

The Project Gutenberg EBook of Manufacturing Cost Data on Artificial Ice, by
Otto Luhr and Herman Friedl

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Title: Manufacturing Cost Data on Artificial Ice

Author: Otto Luhr
Herman Friedl

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*** START OF THIS PROJECT GUTENBERG EBOOK MFG. COST DATA--ARTIFICIAL ICE ***

Produced by Don Kostuch

Manufacturing Cost Data

ON

**Artificial
Ice**

MADE IN
ACCORDANCE WITH

OTTO LUHR
CONSULTING ENGINEER
&
HERMAN FRIEDL
ARCHITECT

ICE MAKING SYSTEM

PATENT APPLIED FOR

154 WEST RANDOLPH STREET
CHICAGO, ILL.

Ice for Commercial Purposes

ICE for commercial purposes is obtained in two ways: either by cutting during the winter time from our lakes and rivers and storing in large Ice Storage Houses located alongside, or by freezing pure clean water by means of artificial refrigeration.

All authorities are agreed that artificial ice is more sanitary than natural ice and it is only a matter of time when the use of natural ice will be prohibited except in special cases when the purity of its source of supply is beyond doubt.

Our improved method of making artificial ice will cut the labor cost down to the minimum and will enable the manufacturer to profitably sell artificial ice at the price natural ice can be harvested. The logical result thereof will be the building of a large number of modern ice plants all over the country to supply the market with artificial ice in place of the present natural ice.

We do not claim any wonders for our system but believe that the following points of advantage will convince any practical ice manufacturer that the labor cost has been cut in two.

First. We pull a complete row of the full width of tank at one time.

Second. Our air supply is permanently connected to the cans and the supply to each can can be regulated, if required.

Third. We have a continuous air supply to the cans during freezing as well as during thawing, dumping and filling. Our air supply never ceases.

Fourth. Our air is automatically cooled down to the temperature of the brine in the tank thereby eliminating all possibility of moisture in the air pipes.

Fifth. Our cans are held in a solid frame of steel work and are connected to the crane from the time the cans are pulled until they are put back into the tanks, thereby doubling the life of the cans.

We give herewith data covering the cost of manufacturing ice and will guarantee that under reasonably fair management the number of men required will not be exceeded.

Do not fail to carefully analyze the following cost data. They may seem extremely low but a thorough study of our system will prove them to be very conservative.

NUMBER ONE

Manufacturing Costs Per Ton of Ice Using Electric Power at Present Chicago Rates for Power and Labor

Capacity of plant, 240 tons of ice per day, using 2692 cans of 400-lb. capacity.

18000-ton storage house.

Average current requirement for freezing one ton of ice, including storage cooling and all auxiliaries, 55 K. W. hours.

Average cost per K. W. hour, **.9 cent.**

Current cost per ton of ice, $55 \times .9$, equals **49.6 cents.**

Assuming one month's shut-down for inspection and repairs, the total output of 240 tons of ice for 333 days amounts to 79,920 tons, or roughly speaking 80,000 tons of ice.

Adding 1/2 cent per ton of ice for the required heating, the total power cost of making 80,000 tons of ice is $(80,000 \times .50)$ \$ 40,000.00

ENGINE ROOM LABOR COST:

1 chief engineer per day	\$ 10.00	
3 engineers per day	\$ 8.00	
Total per day	\$ 34.00	
365 days at \$34.00 equals		\$ 12,410.00

or $12410 / 80000 = 15.62$ cents per ton

ICE PLANT LABOR COST:

3 men pulling ice and setting it up in store-room.	per day \$ 6.00
3 men in store-room	per day \$ 6.00
1 shipping clerk	per day \$ 8.00
Total labor	per day \$ 44.00

365 days at \$44.00 equals 16,060.00

For filling the winter storage house and taking the ice out of it will require 3 additional men for five months, equals 150 days x \$18.00, equals \$ 2,700.00

Total Ice Plant Labor Cost Equals \$18,760.00

or $18670 / 80000 = 23.46$ cents per ton

240 tons of ice equal 1200---400-lb. cans. As 24 cans are pulled at one time it requires $1200 / 24 = 50$ pulls per day, or one pull every 29 minutes. The ice-puller has therefore ample time to set up all ice pulled in storage house as directed.

Cost of Ammonia at	2 cent per ton	\$ 1,600.00
Cost of Oil and Waste at	2 cent per ton	\$ 1,600.00
Cost of Water at	3 cent per ton	\$ 2,400.00
Cost of Salt at	72 cent per ton	\$ 400.00
Plant Maintenance and Repairs		\$ 3,500.00

or $3500 / 80000 = 4.37$ cent per ton

OFFICE EXPENSES:

1 Manager and Salesman, per year	\$ 5,000.00
1 Bookkeeper, per year	\$ 2,400.00
Stationery, Telephone, etc	\$ 600.00
Total Cost	\$ 8,000.00

or $8000 / 80000 = 10$ cent per ton

OVERHEAD CHARGES:

8 per cent interest on \$350,000.00 investment	\$ 28,000.00	
8 per cent interest on value of land (\$20,000.00)	\$ 1,600.00	
8 per cent interest on \$10,000.00 working capital	\$ 800.00	
3 per cent depreciation on \$350,000.00	\$ 10,500.00	
Insurance (estimated)	\$ 1,500.00	
Taxes (estimated)	\$ 3,500.00	
Total		\$ 45,900.00

or $45900 / 80000 = 57.375$ cent per ton

Total Expense		\$134,570.00
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or $134570 / 80000 = \$1.68.215$ per ton

Divided as follows:--

Manufacturing cost including office expense	\$ 1.10.840
Overhead charges	\$ 0.57.375

ICE SALES ASSUMPTIONS:

Month	Ice produced per day	Ice sold direct per day	Ice stored per day	Ice Sold from storage daily	Total Ice stored in 30 days
January	240	65	175		5250
February	240	65	175		5250
March	240	115	125		3750
April	240	165	75		2250
May	240	300		60	
June	240	400		160	
July	240	400		160	
August	240	400		160	
September	240	350		110	
October	240	200	40		1200
November	240	140	100		3000
December	None	65		65	

Tons	20700
Less Tons	1950
Total Tons	18750

During the month of December, the Ice Plant will be shut down for overhauling and repairs, and part of the ice stored during November will be sold in December, therefore, requiring a total storage capacity of 18,750 tons, of which 750 tons will be stored in the ante-room and 18,000 tons will be stored in the big winter storage.

NUMBER TWO

*Manufacturing Costs Per Ton of Ice Using
Electric Power at Present Chicago Rates for Power and Labor*

240 TON CAPACITY PER DAY

No Storage House for Surplus Ice

ICE SALES ASSUMPTIONS:

	Tons per day	Total Tons
January	65	1,950
February	65	1,950
March	115	3,450
April	165	4,950
May	240	7,200
June	240	7,200
July	240	7,200
August	240	7,200
September.	240	7,200
October	200	6,000
November	140	4,200
December	65	1,950
	Total output tons	60,450

NOTE--These sales can only be realized if the dealer has at least 18,000 tons of natural ice on hand to enable him to take care of the family trade during the hot months.

If no large supply of natural ice is on hand hardly 50,000 tons can be sold, thereby increasing the cost per ton considerably.

POWER COST:

Due to numerous starting and stopping of compressor during the slack months the maximeter charges will be higher and therefore it must be assumed that 60 K. W. hours will be required per ton of ice instead of 55 K. W. hours for continuous consumption.

60 K. W. hours per ton of ice at .9 cent per K. W. hour equals 54 cents per ton. Adding 1/2 cent per ton for the required heating the power cost for making 60,450 tons of ice equals 60,450 x 54.5 cents, equals \$ 32,945.25

ENGINE ROOM LABOR COST:

1 chief engineer per day	\$ 10.00	
3 engineers per day	\$ 8.00	
Total per day	\$ 34.00	
365 days at \$34.00 equals		\$ 12,410.00
or $12410 / 60450 = 20.54$ cent per ton of ice		

ICE PLANT LABOR COST:

(Using present method of pulling ice)

May, June, July, August, September and October require:

6 ice pullers per day	\$ 6.00	
3 air men per day	\$ 6.00	
6 storage house men per day	\$ 6.00	
Total per day	\$ 90.00	
184 days at \$90.00 equals		\$ 16,560.00

March, April and November require:

6 pullers per day	\$ 6.00	
4 storage house men per day	\$ 6.00	
Total per day	\$ 60.00	
91 days at \$60.00 equals		\$ 5,460.00

December, January and February require:

3 pullers per day	\$ 6.00	
3 storage house men per day	\$ 6.00	
Total per day	\$ 36.00	
92 days at \$36.00 equals		\$ 3,312.00

1 shipping clerk per day	\$ 8.00	
330 days x 8 equals		\$ 2,640.00
Total Labor Cost		\$ 27,972.00

or $27972 / 60450 = 46.27$ cent per ton

Cost of Ammonia at	2 cent per ton	\$ 1,209.00
Cost of Oil and Waste at	2 cent per ton	\$ 1,209.00
Cost of Water at	3 cent per ton	\$ 1,813.50
Cost of Salt at	1/2 cent per ton	\$ 302.25
Plant Maintenance and Repairs		\$ 2,800.00

or $2800 / 60450 = 4.63$ cent per ton

OFFICE EXPENSE:

1 Manager and Salesman per year	\$ 5,000.00	
1 Bookkeeper per year	\$ 2,400.00	
Stationery, Telephone, etc	\$ 600.00	
Total Cost		\$ 8,000.00

or $8000 / 60450 = 13.23$ cent per ton

OVERHEAD CHARGES:

8 per cent Interest on \$280,000.00 investment	\$ 22,400.00	
8 per cent Interest on value of land (\$12,000.00)	\$ 960.00	
8 per cent interest on \$8,000.00 working capita	\$ 640.00	
3 per cent depreciation on \$280,000.00	\$ 8,400.00	
Insurance (estimated)	\$ 1,200.00	
Taxes (estimated)	\$ 2,500.00	
Total Overhead Charge		36,100.00

or $36100 / 60450 = 69.72$ cent per ton

Total Expense		\$124,961.00
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or $124961 / 60450 = 20.67$ cent per ton

NOTE--If the **LUHR & FRIEDL ICE MAKING SYSTEM** is used, the Ice Plant Labor Cost will be as follows:

May, June, July, August, September and October require:

3 ice pullers	per day \$ 6.00	
3 storage house men	per day \$ 6.00	
Total	per day \$ 36.00	
184 days at \$ 36.00 equals		\$ 6,624.00

March, April and November require:

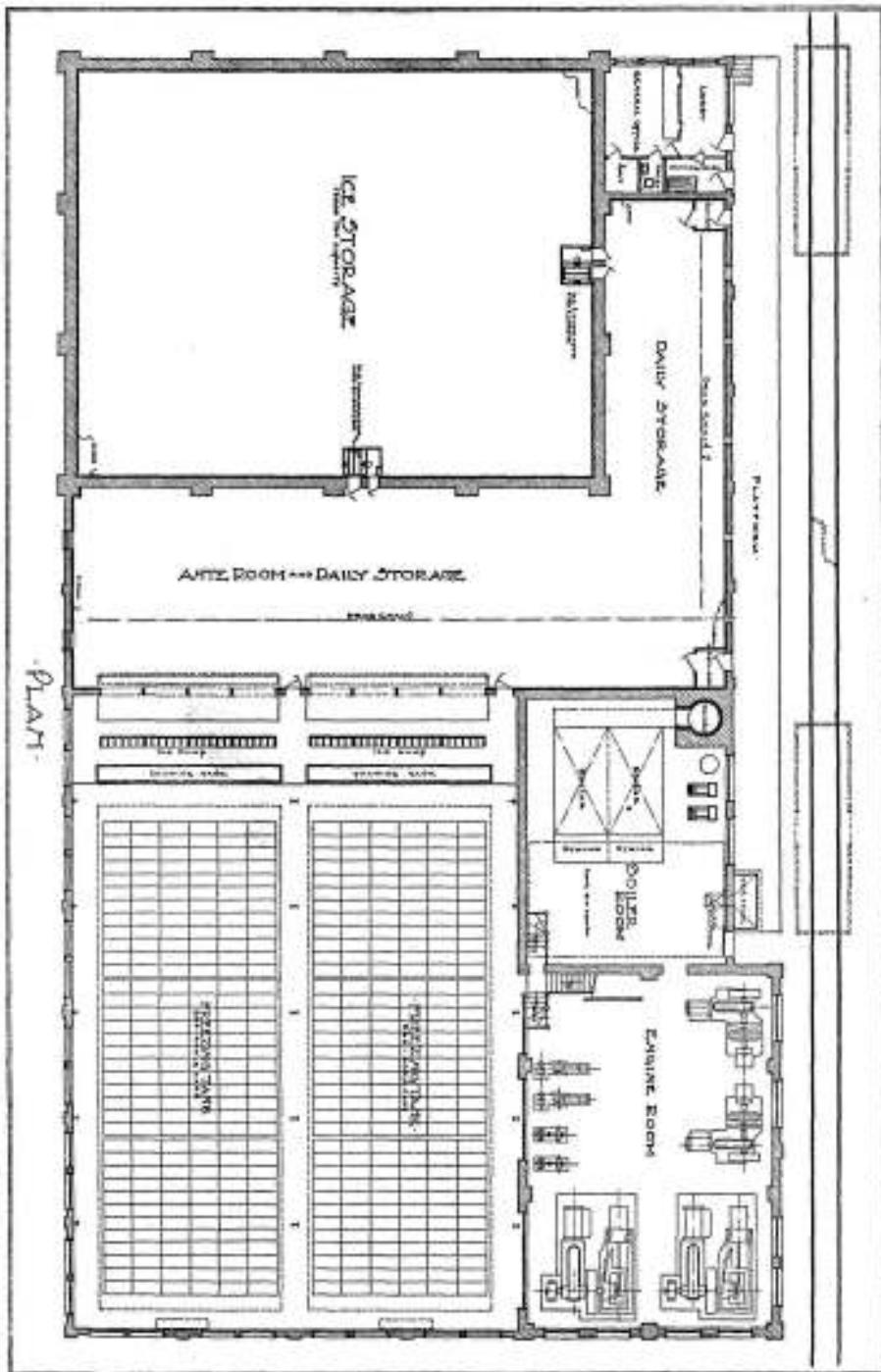
3 ice pullers	per day \$ 6.00	
2 storage house men	per day \$ 6.00	
Total per day	\$ 30.00	
91 days at \$ 30.00 equals		\$ 2,730.00

December, January and February require:

3 ice pullers	per day \$ 6.00	
1 storage house man	per day \$ 6.00	
Total per day	\$ 24.00	
92 days at \$ 24.00 equals		\$ 2,208.00
1 shipping clerk	per day \$ 8.00	
330 days x 8 equals.		\$ 2,640.00
Total Labor Cost.		\$ 14,202.00

or $14202 / 60450 = 23.49$ cent per ton

compared to 46.27 cent per ton, **A SAVING OF 22.78 CENT PER TON.**

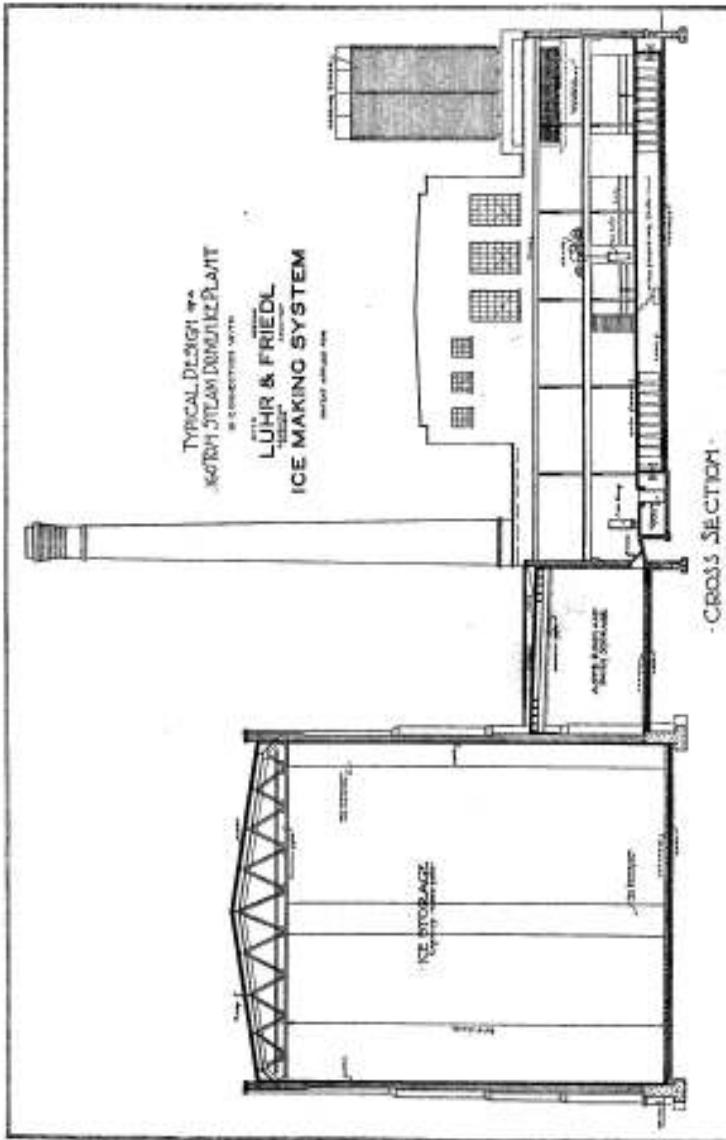


[8]

Typical Design of a 160 Ton Steam Driven Ice Plant.

Interior Details

[8]



[8]

Typical Design of a 160 Ton Steam Driven Ice Plant.

Exterior Cross Section

In connection with

Otto Luhr

Consulting Engineer

& Herman Fridel

Architect

Ice Making System

Patent Applied For

[9]

NUMBER THREE

*Manufacturing Costs Per Ton of Ice Using
Steam Power at Medium-Sized-Town Rates for Labor*

160-ton capacity per day.
1,728--400-lb. cans.
333 days continuous full output.
12,000-ton storage house.

COST OF POWER:

A modern, highly efficient and economical steam driven high speed compressor plant must be installed so as to get the maximum power out of coal. The boiler room will contain two 250-H. P. water-tube boilers with automatic stokers and coal bin overhead holding two weeks' supply of coal. Steam pressure 175 lbs. As the firing of the boilers is automatic and requires practically no work on the part of the engineers, no firemen are needed. Ashes will also be removed automatically. The engine room equipment will consist of two 175-ton high speed compressors, direct connected to two Simple Condensing Una-flow Engines; also two generators, two cooling tower water pumps, two air compressors, switchboard, etc. All to be equipped with the latest labor and power--saving devices.

Equipped as above, 25 tons of refrigeration can be easily obtained from one ton of ordinary 12,500 B T U coal. 1.8 ton of refrigeration is required to produce one ton of ice including the required cooling of storage house.

Therefore the power cost of making one ton of ice with coal at \$5.00 per ton equals \$5.00 divided by 25/1.8 = **37 cent**. (One cent per ton of ice is added for heating of dipping tank water.)

Assuming one month's shut-down for inspection and repairs, the total output of 160 tons of ice for 333 days amounts to 53,280 tons of ice.

The total power cost of making 53,280 tons of ice is therefore,
53,280 x 37 cent \$ 19,713.60

ENGINE ROOM AND ICE PLANT LABOR COST:

1 chief engineer	per day \$ 8.00	
3 engineers	per day \$ 6.00	
1 shipping clerk	per day \$ 6.00	
3 men in Storage House	per day \$ 4.00	
Total	per day \$ 44.00	
365 days at \$44.00 per day equals		\$ 16,060.00
Additional labor cost for putting 12,000 tons into winter storage and taking out at \$4.00 per day		\$ 1,200.00
Total Labor Cost		\$ 17,260.00

or $17260 / 53280 = 32.4$ cent per ton

Engineers will do their own firing of boilers and will pull all the ice. One pull required every 43 minutes.

OFFICE EXPENSE:

1 Office Man (Manager and Bookkeeper)	\$ 3,000.00	
Stationery, Telephone, etc. (per year)	\$ 300.00	
Total Office Expense		\$ 3,300.00

or $3300 / 53280 = 6.2$ cent per ton of ice

Cost of Ammonia at 2 cent per ton	\$ 1,065.60
Cost of Oil and Waste at 2 cent per ton	\$ 1,065.60
Cost of Water at 3 cent per ton	\$ 1,598.40
Cost of Salt at 1/2 cent per ton	\$ 266.40
Plant Maintenance and Repairs	\$ 2,200.00

or $2200 / 53280 = 4.1$ cent per ton

OVERHEAD CHARGES:

8 per cent interest on \$220,000.00 investment equals	\$ 17,600.00	
8 per cent interest on value of land (\$10,000.00)	\$ 800.00	
8 per cent interest on working capital (\$7,500.00)	\$ 600.00	
3 per cent depreciation on \$220,000.00	\$ 6,600.00	
Insurance (estimated)	\$ 1,000.00	
Taxes (estimated)	\$ 2,000.00	
Total overhead charges		\$ 28,600.00

or $28600 / 53280 = 53.7$ cent per ton

Total Expense		\$ 75,069.60
	or $75069.60 / 53280 =$	\$ 1.409 per ton

Divided as follows:

Overhead charges	\$ 0.53.7
Manufacturing Cost (total)	\$ 0.87.2

NUMBER FOUR

Manufacturing Costs Per Ton of Ice Using Steam Power at Medium-Sized-Town Rates for Labor

100-ton capacity per day.

1,080--400-1b. cans.

333 days continuous full output.

7,600-ton Storage House.

COST OF POWER:

A modern, highly efficient and economical steam driven high speed compressor plant must be installed so as to get the maximum power out of coal. The boiler-room will contain two 200-H. P. water-tube boilers with automatic stokers and coal bin overhead holding two weeks' supply of coal. Steam pressure 175 lbs. As the firing of the boilers is automatic and requires practically no work on the part of the engineers, no firemen will be needed. Ashes will also be automatically removed. The engine room equipment will consist of two 100-ton high speed compressors, direct connected to two Simple Condensing Unaflow Engines; also two generators, two cooling tower pumps, two air compressors, switchboard, etc. All to be equipped with the latest labor and power-saving devices.

Equipped as above, 25 tons of refrigeration can be easily obtained from one ton of ordinary 12500 B T U coal. 1.8 tons of refrigeration is required to produce one ton of ice, including the cooling of the storage house.

Therefore, the power cost of making one ton of ice with coal at \$5.00 per ton equals \$5.00 divided by 25/1.8 = **37 cent**. (One cent per ton of ice is added for heating of dipping-tank water.

Assuming one month's shut down for inspection and repairs, the total output of 100 tons of ice for 333 days amounts to 33,300 tons of ice.

The total power cost of making 33,300 tons of ice is therefore,

33,300 x 37 cent, equals \$ 12,321.00

ENGINE ROOM AND ICE PLANT LABOR COST:

1 Chief Engineer per day	\$ 8.00	
3 Engineers per day	\$ 6.00	
2 Storage House Men per day	\$ 4.00	
Total per day	\$ 34.00	
Total 365 days at \$34.00 per day		\$ 12,410.00

Additional labor cost for putting 7,500 tons into winter storage and taking out at \$4.00 per day	\$ 750.00	
Total labor cost		\$ 13,160.00

or $13160 / 33300 = 39.52$ cent per ton

Engineer will do his own firing of boilers and will pull all the ice and set it up in ante room if required. One pull required every 70 minutes.

Chief Engineer will act as shipping clerk.

OFFICE EXPENSE:

1 Office Man (Manager and Bookkeeper)	\$ 3,000.00	
Stationery, Telephone, etc. (per year)	\$ 300.00	
Total Office Expense		\$ 3,300.00

or $3300 / 33300 = 9.9$ cent per ton

Cost of Ammonia at	2 cent per ton	\$ 666.00
Cost of Oil and Waste at	2 cent per ton	\$ 666.00
Cost of Water at	3 cent per ton	\$ 999.00
Cost of Salt at	1/2 cent per ton	\$ 166.50
Plant Maintenance and Repairs		\$ 1,500.00

or $1500 / 33300 = 4.5$ cent per ton

OVERHEAD CHARGES:

8 per cent interest on \$150,000.00 investment	\$ 12,000.00	
8 per cent interest on value of land (\$7,000.00)	\$ 560.00	
8 per cent interest on \$5,000.00 working capital	\$ 400.00	
3 per cent depreciation on \$150,000.00	\$ 4,500.00	
Insurance (estimated)	\$ 700.00	
Taxes (estimated)	\$ 1,360.00	
Total overhead charges		\$ 19,520.00

or $19520 / 33300 = 68.7$ cent per ton

Total Expense		\$ 52,298.50
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or $52298.50 / 33300 = 1.57$ per ton

Divided as follows:

Overhead charges	68.7 cent
Manufacturing Cost	98.3 cent

OTTO LUHR

CONSULTING ENGINEER

&

HERMAN FRIEDL

ARCHITECT

ICE MAKING SYSTEM

154 W. RANDOLPH STREET, CHICAGO

[Transcriber's Note]

I found this document and the attached papers and photographs among my father's papers. I offer it as an insight into the finances and structure of business and trades in the early 1900's.

There are no dates included in this document but a Google search of "Otto Luhr" produced these items:

- Mechanical and Refrigerating Engineer's Handy Book; Otto Luhr; 1913.
- Automatic refrigerating liquid feeder and regulator;
United States Patent 1725875; 8/27/1929.
- Refrigerator car; United States Patent 1642882; 9/20/1927.

Since the title page states "Patent Applied For", this document was probably published around 1925.

Note the prices quoted for materials and labor:

Coal, \$5.00 a ton. [In 2009, about \$100/ton, down from \$300 in 2008.]

Unskilled Labor, \$6.00/day; that's DAY, not HOUR.

Skilled Labor, \$8 to \$10/day

Electricity, \$0.009/KWH [my latest bill (in 2009) was \$0.1317/KWH]

Note the job titles in the attached documents: Barnmen, Washers, Blacksmiths

Finally, the optimistic tone of the document contrasts with the decline of the ice business in the 1940's, fifteen years later. I remember the ice deliveries and the weight sign my mother put in the window before we got our first mechanical refrigerator after World War II.

[End Transcriber's Note]



DETROIT CREAMERY COMPANY
ORGANIZATION

1 -- Board of Directors

2 -- Operating Committee

Harry A. McDonald	President
Nelson J. Dessert	Vice president
Carl F. Siclaff	Vice president
Harry J. Weigand	Treasurer & Comptroller
Jerome H. Remick	Ice Cream Sales & Service
J. Harry Brickley	Retail Milk Sales
Oliver G. Spaulding	Legal Department
Richard L. Baire	Advertising
Frank McVeigh	Purchasing Department
Ben F. Taylor	Ice Cream Production
Ben F. Taylor	Ice Cream Delivery
Edward C. Krahl	Henry St. Production
Doc Grayson	Laboratory
John Kostuch	Plant Engineer - Maintenance
John Kostuch	Power & Refrigeration
J. Harry Watson	Transportation
J. Harry Watson	Shops
H. Terry Snowday	Wholesale Milk Sales
Carl O. Tuttle	Butter Department
Tom Wood	Credit & Collections
J. McWilliams	Detroit Creamery Farms

TREASURER & COMPTROLLER

Harry J. Weigand

Accounting - Detroit Creamery & Subsidiaries
Loans & Contracts - Detroit Creamery & Subsidiaries
Appropriations - Detroit Creamery & Subsidiaries
Banks - Detroit Creamery & Subsidiaries
Account Dept Personnel - Detroit Creamery & Subsidiaries
Credits & Collections
Corporate Records
Purchasing Department
Legal Department

PLANT ENGINEERING--MAINTAINANCE

POWER and REFRIGERATION

John Kostuch (Chief Engineer)

Paul Culver (Consulting)

Norman Mithell (Technical) (Advisory) (Dept. Head)

HENRY STREET (MAINTAINANCE)

James Crunnley (In Charge)

(a) Electrical & General (Ray Casson)

(b) Conveyors, Bottle Washers, Fillers, Cappers (Howard Strauss)

(c) All other Machinery (Assign Mechanics)

HENRY STREET (POWER & REFRIGERATION)

Harry Hollenbeck (In Charge)

(a) Engineers

(b) Firemen

MAIN PLANT (MAINTAINANCE) (POWER & REFRIGERATION)

John Kostuch (In Charge)

REC. STATIONS & MFG. PLANTS

John Kostuch (Chief)

Elmer DeWitt(Asst)

Frank Mortimer (Mech)

C. S. McBride (Production Dept.)

SUBSIDIARY COMPANIES

John Kostuch (Chief)

Paul Culver--Norman Mitchell--Dept. Head

MACHINE SHOP (MAIN PLANT)

John Kostuch (In Charge)

TRANSPORTATION & SHOPS

J. Harry Watson

Garages	Detroit Subs. (Advisory)
Auto Shops	Detroit (Met. Area)
	Subs. (Advisory)
Paint Shops	Detroit & Subs.
Electrical Shops	Detroit Subs. (Advisory)
Carpenter Shops	Detroit & Sub. (Advisory)
Stables	Detroit (Advisory)
Barnmen	Sub. (Advisory)
Washers	
Blacksmiths	
Wagon Shops	Detroit & Subs
Harness Shops	Detroit & Subs.
Plumbing Shops	Detroit
Sign Shop	Detroit & Subs.
Tin Shop	Detroit & Subs.
Special Delivery and Trucking	Detroit (Main)
Branch Trucking	
Special Trucking	

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Produced by Don Kostuch

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