



Liberty Distributors

Making Something from Nothing, DIY

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Rolls-Royce Heritage Trust – Allison Branch

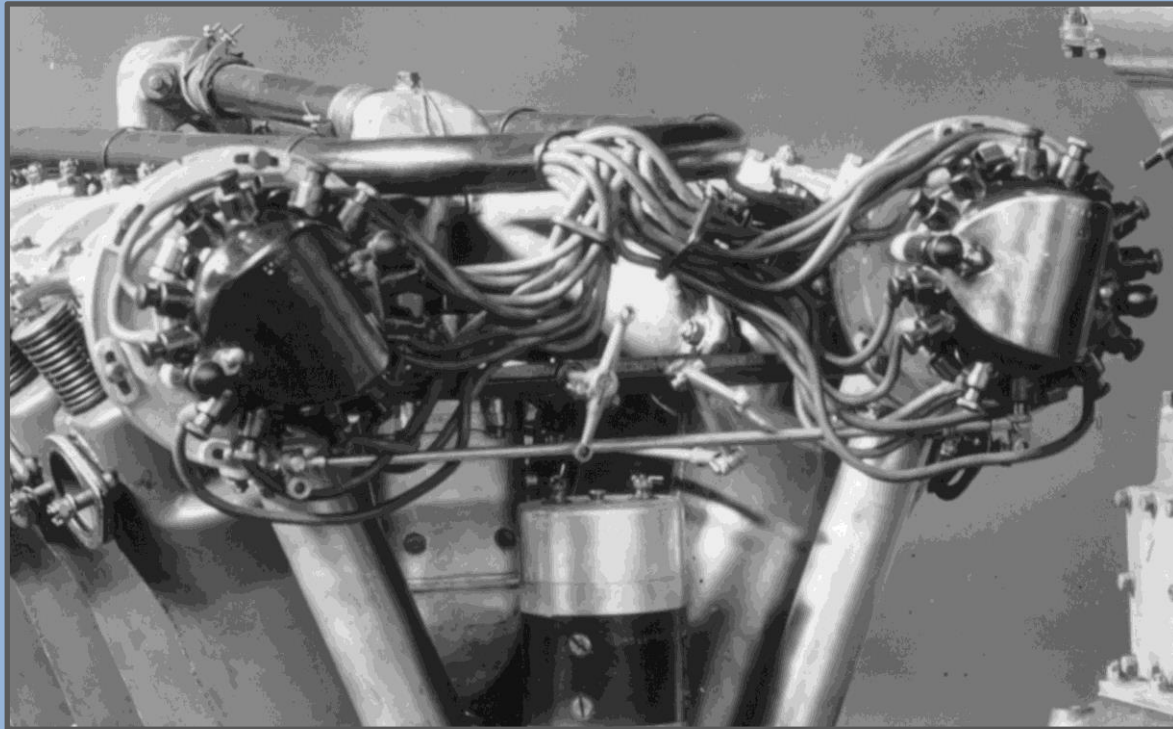
Liberty Engine at Rolls-Royce Heritage Trust – Allison Branch ²

- Packard No. 2501 built August 15, 1918
- US Navy engine per data plate and includes a Navy hand crank starter
- Modified per standard field directives.
- Service history unknown
- Purchased by Allison from Old Reinbeck Aerodrome in the mid 1980.
- Disassembled, cleaned, painted for museum display.

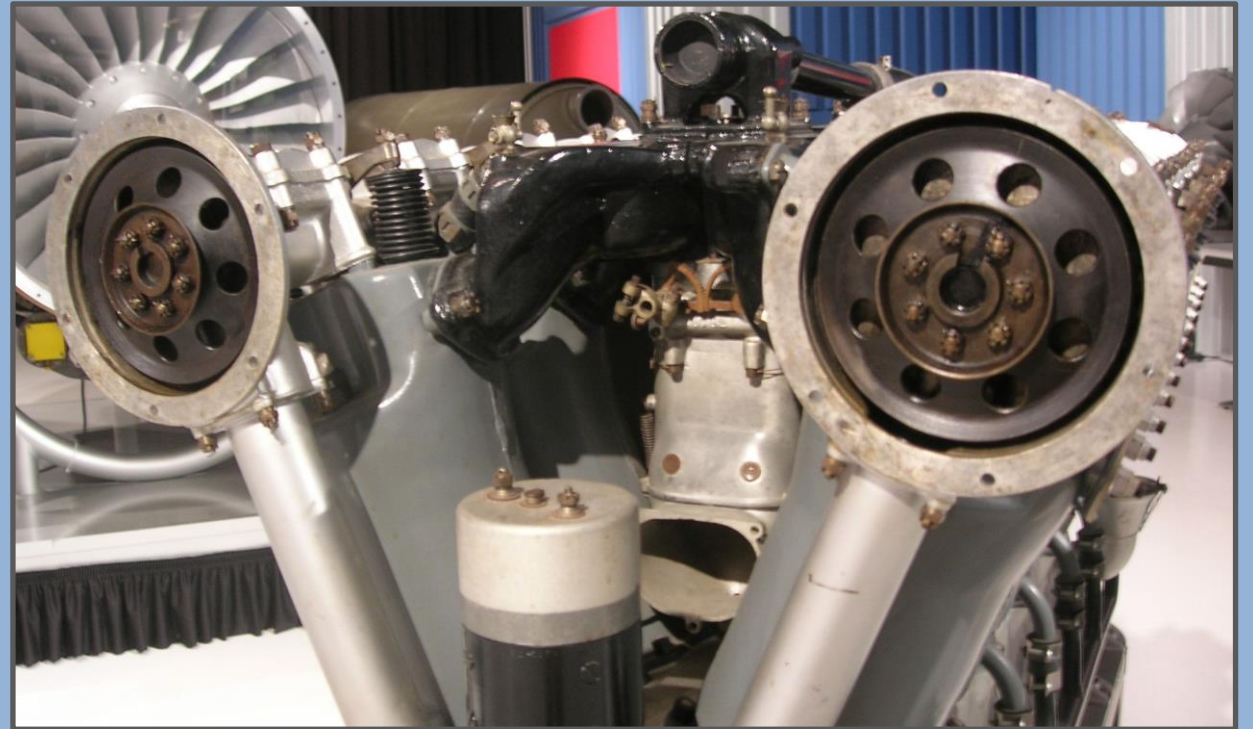


Liberty Engine Aft View

3



Typical Liberty Aft View
with ignition system



RRHT-AB's Liberty Circa 2008
without an ignition System

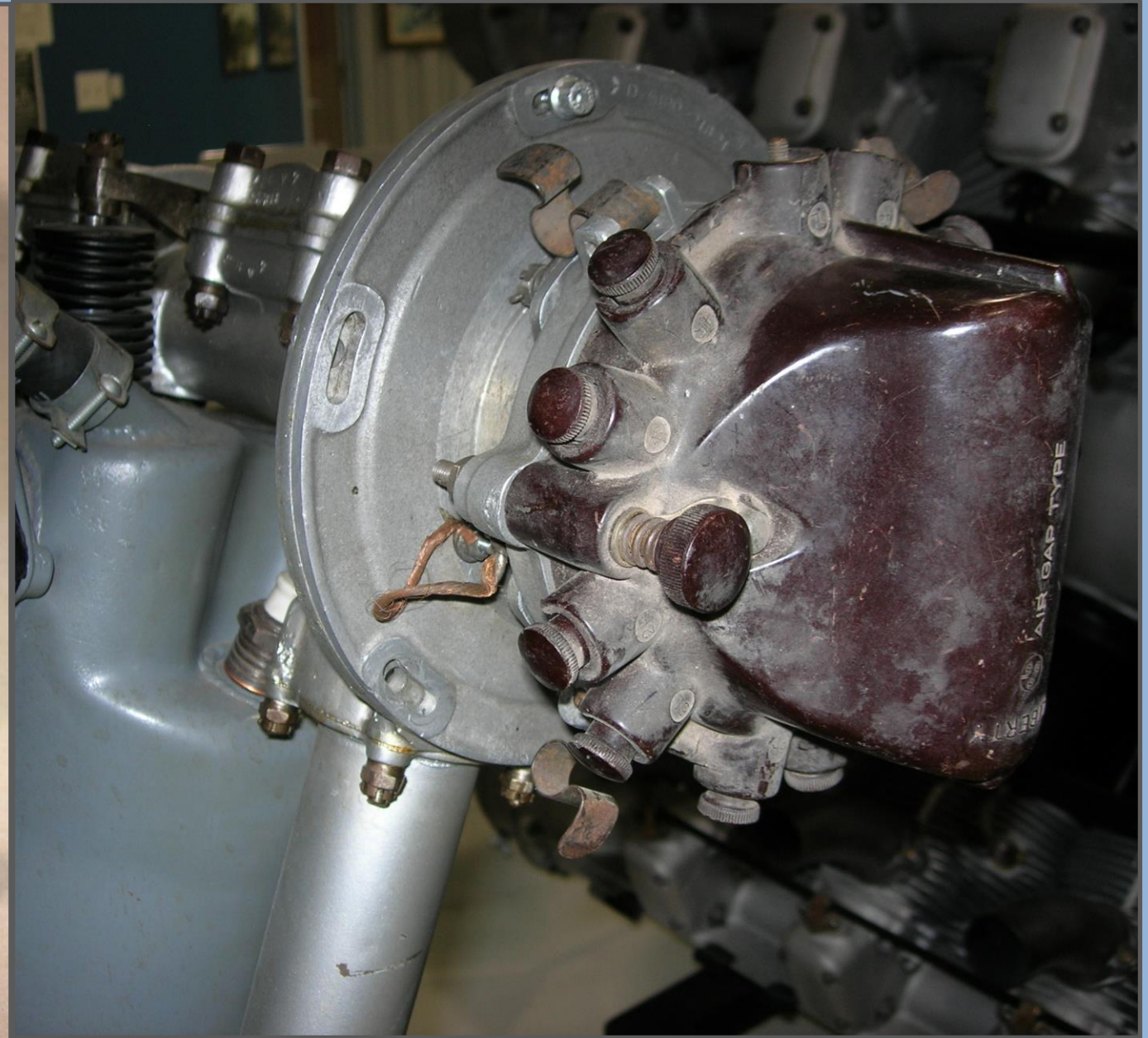
Missing:

- Both distributors
- **15** of 24 AC Titan sparkplugs
- Spark plug wires and connectors
- Sparkplug wire distribution tube
- Spark advance coordinating link
- Throttle and mixture linkage

Options to Obtain Liberty Ignition System ⁴

- US Government Inventory – Liquidated long ago
- Buy parts or get them donated for a 501c3 tax deduction:
 - Very few spare parts available
 - No one willing to donate any spare distributors
 - RRHT-AB Museum funds not available
- Solution:
 - Mark Smith of Century Aviation was willing to loan RRHT an off the shelf spare distributor.
 - R-R Engineering had a 3D printer for small part prototyping
 - Copy the loaned distributor and make non-functional display replica distributors.

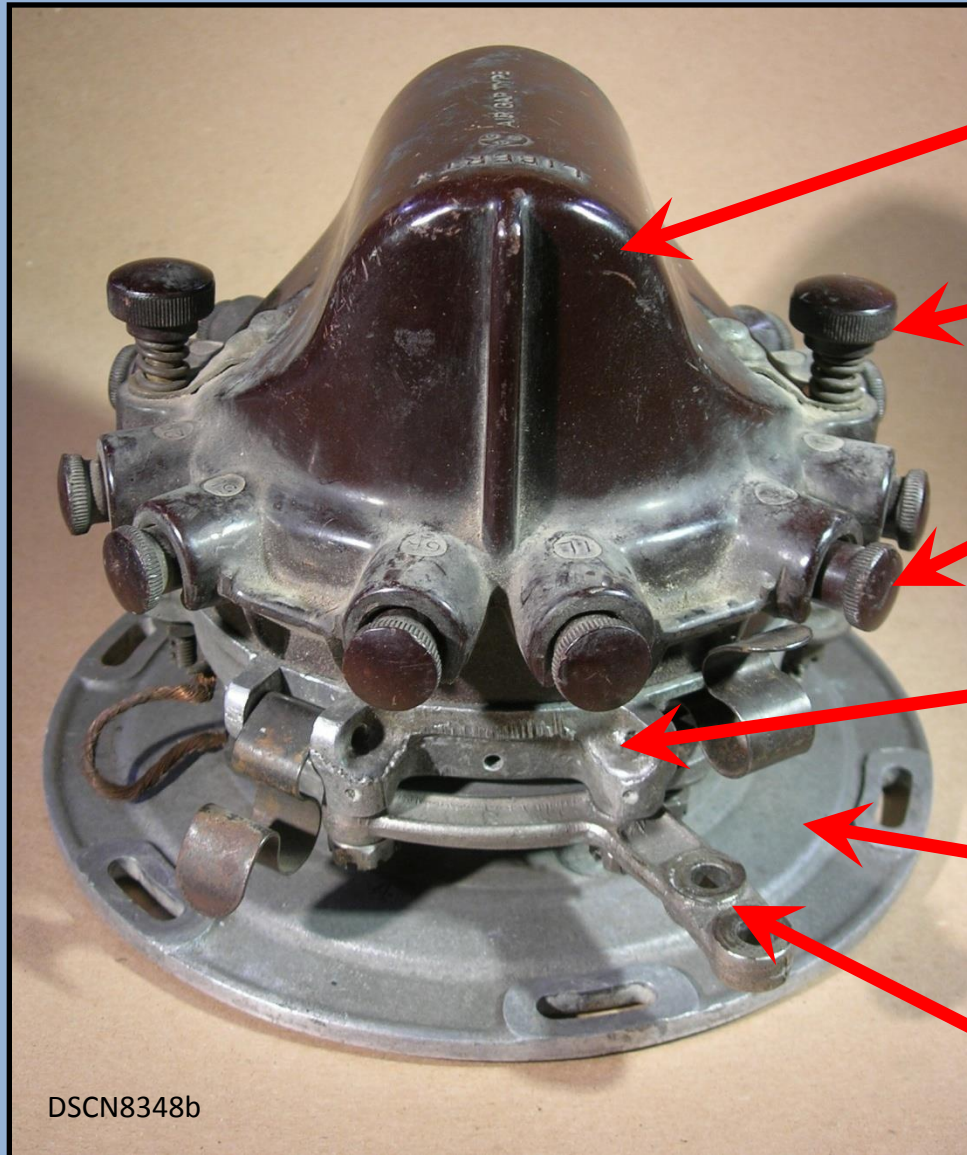
Loaned Liberty Distributor



Replication Goal

- **Non functional display only -- no internal parts.**
- **All visible parts would be replicated.**
- **The distributor spark advance would function.**
- **The two distributors spark advance would be linked to move in unison.**
- **At a 5 foot viewing distance, a typical viewer would not detect the distributor was a replica.**

Initial Plan of Parts to Replicate by 3D Printing



Head (Distributor Cap): Bakelite (1)

Low Tension Terminal Nut: Bakelite (2)

High Tension Terminal Nut: Bakelite (12)

Cup Assembly: Aluminum (1)

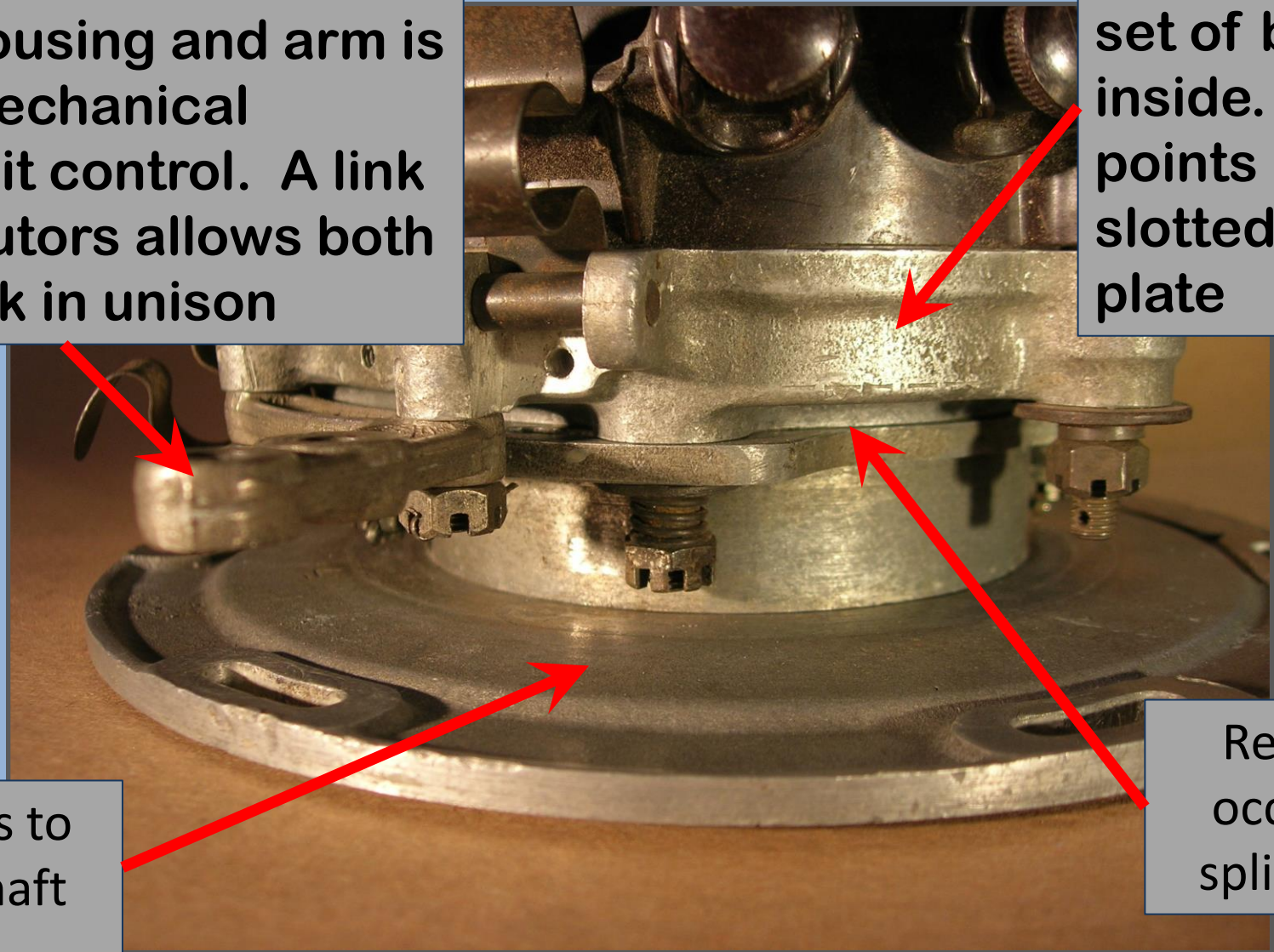
Adaptor Base: Aluminum (1)

Spark Advance Coordinating Lever: Steel (1)

Liberty Spark Advance Function

Spark Advance Lever Arm: Bolted to Cup housing and arm is connected by mechanical linkage to cockpit control. A link between distributors allows both to advance spark in unison

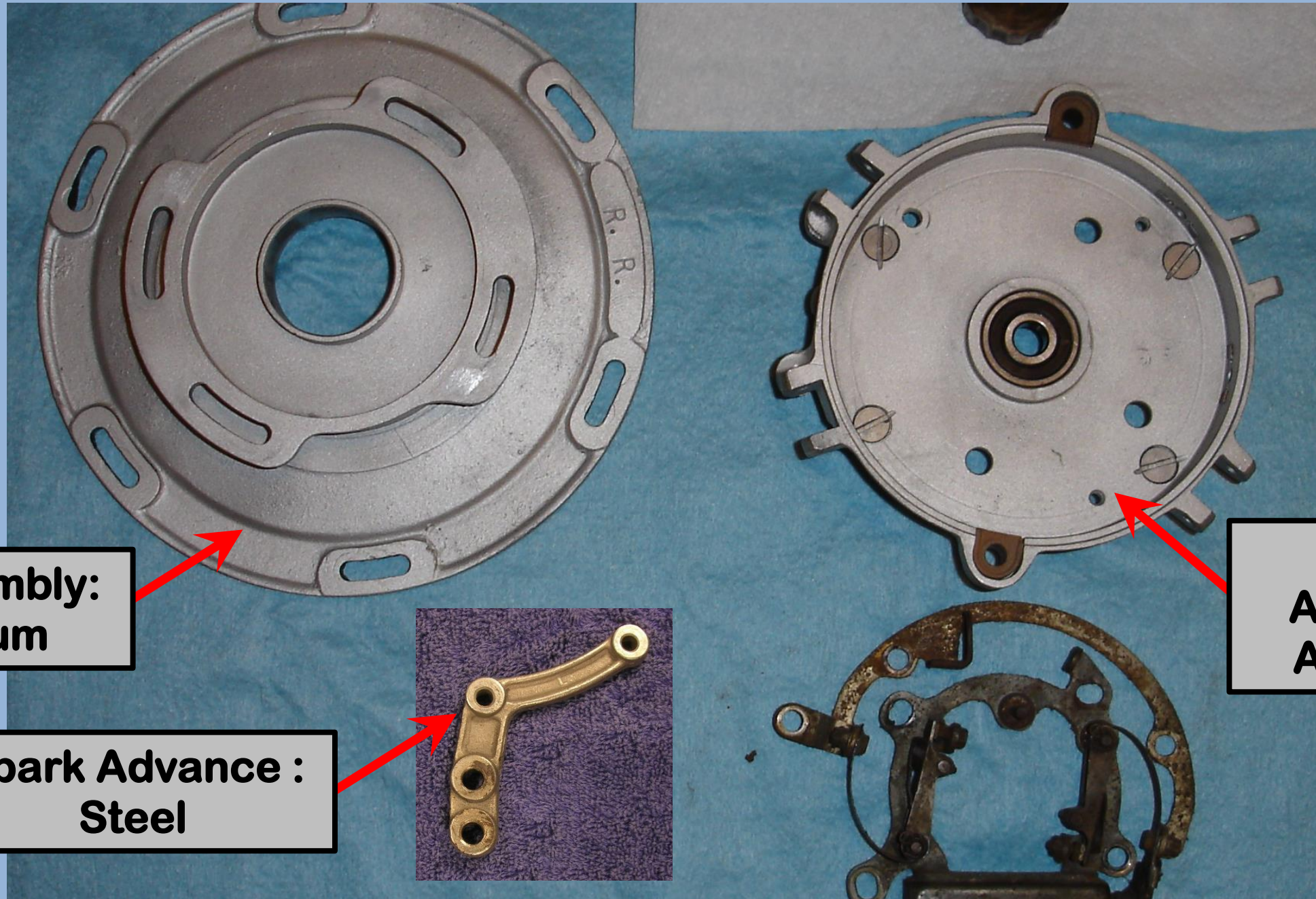
Cup housing: Double set of breaker points inside. Housing and points rotate in slotted holes in base plate



Base plate: Bolts to aft end of camshaft housing

Relative motion occurs along this split line interface

Parts to be 3D Printed Replicated

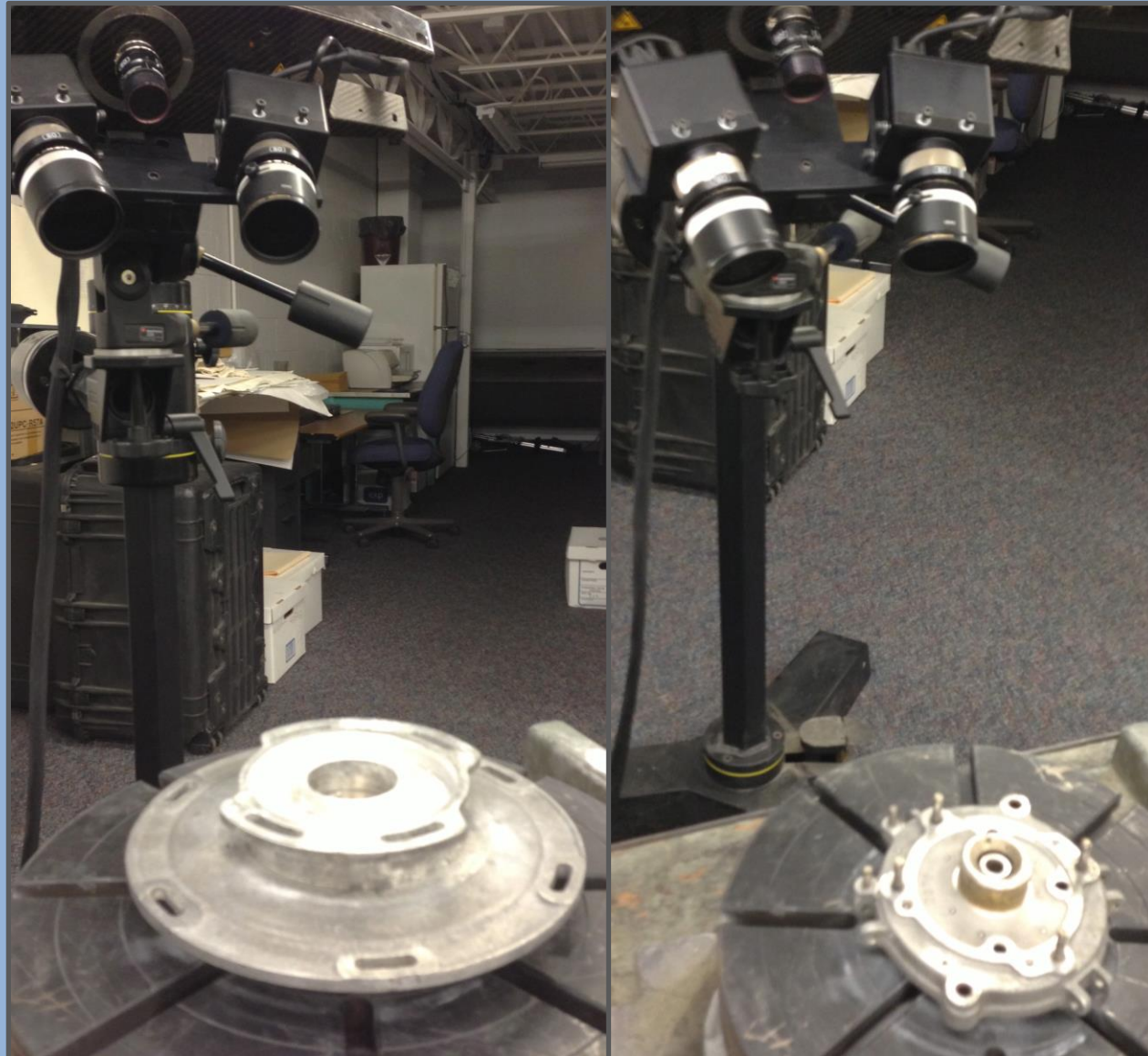


**Cup Assembly:
Aluminum**

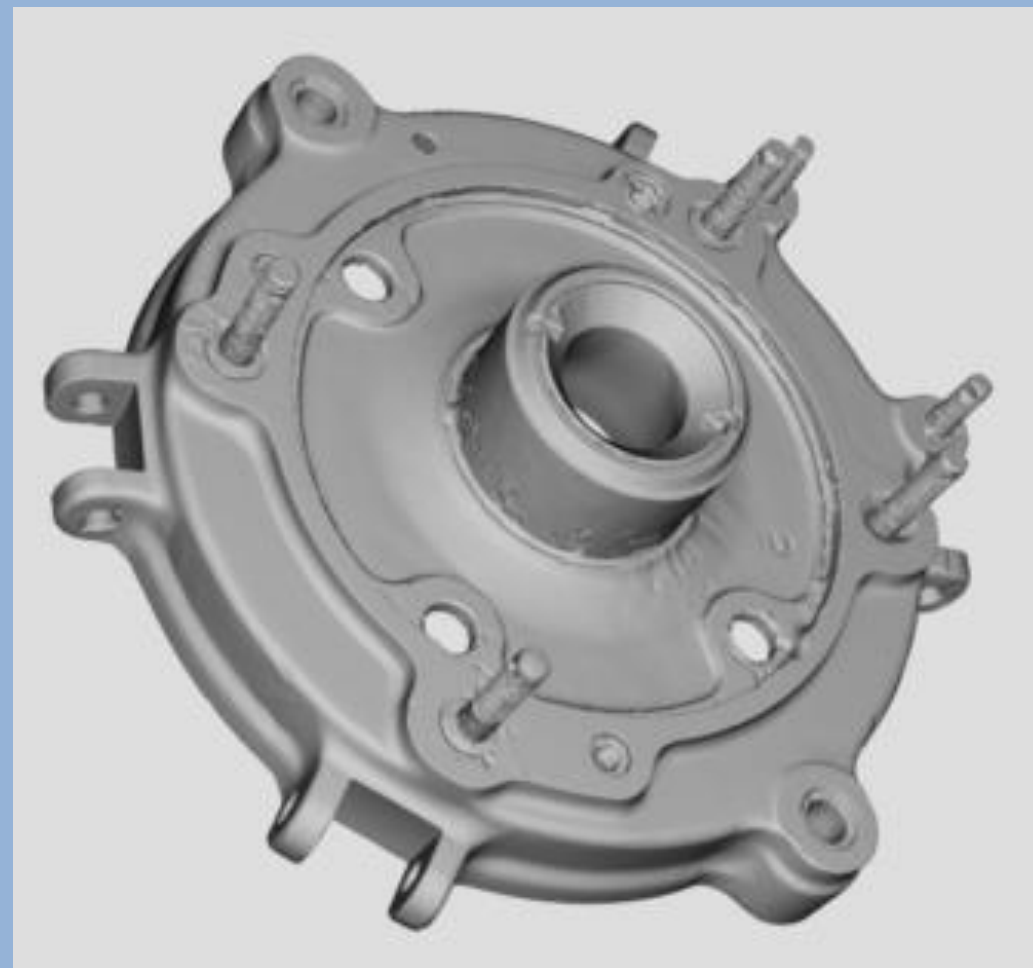
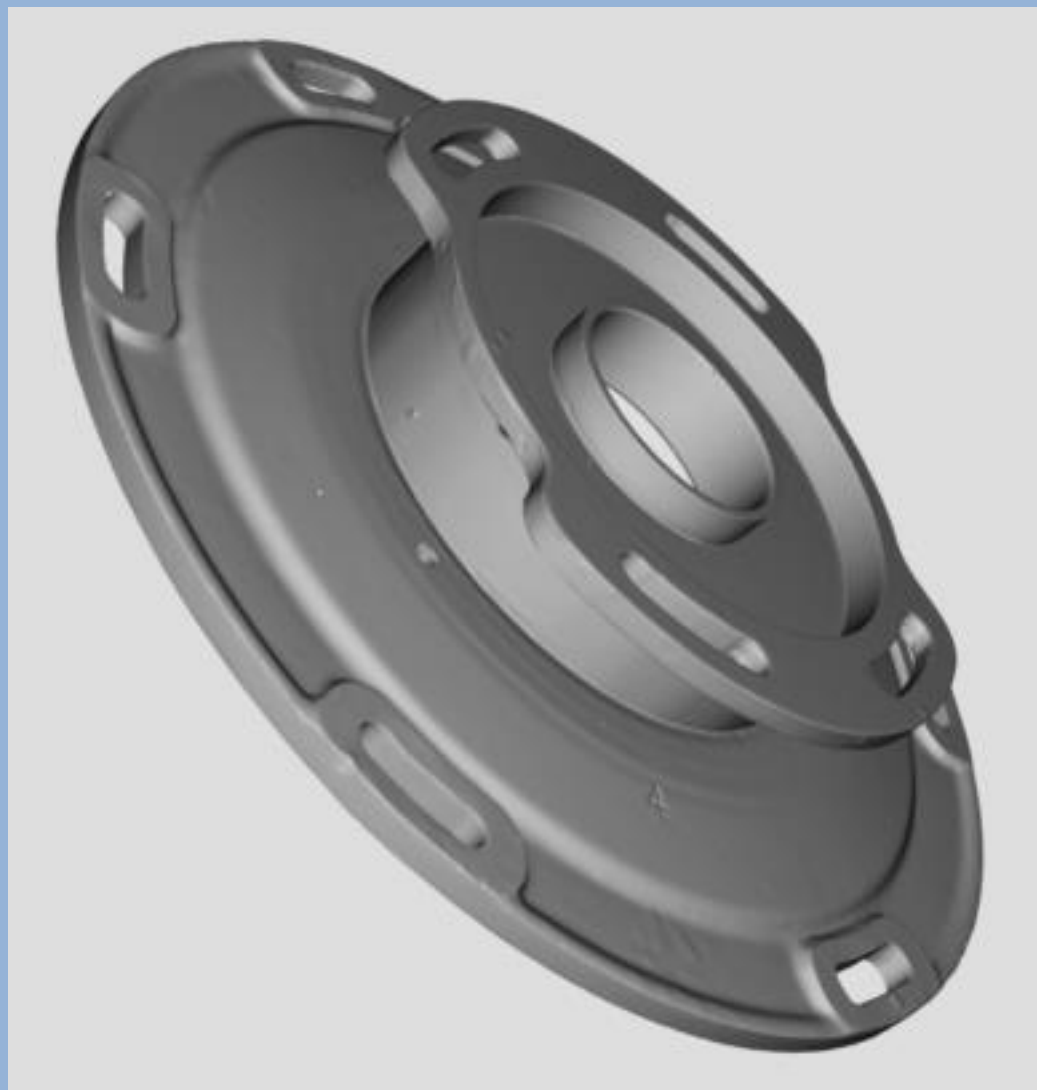
**Spark Advance :
Steel**

**Cup
Assembly:
Aluminum**

Optically Scanning to Create Part Definition Data Base



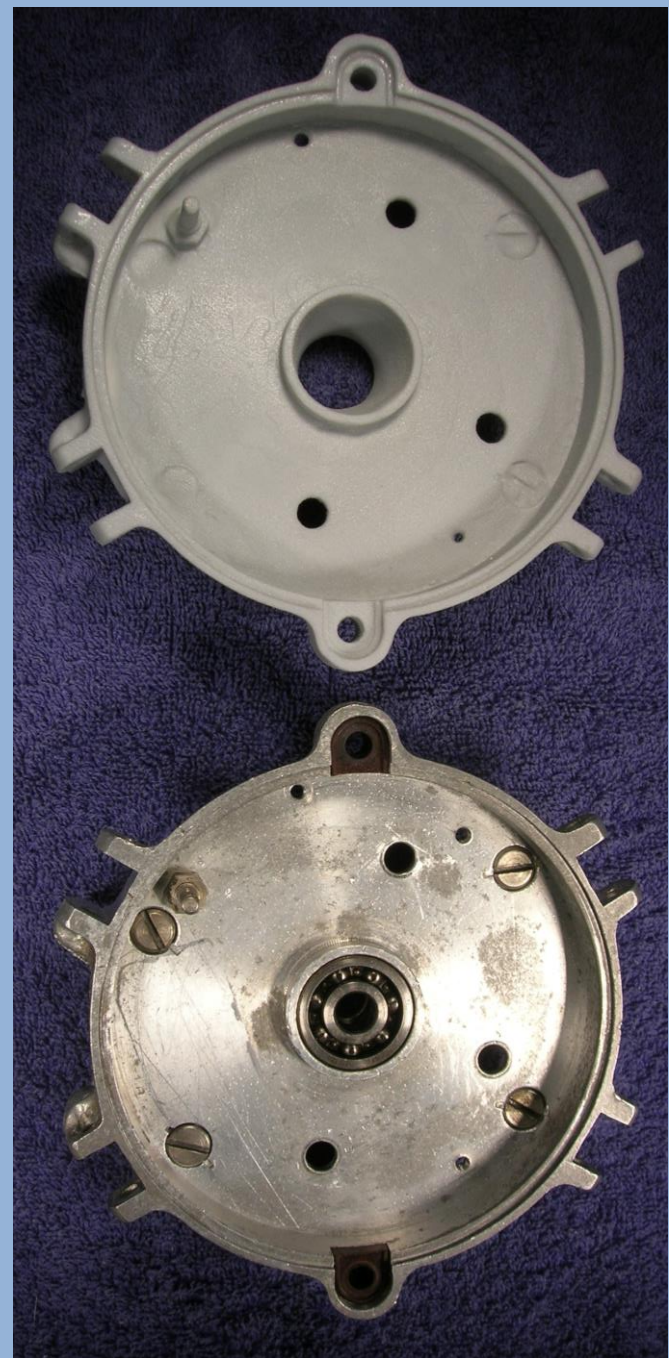
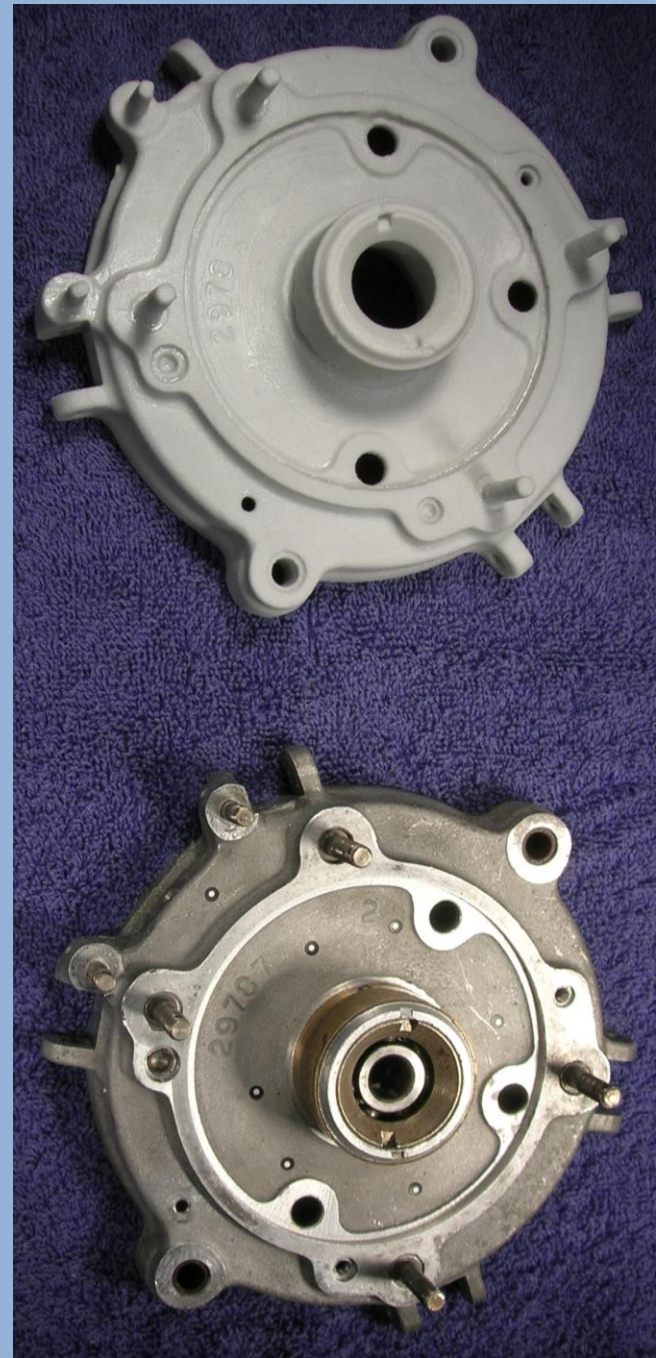
Optically Scanned 3D Models



3D Printed Base Plate compared to original



3D Printed Cup and Spark Lever Arm compared to original



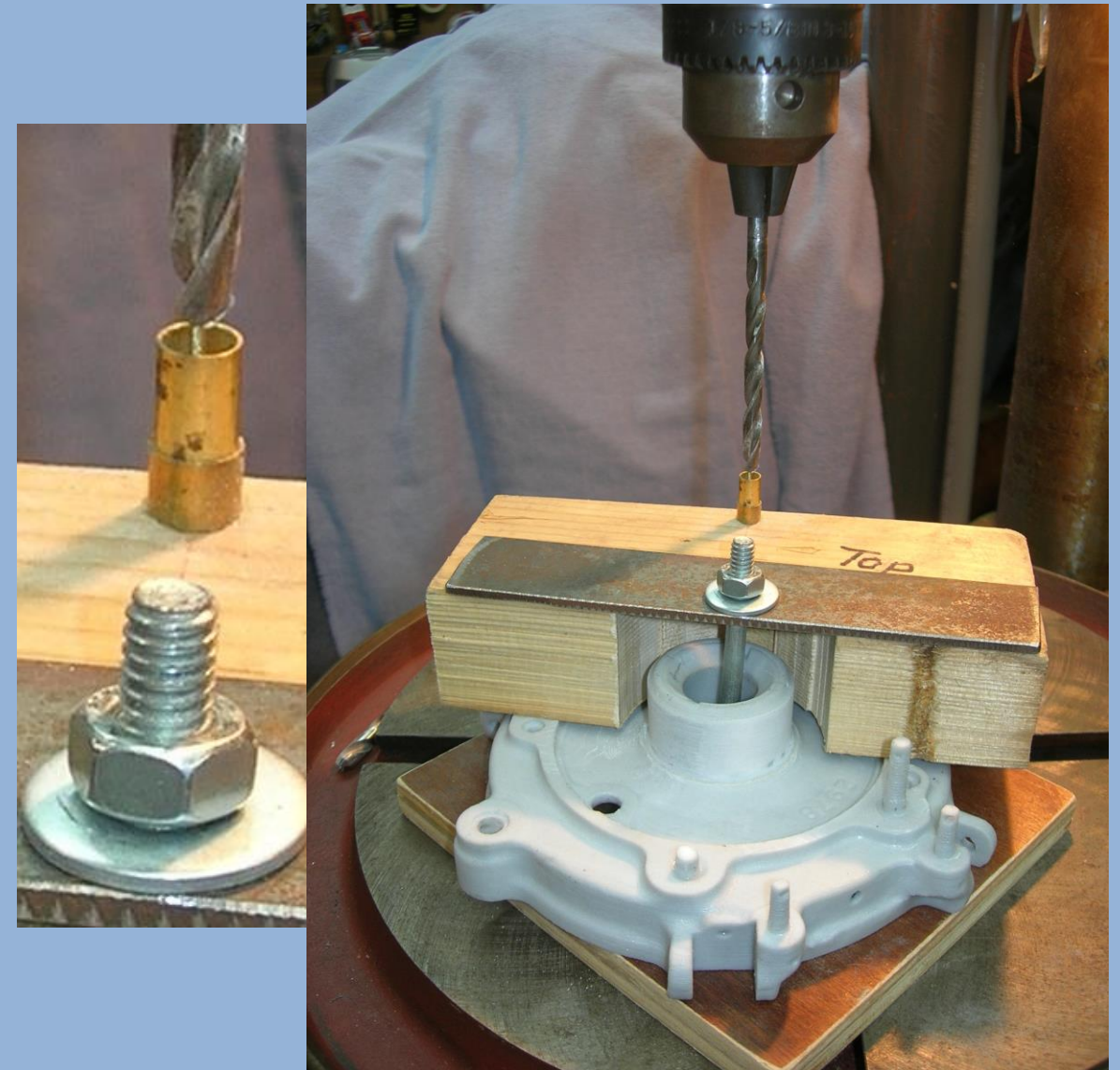
Drilling Out 3D Plastic Studs on Location

Problem:

- 3D printed studs are very weak and will not support loads.
- Plastic studs must be drilled out and replaced with metal studs.

Approach:

- Brass bushings in wood 2x4.
- Bushing & 2x4 located by plastic stud on 3D printed part and clamped in place.
- Drill out plastic stud creating a hole on location.



Glued in Metal Studs in Cup Assembly



Replica stud is epoxy glued into hole having a same projected height as original.

3D Printed Base Plate & cup spray painted with nickel color paint and fogged with flat black for aging pits



Replicate Hardware Fabrication

- Use hardware store available items
- Drill, shorten, or modify to match originals
- Strip cad plate with muriatic acid
- Color age parts with gun bluing
- Spray with WD40 oil and bake in backyard grill



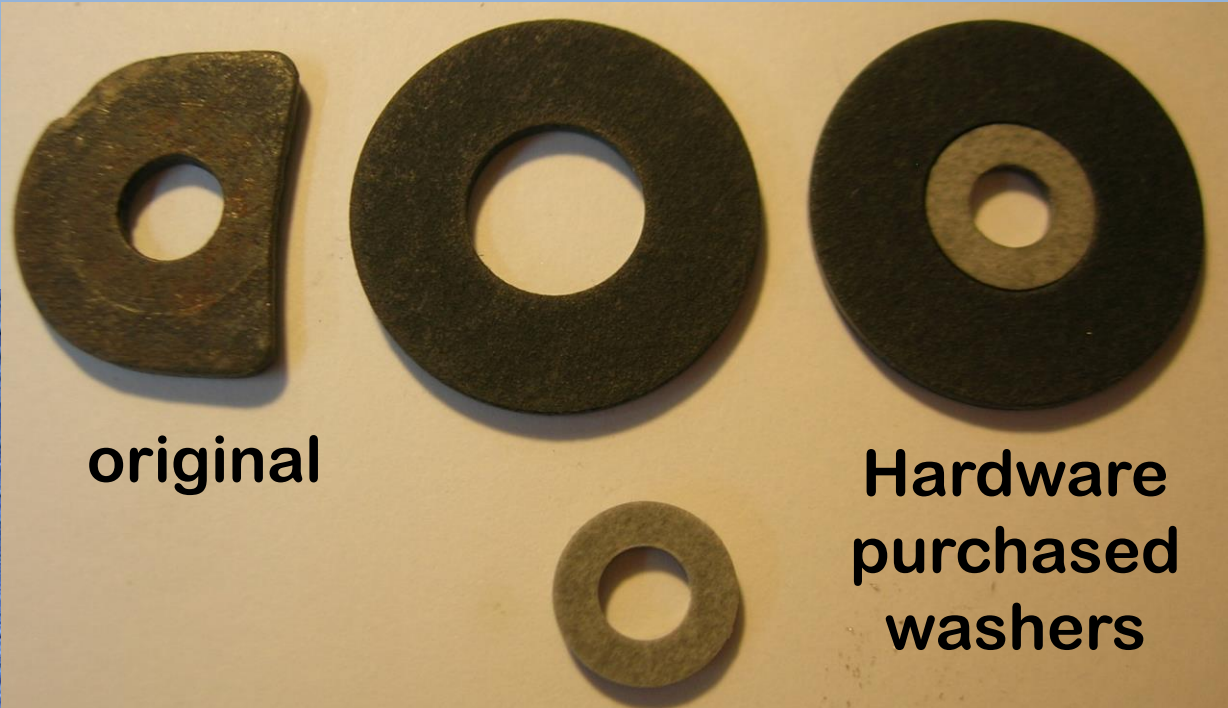
Replica Hardware Fabrication



Original
12-28 thread

Hardware purchased
nut with 1/4-28 thread
and brass tube

Castellated nut with
extended body



original

Hardware
purchased
washers



original

replica

Fiber
washer

Replica Hardware Fabrication



Hardware store spring



Shortened spring



original

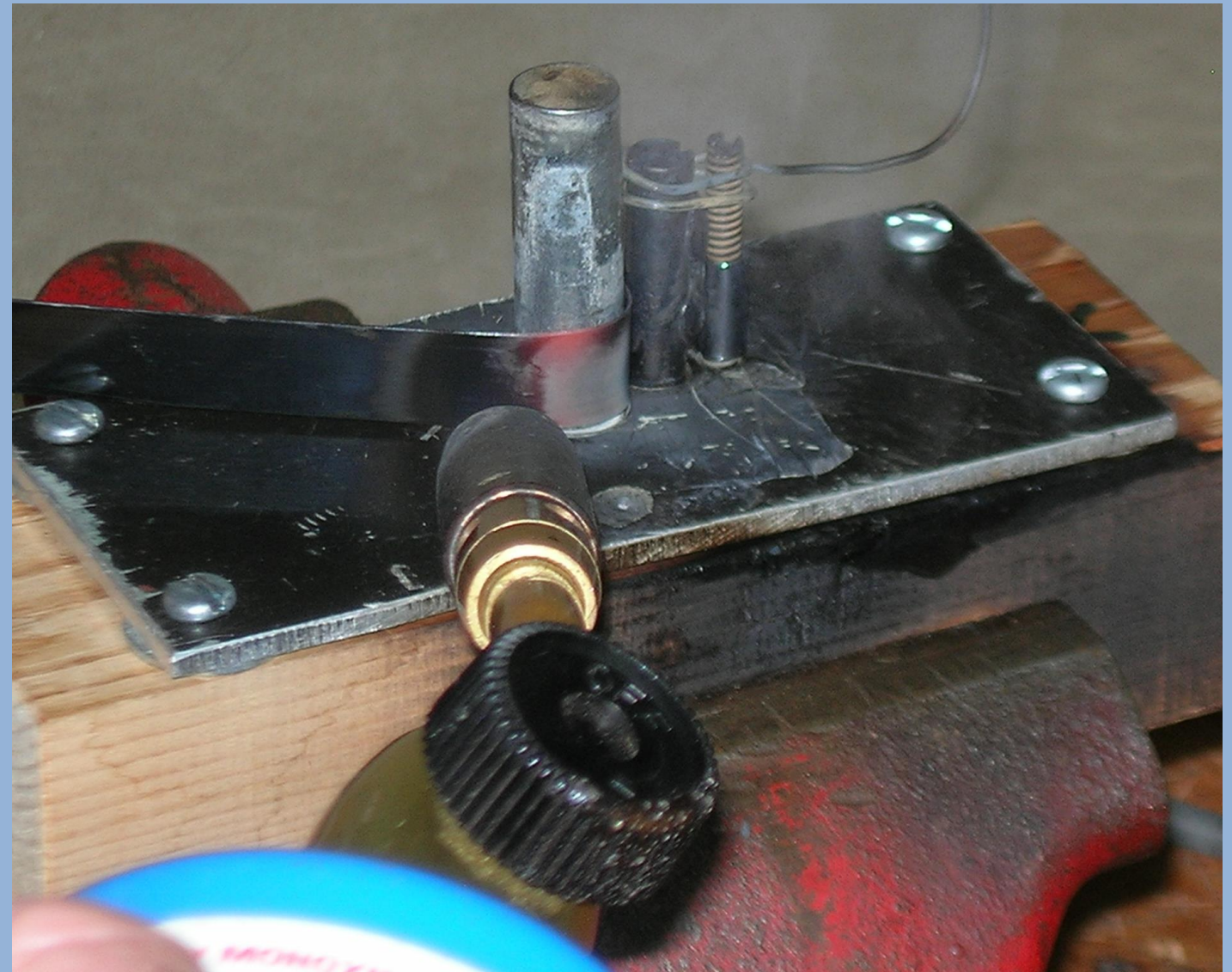
replica

Brass Shim between Cup and Base

Replica Hardware Fabrication



Fabricated from steel banding strapping



Hot forming steel banding around dowel(s) bending fixture

Spring Clip

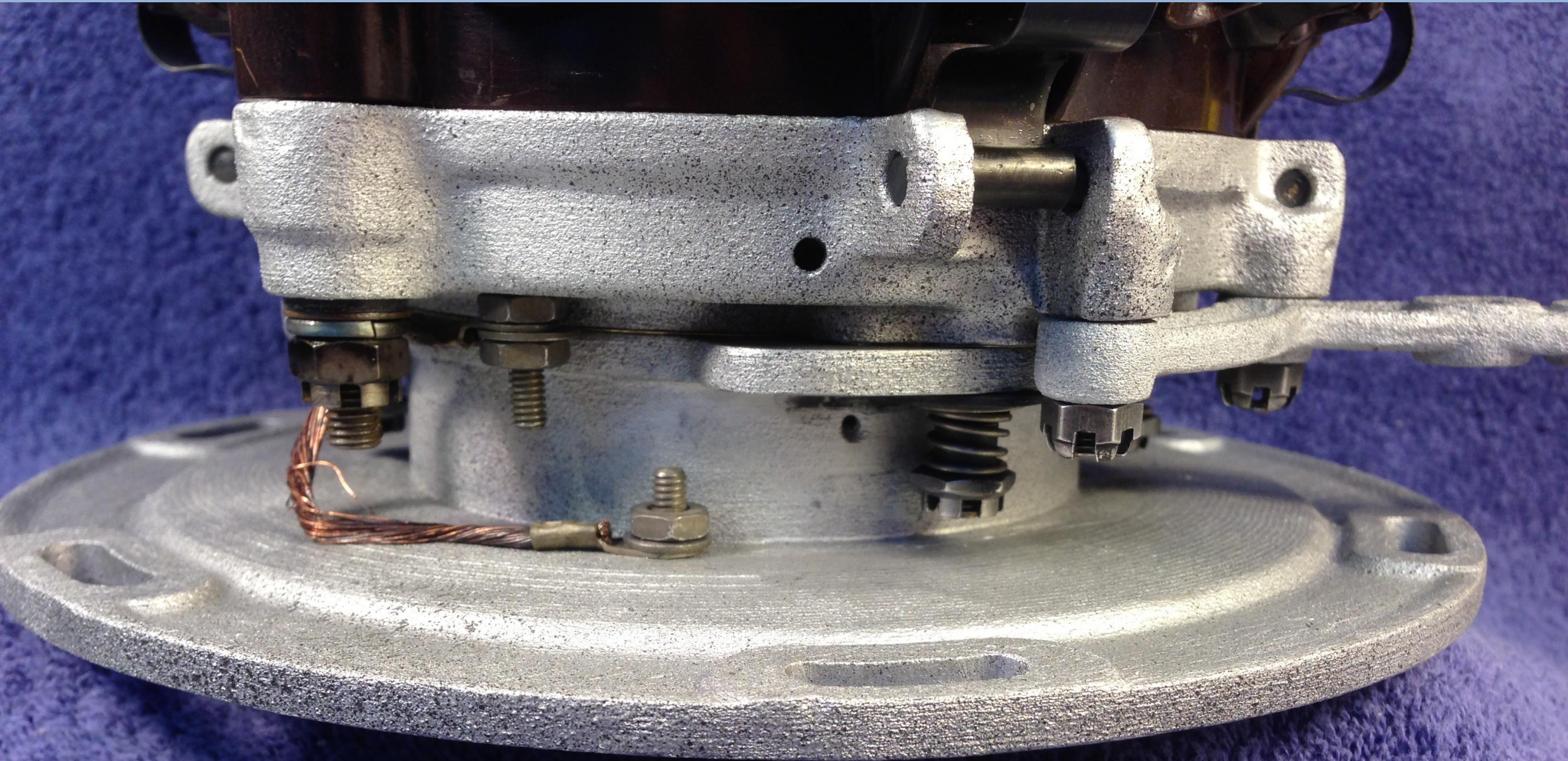
Fabricated Replica Hardware



Assembled cup and spark advance arm to base with cap installed



Replica Distributor Detail



Replica and Original Liberty Distributors or is it Original and Replica?

24



Century Aviation donated sparkplug wire distribution tube and wires



- Tube and wires fit and wires seem to go to appropriate high tension cap terminals
- Wires identified by continuity check from plug end of wire

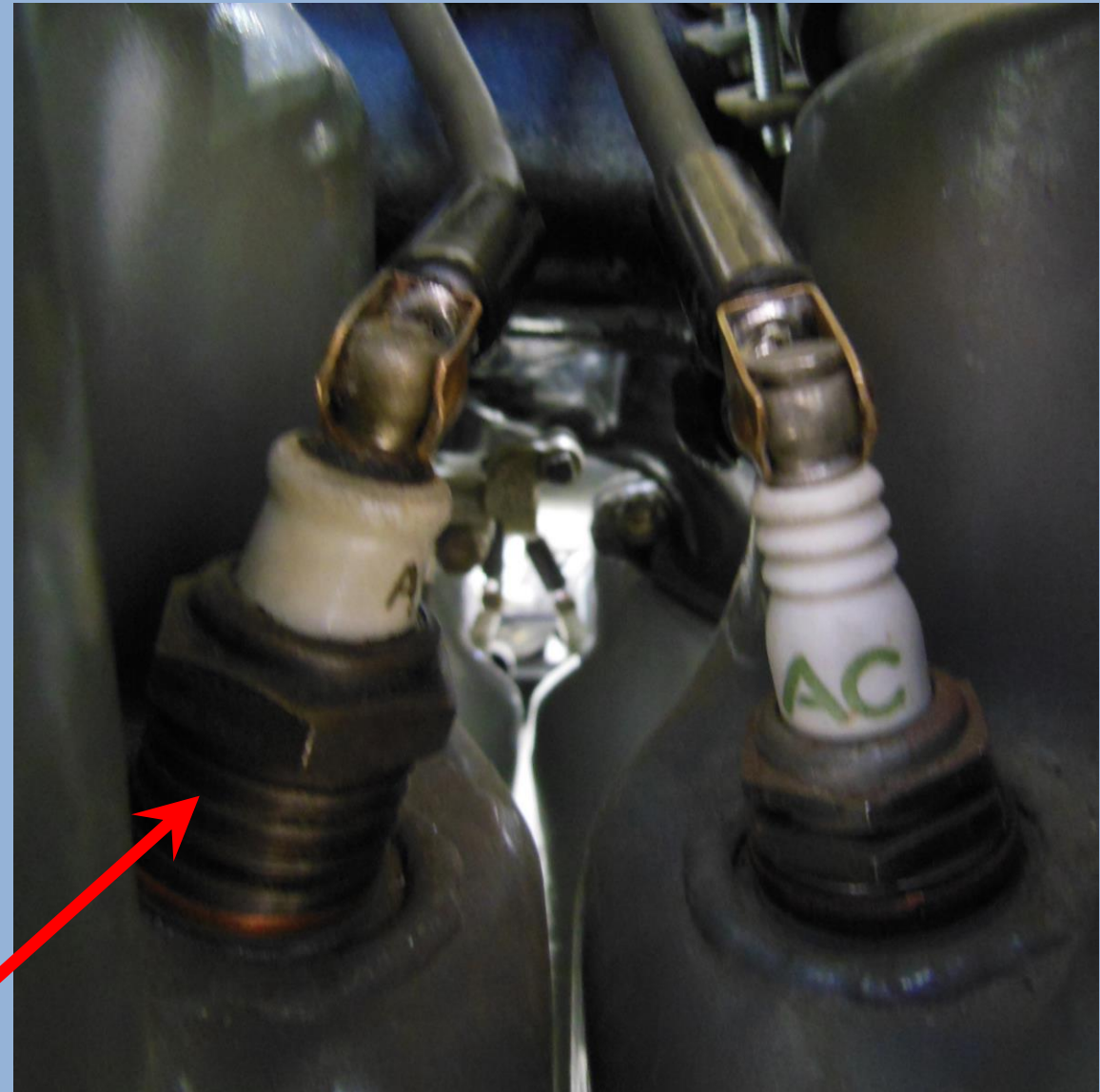


**Bob Dempster
donated
sparkplug wire
connectors**



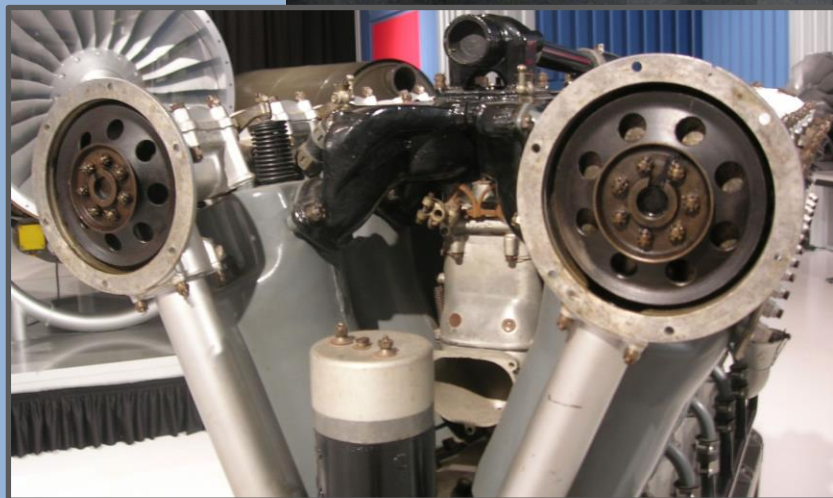
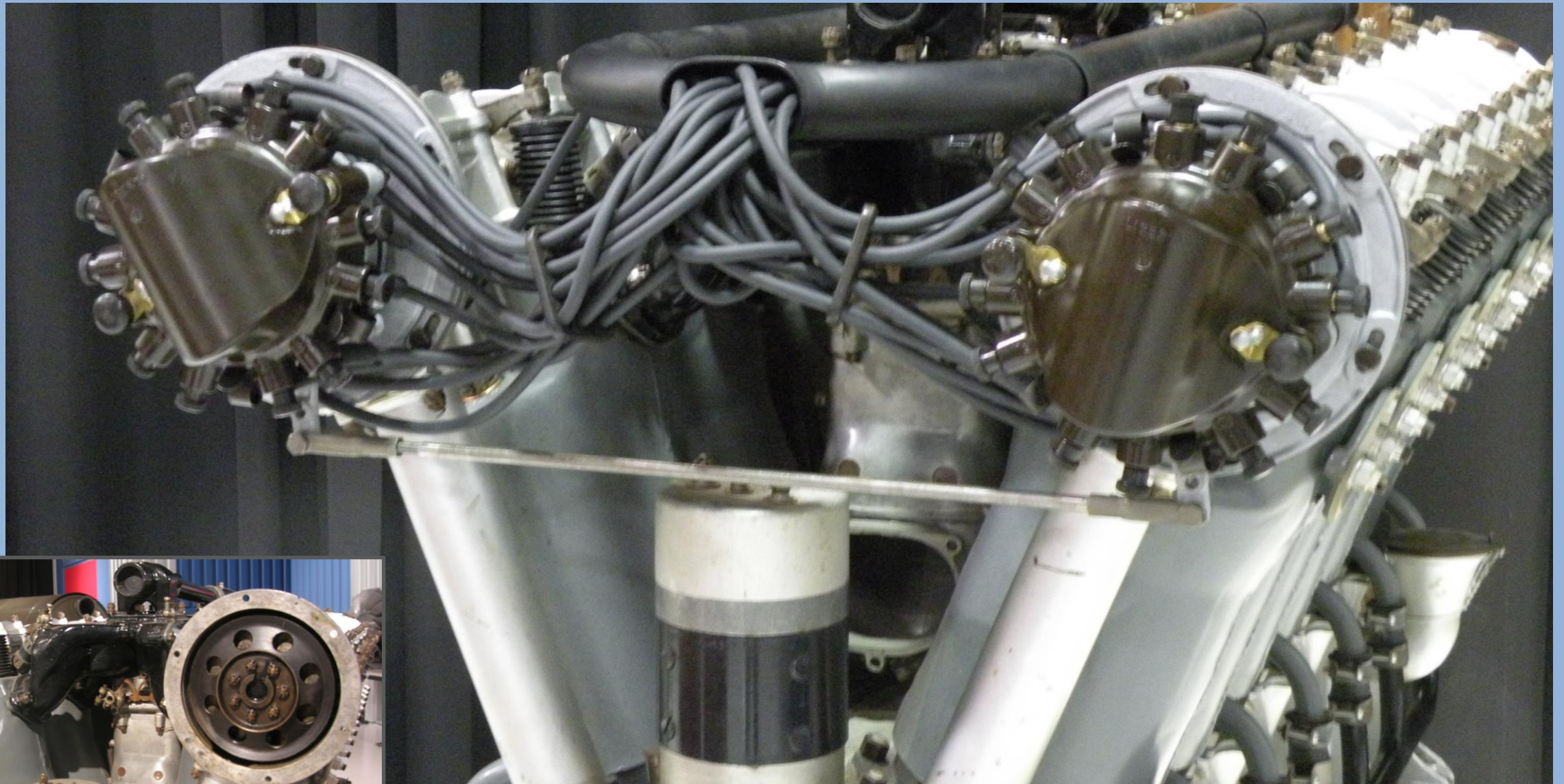


Original AC Titan sparkplug



**Hole filler
AC sparkplug**

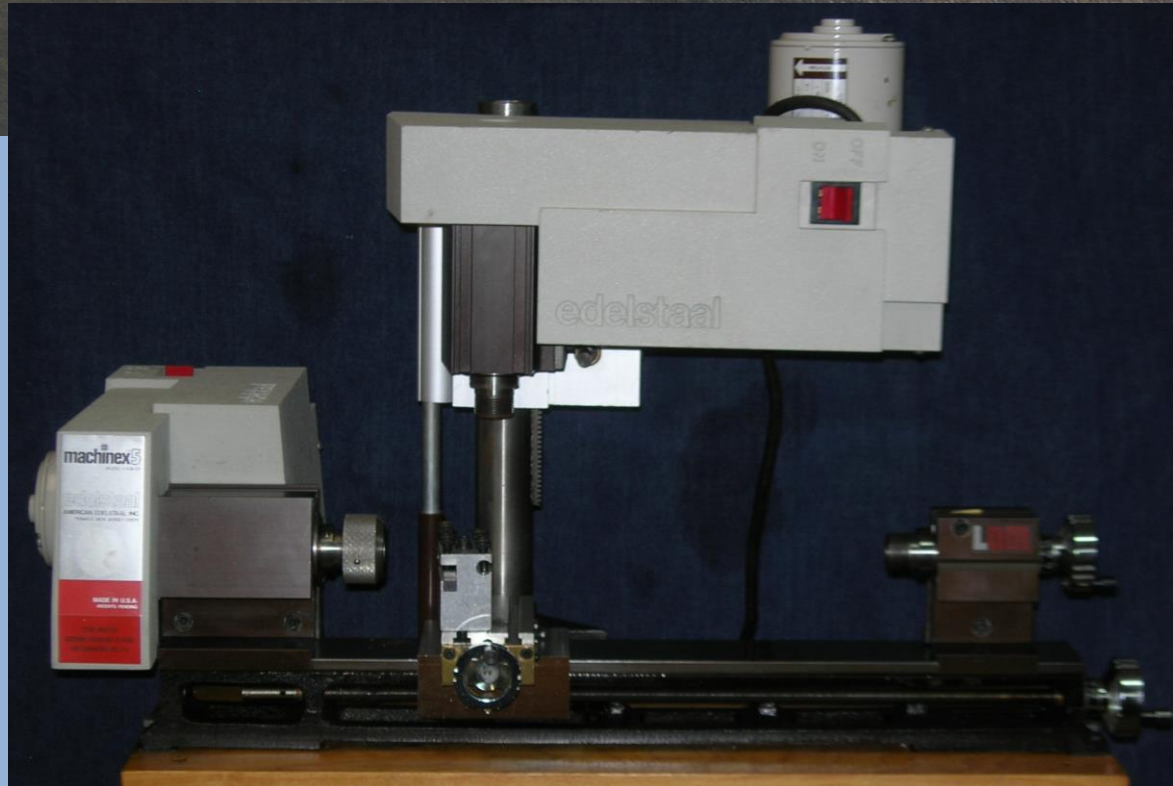
Liberty Ignition System Replication Project



Before

After

Liberty DIY Tooling and Lathe



A Very Big Thanks to

- **Mark Smith, Century Aviation**
- **Kip Lankenau of Kip Motors Co.**
- **Bob Dempster, Seattle World Cruiser Project**
- **Rolls-Royce Liberty Works**
- **Kim Brand of 3D Parts MFG**
- **Andy Salter of Fantasy of Flight**
- **Old Rhienbeck Aerodrome**

What Next?

