A Tale of Clock Oils

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NAWCC Chapter 15
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Ken’s Clock Clinic
Clock Restorations, Vintage Dry Cells, Synchronizers
Agenda

• Short History of Oils
• Types of Oils
• 51 Years of Lubricating Clocks
• Summary and Recommendations
History of Clock Oils

- Boiled from whale blubber (16th Century)
  - Baleen, Sperm, Toothed whales
- Used for lubrication, lighting, soap
- Foul smell without hydrogenation (early 20th century)
- With hydrogenation, used for soaps and margarine
- Extremely stable
- Use declined due to alternatives and environmental concerns (early 1980s)

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Harvesting the Blubber
Whale and Sperm Oil

US Whale Oil and Sperm Oil Imports (1805-1905)

1Walter S. Tower (1907). A History of the American Whale Fishery. Table III, pg 126

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Edwin Drake 1858

- First oil strike in USA
  - Titusville, PA
- Cast iron pipe driven by steam engine
- 25 barrels per day
- Refined into Kerosene
- Alternative to Whale oil
- Refined into lubricants and fuels later
John D. Rockefeller

- Standard Oil of Ohio
- Legendary Tycoon 1870-1897
- Created oil industry by integrating:
  - Drilling, Refining, Transporting
- Cleveland, Ohio major refining area
  - Ohio, Indiana, Pennsylvania, Virginia
- 1911: Standard Oil split
  - Antitrust decision by Supreme Court
- Great philanthropier from first paycheck
The Oil Industry Prevails
(and expands)
What is oil, chemically?

- Organic, complex chains of hydrocarbons
- Oil molecule is non-polar ⇒ slippery, non miscible with water
- Generally, double bonds ⇒ reactive (more electrons!)
- Oxygen included ⇒ esters ⇒ alcohol condensed with organic acid
- Esters ⇒ Frequently synthetic
Grades of Oils

• Group I and II: Derived from crude oil

• Group III – Ultra-refined mineral oil made through hydrocracking
  • Sometimes called “synthetic” in North America (marketing)

• Group IV: True synthetic oils; Polyalphaolefin (PAO)

• Group V: Synthetic stocks other than PAO’s; include esters and other compounds
Types of Oils

- Organic
  - Plants
  - Lipids
  - Whale Oil
  - Animal Fat based oils

- Mineral
  - Name is somewhat misnomer
  - Crude oil and its refined components
  - Fossilized organic materials

- Synthetics

- Blends
  - Mixtures of the above

Clock oils can be any of the above
Synthetic Oils

• “Man Made” building blocks or Esters:
  • Group IV Polyalphaolefins
  • Group V Esters

• Fischer-Topsch process
  • Starts with CO, CO₂, Methane, etc.

• Can be molecular modifications of petroleum
  • Can also be blends of true synthetics and mineral oils

• Originally developed in Germany, WWII
  • Cut off from crude oil
Synthetic Oils

• Most commercial synthetics are blends of different building blocks, including mineral oil

• **Advantages:**
  - Better stability over time and temperature
    - e.g., resistant to sludging
  - Free of hydrocarbons, sulfur, etc contaminants found in mineral oils
  - More slippery
What do clock oils need to do?

- Provide separating film (e.g., don’t break down)
- Stay put, not run off (proper viscosity)
- 5-10 years without sludging, thickening or varnishing
- Don’t discolor brass (green, brown)
- No evaporation
- Safe with lacquers
Clock Oil Challenges

- Graham Dead beat Escapements
- Lever Escapements—especially balance cups
- Main Wheel (and second wheel) Pivots
- Escape Wheel Pivots
- Mainsprings
51 Years of Clock Oils

- 3-in-1 Machine Oil
- Horolube 9-C
- Moebius 8030, 8031, and 8040
- Etsyntha 859
- Keystone Clock Pivot Oil
- Nye Traditional and Synthetic
- Molybdenum Disulphide based oils
- “Nanolube” Diamond ball bearing oils
- “Other”
3-in-1 Household Oil

- Used in my early days for small clocks
- Spindle (mineral) oil
- Citronella oil (perfumes, insect repellant)
- Corrosion inhibitor
- Low Viscosity (runs out)
  - Foul smelling
  - Sludging—Unknown
    - Thickens over time

NO LONGER USED
Horolube 9-C

• 1970s Vintage
  + Whale-oil based
    • May have been blend
  + Very stable
  + Stays put
  + Very good results
• Non-synthetic

NO LONGER AVAILABLE
Etsyntha 859

- Most expensive oil out there
  - 3.5ml is $14.00
  - Compare to 20ml for $17.50 for Moebius
- Claimed to be “compatible” with ‘most’ plastics--Don’t believe it!
  - Melts lacquer on plates into sludge
  - Vanishes in a few years from plates

USED A FEW TIMES AND ABANDONED
Moebius 8030, 8031, 8040

- Used for about 20 years
  - At first, this was a very nice oil!
    - Probably whale oil based initially
  - Then, deteriorated over time
  - Now, pivots sludge and turn green in 3-5 years
  - Stains plates brown and green over time

WE NO LONGER USE THIS PRODUCT
Keystone Clock Pivot Oil

• Used 12 years for re-oiling
  – Somewhat thinner than ideal
• Included in our OK-1 Kit for a few years
• Seems to be mineral-oil based
  + Holds up over time
• Never observed any sludging, varnishing
• Never observed any staining
  – Tendency to run, smear if over-oiled

NO LONGER USE IN OUR KIT
Keystone Mainspring Grease

- Used 15 years for large springs in barrels
  - Comes in 3 grades; prefer “Medium”
- Not sure what’s in it
- No indication that it’s synthetic
  + Works ok but tends to run out and drip
  - Don’t like dark color
  - Sludging--Unknown

NO LONGER USE
Nye Synthetic 140B

+ Used for 10 years now
+ Claimed to be synthetic
+ For lightweight applications
  + Alarm escapements
  + Carriage clock escapements
  + Small movements
+ Still use for Telechron rotor lubrication
+ Never any sign of sludging or varnishing
  - Will run out if over oiled (too thin for large clocks)

GREAT PRODUCT STILL IN OUR SHOP!
Molybdenum Disulfide Oils, Greases

- Light lubricants with additives
- Theory is “Micro particles” add slip
  - No data available
- True advantage uncertain for clocks
- Dirty product
- Oil needs to be mixed before use
- Will contaminate cleaning solution downstream

NEVER REALIZED ANY ADVANTAGE
Butterworth’s Nanolube Clock Oil

- Another light lubricant with additives
- Genealogy of this oil unclear
  - Who did the research, and for what?
- Much smaller particles, teflon slip
- Claim is PTFE particles are polarized
  - Isn’t this anti-lubricating?
- Need to consider base lube + additive individually, then as a system
  - Base lube is runny
  - How do you qualify the system?

NO CLEAR ADVANTAGE, SOME RISK
Who is researching oils?

- WW Oil and Gas industry approaches $10 Trillion (and growing)
- WW Automotive industry north of $5 Trillion (and growing)
- Difficult for any other industry to compete
Automotive Lubricants

- Gearbox Lubricants
- Transmission Oils
- Engine Oils
Gearbox and Transmission Oils

• Sulfur additives—Bad!
  • Will react with brass

• Viscosity too heavy
  • Difficult to match to light loads in clocks
Engine Oils

• Available in broad range of viscosities

• Fully Synthetics well refined, long lasting

• No harmful additives vs. Brass, Bronze, Steel
Of Oil, Oilers and Oil Sinks
by Steve Nelson (NAWCC) pp 76-80
January-February 2014

- This article recommends using 5W40
  - We recommend 0W40 for most pivots

- His research was independent of ours

- Results and recommendations virtually identical

- We’ve added recommendation of 10W60 for:
  - Main wheels and Mainsprings (large clocks)
  - Graham Dead Beat escapements (larger clocks)
## Viscosities

<table>
<thead>
<tr>
<th>Material</th>
<th>Viscosity in Centipoise @ 70F</th>
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<tbody>
<tr>
<td>Water</td>
<td>1</td>
</tr>
<tr>
<td>Milk</td>
<td>3</td>
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<tr>
<td>Nye Clock Oil 140B</td>
<td>20</td>
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<tr>
<td>Sperm Oil</td>
<td>52</td>
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<tr>
<td>Coconut Oil</td>
<td>55</td>
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<tr>
<td>Soap Solution</td>
<td>82</td>
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<tr>
<td>Mobil 1 0W-40</td>
<td>215</td>
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<tr>
<td>Mobil 1 5W-40</td>
<td>250</td>
</tr>
<tr>
<td>Mobil 1 10W-60</td>
<td>500</td>
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<tr>
<td>Honey</td>
<td>2000</td>
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</table>

Modified from Steve Nelson’s article NAWCC Watch & Clock Jan-Feb 2014
Recommended Oiling Methodology

- Mobil 1 Synthetic 0W-40 for most pivots

- Mobil 1 Synthetic 10W-60 for:
  - Main Wheels
  - Mainsprings
  - Second Wheels
  - Graham Dead Beat Pallets

- Nye Synthetic 140B for:
  - Small pivots (<.015”)
  - Balance Cups and Pivots
  - Lever Escape Wheels
Conclusions

• Many clock oils evaporate and leave no residue
• Some can attack lacquer
• Other clock oils thicken greatly and leave green sludge or stains
• Properly selected synthetic motor oil outperforms clock oils

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Time for A Few More Tricks?

- Pendulum Crutch Pins
  - Super Lube Synthetic Grease
- Protecting Mainsprings
  - Boeshield T-9
    - 1 part with 2 parts mineral spirits
    - Also useful for quenching

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Viscosity Experiment