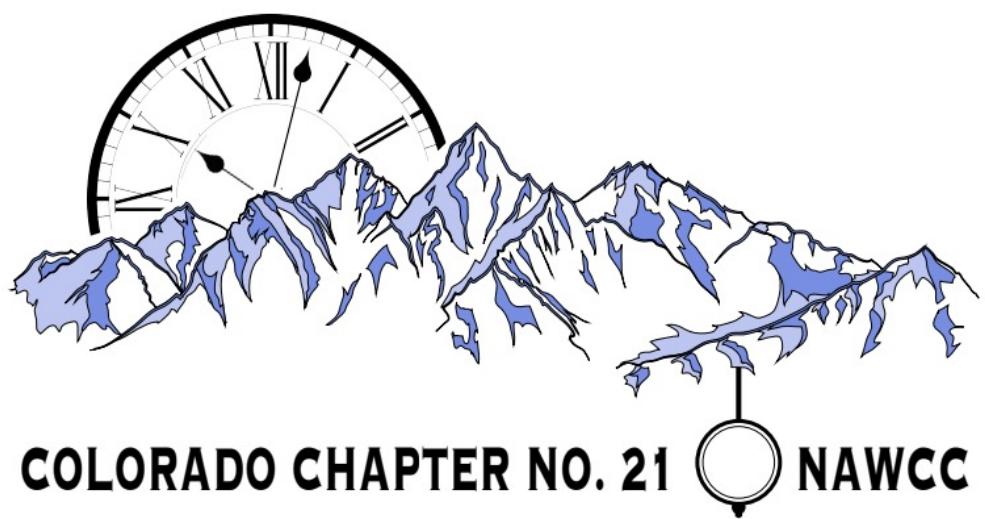


# A Tale of Clock Oils



Ken Reindel  
NAWCC Chapter 21  
April 25, 2022

# Agenda

- Short History of Oils
- Types of Oils
- 59 Years of Lubricating Clocks
- Summary and Recommendations

# Earliest Lubricants

- Early examples of Egyptian chariots found in tombs
  - Circa 1500BC
- Chariots used for:
  - Transportation
  - Military
  - Sporting
- Axle lubrication to prevent heat, wear out
  - Initially, water
  - Olive oils and fats
  - Later, waxes



Unsplash.com  
British Library

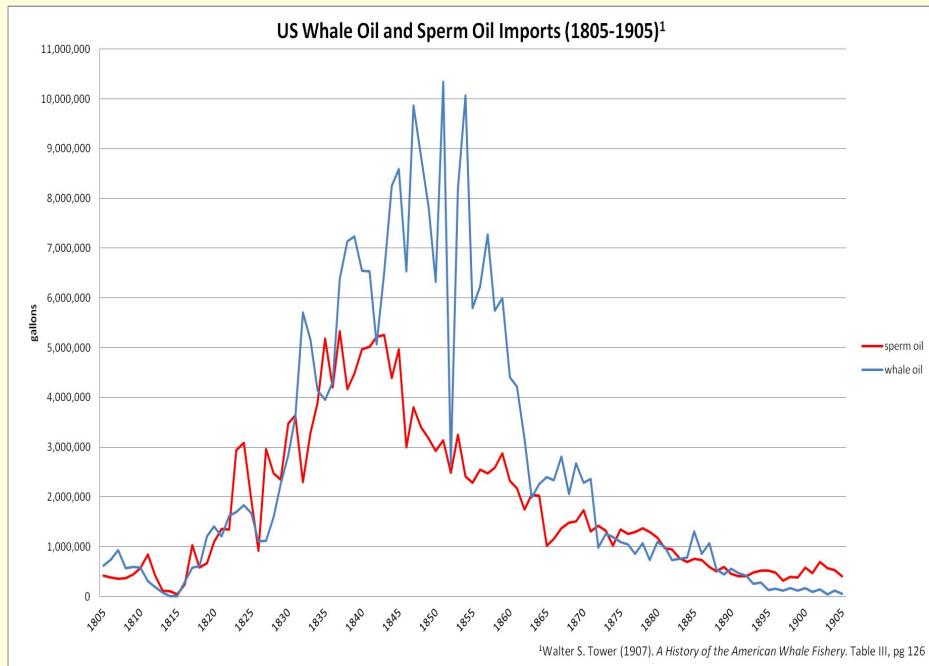
# History of Clock Oils

[https://en.wikipedia.org/wiki/Whale\\_oil](https://en.wikipedia.org/wiki/Whale_oil)



- Boiled from whale blubber (16<sup>th</sup> Century)
  - Baleen, Sperm, Bowhead and Right Species
- Used for lubrication, lighting, soap
- Foul smell without hydrogenation (early 20<sup>th</sup> century)
- With hydrogenation, used for soaps and margarine
- Extremely stable
- Use declined due to alternatives and environmental concerns (1980s moratoriums and bans)
- **Note:** Hydrogenation is oil + H<sub>2</sub>, in presence of catalyst (Pt or Ni for example). Refines certain lubricating properties of the oil.

# Whale and Sperm Oil



[https://en.wikipedia.org/wiki/Whale\\_oil](https://en.wikipedia.org/wiki/Whale_oil)

- Primary use: Lubricating machinery, heating, candle production
- What accounts for the drop off in use after 1860?

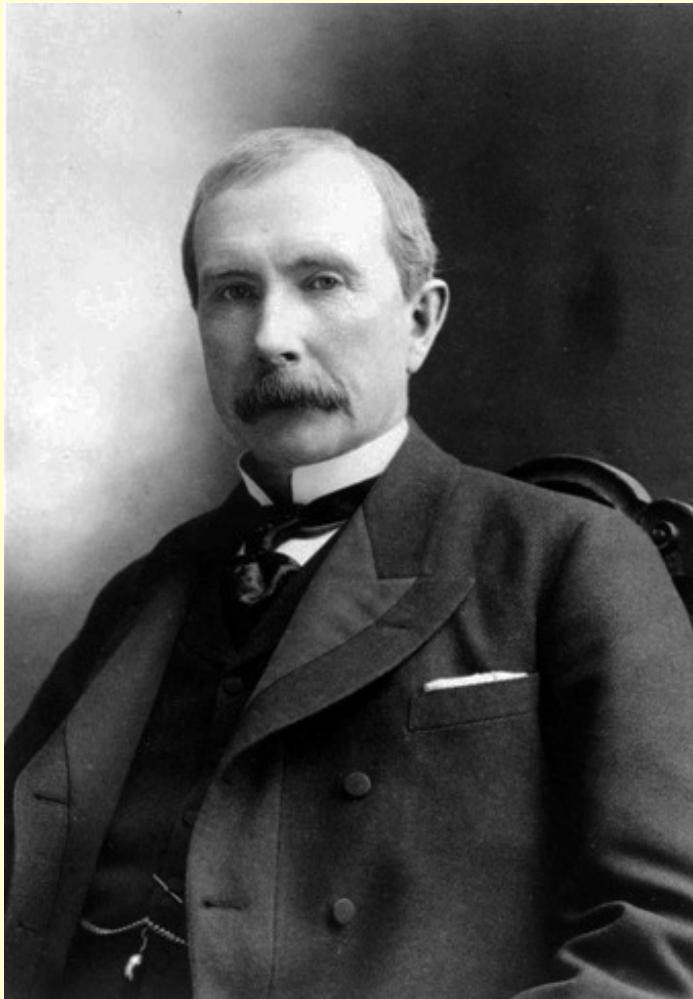
# George H. Bissell, Edwin Drake 1859



[https://en.wikipedia.org/wiki/Edwin\\_Drake](https://en.wikipedia.org/wiki/Edwin_Drake)

- Bissell bought the land
- First oil strike in USA by Drake
  - Titusville, PA
- Cast iron drill driven by steam engine—69 ft down
- 25 barrels per day
- Refined into Kerosene
- Alternative to Whale oil
- Refined into lubricants and fuels later

# John D. Rockefeller



[https://en.wikipedia.org/wiki/John\\_D.\\_Rockefeller](https://en.wikipedia.org/wiki/John_D._Rockefeller)

- One of the founders of Standard Oil of Ohio
  - Run by the legendary tycoon 1870-1897
- Created oil industry by integrating:
  - Drilling, Refining, Transporting
- Cleveland, Ohio major refining area
  - Ohio, Indiana, Pennsylvania, Virginia
- Great philanthropist from first paycheck
- Other oil strikes followed
  - Beaumont, TX (Spindletop)
  - Created competition for Standard Oil
- 1911 Supreme Court decision split Standard Oil into 34 companies
  - Creating even more wealth

# The Oil Industry Prevails (and expands)



<https://www.biography.com/inventor/elijah-mccoy>



<https://www.touring-ohio.com/trivia/service-station.html>

By 1909 US was producing more oil than the rest of the world combined!

# What is oil, chemically?

- Organic, complex chain of hydrocarbons
  - Hydrophobic (non-miscible with water)
  - Lipophilic (mixes with other oils)
- Oil molecule is non-polar
  - London Dispersion Forces
    - Lowest molecular attraction
    - Gives oil its “slippery” nature
  - Excellent insulator
- Animal, vegetable, or petrochemical



unsplash.com  
by Fulvio Cicollo

# 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 (Polyalphaolefin PAO)
- Blends
  - Mixtures of the above
  - PTFE and other additives to improve slip



Clock oils can be any of the above

# Synthetic Oils

<https://www.machinerylubrication.com/synthetic-oil-31800>

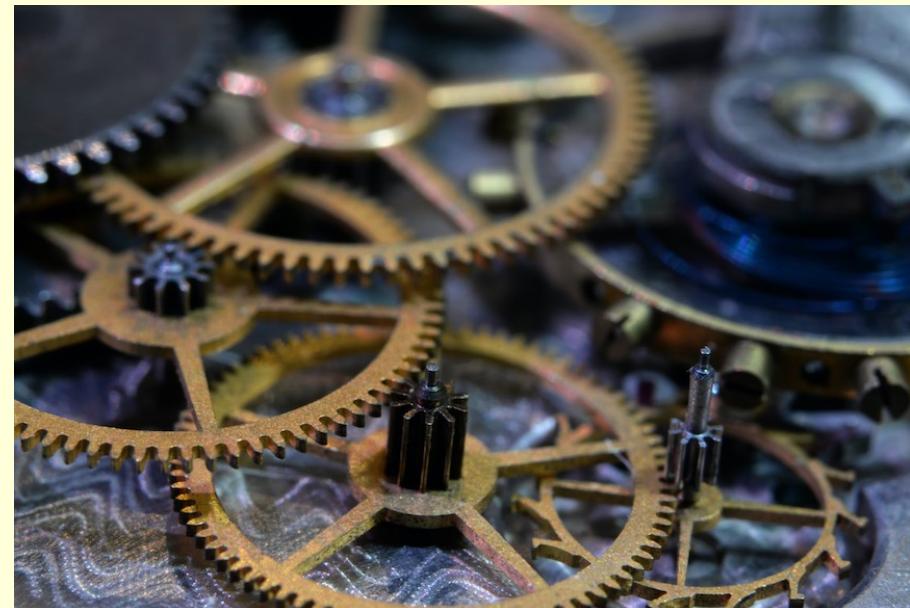
- Most commercial synthetics result from decomposing petroleum molecules and re-engineering them
- Resulting structure is referred to as a Polyalphaolefin (PAO)
- **Advantages:**
  - Better stability over time and temperature
    - e.g., resistant to sludging
  - Free of hydrocarbons, sulfur contaminants found in mineral oils
  - Molecular homogeneity (same sizes and structures)
  - More slippery



# What do clock oils need to do?

Ken's observations

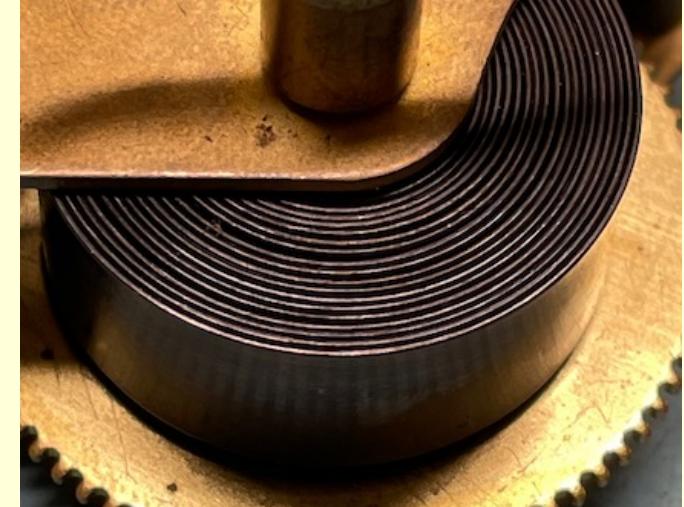
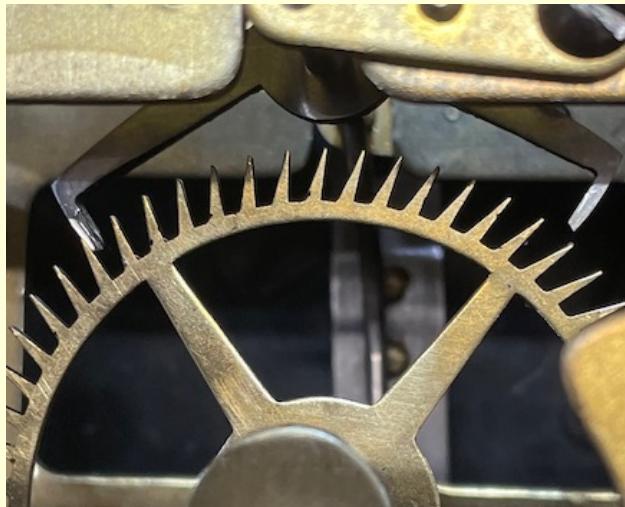
- Provide separating film (eg, don't break down under load)
- Stay put, not run off (proper viscosity)
- 5-10 years without sludging, thickening or varnishing
- Don't discolor or etch brass (green, brown)
- No evaporation
- Hold out moisture
- Safe with lacquers



unsplash.com  
by Laura Ockel

# Clock Oil Challenges

- Graham Dead beat Escapements
- Lever Escapements—especially balance cups
- Main Wheel (and second wheel) Pivots
- Balance wheel, pallet pivots
- Mainsprings



# 59 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
- Moebius Synt-a-Lube Watch Oil
- Molybdenum Disulphide based oils
- “Nanolube” Diamond ball bearing oils
- “Other”

# 3-in-1 Household Oil

- Used in my early days for small clocks
- Hydrogenated Napthenic (mineral) oil
  - Citronella oil (perfumes, insect repellant)
  - Petroleum distillates (2%)
  - Napthenics outmoded today for lubrication
- Corrosion inhibitor
- Low Viscosity (runs out)
- Foul smelling
- Sludging—Thickens, sticky over time

**NO LONGER USED**



# Horolube 9-C

- 1970s Vintage
  - + Possibly whale-oil based
    - May have been blend
  - + Very stable
  - + Stayed put
  - + Very good results
  - Non-synthetic



## NO LONGER AVAILABLE

# Moebius 8030, 8031, 8040

- Used for about 20 years
- Manufacturer states 2 year shelf life (??)
- + At first (1980's), this was a very nice oil!
  - Possibly whale oil based initially?
  - Then, deteriorated over time
  - Now, pivots sludge and turn green in 3-5 years
  - Stains, etches 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
  - Acceptable results generally
- Included in our OK-1 Kit for a few years
- Seems to be mineral-oil based
  - + Holds up over time
  - Never *observed* any sludge, varnish
  - Never *observed* any staining
  - Tendency to run, smear if over-oiled
  - Who makes it and what's in it?
  - + Genealogy unknown, but works fine



## OTHER LIGHT OILS AVAILABLE

# Etsyntha 859

- Most expensive oil out there
  - 3.5ml is \$14.50
  - Compare to 20ml for \$17.50 for Moebius
- Claimed to be “compatible” with ‘most’ plastics—or is it?
  - Melts lacquer on plates into sludge
- Vanishes in a few years from plates



**USED A FEW TIMES AND DISSATISFIED**

# Keystone Mainspring Grease

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

**NO LONGER USE**



# Nye Synthetic 140B

- + Used for 20 years now
- + Claimed to be synthetic
- + For lightweight applications
  - + Alarm escapements
  - + Carriage clock escapements
  - + Small movements
- + Still use for small 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 SHOP**

# Moebius Synt-a-Lube Watch Oil

- Currently experimenting and evaluating
- Good results with small lever escapements and jeweled platforms
- Outlasts other watch oils
  - None of the problems experienced with Moebius 8030
- Shelf life 6 years
- Synta-Visco-Lube
  - For larger watches or platform escapements
  - Have not tried this formulation
  - Colleagues reporting good results



[esslinger.com](http://esslinger.com)

# Molybdenum Disulfide Oils, Greases

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



**NEVER REALIZED MAJOR ADVANTAGE**

# Nanolube Clock Oils

Note: We have NOT used these products

- Another light lubricant with additives?
- Genealogy of this oil unclear
  - Who did the research, and for what?
  - Why are some clear and others black/dirty?
- Nanometer-sized particles, Teflon-like slip claimed
- Need to consider base lube + additive individually, then as system
  - Base lube is runny—what's in it?
  - Some report that the base lube tends to disappear over time
  - What is the solid material used for slip and where did it come from?
  - How do you qualify the system?
- Some concern expressed over nano particles
  - Are they more like rouge (diamond) or more like spheres (Fullerenes)?
  - Do these spheres break up or remain intact over time?
  - At what diameter do these spheres become too small to do any good?
- Initial reports were positive, but no follow up found
  - Cannot buy Butterworth's at Timesavers or Merritts today
  - Some respected colleagues report pivot corrosion
- Differences between Butterworth? St. Claire? Quicken?

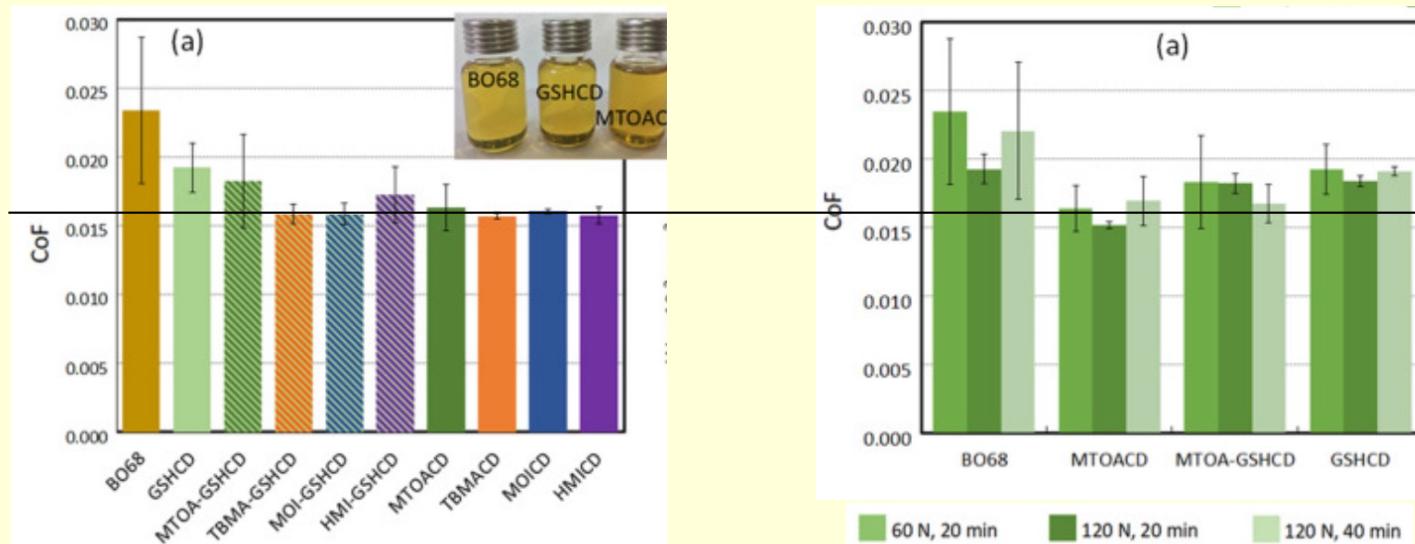
**NO CONCLUSIVE RESULTS TO REPORT**

**USE AT YOUR OWN RISK (or benefit)**



# Nano Lubricants--More

- Excellent study in JIEC (Journal of Industrial and Engineering Chemistry)
  - <https://www.sciencedirect.com/science/article/pii/S1226086X20301611>
- Nine different nanoparticle formulations tried
- Results mixed—10-60% initial improvement in Coefficient of Friction (CoF)
- Under load and time, improvement deteriorated in all formulations vs. base lube
- ***Again, difficult to draw any strong conclusions***
  - ***More development effort needed***



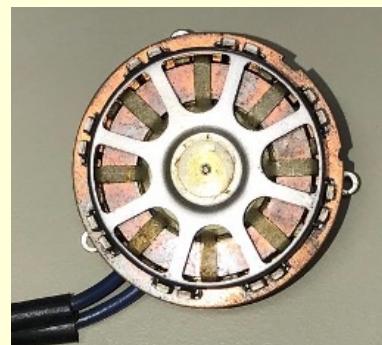
# Super Lube Oils

Primarily used on electric clock motors

- Lightweight Synthetic Oil without Teflon is impressive
  - Viscosity higher than 140B
  - Long lasting when used on clock motors
  - Holds up well under heat
  - Manufacturer specifies 5 year shelf life (can be used beyond that)
  - Works well as Telechron B-rotor lube
- Lube with Teflon seems effective
  - Can use to reduce Super Lube Grease viscosity
  - Use to oil electric clock motors
  - Don't like that it curdles—need to mix before use



[telechronclock.com](http://telechronclock.com)

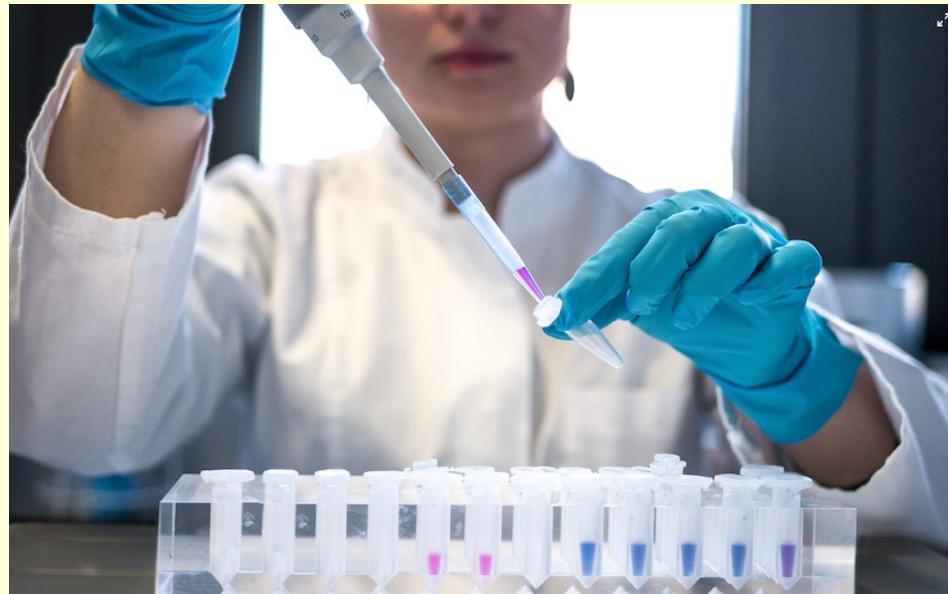


Ken's Clock Clinic  
Clock Restorations, Vintage Dry Cells, Synchronizers



# Who is researching oils?

- WW Oil and Gas industry approaches \$10 Trillion (and growing)
- WW Automotive lubricants industry north of \$70B (and growing)
- Difficult for any other industry to compete with research effort



unsplash.com  
by Julia Koblitz

# 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



Ken's Clock Clinic  
Clock Restorations, Vintage Dry Cells, Synchronizers

# Synthetic Engine Oils

- Available in broad range of viscosities
- Fully Synthetics well refined, long lasting
- No harmful additives vs. Brass, Bronze, Copper, 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)

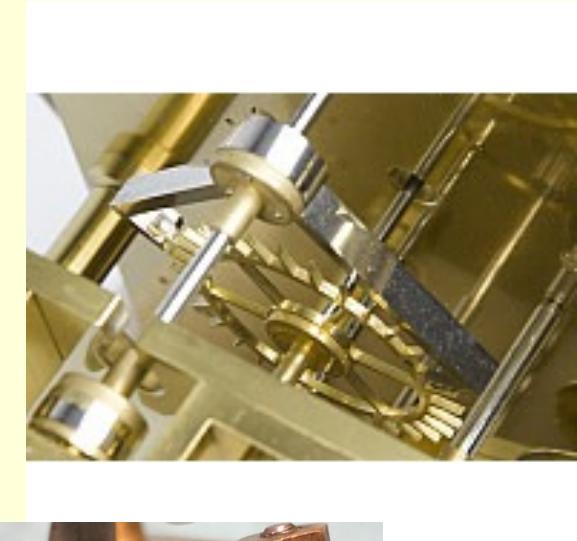
# Observed Benefits of Engine Oils for lubricating clocks

- Clocks coming back 5 years later:
  - Oil sinks are bright and clean, very little wear
  - Golden, wet oil still present
  - No corrosion
  - Oil has stay put
- Contrast to clock oils where:
  - Corrosion or green stains in oil sinks
  - Oil has run down plate, leaving a line of corrosion
  - No wet oil to be found



# Recommended Oiling Methodology

- Mobil 1 Synthetic 0W-40 for most pivots
- Castrol 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



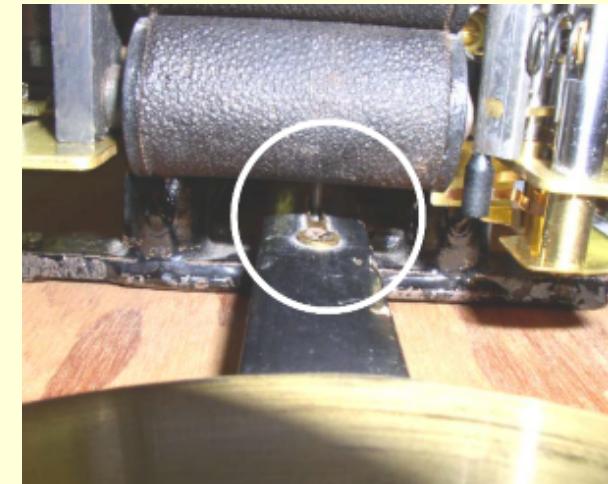
# Conclusions

- Many clock oils evaporate and leave no lubrication
- Some can attack lacquer
- Other clock oils thicken greatly and leave green sludge or stains
- Properly selected synthetic motor oil outperforms clock oils
  - Corroborated with colleagues also reporting excellent long term results



# 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



# Future Investigations

- 0W8 or 0W16:
  - Rotors?
  - Small escapement components?
  - How does viscosity compare in cP?
- Follow up on Moebius Synt-a-Lube
  - Colleagues report good results with Synta-Visco Lube
- Follow up on Super Lube grease

# Thank you!!