11-7-62

REFRIGERATED CARGO CONTAINERS.

K.M. Murray, A.M.R.I.N.A., M.I.Mar.E.

Where large quantities of similar refrigerated cargoes are to be carried the most economical method is, of course, the specially designed vessel. This, however, limits its use for other general cargo purposes. It has been the practice in the past when requiring to transport smaller quantities of refrigerated cargoes, to fit out a general cargo vessel with sometimes one or more compartments. This means that for the lifetime of the vessel she is fitted with a compartment which is not always in use for the purpose intended and also its use for the carriage of other cargoes is limited. Over a period of time chambers of this type incur considerable costs for maintenance and survey inspections.

With a greater use by the public of "quick deep frozen" and other refrigerated foods, problems have arisen which sometimes necessitate their carriage at a variety of temperatures. This calls for a number of similar compartments and by far the most economical way to handle this type of cargo is by the refrigerated cargo container, particularly when their carriage is seasonal.

Refrigerated cargo containers can be designed to operate at any of the temperatures required in practice which are usually in the range between -10°F to +40°F, the exact temperature of which can be thermostatically controlled. Their capacities usually range between 150 and 600 cubic feet but even larger containers could be designed provided the lifting facilities are available for loading and discharge. The methods used for refrigeration could be air or coils working on the direct expansion principle but whatever method is used the vessel would have to be fitted with the necessary connections. If air is used, coupled with the air cooling of the compressor, and the units were stowed in the holds then an adequate supply of circulating air would be required to keep the hold at a reasonable temperature. If, however, the refrigeration of the container should be air and the compressor cooled by water - prferably fresh - it would then be necessary to connect the ship's water piping to the compressor. The same would apply if the cooling of the container were done by the direct expansion principle with the compressor either to be cooled by air or water. If the containers are carried on deck then air cooling of the compressor is very convenient but if in the holds then I prefer the fresh water cooling method used with a heat exchanger.

Where several containers are carried one heat exchanger could be used and then the fresh water cooling of the compressors could be easily arranged by means of portable connections to a ring main. Electric power connections would also have to be fitted for operating the motor driving the compressor. However, there is another method which could be used if the containers were placed on deck and that is by driving the compressor with a small petrol or diesel engine. This method, however, could be subject to constant attention, and in my opinion is not as reliable as the one using an electric motor operating on ship's current. The electric supply should, by preference, be 415 volts A.C. This, I realise, is not the same as usually fitted in most merchant vessels but the present trend in shipping is to turn to A.C. current and therefore my recommendation is in keeping with modern trends.

The advantages of A.C. current are considerable, (1) ready availability of electric motors; (2) less weight of motor for same horsepower; (3) because the motors are the same as used in shore establishments and are mass produced, there is less cost (motors of this type are readily available in Australia whereas D.C. motor would have to be specially made or imported). Due to

the fact that the proposal to use 415 volts A.C. current is the same as used ashore it opens up the further possibility of using the containers to augment the capacity of cold stores. This applies particularly to some ports where facilities are usually limited and refrigerated cargoes are only seasonal and I would assume that there would be distinct advantages in some island ports.

I touched earlier in the paper on the question of carrying cargoes at varying temperatures and the necessity for keeping them in separate compartments. In addition to this, it is not always possible to carry cargoes even if they are stowed at the same temperature as some become contaminated very quickly - this applies particularly to dairy produce.

Refrigerated containers could be made from a variety of materials. The most common in use are mild steel and aluminium. The former is, of course, much cheaper in initial outlay but would, I feel, be subject to a higher maintenance cost and of the metal containers I favour aluminium and by using special alloys which are not affected by a salt water atmosphere, maintenance costs would be kept to a minimum. The weight of the aluminium container would be slightly less and this would give an advantage over mild steel due to the increase in deadweight capacity.

I feel that in Australia we are only in the infancy of carriage of cargoes by containers and that in the future we will see a greater use of materials for their manufacture such as fibreglass which has all the advantages of lightness with strength together with ease of repair when damaged. (The repair of damaged insulated metal containers could at times present difficulties.) The cost factor with fibreglass material is probably against its use at present but I feel that the idea is well worth while investigating as unskilled labour could be used for the manufacture of fibreglass containers and once the moulds are made then a considerable saving in labour costs over the metal container could be obtained.

There are numerous types of insulating materials available such as cork, slag wool, fibreglass, silicate, plastic foams, etc. all of which have their various possibilities. The type which I prefer is one which has been placed on the Australian market only recently and is of the Polyurethane foam plastics. This material can be applied by either spray or foaming in place.

I will not, however, attempt in this paper to cover the practical and varied methods of constructing the types of refrigerated containers which could, in itself, develop into a separate paper but to return to the means of insulating a container I would like to mention several advantages of Polyurethane foam plastic over the other forms of insulation mentioned. (1) It is very light, weight being 2.5 lbs. per cubic foot (2) thermal conductivity (K Factor) between 0.16 and 0.23 (3) Mechanical strength of 3 tons per square foot and although this is only small it does add slightly to the overall strength of a container which means that the strength of the container body itself could be reduced by the equivalent amount thus saving weight and increasing the deadweight capacity (4) water absorption is negligible as it is constructed from very many minute air-tight cells (5) chemical resistance is very good and is not affected by most acids, etc. (6) fire retardant - although it is not fire proof it does not support combustion which is very desirable feature on board ship (7) adheres readily to most surfaces but if the surfaces are greasy such as aluminium, it is then necessary to clean the surfaces of the aluminium with a degreasing agent.

An illustration of a typical refrigerated container produced in the United Kingdom is attached hereto and by reference to the illustration the louvred compartment housing the refrigerating machinery can be readily seen.

In conclusion I would like to say that where the types of refrigerated cargoes carried are seasonal and dis-similar, then the most economical way for their transport is by means of the refrigerated container and I would also like to prophesy that the most suitable type of container for the job would be one made from fibreglass and insulated with Polyurethane foam plastics and refrigerated by the direct expansion principle with the compressor unit cooled by fresh water and driven by a 415 A.C. motor.

11-4-62

THE ROYAL INSTITUTION OF NAVAL ARCHITECTS
AUSTRALIAN BRANCH.

DISCUSSION ON PAPER ENTITLED "REFRIGERATED CARGO CONTAINERS."

Mr. Eken: "Refrigerated Containers" Chapter of P.15-20 of Further Developments of a Container System for the West Coast Hawaiian Trade" of the S.N.A.M.E. Spring Meeting, San Francisco Calif. April 10-11 1961 by Leslie A Harlander was read by Mr. Eken followed by paragraph on "Facilities for Refrigerated Containers" of P. 8-8.

That is as far as I think it refers to refrigerated containers and obviously what Mr. Murray has in mind is something along the same lines, I would say, according to his paper.

Mr. Follan: Thank you Mr. Eken.

Well Gentlemen, you can see from the notes Mr. Eken has just read out what Mr. Murray is aiming at. The problem now is, you might say, what have refrigerated cargo containers got to do with Naval Architecture and ships. Well from these notes it is quite evident that it has a lot to do with Naval Architecture. There is the power supplies, the space provided for the prime movers, the generator sets and all the auxiliaries that go with it, water systems and so on. It is quite a complex question. Actually the point now is, do we think there is scope for refrigerated cargo containers on the Australian coast. There is no doubt it must come. We have evidence of the roll-on ships coming forward. There are two in Tasmania at present and another one building and as these vessels are developed I have no doubt in my own mind that the necessity for refrigerated containers will grow, not only in the southern part of Australia, but also in the northern part, particularly up north where most of our meat comes from. I will not take up any more of your time on that, but it is quite evident that Mr. Murray has hit on a subject that will develop as time goes on. I will leave the discussion open to you gentlemen. The meeting is now open for discussion.

Mr. Eken: I would like to add one more point to this reading. I have found also another short note where it says that in the future development of refrigerated containers, attention should be given to insulated moulded plastic containers, which when "super cooled" (See liquid nitrogen suggestion) can carry perishable products for weeks without further refrigeration. As a new line, do away with all this auxiliary refrigeration and do it ashore. I think that is the most logical approach. Why should a ship have to cool down all this enormous amount of cargo. Let them deliver it cool and we will keep it cool on the ship. It saves a lot of power on the ship, and you dont admit cargo unless it is delivered at a certain degree of temperature. That is how I feel about it. After all the meat works freeze their meat, they can deliver it frozen. Well let us keep it frozen, that is all we should have to do on the ship. Why should the ship owner be landed with the power that is necessary to bring the temperature down. I do not mind at all of course having a margin on it to keep it right under all conditions; but don't let us do the freezing for somebody else.

Mr. Follan: That is a point Mr. Eken. I think you have something there. If the contents of the container are frozen to such a degree that it could be kept at that temperature

for a short voyage, as one could envisage on the Australian coast, then there might not be the necessity for this additional machinery that one would expect to be fitted to a ship of this type. That again would cut down the initial cost of building such a craft.

MR. MIDDLETON: I think the paper does not mention dunnage in between the containers. I think there would have to be air bags. It also looks as though the loading of these containers is cutting out a lot of space, but there must be a profit somewhere. Perhaps it is easier for the ship owner to carry these space using containers rather than have the individual handling of the cargo from ship to shore. I have seen this, fruit and meat especially, each carcass has to be individually handled from a refrigerated ship into a sling, taken ashore and handled again into refrigerated trucks to be taken away. So they must see a profit in it but I think for short runs in Australia, I cannot see where there would be any call for great cargo loadings for short runs between ports in Australia. I think the insurance rates would be pretty high if deep frozen food was put into a ship with no guarantee that it would arrive in good condition.

MR. EKEN: If I may answer part of that question. In this paper, it is published that those ships are equipped with 4 x 4 vertical angles in which the containers are more or less slid down, so that they are stacked in line and also you may recall, it has cast corners. These cast corners have a sort of pin arrangement, where one container fits into another like the female and male arrangement, so that there is no shifting that way, and that is how they are stacked. This will give you an idea that t ere is very little space lost that way. Of course there is space lost with the shape of the ship to fit all these square faces. I have done a few of these preliminary designs and I have never managed to get higher than about 70%.

MR. MIDDLETON You would not get it at the front end anyway.

MR. EKEN: I frankly admit there is a lot of loss in the front end. There is a part solution of course. If you obtain a standard where you have multiples of a basic size, say 8 x 8 the vertical and horizontal size, then you can go in multiples of 8. Say 16', which is at the moment what they are doing here, 24' and so on up to 40' the Americans go, and in that way you can fit smaller containers in the corners and still get a quite good coefficient. But I cannot see it going at any time much over 80 or 85%. I would be optimistic if I promised 85% to anybody.

MR. J. PALMER: I think it would be a shame to let this evening go without mentioning Liquid Nitrogen. I know this is almost verging on selling, and I have to be careful what I say, but to me Liquid Nitrogen has a real place to play in this type of package unit. It is very much on the scene road transport wise in the States and for a long time I have been puzzling the idea of how you could adapt it to a ship. The thought of filling an insulated hold up with Nitrogen and paying for it horrifies me, but here I think is the answer - this package container, which I certainly was not aware of until this paper came, would provide the very answer to this. You see this nitrogen

has three potential advantages as I see it. The first, simplicity, second possible economics and three, the fact that it is an inert gas. Perhaps if I can dwell on these things it may be of interest to you. The nitrogen itself is one of these oriogenic liquids that come from industrial gas manufacture and with the modern vacuum insulated container it is an easy thing to handle. You can handle it for weeks on end without losing anything. I would think that the basic unit that would be employed is something about 18" in diameter 4'8" to 5' high and weighs around 500 lbs. Now in that there is an equivalent of 10 ordinary industrial cylinders of gas so there is quite a package deal here for you. It is not a heavy deal, but that when you apply to it the simplicity you have got the cold inside there, all you have to do is get it out and get it into the container. There is no electricity required. There are no circulating waters, fresh or cold and that then in turn requires nothing other than the simple control to allow the cold nitrogen to be sprayed into the top of the container and so provide you with this source of refrigeration. The second thing is, I cannot really comment here on the cost aspect, the economics of it. We have already heard Mr. Eken mention the power side. There is none of that of course, that is already done for you back in your industrial gas supply works. The question though is that like other industrial gas you buy, the price you pay for it is dependent upon how much you use. And how much you use in this is in the question of how many packages you are handling; all I can say is I have no knowledge of the economics of it, which are perhaps to be considered on its own merits, but there is no question it is coming up very largely in road transport scene in the States.

MR. EKEN: It is logical to go into shipping.

MR. PALMER: I think it must follow. That is why I have taken the chance of mentioning it to you. The third aspect I think must appeal to you is the fact that it is an inert gas and this does overcome some of your problems. It may not be known to all of you that there was a most successful shipment of four sides of chilled beef four years ago from Queensland to the United Kingdom. I think that we all know that it is quite impossible to compete with the Argentine chilled beef trade. I think we all agree that the time factor is against us and we can only enter into the field in the frozen meat cargo. But four years ago there were these four sides of beef sent from Queensland in a package container like those envisaged, but it was not a self contained package container. The beef was just put in this container, it was trundled aboard ship as quickly as possible and put in a refrigerated compartment at about 30°F. just on the chill. The container itself was purged first of all with nitrogen and then any leakage in the voyage and it was a very nominal figure - about 1 cu. ft. per day. The leak was made up from compressed gas. This is not to be confused I suggest between the ultimate, which is the use of liquid nitrogen as a refrigerant as well as an atmosphere. This was the second part of the thought where it was definite atmosphere. It provided an inert atmosphere which beat a lot of the bacterial action which spoils the meat sides. There is no doubt that when it arrived at Smithfield about 60 days after leaving

Australia it was opened up to a large assembly and declared to be of prime condition, far better possibly than what the Argentine were offering. It strikes me this nitrogen has a potential - third wise this inert atmosphere, secondly the potential saving that can be envisaged from the cost angle, and firstly from the simplicity of it all.

MR. MIDDLETON: How exactly does the refrigerated action take place?

MR. PALMER: The pattern as seen so far is that you dispense liquid nitrogen through a pipe in the top of the container and just let it spray out. You may, if the cargo is likely to be damaged, have to put down a trough into which it spills so that it can vaporise; but you actually handle liquid nitrogen from a container and put it into your proper food package container.

MR. EKEN: The limit would be the saturation then of the volume of this container? The cooling is caused by the evaporation of the nitrogen.

MR. PALMER: There is a great deal of sensible heat as well because this nitrogen is way down at -300°F. I think it would be half and half. What I have seen so far they just simply spill liquid nitrogen through the control valve. When the thermostat says the temperature is rising, out drips a little liquid nitrogen which in turn vaporises. You would say that you are going to build up pressure in the container. Well, yes, but there would be a simple relief device on it to allow that to spill out as you wanted it.

MR. MIDDLETON: One side effect may be quite a hazard to personnel going into the hold filled with nitrogen.

MR. PALMER: That would need to be considered of course.

MR. EKEN: The hold could be ventilated.

MR. FOLLAN: Any further discussion on that, or perhaps on the installation of the containers? I notice Mr. Haddock sitting over there, perhaps he could have some thoughts on this mention of fibre glass lining of the containers by Mr. Murray, or the polyurethane.

MR. HADDOCK: Definitely we feel a great interest in this paper, because we thought here is a place where the material could be used to great advantage. Often people think fibreglass is a cure all for everything, this is not so. In this particular job in hand I would say it would be an ideal material, especially with the polyurethane which could be used as an insulation. It could be used with great advantage and I think the moulding cost would make it very economical, if they were all standardised, lightness, strength, and good insulation properties. I think there is a lot of future for that.

MR. JAMES: The size of the containers have got me intrigued. I think in the American practice it is quite a lot larger than Australian.

MR. EKEN: I can confirm that the Australian standard is 8' wide, 8'6" high and patent design is 16'8" long.

MR. JAMES: Would that be the refrigerated containers or general?

MR. EKEN: That is the general container they have adopted at the moment. Refrigerated containers would be the same exact multiple.

MR. JAMES: I know the sea cones they use are 4' square by 6' high.

MR. EKEN: That is the normal small one that has been in use for quite a long time. Already by different companies, by the Union Steamship Co., Howard Smith and by McIlwraith McEacharn. Only as I suggested the corners could be filled with the small ones.

MR. HADDOCK: For the design feature the advantage in using the fibre glass and polyurethane foam as you can utilise the strength of both by using the polyurethane as a sandwich in shear and the outside materials to take the tension.

MR. EKEN: I am not sure how much it can be made to carry but the Americans go to stacks as high as 6 and 7 containers. The containers here in Australia go to 15 tons in weight, i.e. loaded containers, so I can imagine a stack of 6 of those containers one on top of the other. I do not know what I would design for that. We have only once designed three containers for Howard Smith in aluminium. They were supposed to be able to carry one on top of the other, that was the maximum they asked. The cost was really frightening. They were first aluminium containers made here. They were not as big as the present standard ones.

MR. JAMES: The trouble with polyurethane though, to use it is that the strength increases its K factors becomes worse.

MR. FOLLAN: Any other points gentlemen?

MR. DODDS: It is rather unfortunate that Mr. Murray is not here tonight to give us a history of the carriage of refrigerated cargo on the Australian coast. I do not know whether there is anybody here to tell us how much cargo is carried in this fashion and what is the potential. I should have thought that sticking to the Australian coast that these freight mobiles, I think is their name, where big lorries just drive on to the garage of the "Princess of Tasmania" or any other ship and just plugs into A.C. current and these freight mobiles are entirely self contained. I should have thought with the advent of the "Princess of Tasmania" and the "Bass Trader" and probably two more of the Union Co's., there may not be the necessity for going too far into the field of these separate containers. If we want to carry refrigerated cargo from the Northern Territory there may be the possibili there until such time as we get ample road and rail transport, but the thing is to design a ship for that sort of trade I do not think would be a very economica proposition. I think what he says here "it is only a seasonal cargo" and it is only going to be carried at odd intervals. There agin he may have had in mind the New Zealand trade and there I think he has got good opportunities. You have no opposition from the rail and road for a change and that is where he might be thinking of, but as far as the Australian coast is concerned, personally, unless somebody can enlighten me on this, I cannot see the need for any special ships; unless possibly small quantities,

occasionally Tasmania or any other places away from rail and road transport.

MR. EKEN: In that connection I would like to bring to your attention that of course even the Americans have only, as I have said, roughly 30% of their containers as refrigerated cargo containers and any ship like that is always suitable for ordinary containers. The question is they have a slight loss of space due to those platforms that have to be built in for connecting up those containers but you still have your normal container capacity. But as far as I know, I am only talking from hearsay, certain ships have been designed for container ships in general with provision for certain percentage for refrigerated container cargo. The general attitude is that the container ship is a more economical one than the roll on roll off provided that you have your own means of handling the containers, because you can't provide the shore handling means being installed in time and being available at any port where you come to. That is one of the main problems. The Maritime Services Board is apparently not very forward particularly in Sydney, I am now talking about, with having the means installed so that they have to help themselves, and that means that quite a weight in cranes has to be installed.

MR. MIDDLETON: Well we did a ship once, as a proposal and we had a gantry run along the rails on the upper deck.

MR. EKEN: Well that solution goes for the new design ships.

MR. MIDDLETON: Well the rails were out as far as the bulwark. We had a gantry that ran up and down and picked up 15 ton containers carried them outboard and put them on the deck.

MR. EKEN: By now I imagine everyone is familiar with the Hollyman ship that has been designed. It is a peculiar shape. It has the largest hatch opening. The present larger ship as far as I know will be of similar design. They have a strip hatch along the longitudinal girder between the two hatches which, by the way, does not account for Lloyd's.

MR. MIDDLETON: That is the one I am talking about. He wanted one big long hatch with no pillars in the middle. We had to put web frames instead of frames so that the containers would fit between the webs and he would not lose any space between the...

Mr. Dodds mentioned that probably the best outlet is to the north for refrigerated containers but I would say that the number of ships on the coast that were free for that sort of trade and had a capacity of 15 tons would be very limited at the moment. There would be about two ships available at the moment.

MR. EKEN: At the moment there are no ships interested in the northern trade because of the delay they would only make about three trips per year on the way the handling of the cargo goes. If you can really work with containers, the shore hold up is what affects the ship rotation and if you can work with containers you can expect a considerable increase in the turn around of the ship, and it will be worthwhile to run a ship under those conditions. Very much so, I would say.

With the roll-on roll-off you dont have to depend on shore facilities. I am talking about the waterside. With containers you would have to find waterside.

MR. EKEN: Perhaps you are aware that the roll-on is still handled by waterside labour.

MR. MIDDLETON: Yes, but some trades you have to guarantee them a permanent job.

MR. EKEN: Admittedly, that will come more and more of course. That will be the handling of the containers. It is just a question of getting men to do that, then you will certainly get an improved turn around ofthe ship.

I understand "The Southesk", isn't it, the one that is fitted with the big crane, proved a good propositic as far as freight handling cost goes, and the turn around.

MR. FOLLAN: If the trade was there and the ship was specifically designed for the purpose lifting capacity and handling capacity would automatically be provided. That would not present any problem. The whole thing gets back to if the trade is such that would warrant fitting of ships for container service. That is the thing that we would have to face up to in this country. I have no doubt that as time develops there would be requirements for this sort of thing. It proved so with roll-on roll-off ships. Ten years ago if you suggested building a ship for service between the mainland and Tasmania with roll-on roll-off units people would have said "fantastic", and rather silly, but it has proved to be a fact and has boosted trade between Tasmania and the mainland. I have no doubt in my mind that if the coastal trade had something similar to this proposal here whereby a ship was fitted for cargo container transport once it was developed it would grow, there is no doubt about that. Cargo containers for general cargo is becoming more and more of a demand on the coast. I have no doubt that if it were used for refrigerated cargoes it would also increase.

MR. MIDDLETON: I was wondering if the initial cost of these containers was very very high. The other thing was the maintenance of the units. A number of units, knowing our maintenance problems in the Navy, I can imagine you would have a bit of fun with these. I do not know much about this business.

MR. FOLLAN: There are design problems which no doubt would have to be faced. On the onehand of course we must look at the economics of this thing from the point of view of labour costs in handling the cargo from the ship; with container you do cut down on the labour cost, it is ju a question if one offsets the other or not. Whether you get your cargo in a far better condition than you do with the normal transport systems we have, whether cargo is handled by the wharf labourers or stevedores. As well as double handling with the containers it is more or less from ship to jinker and road transport straight away. All of these things of course would have to be gone into. It is quite a complex question of course. There is no doubt about that.

MR. EKEN: I would like to add in the first place that insurance on a refrigerated cargo is very high, which probably compensates for part of it, and here is something that

I could read out in connection with the maintenance of the containers ....

most abused piece in the container system". Well that relates to the following facilities. That might answer part of the container maintenance problem.

M.R. DODDS: To go a bit further into that Mr. Eken we would have to work in conjunction with Lloyd's on that. You would get a R.M.C. certificate. I think the normal procedure is once every two years, but I think you could go on a continuous survey basis and get it done every year. You could probably do the maintenance in conjunction with the R.M.C. survey. I recently read an American paper boasting about the containers being all right at 45°. I just wonder what happened to the cargo inside them.

MR. EKEN: I cannot answer that, not here. I suppose the insurance paid.

MR. FOLLAN: Any further discussion, gentlemen? Time is getting on.

There is just one thing, Mr. Eken - Did the paper mention there the total number of refrigerated containers on the U.States Coast?

MR. EKEN: All they indicated was that there were 700 in use in the first batch. The latest is the design for 1800 dry plate containers, 270 refrigerated containers each with refrigeration unit and 656 tandem axle chasis and 196 single axle chasis, all that has to be carted around on these ships.

MR. FOLLAN: Any further discussion, gentlemen?

Just one point, Mr. Chairman. The duplication of containers: whereas you go from point A loaded you come to point B to off load so many containers, and unless you have a cargo to take on either refrigerated or otherwise, the containers remain there empty. When you come back over the route again, unless you have enough cargo to fill those containers, you have to carry the containers back empty to the starting point. It would seem to me as though it would be a loss of carrying capacity on your ship.

MR. EKEN: To that I would like to answer, that it would be no more a loss than it would be on a refrigerated ship that has a cargo one way and nothing to take back. You don't load a refrigerated hold with other cargo very much.

Yes, but we are discussing using a general cargo ship and refrigerated containers.

MR. EKEN: Yes, the refrigerated container part - the others are now often made collapsible, and that is how they gain quite a bit of space back for return freight. I don't know of any refrigerated containers being collapsible, I dont think they exist.

MR. MIDDLETON: When I did sea-time with the Port Line, they carry refrigerated cargo from Australia to England and they also bring back general cargo in the hold.

MR. EKEN: They would have to be choosey in the choice of cargo they take.

That is essential. Mr. Hollyman carries general cargo and empty containers to Melbourne and carries back full containers. He told me that he could never get down into deadweight. The one thing he never had to w worry about was draft. He always had to have room to bring back the empty containers, and he was making a profit. Timber and general cargo from Tasmania. We had to have specially strengthened hatches to carry the empty containers as deck cargo.

MR. FOLLAN: Any further discussions gentlemen? There is one point I would draw to your attention, that is the circular that went out in connection with the meetings. The next meeting is for Wednesday 13th June, then the paper by Mr. Boden on Wednesday 8th August and then we have a further paper on Wednesday October 31st. I would draw your attention to reserve those dates, we do hope to get a good crowd along. I would ask you too, try to encourage other members to come along to the meetings, I am sure that the more we get the far better the discussions. It is rather disappointing tonight, but I do thank you for your attendance and I do thank you for your discussions on this particular paper. It is a difficult subject, but it has been most interesting and has many possibilities. We could go on for hours discussing this particular subject.

K.M. Murray - A.I.R.I.N.A.,
M.I.Mar.E.

Replies to discussion on paper entitled -

"REFRIGERATED CARGO CONTAINERS".

Mr. President, Gentlemen -

It was with very great regret that I was unable to read my paper at the last meeting of the Australian Branch of the Institution as, no doubt, I would have been able to clear up a few points which have been raised by the various questions asked by those present.

As you will have gathered from the paper, it was only of short duration and was designed to promote discussion as I feel that this is one of the main aspects of any paper as it is from discussion which takes place that one can learn more of the subject.

I will now endeavour to answer the various questions raised and will deal firstly with Mr. Eken -

MR. EKEN It was not our idea to have the containers fitted with such a unit that it would be possible to cool or freeze the cargoes in their entirety within the container but that they should be placed in the container at the temperature at which they were to be carried and it would be our job to maintain that temperature throughout the voyage of the vessel. We appreciate that if it were necessary to use equipment capable of deep freezing the cargoes within the container then it would not be an economical proposition due to the size of unit necessary. This is the method which is adopted at present in carrying frozen cargoes on board our vessels in the special refrigerated compartments.

MR. MIDDLETON There is no need for dunnage to be fitted between the containers as they would be securely attached to special fittings on the deck or to guide bars, depending upon the type of vessel being used. It should also be pointed out that in any container vessel the effective stowage rate is between 100/120 cubic feet to the ton which, you will see, is considerably more than when carrying cargo by conventional means. The reason for the container system is to cut down the amount of time the vessel remains in a port which is done by speeding up the rate of discharge and loading and it pays the Shipping Company to carry a lot of air space on the vessel in order to achieve this effective turn-round. We carry deep frozen cargoes from Tasmanian to N.S.W. ports amounting to possibly 50 to 60 tons per trip during the season and we have had very satisfactory results throughout. The main thing which we have to watch is that the cargoes when delivered to us are within a reasonable range of temperatures so that they would not have spoiled prior to loading.

It would appear from Mr. Middleton's comments that he imagines that the whole of the vessel would be fitted for refrigerated containers. This is not our proposal at all as, if this were the case, then a proper refrigerated vessel would be much more economical. Our idea for using refrigerated containers is purely to provide a fast service for limited seasonal refrigerated cargoes which, in most cases under present conditions, would amount to 100 or at the maximum, 150 tons per trip.

MR. PALMER I was very interested to read Mr. Palmer's comments regarding the use of liquid nitrogen for refrigeration purposes. I have not been able to obtain much literature on this subject but can appreciate the potential.

However, from the enquiries which I have made it would appear that the cost factor for providing liquid nitrogen at the present time would not be an economical proposition but if some cheap method were to be found for the manufacture of liquid nitrogen, then I can see no reason why this could not be used to supersede mechanical refrigeration equipment. If Mr. Palmer should have any literature on the cost aspect of liquid nitrogen and any other relevant details, I would be most appreciative to receive copies as I could then examine this matter more closely and possibly do business with Mr. Palmer's organisation.

On the question of the escape of nitrogen into the holds of the vessel during refrigeration process, most modern vessels and particularly those which the Union Company are constructing are fitted with adequate hold ventilation and consequently there should be no hazardous effects upon personnel entering the hold.

MR. HADDOCK I appreciate Mr. Haddock's interest in the paper particularly with my suggestion to use fibreglass containers insulated with polyurethane and I would very much like to see some experimentation made in this direction.

MR. JAMES The question of standardisation has been raised by Mr. James and I confirm that our idea of a refrigerated container would be one 16'8" long, 8'0" wide and 8'6" high which conforms with the Australian Standards Association and this container would have a capacity of approximately 10 tons deadweight of refrigerated cargo.

I do not feel that any container smaller than this size would be an economical propostion if it were fitted with a self-contained unit, however, we have at present in operation on one of our vessels trading between Aukland and Melbourne a prototype refrigerated container which is of 5 tons capacity. Two of these containers are mounted on either side of an air-cooled refrigeration unit and these were designed for this capacity as the cargo gear of the vessel was limited to 5 tons but, with the latest forms of cargo lifting equipment and the more extensive use of cranes, then full use of 10 tons capacity containers could be made.

I cannot visualise the necessity for stacking refrigerated containers used in trades on the Australian coast any more than two in height and, in any case, it should not cause a great deal of difficulty to provide sufficient strength at the four corners of the container for this purpose whether they be made from the usual types of materials such as aluminium or steel or, looking to the future, materials such as fibreglass and polyurethane foam plastics.

MR. DODDS There is quite a considerable amount of refrigerated cargo trade between Tasmanian and mainland ports and not all carried by such vessels as the "Princess of Tasmania" and "Bass Trader". When the Union Company's two new vessels come into use they will, of course, be carrying refrigerated containers but, at the present time dispensation is given occasionally to large overseas vessels to carry quantities of sometimes up to 500 or 600 tons of refrigerated cargoes from Tasmanian North West Coast ports to New South Wales ports and also there is a small vessel at present under charter also carrying refrigerated cargoes direct from Tasmanian ports to the mainland. I feel that it would be much better if we could keep this trade for the Australian registered vessels and thereby save overseas payments.

I agree with Mr. Dodds that the use of a special refrigerated vessel or one specially fitted to carry a full cargo of refrigerated containers on the Australian coast would be

uneconomical but my idea was to carry refrigerated containers on conventional general cargo vessels or as part of the container traffic on a composite container/general cargo/ roll on roll off type vessel in quantities of between 100 and 150 tons each trip. By doing this we would then do away with those small poky refrigerated cargo chambers at present fitted on some of the Union Company's vessels which are limited to particular trades and also, in most cases, are difficult to stevedore.

MR. FOLLAN The question was raised in Mr. Follan's discussion on the aspect of the cost and I would advise that I had gone into the question some 2½ years ago and at that time, if we were to have ordered approximately 50 containers of 10 tons capacity, the cost would have been £3,200 each so it will be seen that the total cost is not prohibitive when it is considered that to fit out the whole of a vessel for the carriage of a similar amount of refrigerated cargo would be inthe vicinity of £130,000.

Regarding the maintenance of the units we find that on our present vessels only routine maintenance is required and in all we have very few problems in this direction. In any case, with the type of container it would be possible to have several spare units which could easily be used as replacements and thus enable full use to bemade of the container at all times whilst the refrigeration unit is being overhauled.

I have found that with the present method of carrying refrigerated cargo, each item is practically handled individually from the compartment, placed on either a cargo tray or pallet and then lifted ashore and stowed individually into refrigerated vans. It can be readily seen that a considerable amount of labour is required for this procedure whereas with the refrigerated container it is possible to lift 10 tons of refrigerated cargo in one lift, place it on a flat top truck and take it to the destination with a minimum amount of stevedoring labour required. I have gone into this question very thoroughly and there is no doubt that this method is by far the cheaper form of handling refrigerated cargo.

To the best of my knowledge there are no refrigerated containers owned by any Shipping Company operating on the Australian Coast, the only refrigerated containers used are those fitted to semi-trailer units and which are transported by the "Bass Trader".

With respect to the possibility of using containers in one-way traffic, our particular vessels fortunately are not affected in this manner as we are able to carry traffic in containers in both directions. As an example, we carry bagged sugar in containers from Sydney to Hobart and those same containers are used to bring back confectionary. Regarding refrigerated containers there is nothing to stop them being used for normal general cargo purposes if refrigerated cargoes are not available and we envisage the use of refrigerated containers for the carriage of such items as insulating materials and breakfast foods, etc. on southbound voyages and, of course, used as refrigerated containers northbound.