Gathering of the Green
2008 Winter Convention
March 12 - 15
Moline, IL

Magnetos: History, Application and Servicing
Splitdorf
Fairbanks Morse
Wico
Edison Splitdorf

Duane Larson
Knoxville, TN

Introduction

- Magnetos require periodic servicing and repair to properly perform their function
  - Provide an adequate spark at the proper time to the spark plug
- Several knowledgeable people have led this workshop in the past
  - Covered mainly Wico C and X series
- I have researched and rebuilt magnetos for over 25 years
  - Expand workshop to cover magnetos which came on Deere tractors from the factory

Acknowledgements and References

- Several folks have provided me information
  - Mark Maikshilo – Mark's Magneto Service
  - Steve Ridenour and Jack Kreeger – Y and 62
  - John Nikodym – early D magnetos
- References
  - Magneto manuals
  - Deere parts books and SM-2029 Electrical Manual
  - Field Service Bulletins
  - Public libraries – Flint, MI and Indianapolis, IN
- Handout available – Application Chart plus other information

Handouts from the Gathering of the Green workshops are among the information included on the CD available through this web site.

EXTRA Slides

- Magneto talk was long, several slides not used for time consideration
- Noted by *EXTRA* in Title box at top of slide
- Included here because often contain useful information
  - However, in the presentation summary slides were sometimes used
  - May affect flow of information, if confusing just skip slides with *EXTRA* in title

Outline of Talk

- Magneto theory and operation
- Edge gap and point setting
- Engine and magneto timing
  - Impulse and running
- Specific magnetos used by Deere
  - Splitdorf
  - Fairbanks Morse
  - Edison-Splitdorf
  - Wico
- Repair suggestions included for each magneto

Outline of Talk *EXTRA*

- Magneto theory
  - How a spark is produced
- Magneto operation and timing
  - Getting a spark at the correct time
    - Impulse and running
- Apply these principles to magnetos found on Deere tractors from the factory
  - Splitdorf Dixie, Aero, 246C, 246T – Waterloo Boy, D
  - Fairbanks Morse DRV2A, B – A, B
  - Edison Splitdorf CD, (RM) – A, D, G, (L, LA)
  - Wico AP, C, X – A, B, D, G, H, L, LA
- History and Servicing information

Magneto Theory

- Magneto – converts mechanical energy into electrical energy
  - Magnetos DO NOT use batteries
    - Wico XB distributor looks like a magneto
- Faraday's Law – any relative motion between magnet and wire induces current flow in wire
- Magneto Classification
  - "Low tension" provide spark for ignitors
  - "High tension" provide spark for spark plugs

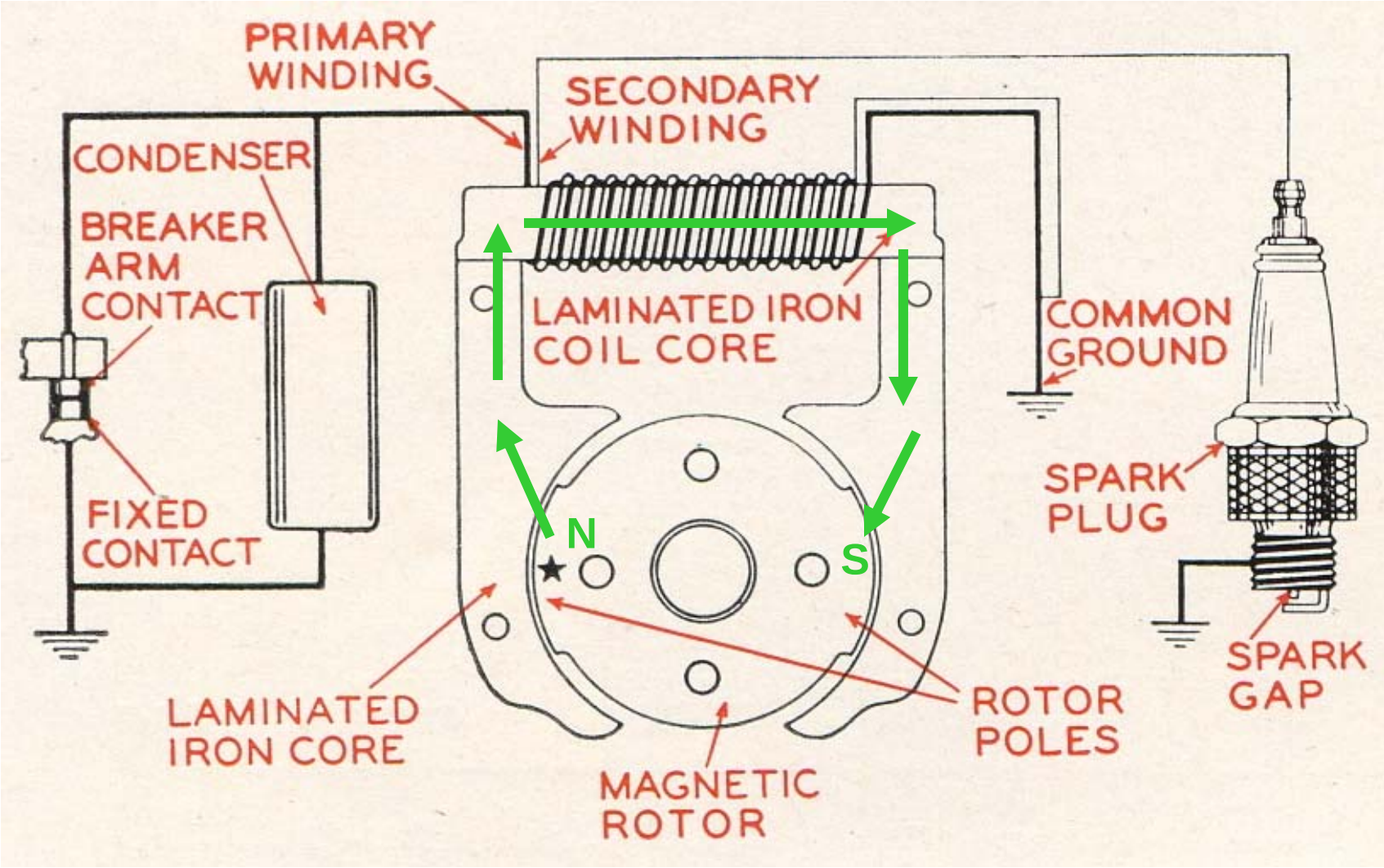
Magneto Theory cont'd

- High Tension magneto classification
  - Shuttle wound – stationary magnet, rotating coil
    - Fairbanks Morse R2 on GP series
  - Rotating inductor – stationary magnet and coil, rotating "flux reverser" armature
    - Splitdorf Dixie, Aero
  - Rotating magnet – stationary coil
    - Fairbanks Morse DRV2A,B, all Edison Splitdorf, Wico
    - Common after AlNiCo magnet became available
- Base or Flange mount
  - All Deere tractors use flange mount, except
    - Waterloo Boy
    - D 30401 – 130700
    - All GP series (including C)

Magneto Theory cont'd

- Magnets
  - Prior to 1917 magnet steels were used, most commonly alloyed with tungsten or chromium
  - Cobalt steel was introduced in 1917, with improved retentivity
  - Cobalt chromium steel came in 1921
    - Typical horseshoe magnet on magnetos
  - In 1935 aluminum-nickel-cobalt (AlNiCo) steel was introduced
    - Huge improvement in magnetic retentivity
    - Allowed practical use of rotating magnet magneto
    - Still used today

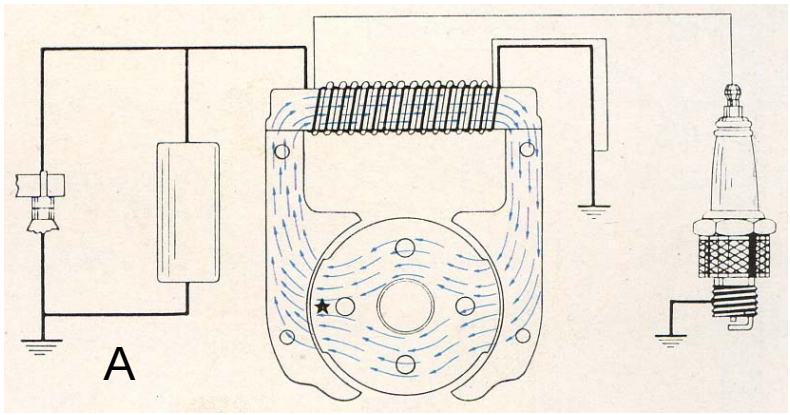
Magneto Operation

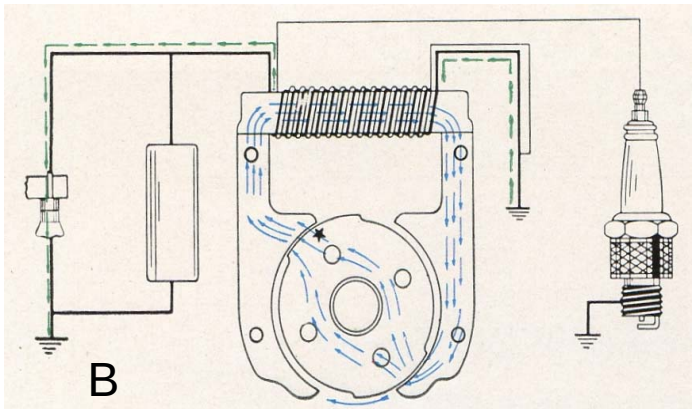


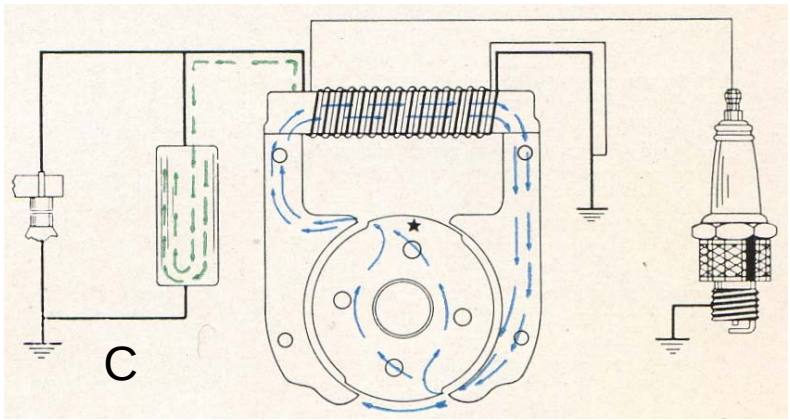
Purpose of the Condenser

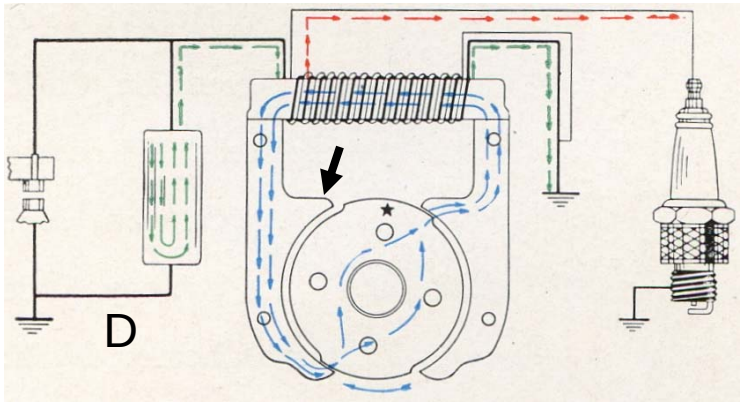
- Purpose is twofold
  - Reduce sparking at points
    - As points open, condenser absorbs energy from collapsing magnetic field, lessens sparking
  - Increase rate of collapse of magnetic field
    - As condenser discharges back through coil primary, it increases high voltage available from coil secondary
- Choice of condenser
  - Based on choice of coil and cam properties during magneto design
- Coil, cam, and condenser choices are a significant engineering design issue

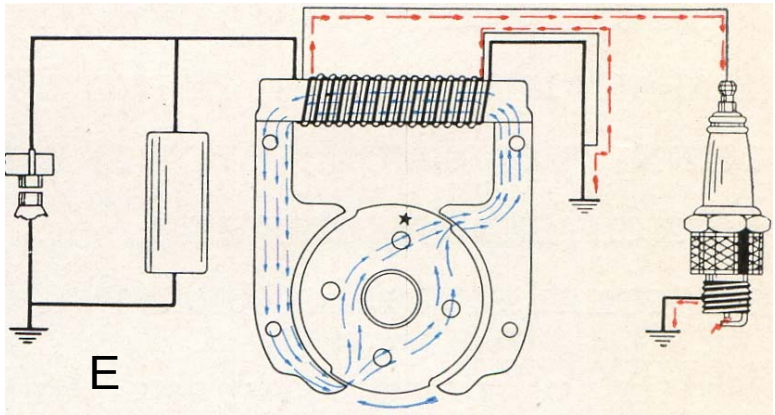
Magneto Operation – Overview *EXTRA*

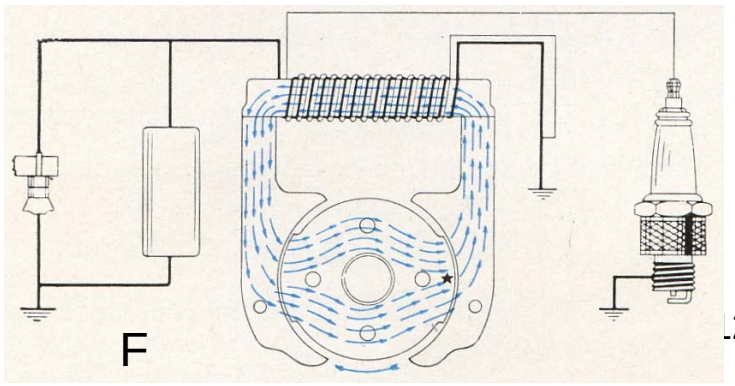






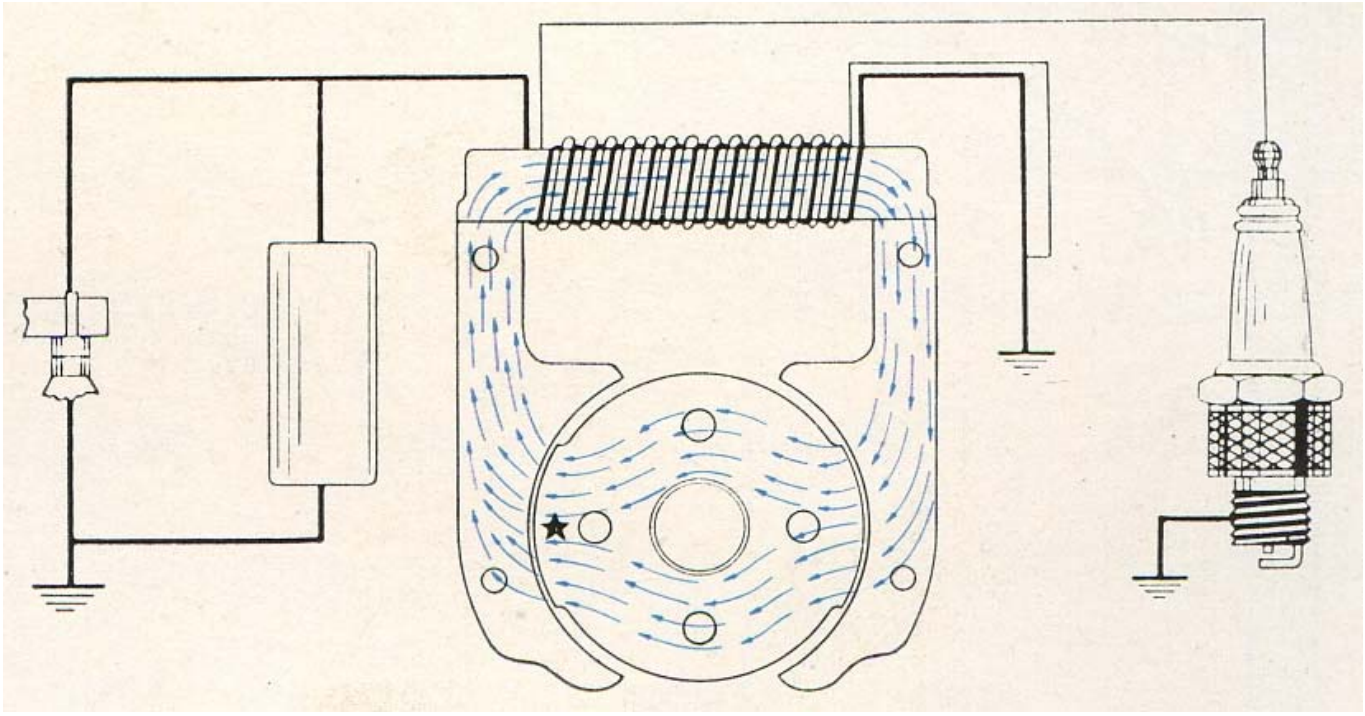






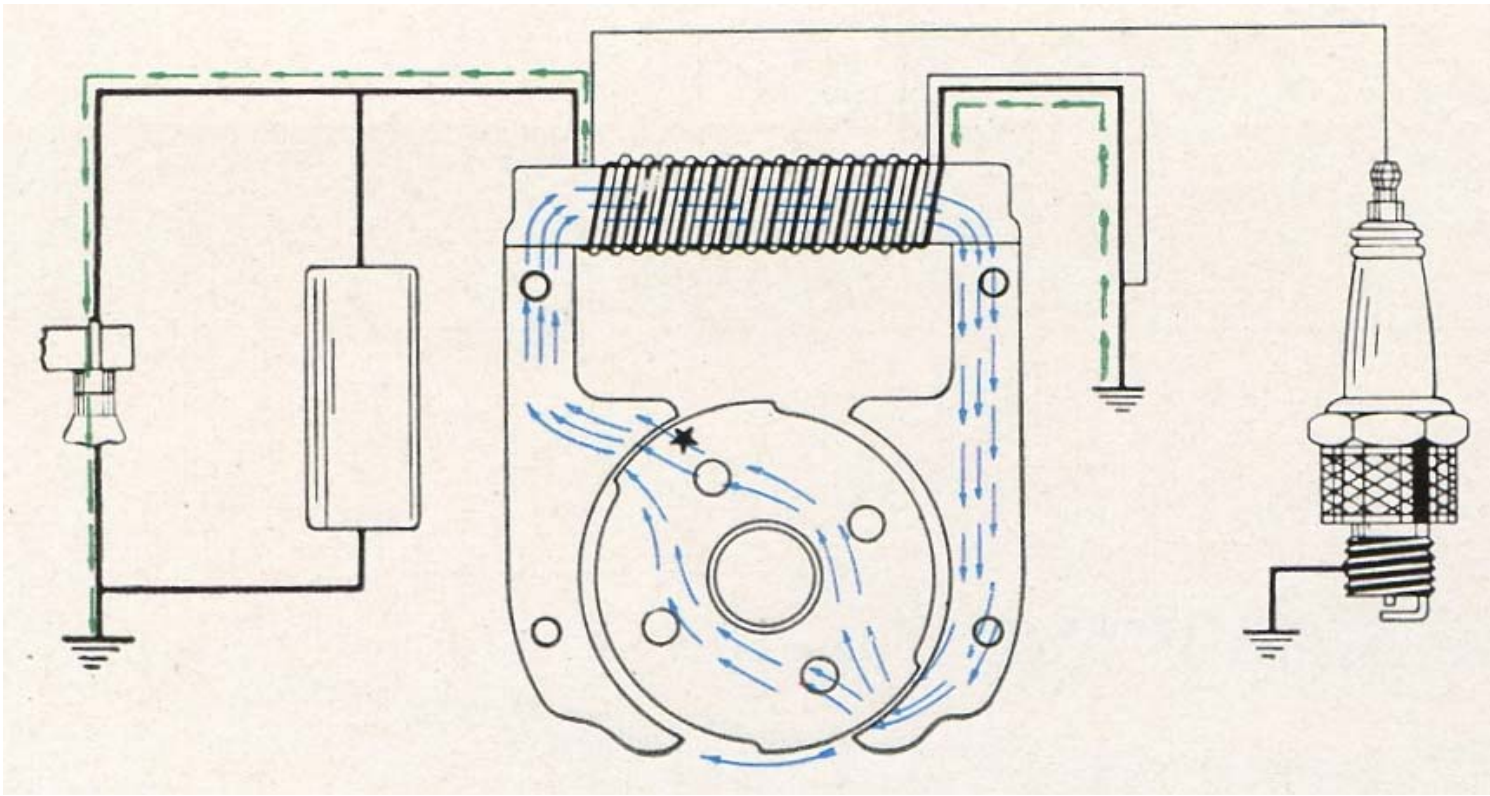
Magneto Operation – A *EXTRA*

- Magnetic lines of force flow out of left end (N pole) of magnet, through coil, back to right end (S pole)



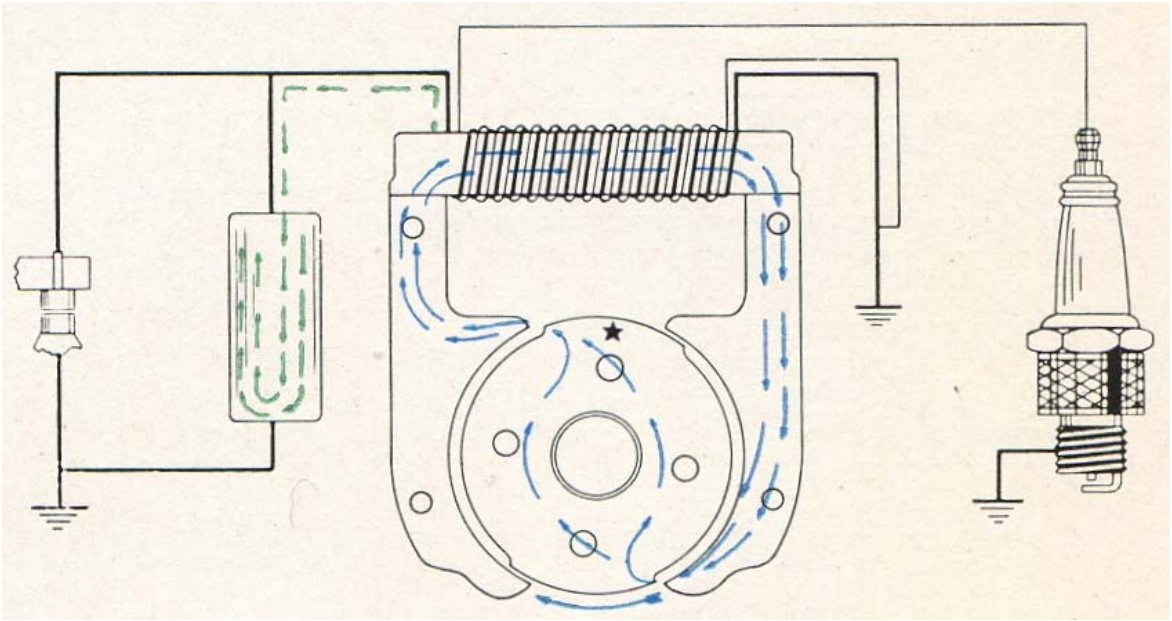
Magneto Operation – B *EXTRA*

- Less of rotor covered by core, so magnetic field through coil also decreases
- Changing flux causes current to flow in coil primary – points closed



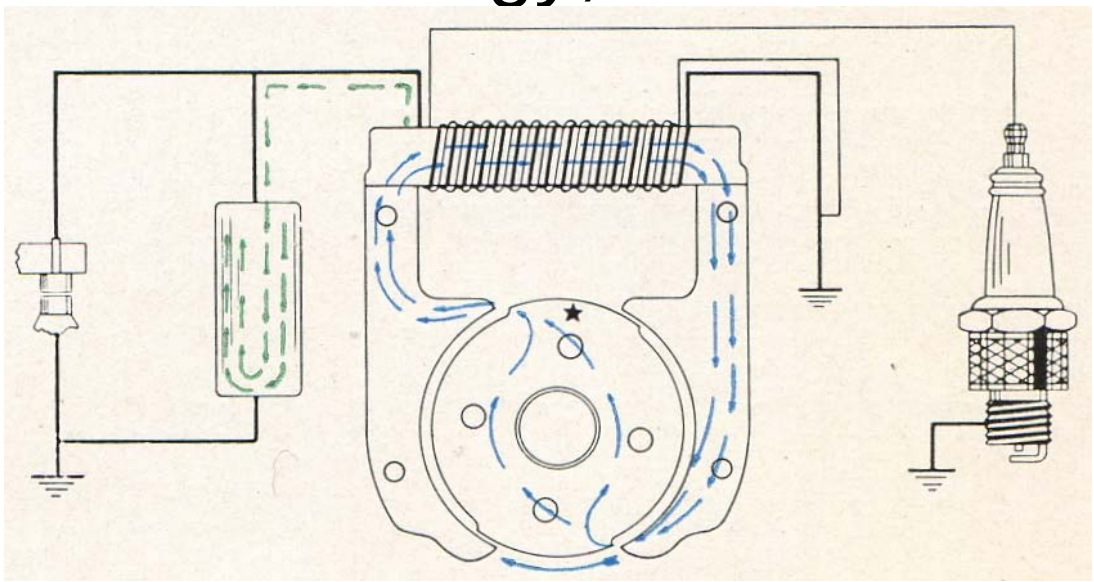
Magneto Operation – C *EXTRA*

- Prior to points opening, primary current in coil resists flux decrease
- When points open, effect is gone, resulting in extremely rapid change in flux
- Here, primary current has reached maximum value and points are opening (edge gap)



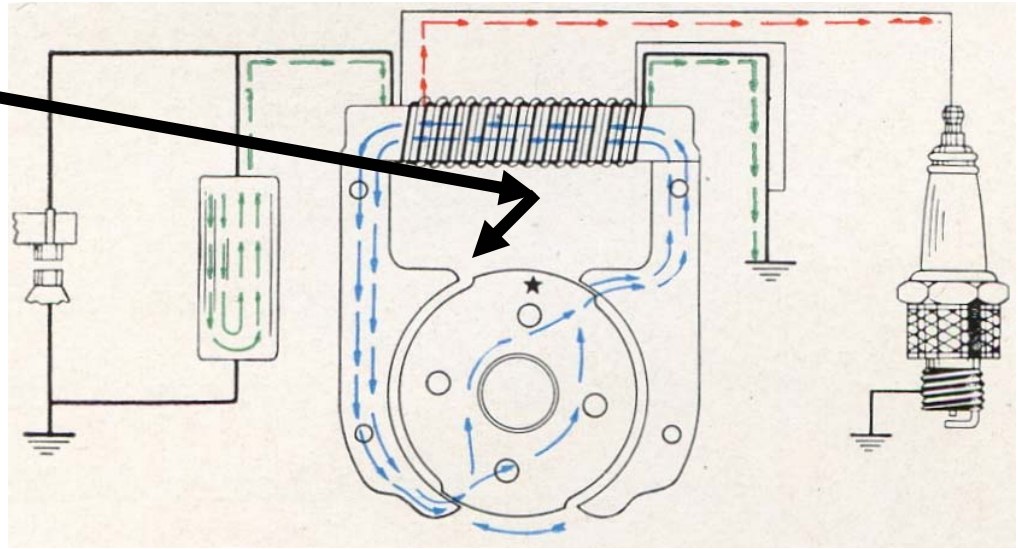
Magneto Operation – C cont'd *EXTRA*

- Primary resistance increases from 0.5 ohms to infinite as points open
  - Current drops to zero
  - Voltage spikes
  - Arc at points as they open
- Condenser absorbs arc energy, reduces arc



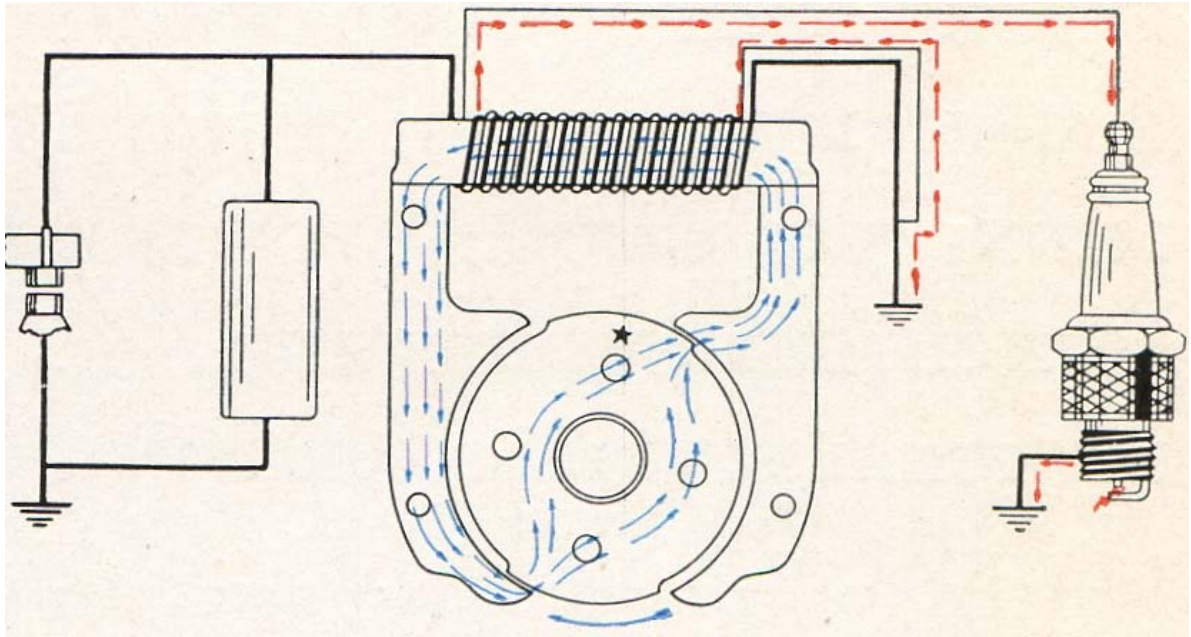
Magneto Operation – D *EXTRA*

- Points open, arc stops
  - Flux reverse through coil complete
  - Condenser discharges back into coil primary
    - Aids flux reversal
- Flux reversal induces high voltage in coil secondary
- Edge gap
  - Points open
  - Maximum HV



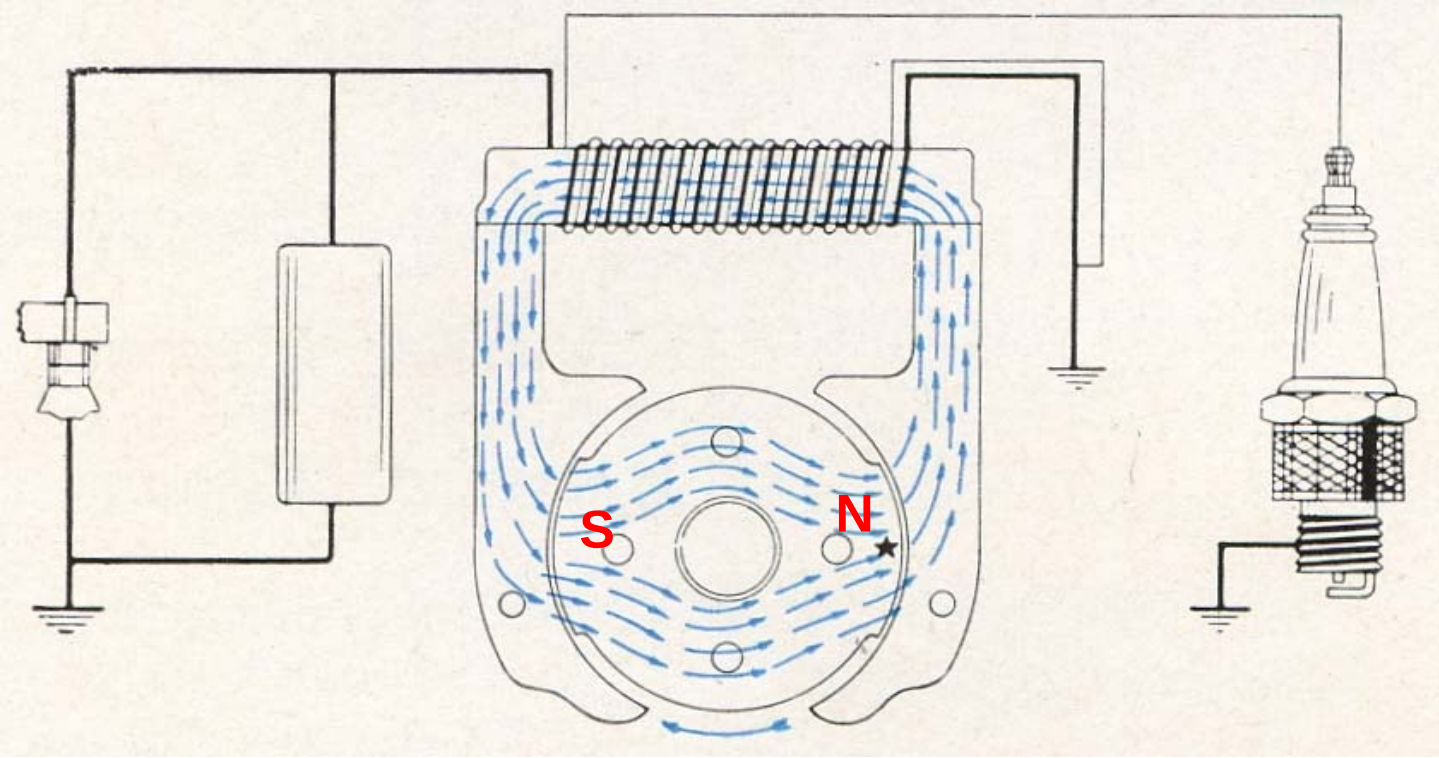
Magneto Operation – E *EXTRA*

- Secondary voltage overcomes plug gap resistance – get spark
  - Current flow across plug gap, resistance decreases, secondary continues to discharge
  - Flux change inhibited, extends time of spark



Magneto Operation

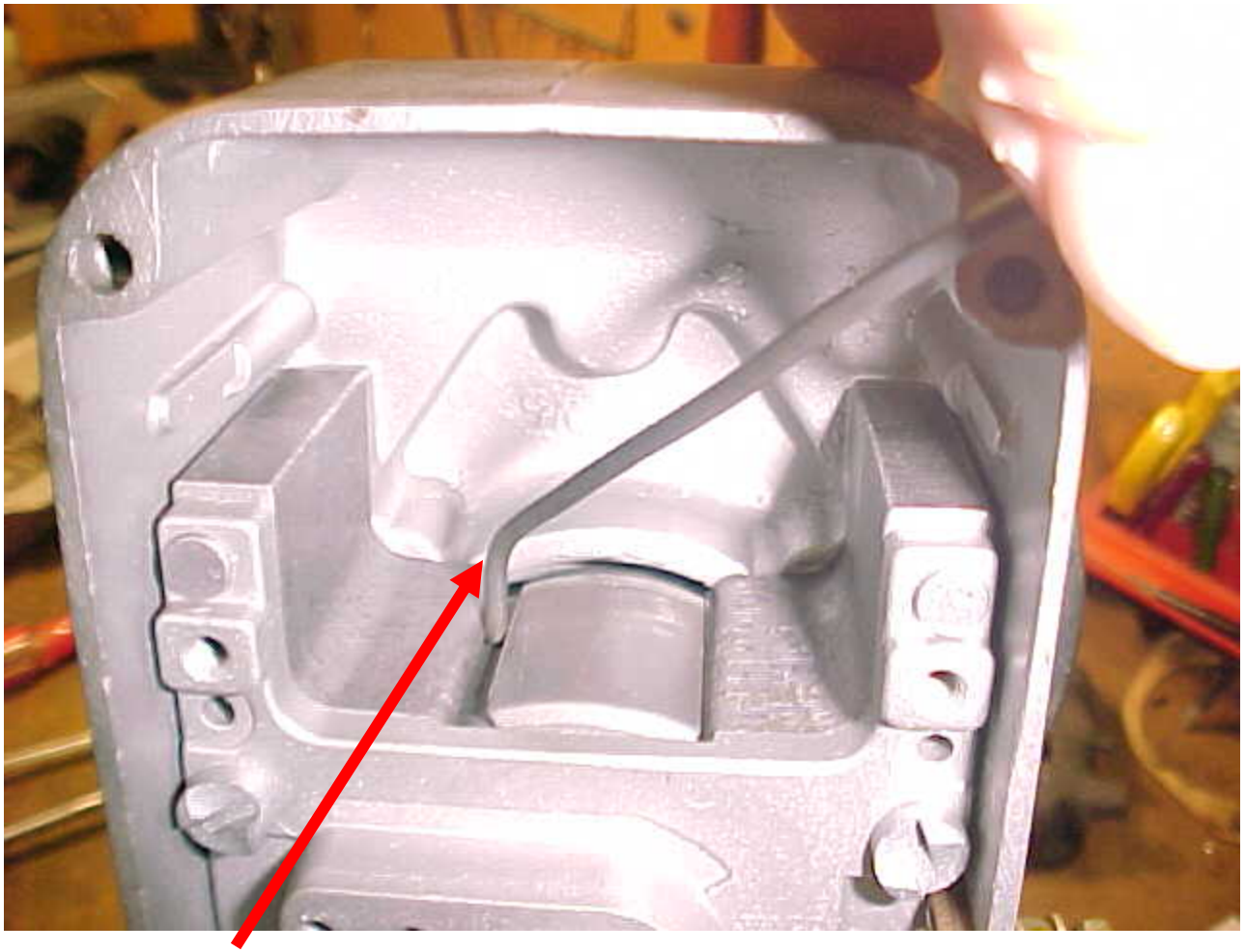
- Magnetic rotor has moved 180°, flux reestablished in opposite direction
- Cycle repeats to produce two sparks per rotor revolution



Magneto Operation - Summary

- There is a critical position during rotation of the magnetic rotor
  - Magnetic field collapsing and reversing in coil
  - Maximum current is flowing in the primary, and opening the points at that point in the rotation produces the “best” spark
- Critical rotor position is the distance between the edge of the magnet and the trailing pole face and is called the Edge Gap

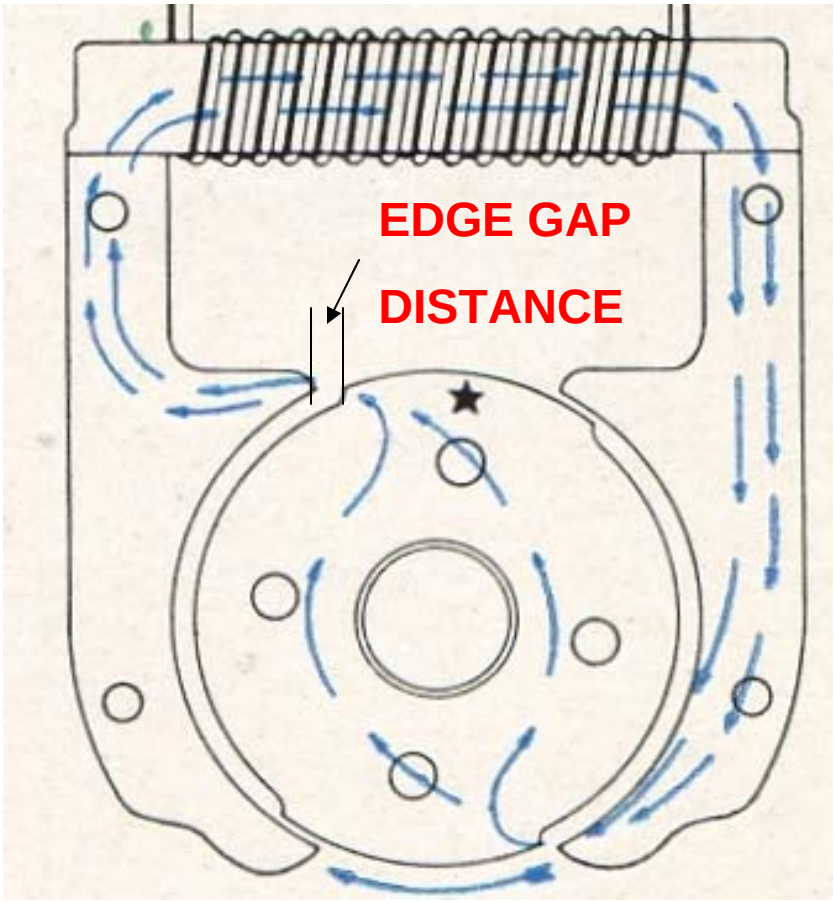
Edge Gap Distance in Wico X Magneto



0.095” wire gives correct Edge Gap

Edge Gap

- Edge gap distance
  - Distance between magnet edge and trailing pole face
  - Determined during magneto design
- The cam, which opens the points, is part of the magnetic rotor shaft
- Set points to open when rotor position is at edge gap
  - Ensures hottest spark possible
- Setting the point gap approximates the edge gap



Setting Point Gap vs Setting Edge Gap *EXTRA*

- What does “Setting the Points” mean?
  - Rotate magnetic rotor (and cam) until point rubbing block is on highest part of cam
  - Adjust stationary point to proper gap
- Rotate magnetic rotor back until points **JUST** start to open
  - The trailing edge of the rotor should be at the edge gap distance from the pole face
- So, setting the points approximates setting the edge gap
  - Not as accurate due to cam wear, worn bushings, or worn rubbing block

Point Gap and Edge Gap Distances

- Splitdorf Dixie, Aero, 246C,T
  - Point gap 0.020”, edge gap 0.020”
- Fairbanks Morse DRV2A,B
  - Point gap 0.012”, edge gap 0.203”
- Edison Splitdorf
  - CD Point gap 0.015”, edge gap 0.042”
  - RM Point gap 0.015”, edge gap <0.125”
- Wico AP, C, X
  - Point gap 0.015”, edge gap 0.095”

Magneto and Tractor Start and Run Timing

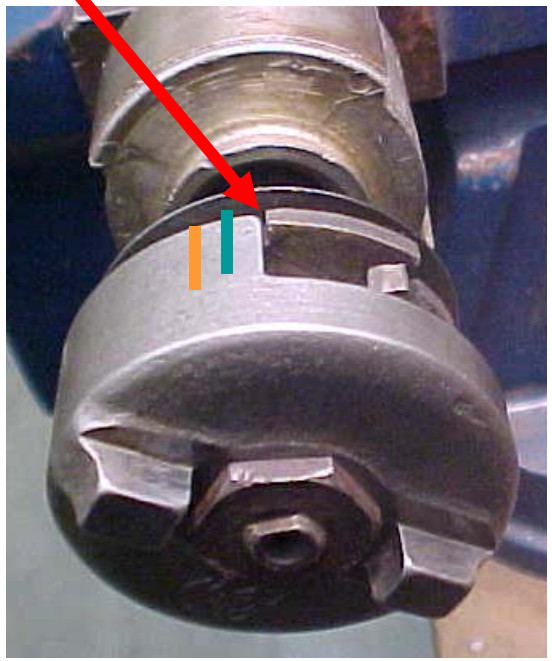
- Basics
  - Drive cup slot in end of governor shaft
    - Drives magneto
    - Rotates in same direction and rate as flywheel
    - Horizontal when piston at TDC (1937 SAE Standard)
      - Magneto impulse spark occurs
  - "LH Impulse" flywheel mark
    - Lines up with mark at 3:00 on transmission housing
      - One piston is at TDC
    - 30° below transmission mark – piston 30° BTDC
  - Flywheel side plug fires, 180° later pulley side

Magneto and Tractor Start and Run Timing

- First discuss running timing
  - Example
    - John Deere A
    - Wico C or X magneto
    - Choose 30° BTDC for spark to occur
  - Magneto produces spark when magnetic rotor is at Edge Gap distance
    - Fixes position of magnetic rotor
  - Key element is the magneto drive cup
    - Connects the magnetic rotor to drive slot

Magneto Timing – Wico C or X

- Driven Flange Group
  - Fixed to rotor by mated flat on shaft
- Drive cup
  - Edge held against driven flange by impulse spring inside cup
  - Drive cup free to turn on rotor shaft
- Running timing is determined by drive cup
  - Cup shown is 25° drive cup
    - Blue edge is for 30°, orange for 35°
- Wear points
  - Driven flange on rotor shaft
  - Drive cup on driven flange



Magneto and Tractor Start and Run Timing

- Back to example – want spark with pistons at 30° BTDC
  - Flywheel is 30° BTDC
  - Drive slot at 30° BTDC
  - Magneto has 30° drive cup
    - When rotor at edge gap distance magneto drive cup fits into slot
  - Sparks occur at 30° BTDC with tractor running
- How do we get the starting timing at TDC with 30° drive cup?

Timing Considerations *EXTRA*

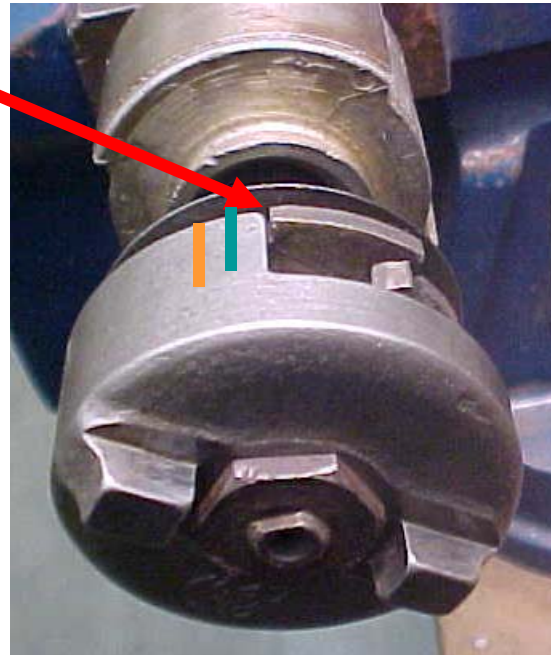
- Determine when engine requires spark
  - Starting – at Top Dead Center (TDC)
  - Running – choose 30° BTDC for our example
    - Distillate burners - 35°, gasoline burners - 25°
- Determine when magneto produces spark
- Couple magneto to tractor to get spark at right time
  - Accommodate both starting and running timing
- For example, choose simple case
  - John Deere A
  - Wico C (or X) magneto

Engine Timing – Spark on Compression Stroke *EXTRA*

- Flywheel (left, #1) side spark plug fires first, followed 180° later by pulley (right, #2) side spark plug
- Want starting spark on flywheel side, at TDC
  - Remove spark plugs, put thumb over hole, rotate flywheel slowly until air pushes on thumb (compression stroke)
  - Continue to rotate until LH Impulse line on flywheel lines up with mark on transmission case
    - Late A, punch mark on flywheel hub lines with V on cover
  - Confirm TDC
    - Wire in spark plug hole
    - Remove crankcase cover, visual inspection
  - When all is correct, magneto drive flange will be horizontal
    - S.A.E. Standard, adopted January 1937, revised 1941

Magneto Timing – Wico C or X *EXTRA*

- Magneto produces spark when magnetic rotor is at edge gap distance
  - Fixes position of magnetic rotor
- Driven Flange Group is positioned on rotor by machined flat on shaft
- Drive cup lip is held against driven flange by impulse spring inside cup
  - Drive cup is free to turn on rotor shaft
- Running timing is determined by relative position of cup and flange
  - Cup shown is for 25° drive cup
    - Blue edge is for 30°, orange for 35°



Running Timing *EXTRA*

- Running timing is determined by the choice of drive cup
  - Only variable in the whole system

• 3744	35 deg	long lug	
• 4702	35 deg	long lug	¼” lugs
• 3565	35 deg	short lug	
• 2061B	30 deg	short lug	
• 7596	25 deg	long lug	hard to find
• 6274	25 deg	short lug	
• 2040	20 deg	short lug	gear driven

Running Timing *EXTRA*

- The governor drive cup slot and flywheel rotate in the same direction at same rate
- When the flywheel (and crank and pistons) is 30° before TDC
  - The magneto drive slot is 30° BTDC
    - 8:00 – 2:00 position
  - The 30° drive cup on the magneto is also in the 8:00-2:00 position when the rotor is at the edge gap distance
  - A spark is produced and the engine fires at 30° BTDC
- But how do we get the starting timing to be at TDC with a 30° drive cup?

Impulse Unit Aids in Starting *EXTRA*

- Achieves two goals
  - Provides mechanism to delay spark
  - Increases spark intensity for easier starting
- Operation
  - Magnetic rotor shaft rotates slowly during starting process
    - Pawls on driven flange group rotate out, catch stop
    - When pawl strikes stop, magnetic rotor stops but drive cup continues to rotate and winds up impulse spring about 70°
    - When the drive cup lugs are nearing horizontal, an edge of the drive cup strikes the pawl and pushes it off the stop
  - Energy stored in impulse spring is released, the rotor snaps forward, rapidly passes through the edge gap, and stops against the drive cup
    - As the rotor passes the edge gap distance the points open and a spark is produced at TDC
- Difference between running and impulse timing is the “lag angle”

Impulse Unit Aids in Starting

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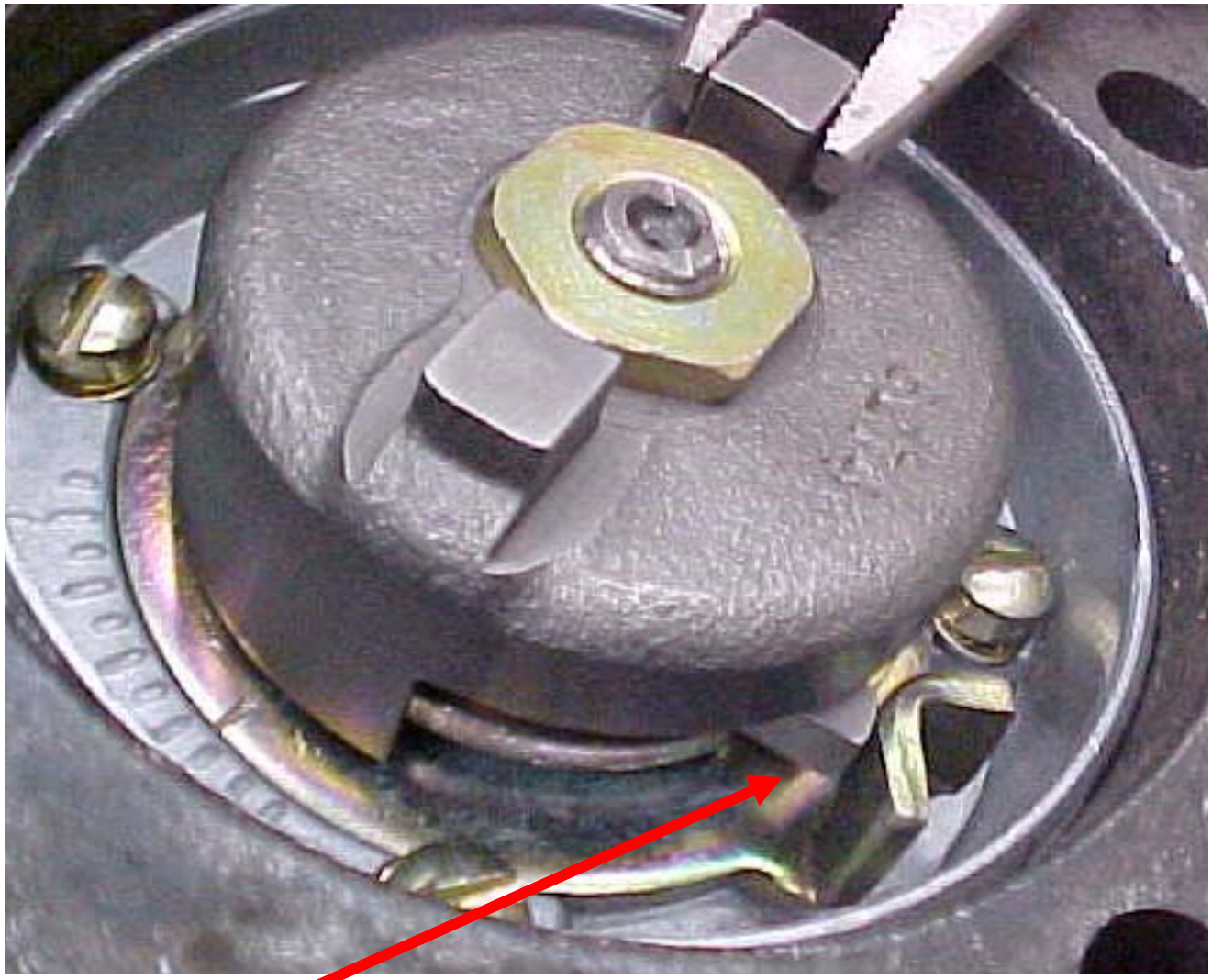
  - Pawl on driven flange rotates out, catches stop
    - Magnetic rotor stops
    - Drive cup continues to rotate
      - Winds up impulse spring about 70°
    - As drive cup lugs approach horizontal, edge of drive cup strikes pawl, pushes it off stop

Impulse Unit Operation



Pawl striking trip arm, spring windup starting

Impulse Unit Operation

Drive cup pushing pawl off impulse stop

Impulse Unit Aids in Starting

- Operation cont'd
  - Energy stored in impulse spring is released
    - Rotor snaps forward
      - Rapidly passes through the edge gap, stops against the drive cup
    - As rotor passes the edge gap distance, points open and spark is produced at TDC
  - Rotor speed ~800 rpm
  - Pawls drop out at ~220 rpm
- Difference between running and impulse timing is the "lag angle"

Impulse and Running Timing

- Wico has an adjustable impulse stop
  - Other brands used on Deere use fixed stops
  - Accomodates
    - Impulse timing changes when magneto is rotated to fine tune running timing
    - Accumulated wear in magneto and gears that drive the magneto
- Running timing determined by drive cup
- Impulse timing determined by position of impulse stop

Impulse Stop and Running Timing *EXTRA*

- Can use impulse stop to approximate running timing
  - Assuming no wear in magneto or drive gears
- Set points at 0.015 (approximates E-gap)
- Set impulse stop at degrees of running timing of drive cup
  - Use marks cast in housing
  - Details in Handout
- Mount magneto, rotate backward until impulse trips, lock down

Handouts from the Gathering of the Green workshops are among the information included on the CD available through this web site.

Mounting (any) Magneto on Tractor

- Rotate flywheel so #1 piston is at TDC on compression stroke (air rushes from plug hole)
  - Magneto drive slot horizontal
- Hold magneto in a vise in the same position as on tractor
  - Connect plug wires from magneto to spark plugs – ground spark plug case to vise
  - Rotate drive cup with wrench until spark occurs at plugs
    - Drive cup lugs will be ~ horizontal
  - Not all magnetos provide a spark every impulse
    - Rotate enough times until you know which plug fires first, followed by spark at second plug 1/2 turn later
  - Rotate until spark occurs at first plug, and stop
- Put magneto on tractor without rotating drive cup
- Install spark plugs and plug wires – first to #1, second to #2

Setting Running and Starting Timing

- Measure circumference of flywheel
  - About 66” for Model A
- Calculate distances for different timings
  - Distance = circumference x deg adv/360
    - D(25°) = 66 x 25/360 = 4.583” ~ 4 19/32”
    - D(30°) = 66 x 30/360 = 5.500” = 5 1/2”
    - D(35°) = 66 x 35/360 = 6.417” ~ 6 13/32”
    - D(40°) = 66 x 40/360 = 7.333” ~ 7 11/32”
- Measure off and chalk these distances CCW starting at the LH Impulse mark

Setting Running and Starting Timing

- Locate a timing light and battery to run it
  - Hook spark sensor to #1 plug wire
- Start tractor, being careful to leave marks
- With the timing light in the plane of the flywheel center and mark on transmission case, see which mark lines up with case
  - RPM does not matter
- Get about ±10° change by rotating magneto
  - If the 35° mark lines up and you want 30° timing, rotate magneto forward
    - Forward retards spark, back advances spark

Setting Running and Starting Timing

- After running time is correct, set start timing
  - Stop engine, remove timing light, mark position of magneto so it can be replaced accurately
  - Rotate flywheel, note where impulse occurs relative to LH Impulse mark
    - Adjust Impulse Stop Ring for spark at TDC (or 1°-3° ATDC)
    - If magneto impulses after LH Impulse has passed mark, impulse stop ring will be rotated CW
  - Remove magneto, loosen four screws holding impulse stop ring, rotate stop ring, tighten screws
    - Each cast-in mark in case near top of stop ring is 5°
  - Replace magneto, lining up with mark, check impulse time, if not correct, redo last steps

Setting Running and Starting Timing

- Now both running and starting timing are set to proper values.
- If rotation of magneto does not provide desired run timing
  - Change drive cup
  - Lift governor box, rotate governor drive gear 1 tooth
    - Backward – spark occurs 12°-15° later (most common)
    - Forward – spark occurs earlier
- If timing light shows spark jumping in time
  - Loose distributor rotor
  - Worn bushings
  - Loose point pivot pin

Look at Specific Magnetos used by Deere

- Up to now information has been general, applying (mostly) to all magnetos
- Look at specifics of magnetos
  - Splitdorf Dixie, Aero, 246C, 246T – Waterloo Boy, D
  - Fairbanks Morse DRV2A, B – A, B
    - Fairbanks Morse R2 used on GP series – Cork Groth seminar
  - Edison Splitdorf CD, (RM) – A, D, G, (L, LA)
  - Wico AP, C, X – A, B, D, G, H, L, LA
- History, Application and Servicing information

General Servicing Information

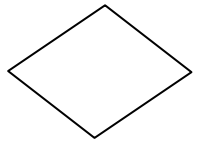
- NEVER charge magnets with the impulse unit on
  - Impulse dogs get magnetized, slow to drop out
- Always remove magneto for governor work
- Disconnect coil and condenser before testing
- Always use a flange gasket
- Ensure ventilation holes open in caps
- If impulse unit doesn't "snap", broken spring
  - Really messes up timing – tractor runs poorly
- Changing point gap changes timing
- 2 "points of resistance" when turning drive cup
- Get a parts book which shows exploded view of magneto (n/a for Splitdorf magnetos)

Splitdorf Magnetos

- Splitdorf Company began in 1858
  - Spark plugs by 1903
  - Magnetos by 1908 (shuttle wound)
- Sumter Magneto Co. (Sumter, SC)
  - Charles Mason patented new type magneto
    - Based on Mason Principle – rotary inductor design
    - “Revolutionary” – named magneto line DIXIE
- Splitdorf bought all patents, manufacturing capabilities for $1 million in August 1915
  - Sumter Division in Chicago built DIXIE magnetos
    - Mostly for 1-cylinder engines prior to Splitdorf purchase
  - Splitdorf developed the Model 46 (and 246)

Splitdorf Magnetos

- Neither Sumter or Splitdorf names appear
  - Only DIXIE, inside Splitdorf Trademark



- Splitdorf AERO announced between March and August 1920
  - Change to rotor, pole faces, cam and condenser provided all sparks with the same polarity
    - All spark plugs want a negative center terminal
  - Added suffix “C” to model
    - Now 46C, 246C
  - “Splitdorf Electrical Company” and “AERO” replaced DIXIE on the brass cover
    - “DIXIE AERO” doesn’t exist

Waterloo Boy Magnetos *EXTRA*

- Summary in J.R. Hobbs Unstyled Deere book
- KW, Kingston, Sevison, Swiss and DIXIE on R
  - Instruction Book, price list No. 3 for “R”
  - Instruction Book, price list No. 5 dated 8-1-1917
- CW rotation
- Model N Instruction Manual No. 7 April 1, 1920
  - DIXIE only used on N through end of production
  - Models 46, 246 listed
    - Same except for 4 (46) or 2 (246) terminal distributors
- Parts Catalog No. 26 (1926)
  - Lists 46,246, 46C, 246C
  - Assume went from 246 to 246C by late ’20 or ‘21

Waterloo Boy Magnetos

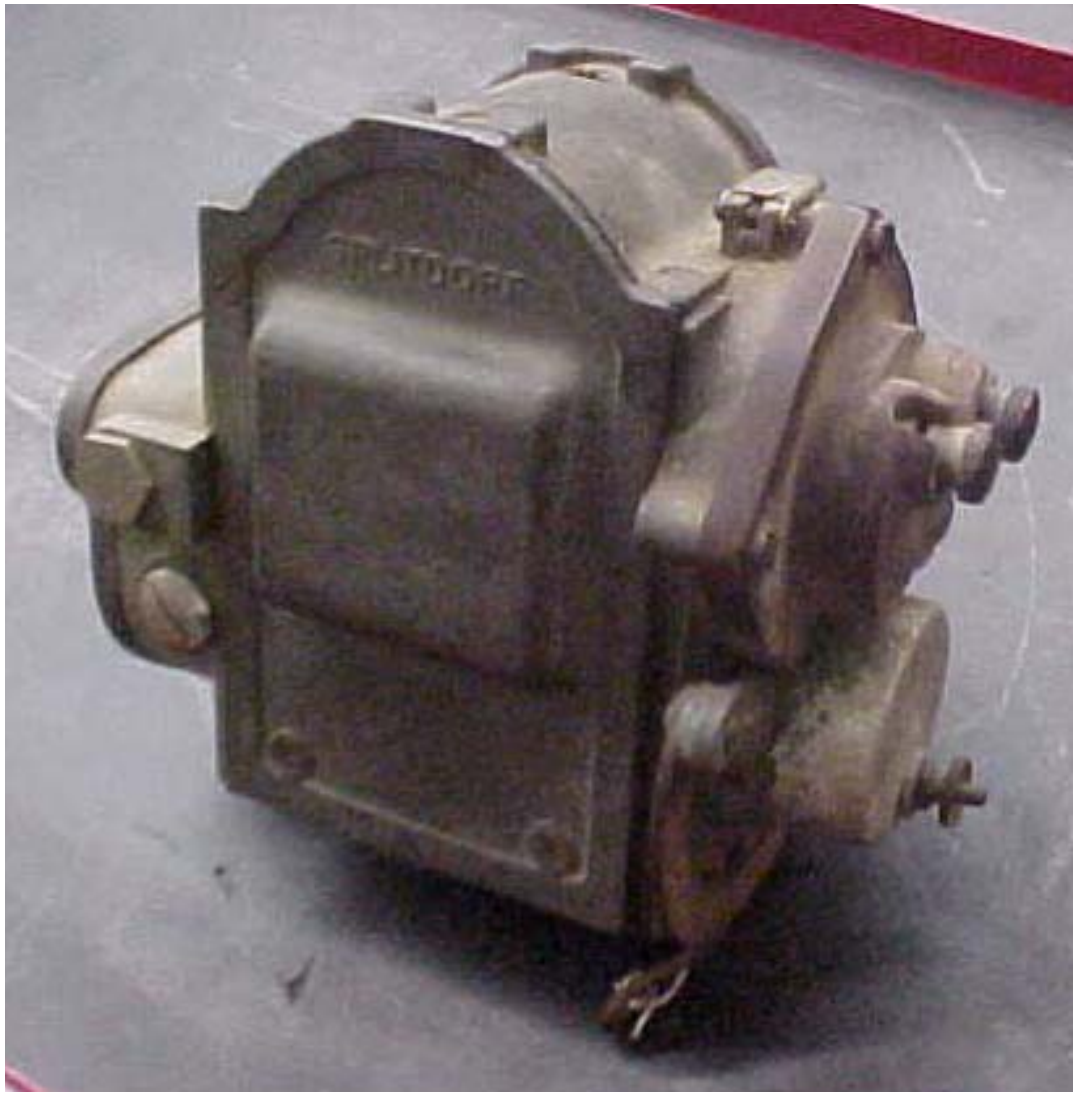
- Summary in J.R. Hobbs Unstyled Deere book
- KW, Kingston, Sevison, Swiss and DIXIE on R
  - Instruction Book, price list No. 5 8-1-1917
- CW rotation
- DIXIE used until late ’20 or ’21
- Replaced by AERO
  - Used until end of production

Splitdorf Magnetos on Model D

- CCW rotation base mount
- 30400 – 35308 AD116R
  - Aero 246C magneto with Sumter Model B impulse using a top switch to set trip
    - Spec 136115
- 35309 – 81069 AD295R
  - Aero 246C magneto with Splitdorf Model EM enclosed impulse unit with side switch for trip
    - Spec 136116
- 81070 – 130699 AD597R
  - Aero 246T magneto with EM impulse
    - Spec 136540
- 246C had brass sides and cover
- 246T had zinc alloy cast sides and cover

Splitdorf Aero 246C with B2 Impulse Unit

Splitdorf 246T Magneto with EM Impulse Unit



Splitdorf 246T with EM Impulse Unit

Splitdorf Service Information

- Disassembly straightforward
  - Remove covers, impulse unit, magnets
  - Remove condenser, coil
  - Pot metal base and end plates
    - Check for looseness of rotor and bearings
      - Bearing cups become loose in end plates – problem
- Check coil
  - Primary 0.5 ohms, secondary 7000 ohms
  - Replacement coils available
- Check condenser
  - 0.09 – 0.11 mfd
  - Often leaky, use a modern replacement with a working voltage >500 volts

Splitdorf Service Information

- Be careful to line up timing dots on pinion and distributor gear
- Point setting 0.022”
  - Make sure they fit together squarely
- Splitdorf service information
  - IH Magneto Manual

Fairbanks Morse Magnetos

- Magneto development started in 1921
- R series introduced in 1924
  - Shuttle wound armature
  - R2 use began on the C at 200111
    - Used on all GP series tractors until GPWT 405109
- RV series introduced ~July 1933
  - First “rotating magnet” design
    - Chrome steel magnets
  - Furnished to Deere, have “D” prefix
  - Base mount DRV2 used on GPWT 405110-end
  - Flange mount DRV2A used on A series
  - Flange mount DRV2B used on A and B series
  - Spark at uneven intervals –(180° - 540°)
    - Click (spark) – click (spark) – click (no spark) – click (no spark)

Fairbanks Morse R2 “John Deere” Magneto

Fairbanks Morse Magnetos

- Deere unhappy with FM service - documented
  - Letter to FM Dec 20, 1934 lists complaints
    - FM needs to provide same high level of service obtained from other manufacturers
      - Magnetos not efficiently serviced
      - Require re-servicing too quickly
      - Service costs too much
  - FM letter (Jan 15, 1935) to their Service Stations
    - Read enclosed JD letter
    - Get supply of parts
    - Need to “render real service”
- Deere starts experimenting with Wico
  - June 17, 1936 - first use of AP477 on B
- Last use of FM magneto by Deere Oct 1937

Fairbanks Morse Magnetos *EXTRA*

- Impulse units on DRV2A, DRV2B
  - Lag angle determined by key position in drive member, not drive cup
    - Drive cups same, drive members labeled
      - Wico – drive member fixed to rotor shaft, lag angle determined by drive cup
  - Lag angle NOT adjustable as on Wico magnetos – pawl stop is a fixed pin
  - Running timing cannot be adjusted separately from impulse timing, as can be done on Wico

Fairbanks Morse DRV2A Magneto

Fairbanks Morse Magnetos *EXTRA*

- DRV2A
  - A 410000 – 424024
  - AR, AO 250000 – 251485
  - Two different impulse units used
    - YB – pressed steel drive cup, welded lugs
      - Replaced at magneto s/n 136200 by
    - XD – machined drive cup
    - UB3 – modern replacement unit - forged drive cup
  - “short lug” drive cup used

Fairbanks Morse DRV2B Magneto

Fairbanks Morse Magnetos

- DRV2B
  - Model B has gas tank flange ½” closer to governor box – not room for DRV2A
  - Goal was to use same magneto on A and B, rotated magneto body 90°, leave flange same
    - Provided adequate clearance for plug wires
  - Problem with B flywheel casting, used p/n AB210R until B14038, after which AB706R was used on both A and B
    - Interesting story here!
  - Long lug drive cup, 35° lag angle
  - YB and XD impulse units used as for DRV2A

Fairbanks Morse Magnetos Service

- Deere provided a DRV2A, B Service Manual
- Remove top cover
  - New gaskets available
  - Check coil (correct replacements available)
    - Primary 0.5 ohms, secondary 5000 ohms
- Remove end cap
  - New gaskets not available
  - To replace condenser, must remove points and distributor assembly – clean both
  - Check condenser, 0.19 – 0.21 mfd
    - Unsolder can, remove stuffing, solder in modern capacitor
- Remove impulse unit, magnetic rotor, bearings
- Reassemble, set points 0.012”, check gear timing

Fairbanks Morse Magneto Timing *EXTRA*

- Time magneto to tractor
  - Remove spark plugs
  - Rotate flywheel until #1 on compression stroke
  - Not every magneto impulse generates spark
    - Click (spark) – click (spark) – click (no) – click (no)
  - RH (bottom) terminal provides 1st spark, then LH (top)
  - Lay plug on magneto, connect to RH terminal
    - Turn impulse with wrench, observing sparks
    - When plug fires, stop turning, mate horizontal magneto drive cup to horizontal slot on governor
  - Attach magneto
    - RH (bottom) plug wire to #1, LH (top) wire to #2
  - Time magneto with timing light

Edison Splitdorf Magnetos

- History
  - Edison company wanted to make radios
    - No licenses being sold, bought Splitdorf for license
    - Formed Edison-Splitdorf subsidiary of Edison Co
      - October 1932
      - Made spark plugs and magnetos
  - Edison Splitdorf Model CD announced Jan ’36
    - First use by Deere on Model D November 1936
      - Followed by use on Model G in May 1937
      - Model A in Fall 1937
  - Edison Splitdorf Model RM announced Feb ’37
    - First magneto with AlNiCo magnetic rotor
    - First use on Model 62 (March – July 1937)

Edison Splitdorf CD Magneto

Edison Splitdorf CD Magneto

- Rotary Inductor design
  - Stationary coil and magnet
  - Rotate legs of magnetic circuit to reverse field in coil
  - Carry over from AERO design
- Model AA impulse unit
  - Check to hear/feel impulse “clunk”
- Disassembly – remove
  - Distributor block, rotor, safety gap
    - Rotor pin offset so goes on only one way
  - 6 screws holding front plate, remove plate
    - Leave 2 dowel pins which locate plate
    - Remove primary lead wire
- Can now check coil, points, condenser

Edison Splitdorf CD Magneto

- Coil
  - Primary 0.5 ohms, secondary 6000 ohms
  - New coils are available
- Condenser
  - Capacity 0.132 – 0.168 mfd
  - Tecumseh 30548-B 0.172 mfd, physically fits
- Points
  - Rework existing points
  - Set opening to 0.015”
- Additional work requires magnet charger
  - Remove rotor, clean & repack bearings, etc.
- Typical problems
  - Coil insulation drips into rotor causing it to stick
  - Thumb nuts holding spark plug wires missing

Edison Splitdorf CD Magneto

- Reassemble magneto
  - Reconnect primary wire
  - Install new gasket, line up dowel pins, install cover
    - Mate “L” on distributor gear with pinion gear mark
- CD Service Information available includes
  - Edison Splitdorf CD Service Manual
  - JD Field Service Bulletin 125
  - JD Electrical Systems SM-2029

Edison Splitdorf RM Magneto

Edison Splitdorf RM Magneto

- Rotating magnet design
  - AlNiCo magnet
- Model AA impulse unit, different from CD
- Types used:
  - Spec 03509
    - L621000 – L622580 62 and unstyled L
    - 10° 6702 drive cup and 62953 gear
  - Spec 03757
    - L625000 – (5/39 - 2/42) styled L
    - 20° 6734 drive cup and 62953 gear
    - Used short magnetic rotor shaft
  - Spec 03761
    - L (?) – L639999 styled L
    - LA1000 – LA4532
    - 20° 6733 drive cup and 62961 gear
    - Used long magnetic rotor shaft

Edison Splitdorf RM Magneto

- Remove the distributor cap and rotor
  - Clean rotor disk with eraser
- Remove points and condenser for inspection and servicing
  - Neither are readily available, no longer made
  - Condenser has value 0.19 mfd
    - Point spring attaches to condenser can
    - Modify condenser for diesel pony motor
      - Too much capacitance – 0.33 mfd
- Remove coil cover to check coil
  - Primary 0.4 ohms, secondary 5000 ohms
  - New coils are available
  - May have to remove coil to clean up “tar” from coil

Edison Splitdorf RM Magneto

- Replace coil cover using new gasket
- Check brushes in distributor cap
- Set points to 0.015”
- Time magneto to tractor
  - Verify correct gear 10° thru unstyled L, 20° rest
  - Move timing hole cover on bell housing
    - Turn motor until “SPARK” on flywheel in hole center
  - Turn rotor CW until center of copper is next to grounding button, then turn until points open
  - Rotate magneto top to the right, mesh magneto gear with driving gear
  - Rotate magneto left to keep rotor from moving, push in place, adjust so points just opening, fasten in place

Wico magnetos

- Started as Witherbee Igniter Company 1897
- Developed EK magneto 1919-22
  - Over 1 million sold for 1 cylinder farm engines
- 1920 changed name to Wico
- Developed good rotating magnet designs
  - Implemented in models A and AP
- June 17, 1936 - first use of Wico magneto by Deere
  - AP477B on B 24050
  - Deere flip-flopped between AP477 & DRV2B
    - Used AP477B only from B49200 - 89999
  - Used on A from 478500 – 488000

Wico magnetos

- Wico introduced model C January 1939
  - Used immediately on Deere H (Jan 1939)
    - Nebraska test on H1000, Oct ’38, used E-S RM
  - Then exclusively on the
    - B at 90000 (~Feb 1940)
    - A at 488000 (~July 1940)
    - L at 640000 (7/17/41)
    - LA at 4533 (~July 1941)
    - G at 11981 (10-1-41)
    - Tried on D at 152708 (1942)
      - But the D continued mostly with the E-S CD-0010
  - The C was used until introduction of the X

Wico magnetos

- Wico introduced the model X Aug 1946
  - Available as X(H)orizontal and X(V)ertical
  - Featured better magnetic rotor design
    - AlNiCo replaced the Nipermag rotor
    - Improved bearing design
- Replaced the model C on the
  - A at 598519 (~Dec 1947) to 659289 (XB)
  - B at 217799 (~Dec 1947) to 268819 (XB)
  - G at 29248 (~Jan 1948) to 46500 (D-R)
- And the E-S CD spec 0010 on the D at 187103 (~Oct 1949) to end

Wico AP Magneto

Wico AP Service Information

- Well built magneto – rotor spins on needle bearings (available)
- Coils available, not points and condensers
  - NOS points around, rebuild condenser
    - Condenser value 0.16 – 0.20 mfd
- Impulse drive cup spring not available
  - 5/16” wide, C & X springs ¼” wide
- Overhaul instructions in SM-2029
  - FSB 126

Wico C Magneto

Wico C Service Information

- Replacement for AP series
  - Needle bearings to bushings
  - Cheaper
    - AP – Aug 1939 list price $37.20
    - C – March 1941 list price $24.50
    - FSB 131 (March 1942) – C furnished as AP replacement
- Points, condenser, coil, most parts available
- Model C issues
  - Early versions had Zimac castings
    - Stalk holding magnetic rotor came loose
      - Damaged rotor and pole faces, point opening varies
    - Wico improved design, noted by “3” cast in frame
    - Always ensure magnetos have the 3 cast in!
  - Later versions had aluminum castings

Wico C Service Information

- Remove distributor cap, make sure rotor button is not loose on magnetic rotor shaft
  - If loose, replace it
  - Try to wiggle end of rotor shaft
    - Problems if it moves
      - Loose stalk – replace case
      - Worn bushings – replace
      - Allows timing to vary as point opening varies in time
  - Rotate shaft to open/close points
    - Check if movable point loose on pivot pin
- Remove points and condenser
  - Be careful to note locations of point spacers

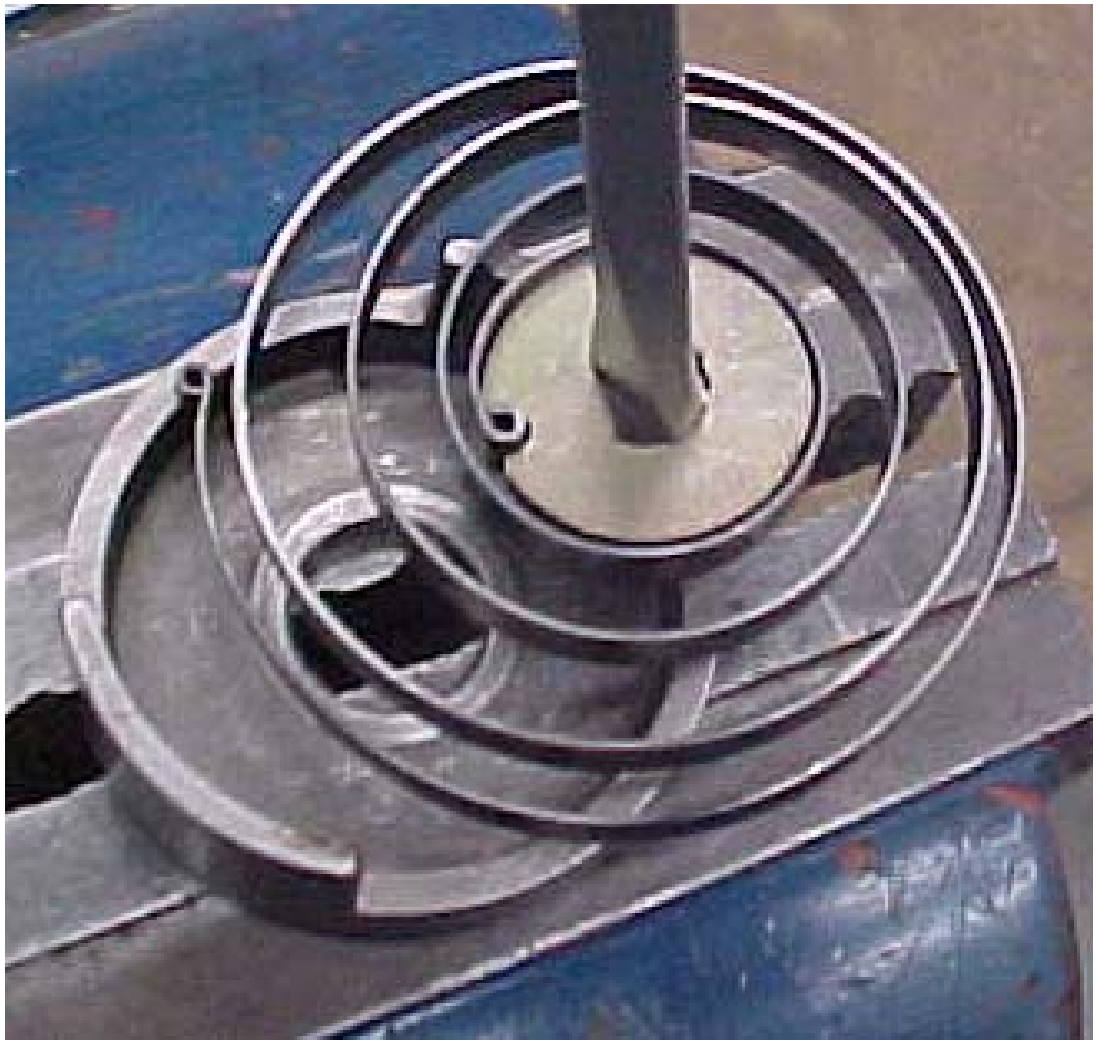
Wico C Service Information

- Check condenser
  - 0.16 – 0.20 mfd, no leakage
  - Replace if bad
- Check points, clean and hone smooth
  - Check rubbing block – if worn replace
- Check coil
  - Primary 0.42 ohms, secondary 5000 ohms
  - If secondary open, replace

Impulse Servicing for C and X

- Inspect impulse end for wear
  - Check where drive cup edge meets driven flange – if worn increases running timing
- Remove drive cup nut, and drive cup
- Pry out impulse spring, clean, re-grease
- Remove spacers, washers, spring retainer
- Inspect where driven flange/rotor shaft meet
  - Should not be able to rotate flange on shaft
    - May be stuck so tap to see if loosens on shaft
  - Often worn, also increases running timing
    - If magneto shaft worn, replace shaft (expensive)
    - If driven flange worn, replace
- Replace parts in order, keep last spacer

Replace Impulse Spring in Wico C, X Units



Impulse Servicing for C and X

- Replace spring in impulse cup
  - Picture shows procedure
  - Using pliers to wind can damage spring
- Replace spacer on shaft, place cup over shaft, line up inner spring loop in both spacer holes
- Carefully lift cup, rotate CCW 1 full turn
- Replace nut and tighten
- Smaller spacer washers available, allows additional windup for hotter starting spark

Wico C Service Information

Wico C Service Information

- Install cover, condenser, points
  - If new, check carefully where the point spring attaches to the condenser bracket
    - Common for edge of spring bracket to touch condenser bracket – grounds out points
    - Problem worse with aftermarket kits
  - Set points via edge gap distance
- Install rotor button and cap

Wico C Service Information *EXTRA*

- Check point opening – should be ~0.015”
  - If “close”, leave as is, as points set for max spark
  - If not, something else wrong, have checked
- Install condenser and coil wires under point spring screw
- Install rotor, distributor cap
- Check for spark
  - Do final timing when on tractor
- Service information for C, X in SM-2029
  - FSB 127 (C), FSB 159 (X)

Wico X Magneto

Wico X Service Information

- Replacement for Wico C (and E-S CD)
- Better magneto
  - AlNiCo magnetic rotor – hotter spark
  - Bearing on outboard end of magnetic rotor
    - No stalk to come loose
- Common troubles
  - Rotor button comes loose
    - Can replace just spring
  - Coil clamps crack and break, get into magnetic rotor
  - Bearing goes bad (rust, dirt, …), sticks

Wico X Service Information

- Remove cover, check rotor button
- Remove condenser, points
  - Check condenser, value depends on coil used
    - X5700C (stamped), capacitance 0.30 – 0.34 mfd
      - Or “hot” coil
    - Taped coil, 0.16 – 0.20 mfd
- Remove coil clamps, check for cracking
  - If cracked, replace
- Check coil resistance
  - Primary 0.50 ohms, secondary 7500 ohms

Wico X Service Information

- Check ease of rotation
  - If rotates freely, except for two points of resistance per revolution, bearing ok
  - If not, must disassemble impulse unit completely, replace bearing (6201)
- Install points
  - Set points via edge gap distance
- Install rotor button, cover

Set Edge Gap on Wico X Magneto

Wico X Service Information *EXTRA*

- Check point opening – should be ~0.015”
  - If “close”, leave as is, as points set for max spark
  - If not, something else wrong, have checked
- Install rotor, cover
- Check for spark
  - Do final timing when on tractor

Summary

- Discussed OEM magnetos for all Deeres
- Seen improvements in magnetos
- How to time magneto to tractor
- Importance of correct drive cup
- Advantage of adjustable impulse on Wicos
- Highlights of service for magnetos
- Handouts contain application details
- Service information available

Handouts from the Gathering of the Green workshops are among the information included on the CD available through this web site.