ADDING BEVERAGE ALCOHOL DISTILLATION TO AN EXISTING BREWERY

Presented by Stephen Harkness, P.Eng., President, cemcorp LTD.

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HISTORY

Built by Experience, Managed with Strategy

Coming of a Coppersmith

The history of the company known today as cemcor Ltd., goes back to 1853, when an Englishman Henry Gough Booth, a fruiter and coppersmith, opened Booth & Sons, at 218 Yonge St., Toronto, Canada. He had learned his trade in Newcastle, England and was an experienced craftsman by the time he emigrated. His second son George Booth who was apprenticed as a coppersmith to his father, took over the business in 1870. The first task with the present company was foisted upon him when William Conder Sr. started his apprenticeship with the Booths in the same year.

The Business Grows

The Booths' business steadily expanded in every conceivable article of brass and copper work that could be manufactured, including copper steam, brewery kettles, stills, conductioners, pots, kettles, water systems, wash boilers, and food service equipment for hotels.

William Conder Sr. soon became a master. With his practical knowledge and ability to supervise others, it seemed natural that he would start his business for himself which he did in 1886 with a fellow coppersmith to found the Conder & Campbell Co. The Booth & Conder companies merged in 1901 when George Booth as President and William Conder Sr. as Vice President of the new firm. At this time William Conder Sr.'s sons, William C. Conder and Albert E. Conder were fully involved in the family business. The merger rounded out the new firm's field of operations by providing a brass foundry, stamping, machine shop and stamping press operations. With the outbreak of World War I, the Booth Conder company set up a munitions department and Canada's first electrolytic plating plant. In 1923, the Conder Smith bought out the Booth family. George Booth moved to Michigan to expand the Cranbrook Institute of Fine Arts that he had founded in 1897 and which is highly distinguished still today. The company became known as Conder Copper & Brass Co. Ltd.

Conders in Command

Following World War I, the company converted the munitions department into the rapidly growing area of automotive parts manufacturing. This science of metalworking was used in aircraft in great strides and the company moved into manufacturing many products with these new alloys, such as moly, stainless steel, inconel. The initial business started by Henry Gough Booth of Coppersmithing had evolved into every business of metalworking all rolled into one. And so with other developments - branches, like the branches of a bamboo tree, had grown into independent ranks.

In 1931 William C. Conder took over as President, joined by his sons Howard and Warren R. Conder. The company was divided between the two brothers. Albert left to start his own automotive parts manufacturing business in competition to Conder Copper & Brass. In 1956 Warren R. Conder took over as President and later was joined by his 2 sons, Terry and Mc. J.A. Conder. In 1976, Michael A. Conder took over as President and the company was again divided as Terry Conder left to carry on the Swimming Pool and Accessories (pumps, filters) business that the company had started in 1959.

Throughout all this time, the brass, copper, brass, and copper products and chemicals that were manufacturing business remained the core of the business. The company could now design, manufacture, install, commission and service whole plants with modern technology in these industries, producing brass, copper, ferronickel, distillation towers, and heat exchangers, evaporators, industrial mixing kettles, reactors and a wide range of custom fabricated, boilers, pressure vessels to International Codes and Standards.

cemcor

The Conder Copper & Brass company continued until 1981 when it merged with another fabricator who was later acquired by a larger American multinational company. In 1984, Michael A. Conder decided to sell off manufacturing capabilities to focus solely on the engineering and project management aspects of the business and joined cemcor ltd. CONSULTING ENGINEERS. This realignment, together with the retaining and acquiring of a select core of international experts, and the building of strategic alliances with fabricators and contractors, has given cemcor a flexibility unmatched anywhere in the industry. Today, cemcor provides a unique Project Management Consulting Engineering service to the Industrial Process industries.
DIFFERENCES
BREWERY VS. DISTILLERY

1. NOMENCLATURE/TERMINOLOGY
2. RAW MATERIAL
3. MASHING/COOKING
4. FERMENTATION PROCESS
5. DISTILLATION PROCESS
6. FINAL PRODUCT
7. BUILDING DESIGN
8. LICENSING REQUIREMENTS
1. NOMENCLATURE PROOF STRENGTH

U.S. DEFINITION: 1 PROOF = 0.5% A/V
i.e. 200 PROOF = 100% A/V

BRITISH DEFINITION: 100 PROOF = 57.06% A/V
i.e. 175.25 PROOF = 100% A/V

METRIC DEFINITION: 1°GL (GAY LUSSAC) = 1% A/V
i.e. 100°GL = 100% a/v
1. NOMENCLATURE

- BREWERS MEASURE VOLUMES IN HECTOLITRES
  1 HL = 0.85 US Barrels = 0.61 UK Barrels (BBL)
  DISTILLERS MEASURE VOLUMES IN LAA (LITRES ABSOLUTE ALCOHOL) OR PROOF GALLONS

- CANADIAN CASE OF BEER IS 24 BOTTLES 341 ml
  CASE OF LIQUOR IS 12 BOTTLES 750 ml

- CANADIAN BREWERS STATE STRENGTH AS %A/V
  (AMERICAN BREWERS STATE STRENGTH AS %A/W)
  DISTILLERS STATE STRENGTH AS % OF LAA

- REFLUX, DEPHLEGOMATOR, DOWNPIPE, WEIR, CONGENERS
2. RAW MATERIAL

WHISKY/WHISKEY, including CANADIAN WHISKY, AMERICAN WHISKEY & BOURBON
   – CORN, RYE, MALT

SCOTCH WHISKY AND IRISH WHISKEY
   – MALT

RUM
   – MOLASSES OR CANE JUICE
VODKA
   – ANY STARCH OR SUGAR

GRAPPA, LIQUEURS, BRANDIES SNAPPS
   - FRUIT
3. MASHING/COOKING

1. BATCH COOKERS

2. CONTINUOUS COLUMNAR COOKERS

3. U-TUBE CONTINUOUS JET COOKERS

4. EXTRUDERS
4. FERMENTATION

BREWERIES
FERMENT 5 – 20 DAYS @ 12°C. – 20°C.
@ 3% – 9% A/V

DISTILLERIES
FERMENT 54-72 HRS @ 32°C. - 34°C.
@ 8% – 16% A/V
5. DISTILLATION SYSTEMS

1. BATCH STILLS
   SIMPLE BATCH KETTLE W/ COLUMN(S)

2. CONTINUOUS STILLS
SIMPLE POT STILL

- GIN
- MALT WHISKY
- SCOTCH WHISKY
- IRISH WHISKEY
- TEQUILA
- RUM
- PISCO
ALAMBIC POT STILL
GRAPPA, BRANDY, COGNAC, ARMAGNAC

KETTLE WITH COLUMN
BOURBON, AMERICAN WHISKEY, HEAVY RUM, LIQUEURS
Multiple Batch Kettles (Stills) with Columns
5. DISTILLATION SYSTEMS

2. CONTINUOUS STILLS

W/SIEVE TRAYS

W/BUBBLE CAP TRAYS

W/PACKING
CONTINUOUS STILL

- GRAIN ALCOHOL
- VODKA
- GRAIN WHISKEY
- BOURBON
- CANADIAN WHISKY
- IRISH WHISKEY
SIMPLE DISTILLATION

- Condenser
- Alcohol/water vapor
- Product
- Reflux
- Liquid
- Vapor
- Still pot
- Beer
- Heat
Series of Interconnected Pot Stills

CROSS SECTION OF BUBBLE TOWER WITH SINGLE CROSS-FLOW TRAYS

FEED

STEAM

WASTE

SERIES OF INTERCONNECTED POT STILLS

ILLUSTRATION #15
PCflow® control of 3 column ENA Distillation System

Beer Column
Extractive Column
Rectifier Column
6. FINAL PRODUCT

**BEER IS 0.5% - 8.0% A/V**

**DISTILLED SPIRITS ARE DISTILLED TO:**

- **WHISKY/WHISKEY** 70% - 94% A/V
- **GIN** 80% A/V
- **RUM** 70% - 94% A/V
- **VODKA (NEUTRAL SPIRIT)** 96% A/V
- **BOURBON** 80% A/V MAX
- **BRANDY, COGNAC** 70% A/V
### 7. BUILDING DESIGN

#### ALCOHOL CLASSIFICATION CHART

<table>
<thead>
<tr>
<th>CHARACTERISTICS</th>
<th>CLASSIFICATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>20% ALCOHOL AND GREATER WITH CLOSED CUP FLASH POINT &lt; 38°C</td>
<td>CLASS 1B FLAMMABLE LIQUID</td>
</tr>
<tr>
<td>6% - 20% ALCOHOL WITH CLOSED CUP FLASH POINT &gt;38°C AND &lt; 60°C</td>
<td>CLASS II COMBUSTIBLE LIQUID</td>
</tr>
<tr>
<td>0 – 6% ALCOHOL WITH CLOSED CUP FLASH POINT 60°C AND &lt;93°C</td>
<td>CLASS III COMBUSTIBLE LIQUID</td>
</tr>
</tbody>
</table>
7. BUILDING DESIGN

- CLASS 1 DIV 1 ELECTRICAL WHERE ALCOHOL STRENGTH 20% A/V OR MORE (STILLHOUSE, ALCOHOL STORAGE).

- FIRE CODE SECTION 4 PART 9 APPLIES WHERE >20% A/V.

- CLASS 1 DIV 2 ELECTRICAL IN WAREHOUSE AND XP OR PNEUMATIC PACKAGING UP TO FILLED BOTTLES.

- NO FLOOR DRAINS TO SEWER IN THESE AREAS.
7. BUILDING DESIGN

- LEL “SNIFFER” IN STILLHOUSE INTERLOOCKED TO XP CEILING FAN.
- 4 HOUR FIREWALL SEPARATION FROM MAIN PLANT.
- NFPA 68 CODE (EXPLOSION VENTING) WHERE >20% A/V.
- SPRINKLER DELUGE SYSTEM, W/SPRAY UNDER ALCOHOL STORAGE TANKS.
8. LCBO LICENCING

(DIFFERENT LICENCES THAN BREWERY LICENCES)

1. LCBO

2. CRA EXCISE

3. AGCO (IF RETAIL STORE, 3173 APPLIES)
8. LCBO LICENCING

AGCO 3173

- MUST HAVE CRA MANUFACTURING LICENCE
- RETAIL STORE MUST BE ON SAME PROPERTY AS DISTILLERY
- SPIRITS SOLD MUST BE BRANDS OWNED BY MFR.
- MINIMUM BATCH STILL CAPACITY OF 5,000 LITRES OR MINIMUM CONTINUOUS STILL CAPACITY OF 150 LAA/HR.
- MFR. MUST MAKE AT PRODUCTION SITE FROM START TO FINISH 50% OF VOLUME OF SPIRITS SOLD AT RETAIL STORE
- REMAINING 50% MUST BE DISTILLED, BLENDED, AGED OR BOTTLED AT PRODUCTION SITE.

PLANNING STEPS

1. PREPARE CONCEPTUAL DESIGN

2. CONDUCT MARKET STUDY TO DETERMINE CAPACITY, PRODUCTS

3. FEASIBILITY STUDY (CAPITAL & OPERATING COSTS, BUILDING CODE, LICENCING, TECHNOLOGY)

4. PROJECT JUSTIFICATION (CHECK FEASIBILITY STUDY ASSUMPTIONS)
PLANNING STEPS

5. FINANCING

6. PROJECT PLANNING (EPCM?)

7. CONSTRUCTION/IMPLEMENTATION

8. FINAL INSPECTION/TESTING/LCBO APPROVALS

9. COMMISSIONING, STARTUP, OPERATION MANAGEMENT
Key Message

1. UNDERSTAND THE DIFFERENCE
2. THOROUGH PLANNING
3. GET PROFESSIONAL HELP
Thank you for your attention

Any Questions?
ADDITIONAL INFORMATION

Contact: Stephen Harkness or Michael Coulter at cemcorp LTD

2181 Dunwin Drive, Mississauga, Ontario L5L 1X2

TEL: (905) 566-7227 or TOLL FREE: 1-888-6PC-BREW

Email: cemcorp@cemcorp.com www.cemcorp.com
ADDITIONAL PLANNING STEPS

GO TO CEMCORP.COM/ARTICLES FOR FULL DETAILS

BUILDING A MICROBREWERY OR BREWPUB
WHAT THEY DO

Cemcorp of Mississauga, Ontario, designs projects and the process, and coupled with the company’s history as a fabricator and contractor, brings a single source responsibility that gives its clients more flexibility to have direct input in the design and implementation of a project. If you want a brewery or distillery built, here’s what they can do for you:

- **BREWTERIES**: Cemcorp Ltd. specializes in complete plant designs, from Brewpubs to Microbreweries and large commercial breweries, including: Grain Receiving and Milling; Brewhouses, including liquefaction, lautering, brewing; Fermentation, Unitanks, Yeast Propagation, Ageing & Storage; Filtration, CO2 collection/addition; Refrigeration systems design; **PCbrew**®, PC-computer control systems including hardware and software based on flow logic for precise control; Spent Grain handling/ dryers, batch and continuous; Water Pre-Treatment/Treatment; Effluent Treatment/Alcohol Recovery; Commissioning, Start-up, and Operator Training.

- **ALCOHOL DISTILLERIES**: Cemcorp specializes in complete plant designs for both Potable Spirits (Whiskeys, Rum, Gin, Vodka, Liqueurs) and Industrial Alcohols (Fuel, Chemical) including: Starch liquefaction conversion and saccharification; Fermentation, Yeast Propagation, Enzyme preparation; Sterilizers and reactors; Distillation columns and internals, batch stills and multi-column continuous, dehydrators; Evaporators and dryers, batch and continuous, mixers; **PCflow**® PC-computer control systems including hardware and software; Effluent Treatment, alcohol recovery; Water Pre-treatment/Treatment; Cogeneration; Commissioning, Start-up; and operator training.
Continuous or Batch Distillation?

**Continuous?** or **Batch Distillation?**

Contact us if you are planning or expanding your distillery. We can provide:
- Conceptual Designs and Capital & Operating Cost Estimates for your Business Plans
- “Bankable” Economic Feasibility Studies for Investors’ and Lenders’ Financing Plans
- Design Engineering, Procurement, Construction Management, Project Management
- Detailed Distillation Designs from Pot Stills to ENA Continuous Stills
5 Generations of experience as Distillery Designers and Builders.

**cemcorp LTD.**

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Building or renovating a distillery?
Mike Coulter will git ‘er done!

by Dennis McCloskey

I had never met Michael A. Coulter until the day I walked into his office in Mississauga, Ontario, on a cold, Canadian winter afternoon in 2007. Ten seconds after entering his spacious, 2,600 sq. ft. workspace above his magnificent residence, I knew all I needed to know about this world-renowned designer of distilleries and breweries.
Blog Post

26 FEB 2014

Contract Brewing Arrangements in Ontario – Selected Legal Issues

by: Gary Gillman  |  comment: Off

Today we include in the Publications section of this website an article Gary authored called Contract Brewing – Selected Legal Considerations. The article canvases numerous legal considerations of importance to anyone who has concluded, or is thinking of concluding, an agreement whereby an operating brewery brews beer to be marketed by a non-brewing party (generally an entrepreneur) who has developed a specific brand name and marketing approach. The article reflects the expertise of Gillman Professional Corporation in the field of beverage alcohol regulatory law.

About the Author

Gary Gillman holds undergraduate law degrees in Civil Law and Common Law from McGill University in Montreal, Quebec. He is a member of the Quebec Bar and has been a member of the Ontario Bar since 1983. He was trained and practiced for many years in nationally-known law firms in Montreal and Toronto, principally in numerous areas of corporate and commercial law. In 1995, he obtained a Master’s Degree (LL.M) with Distinction in European Management and Employment law from the University of Leicester in England. His training in the law of European economic and political integration allows him to help clients understand international business and legal trends, the North American Free Trade Agreement and economic globalization. Gary regularly attends and speaks at professional conferences and keeps current on all the legal areas he covers. Gary has authored during
Continuous Column Stills
CONTINUOUS DISTILLATION

• COFFEY PATENT STILL (2 COLUMN SYSTEM)
• BARBET DISTILLATION
  – OPTIONS: 2,3,4,5 COLUMN SYSTEMS
• GUILLAUME DISTILLATION (EXTRACTIVE/AZEOTROPIC DISTILLATION)
  – OPTIONS: 2,3,4,5 COLUMN SYSTEMS
• PRESSURE/VACUUM DISTILLATION SYSTEMS
  – OPTIONS: 2,3,4,5 COLUMN SYSTEMS
• COMBINATION FERMENTATION/DISTILLATION/STILLAGE SYSTEMS
Figure 2. Congener peaks in a beer still with alcohol proof curve superimposed.
PHASE EQUILIBRIUM DIAGRAM

TEMPERATURE–COMPOSITION DIAGRAM
FOR ALCOHOL AND WATER
Series of Interconnected Pot Stills

ILLUSTRATION #15

SERIES OF INTERCONNECTED POT STILLS
VAPOR-LIQUID COMPOSITION DIAGRAM
FOR ALCOHOL-WATER MIXTURES
McCABE-THEILE DIAGRAM

- MOL FRACTION IN VAPOR

- MOL FRACTION IN LIQUID

OPERATING LINE OF RECTIFYING SECTION SLOPE=A

OPERATING LINE OF EXHAUSTING SECTION SLOPE=BC

McCABE-THEILE DIAGRAM
SECTION OF COLUMN WITH PERFORATED PLATES
Contraction of Vapors to Pass Through Perforation

ILLUSTRATION #19

PLATE

1/2" PERFORATION

LIQUID

CONTRACTION OF VAPORS AS THEY PASS THROUGH A PERFORATION
CROSS SECTION OF BUBBLE TOWER WITH SINGLE CROSS-FLOW TRAYS
Packing for Packed Columns

INTALOX SADDLE

PALL RING

RASHIG RING

BERL SADDLE
3 Column Continuous Distillation System

FROM BEER FEED PUMP

CONDENSER

PRE-HEATER DEPHLEGOMATOR

HIGH WINES

TYPICAL 3 COLUMN DISTILLATION SYSTEM.
(Valving, Controls, Utilities omitted for simplicity)

HEAT RECOVERY

BEER COLUMN (ANALYSER)

HIGH WINES TANK

STEAM

WASTE DISPOSAL

CONDENSER

SEPARATOR

EXTRACTIVE COLUMN

STEAM

CONDENSER

DEPHLEGOMATOR

HEADS 95°+

ESTERS 70-85°

95°GL. PRODUCT

95°-GL.

50-70°GL.

OILS

50-40°GL.

LOW WINES

TO CLOSED RECEIVERS

95°GL.

OILS DECANTER

RECTIFIER

C = COOLER
T = TESTER
OD = OILS DECANTER
Flammability

See also: Alcohol proof, Flash point and Fire point

Liquor that contains 40% ABV (80 US proof) will catch fire if heated to about 26 °C (79 °F) and if an ignition source is applied to it. (This is called its flash point. The flash point of pure alcohol is 16.6 °C (61.9 °F), less than average room temperature.\(^{[14]}\) The flash points of alcohol concentrations from 10% ABV to 96% ABV are:\(^{[15]}\)

- 10% — 49 °C (120 °F) — ethanol-based water solution
- 12.5% — about 52 °C (126 °F) — wine\(^{[16]}\)
- 20% — 36 °C (97 °F) — fortified wine
- 30% — 29 °C (84 °F)
- 40% — 26 °C (79 °F) — typical vodka, whisky or brandy
- 50% — 24 °C (75 °F) — strong whisky
- 60% — 22 °C (72 °F) — normal tsikoudia(called mesoraki(middle raki))
- 70% — 21 °C (70 °F) — absinthe, Slivovitz
- 80% — 20 °C (68 °F)
- 90% or more — 17 °C (63 °F) — neutral grain spirit

Beverages with low concentrations of alcohol will burn if sufficiently heated and an ignition source (such as an electronic fire) is applied. The flash point of pure alcohol is about 52 °C (126 °F).\(^{[10]}\)
# Materials Safety Data Sheet (MSDS)

## Ethanol (C₂H₅OH)

### Company Details

- **Name:** NCP Alcohols
- **Emergency Telephone No.:** +27 (21) 517 2004
- **Address:** 1213 Sea Cow Vale Road, Durban, 4001, South Africa
- **Telephone:** +27 (21) 517 1311
- **Fax:** +27 (21) 517 2147

### 1. Product and Company Identification

- **Trade Name:** Ethanol (Industrial, Absolute or Anhydrous, Rum, Light Spirits, Extra Neutral Pure, High Fructose Ethyl Alcohol, Anhydrous, Ethyl Alcohol, High Fructose Ethyl Alcohol, Pure Alcohol, Absolute Ethyl Alcohol)
- **Chemical Abstract No.:** 64-17-5
- **Chemical Name:** Ethanol
- **Chemical Family:** Alcoholic Alcohol
- **NOMS No.:** JQ 600000
- **Synonym:** Ethyl Alcohol, See Trade Name
- **UN No.:** 2359

### 2. Compositions

- **Hazardous Components:** Ethyl Alcohol (75.0 – 99.9%)
- **IEC Classification:** 200 – 570 – 6
- **RI:** All (Flammable)

### 3. Hazards Identification

- **Main Hazards:** Harmful if swallowed or inhaled. Possible aspiration hazard if inhaled. Can entangle and cause damage. May be irritating to the skin, eyes and respiratory tract. Over exposure may cause CNS depression. Possible respiratory hazard.
- **Flammability:** Flash Point: 12°C. Extremely flammable liquid (FL1). Ignition temperature 52°C.
- **Chemical Hazards:** Ethanol is a flammable liquid whose vapors can form combustible and explosive mixtures with air at certain temperatures. Thus, an explosive mixture containing 30% ethanol can produce an explosive mixture of vapor and air at 20°C, and even one containing only 6% (v/v) ethanol can produce a flammable mixture at 90°C. Ethanol reacts vigorously with a wide range of oxidizing materials and other chemicals, e.g., Bleaching Powder, Silver Nitrate, Ammonium Persulfate, Potassium Permanganate, Potassium Dihydrogen Deuterium, Sodium Hypochlorite, Hydrogen Peroxide, Oxalic Acid, Acetic Acid, Acetic Anhydride, Ethanolamines, Amines, Organic Peroxides, and Chlorine.

### 4. Fire – Fighting Measures:

- **Extinguishing Media:** Use dry chemical, alcohol foam or carbon dioxide to extinguish fire. Water may be ineffective but should be used to cool fire-exposed containers, structures and to protect personnel. If a fire or spill has not ignited, ventilate area and use water spray to disperse gas or vapour and to protect personnel attempting to stop a leak. Use water to dilute spills and to flush them away from sources of ignition. Do not flush down public sewers or into other drainage systems.

### 5. Accidental Release Measures:

- **Personal Protection:** Protective clothing should be worn to prevent excessive skin contact.
- **Environmental Protection:** Prevent liquid entering sewers. Do not allow to enter waterways, storm drains, etc.
- **Small Spills:** Take immediate steps to stop and contain the spill. Caution should be exercised regarding personnel safety and exposure to the spilled material. Eliminate all sources of ignition and wear protective clothing. Absorb small spills onto paper towels and dispose in a safe place e.g., in a flameproof container with plenty of water.
- **Large Spills:** Stop leak if you can do it without risk. Contact your local fire department. Eliminate all sources of ignition and contain material to stop until completion of clean-up procedure. Wear adequate protective equipment, use self-contained breathing apparatus in confined poorly-ventilated areas. Large quantities should be absorbed on to sand, vermiculite or an equivalent absorbent material and removed to a safe area for disposal. Flush the contaminated area with plenty of water. Incineration is the recommended method of disposal.

### Product Usage:

- If victim is conscious, give 1-2 glasses of water or milk to dilute stomach contents. If persistent vomiting occurs, or when vomiting is induced, monitor for breathing difficulty. Do not induce an unconscious or semi-conscious person vomiting. Keep affected person warm at rest. Get medical attention for substantial ingestion and/or psychiatric symptoms.
- **Product hazard:**
  - Remove the victim to fresh air. If not breathing, ensure open airway and institute cardiopulmonary resuscitation (CPR). If breathing is weak, irregular or has stopped apply artificial ventilation. Oxygen may be beneficial. Keep affected person warm and at rest. Get immediate medical attention.
Do you want to learn more?

www.distill.com
www.distilling.com
www.canadianwhisky.com
www.cemcorp.com
Also, Contact Niagara College for their new Master Distiller training program, expected to begin in 2016