MATERIALS HANDLING SYSTEMS TO INCREASE PRODUCTIVITY OF INSHORE FISHERY

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OF INSHORE FISHERY

by

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ABSTRACT

Many traditional methods of holding and handling fish in small boats persist throughout Newfoundland today. Not only are these methods inefficient from the materials handling point of view but the resulting poor quality causes great waste of the dwindling resource and contributes to consumer non-acceptance of fish as a regular source of protein food.

A number of experiments on filleting cod, the principal inshore species are described. These experiments demonstrate the clear economic advantage of processing good quality raw material, and an incidental advantage, to the processor, of filleting dressed cod as compared with round (gut-in) cod. Further, the experiments show, as expected, the more rapid deterioration of quality in round cod compared with dressed cod.

The experimental results together with statistical reports of Environment Canada on annual cod landings and production are extrapolated to estimate annual losses resulting from processing and marketing poor quality fish of all species. A system of handling, discharging and transporting fish from inshore boats based on the principle of containerization is proposed as a solution to many of the problems of this fishery.

Flexible containers of net or plastic covered cloth for use in open boats and rigid containers for use in decked boats would be

hoisted by a suitable shore-based facility, discharged into an elevated hopper and, after any necessary processing, culling or grading, placed in an insulated, covered container with ice for transportation to a processing plant.

A province-wide network of some 200 such systems would handle most inshore and near-offshore landings, at reasonable cost and with a much higher average level of product quality.

A case is made for joint involvement of Federal and Provincial Governments with industry to implement the proposed Province-wide system over a five year period.

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CHAPTER I

1.00 INTRODUCTION

1.10 Historical: Since the 15th century, and probably earlier, European fishermen have fished the Grand Banks, using the only known preserving method of their time to bring quantities of salt cod back to Europe. It was early discovered that vast quantities of cod could also be taken near shore with hand line and traps, and this fact, together with the need to escape the "Fishing Admirals" and the differences between groups of settlers resulted in the present multiplicity of small settlements on the southeast and northeast coasts of the Island, each preserving to a great degree its own culture and way of life.

Until fairly recently, dried salt cod was the principal fish product of insular Newfoundland and the Labrador coast. Handling and processing was carried out by traditional methods which for much of the inshore fishery have changed but little to this day.

These methods and the very serious problems associated with them today are discussed under Section 1.20. In earlier years, the methods used were considered acceptable by most since the cod fishery was a way of life for many Newfoundlanders and all processing was carried out by each fisherman and his family on his own premises, whence little time was lost between catching and salting. The quality of production was of a relatively high standard, at least as regards appearance and taste, and Newfoundland salt fish was in good demand throughout the world.

In the early 1940's, the salt fish industry began to decline as new technology resulted in ever greater quantities of cod and other groundfish species being processed for the fresh-frozen market in the United States. This decline accelerated in the '60's and salted cod production fell rapidly from some 70% of total cod landings in 1960 to less than 20% in 1973. (Fig. 1)

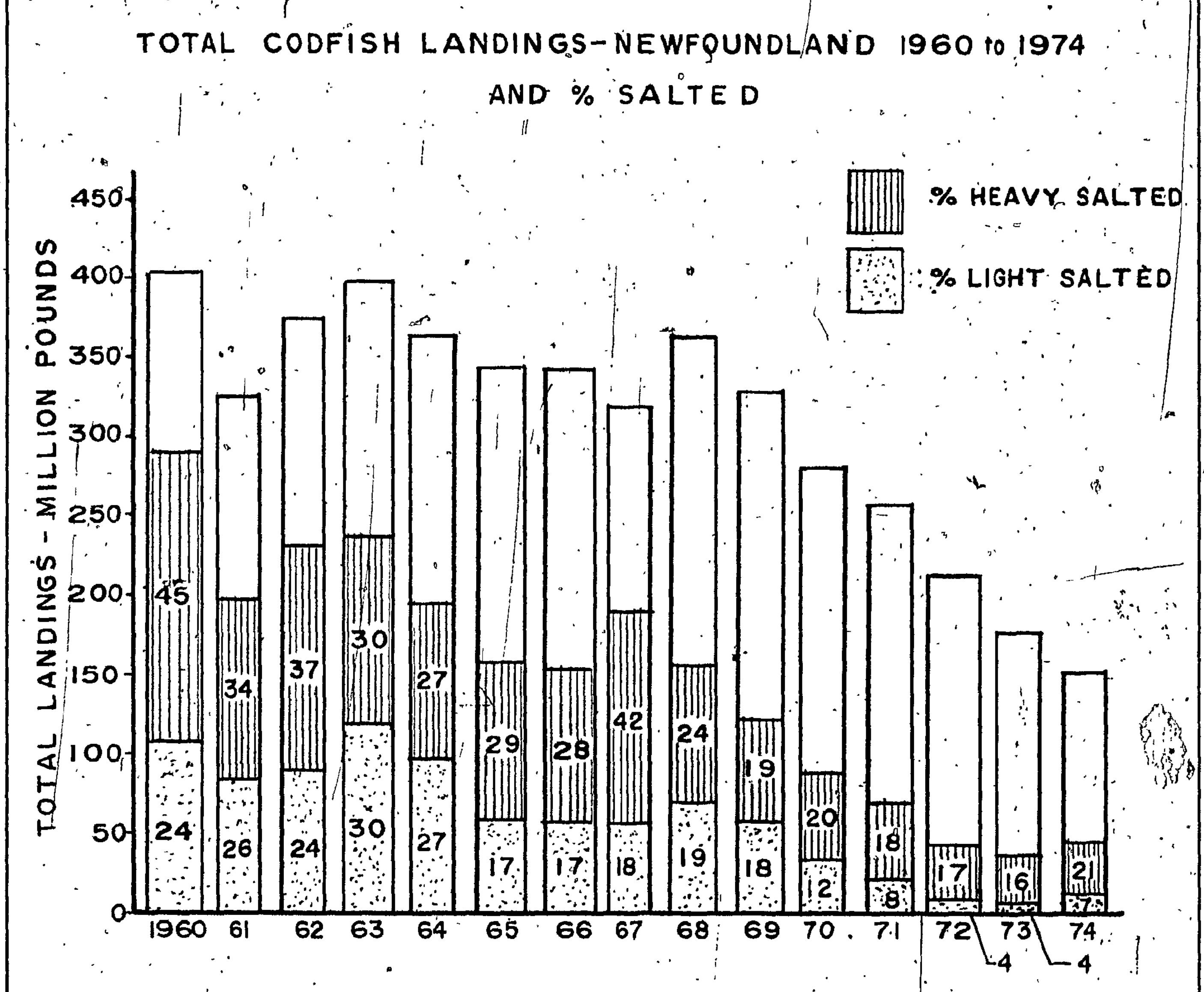


Fig. 1

With more and more inshore cod being purchased for filleting plants, the average time between catching and processing increased. Fish which would have been placed under salt almost immediately was now trucked to remote processing plants, often hundreds of miles distant and usually without ice.

During this period, other factors also contributed to quality deterioration. Gillnets had been introduced to fishermen in the '50's and initially produced good catches in most areas so that nets were hauled regularly and daily. With declining catches in the late '60's and '70's, however, fishermen were forced to set more than could be tended in a day in order to maintain catch level. Today, the normal practice of those fishing gillnets is to haul the nets three days after setting. If weather or other circumstances interfere with this schedule, the time could be much longer. As a result, some two thirds of all gillnetted groundfish is of poor quality when taken from the nets.

Also, the style of life of fishermen and their families changed following World War II and Confederation and fishermen became more reliant on Governmental programs of Social Assistance, so much so that few are now willing to spend time and effort to look after fish catches. On the other hand, there was probably little that fishermen alone could do to preserve quality which would not be offset by subsequent poor handling by buyers and processors.

Thus, the physical and economic problems of handling fish are complicated by social factors which must be considered in any attempt to solve those problems.

1.20 Problems of The Inshore Fishery

Today, the inshore fishery is engaged in by 8000 to 10,000 small, open boats ranging in size from 15-16 ft. to 45 ft. overall length, which are true inshore boats, seldom venturing out of sight of land, and 700 to 800 decked vessels, usually called longliners, which range in size from 35 ft. to 65 ft.[1] and frequently fish in near-offshore grounds, 40-50 miles from land. These boats land fish at some 700 to 800 different communities throughout the province.

Although "longliners" are not true inshore boats, they are usually grouped with the inshore fishery since, in the main, they land at the same ports, i.e. not at a trawler-supplied plant.

Appendix A outlines in some detail the fishing operations carried out. In this section, some of the problems associated with the inshore and near-offshore fisheries will be listed and discussed. These are the problems which the materials handling system proposed in subsequent pages is designed to overcome.

There are three general problem areas, namely:

I. Catching and handling on board the fishing vessel.

II. Discharging, dockside handling and holding.

III. Transportation of fresh fish to the processing plant.

I. Catching and Handling

In Newfoundland the universal method of holding most fish species is in bulk in the holding space resulting in the following problems:-

[1]Vessels 65 ft. in length and over must fish outside the 12 mile limit, such vessels, however, could still contribute to "inshore" landings.

(a) Unsanitary holds: Most Newfoundland inshore fishing vessels are wood, having wooden fish holding spaces, generally with open seams. Such holding spaces quickly become rough from using pitchforks, making them extremely difficult to clean. Fish held in them quickly become contaminated with spoilage bacteria, thereby shortening storage life, and reducing quality.

(b) No Protection from Sun and Weather: Most open boat fishermen fail to provide cover for their catch and, as a result, fish become dried out and/or overheated.

(c) Use of Pitchforks: On both open boats and longliners pitchforks are commonly used to move and handle fish. This damages the flesh and causes bruises and blood spots with resulting low quality and loss of yield.

(d) Stowing Fish too High: Larger longliners have holds well over 3 ft. deep. Fish stowed at this depth and higher will result in crushing of bottom layers.

(e) Lack or Improper Use of Ice: Experience has shown that the best way to hold fresh fish is by stowing with ice to reduce the fish temperature rapidly and hold it at or near 0° C.[1] Few inshore boats have had access to ice or to ice in sufficient quantities,[2] thereby seriously limiting the length of time a longliner type vessel could remain on the

[1] Refrigerated seawater systems are also in use in other parts of Canada but this method of holding is not used in Newfoundland up to now.

[2] A Federal Government program to provide assistance for ice making facilities will result in some 650 to 700 tons per day more ice available in future years and should alleviate this problem to a great extent.

fishing grounds.

(f) Fish not Bled or Gutted on Removal from the Water: Bleeding by cutting the throat or tail (of some species such as cod, turbot, flounder, etc.) is the general practice in most European fisheries. This practice results in a whiter fillet and reduces or eliminates blood spots and bruises. Gutting of cod achieves a similar result, but this results in discarding all the gut contents, which has some commercial value.

(g) Fish left too long in Gillnets: Gillnets should be tended every day to remove fish caught, otherwise bruising, blood-spots and general discoloration of the fillets result. The general practice in Newfoundland is to haul nets only after 3 days, or more if weather interrupts fishing operations.[1]

II. Discharging, Dockside Handling & Holding

(a) Discharging: In most communities, pitchforks are used to transfer the larger species of fish (groundfish, salmon, etc.) from the boat to the landing wharf. In a number of communities, the fish is forked into a tub or bucket holding about 250 lbs. This tub is then elevated, using a small drum and rope hoist and the fish dumped into an elevated hopper. The fish is held in this hopper until a truck arrives to transport it to a processing plant. Smaller fish

[1]The southwest coast of the Island is an exception. Here the fishermen refuse to use gillnets, claiming that they drive fish away from the inshore grounds whereas baiting (by handline and trawls) tends to attract fish. The relative consistency of catches in this area tends to support this claim.

such as herring and capelin are usually shovelled.

In the case of pitchforking, considerable damage is done to the fish. In both cases, the operation is quite slow and inefficient from the materials handling point of view.

(b) Dockside Handling: Most handling at dockside is by pitchfork and buggy (a deep wheelbarrow) which is again inefficient or damaging to product quality. In those few places which hold fish in elevated hoppers, the discharge of fish into the truck is an efficient operation from the materials handling point of view, but the fish is frequently damaged in dropping from the hopper to the truck, a distance usually of 4 to 6 ft.

(c) Holding: In many communities where fish is landed, holding facilities are non-existent. Other communities, however, have "community stages" or "holding units."

Community stages were constructed in the '50's and '60's by the federal and provincial governments in some 70 to 80 communities and were intended to be used as salting stages in place of antiquated and unsanitary fishermen's stages. However, the decline in the salt fish industry and the increase in fresh, resulted in many of these buildings being used solely to hold fishing gear and, in some cases, to hold fresh fish prior to transportation.

In more recent years, the provincial government has constructed a number of so-called holding units for the expressed purpose of holding fresh fish prior to transportation.

Over the past 5 years, a number of both community stages and holding units have been converted to small processing plants (feeder plants) which supply fillets to a larger, freezing plant.

The fact is, that as holding units these facilities are most unsatisfactory. Very few, if any, have any ice facilities and, as mentioned, the means of moving fish into and out of them is most inefficient. Conversion to feeder plants was an attempt on the part of the provincial government to overcome this holding problem. It has been partially successful in that respect, but not in the overall picture. The proliferation of many such small plants makes control of the industry much more difficult; the operators are usually under-financed and therefore highly vulnerable to depressed conditions such as are now being experienced, and the efforts of government to assist the industry must, if it is to provide help to such facilities, be spread too thin to really accomplish the (presumed) objective of making the fishing industry viable.

III. Transportation: The almost universal method of transporting fresh fish from landing point to processing plant is in bulk, in steel or stake body trucks, often uncovered. Recently, some covered trucks have been used. The method of loading depends on the facility at the landing point, but the most common is with the use of pitchforks. Similarly, pitchforks are used to discharge the trucks at the fish plants. Variations include filling the truck body from overhead holding hoppers and using dump trucks to dump the fish, usually into a holding room, but occasionally into a hopper with conveyor feed to the processing room (e.g. Booth Fisheries, Fortune).

Such bulk handling is damaging to quality, as is the pitch forking; frequently, the fish is trucked without ice and with no protection from sun, road dust, etc.

One particular fishery, the codtrap fishery is especially affected by this transportation method. During the months of June and July, high volume landings of cod result from this fishery (described in Appendix A. In an effort to overcome the problems mentioned above, most buyers have adopted the practice of transporting trap fish to the plant and processing it in the ungutted (round) condition, the rationale being that gutting, by fishermen, takes so much time that the fish is soft by the time it is purchased and processing in the round condition reduced that time considerably.

Unfortunately, this practice introduced other problems. Even if the fish could be processed soon after landing, inevitably guts would be spilled over filleting tables, thereby increasing plant contamination, but frequently, the fish had to be held for a period, e.g. overnight, before it could be processed and gut-in fish deteriorates much faster than gut out. Hence, the gain which was hoped for was not achieved and frequently, an overall loss was the result.

It will readily be seen that the problems described above either directly or indirectly affect the quality of the final product and, in fact, a large proportion of frozen fish shipped to the U.S, (the principal market) is of No. 2 quality or even worse.[1]

[1] Federal Inspection places fish in three quality grades; 1 is good to top quality, 2 is acceptable quality for human consumption and 3 is rejected as unfit. On January 11, 1973 the then Minister of the Department of the Environment, Jack Davis, stated that some 100,000,000 lbs. fishery products are rejected annually as unfit for human consumption and about 50% (of marketed fish) is of second quality.

CHAPTER II

2.00 OBJECTIVES

2.10 Discussion

The experience of Inspection Branch personnel in Newfoundland indicates that the quality of exported fish from this Province has deteriorated in recent years. The many reasons for poor quality are outlined in Chapter I, Section 1.10. The main reason for the decline in quality, as suggested in the Introduction, p. 1, is that the inshore fishery changed from a locally produced salt cod industry to more centralized, fresh frozen production of many species. The fish processors either never fully understood the importance of good quality or were not capable of solving the problem of collecting fish from many locations and delivering it without significant quality deterioration to the processing plants.

With limited resources, this project is an attempt to (a) demonstrate that preservation of quality will result in substantial benefit to the industry as a whole and (b) propose a system of handling and transportation that will help to preserve good quality.

The present scarcity of fishery resources caused by over-exploitation of stocks offshore makes the solving of the problems mentioned above quite urgent. It is no longer acceptable that a large portion of landed trapfish or netted groundfish, for example, be dumped because its quality has deteriorated to the reject level.

2.20 <u>Objective Statement</u>

The specific objectives of this project are:

I. TO OBSERVE THE YIELD AND OUTPUT RATES WHEN PROCESSING COD OF VARIOUS LEVELS OF INPUT QUALITY.

II. TO PROPOSE A MATERIALS HANDLING SYSTEM AND PROCEDURES TO OPTIMIZE RETURNS FROM THE INSHORE FISHERY.

CHAPTER III

3.00 METHOD - OBJECTIVE 1

3.10 Experimental Design

Three sets of experiments were performed,[1] the first with gut-in and gut-out trap cod, landed at the same time; the second with gut-in and gut-out cod from a mixture of gillnet and handline caught fish landed at the same time; the third with gut-in and gut-out gillnet fish landed at the same time but obviously having been in the net for varying lengths of time. In all cases the fish received similar handling and holding treatment, however, the experiments were constrained by the necessity of having to use the fish available, rather than obtaining the fish required for reliability of results.

3.20 Work Task

3.21 Experiments 1 to 24

2000 lbs. of 10 hour old trap cod was separated into two lots of 1000 lbs. each. The first lot was gutted and well iced, the second lot well iced without gutting.

1 to 6

A filleter of average experience was asked to fillet about 210 lbs. each of dressed and undressed 10 hour old inshore cod, (3 boxes each of gutted and gut-in fish, weighing approximately 70 lbs. per box).

7 to 16

The same filleter was asked to fillet about 350 lbs. each of dressed and undressed 54 hours old in ice inshore cod, (5 boxes each of gutted and gut-in fish, weighing approximately 70 lbs. per box).

[1]Raw Data for all experiments given in Appendix L, p.78

17 to 24

The same filleter was asked to fillet about 280 lbs. each of dressed and undressed 78 hours old in ice inshore cod, (4 boxes each of gutted and gut-in fish, weighing approximately 70 lbs. per box).

3.22 Experiments 25 to 54

3000 lbs. of a mixture of gillnet and handline cod was separated into two lots of 1500 lbs. each. The first lot was gutted and iced into a large container, the second was iced into a similar container without gutting.

25 to 34

An experienced filleter was asked to fillet about 300 lbs. each of dressed and undressed fish from the containers, the fish being now approx. 21 hours in ice. (5 boxes each of gutted and ungutted fish weighing approx. 60 lbs. per box).

35 to 44

The same filleter was asked to fillet about 300 lbs. each of dressed and undressed fish from the same containers, the fish being now approx. 45 hours in ice (5 boxes each of gutted and ungutted fish weighing approx. 60 lbs. per box).

45 to 54

The same filleter was asked to fillet about 300 lbs. each of dressed and undressed fish from the same containers, the fish being now approx. 95 hours in ice (5 boxes each of gutted and ungutted fish weighing approx. 60 lbs. per box).

3.23 Experiments 55 to 62

600 lbs. of gillnet cod was separated into two lots of 300 lbs. each. The first lot was gutted and iced into containers, the

second lot iced into similar containers without gutting.

55 to 58

An experienced filleter was asked to fillet about 150 lbs. each of dressed and undressed fish from the containers, the fish now being 20 to 30 hours in ice. (2 boxes each of gutted and ungutted fish weighing approximately 75 lbs. per box).

59 to 62

The same filleter was asked to fillet about 150 lbs. each of dressed and undressed fish from the same containers, the fish now being 68 to 78 hours in ice. (2 boxes each of gutted and ungutted fish weighing approximately 75 lbs. per box).

3.30 Experiment Controls

3.31 Experiments 1 to 24

Work layout (individual), working height, type of filleting cut, method of filleting and number of fish per box (fish size) were kept constant. Input quality varied as recorded. This set of experiments was carried out under plant operating conditions using a filleter of average experience who was experienced in cutting both gut-in and gut-out cod.

3.32 Experiments 25 to 54 and 55 to 62

Work layout (group-experimental), working height, type of filleting cut, method of filleting and number of fish per box (fish size) were again kept constant. Input quality varied as recorded. These sets of experiments were carried out at the Fisheries College, St. John's using an experienced but much slower paced, filleter employed by the College, and a different work layout.

3.40 Measurements

The actual time, performance rating, [1] output of fillets (skin-on) and the quality of workmanship were measured for each experiment. The normal output, lbs. per hour for the dressed and undressed fish was calculated as was the normal output of fillets skin-on, skin-off and trimmed, normal output of skin-off and trimmed fillets being related to the normal output of skin-on fillets rather than to the actual skinning and trimming rates, which were not measured.

Where percentage yields were calculated, the average percentage of gut weight was used to relate yield from dressed fish to undressed weight and vice versa. Input and output quality was judged by federal inspectors. Characteristics of the three grades of fish are given in Appendix B

[1] Normal Output is related to actual output by the formula

$$\text{Nornal Output} = \frac{\text{Actual Output}}{\text{Performance Rating}} \times 100$$

where the performance rating of the filleter is expressed as a percentage of that performance which would be achieved by a filleter working at an normal pace. This rating is done by raters trained in this technique of work study which provides better comparisons than actual output results.

CHAPTER IV

4.00 RESULTS

4.10 Differences in Yield and Normal Output between gut-out and gut-in cod (Table I, page

For experiments 1 to 24 the average normal output of trimmed fillets[1] from gut-out cod exceeded the average normal output of trimmed fillets from gut-in cod by 16% while the average yield of trimmed fillets from gut-out cod exceeded that from gut-in cod by 15%.

For experiments 25 to 54 the average normal output of trimmed fillets[1] from gut-out cod exceeded the average normal output of trimmed fillets from gut-in cod by 9% while the average yield of trimmed fillets from gut-out cod exceeded that from gut-in cod by 6%.

For experiments 55 to 62 the average normal output of trimmed fillets[1] from gut-out cod exceeded the average normal output of trimmed fillets from gut-in cod by 7% while the average yield of trimmed fillets was virtually the same for gut-in and gut-out cod.

In each set of experiments there were substantially greater percentage of fillets rejected from the gut-in cod on the final day of each set, but this fact is not taken into consideration in the above.

[1] The Normal Output of trimmed fillets is based on the filleting rate, not on the rate of trimming and, in effect, reflects both trimmed yield and filleting rate.

4.20 <u>Differences in Yield from gut-in and gut-out cod as quality deteriorates.</u> (Table II, p. 19 and Figs. 2 & 3 pp. 20 and 21).

For gut-in cod the yield of trimmed fillets fell from a high of 36.4% of gut-in weight at 21 hours old in ice to a low of 16.9% at 110 hours old in ice, a drop of 53.5%.

For gut-out cod the yield of trimmed fillets fell from a high of 36.7% of gut-in weight at 21 hours old in ice to a low of 29.2% at 110 hours old in ice, a drop of 17.5%.

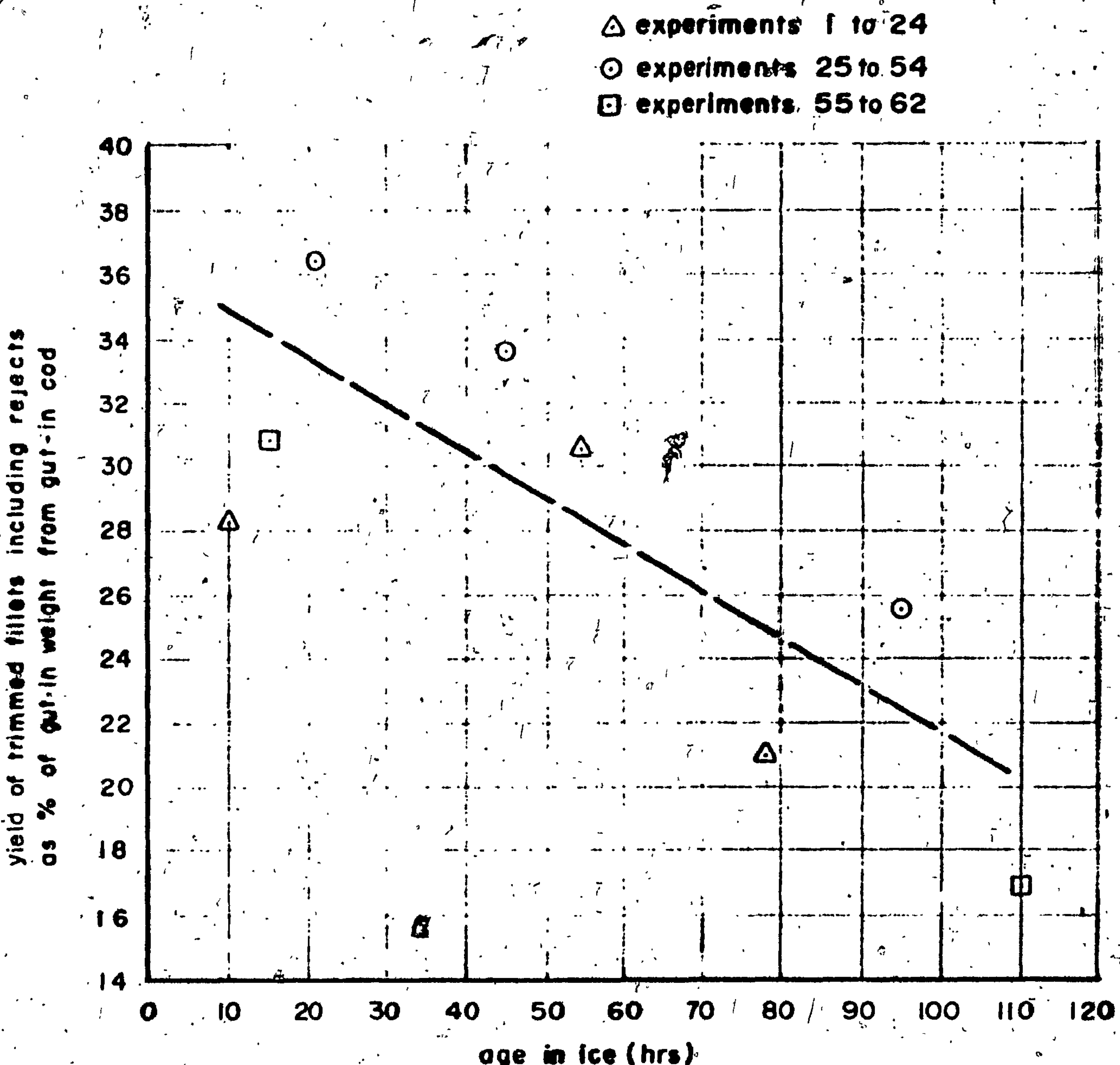
		EXPERIMENT 1 TO 24 HOURS OLD IN ICE						EXPERIMENT 25 TO 54 HOURS OLD IN ICE						EXPERIMENT 55 TO 62 HOURS OLD IN ICE			
		10		54		78		21		45		95		15		110	
		gut in	gut out	gut in	gut out	gut in	gut out	gut in	gut out	gut in	gut out	gut in	gut out	gut in	gut out	gut in	gut out
% YIELD (based on gut-in weight)	skin-on	35.83	40.63	39.52	42.05	37.60	41.54	45.60	48.20	47.12	46.50	45.14	47.07	41.80	41.55	42.98	41.07
	skin-off			36.86	39.48	35.60	39.90	39.80	42.50	41.00	41.30	40.20	41.11	38.23	38.16	39.00	37.90
	trimmed			30.52	33.56	① 27.83	② 33.74	36.40	37.70	33.60	36.45	③ 32.48	④ 34.24	30.82	32.30	⑤ 30.75	⑥ 29.20
NORMAL OUTPUT lbs/hr	gut-in round fish	990.6	1003.5	925.8	881.8	910.5	965.3	391.5	389.7	364.5	407.8	420.1	411.5	676.0	763.0	684.0	689.0
	skin-on fillets	354.9	407.7	365.9	370.8	342.3	401.0	178.3	187.8	171.8	188.2	189.7	193.9	297.5	316.0	280.0	282.0
	skin-off fillets			341.3	348.1	324.2	385.2	156.9	165.8	149.3	168.4	168.9	169.4	258.0	291.0	266.0	255.0
	trimmed fillets			282.7	295.9	253.2	325.7	141.9	147.1	122.5	148.7	136.5	141.1	208.0	246.0	209.0	200.0

① 25% reject ② 10% reject ③ 21.5% reject ④ 9.5% reject ⑤ 45.5% reject ⑥ 0% reject

TABLE—1

experiments	INPUT AGE (IN ICE) CONDITION & QUALITY	YIELD - % OF GUT-IN WEIGHT			
		skin-on	skin-off	trimmed	trimmed less rejects
1 to 24	10 hrs. - gut-in high no. 1	35.83			
	10 hrs. - gut-out high no. 1	40.63			
	54 hrs. - gut-in med to low no. 2	39.52	36.86	30.52	30.52
	54 hrs. - gut-out low no. 1 to med no 2	42.05	39.48	33.56	33.56
	78 hrs. - gut-in low no. 2 to no. 3	37.60	35.60	27.83	20.90
	78 hrs. - gut-out med to low no. 2	41.54	39.90	33.74	30.40
25 to 54	21 hrs - gut-in med. to low no. 1	45.60	39.80	36.40	36.40
	21 hrs - gut-out med. to low no. 1	48.20	42.50	37.70	37.70
	45 hrs. - gut-in med. to low no. 2	47.12	41.00	33.60	33.60
	45 hrs. - gut-out low no. 1 to med. no. 2	46.50	41.30	36.45	36.45
	95 hrs. - gut-in low no. 2 to no. 3	45.14	40.20	32.48	25.60
	95 hrs. - gut-out med no. 2 to no. 3	47.07	41.11	34.24	31.00
55 to 62	15 hrs - gut-in med to low no. 2	41.80	38.23	30.82	30.82
	15 hrs - gut-out med to low no. 2	41.55	38.16	32.30	32.30
	110 hrs. - gut-low no. 2 to reject	42.98	39.00	30.75	16.90
	110 hrs. - gut-out med no. 2 to reject	41.07	37.90	29.20	29.20

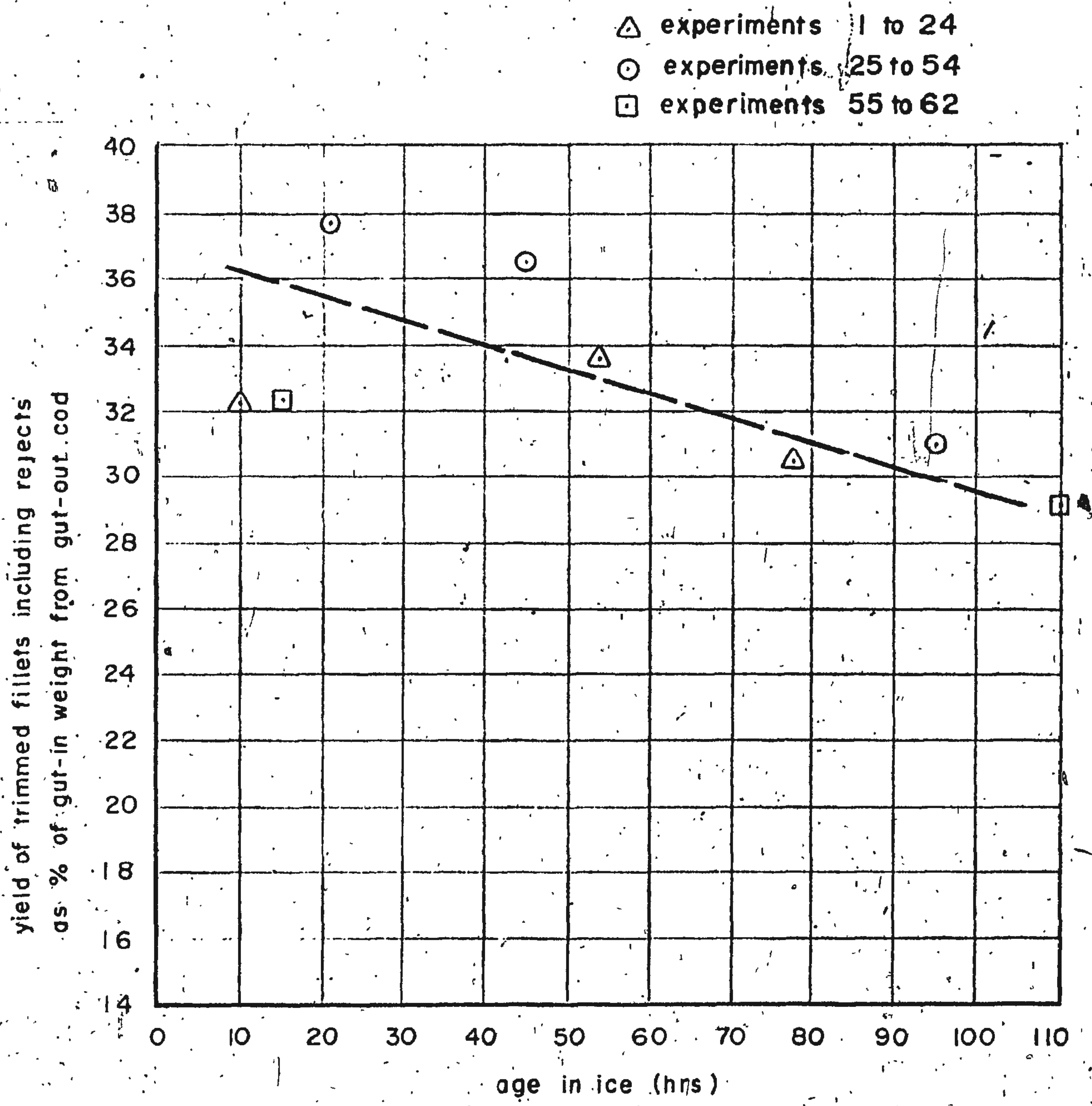
TABLE II



YIELD OF TRIMMED FILLETS (INCLUDING REJECTS) FROM GUT-IN COD

VS. AGE OF FISH IN ICE

Fig. 2



YIELD OF TRIMMED FILLETS (INCLUDING REJECTS) FROM GUT-OUT COD VS, AGE OF FISH IN ICE

Fig. 3

CHAPTER V

5.00. DISCUSSION

5.10 Differences in Yield and Normal Output between gut-out and gut-in cod.

There appear to be appreciable differences between both normal output rate and yield in favor of gut-out cod, as demonstrated particularly in experiments 1 to 24. There are two reasons why this set of experiments is considered more significant than the other two; first, they were carried out under actual plant conditions by a filleter on incentive pay; second, the output rates in the other experiments were much lower so that the filleter had more time to overcome the apparent disadvantage of filleting gut-in cod.

Further, in considering whether cod should be processed gut-in or gut-out, the only period this is of concern is during the trap season since cod caught by other means are, in general, required to be gutted at sea and Experiments 1 to 24 are the only experiments where trap cod were used.

Based on those experiments, Newbury & Amaria (1974) derived the relative benefit/cost ratios of processing gut-in and gut-out trap cod when purchasing trap cod at 9¢ per lb. gut-in or 11¢ per lb. gut-out, and selling at 77.6¢ per lb. for cod fillets and 58.2¢ per lb. for cod blocks (the then-prevailing rates).

For ten hours old (in ice) cod, these ratios for gut-in and gut-out cod are as follows:

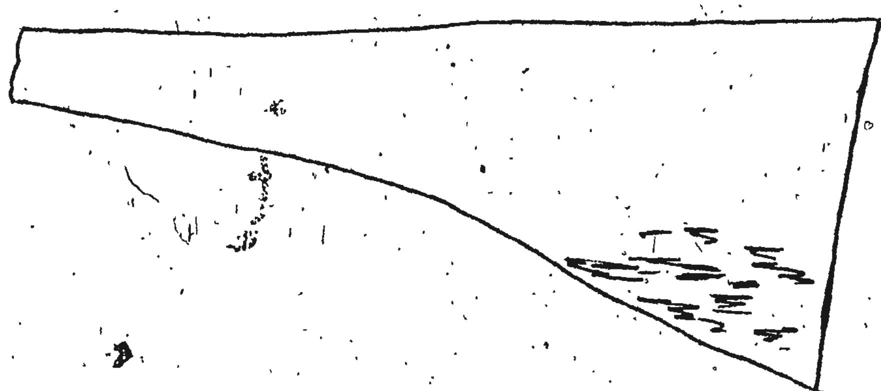
B/C, Gut-in cod = 3.0149

B/C, Gut-out cod = 3.3016

5.20 Differences in Yield from gut-in and gut-out cod as quality deteriorates

Each set of experiments demonstrated a rapid yield loss with deterioration in quality, even without considering rejection of fillets as unfit for human consumption. If quality deteriorates to the extent that fish are beginning to spoil, rejection of spoiled fillets results in much greater loss of yield.

The experiments also demonstrated that quality of fillets deteriorates faster with gut-in cod compared with gut-out. The main reason for this is that enzymatic and bacterial action within the gut quickly break down the gut wall and begin attacking the belly cavity causing "belly-burn", a spoilage of the lower part of the fillet characterized by brown jelly-like patches. (Fig. 4)



COD FILLET SHOWING AREA OF "BELLY BURN"

Fig. 4

5.30 Conclusions

The average trimmed yield from gut-in and gut-out cod was calculated for experiments 1 to 6, using the average ratio of trimmed yield to skin-on yield for the other experiments of .786 for gut-in cod and .791 for gut-out cod. This point on the graphs of Figs. 2 and 3 pp. 20-21 shows that really fresh fish may not produce a higher yield as might be expected.

There are two possible reasons for this low yield from 10 hr. old fish, one is that at least some of the fish were passing through the rigor mortis stage and were thus not laying flat on the cutting board but were curved, rigid and difficult to handle and fillet. This condition was not noted at the time of filleting, however, and the output rate for this first set of experiments was quite high, indicating absence of rigor.

On the other hand there is no question that rigor mortis will affect both output and yield adversely, and manual or machine filleting of "in rigor" fish is avoided by processors when possible.

The second possibility is that yield was adversely affected by speed. Amaria (1974) observed a significant negative linear correlation between speed (performance-rating) and yield, indicating that the low yield on experiments 1 to 6 may have been due to the high output rate. (1003.5 lbs/hr. for gut-out fish and 990.6 for gut-in fish, for experiments 1 to 6 compared with 881.6 and 925.8 for experiments 7 to 16 and 965.3 and 910.5 for 17 to 24).

It is likely that a combination of these factors and possibly others caused the relatively low average yield on experiments 1 to 6 and the experiment should be repeated to confirm the results obtained, or otherwise, and to establish the optimum period for filleting freshly caught fish.

Should it be shown that significantly greater yields are possible after rigor, this will have to be weighed against the fact that trap cod processed and frozen pre-rigor has better taste panel acceptability than does trapcod of the same date processed and frozen post-rigor. (MacCallum et al, 1968).

The differences between gut-in yield and gut-out yield varied widely; from a 13.5% increase in yield of gut-out fish over yield of gut-in fish for 10 hours old (in ice) trap fish to a decrease in yield for 110 hours old (in ice) gillnet fish.

There are a number of possible reasons for these variations, for example the presence of the over-large gut in feeding trapcod may make the fish more difficult to handle, thereby adversely affecting both yield and output as observed or the filleter may, unconsciously, be trying to avoid cutting the gut, causing him to be less efficient.

In experiments 25 to 62, the differences between gut-in and gut-out yield are not as significant, probably, as mentioned, because of the lower rate of output and the smaller gut content. Again, further experiments are necessary to conform, or otherwise, the advantage of gutting prior to processing freshly caught cod, both trap cod and cod caught by other means and at other seasons.

While there remains some doubt as to whether or not fresh trap cod should be gutted before processing, these experiments show that if cod is to be held for any appreciable period prior to processing gutting is essential for optimum results.

Similarly, while there appears to be some doubt as to whether or not trap fish should be processed before rigor mortis sets in, it is essential for optimum results to process as soon as possible after rigor.

Finally, for these experiments, all fish were very well iced to preserve quality for as long as possible. In actual practice, fish would not normally be iced as quickly after landing, nor as well and quality deterioration would occur much sooner.

H. Locke & G. Walters (1973, unpublished) showed trap cod deteriorating rapidly to reject quality within 24 hours without ice, while gutted, iced trap cod was held without serious quality deterioration for only two or three days. This work clearly showed the necessity of processing trap cod as soon as possible after landing and of preserving quality with ice for the duration of the holding period.

CHAPTER VI

6.00 METHOD - OBJECTIVE II

To propose a materials handling system and procedures to optimize returns from the inshore fishery.

6.10 System Criteria

It has been shown (in section 1.20) that present methods of holding, handling and transporting inshore fish result in serious deterioration of quality even before the fish reaches a processing plant. Chapters III and IV show clearly that processing yield of cod decreases with decreasing quality.

While comparable experiments have not been carried out on other species, it is likely[1] that poor quality similarly affects the yield from other groundfish species as well as pelagic (herring, mackeral, capelin) and demersal (salmon).

Thus, the first and main requirement of the proposed materials handling system is (a) fish quality must be maintained at a high level, at least for several days.

Other criteria include the following:

(b) The methods to be used must be acceptable to fishermen and buyers.

[1]The Inspection Branch is frequently called upon to inspect, and subsequently to reject, fish of doubtful quality. Rejection alone, then, causes reduced yield.

(c) The system must be usable by both open boats and longliners.

(d) The estimated overall cost must be less than the anticipated gain; i.e. the benefit/cost ratio must be greater than unity.

(e) The system must meet Fish Inspection requirements.

6.20 System Conceptualization

The system proposed is, basically, a system of containerization. Containerization is in widespread use for all modes of transportation, road rail, air and sea, and for these applications has the following advantages:

1. Less handling per unit due to handling relatively large volume.
2. Better control of shipments when using large lots as compared with smaller lots.
3. Better control of pilferage.
4. Packaging (crating) costs reduced.
5. Low or no loss of containers (since they are too large to hide)
6. Suitable for (almost) all manner of goods.
7. May be used to transport goods in both directions.

Most plants in Newfoundland today use forklift trucks for various operations and could readily handle containers designed for use with fork lifts.

For transporting fish, containers have all the advantages listed (they could be used to transport ice back to fish landing points). Also, an insulated container, properly iced, would preserve fish quality for several days in summer compared with only several hours in open trucks.

A further, and very important, advantage is that in the early and late parts of the fishing season when catches are low, trucking can be better scheduled. For example, without containers, if the fish landed is not collected soon after landing the quality suffers drastically, yet most buyers will not send a truck for small quantities of fish; with containers, this fish can be held for a day or so until it is economical to send a truck. Holding in insulated containers would be much better than holding in a "holding unit" since no additional handling would be needed.

Compared with boxes (standard fish boxes of approx. 100 lb. capacity) larger containers, properly designed would also be much less costly to clean per unit of fish delivered. There would be much fewer of them and manual cleaning would probably be economical.

The aim in selecting a standard container for transportation of fish, and it can be a standard container, should be to transport the greatest volume of fish that can be conveniently handled by fork lift truck without damage to fish quality and with safety. Appendix D illustrate two containers which are considered suitable, the first a manufactured, molded-plastic container, the second a wood frame, plywood-sheathed, epoxy-coated container.

While the wood container is cheaper per unit volume and can be built anywhere in Newfoundland, it has the disadvantage that maintenance and replacement costs would be higher than with the plastic container.

Containers are also proposed for use on fishing vessels, but in this case, of course a standard container is not practical.

For open boats the use of net and/or cloth bags is proposed. Two methods of holding the fish in the flexible bags on the boat are suggested:

1. Divide the boat's fish holding space and suspend a bag in

each division.

2. Lay a bag in the bottom of the holding space, place so much of the fish catch in this first bag, cover with second bag, so much more fish, and so on. (Newbury, Amaria, 1974).

Again, the aim is to hold the largest quantity of fish that can be conveniently handled by shore lifting equipment in safety and without damage to fish quality.

The method proposed for containerization of longliners (decked vessels) has been described in two reports, John LeGrow (April 19, 1974) and John Mallam (Dec. 1974).

In a small longliner with a fish hold less than 3 ft. in height, the proposed containers can be filled with fish without concern for damage to fish from crushing. Such would not be the case for longliners having holds of greater depth, for which LeGrow suggests the use of a hinged divider midway up the container which could be dropped in place when the container was half filled, and more fish and ice added. The proposed method of removal of such containers is by a system of pulleys to move the containers along angle aluminum tracks laid on the bottom of the hold. Using the ship's gurdy, the containers are moved to below the hatch where the shore hoist is used to lift them out.

As an alternative to holding fish in ice, refrigerated sea water could be used as is done for herring in Britain. This overcomes the problems of crushing fish and the necessity of complicating the container by using a hinged divider, but may complicate the discharging of the containers ashore.

The advantages of a satisfactory containerization system for longliners are obvious and exciting. With present methods of bulk holding, the only means used for discharging such boats is with pitch-forks,[1] which in most longliner holds is very difficult, very slow and very damaging to fish quality. In fact, many longliner fishermen hold their catch on deck to avoid having to remove it from the hold, thus losing the protection from sun and weather that the hold affords.

Discharge rates anticipated for containers are in the order of 25,000 lbs./hr. using probably not more than two men, compared with 10,000 lbs./hr. using three to five men with pitchforks. Further, containers will provide good protection for fish quality assuming, of course, the fish is well iced as intended and as necessary.

The nature and variety of fish holds precludes the possibility of standardizing fish hold containers and each vessel system must be designed to suit the particular vessel. Based on the work done to date, installed cost for a container system will probably be in the order of $7/800 per 1000 lbs. of holding capacity, somewhat less if the installation of track, pulleys and deck man-holes were done by the fisherman, which is quite within his capability.

The foregoing describes two segments of the proposed system, transport containers and containers for boats. The rest of the system consists of shore facilities, which should facilitate the following functions:

1. Removal of containers from both open and decked boats.

[1] Except where vacuum unloaders are installed and if no trawler is discharging.

2. Weighing of the catch.

3. Provision of buffer storage for fish prior to placing in containers or undergoing some processing operation such as gutting, grading, chilling, de-icing, washing, splitting, cutting tongues, recovering roes, livers, etc.

4. Processing operations as required by buyer and/or fishermen.

5. Icing of fish.

6. Loading fish, with ice, into transport containers either processed or unprocessed.

7. Removal of offal so as not to cause pollution.

8. Moving transport containers on wharf and loading and unloading trucks.

9. Handling of specialty products where landed, e.g. lobsters, crabs, whelks, clams, etc.

10. Washing of all containers, boats, ~~wharf~~ deck, etc. to reduce bacterial contamination.

All these functions should be performed efficiently, in safety and without appreciable damage to fish quality.

6.30 <u>System Design, Installation & Tests</u>

The design of the system based on the concepts described in 6.20 consists of the following steps:

1. Selection of transport containers.

2. Design of open boat containers.

3. Design of decked boat containers and systems.

4. Design of shore facilities.

6.31 Transport Containers

In order to carry out some tests, wood containers (Appendix D) were constructed in the summer of 1974. These containers, which were originally intended to be used as portable ice bins, were used to transport both fish and ice on three occasions only but appeared to be satisfactory. Gut-in and gut-out iced cod were maintained in satisfactory condition indoors for 2 to 3 days in September. Later, they were used to transport and hold ice during September and October. No measure of melting was done, but losses after a month were reported to be about 20%.

No damage resulted from vandalism, even though five containers were left outdoors at Gooseberry Cove, Newfoundland, for several months.

The Norwegian container shown in Appendix E was designed specifically for holding and transporting fish in ice. The size (1500 lbs. of fish) may be more appropriate to Newfoundland requirements, but the cost (approx. $700) may be prohibitive.

Fifty "Coldshipper" containers (Appendix D) have been ordered for tests in 1975 at a cost of approximately $320 each. These containers hold approximately 1100 lbs. of fish in ice, compared with 1500 lbs. for both the wood and the Norwegian containers. They have been tested at Vancouver by federal fish inspectors and are reported to be of exceptionally strong and durable construction.

6.32 Open Boat Containers

Two types of containers have been fabricated and tested, one a 10' x 10' vinyl covered reinforced cloth bag. This bag is not convenient as it requires a lot of head room and is somewhat difficult to discharge. Nevertheless, it may be suitable to use as the bottom container in open boats to keep fish away from unsanitary wood surfaces, thereby meeting inspection requirements without the necessity of applying an expensive, durable coating to the boat hold. The other is a 3" mesh net bag (Appendix F). This bag was tested briefly at Gooseberry Cove in December, '74 and, with minor modifications is considered satisfactory.

6.33 Decked Boat Containers and System

Because of wide variations in boat hold dimensions, even of boats built from the same plans, it will be difficult, if not impossible, to standardize on container sizes for decked boats without excessive loss of carrying capacity on some boats. Because of this and because long-liners have a variety of deck gear and equipment, it will be necessary to design the complete system for each boat fitted with containers.

The 50 ft. longliner, M.V. Reid Brothers, is being modified for containerization by the inspection branch of federal fisheries and this system is described in detail by Mallam, 1974. Layout of containers in the hold and proposed method of loading and removing containers is shown in Appendix G.

6.34 Shore Facilities

Two shore facilities of the type proposed have been installed, one at Tappers Cove, Torbay, the other at Gooseberry Cove, Trinity Bay, Newfoundland. The basic components are described in Drawing No. 7408 Appendix H.

At Tappers Cove, Torbay, an A-Frame has been constructed across the head of the wharf to permit using the same hoist (similar to that at Gooseberry Cove) to discharge boats from both sides of the wharf. At Tapper's Cove, also, it is proposed that different systems can and will be compared for overall effectiveness.

At Gooseberry Cove, a standard jib-crane with 220° of rotation has been installed with the hoist suspended from a trolley fixed to the end of an 8" Channel Boom 8 ft. long. This hoist has a capacity of 1000 lbs. but 2000 lbs. capacity is suggested for greater reliability and flexibility (to allow for fishermen's lack of attention to net loading, if 1000 lbs. or less is the optimum load, or to take a greater than 1000 lbs. load if that is found to be optimum).

Between the hoist and the load being lifted, a dial scale and lifting ring are installed. The dial scale, a Martin Decker "Mariner", is weather-proof and of 2000 lbs. capacity. It will weigh the fishermen's catch as it is being hoisted from the boat (with allowance for the tare weight) so that with agreement between fishermen and buyer,[1] the fisherman knows immediately his landed weight and payment due. This weight can be receipted and the fisherman can then be free to return to fishing or whatever. In the trap fishery it should be possible to tend more traps because of this immediate weighing and faster discharge.

The lifting ring serves two purposes, first it keeps the top of the net spread, reducing the pressure of the net on the fish, second it reduces the effective height of the net, thereby reducing the

[1] The weight of fish to be paid for may create problems for some fisheries, eg. if fishermen want to gut cod upon landing before selling it, then the landed weight is not the weight sold. It is suggested that, rather than weighing the fish a second time, buyer and seller should agree on the percentage of gut (by sampling) and calculate the weight of dressed fish from the undressed weight.

Also, if longliner fish in containers is iced, again, rather than weigh the fish twice an agreed allowance for ice (based on sampling) should be made.

minimum required height of mast needed to discharge the net into the buffer storage hopper, which is elevated for gravity feed to the next operation.

This same hoisting gear, with or without the lifting ring, will be used to discharge containers from longliners. Until longliners are fitted with containers as proposed a suitable container should be constructed for each hoisting station. This container would be lowered into the hold and filled by the boat's crew (presumably with pitchforks).

At this time, the detail of discharging longliner containers into the hopper has yet to be worked out, but design of a simple, effective method should not be difficult. Since a relatively large quantity (up to 2000 lbs.) of fish will be discharged at a time, a fairly large buffer storage is needed to receive the fish from the lifting nets. An elevated hopper, 8' x 8' square, having a sloped bottom and a capacity of about 6000 lbs. of fish is used. A gate at the hopper outlet permits regulation of the discharge of fish. (Appendix I).

The hopper discharge is 4 ft. above wharf level to permit gravity feed to whatever processing operations need to be performed. This part of the system has not been designed or developed since the operations will depend on the needs of fishermen and buyers and on what using the system over the next year or so shows to be desirable. At this stage, it is visualized that most species will be put in the transport containers with ice upon discharge from the elevated hopper. One exception could be trap cod - if experience shows that cod can be more effectively gutted upon landing than gutted after transportation to a plant (or processed without gutting) then gutting facilities, probably fed by a belt conveyor from the hopper discharge, will be installed. Such gutting facilities should provide for economic recovery of roes, livers, etc. and disposal of offal without polluting the harbour.

Most communities will not have an ice making or storage facility and it is proposed that fish buyers provide ice to fishermen as required in the same transport containers used for fish or in portable ice bins (Appendix D).

At Tapper's Cove an overhead track system is to be installed for moving containers of fish, offal, etc. from the head of the wharf to the fish holding facility recently constructed or to an offal storage area. The overhead track arrangement is very expensive ($30,000 for Tapper's Cove) and is not expected to be much more efficient (if at all) than the use of pallet trucks as proposed for most other communities. In general, the use of a pallet truck will necessitate installing a second hoist to load containers of fish unto trucks and to remove containers of ice from trucks. Total cost for two pallet trucks, boom and hoist would be approx. $4,000 for a manual hoist system to $7,000 for an electric hoist system.

As mentioned, details of any required processing facilities will have to be worked out between fishermen, buyers and involved government agencies. Similarly, details of water supply and distribution systems will be determined either at the time of installation of the fish handling system or after some experience has been gained in its use.

6.40 Alternatives

6.41 Boxing

Boxing of fish is widely used, both in mainland Canada, in Europe and most other countries, to hold and transport fish both in boats and on shore. They are accepted by fishermen in Europe because European fishermen are paid for fish on the basis of quality and boxing, in approximately 100 lbs. capacity boxes, is probably the ideal way to preserve fish quality, provided it is well iced and the boxes are not overfilled.

Boxes, however, have disadvantages. They are costly to buy, subject to damage, loss and pilferage and require a lot of manual handling. Attempts to use boxes in Newfoundland, and there have been several,[1] have generally been abandoned, with minor exceptions,[2] due to the disadvantages outlined above. There is evidence that Norway, Britain and perhaps others are now looking at containers also. (Appendices E and J).

6.42 Vacuum Unloaders

Vacuum unloading systems have been developed over the past 10 to 15 years and are now used in most offshore-trawler-supplied plants in Newfoundland. There are a number of objections to their adoption throughout the province:

(a) The installed cost of a vacuum unloader alone is approx. $25,000. Total system cost could be as high as $100,000 depending on cost of power.

(b) Power requirements are very high, about 75 H.P. or greater, with 3 phase supply requirement which is not normally available in many communities except at high cost.

[1] T.J. Hardy Co. Ltd. tried boxes on small longliners and open boats at Port aux Basques in the '50's.

Fishery Products Ltd. recently purchased three Norwegian trawlers, designed for holding fish in boxes. This company is now seriously considering conversion to conventional pen-type holding.

[2] Boxes are used for lobster, crab, salmon, etc.

(c) It is a rather sophisticated system requiring some expertise to operate and maintain; such expertise is not generally available in rural Newfoundland.

(d) The discharge rate is not likely to be faster (and could be slower) than the proposed containerization system.

(e) Operating and maintenance costs would be high because of high power usage and complexity of the system.

(f) Methods of holding and transportation would still be required.

6.43 Existing Methods in Newfoundland

The disadvantages of existing methods of handling and transporting fresh fish in Newfoundland are outlined in Section 1.20. Very few, if any, of these methods are conducive to good quality and should therefore be abandoned.

6.50 Benefit/Cost Ratio

To determine an approximate Benefit/Cost ratio for the proposed system, the following assumptions[1] have been made:

1. Systems installed in 200 communities.
2. These communities would handle a peak of 6,000,000 lbs. of fish per day and a total of 300,000,000 lbs. per year (all species).
3. Present overall yield (all species) is 35% of dressed weight.
4. Expected overall yield using the system is 40% of dressed weight.
5. Average selling price of finished product is $0.50.

[1]These assumptions are discussed in Appendix C

6. Average amortization, 20 years @ 10%.

7. Trucking costs same as at present, therefore not included in analysis.

Cost of Fish Handling Systems

100 Communities (one unloading hoist) @ $25,000	=	$ 2,500,000
100 Communities (two unloading hoists) @ $35,000	=	3,500,000
Nets for (say) 7000 open boats @ $200/boat	=	1,400,000
Container systems for (say) 600 longliners @ $14,000	=	8,400,000
12,000 transport containers @ $350[1]	=	4,200,000
Total	=	$20,000,000

Annual Cost

Amortization (approx)		$ 2,000,000
Operation & Maintenance		
10 full time personnel @ $12,000 p.a.	=	120,000
250 part time personnel @ $5,000 p.a.	=	1,250,000
Total Annual Cost	=	$ 3,370,000

Annual Benefit

300,000,000 (.40 - .35) x .50 = $ 7,500,000

Benefit/Cost Ratio = $\frac{7,500,000}{3,370,000}$ = 2.225

[1]Based on 1100 lb. capacity "Coldshipper" containers (Appendix D). This price could be reduced if similar containers were manufactured in Eastern Canada.

CHAPTER VII

7.00 DISCUSSION

The experimental evidence and the experience gained so far have shown that the proposed inshore fish handling system meets the design criteria stated earlier.

(a) It has frequently been demonstrated that fish quality is best maintained by holding in relatively small quantities with finely divided ice, mixed fairly intimately with the fish. The use of 1000 to 1500 lb. insulated, covered containers permits this and provides the needed protection from the external environment.

(b) All fishermen who have tried the nets or who have been consulted for opinions on the proposed system agree that it is the first proposal which reduces fishermen's labour. In general, the fishermen's response has been enthusiastic. Buyers and plant operators have not been as favourable in their comments, believing that the containers will be very costly and that pay loads of trucks will be reduced, thereby resulting in a loss, rather than a gain. Further experiments on transportation will be necessary to convince buyers of the advantage of containers for this purpose, but they are in favor of the containerized handling of fish on boats.

(c) The system is designed for use by open boats, longliners and other decked boats.

(d) The estimated Benefit/Cost Ratio was observed to be 2.225

(e) The system components are designed to meet inspection requirements.

CHAPTER VIII

8.00 IMPLEMENTATION

The structure of the inshore fishery in Newfoundland is a rather confused system composed of often-conflicting segments interacting with each other and with the offshore fishery (Fig.5 p.45).

Because of the involvement of government in the ownership of wharves, subsidies to fishermen, and other constraints, there appears little doubt that if the system proposed herein is to be implemented in the near future, it must be both sponsored and financed to some degree by government. All interested segments of government and industry will have to be made aware of the proposal, the reasons for it and the expected benefits. Government and industry will have to agree to share the cost on some basis. Since the wharves are government owned, it is suggested that equipment used on the wharf by all fishermen, ie. the shore facilities for handling fish, should be financed by government, perhaps on a shared cost basis between federal and provincial.

Transport containers which would be under control of the fish buyers and plants should probably be financed and owned by the buyers and plants.

Nets for open boats are not a costly item and should probably be purchased and owned by fishermen, who would be required to keep them clean and in good repair.

Container systems for longliners would be owned by the boat owner, perhaps financed under the regular subsidy program now in existence.

A suggested program and timetable for implementation over a period of approximately five years is shown in Appendix K.

CHAPTER IX

9.00 CONCLUSIONS & RECOMMENDATIONS

The experiments described in Chapter III were intended to show that even if yield were the only consideration it would pay industry and government to invest in facilities which would help to minimize quality deterioration in fish products.

While the experiments were incomplete in that only one species, cod, was examined, the loss in yield from this important species alone (Figs. 2 & 3 pp 20 & 21) provides strong justification for substantial investment in on-shore handling facilities. The experience of the Inspection Branch over many years, some of which has been summarized in unpublished papers and referred to herein, confirms the need for such facilities for the inshore fishery. In fact, the concensus of Fishery Officers who are close to the inshore fishery is that lack of adequate handling and transportation facilities is the most significant of the three major causes of poor quality, the other two being lack of ice[1] and abuse of gillnets.[2]

However, there are other considerations than yield, in particular the saleability of the product. Many people in Canada and the United States are reluctant to purchase fish for home consumption or to order fish at a restaurant because they can not be sure of obtaining good quality. That this is true is confirmed by the writer's own experience and by others throughout the Fisheries & Marine Service.

[1] See page 5

[2] See page 3

It is a long-established fact that per capita consumption of fish in the United States is only about 1/3 of what it is in Europe (approx. 12 lbs. per person per year compared with approx. 33 lbs. per person per year). It would be difficult to prove that poor quality fish being delivered to the U.S. market is the cause of this difference and there are undoubtedly many other factors which affect fish consumption (e.g. relative prices of meat and poultry, distribution set-up, tariffs, etc.). Nevertheless, the intuitive feeling is that delivery of consistently good quality to the consumer would result in a significant increase in the per capita consumption, thereby helping to firm up and stabilize this principal market for Newfoundland's fish products.

It is recommended that further experiments be carried out by government and industry similar to those described, to determine the extent to which reduced quality affects the yield of other inshore species.

Further, government and industry should work together to thoroughly test the prototype landing and handling systems which have been installed. This is important at this time in order for rational decisions to be made concerning the future course of the inshore fishing industry.

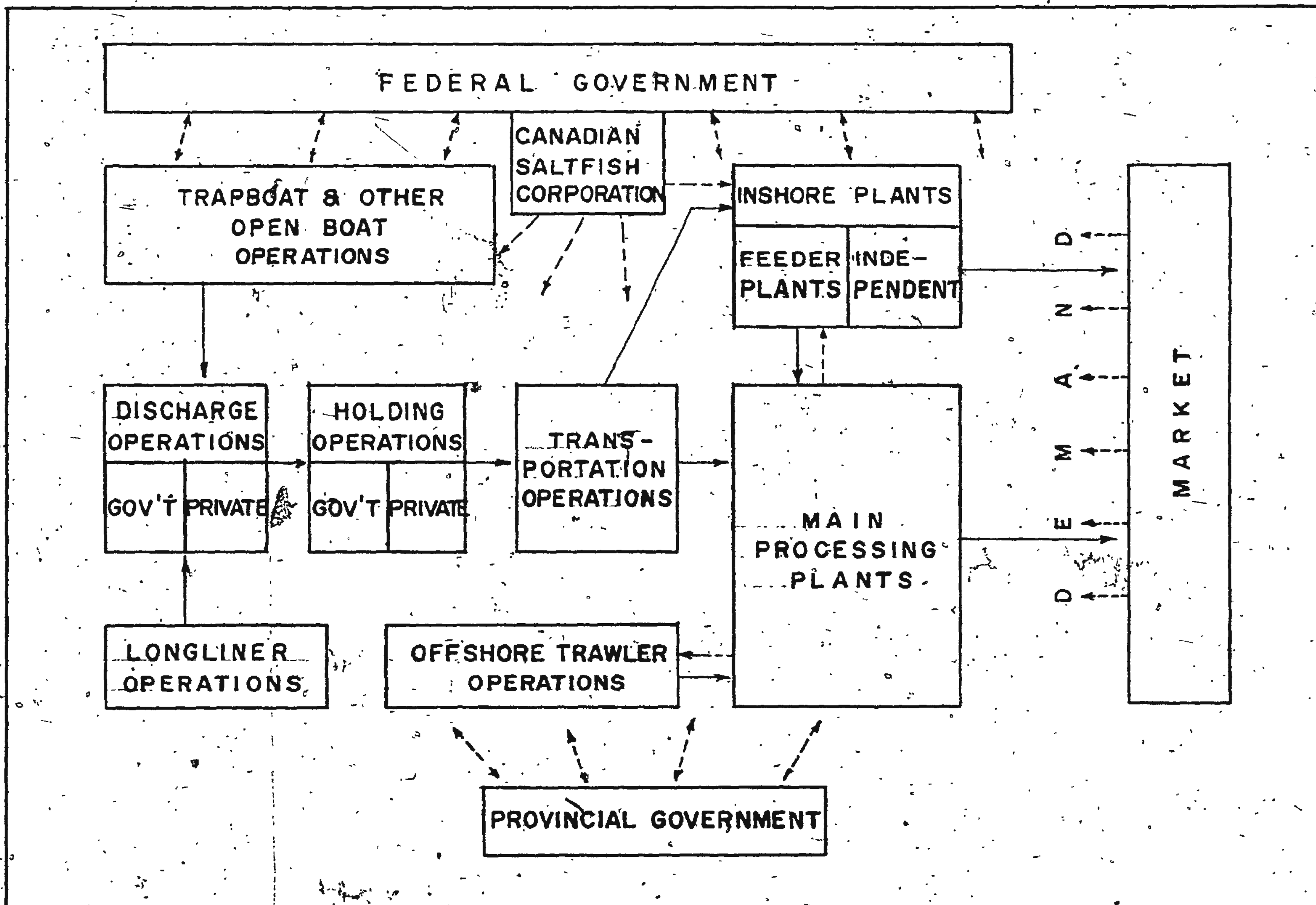


Fig. 5 SYSTEMIC MODEL OF NEWFOUNDLAND FISHERY

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APPENDIX A

APPENDIX A

THE INSHORE FISHERY OF NEWFOUNDLAND

A BRIEF DESCRIPTION

The inshore fishery can be divided between open boats and decked boats (longliners) as has generally been done in the text, or by species and methods of fishing.

The principal species are the groundfish species of which cod is, and always has been, the most important. Other groundfish species taken by inshore and near-offshore boats include turbot, flounder, sole, catfish and redfish.

When small open boats fish groundfish, with very few exceptions they fish for cod, either by handline with a jigger or baited hook; by trawl line, a long line with a series of baited hooks tied to the main line with short "sud-lines"; or by cod trap.

The cod trap fishery of Newfoundland is duplicated in only a few places in the world; and occurs during the spring and early summer when cod feed on large schools of spawning capelin close to shore. The trap consists of a large box-like net, set close to shore with a leader net between the trap and the shore to divert cod into the trap through an opening where the leader is joined to the trap.

Traditionally, trap-boats are ~~small~~, open boats of from 25 ft. to 45 ft. in length. Traps would be hauled once, twice or three times daily, depending on the availability of fish, the distance from shore and the time needed to land the catch. In a few areas, notably Port de Grave, rough water and rather distant trapping grounds necessitated the use of decked boats.

Until recent years, hundreds of millions of pounds of cod were landed annually by some fifteen thousand boats in June and July. Today, over-exploitation offshore has, it appears, all but ruined the trap fishery, and the number of boats engaging in the trap fishery is about five thousand, with landings of approximately seventy-five million pounds.

In the 50's, gillnets were introduced to Newfoundland and most groundfish landings now are taken by this method of fishing. Usually, the nets are set well offshore by longliners, decked boats in the range of 35 to 65 ft. overall length. A boat might set several miles of nets, suspended near the bottom with anchors and buoys since the fish are, as the term groundfish implies, bottom dwellers.

Gillnets are used for cod and all the other groundfish species mentioned. As in the trap fishery, offshore overfishing has drastically reduced landings, causing the quality problems mentioned in the text.

In recent years, long liners have begun to convert to other methods of fishing, both to improve their efficiency in catching traditional groundfish species and to catch other species, such as herring, mackeral, capelin, crab, shrimp, etc.

Some of the methods used include ring-netting, similar to seining, whereby a net is set in a circle around a school of fish at or near the surface, the bottom closed under the fish and the fish then removed from the net by brailing (a large dip net), pumping or winching the net over the side of the vessel; otter trawling and mid-water trawling in the same manner, but with smaller gear, as the large offshore trawlers; and longlining, the setting of very long trawl lines with thousands of baited hooks.

Long lining is rather a traditional method of fishing in Newfoundland (and elsewhere) which, with few exceptions was all but abandoned when gill nets were introduced. The reason is that baiting miles of line by hand is, of course, extremely tedious and time consuming, and has to be done the night before sailing. If weather interrupts fishing, as it frequently does, the baited trawls would often have to be cleared and re-baited, especially if there were no cold storage available.

Several manufacturers have developed automatic line baiting equipment, but the cost is out of reach of most Newfoundland fishermen, and the gear is suitable only for larger boats.

The trap fishery, as mentioned, takes place in June, July and August and occurs around the Burin and Avalon Peninsulas and up the east and north-east coasts to Labrador; the season coming later as one moves farther north.

The gill net fishery is engaged in all around the island and off Labrador except for the south-west coast where fishermen refuse to use them. (See p.6 of the text).

The queen crab fishery (snow crab) has become quite important in recent years (until markets suddenly declined in 1974). Crab are taken in metal framed, conical pots covered with netting, about four feet diameter at the base and two feet high. These pots are set by tying them to a long, buoyed line, on the bottom, usually at around 100 fathom depth, and baited. Crab fishing areas are found around the Avalon Peninsula and north to Labrador.

Lobster has always been an important species, being taken only in shallow water, near shore by small open boats. There is no offshore lobster fishery in Newfoundland as there is in the Maritimes. Lobster are taken in wood-framed pots during a short season in the spring.

Salmon, too, is a very important species in great demand and brings a good price to fishermen. Salmon are taken in season along the coast in gillnets as they migrate from the ocean to their spawning grounds upstream, either in Newfoundland rivers or in mainland rivers.

In the Gulf of St. Lawrence, shrimp are taken in bottom dragged nets. The boats are longliner type converted for this type of fishery. There is only one plant processing shrimp in the Province, at Port au Choix, and some thirty to forty shrimp boats land there.

Scallops are also taken in the gulf by small open boats with scallop drags, a raking device that picks the shellfish off the bottom.

Herring is caught all around the coast of the Island and off Labrador at various times of the year, with seines, ringnets and gillnets. Small open boat fishermen have to use gillnets and may land two or three thousand pounds per day, while the larger boats may land as much as 500,000 pounds.

The inshore fishery season varies around the coast, depending on movement of fish and, primarily, on weather. From the Avalon Peninsula north and on the Gulf coast, ice and poor weather prevent fishing from about December to late May or June (later in Northern areas). On the south coast, which is generally ice free, there could be a year round inshore fishery, but movement of fish stocks are a factor. The south-west coast, traditionally, has a winter fishery, primarily for cod using hand lines and long lines. The rest of the south coast fishermen are mostly trawler (offshore) fishermen.

At present only the following fisheries are regulated; lobster, salmon, herring, shrimp, scallops and queen crab. However, depletion of stocks of all species will probably lead to management control of all fisheries, both inshore and offshore and a federal government licencing and registration program has just begun to acquire the statistical information such control will require.

APPENDIX B

GRADES - GROUNDFISH (ATLANTIC COAST)

	GRADE 1	GRADE 2	REJECT
General Appearance: (Lustre and Bleaching)	Bright with metallic lustre. Very little, if any, bleaching.	Some loss of metallic lustre, some bleaching may be apparent.	Bloom completely gone. Colour faded or bleached.
Eyes:	Bright, translucent, usually full but in some cases may be slightly sunken and somewhat dull.	Dull, slightly sunken, slightly cloudy.	Dull and sunken. May be cloudy, dull, white or opaque.
Gills: (Colour)	Bright red to slightly pinkish red.	Pinkish red to brownish red. Some mucus may be present.	Brownish red to brown or gray. Frequently covered with thick bacterial mucus.
(Odour)	Fresh odour characteristic of species to faint sour odour.	Faint sour or fishy odour to medium sour odour.	Medium to strong sour odour.
Slime:	Usually clear, transparent and uniformly spread but occasionally may be slightly milky or opaque.	Becoming turbid, opaque, and milky, with marked increase in amount of slime present on skin surface.	Thick, sticky yellowish or grayish in colour.
Odour: (Poke End)	Fresh to very faint sour odour.	Slightly sour or fishy odour.	Medium to strong sour odour.
(At neck when breaking)	No odour to very slight odour.	Slightly sour.	Sour or putrid.
Consistency of Flesh:	Firm and elastic to the touch. Occasionally may be slightly soft.	Moderately soft and some loss of elasticity.	Generally soft and flabby.
Kidney:	Bright red	Loss of original brilliance.	Kidney blood brownish in colour.
Liver:	Firm.	Soft.	Almost liquified.
Backbone:	Normal colour - no discolouration. Separation of flesh from bone difficult.	No discolouration to slight pinkish red. Separation of flesh from bone slightly difficult.	Pinkish to dark red in colour. Flesh separates from bone easily.
Belly Cavity:	Flesh adheres firmly to rib bones.	Flesh starting to come away from rib bones.	Rib bones free or almost free from flesh.
Belly Flaps:	No discolouration to slight discolouration.	Slight discolouration.	Marked discolouration
Vent:	Normal in shape and colour.	May show slight protrusion.	Protruding and may be discoloured.

APPENDIX C

APPENDIX C

Discussion of assumptions used in Benefit/Cost Ratio calculation, p. 39

1. There are now some 700 to 800 communities reporting fish landings, however only about 60 report over a million pounds annually and most are below 100,000 lbs. 200 community systems, strategically located should handle more than 90% of total landings. Provision of system facilities in these communities would result in some needed rationalization, while at the same time help to preserve the desirable features of Newfoundland community life by making the inshore fishery more viable.
2. Total inshore landings of all species in 1973 was approx. 323,000,000 lbs.
3. Yield from all cod landings processed for the fresh and frozen market for the years 1970 to 1973 are shown below. Assuming an average yield from offshore cod of 38%, typical of trawler supplied plants, the yield from inshore cod averaged approximately 35% for those years. If we can assume similar yields for other inshore species, and the experience of federal inspection officers supports this assumption, an overall yield from inshore fish landings of 35% is not unreasonable.

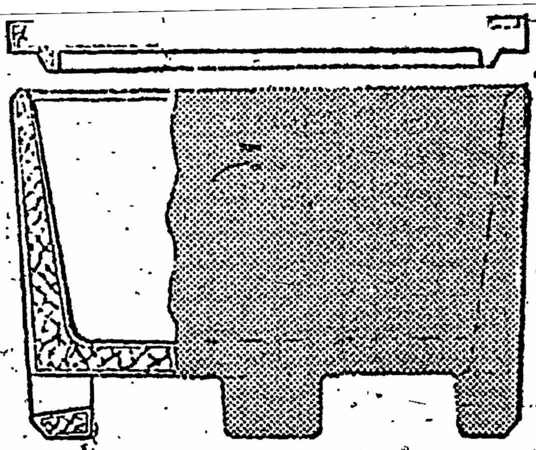
Cod Landings Gut-out Weight less that salted. Million lbs.				Total Frozen Production million lbs.	Overall Yield	Est.* Inshore Yield %
Year	Total	Offshore	Inshore			
1970	192	58.3	133.7	67.9	35.3	34.3
1971	190	57.4	132.6	67.3	35.4	34.3
1972	168	37.1	130.9	58.2	34.7	33.8
1973	142	28.5	113.5	50.3	35.4	34.8

*Estimated Inshore Yield = Total frozen production minus offshore production Inshore landings x 100. Offshore production is assumed to be offshore landings x .38. Yield is expressed as percent of dressed (gut-out) weight.

4. To compare present yield and expected yield to experimental results it is necessary, first, to convert to yield figures based on gut-in weight. Assuming an average of 16% by weight of gut, 35% of gut-out weight = 29.4% of gut-weight and 40% of gut-out weight = 33.6% of gut-in weight. From Fig. 3, p.21 29.4% of gut-in weight is about the equivalent of what might be expected from cod held for some 4 to 5 days in ice, whereas 33.6% is equivalent to about 2 days in ice. This increase in yield should be readily achievable; in fact, the average yield from cod in Norway has been estimated at 45% (skin-off, gut-out; equivalent to 37.8% of gut-in weight) and Baader, the German Processing Machinery manufacturer,

states in its advertising that 45% yield (from head-on gut-out fish) is typical for models 187 and 189 filleting machines.

APPENDIX D

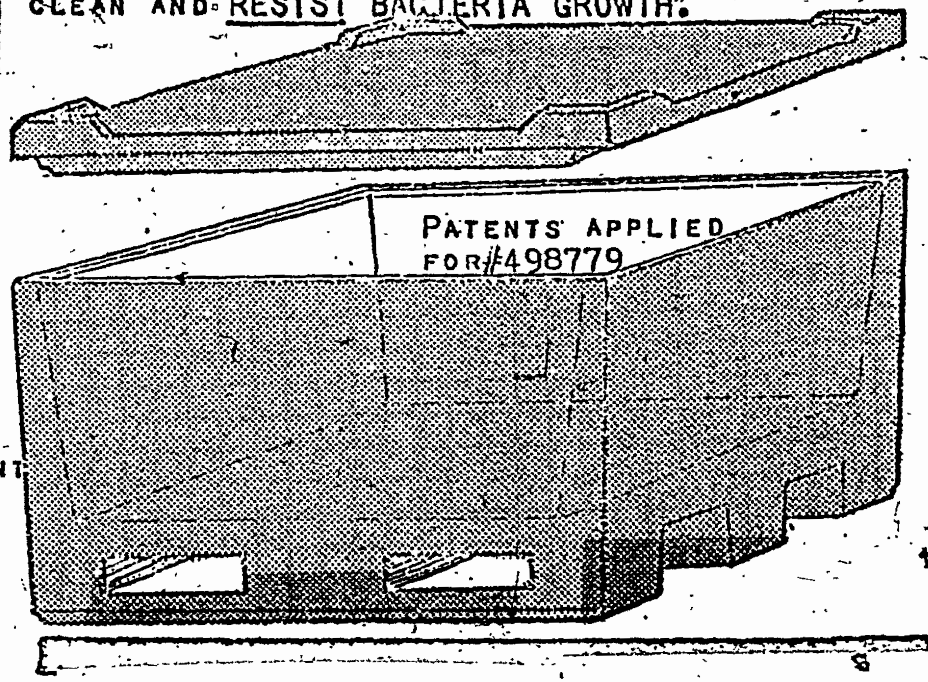


'THE COLD SHIPPER' IS NOT JUST ANOTHER SHIPPING CONTAINER.

IT IS DESIGNED TO SERVE A MULTIPLE USE, BENIFICIAL TO BOTH, THE CONSUMER AND THE FISH AND FOOD PACKING INDUSTRIES.

THE ONE PIECE MOLDED STRUCTURE HAS A SOLID INSULATION INJECTED WITHIN THE DOUBLE WALLS. IT IS BUILT FOR ROUGH HANDLING, LOW TEMPERATURES AND REQUIRES NO MAINTENANCE.

THE MATERIAL, A SUPER STRONG POLYOLEFIN IS INERT, EASY TO KEEP CLEAN AND RESIST BACTERIA GROWTH.



THE COLD SHIPPER CAN BE STACKED WITH OR WITHOUT COVERS.

THE ONE PIECE STRUCTURE HAS NO SEAMS OR WELDS.

LENGTH 47 1/2"

WIDTH 42 1/4"

DEPTH 20" (TUB)

HEIGHT 28" (OVERALL)

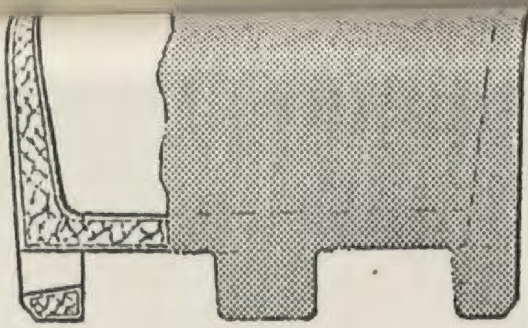
DESIGNED FOR USE OF ROTATING FORK LIFTS.

ADVANTAGES.

1. ELIMINATES BACTERIA HAZARDS.
2. IMPROVES THE QUALITY OF FISH TRANSPORTED TO DISTANT POINTS.
3. PERMITS THE SHIPPING OF MORE FISH AND LESS ICE.
4. LESS SHRINKAGE.
5. INCREASED PAYLOAD.
6. PERMITS THE USE OF STANDARD TRUCKS OR FLATBEDS.
7. STUDIES INDICATE THAT THE ADVANTAGES PAY FOR THE COST OF COLD SHIPPERS RAPIDLY.

Containers Designed by the Inspection Branch →

CONSUMER AND THE FISH AND FOOD PACKING INDUSTRIES.



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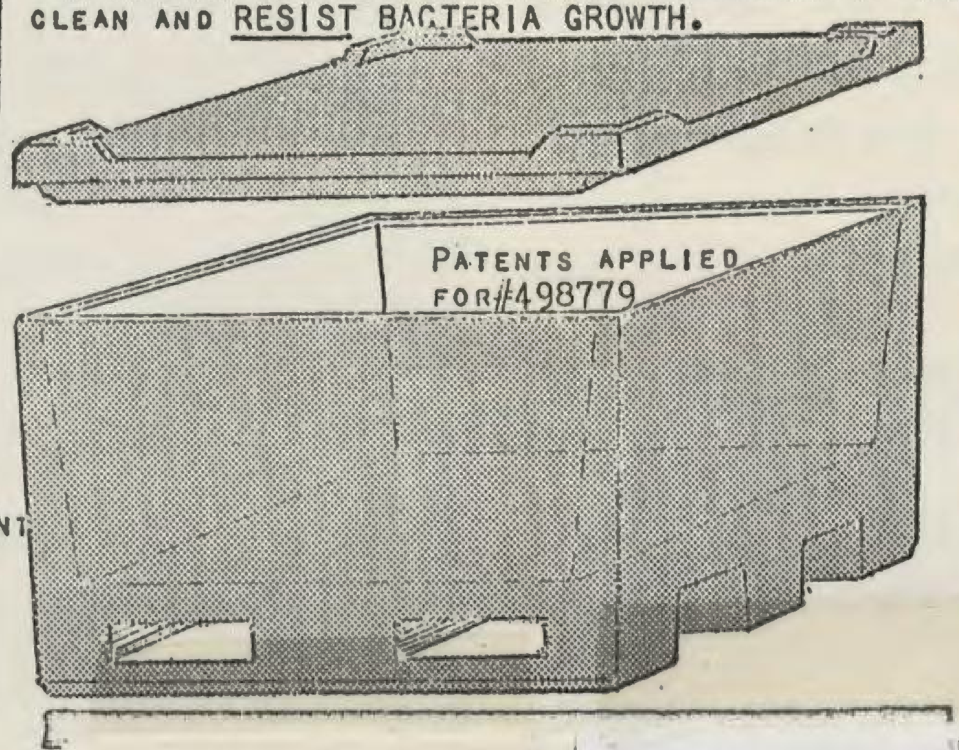

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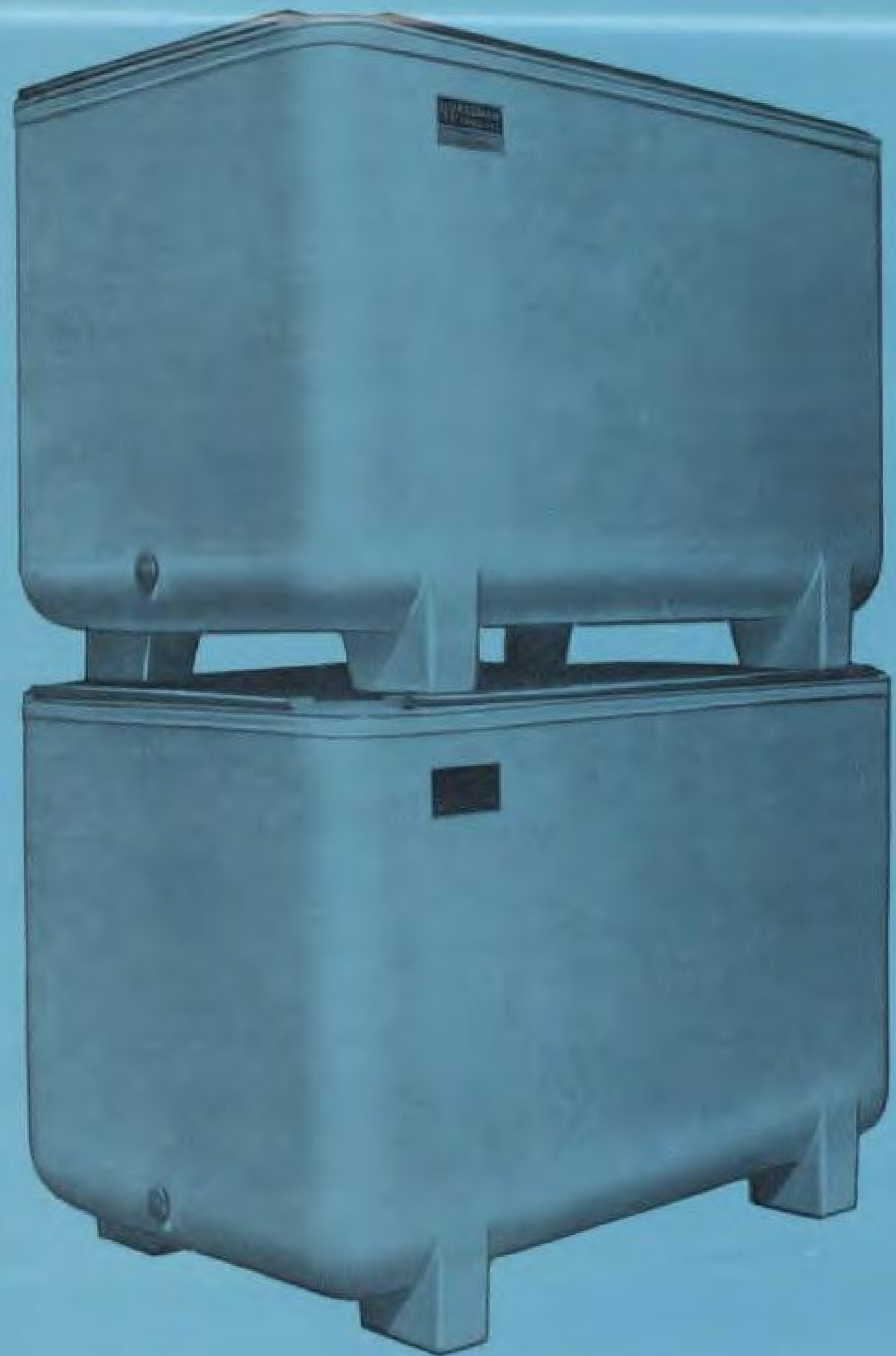
Containers Designed by the Inspection Branch →

APPENDIX E



NORSEMAN FIBREGLASS

STACKABLE THERMO CONTAINER 04.08.—.

★ **Used for transporting goods at controlled temperature.**

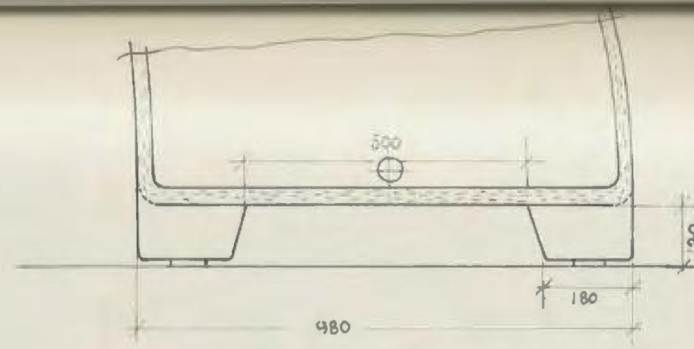
★ **Easy to stack up by use of fork lift.**

★ **Containers automatically lock in place on one another, thus preventing slipping.**

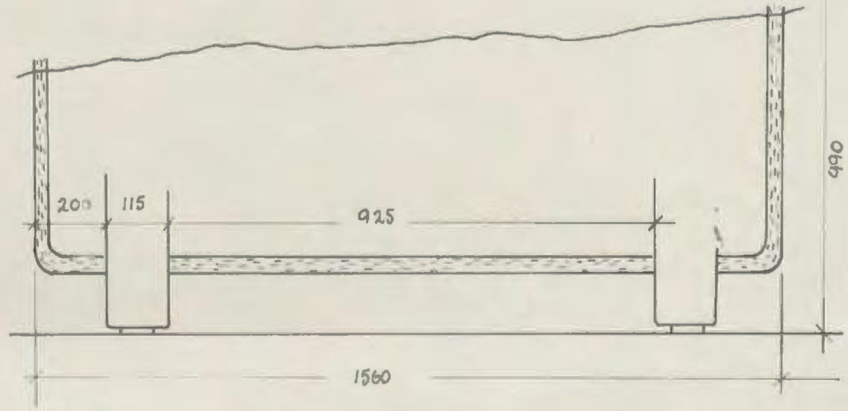
Detail Sketch of Lid.

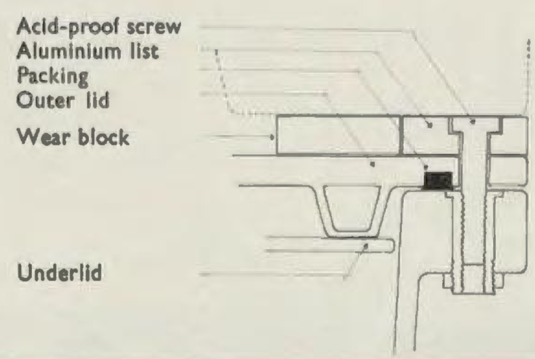
Detail sketch shows under surface of outer and inner lid. Outer lid is insulated and strengthened by 6 ribs. Inner lid is perforated and used specially for transporting products in brine as it prevents goods from coming out of brine. See also detail sketch overleaf.

NORSEMAN STACKABLE THERMO CONTAINER



- ★ Made of fibreglass reinforced polyester with inserts of heat-galvanized steel and polyurethane insulation.
- ★ Used for the transport of various products at controlled temperature.
- ★ Hygienic - smooth inner surface of the container easily cleaned.
- ★ Goods can be transported in the container without first having to be packaged.
- ★ Average insulation effectivity 3,12kCal/°C per hour (Tested at Møre and Romsdal Standard Testing Station, Aalesund, Norway).
- ★ Stackable, also when filled.
- ★ Handled by fork lift or jack cart.
- ★ 1 1/2" filling/draining aperture.
- ★ Approx. weight of container 145 kgs/308 lbs.
  - ,, ,, of lid 50 kgs/122 lbs.
  - ,, total weight 195 kgs/430 lbs.





PRODUCER

PLASTKONSTRUKSJONER A/S

SPESIALITET: ARTIKLER I GLASSFIBER - POLYESTER

SKODJE, NORWAY

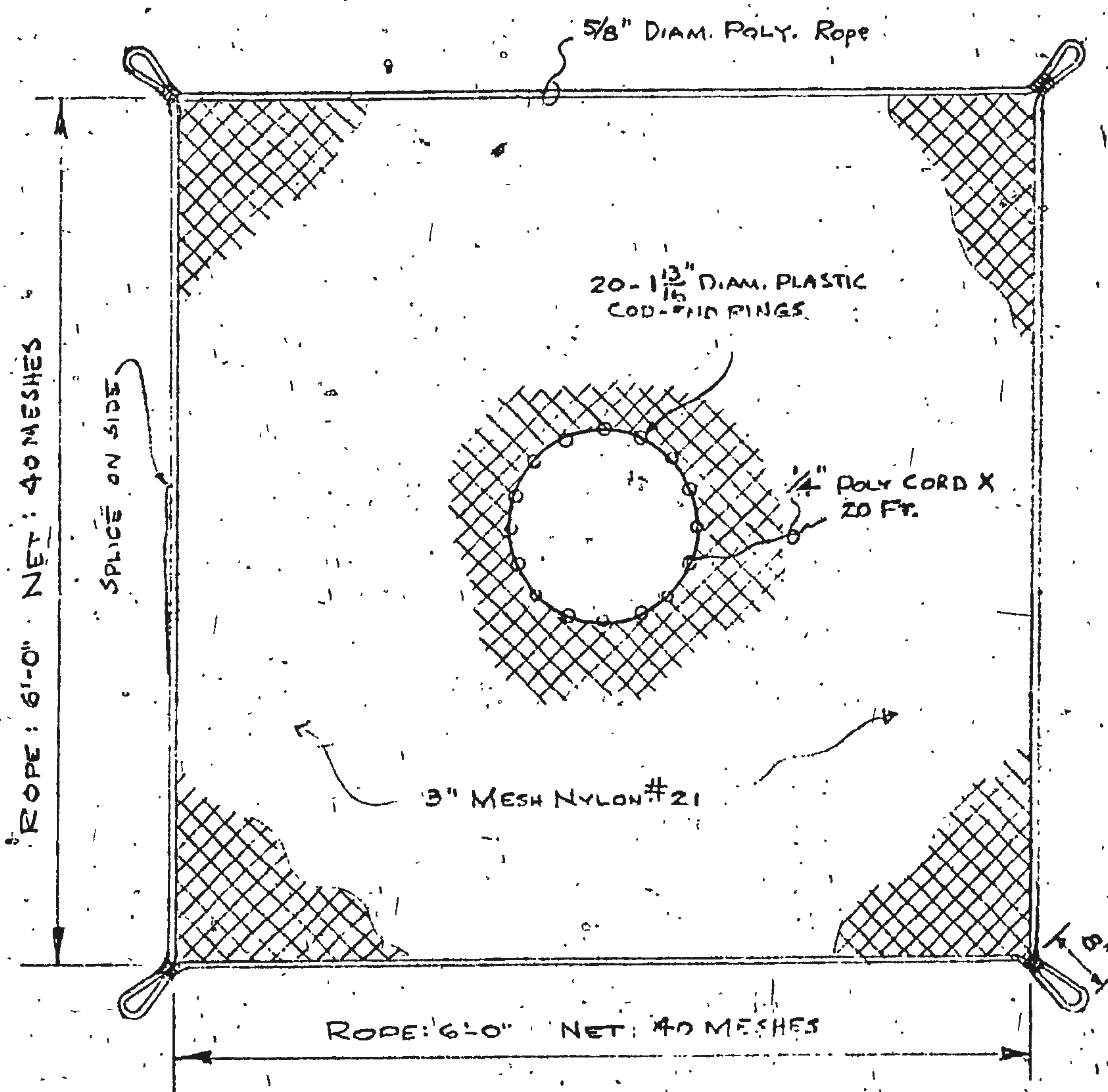
ETING

NORDIC SUPPLY A/S

KONGENSGT. 17 - N-6001 AALESUND
TLF. 071 *25 350 - TELEX 42528 - NORWAY

DEALER

APENDIX F



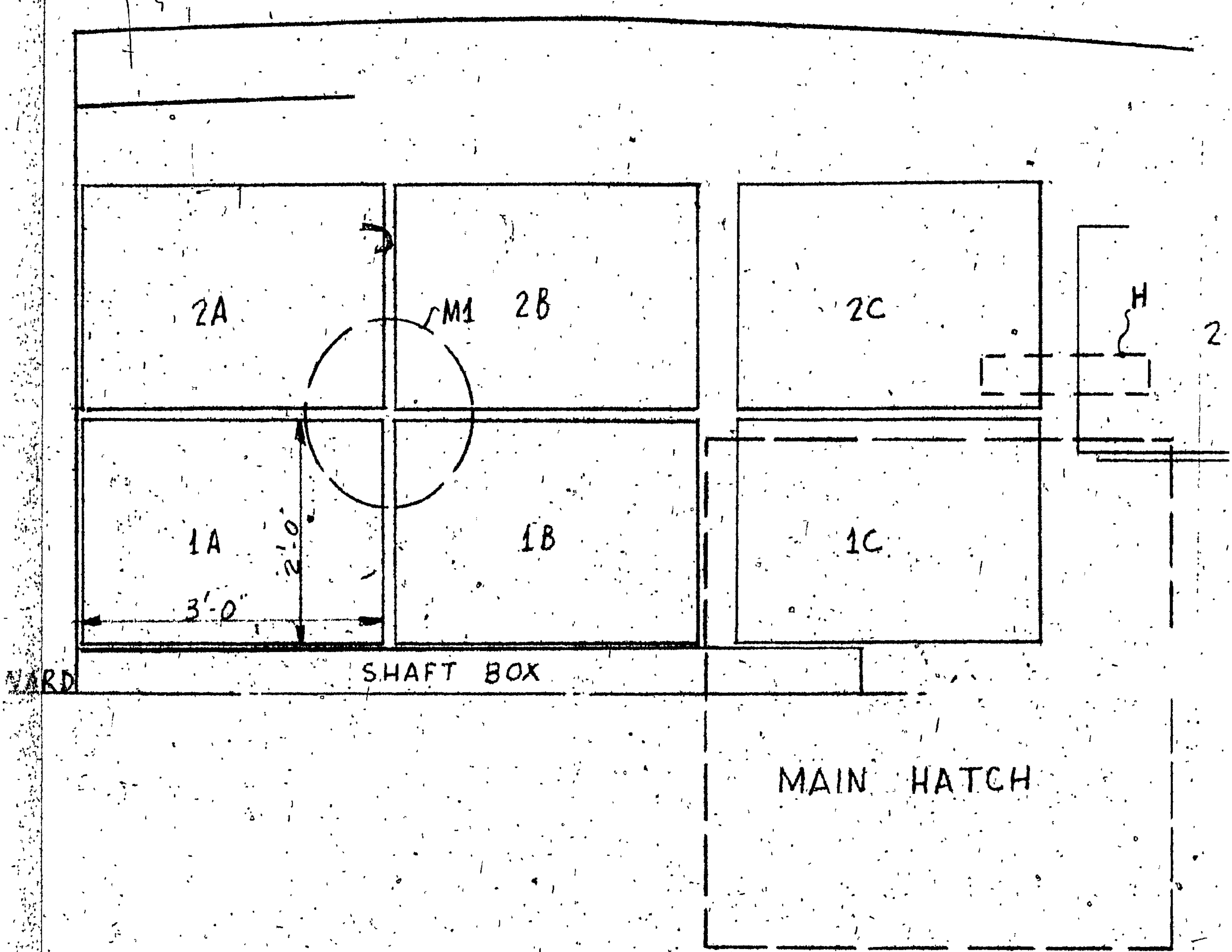
FISH HOLDING & DISCHARGING NET
FOR OPEN BOATS

CANADA DEPT. OF THE ENVIRONMENT
FISHERIES & MARINE INSPECTION BRANCH

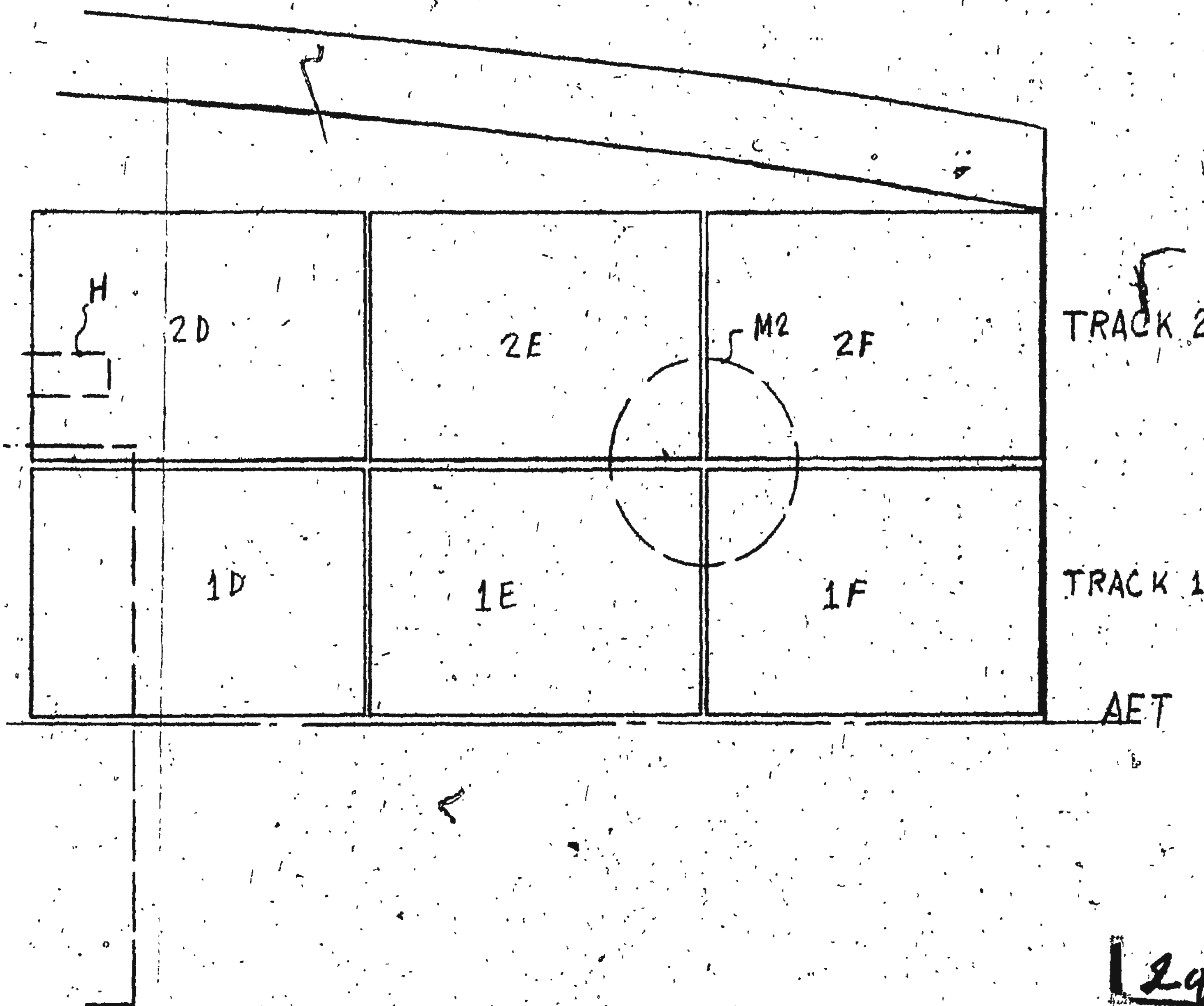
MAR. 1975
DWG 7510

N.T.S

APPENDIX G

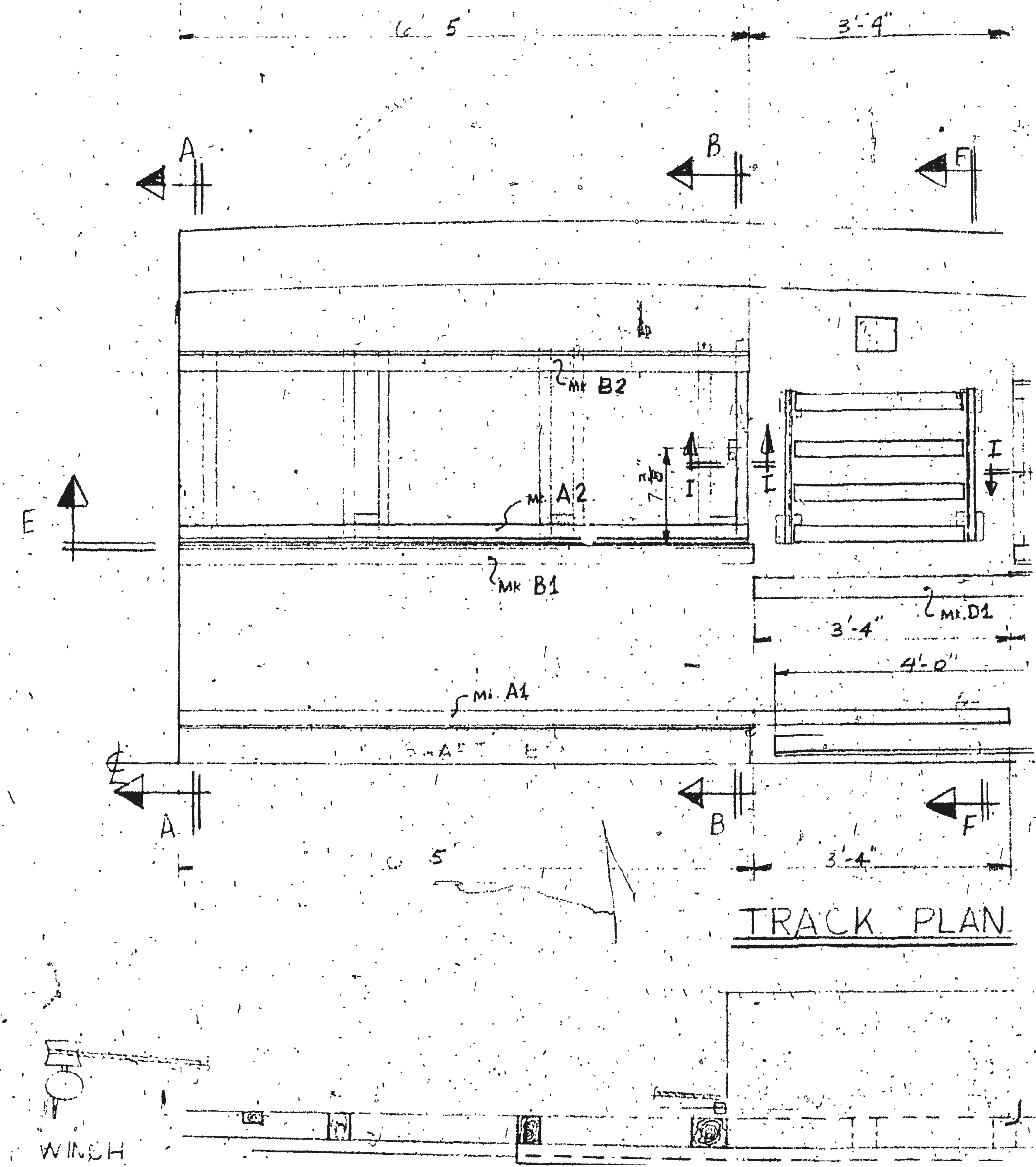


1 of

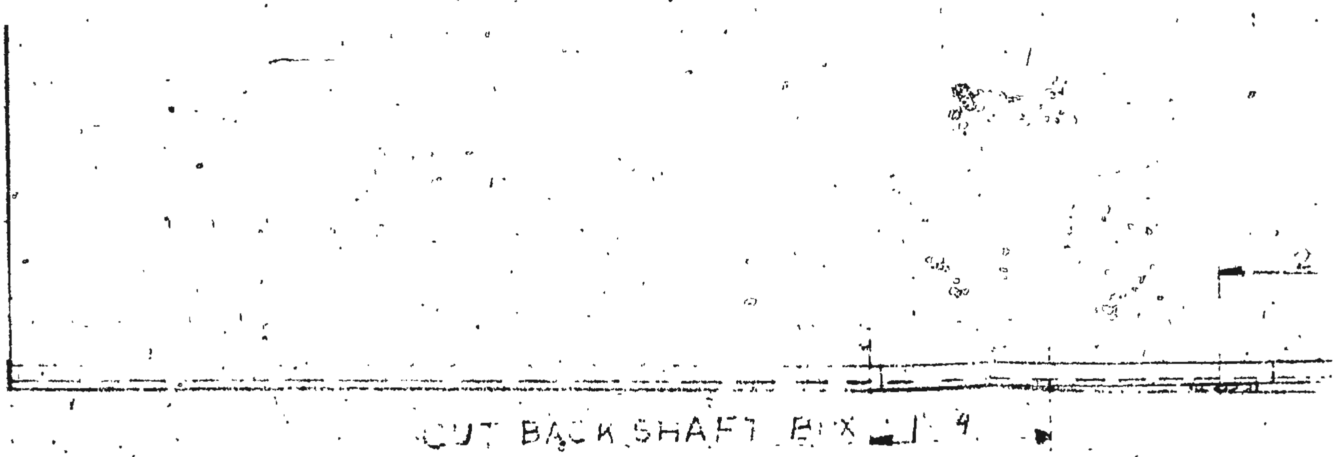


2 of 2

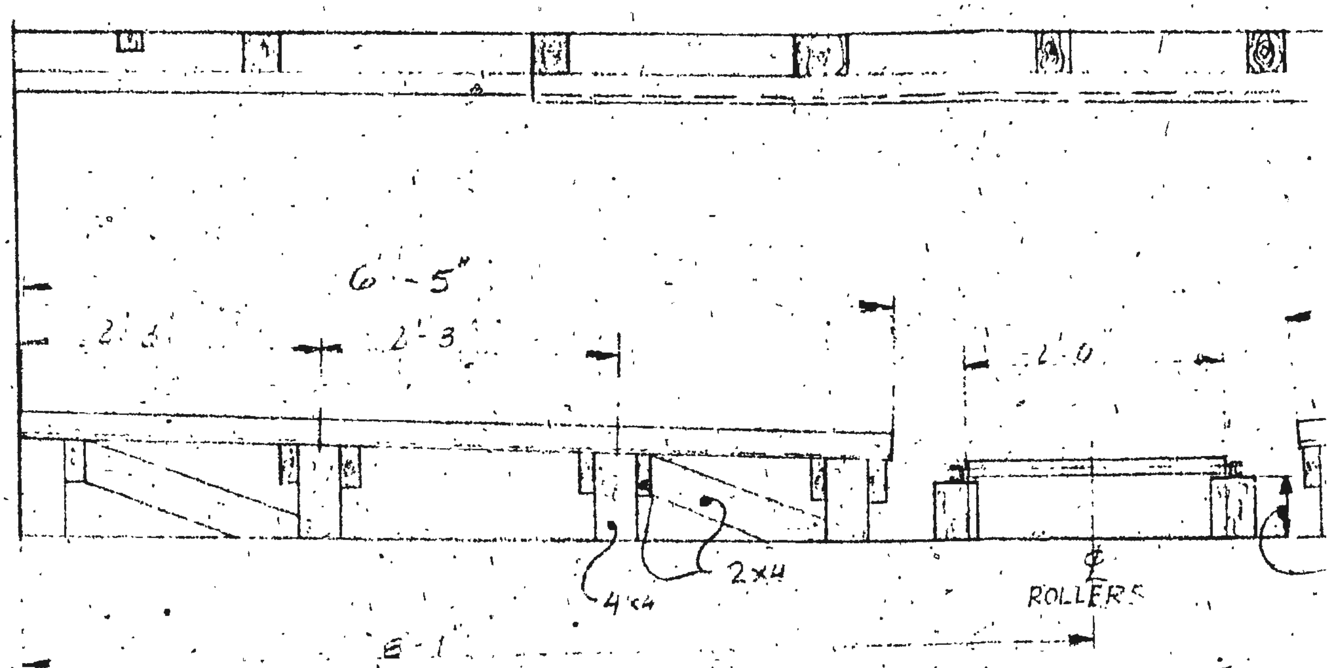
DEPT. of ENVIRONMENT - FISHERIES INSPECTION BRANCH				
CONTAINER LAYOUT				
LONGLINER "REID BROTHERS"				
DATE NOV 14, 1974	DWN. JA	CHKD.		DWG. # 7421-2



TRACK PLAN



SECTION ON
SHOWING TRACK



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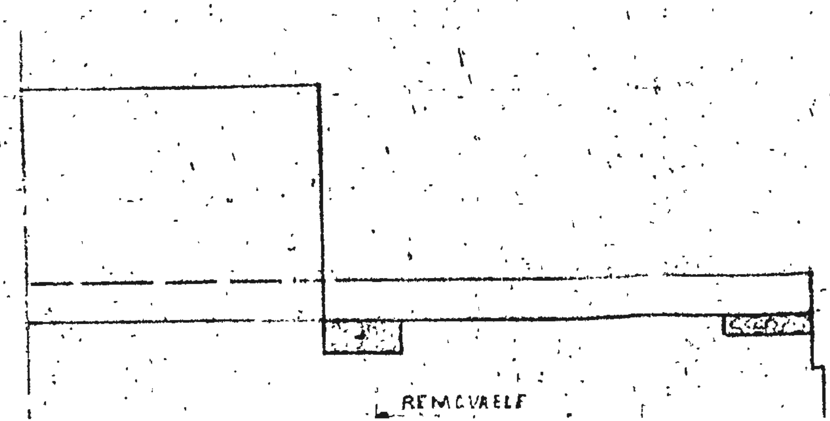
SHOWING TR



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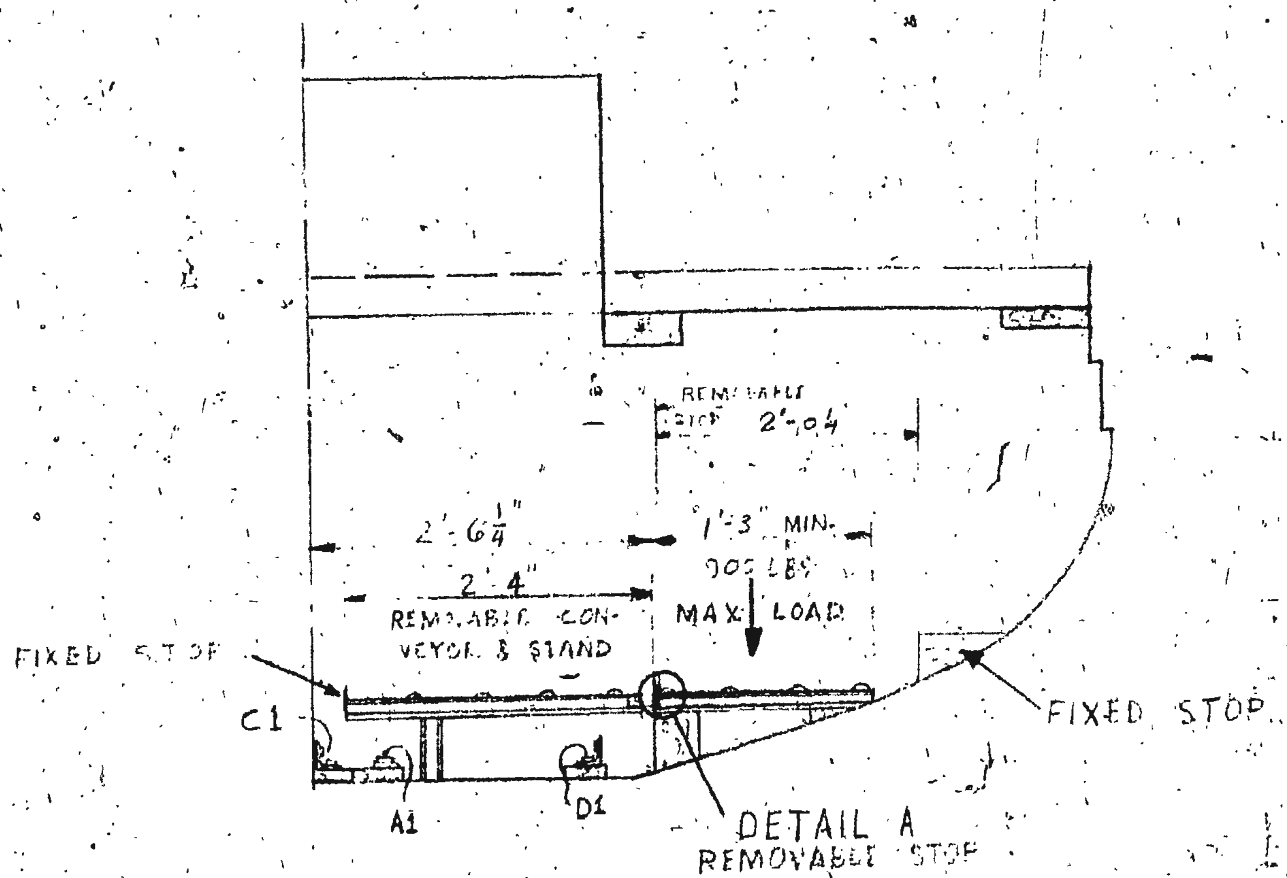

SECTION FF

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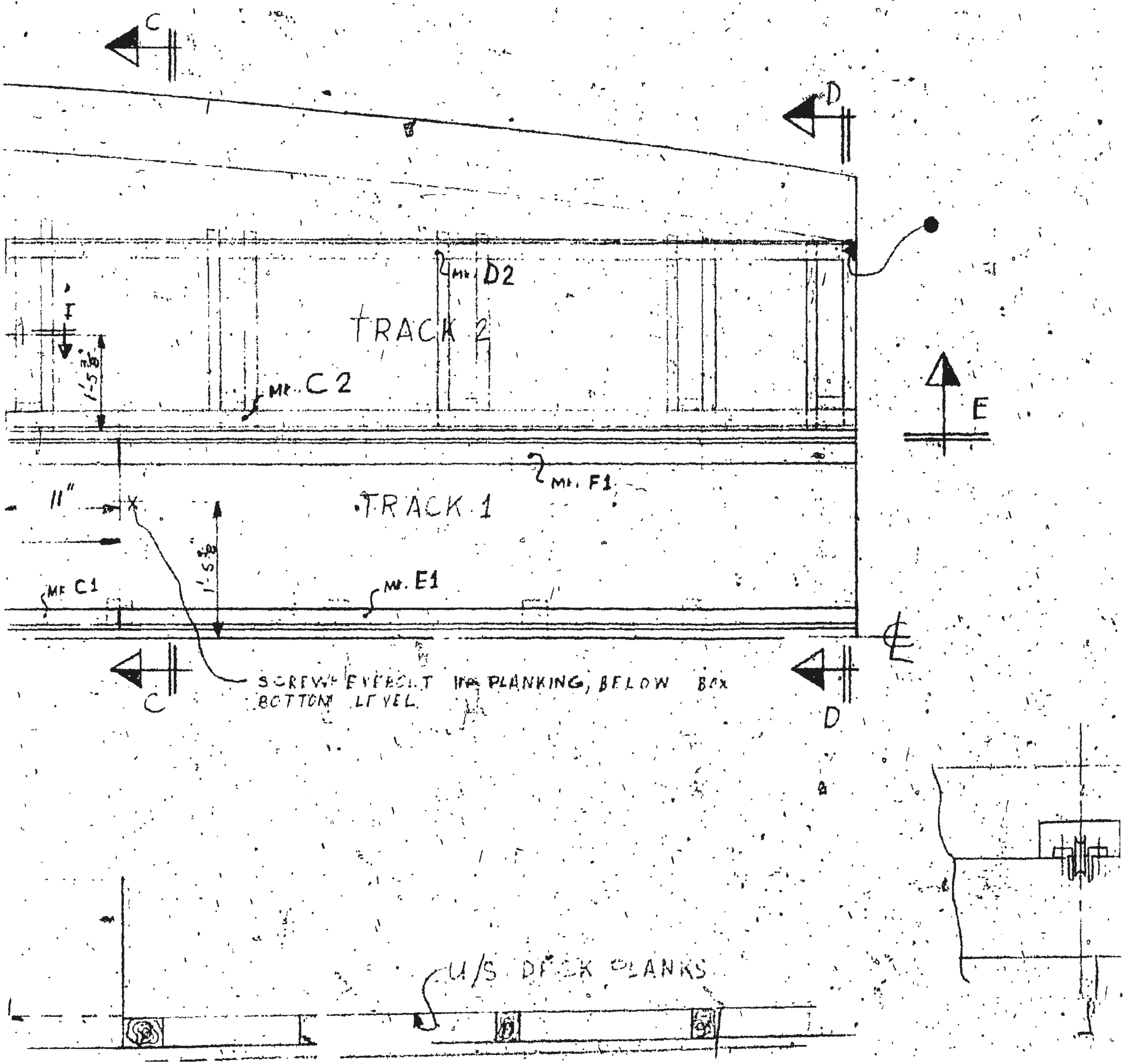
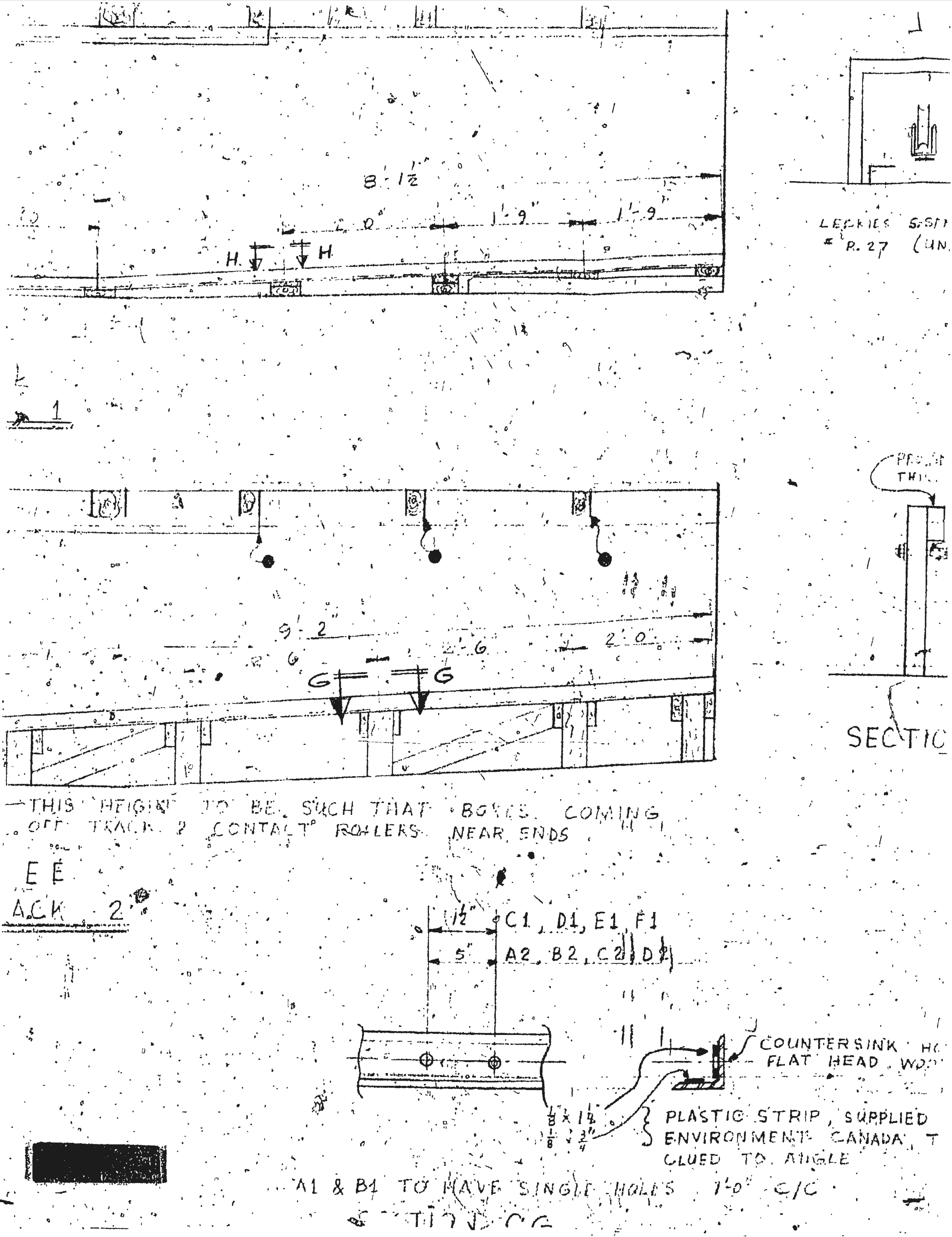
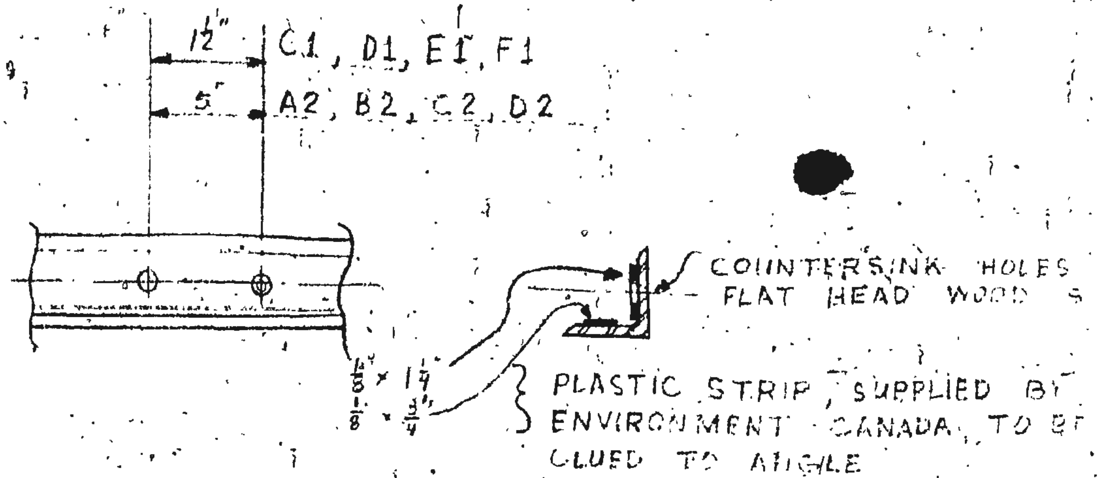

C
D
MK D2
TRACK 2
MK C2
E
MK F1
11"
TRACK 1
MK C1
MK E1
PLANKING, BELOW BOX
BOTTOM LEVEL
C
D
U/S DECK PLANKS



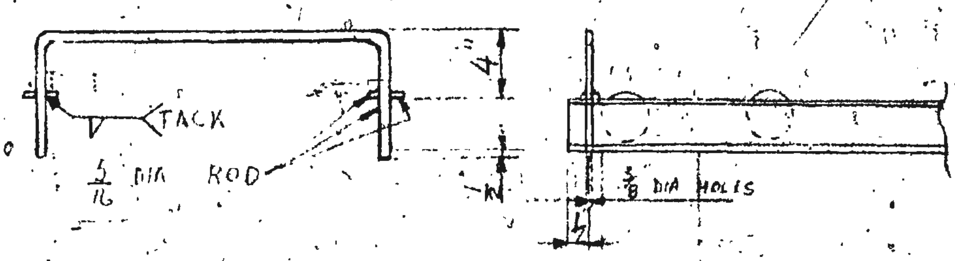
8'-1½
2'-0"
1'-9"
1'-9"
H
H
LECKIES
R. 27
1
9'-2"
2'-6
2'-0"
G
G
SECTIO
THIS HEIGHT TO BE SUCH THAT BOXES COMING OFF TRACK 2 CONTACT ROLLERS NEAR ENDS
E E
ACK 2
1½" C1, D1, E1, F1
5" A2, B2, C2, D2
COUNTERSINK
FLAT HEAD
⅛ x 1½
⅛ x ¾
PLASTIC STRIP, SUPPLIED
ENVIRONMENT CANADA
GLUED TO ANGLE
A1 & B1 TO HAVE SINGLE HOLES 1'-0" C/C

[redacted]

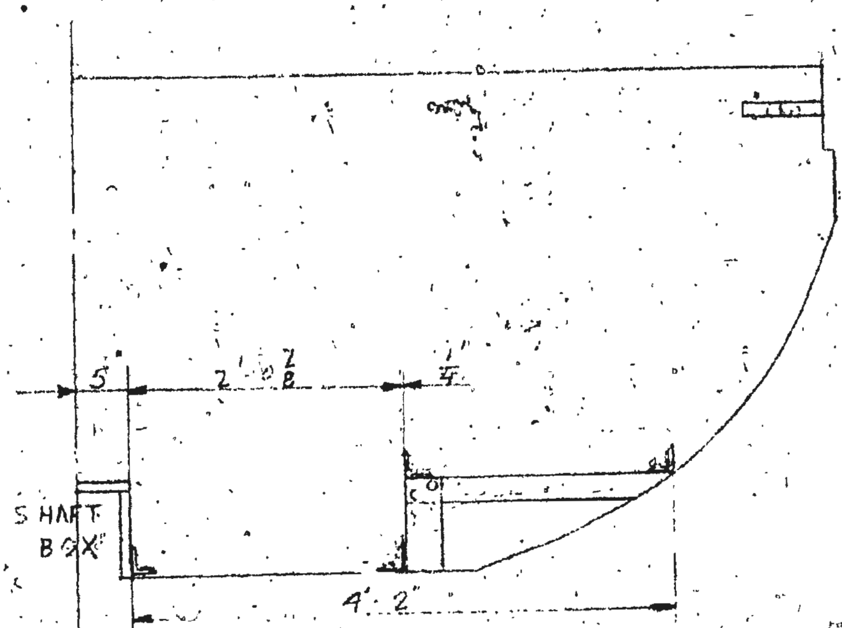


A1 & B1 TO HAVE SINGLE HOLES 1'-0" C/C

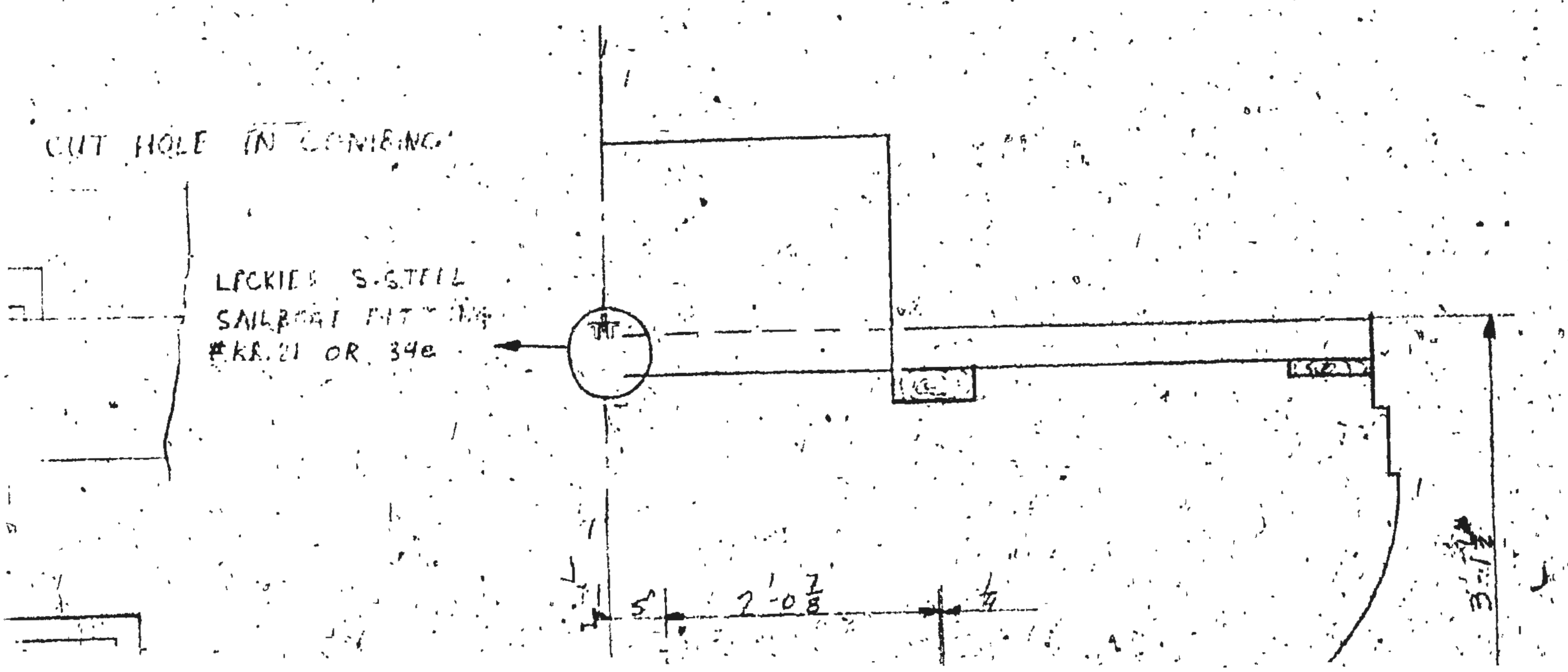
SECTION GG
(HH SIMILAR)

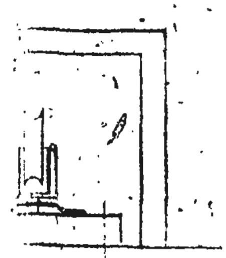


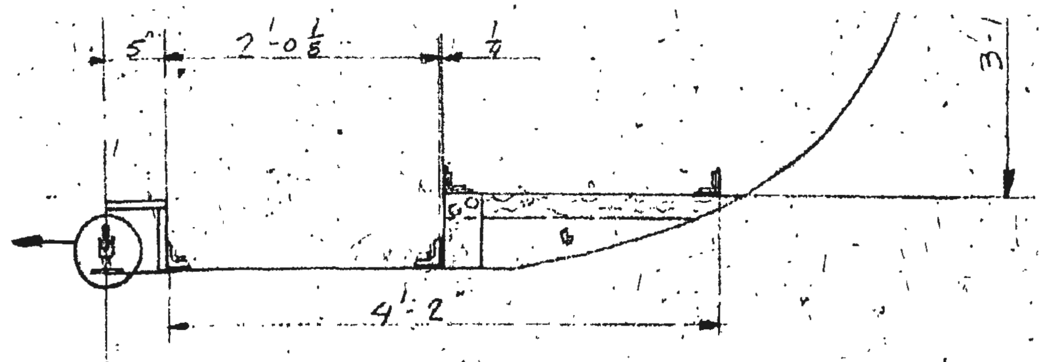
DETAIL A - REMOVABLE STOP



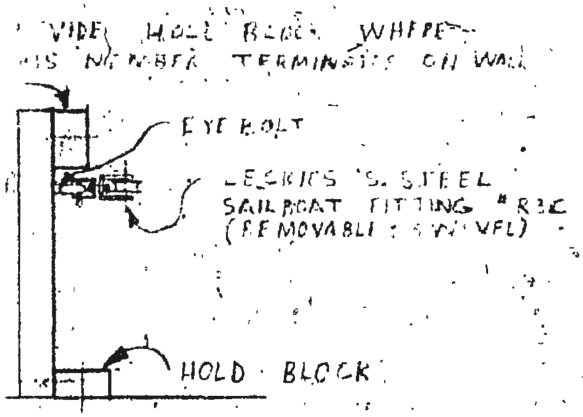
SECTION AA



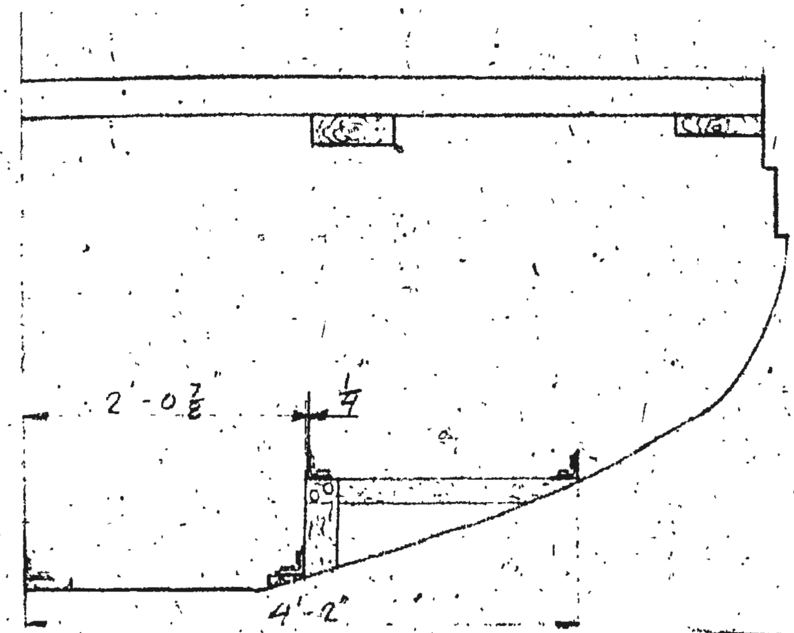




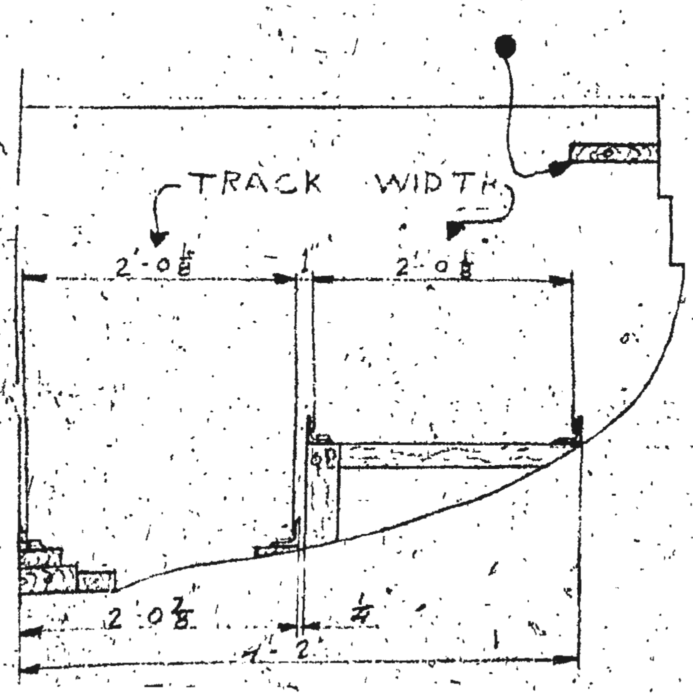
SECTION BB



TION TI



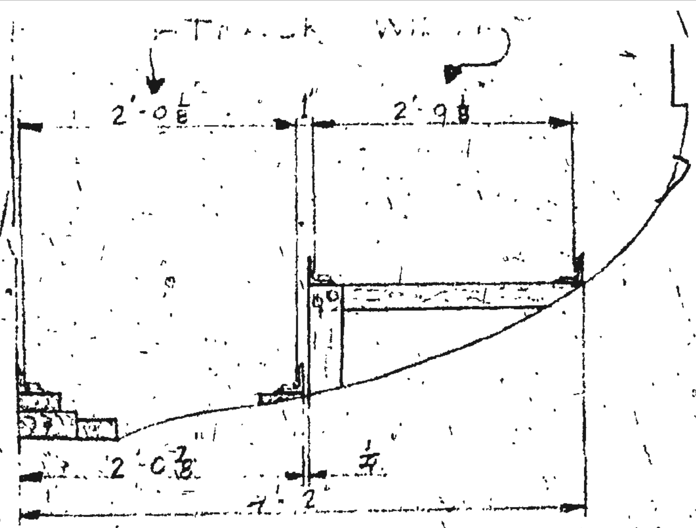
SECTION CC



A HOLES FOR #16
WOOD SCREWS

PLIED BY
A, TO BE

#16



SECTION DD

[redacted]

NOTE:

●→ INDICATES POSSIBLE INTERFERANCE POINTS.

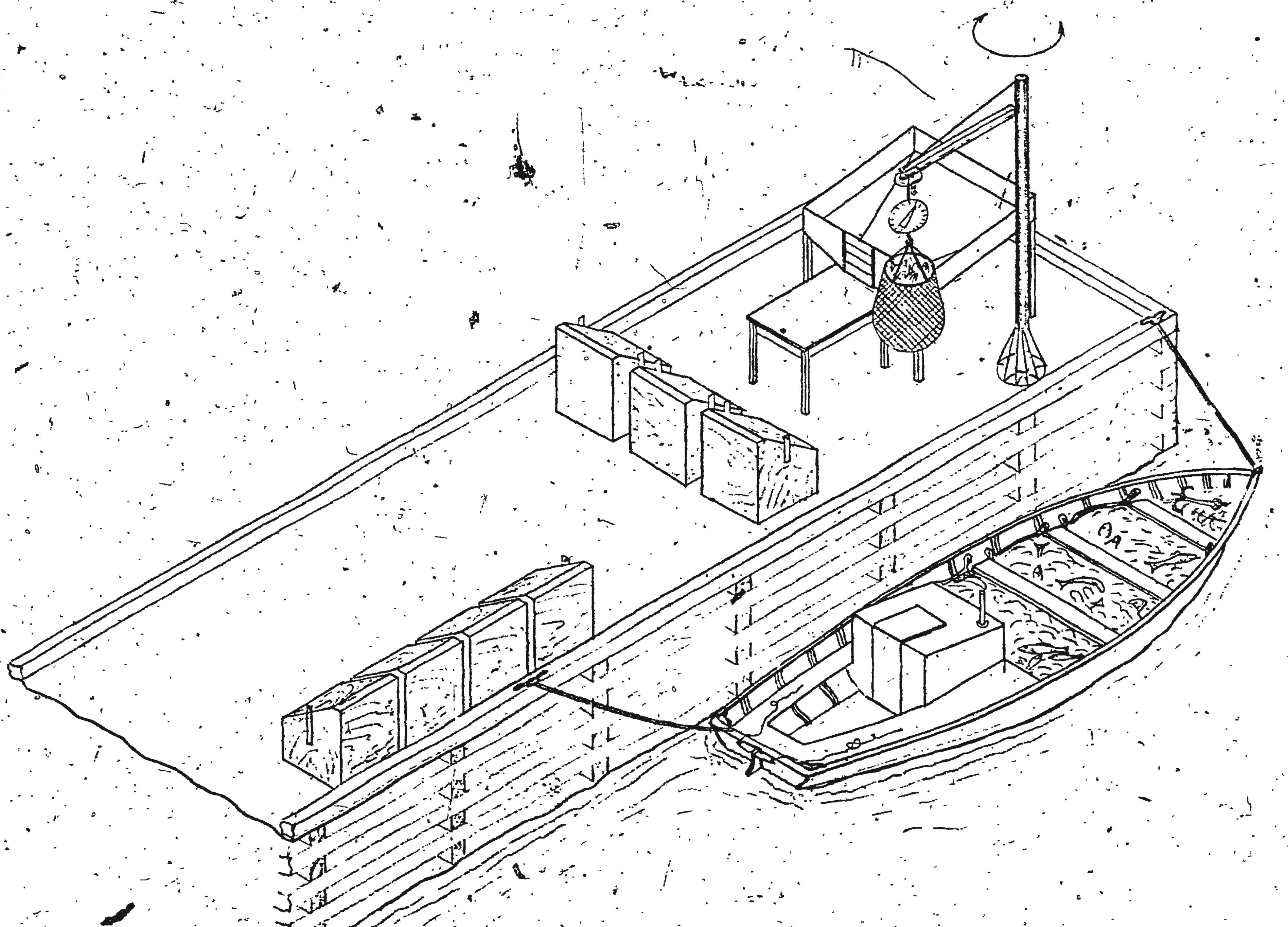
MARK TRACK SECTIONS AS SHOWN.

AT ENDS OF EACH TRACK SECTION, PLASTIC WEAR STRIPS ARE TO BE ROUNDED OFF.

TRACKS TO BE ALUMINUM ∠ 2"×2"×1/4", SUPPLIED WITH SUFFICIENT QUANTITY OF #16 × 2" FLAT HEAD WOOD SCREWS.

DEPT. of the ENVIRONMENT FISHERIES INSPECTION BRANCH				
CONTAINER TRACK SYSTEM LONGLINER – "REID BROTHERS"				
DATE DEC. 12/74	DWN. J.M.	CHKD.	SCALE: NONE	DWG. #7421-1

APPENDIX H



INTEGRATED FISH HANDLING SYSTEM

D. O. E. Fisheries Service Dwg no. 7408

Typical of present unloading method for open fishing boats. Torbay (Tapper's Cove)

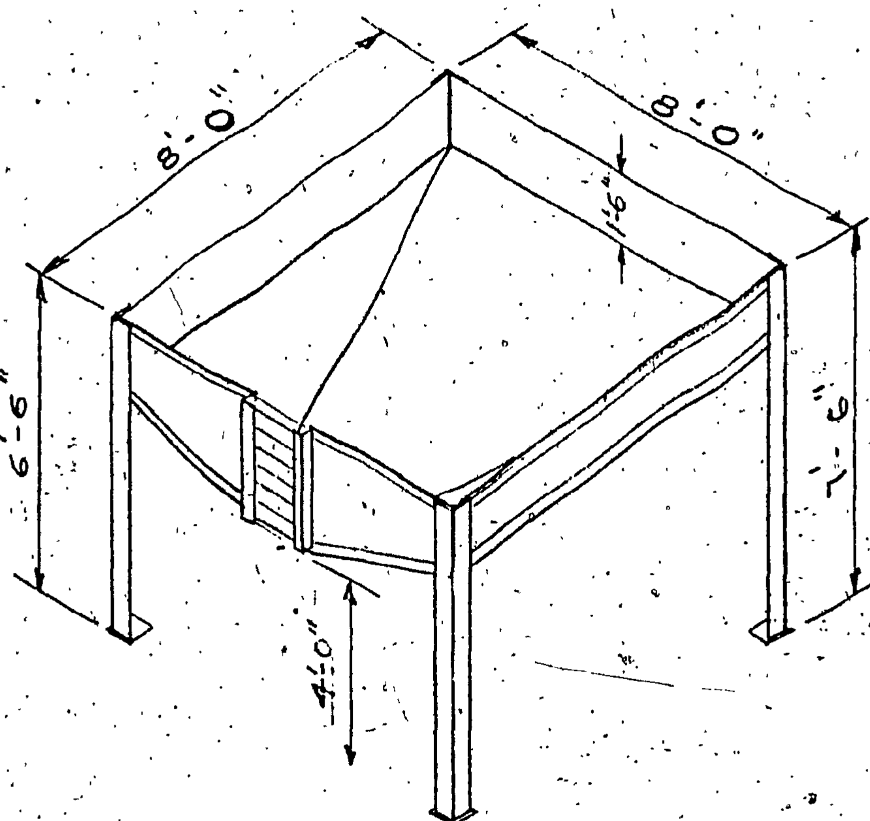
New boom and hoist dwarfs existing boom at Gooseberry Cove

Herring held in net bag containers in open boat

Hoisting (and weighing) bag of herring at Gooseberry Cove. Tilt on lifting ring is due to net being too long and taken up unevenly around ring. Nets have been modified.

Herring discharging from net and from elevated hopper

APPENDIX I



ISOMETRIC SKETCH OF
ELEVATED FISH HOLDING BIN

APPENDIX J

Fresh fish transported in special containers

In "Fishing News International" (December 1972), M. R. Hewitt and I. McDonald of Tor Research Station, Aberdeen, briefly described the development of a new method for the sto age and transport of fish in chilled seawater. The results, they reported, were very satisfacto and the quality of herrings stored in the container was found to be "markedly superior" to th obtained by present icing and handling practice in the United Kingdom. Further details of tl method, its application and equipment used in a recent experiment are given in this articl

FRESH FISH is now being handled from net to processor by Totesystem—the unit load handling system of Alcoa Container Systems (GB) Ltd., Leamington Spa. The Totesystem of intermediate bulk materials handling is a continuous sequence method used to save materials handling costs and to improve quality over a wide range of food and chemical products in almost every country in the world.

For the past two years, the British White Fish Authority has been carrying out experiments on containerisation of herring using insulated Totesystem containers, primarily on behalf of the Herring Industry Board; although the handling of other fish and shell fish has been studied.

These experiments have been so successful that the Herring Industry Board decided to undertake a larger scale operation by hiring a complete Totesystem installation for the purpose. This will enable the first fully integrated containerisation programme to commence using a new 86 ft trawler built for Skipper David Tait of Peterhead and specially designed to carry the Totesystem containers.

Each Totesystem container used within the project is a 74 cu. ft. (2.1 cu. metres) capacity unit constructed of high strength corrosion resistant aluminium alloy, fully insulated with a removable jacket consisting of a closed cell foam insulation protected by a strong GRP skin. The top of each container is equipped with a dome type filling lid and a full width sealed discharge door fitted with a special cam lock. They include lifting and stacking features which enable them to be handled by any crane, fork lift or pallet truck.

Basic principles

The basic principles of the system are as follows:

At the port the trawler is loaded by crane with as many containers as possible each containing 450 kg of ice. When the trawler has reached the fishing ground, litres of seawater are metered into each container, thus providing a mixture of chilled seawater ready to receive the fish. Experiments have shown that this mixture maintains the fish in good condition over a long period of time.

When the catch is taken aboard it is directed through the deck scuttles via chutes into each of the containers up to a maximum capacity of 1350 kg of fish. The contents are aerated to ensure uniform temperature distribution. On arrival back at the port the containers are lifted out of the vessel by crane and, after auction, are loaded onto lorries by either crane or fork lift truck and transported to the processing factory.

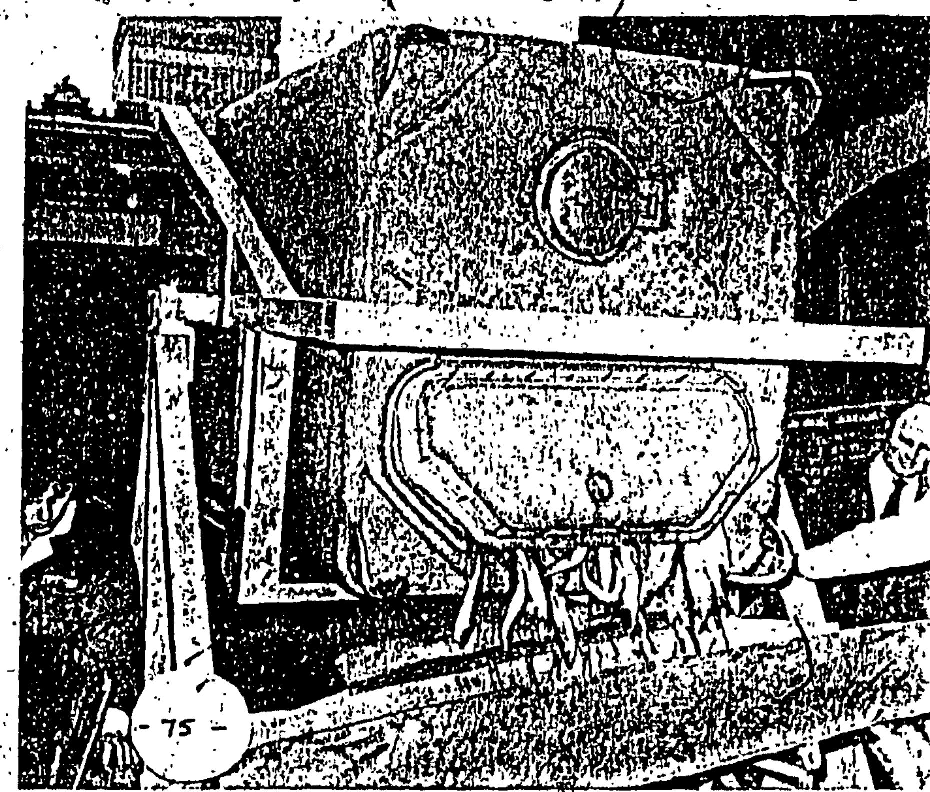
Here the special tilt unit tips each container hydraulically, enabling the fish to be transferred straight into process via the outlet chute with discharge commencing when the cam lock is unlocked by means of a special key.

Meanwhile, clean containers are tak on board the trawler for the next voya It is hoped that up to 12 containers will carried, dependent on space availabili on board.

The system offers all round savings a advantages in the fish handling sequen There are considerable labour and tir savings made in every handling operati and at the same time the resulting pr duct is available in first class conditi to a wider range of consumers.

Vast improvement

There is a vast improvement in trawl utilisation. On board ship the containe allow the rapid stowage of fish at exact the same rate as they are caught, reduci the necessity for the crew to ice and b the catch occasionally. Once stowed in th containers, the fish may be stored f longer periods before landing, whi



The first Totesystem container to carry fresh herring in a mixture of ice and seawate from the north-west of Scotland to London is discharged at Billingsgate market.

increases available fishing time and can on occasions save abandoning a smaller catch due to time considerations.

The system also allows rapid unloading time. The time taken to unload a ship can be reduced by more than a third, as the containers are simply manoeuvred to the hold entrance and then elevated by means of the special Totesystem lifting lugs on to the shore. Thus, the existing system of unloading fish by hand-loading a quarter-cran in a basket, hoisting it ashore and discharging the contents into boxes for re-icing is eliminated. A considerable reduction in the number of personnel needed for unloading the ship is expected.

Improved vehicle utilisation is evident. The containers can be stored at the dockside for long periods eliminating wasted transport time through the standby of lorries at the dockside during unloading. The containers are easily loaded onto a lorry by crane or forklift truck, thus reducing labour costs, the same improvements applying to lorry unloading.

In addition, the system eliminates water and ice spillage en route which has been the subject of recent legislation in the UK, and it is no longer necessary to hose down the vehicle to remove fish slime and melt water. It is possible to arrange the scheduled collection and delivery of containers from the port resulting in optimum truck utilisation.

Catch held

The system allows improved scheduling at the process plant, since the catch can be held in the containers for a longer period than when in boxes without any deterioration. This allows the processing factory to work a normal week, eliminating the necessity for overtime work at the weekend.

There is an improvement in the quality of the fish with the system. Experiments have so far revealed improvements in the quality of stored fish, a large reduction in the percentage of rejects before processing and a significant increase in the proportion of first quality produce after kippering.

These benefits were further confirmed when a recent test run of a single container of herring from the West of Scotland to Billingsgate was discharged. Although the fish had been caught four days earlier, the quality and freshness of the contents was higher than a consignment caught and packed at the same time under existing boxing methods.

The increased storage time provided by the system has a number of interesting results. Apart from eliminating the necessity to re-box and re-ice the fish on delivery to a processing factory, the system offers the possibility of delivering fresh fish overland or even abroad —as confirmed by the Billingsgate experiment outlined above. It will enable the fishermen to obtain the best price for their fish and will make first quality fish available to consumers everywhere.

Experiments are now under way for handling different types of white fish by Totesystem. It is anticipated that the [illegible] use of the system for transporting [illegible]. Several skippers will make the n[illegible] modifications to their vessels and [illegible] advantage of these considerable be[illegible] and a number of processors have al[illegible] ordered in-plant systems in prepar[illegible] for a fully integrated scheme □

FAO examines need for fisheri[es] training in developing countri[es]

MORE ACTION by governments to advance fishery education and training, both as regards artisanal and industrialized fishing was urged at an FAO meeting in Rome in November.

The FAO Expert Consultation on Fishery Education and Training brought together specialists from five continents. The Group reviewed the situation worldwide and concluded that the main responsibility for initiating, developing and financing the training of fishery personnel rested with governments, which should include such training in their national fishery programmes. At the same time, the Group recommended that FAO should help to initiate and co-ordinate action in the field and assist in other ways.

It was agreed that manpower problems in developing and developed countries were different. In the latter, it was noted, there was a shortage of manpower because of the attraction of better-paid jobs ashore, while in developing countries the main problem was a shortage of adequately trained personnel.

Training should be two-fold, aiming at the artisanal fishermen (estimated to be eight million in the world), and at post-artisanal or industrialised fisheries. Efforts should be made, as in India and in the Republic of Korea, to raise subsistence fishing to artisanal level without adverse pressures on the number of those employed.

The need to train fishery instructors and extension workers was emphasized; the establishment of an International Fishery College offering high-level training programmes was discussed. It was suggested that this possibility should be further explored as a long-term measure, in co-operation with the International Labour Organisation. In the meantime FAO should organise *ad hoc* short-term regional courses for the benefit of fishery instructors and extension workers.

The meeting agreed that fishery education and training should be carried out by governmental fishery departments and that fishery graduates should be certified in their [illegible] as is already done with seamen, [illegible] and marine engineers. It also [illegible] more international fellowships [illegible] fishing personnel.

Participants stressed the need for more and better training manuals an[d] wider application of audio-visual [and] other educational aids. FAO, whic[h is] preparing manuals on fishing meth[ods] was also asked to compile bibliograp[hies] and catalogues and to organize works[hops] in the use of audio-visual aids.

The meeting was opened by Dr. J[...] A. Storer, Director of FAO's Fis[hery] Economics and Institutions Divi[sion]. Mr. Frederick E. Popper, Assi[stant] Director-General for Fisheries, em[pha]sized in his address to the meeting [that] much remained to be done in the fi[eld of] fishery education and training and the consultation was expected to pro[vide] guidance to member governments as [well] as to FAO.

WFA plans mov[e] to Edinburgh

THE BRITISH White Fish Authority wi[ll be] moving out of London into new h[ead]quarters in Edinburgh early this [year]. By March, the Authority's Lo[ndon] headquarters in Cursitor Street and offices of its Committee for Scot[land] and Northern Ireland, will be house[d to]gether at 10, Young Street, Edinbur[gh].

A number of common services of [the] White Fish Authority and the He[rring] Industry Board—which is based [in] Glenfinlas Street, Edinburgh—will [be] integrated as part of the overall [or]ganisation.

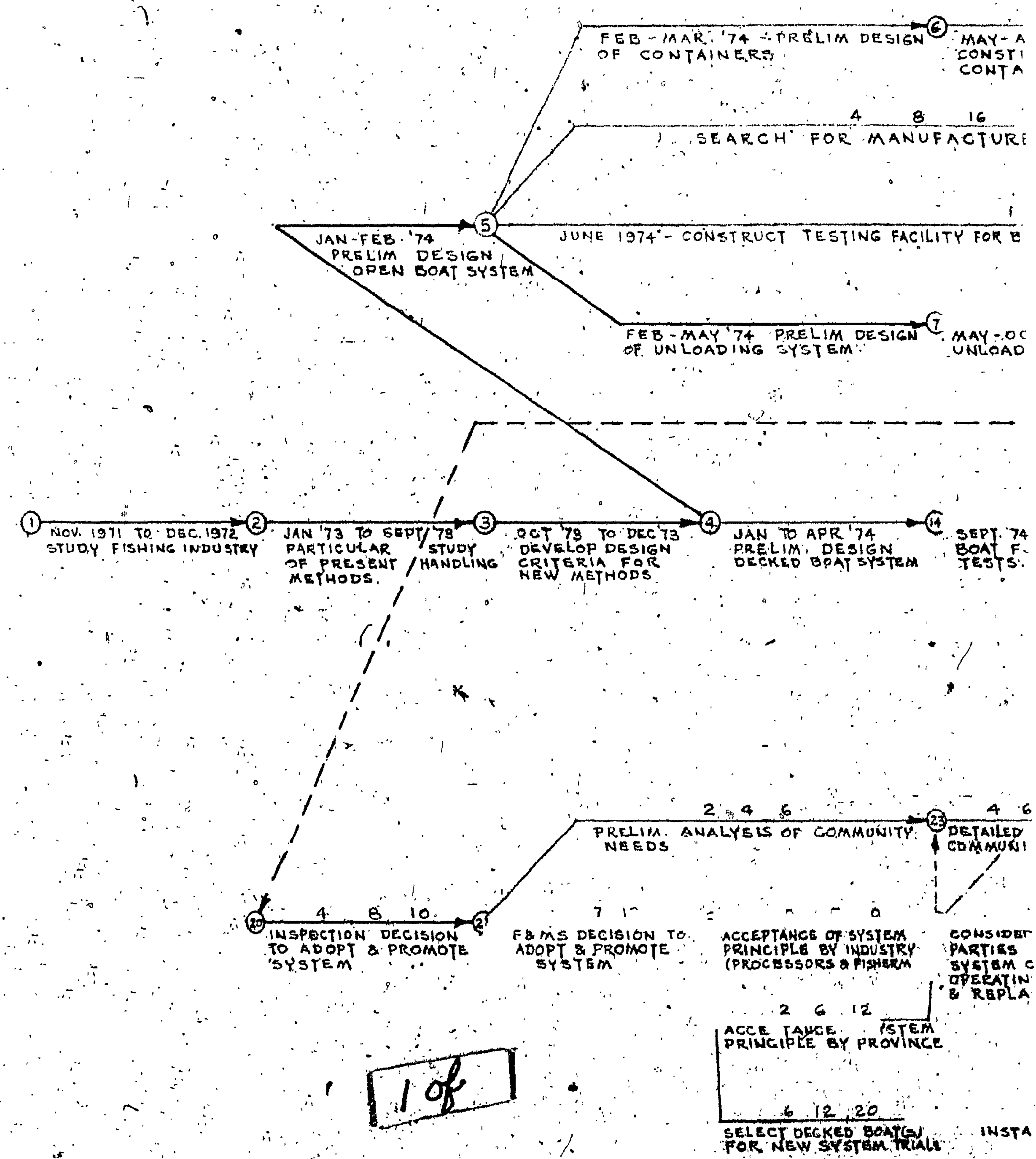
The Authority says it will cont[inue] to maintain close contact with the fis[hing] industry in England and Wales thr[ough] its area offices at the main fishing [ports] and the Industrial Development U[nit in] Hull, which will also house the tech[nical] information service and publica[tions] department.

Offices have been acquired in E[...] Surrey, to accommodate the W[...] market development team and [...] marine surveyor for England and Wa[les].

These changes follow the state[ment] made by the Minister of Agricul[ture,] Fisheries and Food in July, in the c[ourse] of which he asked the White Fish Au[thor]ity to consider urgently with the He[rring] Industry Board what Scottish loc[ation] would best serve both bodies [as] headquarters.

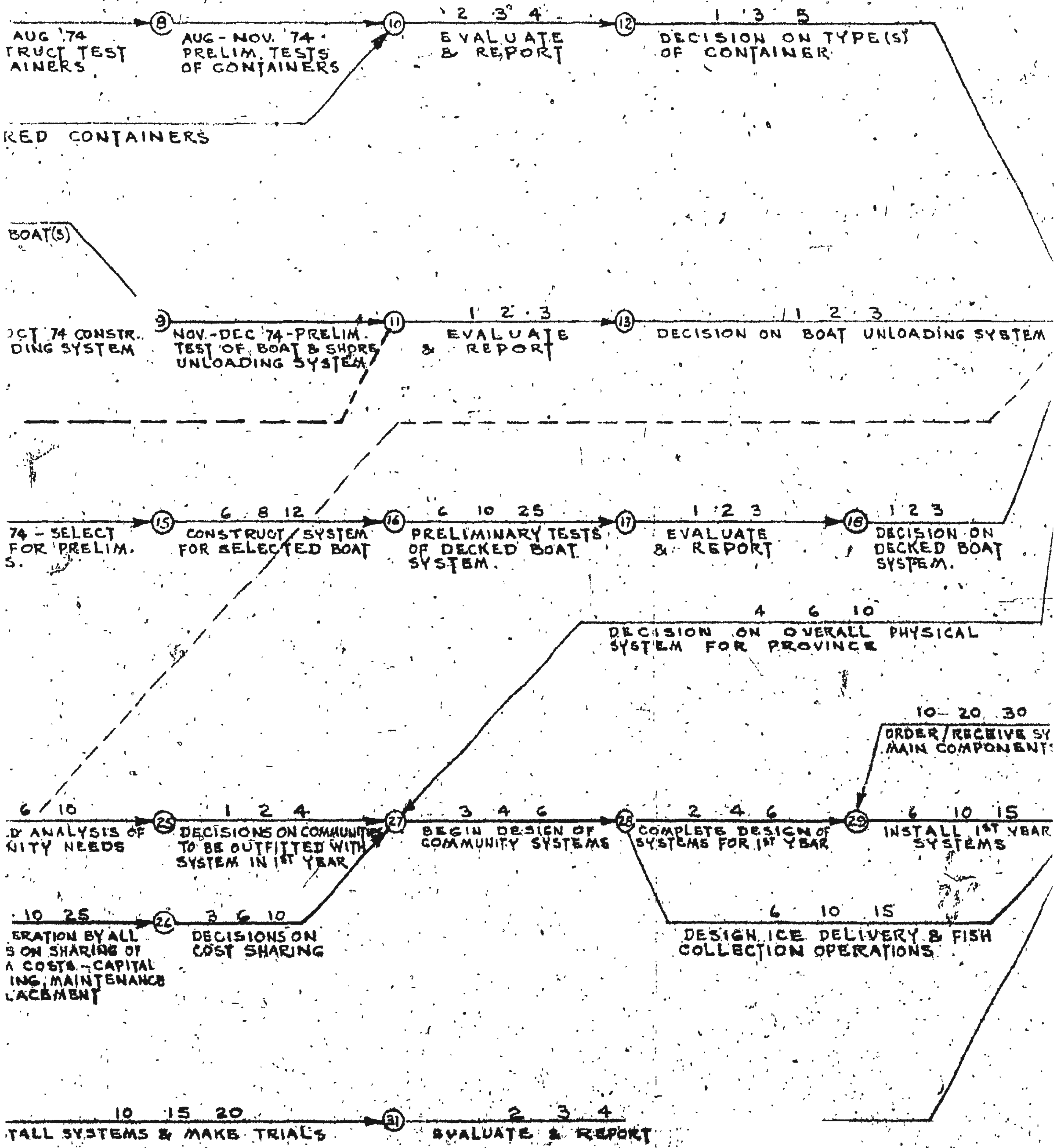
APPENDIX K

IMPLEMENTATION OF FISH
FOR NEW

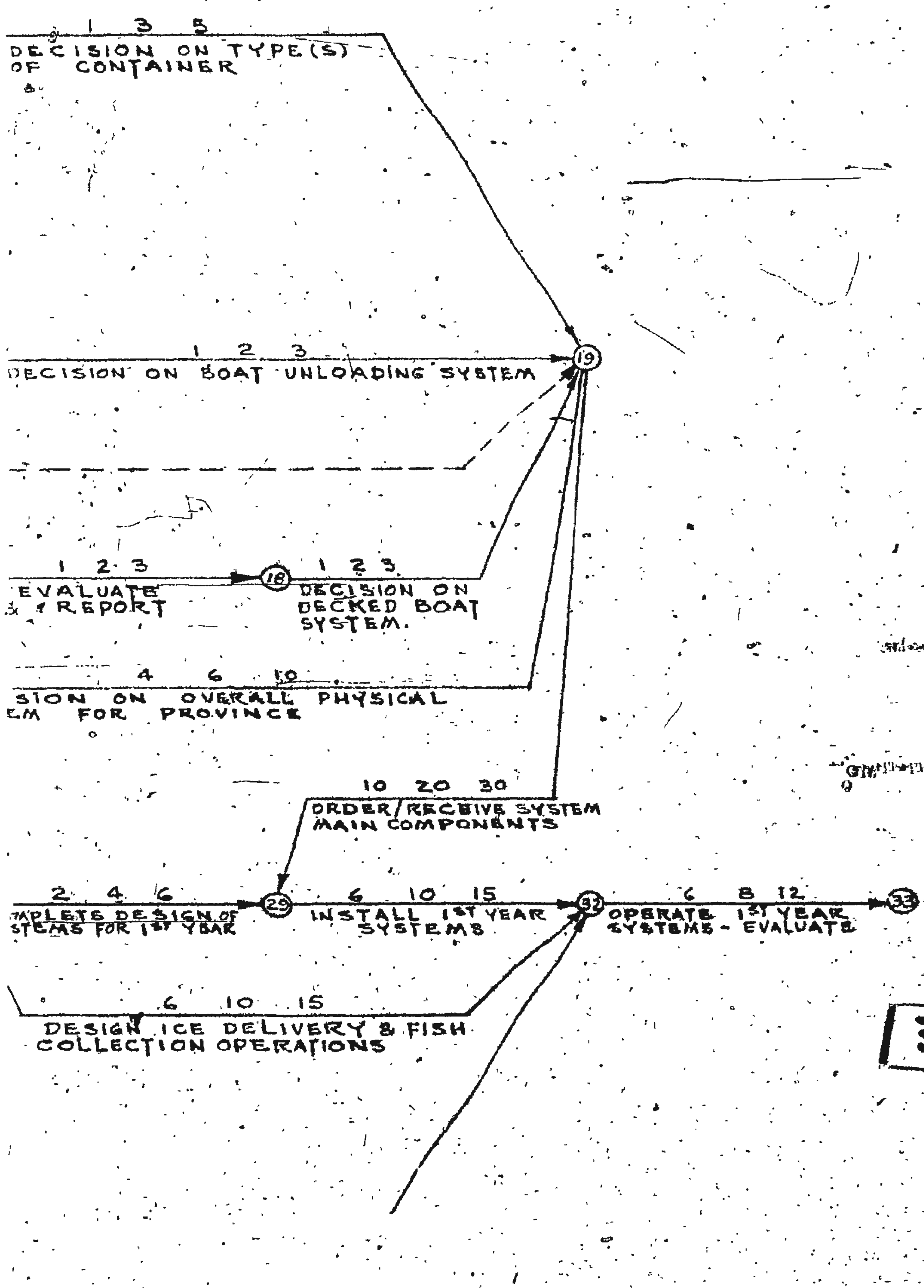


1 of

UNLOADING / TRANSPORTATION SYSTEM
FOUNDLAND & LABRADOR



SYSTEM.



3 of 3

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APPENDIX L

TABLE III RAW DATA
EXPERIMENTS 1 TO 24

LOCATION: WITLESS BAY, NFLD QUICK FREEZE LTD.
LAYOUT: INDIVIDUAL INCENTIVE FILLETING TABLE (FIG. 6 P.)
BAADER 47 SKINNER
SECTION OF GROUP TRIMMING TABLE
INPUT: MIXTURE OF TRAP & GILNET COD, LESS THAN 10 HRS OLD IN ICE. AV. GUT CONTENT, 15.2 % OF GUT-IN WEIGHT.

BOX NO.	AGE IN ICE IN HRS.	ASSESSED INPUT QUALITY [1]	WEIGHT, LBS.		NO. OF FISH IN BOX	ACTUAL FILLETING TIME IN MINS	AVE. PERF. RATING [2]	OUTPUT OF FILLETS – LBS		
			GUT-IN	GUT-OUT				SKIN ON	SKIN OFF	TRIMMED
1				67	20	3.9	105.0	32.0		
2				70	25	6.5	101.2	33.25		
3	10	#1		72	24	5.9	103.0	35.0		
4			70		22	4.4	101.7	24.87		
5			71		23	4.18	102.5	26.25		
6			70		19	3.95	102.5	24.5		
7				69	21	5.63	102.5	33.81	32.0	27.3
8				69	22	5.7	103.3	34.0	31.62	27.1
9		#1		70	21	5.5	104.0	34.87	32.0	27.0
10				68	21	4.9	105.0	33.62	32.19	27.0
11	54			72	21	5.16	105.8	36.25	34.1	29.0
12			74		21	4.27	109.5	28.94	27.1	22.25
13			77		21	4.38	109.2	31.0	28.87	24.87
14		HIGH #2	72		22	4.5	110.0	28.5	26.4	21.7
15			78		21	4.58	109.0	30.5	28.4	23.4
16			72		21	4.51	110.0	28.87	27.1	22.0
17				69	20	4.63	103.6	34.25	33.0	28.1
18				70	22	5.05	103.6	33.87	32.0	27.5
19				68	21	4.9	103.3	33.62	32.75	27.0
20	78	#2 TO #3		70	21	5.1	103.6	33.90	32.5	27.5
21			71.5		20	4.2	106.7	26.75	25.0	20.0
22			73		18	4.1	107.0	27.5	25.75	20.5
23			76		18	3.9	108.3	28.75	27.0	21.0
24			74		16	3.4	107.5	27.75	26.5	20.5

1. QUALITY ASSESSED BY EXPERIENCED FISHERY OFFICER
2. AVERAGE OF SEVERAL RATING READINGS BY ONE RATER OVER THE FILLETING PERIOD.

TABLE IV RAW DATA
EXPERIMENTS 25 TO 54

LOCATION: FISHERIES COLLEGE SOUTHSIDE PLANT

LAYOUT: GROUP TABLE (ONE FILLETER, FIG. p)
BAADER 47 SKINNER
SMALL UTILITY TABLE FOR TRIMMING

INPUT: MIXTURE OF TRAWL & GILLNET COD, APPROX. 21 HRS OLD IN ICE. AVE. GUT CONTENT 12% OF GUT-IN WT.

BOX No.	AGE IN ICE HOURS	ASSESSED INPUT QUALITY [1]	WEIGHT, LBS		No. OF FISH IN BOX	ACTUAL FILLETING TIME MINS	AVE. PERF. RATING [2]	OUTPUT OF FILLETS-LBS		
			GUT-IN	GUT-OUT				SKIN-ON	SKIN-OFF	TRIMMED
25			60		21	9.32	100.1	26.5	23.5	20.75
26			63		21	9.93	100.0	30.0	26.5	24.0
27			60		22	8.88	103.1	26.5	23.5	21.5
28			60		21	8.97	103.0	27.5	24.0	21.5
29	21		61		20	8.58	104.5	28.0	23.75	22.5
30				60	21	9.60	103.0	33.0	28.5	25.75
31				57.5	21	9.55	104.4	31.0	28.0	24.5
32				57	21	9.70	104.0	31.0	27.5	24.5
33				56	21	9.97	104.4	31.0	27.5	24.25
34				58	21	9.67	105.0	32.0	28.0	24.5
35			62		21	9.60	101.4	29.5	25.5	21.5
36			65.5		21	9.90	101.6	30.5	27.0	21.25
37			65.5		21	10.60	101.2	30.75	26.5	22.0
38			64.5		21	11.67	100.6	30.75	27.75	21.0
39	45		60		21	10.10	100.7	28.25	24.0	20.5
40				60	21	9.88	104.3	30.75	27.5	23.25
41				63	21	10.00	105.0	33.0	28.75	26.5
42				65	21	10.20	107.1	34.5	30.75	27.25
43				66.75	21	9.88	106.6	35.75	32.0	28.75
44				58.5	21	9.52	106.2	30.5	27.0	24.0
45			57.25		21	7.77	105.0	26.0	22.5	19.75
46			65		21	8.05	107.0	28.75	25.75	20.5
47			55.5		21	8.25	107.5	24.5	22.0	18.0 [3]
48			64.25		21	8.12	109.2	29.5	26.5	20.5
49	95		57.0		21	7.52	108.75	26.25	23.5	18.25
50				55.5	21	9.17	108.75	30.25	26.0	21.0
51				61.0	21	9.05	109.2	32.5	29.0	23.25
52				54.0	21	8.75	111.1	29.0	25.0	22.0 [4]
53				62.5	21	8.25	114.0	33.5	29.5	25.0
54				64.0	21	9.0	113.1	33.5	29.5	24.25

1. QUALITY ASSESSED BY EPERIENCED FISHERY OFFICER.
2. AVE. OF SEVERAL READINGS BY ONE RATER OVER THE FILLITING PERIOD.
3. 21.4% OF REJECT QUALITY.
4. 9.5% OF REJECT QUALITY.

TABLE V RAW DATA
EXPERIMENTS 55 TO 62

LOCATION: FISHERIES COLLEGE SOUTHSIDE PLANT
LAYOUT: GROUP TABLE (ONE FILLITER, FIG. p)
BAADER 47 SKINNER
SMALL UTILITY TABLE FOR TRIMMING
INPUT: GILLNET FISH OF VARIOUS TIMES IN THE NET
GENERALLY OF POOR QUALITY, 15 HRS. IN ICE WHEN EXPERIMENTS STARTED. AVE. GUT CONTENT 13.33% OF GUT-IN WEIGHT.

BOX NO.	AGE IN ICE HOURS	ASSESSED INPUT QUALITY [1]	WEIGHT, LBS		NO. OF FISH IN BOX	ACTUAL FILLITING TIME IN MINS.	AVE. PERF. RATING [2]	OUTPUT OF FILLITS - LBS		
			GUT-IN	GUT-OUT				SKIN-ON	SKIN-OFF	TRIMMED
55			71			6.19	105.4	29.62	27.24	22.15
56	15	#2	74			5.83	108.0	31.0	28.17	22.5
57				60.5			109.7	29.75	27.13	22.69
58				61.5			112.0	29.69	27.44	23.5
59		#2 To #3	70		11	6.15	103.5	29.81	27.25	21.75 [3]
60	110		74		11	5.94	105.6	31.37	28.81	22.50 [3]
61		#2		59.5	11	5.79	108.0	28.31	26.06	19.94
62				58.0	11	5.03	111.0	27.38	25.25	19.56

1. QUALITY ASSESSED BY EXPERIENCED FISHERY OFFICER.
2. AVERAGE OF SEVERAL READINGS OF SEVERAL RATERS OVER THE FILLITING PERIOD.
3 45.5% REJECT QUALITY.

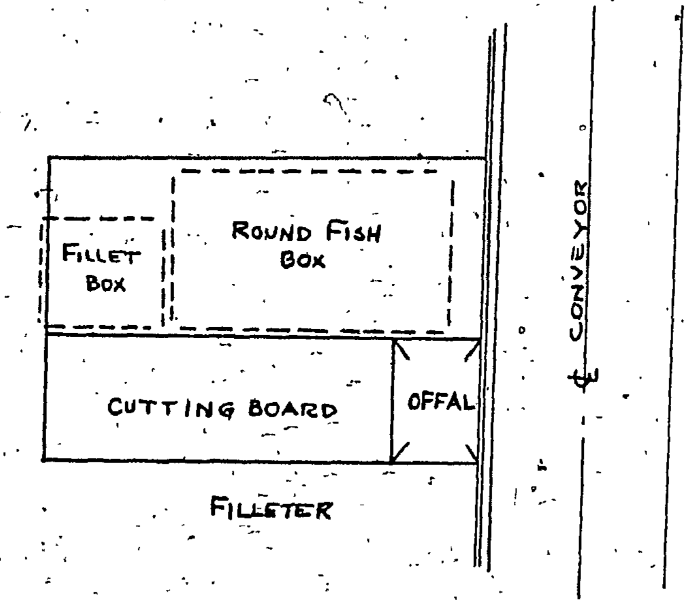

FIG. 7 LAYOUT OF INDIVIDUAL INCENTIVE FILLETING TABLE

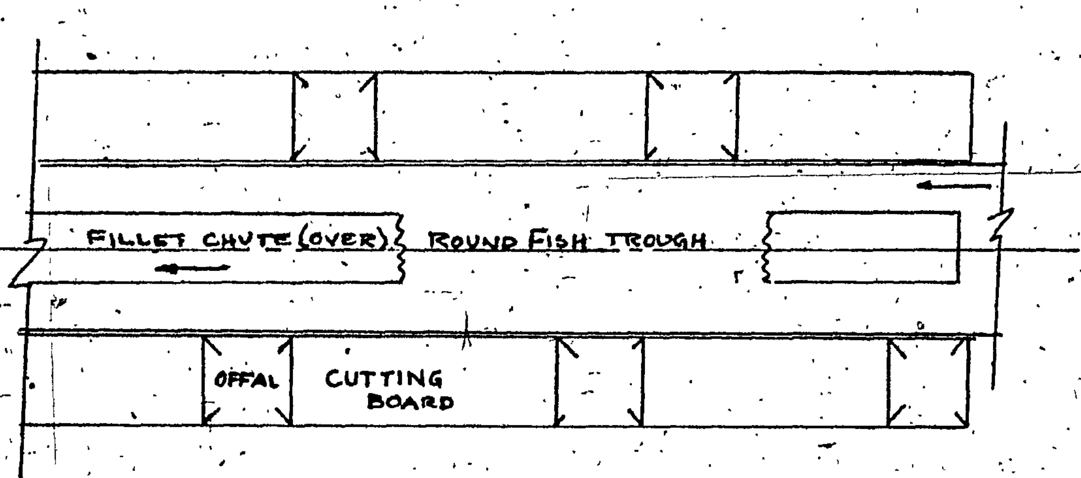

FIG. 8 LAYOUT OF GROUP FILLETING TABLE