THE COST OF ARTIFICIAL REFRIGERATION
AS COMPARED WITH THE COST
OF NATURAL ICE.

By Chas. E. Hart, Milwaukee.

If conditions were uniform, we could set down in two opposing columns the necessary figures, and by a little sum in addition and subtraction arrive quickly at our conclusion. But in this comparison of the cost of artificial refrigeration with the

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cost of natural ice, there are various modifications in different plants which complicate our subject.

I take it for granted that the creamery men of our state are progressive. If not, whence springs Wisconsin splendid record as the foremost dairy state of the Union.

One by one hindrances have been eliminated and difficulties overcome, until we can proudly point to not one, but many properly equipped, well managed creameries throughout our state.
Yet we know that he who pauses to dream of what he has done, instead of looking forward to what he may do, will soon glimpse the heels of his companions vanishing in the hazy distance.

Nothing is complete, but only in a transition stage, moving on to better and more improved conditions.

Already we have our ripeners, pasteurizing machines, valveless pumps and other advanced appliances, but in one direction we seem not to have progressed as the possibilities warrant.

How about a damp, mouldy cooling room, compared with the clean, fresh atmosphere of a well appointed, modern refrigerating room, in which to store the products of carefully calculated, scientific work. It is not quite fitting that we should store our tubs of sweet smelling, golden butter in other than the purest storage room obtainable. Or, to cool the cream of which it is made, with ice which has been shown to be filled with bacteria of multidinous variety. Our product can not be quite perfect under these conditions.

It is not hard for any thinking man to calculate the advantages of this modern system of cooling, but before such an innovation he wants to know many details, and perhaps most of all, the cost in dollars and cents. Usually this is the item of greatest import, yet not always. We know that increased efficiency is far reaching, and can not always be reckoned in the expenditure of the moment.

Let us look first at some of the losses sustained by the usual method of cooling with ice cut from lakes, ponds and rivers.

Competent authorities tell us that in the best built ice houses there is a loss of from 20 to 25 per cent of the ice through melting, and this loss must be many times multiplied when there has been a lack of care or of investment in the construction of the building.

An added percentage of loss is due to handling, washing and placing in the cooler or ripener.

Then there is the time of one or two men to dig out and place this ice, time which might be turned into dollars and cents elsewhere.
Another deficit which strikes home unpleasantly, and which has been known to occur more than once, is the cutting of price for a mouldy flavor in butter, due to the musty atmosphere of an iced refrigerator.

There is a tendency to overlook small losses which, though not actual money, mean money in the end. If we could see pennies dropping one by one through a crevice, we would lose no time in scrambling to gather them. They are money, and from the cradle we have known their value. And that is just what is leaking away wherever there is a crevice in our business arrangements. Perhaps it's a small hole in a far corner, but there they are piling up with the unremitting regularity which means many dollars at the end of the year.

The present day business man has learned to keep a sharp eye open for leaks. Sometimes the result is amazing. A few days ago I was in a plant burning 200 tons of coal a day, where they have installed a machine to detect loss of heat units. At first there was a question of the advisability of expending $350 for this small device to determine possible waste in a well equipped plant. But it has proven a wonderful investment: discovering an actual loss of $50 a day, or $1,500 a month.

So, to insure value received for the time, energy and money we put into our business, it is wise to investigate modern appliances.

I take it for granted that we all appreciate this point, and many of our creamery men today are looking toward the ice machine, and are asking, "Will it pay me in my plant, and what will be the cost of installing such a system of refrigeration?"

Let us see. You will understand that all figures given must be merely approximate. Each particular case is a law unto itself and its needs must be gone into in detail before definite figures could be given.

To answer the question, "Will it pay?" let us look into the expense of natural ice. The first cost of a well built ice house is not a small item. There are ice houses, and ice houses, and of course, the better the house the less waste from melting ice.
One recently built, of fairly good lumber, dimensions 18x24, 20 ft. studding, cost $320 exclusive of packing the walls. This holds 60 cords of ice. At a cost of $150 a cord loaded f. o. b. source of supply, it amounts to $90 for the 60 cords. One-half ton of shavings to a cord, at $5.00 a ton, amounts to $150. So we have a first cost of $560, not including hauling, (which can not be estimated without knowing the distance) or hoisting and packing the cakes in the ice house. In view of this, $600 would be a conservative estimate of the total cost.

As to the first cost of a good refrigerating plant, several of which I have seen throughout the state, I find that a machine of 1½ ton capacity will cool a room 8x12 by 10½ ft. high, which will hold 220 tubs of butter or will store 180 cases of eggs.

Such a machine, with necessary piping, brine tank, ammonia, etc., can be installed for $900. It will require a three horse power motor to drive the machine.

For a box twice the size, taking care of twice the quantity of eggs or butter (440 tubs of butter or 360 cases of eggs) a machine of three tons capacity would be required. This can be installed for $1,100, and will need a six horse power motor.

A five ton machine will cool a room 14x34 by 11 ft. high and will cost $1,600. A room of this size holds 1,100 tubs of butter or 900 cases of eggs. 10 horse power will be required.

Thus we see that the cost decreases proportionately as the size increases. And right here it may be well to mention that a man should always install a larger machine than his present necessities require, to provide for future growth.

Besides these general estimates I will give you a few figures furnished me by a creamery man in my territory. Two years ago he installed a three ton ice machine and an electric motor to drive it, at a total cost of $1,600. He makes 75 to 100 gallons of ice cream, cools hardening room 4x8 by 7 ft. high, from 10 degrees above to 0 and sometimes 17 degrees below, cools 100 gallons of cream for butter in ripener and stores his butter in a refrigerator 10x10 by 8 ft. high at a temperature of 32 to 40 degrees. He also cools 150 to 350 gallons of buttermilk. To run
this machine costs him $1.00 a day for electric power. His only
cost for repairs in two years has been $1.00 for packing.

Before installing the machine, it cost him three to four dollars
a day for ice, and he now runs his plant with one man less.

Another creamery man gave me the following figures: He
put in a seven and eight-tenths ton machine, with equipment for
$1,475. He previously had the motor.

He cools 250 gallons of cream from 85 to 40 degrees and
keeps 2,000 pounds of butter in a refrigerator at 40 degrees.
The machine is run 10 hours in hot weather and 4 to 5 hours
spring and fall, at a cost of 4 to 4½ cents per kilowatt hour,
amounting to $225 for the year. This includes the expense of
running the entire plant, cooling, ripening cream and churning.
It formerly cost him $500 a year for ice. He has run the machine
something over a year with no repairs.

These are a few comparative figures which may serve to aid
those who are thinking along these lines.

And aside from the question of dollars, there is a most worthy
ambition among us to work for QUALITY.

There is a supreme satisfaction in a clean, sanitary plant,
turning out the best on the market.

So let us welcome new ideas, investigate, compare and choose
whatever will assist us in reaching the highest standard of
quality. (Great applause.)

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**DISCUSSION.**

**MR. MEYER:** I would like to ask Mr. Hart how many horse
power is required for a creamery making on the average about
75 tubs a week?

**MR. HART:** The smallest machine that would be practical
for that would be the 1½ ton machine. I believe that is the
smallest that is made for practical purposes. That would take
a 3 horse power motor, that is if he runs by electricity, or in the
neighborhood of about 600 pounds of coal a day if he is running
by steam with a common slide valve engine. A Corliss would
take a little less.
Mr. Meyer: Do I understand, Mr. Hart, that that means cooling cream and everything pertaining to creamery work?

Mr. Hart: That means from taking in the cream in the plant at an average temperature in summer months of 85 or 90, cooling it to 40 or lower, ripening it, cooling it again, making it into butter and keeping in first class condition in your refrigerator, that includes the entire process from start to finish.

Mr. C. J. Dodge, Windsor: Does that include the motor, the $900?

Mr. Hart: The $900 does not include the motor.

Mr. M. E. Brunner, Ft. Atkinson: I would like to ask Mr. Hart what he means by a 3 ton machine?

Mr. Hart: A machine that will cool a sufficient area equal to three tons of melting ice. This 3 ton machine will also take care of running your machinery.

Mr. Guy Speirs, Eau Claire: I would like to ask Mr. Hart if he don't think it is a mistake to recommend a small machine. You are figuring 3 ton refrigeration on a ton and a half machine. How many hours run would you have to operate that 1½ ton machine to get that efficiency out of it?

Mr. Hart: Eight hours per day.

Mr. Speirs: Don't you think it would be better to recommend a larger machine so that that machine would only have to run while the regular creamery machinery was in operation?

Mr. Hart: Yes, I do in a way, but Mr. Meyer has asked me a direct question, what size machine, in my estimation, it would take to take care of a creamery making 75 tubs of butter a week, and my answer was merely an answer to Mr. Meyers. But I do advocate putting in a 3 ton machine where a 1½ ton will do the work. You understand you have only got to run the machine for the number of hours you need it.

Mr. Frank Bowar, Cazenovia: Wouldn't the question of power come in there, too? A larger machine would do the same amount of work. This particular creamery would not have power enough, so he would probably have to run a larger machine.

Mr. Hart: That is an individual point which the man would have to take up with the manufacturer he buys his machine
from. As Mr. Bowar says, he would possibly have to get a larger engine or larger motor, which would entail a larger expense.

Mr. George E. Young, Menomonie Falls: We had a 4 ton machine and a 15 horse power engine and it is a pretty hard pull. I have had to get a smaller machine.

President: The way I understand you, a 4 ton machine was pretty heavy for a 15 horse power engine—pulls pretty heavy on a 15 horse power engine.

Mr. Hart: I understand, a pretty hard pull for his 15 horse power engine, and it is his opinion that he would advocate a creamery of the same size as his to put in a little smaller machine instead of putting in a 4 ton machine. In that way he believes you can run the other machinery too, rather than run the ice machine individually, and then shut down his ice machine.

Mr. H. H. Whiting: Mr. President, I know of a 3 ton machine and they have a 10 horse power engine and they have a churn that will churn about 600 pounds of butter, and I know of this ice machine and the churn being in operation at the same time with the 10 horse power.

Mr. Hart: That, I believe, is sufficient proof to you that the figures I have given are accurate.

Mr. Young: I want to ask this gentleman if he starts his machinery or his ice machine first.

Mr. Whiting: I have known of these to be in actual operation. I don’t know anything about the starting of them. I know these to have been in operation, the churn and the ice machine, at the same time. Whether the ice machine was started before or afterwards I don’t know.

Mr. Bowar: There is something involved there. You all know that there is some difference in the amount of power required by different makes of churns. That churn of 600 pounds capacity is a small churn.

Mr. Ed. Seaman, Markesan: I know of a factory where we have run a 6 ton ice machine and a 1,000 pound electric churn and other pumps and 4 separators, every separator with a 60 horse power motor, all with a 15 horse power engine.
Mr. Young: I don’t know what the effect of a 60 horse power machine would be.

Mr. Hart: Mr. Young, I would suggest for your benefit to increase the pressure of your steam to 110 or 115 pounds,—your boiler will stand it easily. Change the safety valve so that it will blow off at 110 or 115 pounds, that will give you the increased power.

Mr. Seaman: Our experience is that 100 pounds of steam pressure is sufficient to run the 6 ton ice machine, as stated before, with a 60 horse power motor.

Mr. H. O. Strozinski, Neillsville: I would like to ask the gentleman if, with a 30 horse power boiler and a 15 horse power engine connected, a 1,000 pound churn and two 600 power ripeners, would this engine handle this, or would the machinery have to be shut down in order to handle this?

Mr. Hart: I believe that the boiler is entirely too small for economical work. You possibly could do it, but I believe your boiler and equipment is too small for economical work.

Mr. Strozinski: You possibly misunderstand me. We are running at the present time a 15 horse power engine and a 1,000 pound churn and two Simplex ripeners.

Mr. Hart: With a 30 horse power boiler?

Mr. Strozinski: Yes.

Mr. Hart: And now you want to put in a 3 ton machine?

Mr. Strozinski: I ask you that question, if it would handle it?

Mr. Hart: No, I think not.

Mr. Strozinski: Would it handle a 1½ ton machine?

Mr. Hart: No, I hardly think so. I don’t think you have sufficient capacity in your boiler in the first place to give you the amount of power to run on a safe working economical basis.

President: Mr. Young, didn’t I understand you to say 25 horse power boiler?

Mr. Young: 25 horse power boiler.

President: I would like to ask the speaker one question. What is the cost of running the different ice machines, 3 to 5 tons, outside of the fuel and the wear and tear on the machine?
Mr. Bowar: I think this man here with his 15 horse power engine, 1,000 pound churn certainly ought to be able to handle a 3 ton machine with that, and while of course I don’t know how these steam engines are, I run a 1,000 pound churn aside from a pump and a separator and it can handle it all. Of course it makes the engine work. At the same time she runs it and holds the steam up. Of course how the gas engine is rated, according to steam, I don’t know.

Mr. Hart: I would suggest this to this gentleman that spoke, who is wanting the information whether the boiler would do it, I am not selling any machines. I simply got the data together from the knowledge of the business I had to give you the benefit of my knowledge, and it would be unfair to the manufacturers to undertake to state that such and such a machine and such and such a boiler would do the work. When they would come to figure on that job they would find that my estimated statement was not correct, consequently the man who figured on putting in the machine would think that the manufacturer was holding him up. For that reason you will please bear in mind that my figures are only estimated. If there are any men in this room representing any ice machine or any power pertaining to it, he will tell you the same thing. I cannot get definite figures. We have got to know as a matter of fact how much cream or milk he takes in, what temperature it comes in, how cold he wants to cool it, or whether he wants to pasteurize. I am just giving you these to give you an idea what the manufacturer is up against when he is asked to give an estimate. I will say this, that the figures given in my paper are absolutely correct, and you will not find a machine I mentioned here that will cost you any more money than I mentioned.

Mr. Olsen asks for the cost of running the ice machine. That cannot be answered because different men who have put in these ice machines have run one without one cent of cost. The average cost of ammonia in one year’s run is conceded to be, a very fair estimate, 2 per cent less in ammonia, and that must be drawn off once a year, so that the cost of running the machine, outside of the fuel, is practically nothing.
Mr. E. L. Aderhold, Neenah: This is very interesting, but I am sure that Mr. Hart's discussion of the subject has been entirely free from hot air.

Mr. Hart: I thank you, sir. (Laughter and applause.)

President: If there are no other questions, we will go on to the next subject.

Prof. Benkendorf has a few announcements to make.

Secretary Benkendorf: Ladies and Gentlemen: I have just a few announcements. I want to call your attention to the rules governing the district prizes on Page 29 of the program, the second rule is "In order to be eligible for these prizes it is necessary that either the butter maker or some representative of the creamery must be present at the convention, and register with the Secretary before 6 o'clock Wednesday, Feb. 4." Be sure that you call at my office at the Park Hotel, and sign the entry blank that you sent in. Do not come to me tomorrow and say that you saw Prof. Lee, or Prof. Farringon or me at the Dairy School and we know that you were here.

Last year I had a complaint from a man. He wrote me that he had been at the convention and he could prove it by Mr. H. C. Larson. Even if he had seen Mr. Larson, the rules say he must sign the entry blank, at my office. This thing must be settled tonight.

The second announcement I have to make is that the Dairy and Food Department has prepared a very interesting exhibition on the ground floor and I advise the creamery men to get acquainted with the new laws on weights and measures, and the new laws on the Babeck glassware.

I want to call your attention to the sale of butter in the Exhibition Hall of the Dairy School. The butter will be sold tomorrow at 11 o'clock in the Dairy School.

I also wish to call your attention to the fact that we have a lot of Danish butter, New Zealand and Australian butter at the Dairy School which you ought to look at. Are there any questions that anybody wants to ask me?

I also want to call your attention to the fact that there may be some of you who haven't become members of our organization.
Remember it costs money to run this organization, so if you happen to be over at the Park Hotel call at my office and there will always be someone there who will be ready to take your dollar.

President: We will next hear a very interesting speaker. His paper is entitled "Guard Ye Well Her Bulwarks," by the Hon. J. Q. Emery, of Madison.

"MARK YE WELL HER BULWARKS."
By Hon. J. Q. Emery, Madison.

Mr. President and Members of Wisconsin Buttermachers' Association: The printer has taken some liberty with my subject. It is not "Guard Ye Well Her Bulwarks," but "Mark Ye Well Her Bulwarks," and it contains an appreciable difference.

Upon what do the nations of the earth depend in the construction of their battleships for their own defense or for the mastery of the sea? Do they depend upon poor, rotten, or otherwise faulty or inferior material in the construction of those battleships? Do they depend upon poor or indifferent workmanship? What consummate folly such a course of procedure or such reliance would be!

Soon after war was declared by the United States against Spain it was announced in the newspapers that the Spanish war fleet had set sail for American waters. Then disturbing questions arose in the minds of the people of this country. Would the Spanish fleet be able to overcome all the resistance that would be offered by our own fleet and coast defenses, steam along our sea coast and destroy our cities and dictate terms of peace? All depended upon the strength of the respective fleets, the material out of which they had been constructed, the skill in workmanship and the skill of the men who manned the vessels. This was a time when the entire nation stood almost breathless in suspense.

When the supreme test of strength came, it was found that the Spanish fleet was weak, rotten, faulty, inferior, and that