

17 Pacific Fisherman, January 1904, Vol. II, pp. 49-50.

18 Vancouver Sun, May 29 1916, pp. 1, 4; Pacific Fisherman, July 1916, Vol. XIV, p. 27; Pacific Fisherman, June 1916, Vol. XIV, p. 11.

19 British Columbia Registrar of Companies, Victoria, B.C. Canadian Fishing Company, List of Persons Holding Shares in the Canadian Fishing Company, November 1, 1910.

20 Canada, British Columbia Fisheries Commission, 1905-1907, evidence submitted, Victoria, 1906, p. 181.

21 University of British Columbia, Canada, Department of Marine and Fisheries. pre-1915 manuscripts, microfilm, memorandum for Sir Louis H. Davies, Ottawa, November 28, 1900, reel #33.

22 ibid, letter from Henry Doyle to the Minister of Fisheries, November 18, 1902, reel #33.

23 ibid, letter from C.F. Watson to the Hon. Clifford Sifton, December 8 1904, reel #33.

24 ibid, letter from C.P.R. to the Minister of Fisheries, November 26 1902, reel #33.

25 ibid, letter to the Minister of Customs from Chrysler, Bethune, and Larmouth, November 24, 1909, reel #33.

26 Canada. British Columbia Fisheries Commission, 1905-1907, evidence

submitted, Victoria, 1906, p.183.

27 Same as 25.

28 Pacific Fisherman, June 1916, Vol. XIV, p. 11.

29 Pacific Fisherman, October 1910, vol. VIII, p. 16.

30 Vancouver City Archives, Bell-Irving diary, Vol. 33, February 1907.

31 Pacific Fisherman, October 1910, Vol. VIII, p. 16.

32 There is no connection between the Canadian Fishing Company and the Canadian Fish and Cold Storage Company, but the names are often confused as they sound the same and C.F.C. is often referred to as "Canadian Fish".

33 Canada, Sessional Papers, 1917, No. 210a, "Cold Storage in Canada", p. 8.

34 Pacific Fisherman, September 1913, Vol. XI, p. 22.

35 Appraisement of the Canadian Fishing Company Ltd., Vancouver, B.C. 1924-1928, pp. 68, 83-84.

36 Pacific Fisherman, January 1906, Vol. IV, p. 77.

37 United States Bureau of Fisheries Document No. 1016, H.F. Taylor, "Refrigeration of Fish", Washington 1927, p. 534.

38 The Triumph Ice Machine Company, catalogue 1901-1902, Smithsonian Institute, p. 31.

39 This explanation was provided by Alex Barbour of Parks Canada's Machine and Vessels Department, Ottawa.

40 Triumph Ice Machine Company catalogue, pp. 11-13.

41 ibid, p. 33.

42 ibid, pp. 34-35.

43 ibid, p. 35.

44 Appraisement of the Canadian Fishing Company Ltd., Vancouver Cannery (Home Plant), 1930-1939, pp. 102A, 102B., General Appraisal Co. Ltd., Vancouver, B.C.

45 ibid.

46 All that exist are photos, blueprints, and insurance appraisals provided by the Canadian Fishing Company's Home Plant personnel.

47 Fernand Braudel, The Perspective of the World, Civilization and Capitalism Volume 3 (New York, Harper and Row Publishers Inc., 1981) p. 540.

48 The descriptions of these production lines are based on tours and interviews in July 1985 with Matt Statl, charge hand of the Home Plant's freezer, and Everett Pierce, the cannery manager.

49 United States Bureau of Fisheries Document No. 1016, H.F. Taylor, "Refrigeration of Fish", Washington, 1927, p. 541.

50 Appraisement 1930-1937-1939, pp. 102C.

51 This description is based on tours and interviews with John Clerk of the Home Plant ice making gang, July 1985.

52 C.F.C., Daily Report, Gulf of Georgia Cannery, May 9 10 13 1927.

53 Interviews with Dick Jack, 1980-81.

54 C.F.C., Daily Report, Gulf of Georgia Cannery, June 21 1927.

55 As above. "Received 769 Reds, 211 White, 25 Ling Cod, and 350 Sturgeon which was sent to town."

56 "This morning at 3:30 the driver crew started putting in piles for driveway inside right wing of cannery ... Tonight they completed driving piles for driveway." C.F.C., Daily Report, Gulf of Georgia Cannery, May 20 1927. "Cannery crew continues to tear out lumber and cut through second floor old wing for driveway." C.F.C., Daily Report, Gulf of Georgia Cannery, May 14 1927.

57 "A partition to be made to separate the old wing which was formerly the fish wharf and which we intend to use for a net room." C.F.C., Machinery 1928, Necessary Repairs and Renewals to the Gulf of Georgia Cannery, for the season 1928.

58 These bins were presumably built for the 1933 salmon season as in December 1932 a winter storm collapsed the west wing and most of its front dock. Interviews with Dick Jack, 1980 and 1981; Vancouver Province, December 23 1932, p. 2.

59 Appraisement of Gulf of Georgia Cannery, 1937-1939, p. 52.

60 The pilings for this structure were integrated into the seine loft's front dock in 1939.

61 C.F.C. file re labour force 1930s; also interviews with Dick Jack, 1980-1981.

62 Appraisment of Gulf of Georgia Cannery, 1943-1948, p. 231.

63 ibid, p. 237.

64 Interview, Tad Hayashi, September 1985.

65 ibid.

66 ibid. Also based on personal experience while employed as a C.F.C. tenderman on ice packers.

67 Interviews with Tad Hayashi, September 1985, and Gordie Johnson, 1982-1983.

Bibliography

Braudel, Fernand
The Perspective of the World, Civilization and Capitalism. Vol. 3. Harper and Row Publishers Inc. New York, 1981.

British Columbia. Department of Fisheries. Annual Reports, 1900-1940's. King's Printer Victoria, 1901-1940's.

Canada. Department of Marine and Fisheries Annual Report for British Columbia. Ottawa, King's Printer, 1880-1940's.

Canada. Department of Marine and Fisheries. Dominion Fisheries Commission for British Columbia 1905-07. Government Printing Bureau, Ottawa, 1908.

Canadian Fishing Company
Interview with selected Fresh and Frozen Fish Staff of Home Plant (Vancouver) and Gulf of Georgia (Steveston), 1984, 1985.

Canadian Fishing Company. Archives
Gulf of Georgia Papers 1926-1980's, Home Plant Papers 1920's-1980's.

Jack, Dick.
Private Notebooks on the Gulf of Georgia Plant. Two Volumes 1939-40.

Pacific Fisherman (Seattle)
1903-1940's

Provincial Archives of British Columbia
British Columbia. Department of Fisheries Papers, 1900-1950's.

Public Archives of Canada.
Canada. Department of Fisheries Papers, 1915-1960's.

Smithsonian Institute
Industrial Catalogue Collection, The Triumph Ice Machine Collection.

University of British Columbia, Special Collections.
Papers of Henry Doyle 1900-1940's.
Canadian Fishing Company.
General Appraisal Co. Ltd., Vancouver, B.C., Blueprints and Insurance Appraisals of Home Plant and Gulf of Georgia 1920's-1980's.

University of British Columbia
Government Publications. Federal Department of Fisheries (Microfilm) Pre 1915.

United States Fisheries Commission
Bulletins 1880-1930.

United States Bureau of Fisheries
Documents 1880-1930.

United States
Patent Lists 1890-1920.

Vancouver City Archives
Papers of Henry Bell-Irving 1880-1930.

Williams, Hal
Mechanical Refrigeration. Sir Isaac Ritman and Sons Ltd., London, 1924.

Illustration I

Goad's Fire Insurance Map,

#342, Sheet GG, 1912

(Vancouver City Archives)

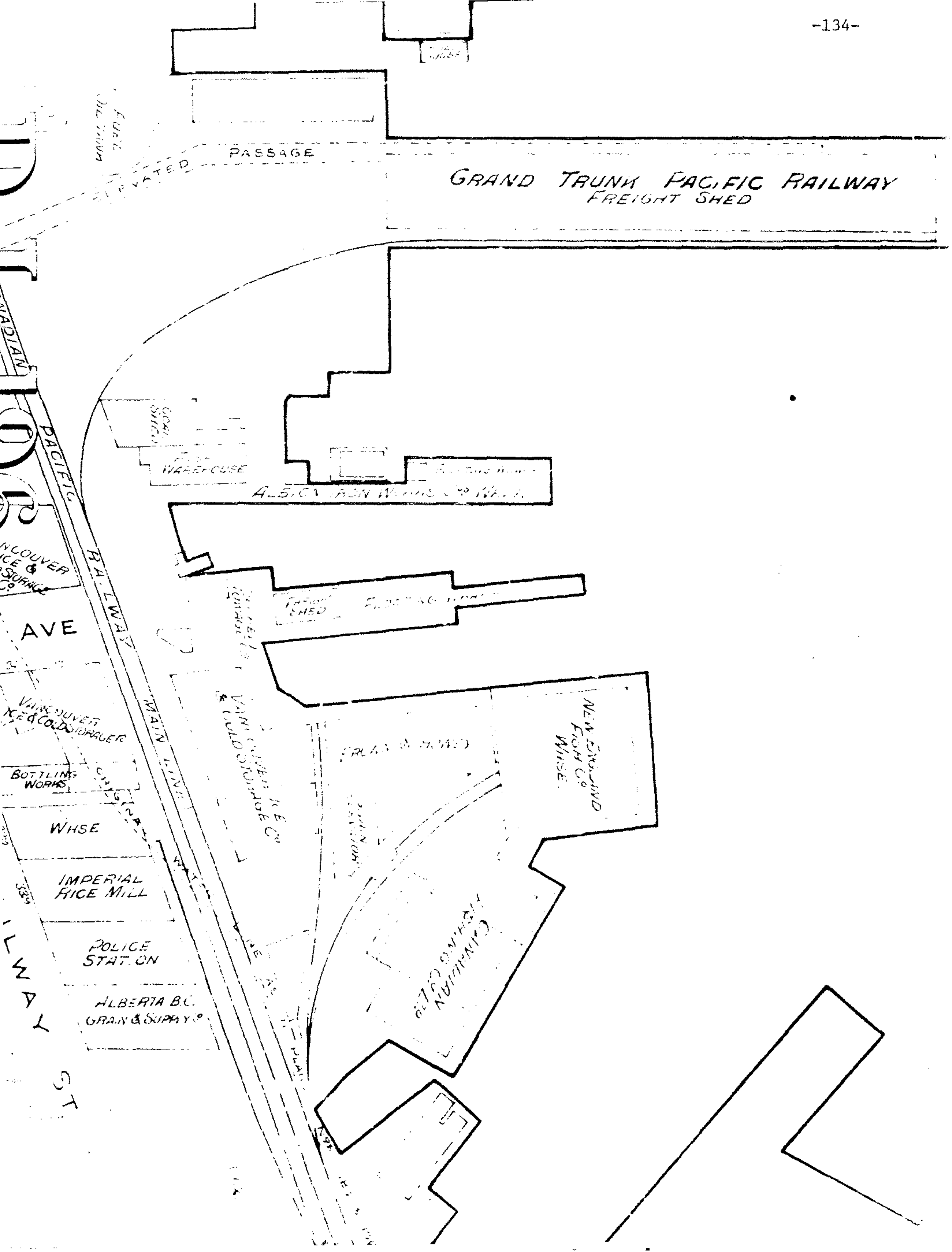

PASSAGE
ELEVATED
GRAND TRUNK PACIFIC RAILWAY
FREIGHT SHED
WAREHOUSE
PACIFIC
RAILWAY
MAIN LINE
AVE
BOTTLING WORKS
WHSE
IMPERIAL RICE MILL
POLICE STATION
ALBERTA B.C. GRAIN & SUPPLY Co
FREIGHT SHED
NEW ENGLAND FISH Co WHSE.
VANCOUVER ICE & COLD STORAGE Co
CANADIAN FISHING Co Ltd
ST

Illustration #2

Goad's Fire Insurance Map,

#599, vol. A, p. 12,

Revised June 1933

(Vancouver City Archives)

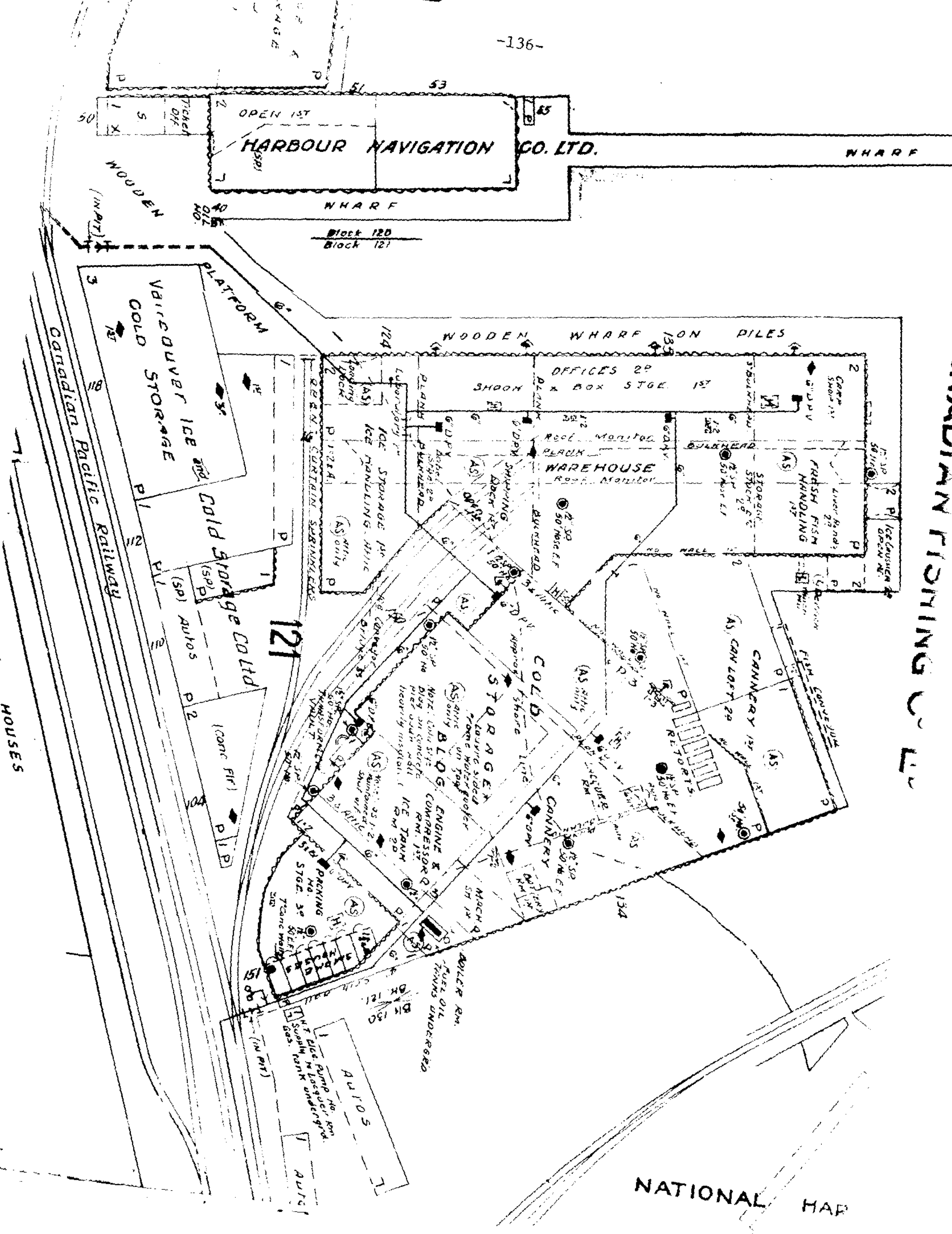

HARBOUR NAVIGATION CO. LTD.
OPEN 1ST
WHARF
WOODEN
Block 128
Block 121
PLATFORM
Vancouver Ice and Cold Storage
Cold Storage Co Ltd
Canadian Pacific Railway
WOODEN WHARF ON PILES
OFFICES 2º
SHOOK & BOX STGE. 1ST
WAREHOUSE
Roof Monitor
ICE STORAGE 1ST
ICE HANDLING
FRESH FISH HANDLING
COLD STORAGE BLDG.
ENGINE & COMPRESSOR RM. 1ST
ICE TANK RM 2º
CANNERY 1ST
CAN LOFT 2º
RETORTS
CANNERY
PACKING
AUTOS
(SP) Autos
(Conc Flr)
OPEN CURTAIN SPRINKLERS
FISH CONVEYOR
BOILER RM.
FUEL OIL TANKS UNDERGRD.
121
HOUSES
NATIONAL HAR

Illustration 3
Compressor, Triumph Ice Machine Company,
Catalogue, 1901-1902, p.32
(Smithsonian Institute Catalogue Collection)

THE TRIUMPH ICE MACHINE COMPANY

Manufacturers of

Ice Making and Refrigerating Machinery

Steel Ammonia Fittings and Specialties for Ice and Refrigerating Plants

CINCINNATI, OHIO, U. S. A.
1901-1902

SMITHSONIAN INSTITUTE INDUSTRIAL CATALOGUE COLLECTION, TRIUMPH ICE MACHINE COMPANY 1901-1902 p.32

Illustration 4

Canadian Fishing Co. Ltd.,

Gulf of Georgia Cannery,

Steveston B.C.

December 1937

(General Appraisal Co. Ltd.)

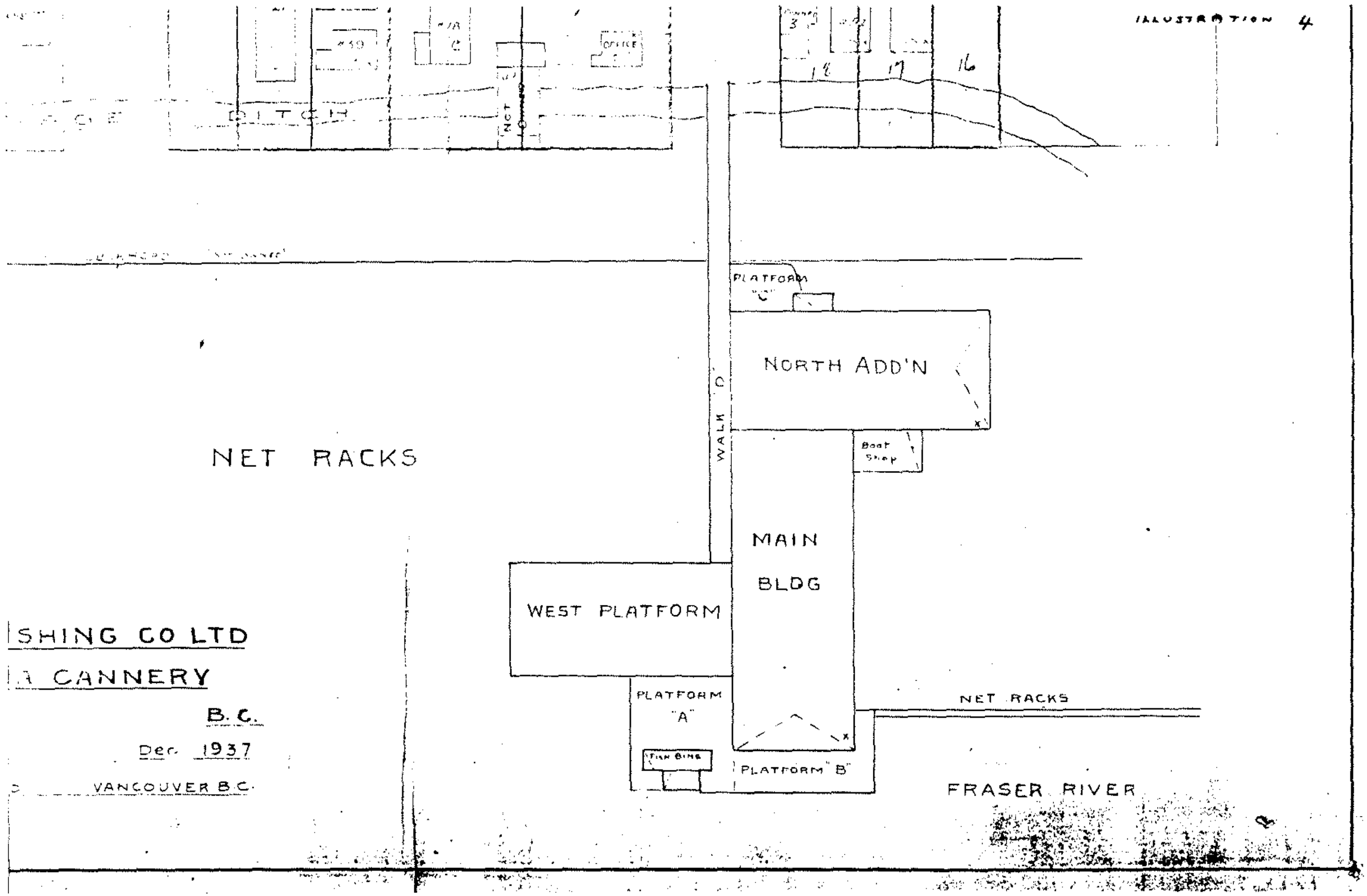


ILLUSTRATION 4
DITCH
OFFICE
18
17
16
PLATFORM "C"
NORTH ADD'N
WALK 'D'
NET RACKS
Boat Shop
MAIN BLDG
WEST PLATFORM
PLATFORM "A"
PLATFORM "B"
Fish Bins
NET RACKS
FRASER RIVER
SHING CO LTD
CANNERY
B.C.
Dec 1937
VANCOUVER B.C.

Illustration 5
Canadian Fishing Co. Ltd.,
Gulf of Georgia Cannery,
Steveston B.C.
July 1944
(General Appraisal Co. Ltd.)

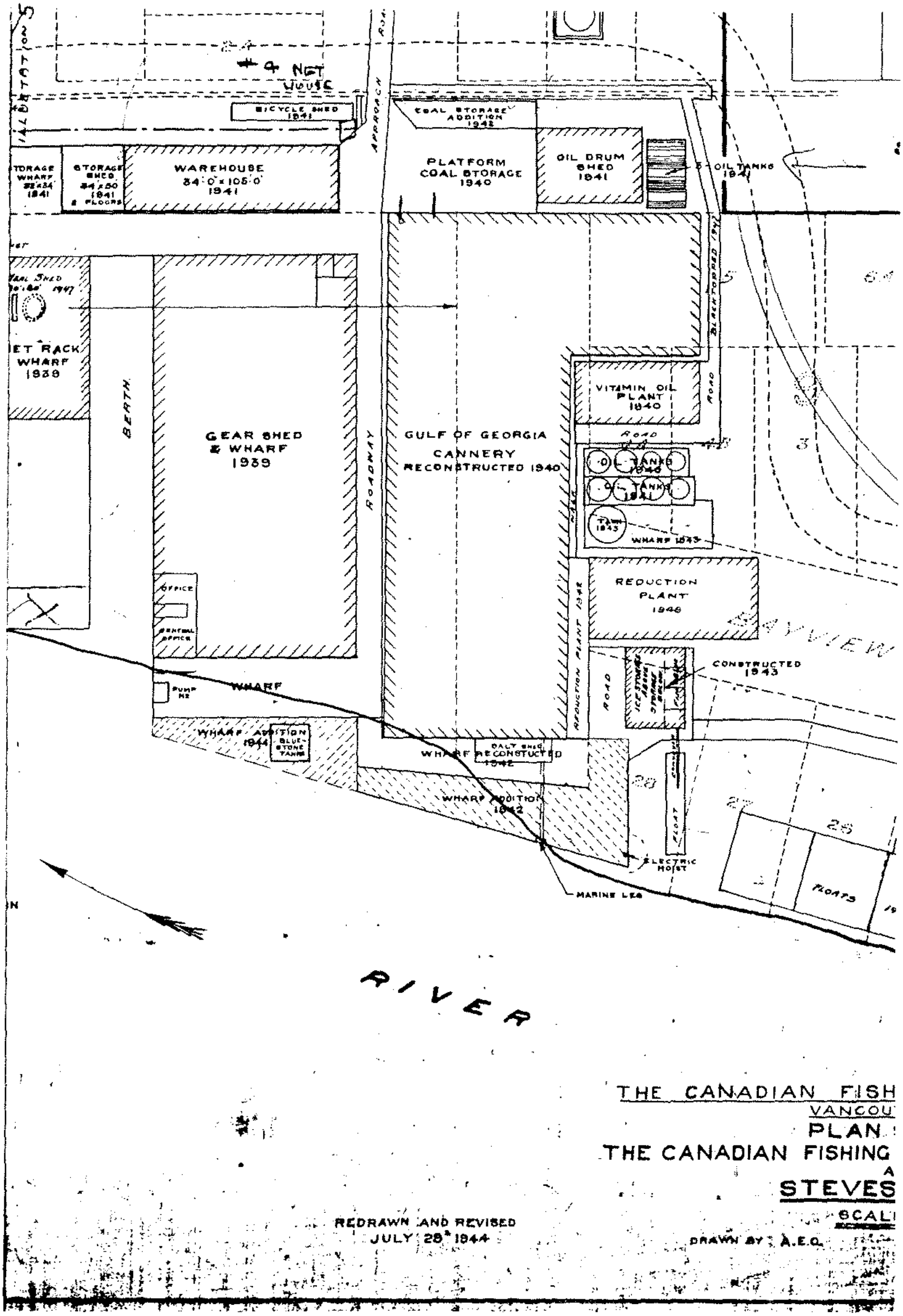

#4 NET HOUSE
BICYCLE SHED 1941
COAL STORAGE ADDITION 1942
STORAGE WHARF 1941
STORAGE SHED 1941 2 FLOORS
WAREHOUSE 34'0" x 105'0" 1941
PLATFORM COAL STORAGE 1940
OIL DRUM SHED 1941
OIL TANKS 1941
NET RACK WHARF 1939
BERTH
GEAR SHED & WHARF 1939
ROADWAY
GULF OF GEORGIA CANNERY RECONSTRUCTED 1940
VITAMIN OIL PLANT 1940
OIL TANKS 1940
OIL TANKS 1941
WHARF 1943
REDUCTION PLANT 1946
CONSTRUCTED 1943
OFFICE
WHARF
WHARF ADDITION 1944
WHARF RECONSTRUCTED
WHARF ADDITION 1942
ELECTRIC HOIST
MARINE LEG
FLOAT
FLOATS
RIVER
THE CANADIAN FISH
VANCOU
PLAN
THE CANADIAN FISHING
A
STEVES
SCAL
REDRAWN AND REVISED
JULY 28th 1944
DRAWN BY A.E.C.

Illustration 6
Two Stage Ammonia
Compression Refrigeration
System

TWO STAGE AMMONIA COMPRESSION REFRIGERATION SYSTEM

FOR TRADITIONAL SINGLE STAGE:
REMOVE BOOSTER COMPRESSOR

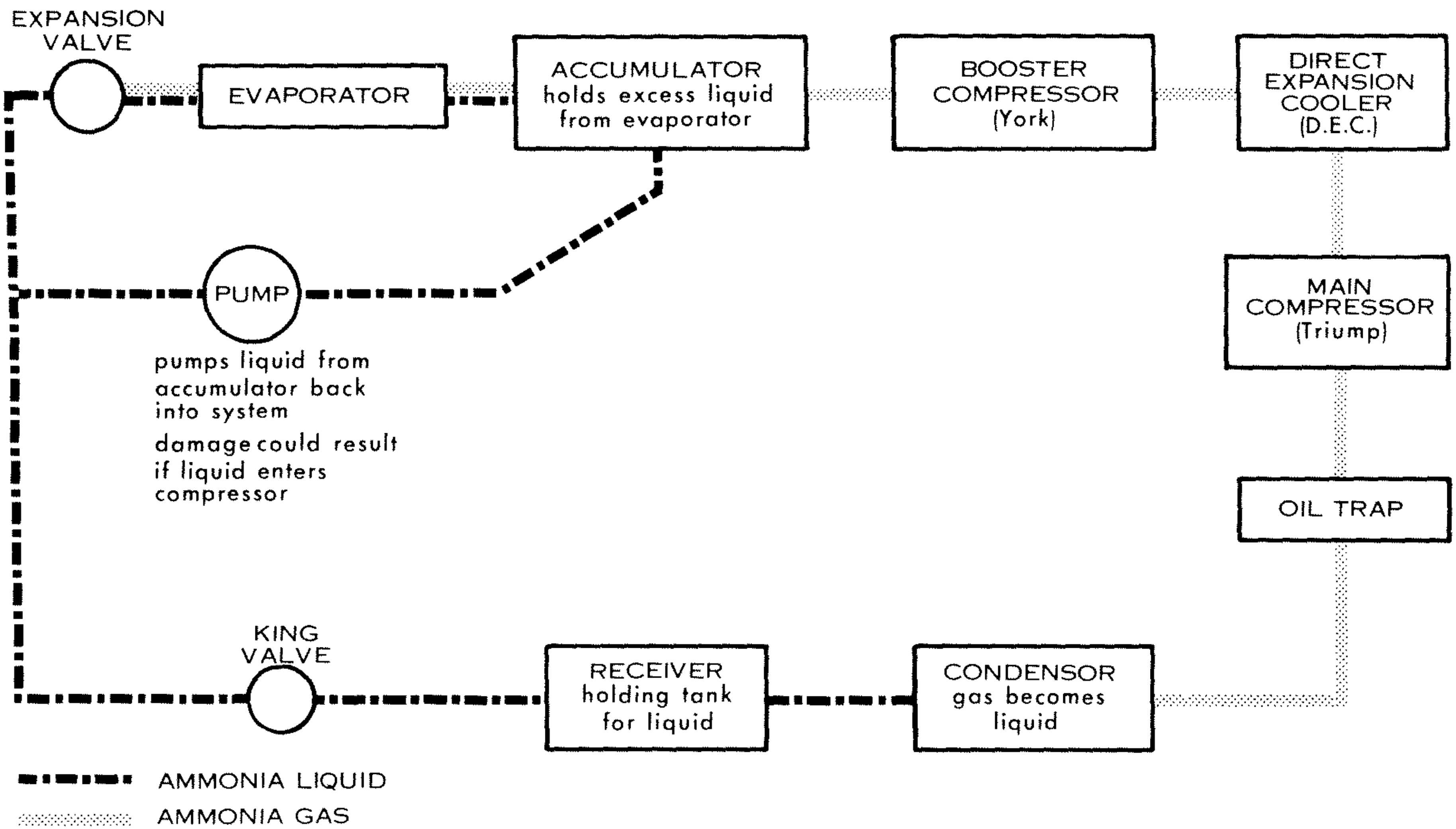


Illustration 7
First Foor Plan of
Cold Storage, 1930
(General Appraisal Co. Ltd.)

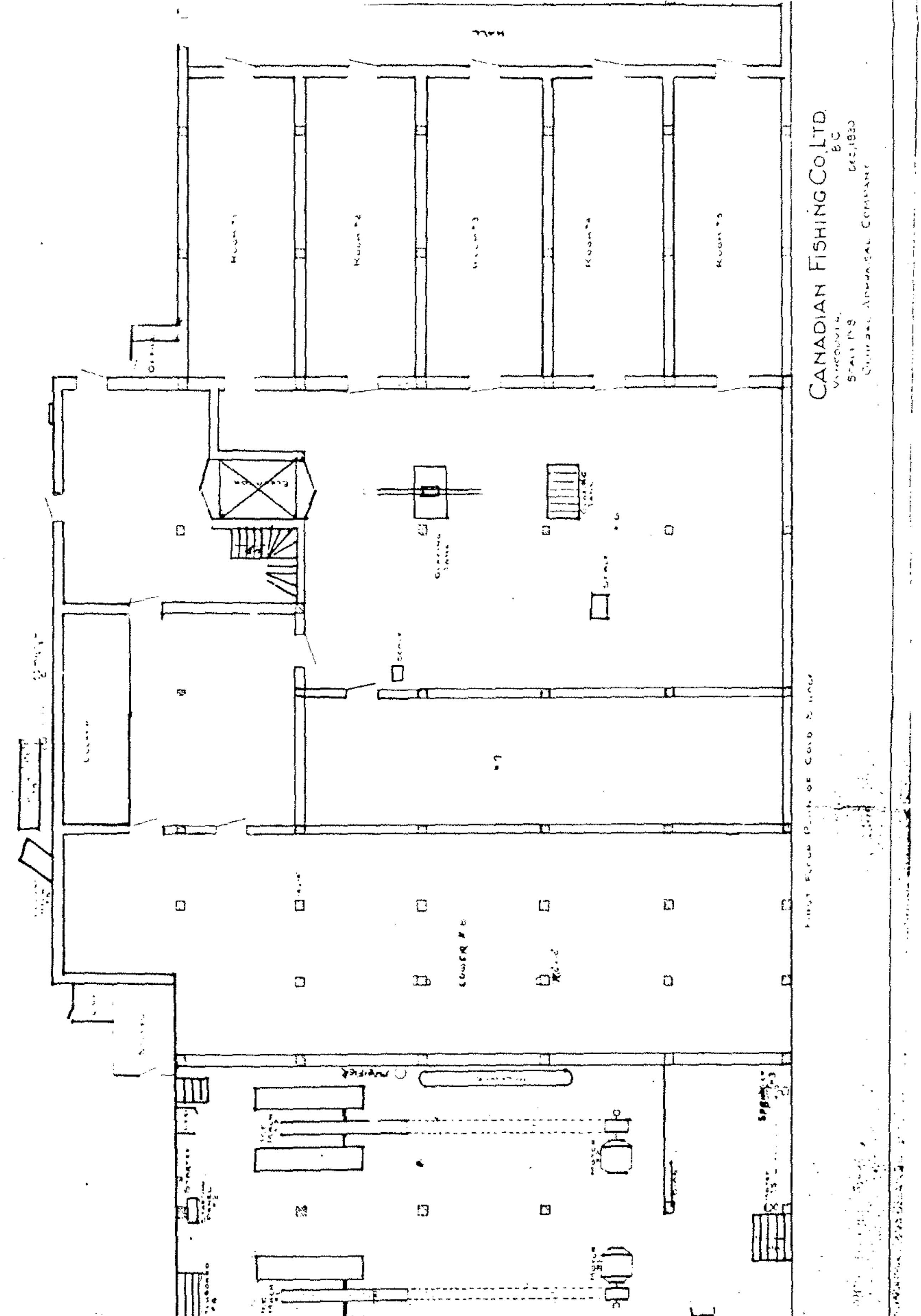

HALL
CANADIAN FISHING CO. LTD
B.C.
COOLER

Photo 1

Home Plant Fire, 1916

(Canadian Fishing Co.)

Photo 2
Home Plant after 1916 Fire
(Canadian Fishing Co.)

Photo 3
Pair of "Triumph" Compressor Units,
Home Plant Engine Room, 1918
(Canadian Fishing Co.)

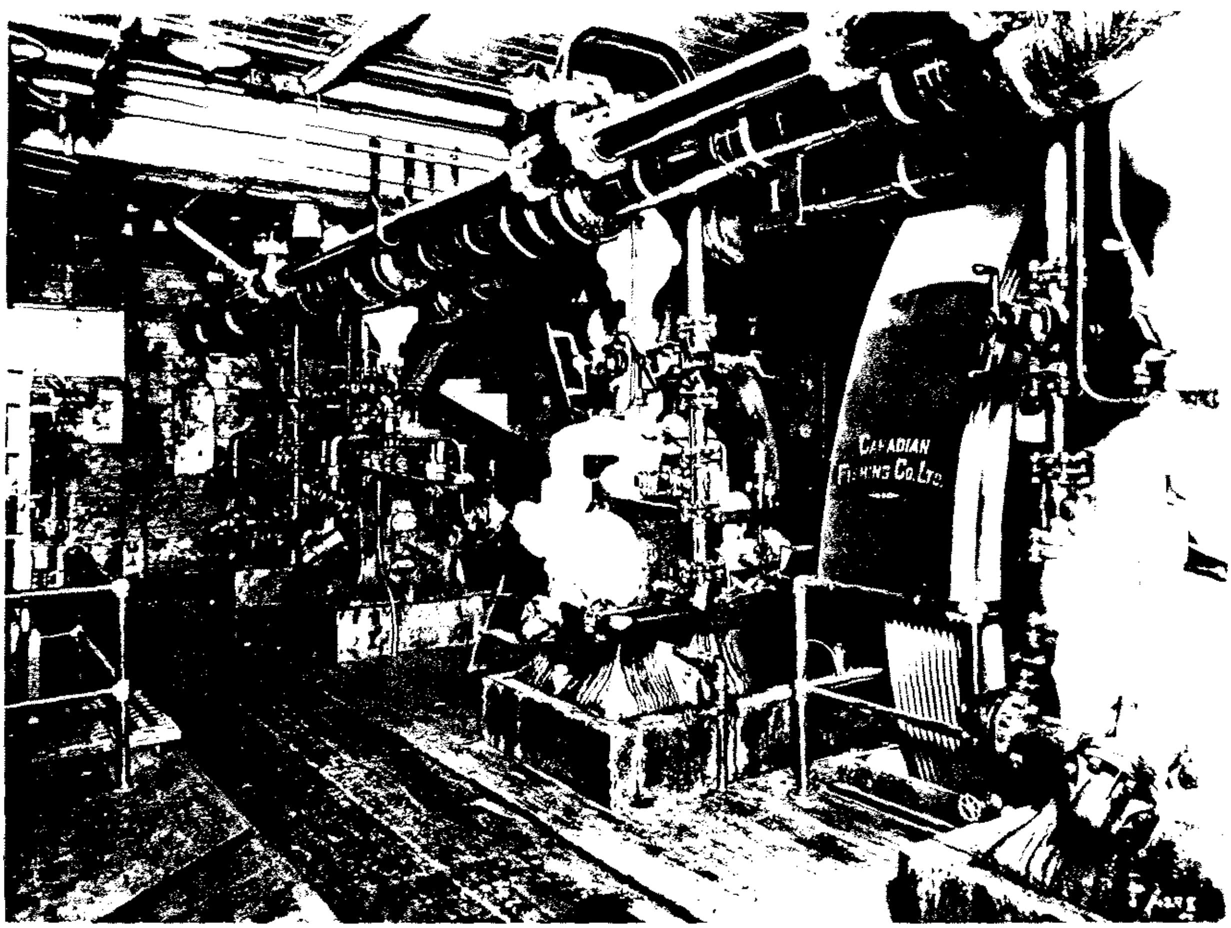

Co. Ltd.

Photo 4

Electric motor and sheeve in foreground,
flywheel and compressor in background, 1984
(author)

Photo 5

Electric motor on left,sheeve and rope drive
in centre

(author)

Photo 6
Flywheel and compressor,
1984 (author)

Photo 7
Note bolts on right which hold the
two halves of the flywheel together,
1984 (author)

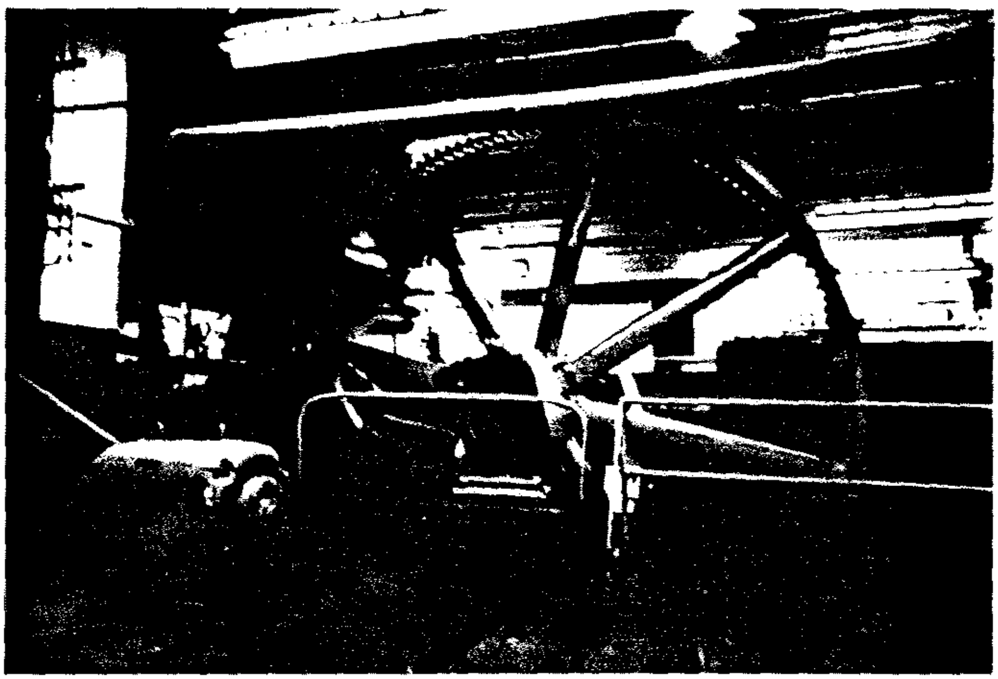


Photo 8
Rope drive and pulleys with
generator in background,
1984 (author)

Photo 9

Compressor on right, shaft to flywheel
in centre, and flywheel on left.
1984 (author)

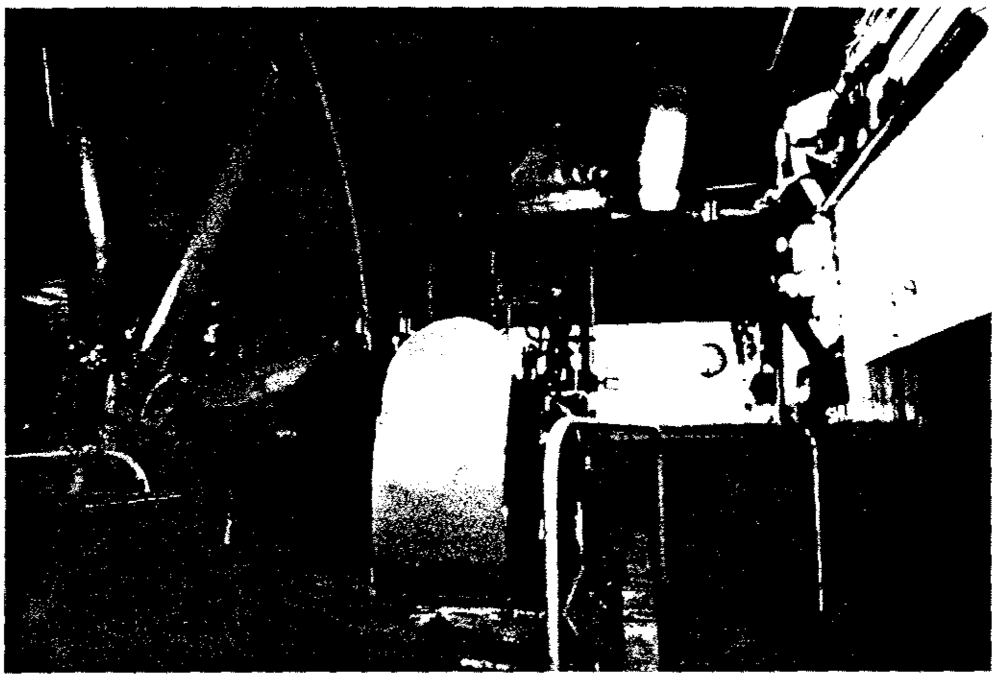


Photo 10

Dressing gang, Home Plant 1918.

Note wooden dressing table

(Canadian Fishing Co.)

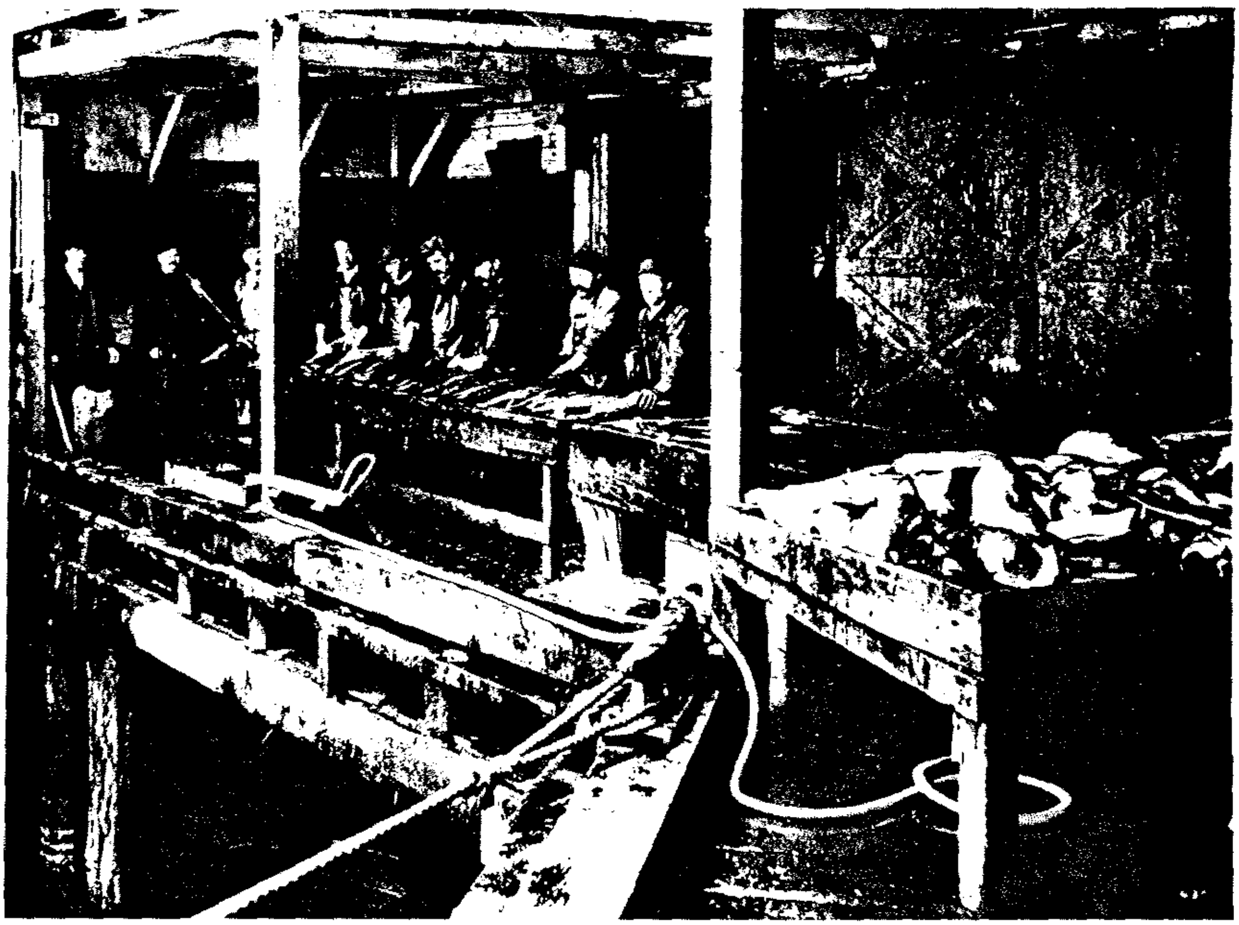


Photo 11

Dressing gang, Home Plant, 1985.
Note aluminum dressing table and
plastic dressing boards. These
boards prevent dressers' knives
from blunting on the aluminum tables
(David Hill-Turner)

Photo 12
Dressing salmon,
Home Plant, 1985
(David Hill-Turner)

Photo 13

Weighing freezer truck of dressed salmon at tally station prior to entering freezer.

Home Plant, 1985

(David Hill-Turner)

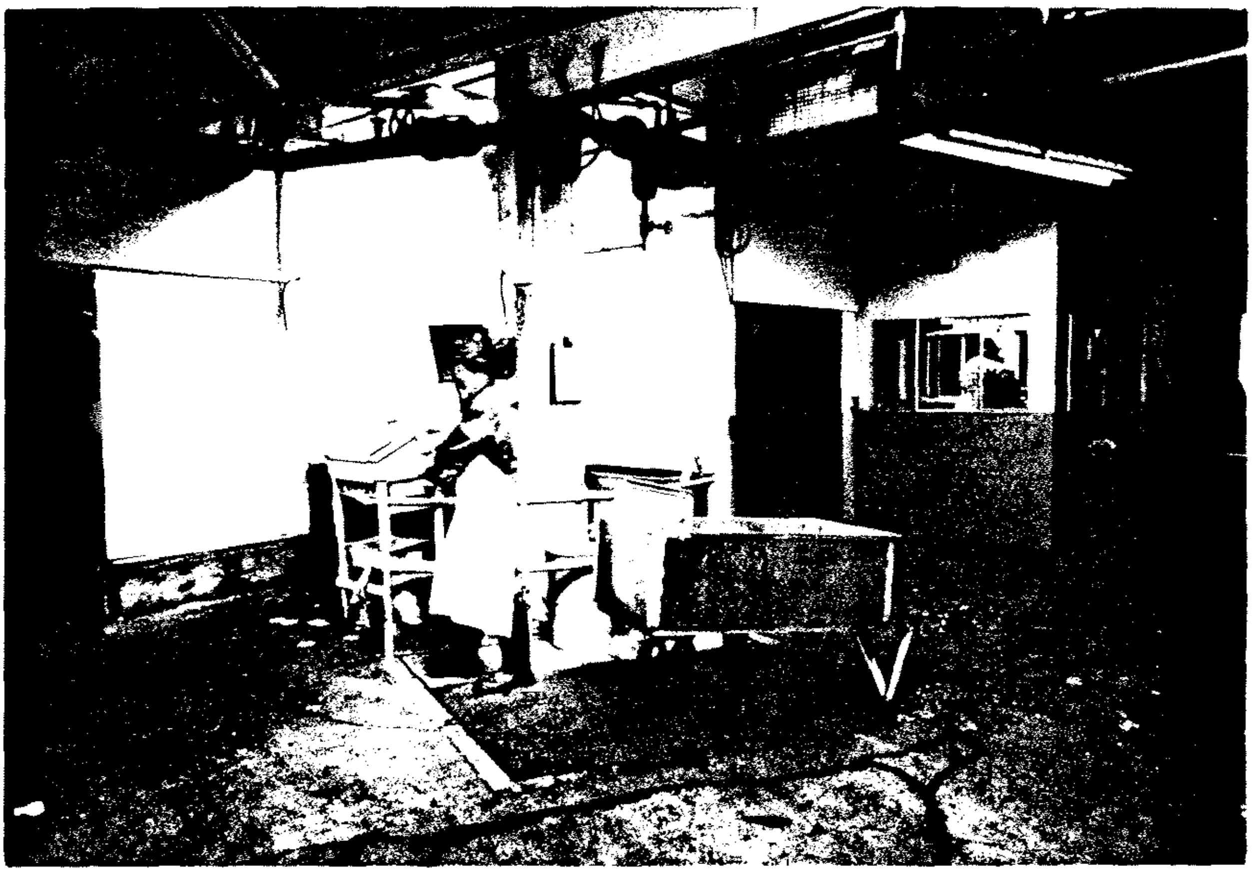


Photo 14
Freezer truck entering the freezer
unit on the way to the shop
freezer, 1985
(David Hill-Turner)

Photo 15

Entrance hallway to sharp freezers.
Dressed fish enter freezer complex through
doorway on left and sharp freezers through
doors on the right. Note the five sharp
freezers are numbered 1 to 5 on the doors.
The numbers for No. 1 and No. 2 sharp
freezers are visible, left and centre.
Home Plant, 1918
(Canadian Fishing Co.)

Photo 16

Glazing room and tank.

The exit for No. 1 sharp freezer

is visible behind the glazing tank.

Home Plant, 1918

(Canadian Fishing Co.)

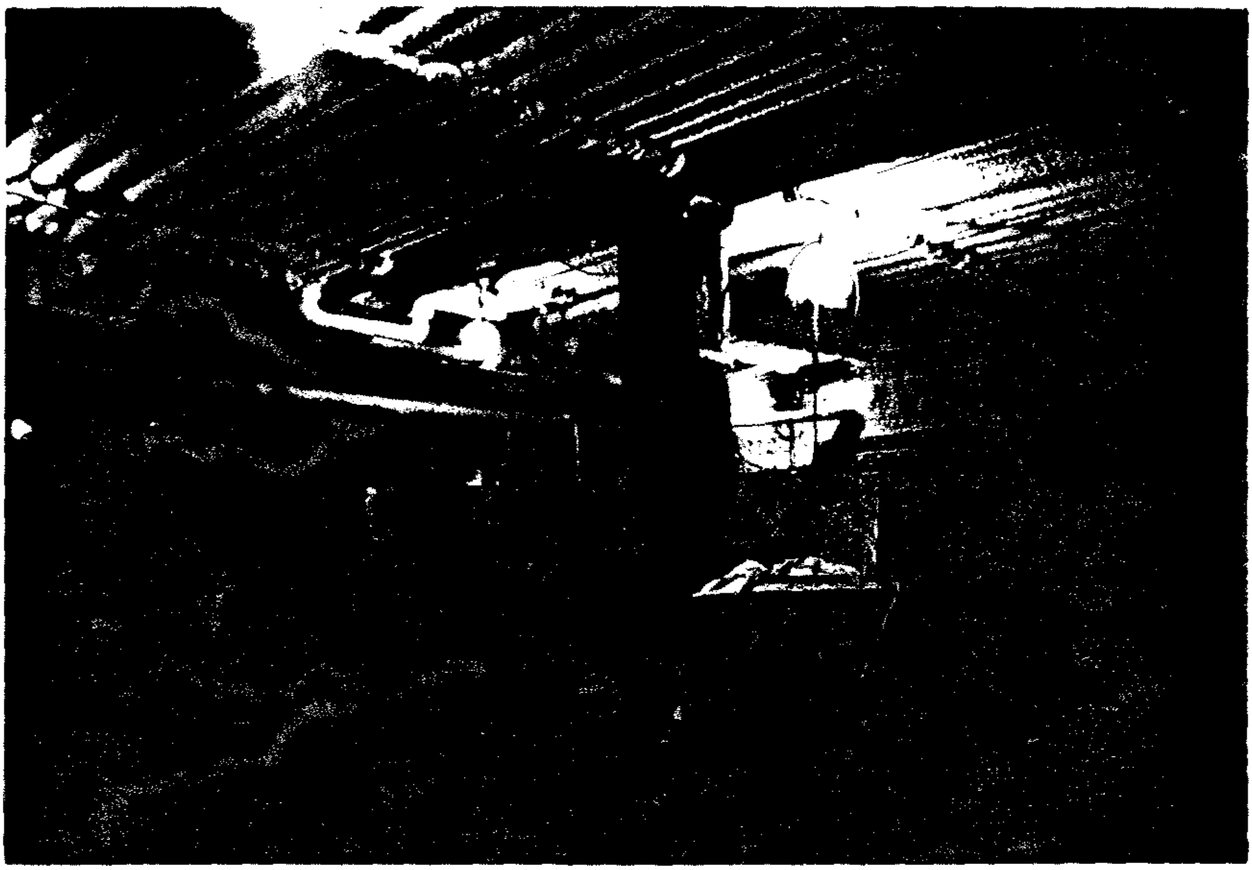


Photo 17
Empty sharp freezer, door at
rear leads to glazing room.
Home Plant, 1918
(Canadian Fishing Co.)

Photo 18
Loading right hand side of sharp freezer. Fish are placed back to the wall and belly to belly. Note metal shelves on top of expansion coils which allow fish to freeze flat on one side to ensure easy stacking and a tight pack.
Home Plant, 1985
(David Hill-Turner)

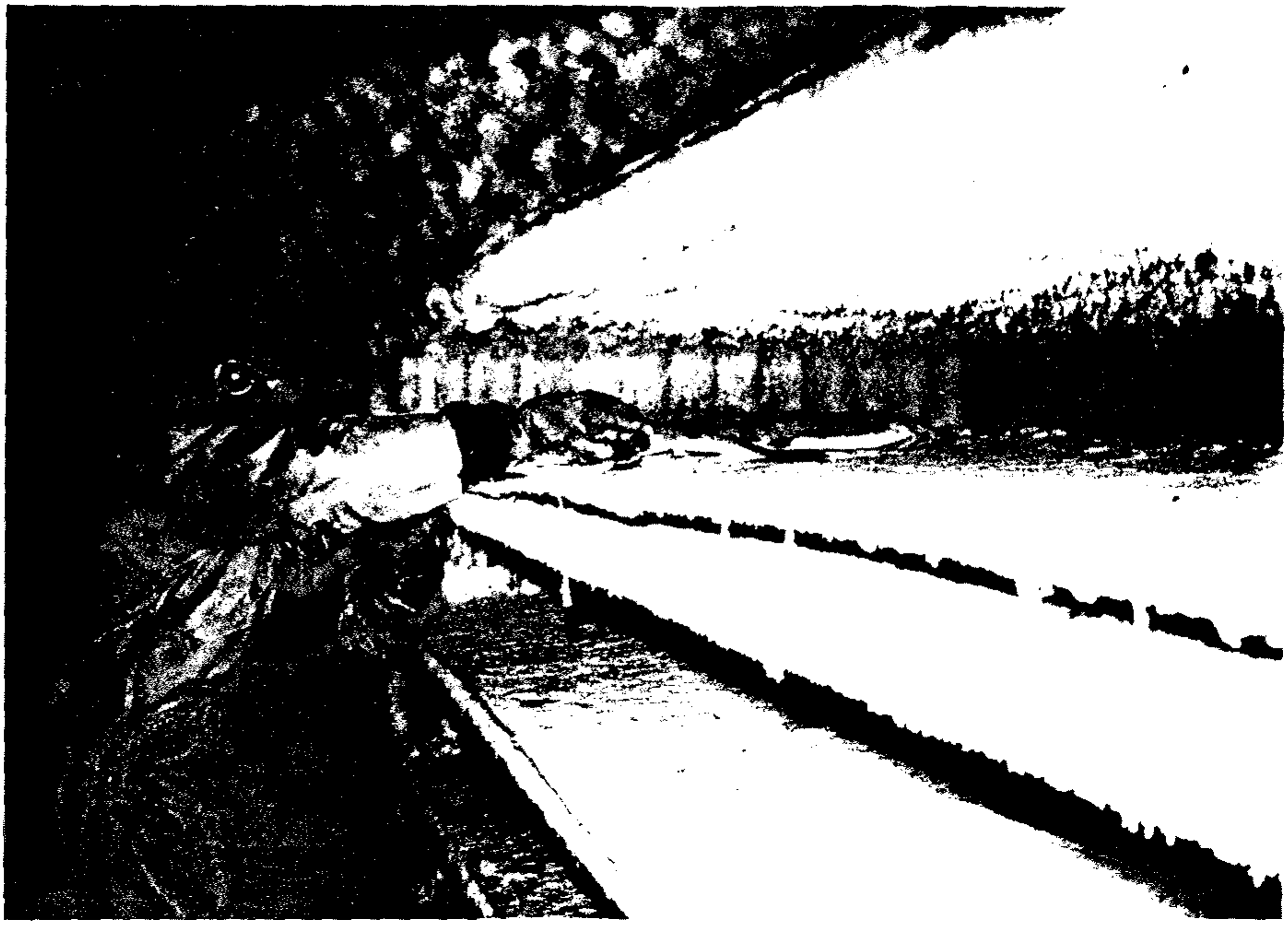


Photo 19

Loading a charge of salmon into a
sharp freezer. Note, in loading
left side of freezer, salmon are
placed belly to the wall and back to back.
Home Plant, 1985
(David Hill-Turner)

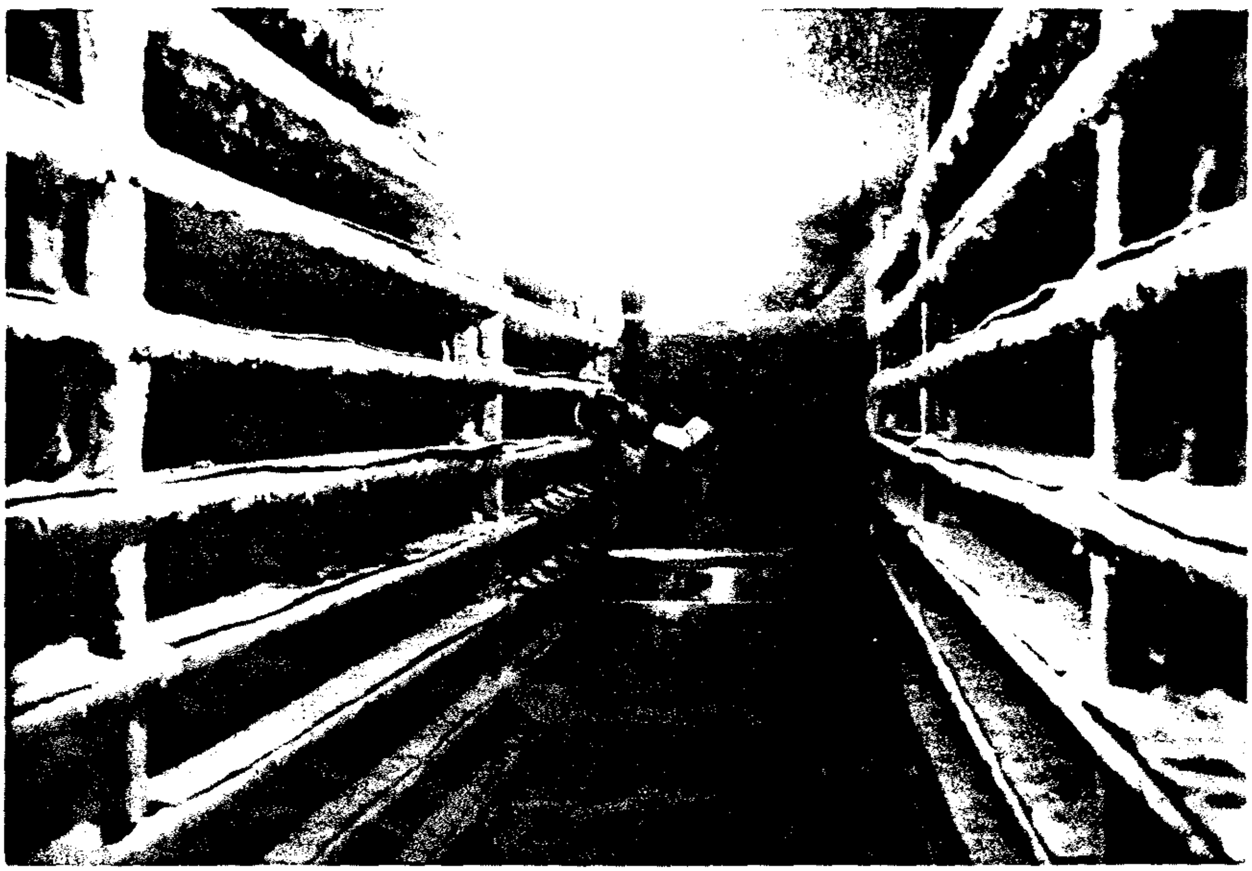


Photo 20
Sharp freezer with a full charge.
Home Plant, 1985
(Canadian Fishing Co.)

Photo 21

Glazing room. Note wooden freezer
truck with glazing tank behind.
Home Plant, 1918
(Canadian Fishing Co.)

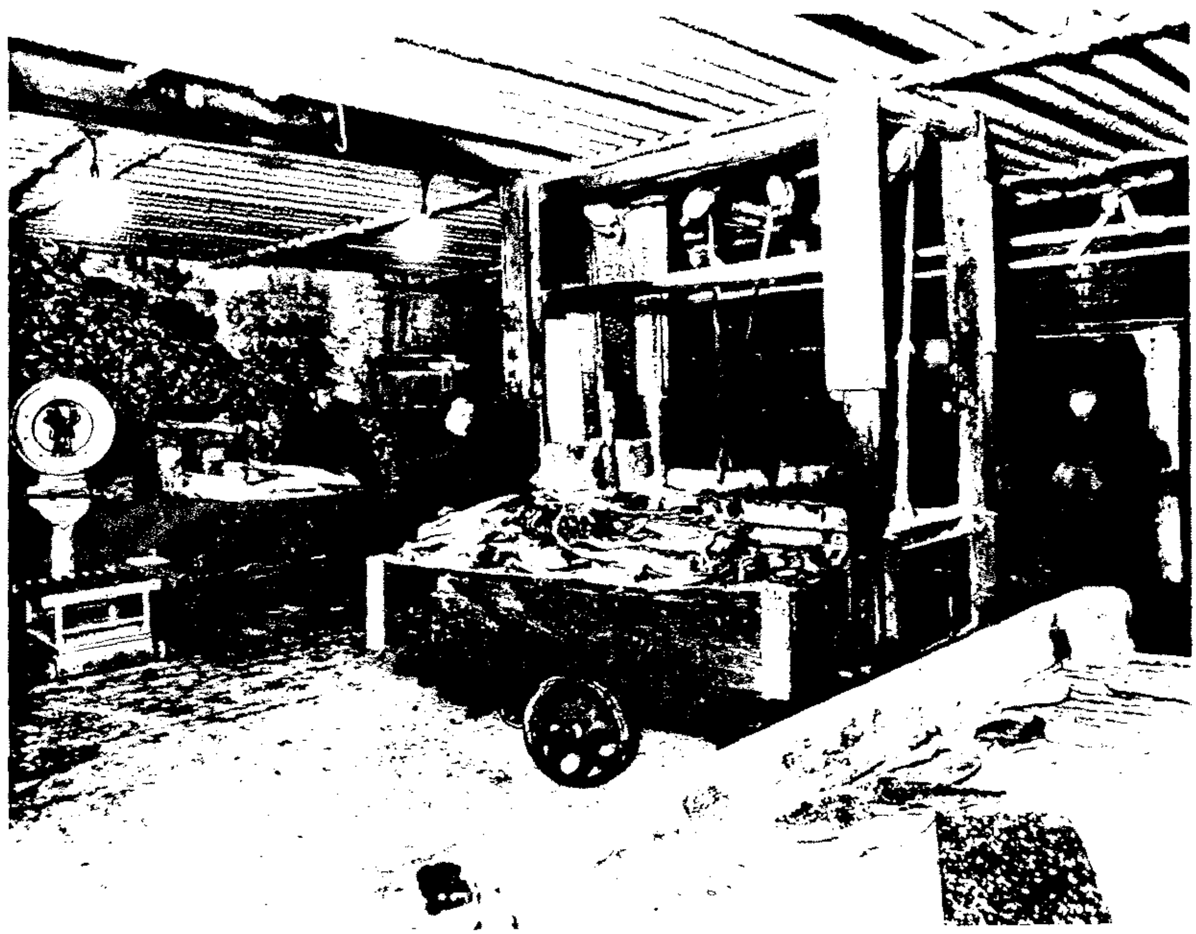


Photo 22

Glazing room.

Removing fish from glazing tank.

Home Plant, 1918

(Canadian Fishing Co.)

Photo 23

Fish in storage freezer.

Note they are stacked like cordwood.

Home Plant, 1918

(Canadian Fishing Co.)

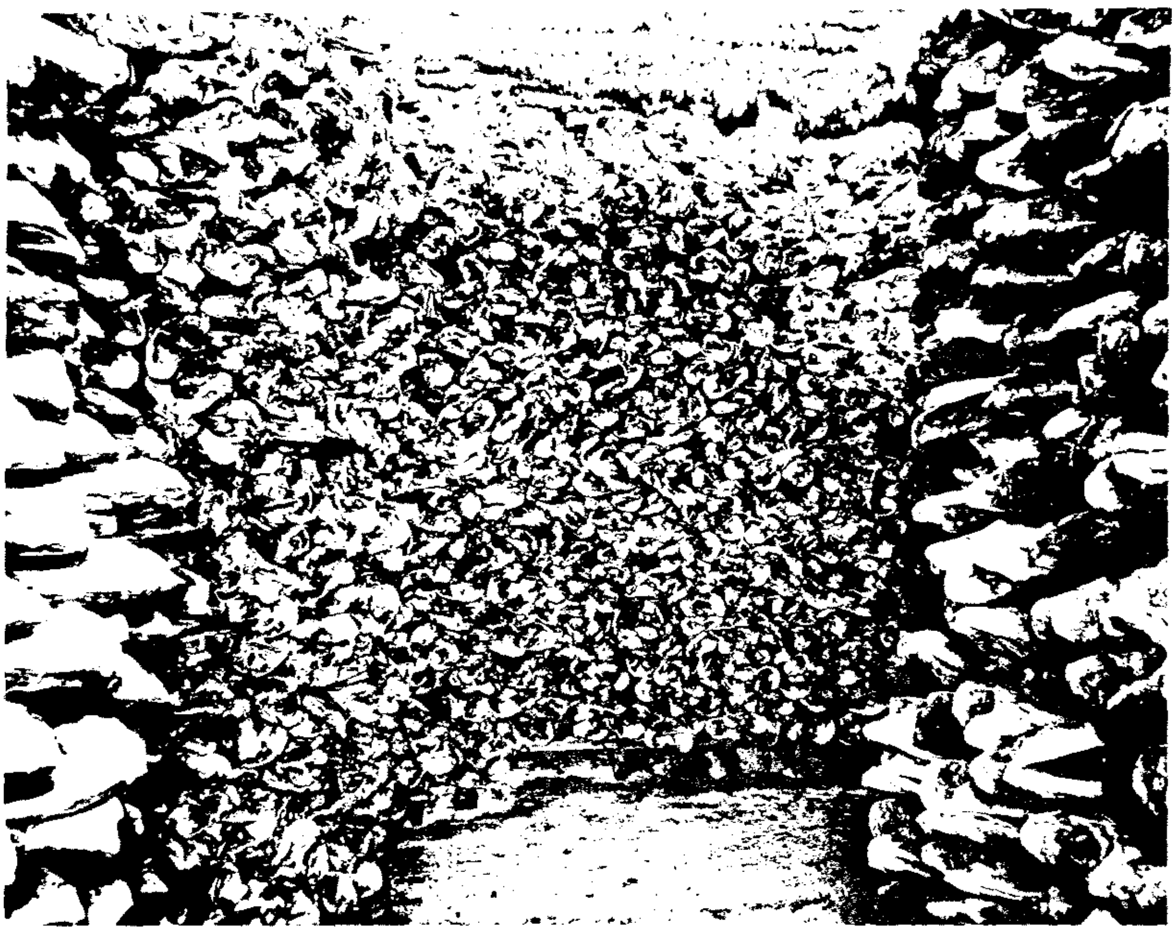


Photo 24

Fish in storage freezer.

Note direct expansion pipe on ceiling.

Home Plant, 1918

(Canadian Fishing Co.)

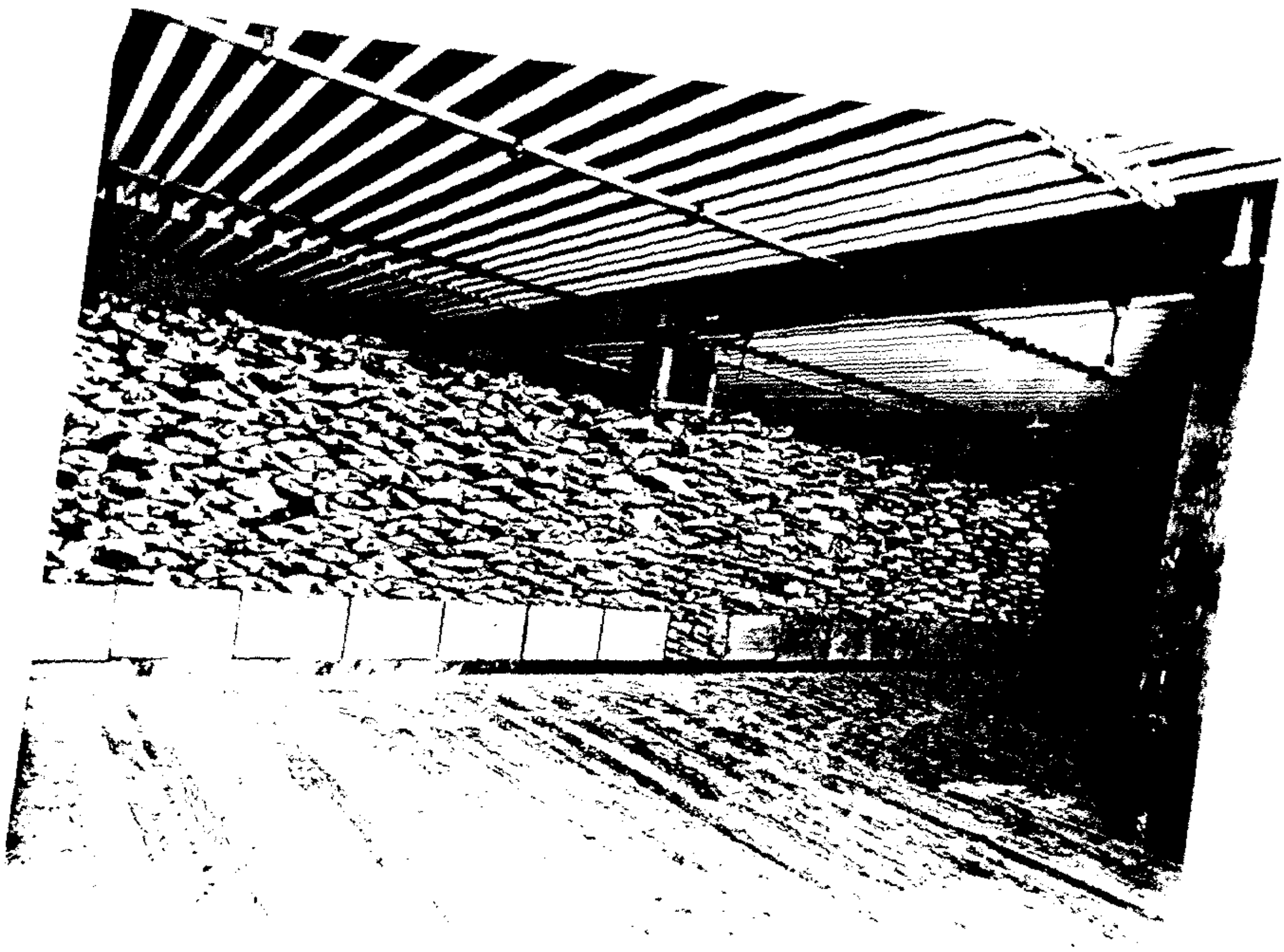


Photo 25

Fish in storage freezer.

Note traditional wooden crates for frozen fish.

Home Plant, 1918

(Canadian Fishing Co.)

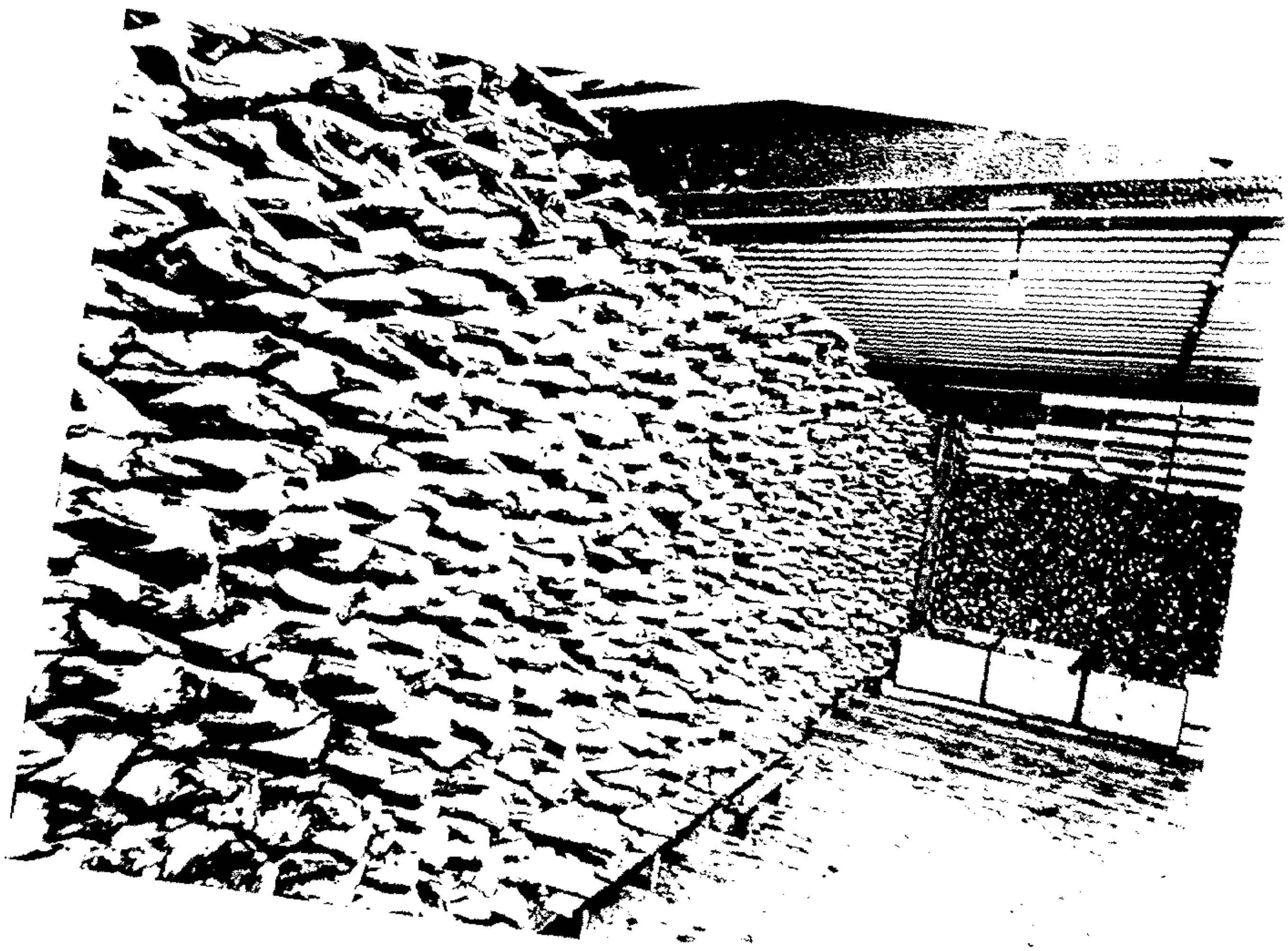


Photo 26

Frozen salmon packed for market in
traditional wooden crate lined with
freezer paper.
Home Plant, 1918
(Canadian Fishing Co.)

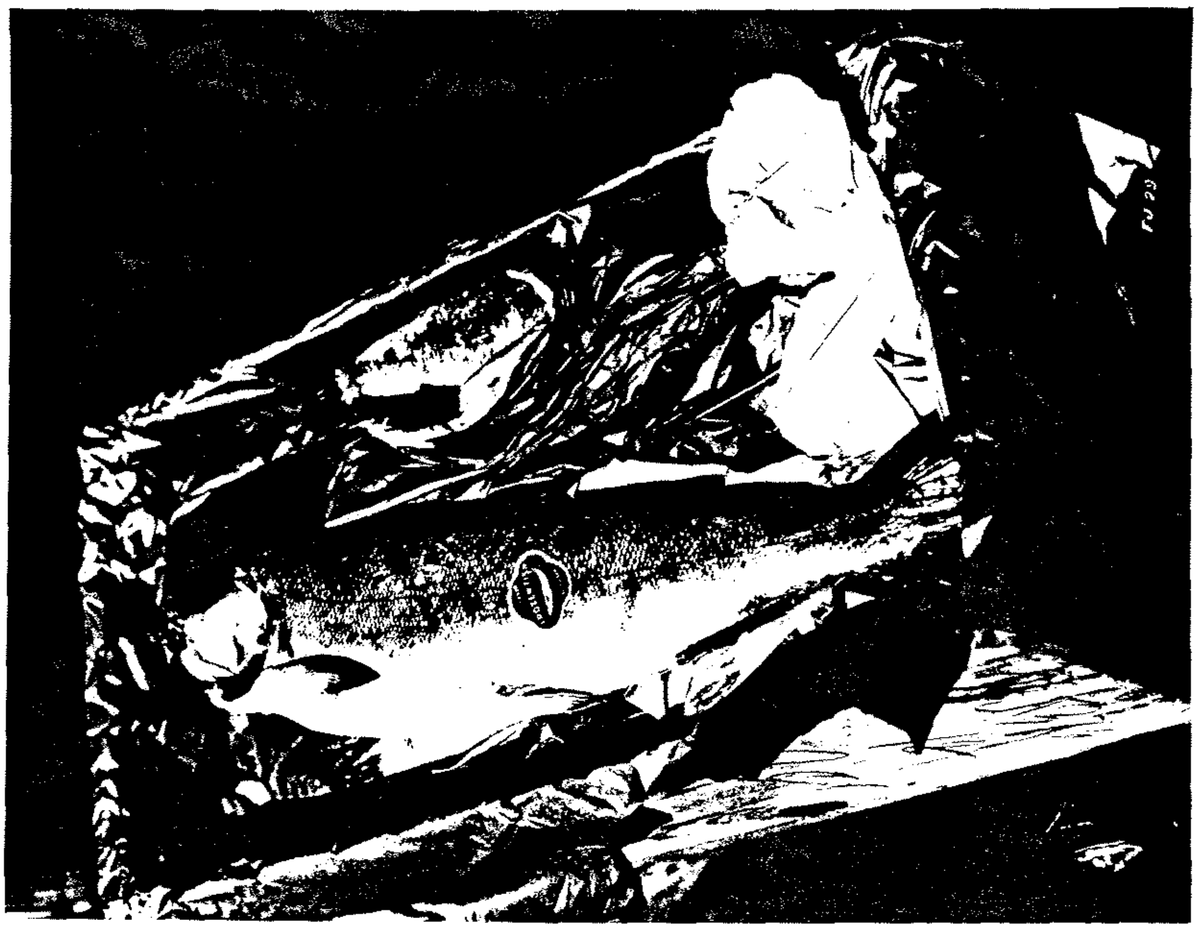


Photo 27

Loading freezer car destined for
eastern markets. Note freezer hand
in centre of picture wraps sacking
around his feet to keep warm.
Home Plant, 1918
(Canadian Fishing Co.)

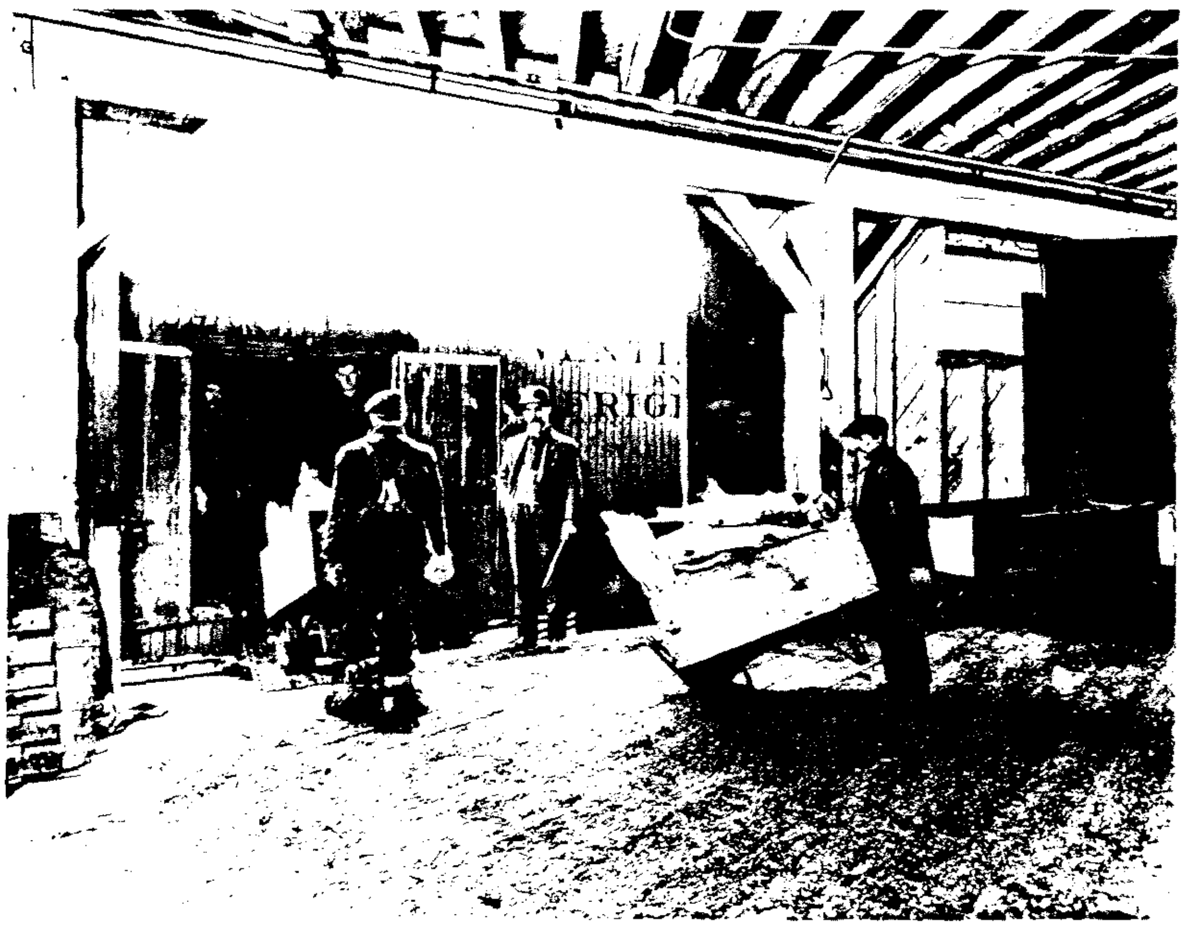


Photo 28
Trainload of Canadian Fishing Co.
fresh or frozen halibut and salmon
leaving Vancouver for Boston via
the Canadian Pacific Railroad, 1918.
(Canadian Fishing Co.)


TRAIN LOAD OF CELEBRATED
Belleanna HALIBUT & SALMON
FOR
NEW ENGLAND FISH CO., Boston
TRAIN LOAD OF CELEBRATED
Belleanna HALIBUT & SALMON
FOR
NEW ENGLAND FISH CO., Boston

Photo 29

Trimming and packaging groundfish,

sole, prior to freezing.

Home Plant, 1918

(Canadian Fishing Co.)

Photo 30

Fresh fish packing room.

Note wooden crates.

Home Plant, 1918.

(Canadian Fishing Co.)

Photo 31

Ice making plant.

Note cans being filled in

foreground and tipper in background.

Home Plant, 1918

(Canadian Fishing Co.)

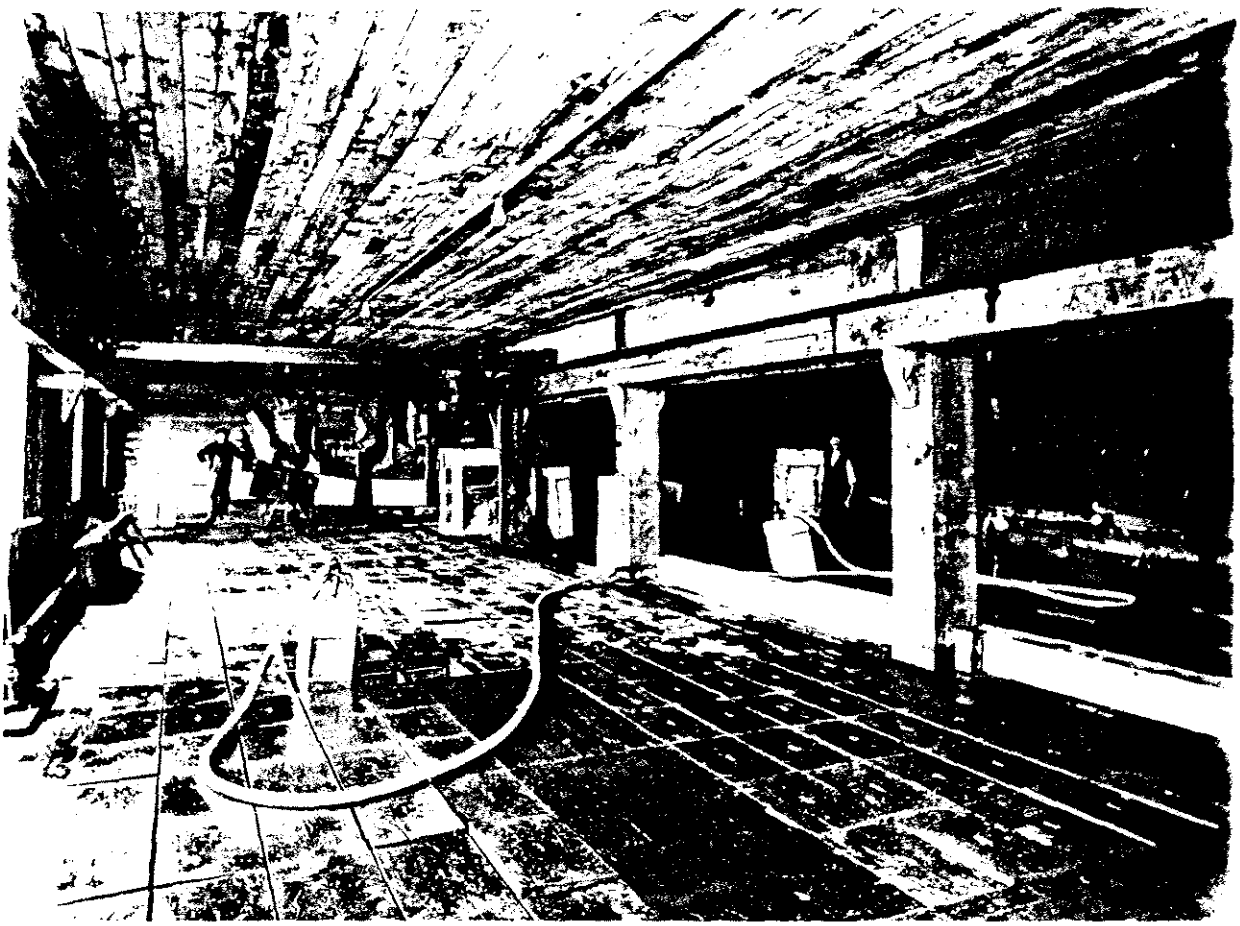


Photo 32
Ice making plant.
Note cans on left.
Home Plant, 1985
(author)

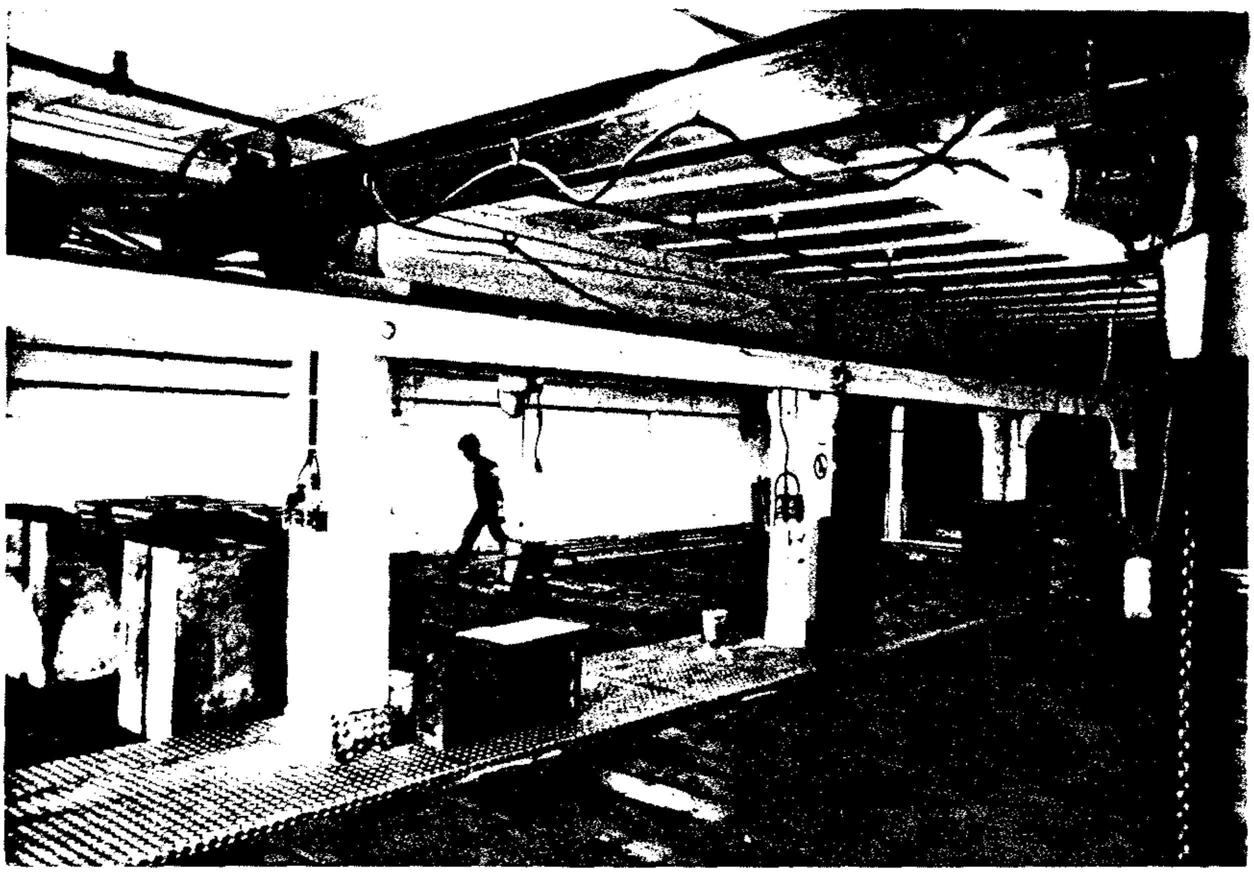


Photo 33
Ice making plant.
Filling ice cans.
Home plant, 1985
(author)

Photo 34

Ice making plant.

Removing fresh ice from brine tank.

Home Plant, 1918

(Canadian Fishing Co.)

Photo 35

Ice making plant.

Removing fresh ice from brine tank.

Home Plant, 1985.

(author)

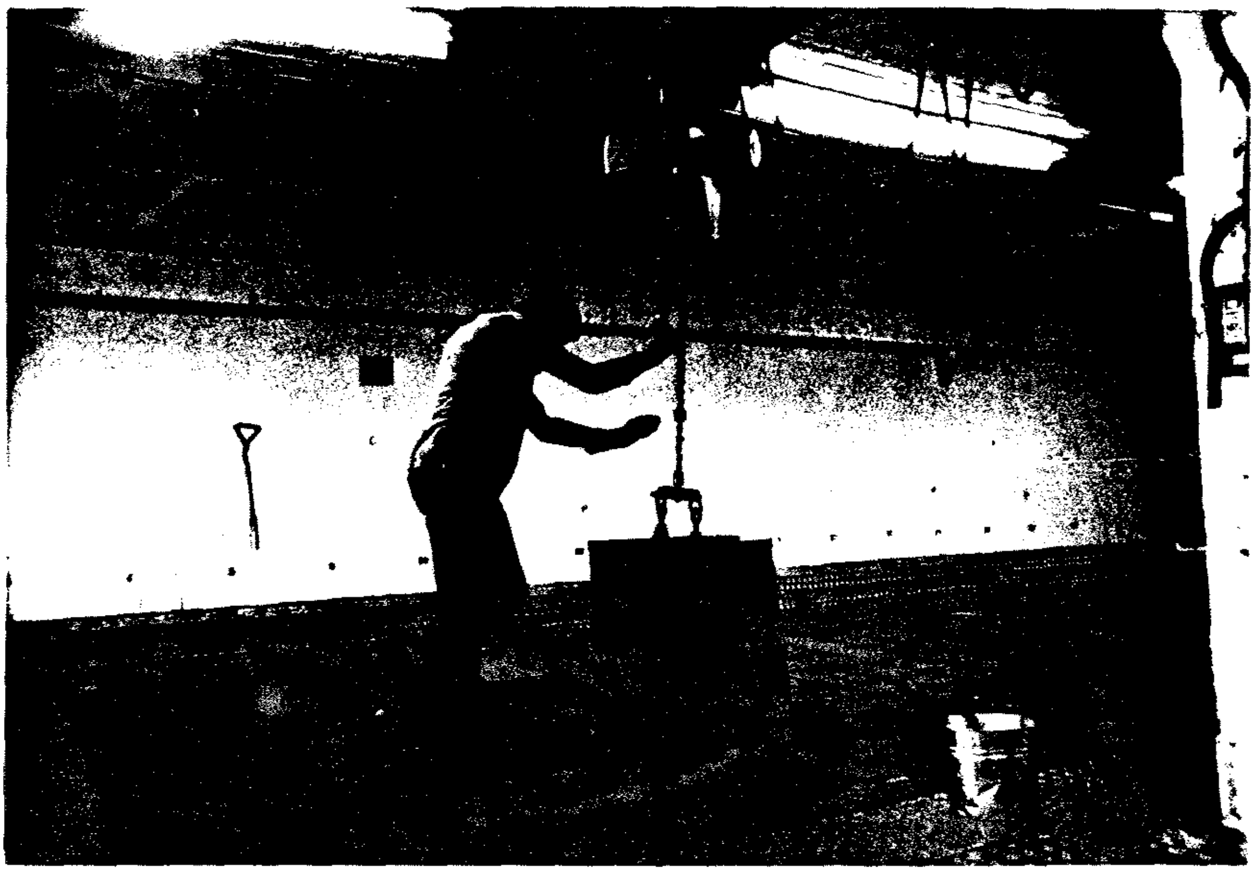


Photo 36

Ice plant. Moving ice to tipper.

Note block of ice entering freezer, right side

Home Plant, 1985

(author)

Photo 37
Ice plant. Can tipper unit.
Home Plant, 1985.
(author)

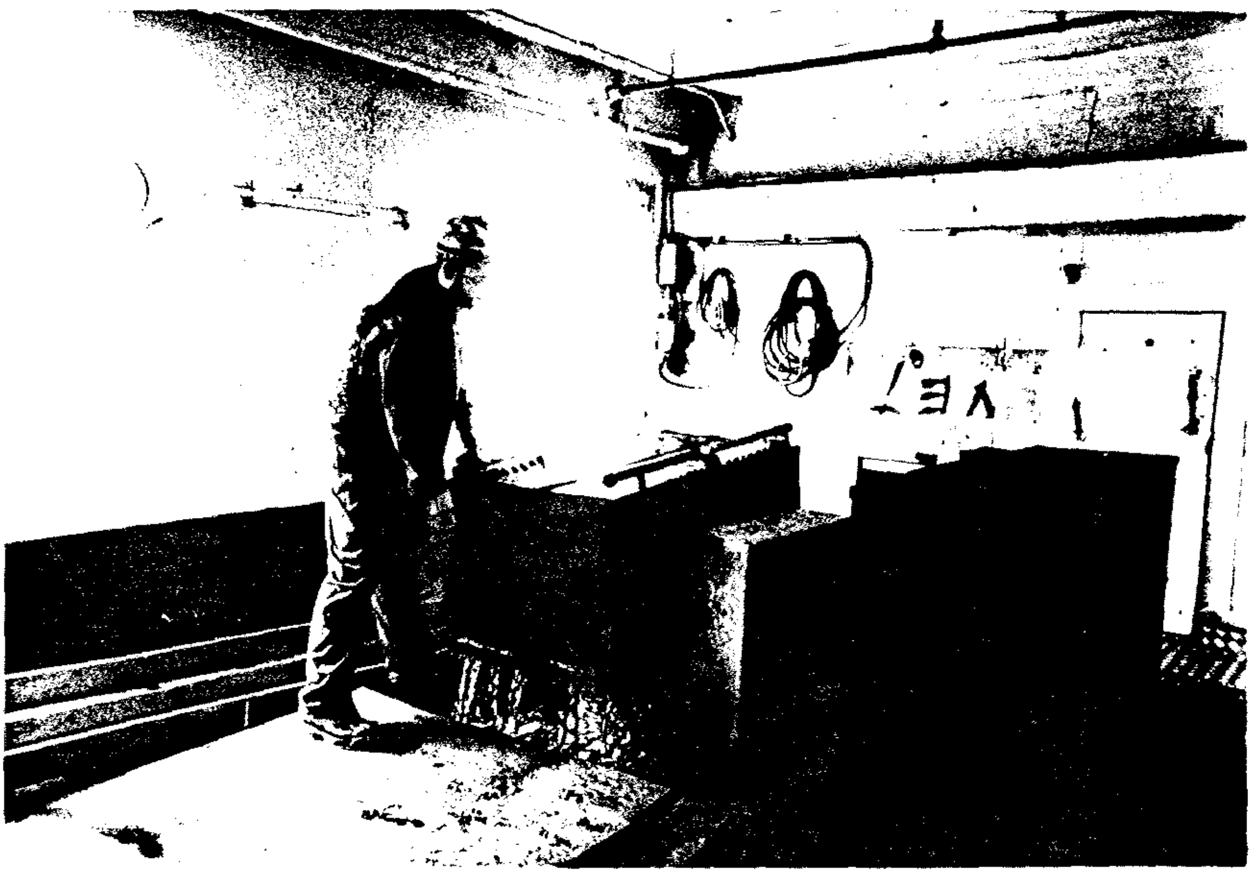


Photo 38

Ice plant. Tipper units discharging
ice to freezer. Note electric hoist
for delivering can to tipper.
Home Plant, 1918
(Canadian Fishing Co.)

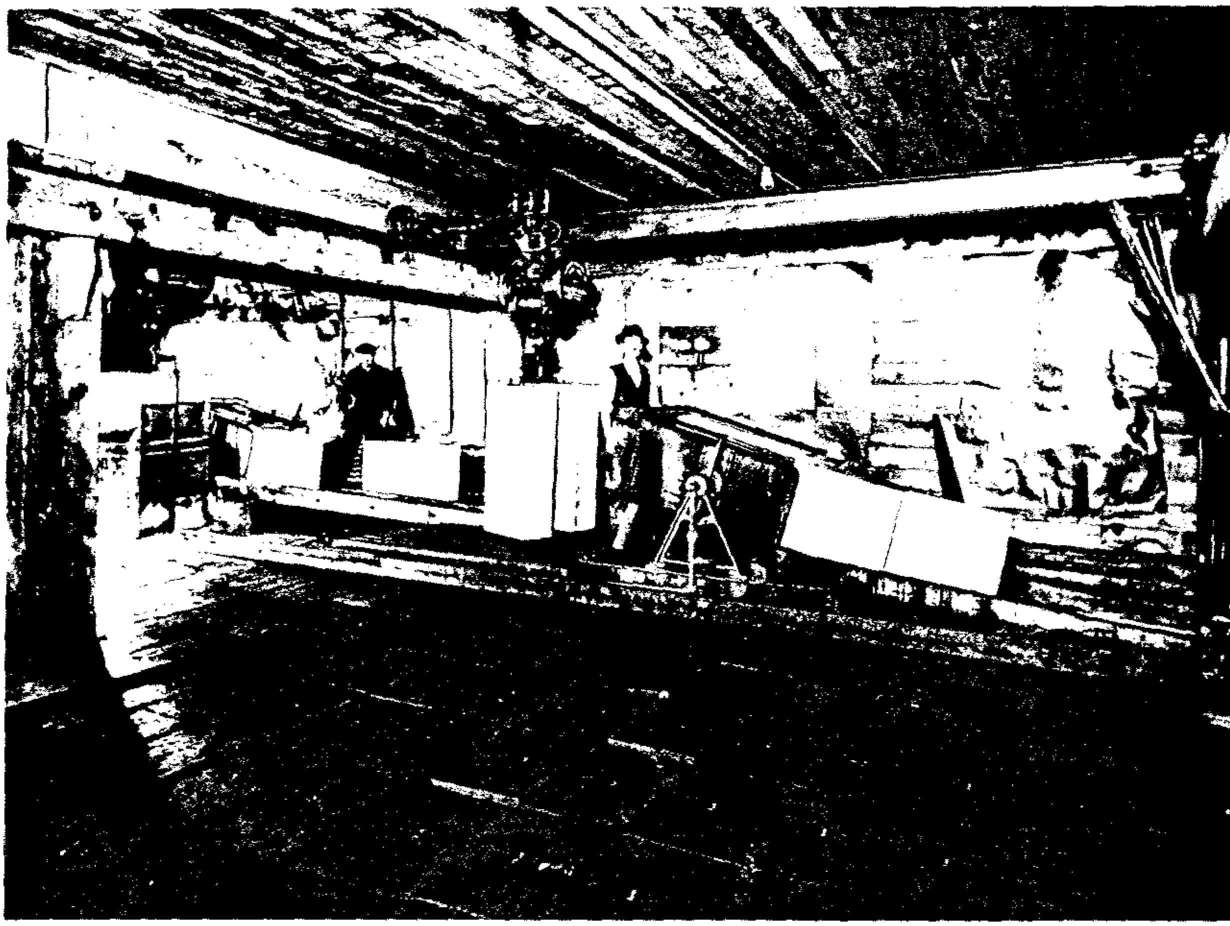


Photo 39

Ice Plant. Tipper discharging block
of ice into freezer.
Home Plant, 1985.
(author)

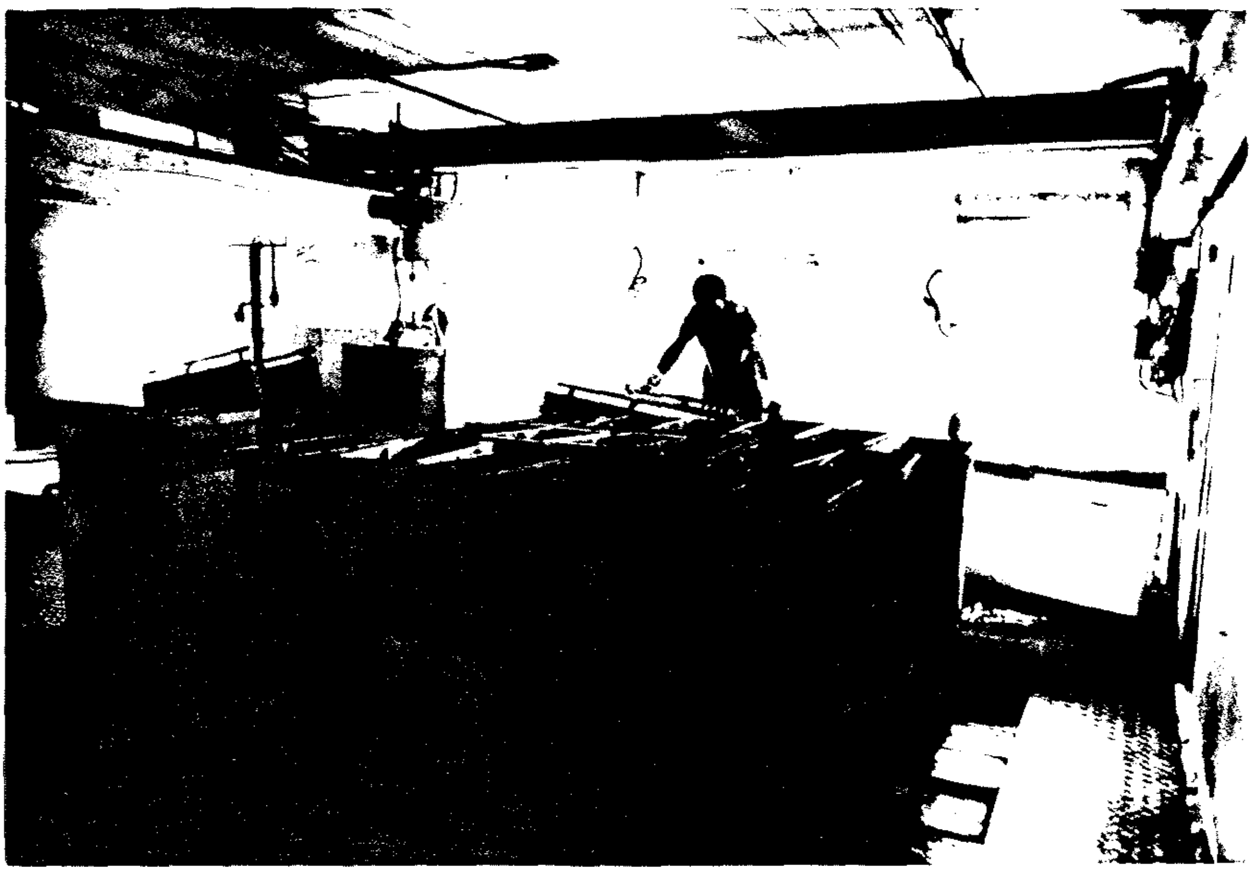


Photo 40
Freezer. Moving block ice
into storage.
Home Plant, 1985.
(author)

Photo 41
Freezer. Block ice storage
freezer room.
Home Plant, 1985
(author)

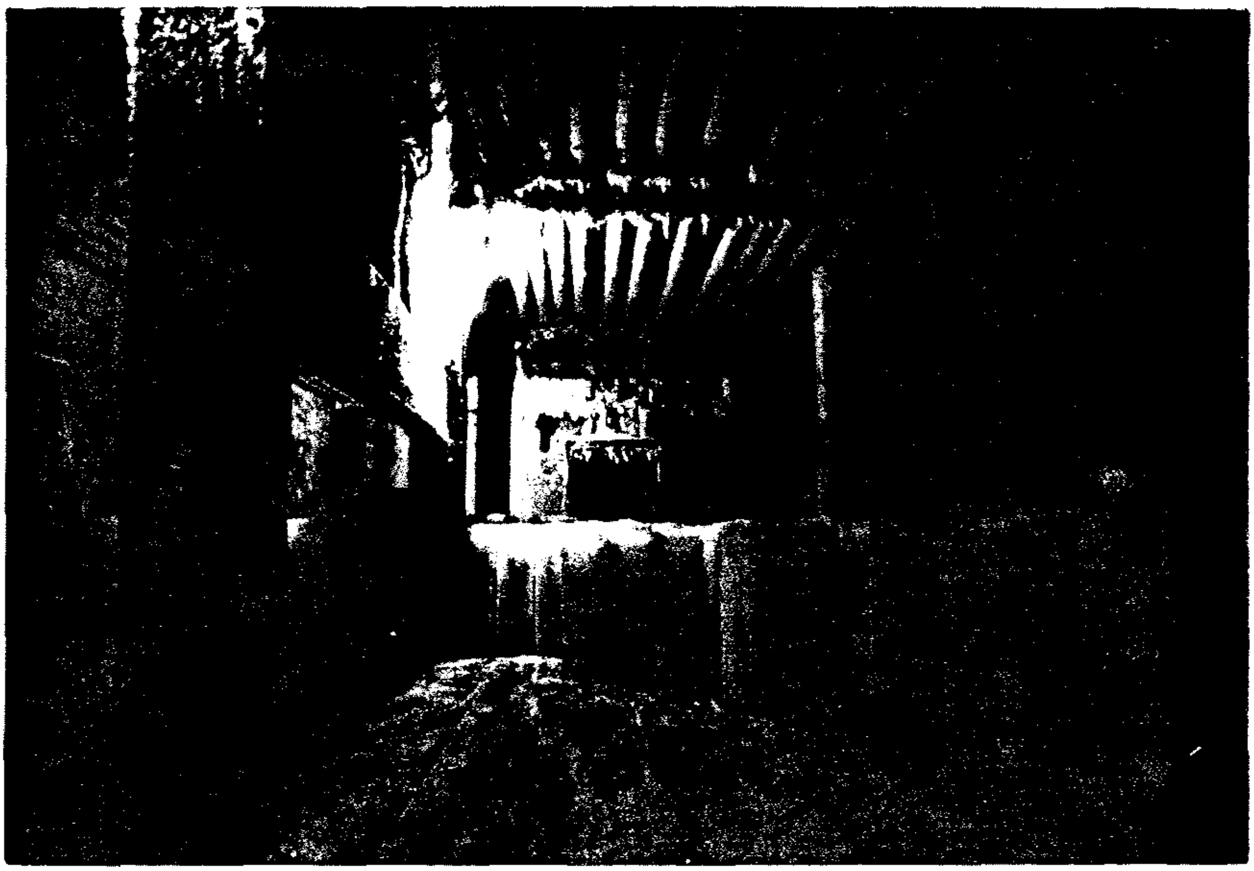


Photo 42

Home Plant, 1918.

Note ice chute on face of building,
which delivered ice from storage
to cooler car loading area.
(Canadian Fishing Co.)

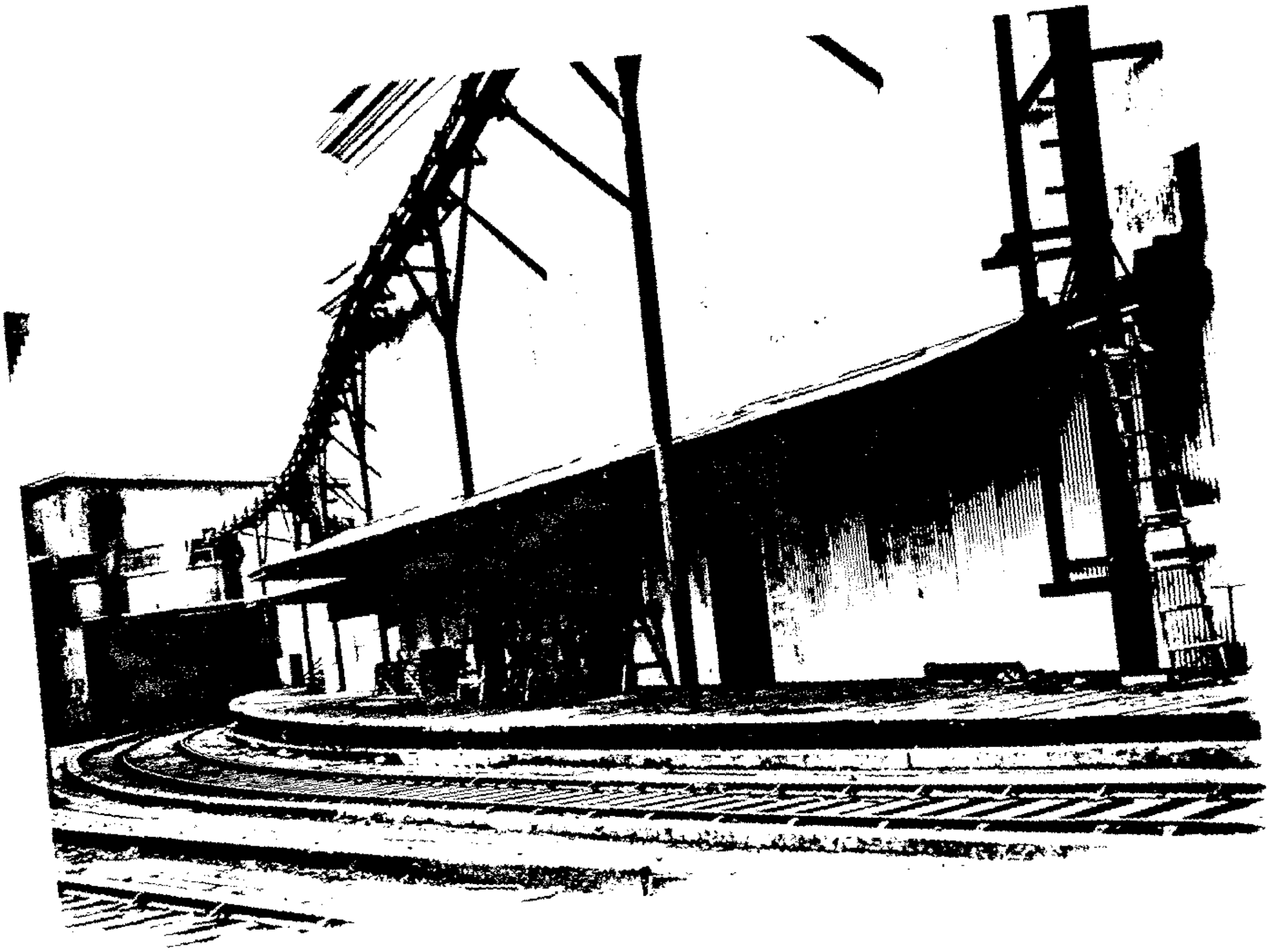


Photo 43

West side of main cannery building,
Gulf of Georgia plant. Fish bins
on right, 1939.
(Dick Jack)

Photo 44

Front of main cannery building, 1939.
Fish bins on right removed in 1939 to
accommodate the construction of the
seine loft's front dock.
(Dick Jack)

Photo 45
Gulf of Georgia ice house in centre,
cannery on left, reduction plant
on right, 1985.
(author)

Photo 46

West side and front face of

Gulf of Georgia ice house.

Note timber framework on

front face, which held ice chute

to load ice directly into vessels, 1985.

(author)

Photo 47

Gulf of Georgia ice house.

Close up of ice loading door, 1985

(author)

Photo 48

Gulf of Georgia ice. house.
Note door on top storey which made
it possible to load ice blocks directly
into the cold room for storage, 1985.
(author)

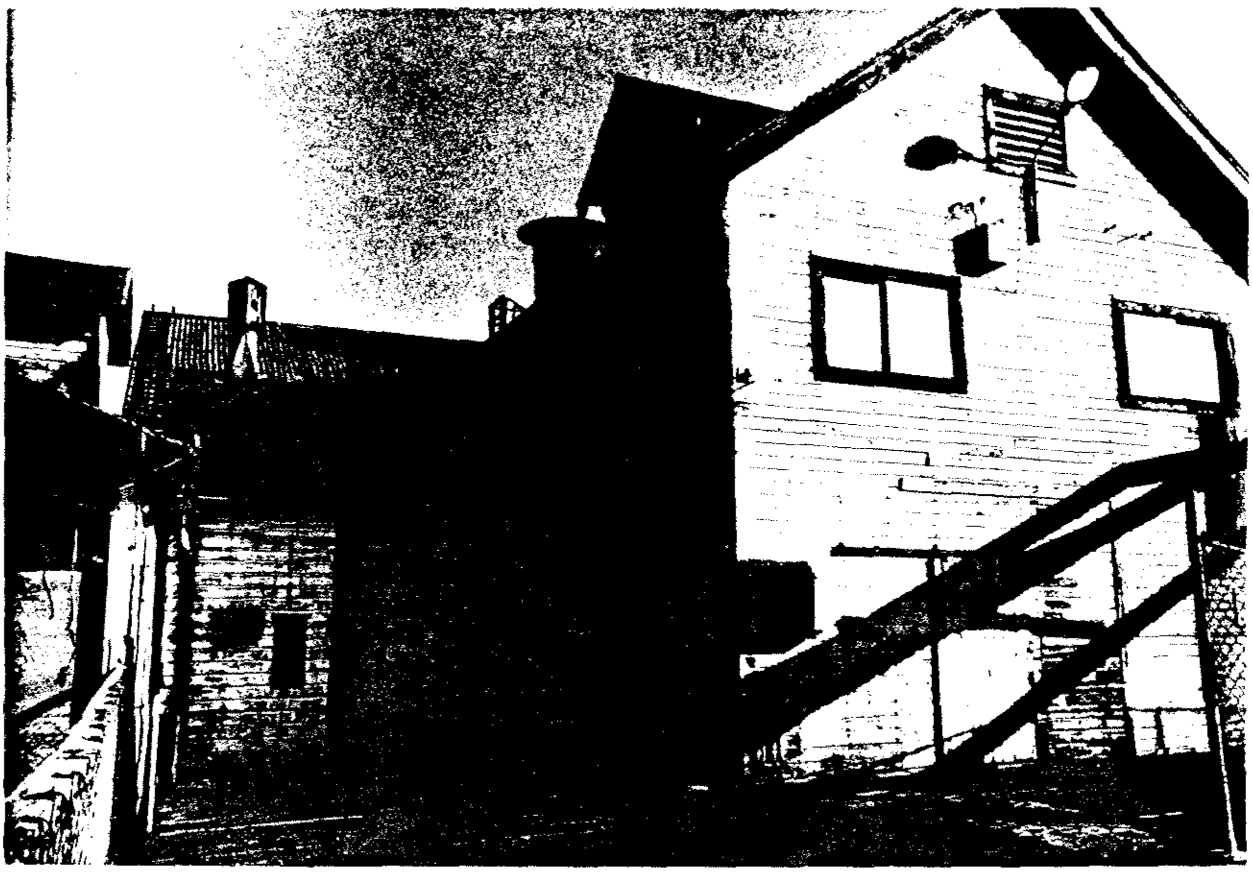


Photo 49

Gulf of Georgia ice house, front view.
Sliding doors on left give access to
fresh fish area, where fish are
weighed and toted prior to shipment
by truck to the home plant, 1985.
(author)

Photo 50
Fish collecting vessel on left
preparing to take ice. Note ice
conveyor in timber framework, c.1979
(author)