

ROYAL CANADIAN AIR FORCE



**HANDBOOK WITH PART LIST**

**TIME-RITE  
PISTON POSITION INDICATOR  
PISTON TYPE ENGINE**

**REVISION**  
NOTICE

LATEST REVISED PAGES SUPERSEDE  
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**28 MAY 56**

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## LIST OF RCAF REVISIONS

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## PART 1

## DESCRIPTION

1 The Time-Rite is a piston position indicator designed to afford precision engine timing for all aircraft engines by direct measurement of piston travel.

2 The features of the Time-Rite design are a slide pointer, automatically referenced and an adjustable calibrated scale that eliminate the need for finding top dead center and compensate for the variables involved in accurate piston positioning, see Figures 1-1 and 1-2.

3 Calibrated scales are available for all type engines, and all scale calibrations are obtained in co-operation with, and are approved by, the engine manufacturers.

4 Because of the difference in spark plug

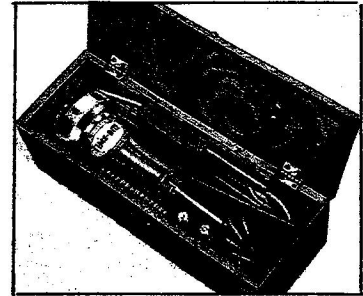


Figure 1-1

locations and piston dome shapes, several different pivot arms are available to adapt the Time-Rite to all aircraft engines. All arms are easily interchanged, as described in Part 5

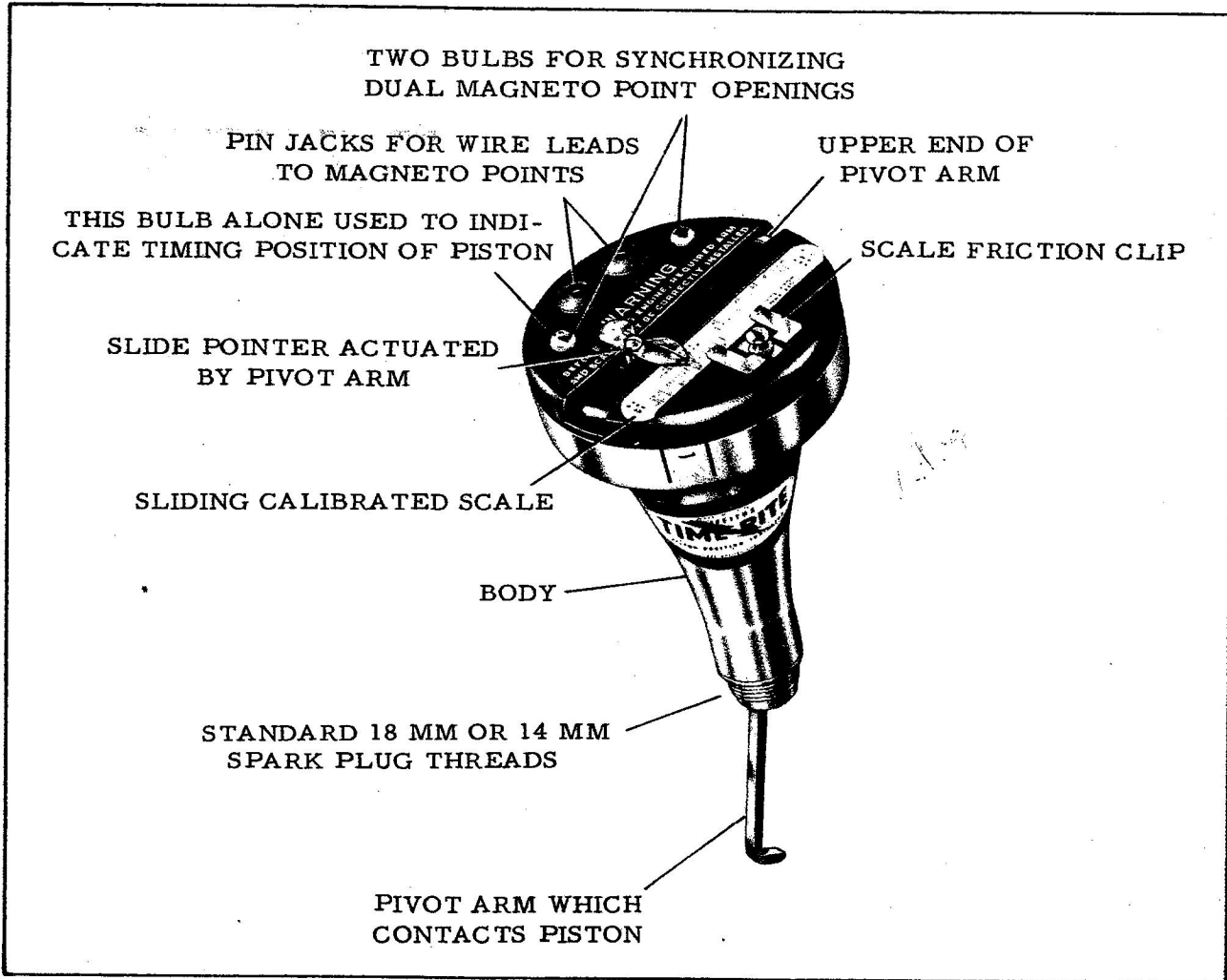


Figure 1-2

## PART 2

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## HOW TO USE THE TIME-RITE

## STEP 1, see Figure 2-1

1 Screw the Time-Rite tightly into the front sparkplug bushing of #1 cylinder after making sure that the piston is on the compression stroke and not too near the top. The Time-Rite cannot be readily installed with the piston at the top of the stroke. Remove all spark plug gaskets.

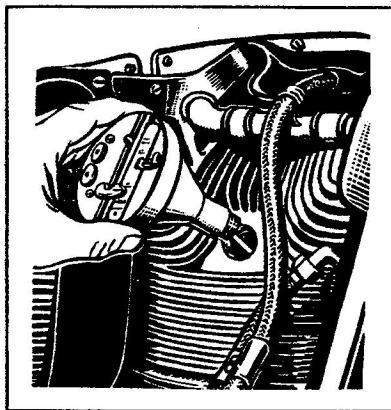


Figure 2-1

NOTE

In some engines when using a hooked pivot arm, it may not be possible to screw the Time-Rite into the spark plug bushing because the pivot arm hits either the cylinder wall or head.

2 In this case, simply hold the cap so that it will not rotate and screw the body into the bushing. Be sure the required arm and scale are correctly installed before timing the engine.

## STEP 2, see Figure 2-2

3 Turn cap so that slot is parallel with the vertical axis of cylinder. Scale should be to right of slot when indicator is installed in radial

engines as illustrated, refer to Figures 4-1 through 4-3.

the correct scale is used for the engine being timed.

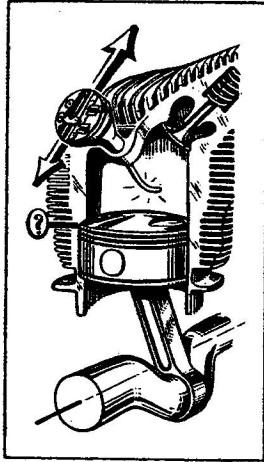


Figure 2-2

STEP 3, see Figure 2-3

4 Turn the engine in the direction of rotation so that the piston goes through the top center position. This will leave the slide pointer at the highest point of piston travel. This operation takes the place of finding top dead center, necessary with all other methods of engine timing.

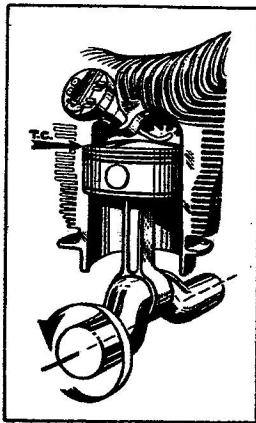


Figure 2-3

STEP 4, see Figure 2-4

5 Set the 0° position of the scale opposite the slide pointer reference mark. Be sure that

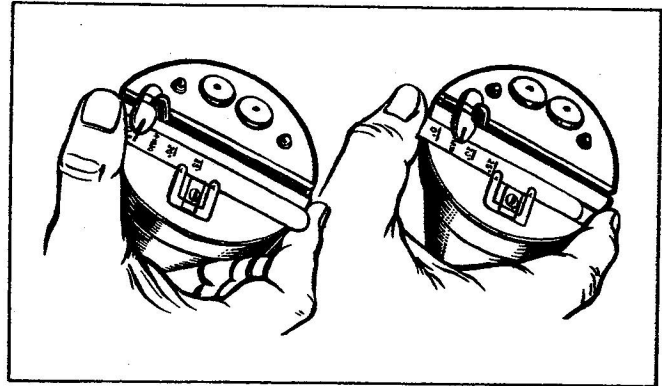


Figure 2-4

STEP 5, see Figure 2-5

6 Turn the engine back through the top center position so that the piston has reached some point before the desired timing position. Set the slide pointer opposite the desired timing position on the scale.

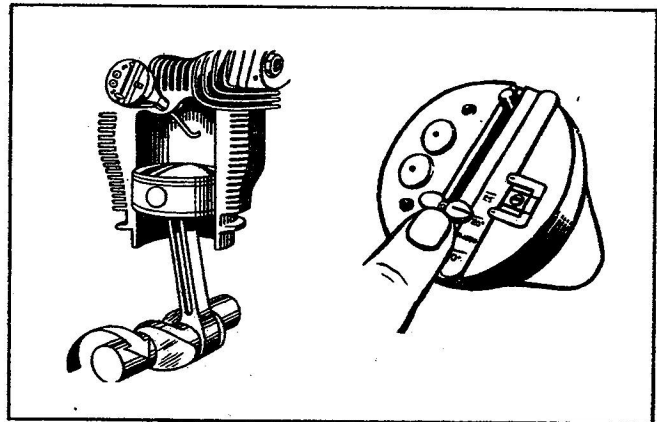


Figure 2-5

STEP 6, see Figure 2-6

7 Turn the engine in the direction of rotation until the pivot arm just touches the slide pointer which will cause the bulb to light, indicating that the piston is at exact timing position.



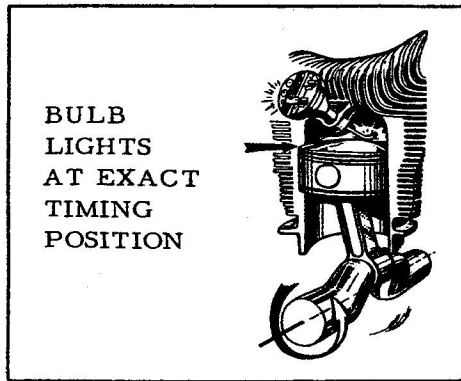


Figure 2-6

NOTE

If the battery is dead, accomplish this final step by pushing the slide pointer up beyond the desired timing position, and allow the pivot arm to push the slide pointer down to the selected timing position. This method may be used after first accomplishing paras. 4 and 5 of this Part.

STEP 7, see Figure 2-7

8 Although the Time-Rite is primarily a piston position indicator, it can also be used for checking magneto breaker point opening and synchronization.

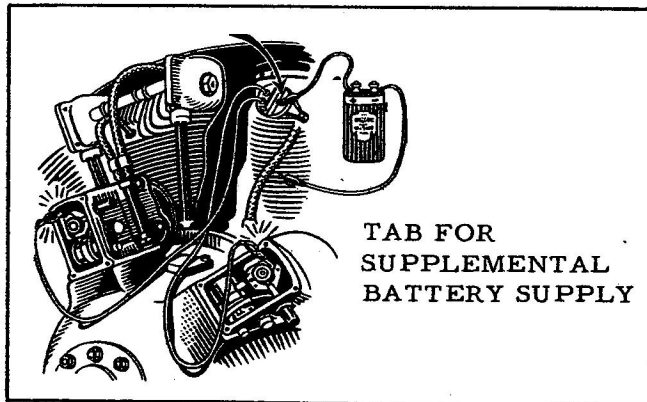


Figure 2-7

(a) When using the Time-Rite for this purpose, it is important to disconnect or insulate the primary coil leads, as is done with any other similar direct current circuit checks

on magneto operated ignition systems. The individual magneto manufacturers' recommendations on insulation or disconnection of the primary coil leads should be followed. This is not necessary, however, on battery operated ignition systems.

(b) After finding the desired timing position of the piston as previously described, move the slide pointer down and away from the pivot arm so as to disconnect the bulb circuit through the arm and slide. Insert the phone tips into the jacks and attach the alligator clips to the proper connections on the magneto for checking operation of the breaker points as shown in Figure 2-7. Adjust the magneto timing in the usual manner so that the breaker points are just opening. The lights will be lit when the breaker points are closed, and will go out when the points open.

(c) To check the setting, turn the crank shaft back; then turn it in the direction of rotation until the lights go off, indicating the points have opened. Push the slide pointer up until it contacts the pivot arm and then note its position on the scale. The position of the slide pointer should align exactly with the degree mark to which the engine is timed when the magnetos are properly timed.

NOTE

Scale should not have been moved once it was properly referenced.

(d) Because it may take some time to complete the foregoing operations, it has been found desirable to provide a supplemental battery so as not to interrupt the work in the event the small battery runs down. The supplemental battery may be used in parallel with the small battery by connecting the "plus" terminal to the screw on the scale friction spring and grounding the "minus" terminal to any convenient place on the engine.

(e) As an alternate method, Time-Rite may be used in conjunction with a magneto

synchronizer. Use Time-Rite to accurately determine the timing position, follow paras. 1 to 7. The slide pointer should then be moved away from the pivot arm to disconnect the bulb circuit. The magneto points may now be synchronized and set at this position using the magneto synchronizer. To check the point opening, turn the engine in the normal direction of rotation until the synchronizer shows the points have just opened. Move the Time-Rite slide pointer up until it just touches the pivot arm causing the bulb to light. Read the degree position on the scale. If the synchronizing and point opening are correct, the Time-Rite pointer will be on the desired timing position.

#### FINDING EXHAUST VALVE CLOSING POSITION

9 Check the "after top center" position of the piston relative to the closing of the exhaust valve as follows. Move the slide pointer up against the arm. Turn the crankshaft through top center to the point where the exhaust valve closes. Align the 0° position of the scale with the slide pointer which was left at the highest point of piston travel. Then push the slide pointer up until it contacts the pivot arm and read its position on the scale. This reading is the "after top center" position of the piston at the time the exhaust valve closes.

#### TOP DEAD CENTER

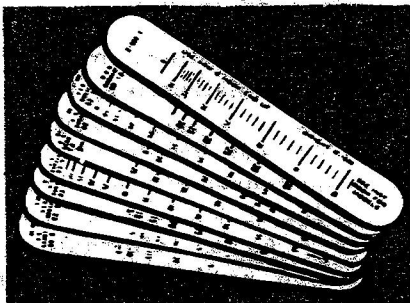
10 Older methods of engine timing require the use of top dead center indicators, propeller shaft pointers, protractors or timing discs, none of which are necessary when the engine is timed with Time-Rite. It is not necessary to

find top dead center when Time-Rite is used as is explained in Part 2, para. 12.

11 However, Time-Rite may be used as a top dead center indicator, and the following method is recommended. The ordinary top dead center indicator has a very short range necessitating the finding of top dead center (TDC) by measurement of the flat spot. Many errors in this method are due to working with piston positions too close to the top of the stroke where small piston movements correspond to relatively large crankshaft movements. A more accurate method is to locate a piston position 20-25° either side of the top of the stroke. Set the slide pointer at any convenient degree position on the scale, and with a pointer on the crankshaft, turn the engine in the direction of rotation until the bulb lights. Mark this position against the crankshaft pointer. Turn the engine so that the piston goes through the top center position and reset the slide pointer. Turn the engine backward until the bulb again lights. Mark this position against the crankshaft pointer. Half-way between these marks is true top dead center.

#### SCALE CALIBRATIONS, see Figure 2-8

12 All scales are calibrated and checked under engine manufacturers' supervision and are guaranteed accurate. Piston dwell is a constant factor for engines of the same model, and is equidistant either side of top dead center. A scale once correctly calibrated is accurate on all engines of that particular model. The piston dwell or flat spot is accurately considered in the calibration of the scale. All piston positions on the scale are referenced from the top of the stroke and represent true crankshaft positions relative to true top dead center.



SCALE CALIBRATIONS

Figure 2-8

## PART 3

## DISASSEMBLY AND MAINTENANCE

1 The Time-Rite may be easily disassembled by slipping the cap out of the body. A slight turning movement while slipping them apart will facilitate the operation. If a hooked pivot arm is installed, be sure that the hook passes through the slot provided in the spark plug thread adapter. It may be re-assembled by snapping the cap into the body until the body stops at the cap shoulder, and the spring tabs grip into the groove in the cap.

2 If the cap ever gets too loose, the spring tabs on the body can be bent slightly to obtain a firmer grip.

3 The battery is easily replaceable by slipping it out of its place in the cap. Dead batteries should not be allowed to remain in the instrument, as they tend to produce corrosion and may cause damage.

4 A bulb may be removed by rotating the spring which bears on its base.

5 In case of malfunctioning of the electric circuit, each connection can be easily checked by tracing the wiring.

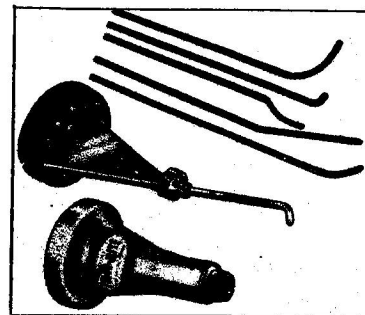


Figure 3-1

6 Pivot arms may be interchanged by lifting the pivot arm retainer and return spring out of the hole in the pivot arm.

7 The slide pointer should always be kept in good working order. It should be removed occasionally for cleaning or regulation of the spring friction. The spring can be manually manipulated so to produce a condition where the slide will move freely, but retain sufficient friction to hold its place in the T slot.

8 It may be desirable to occasionally adjust the friction spring which retains the calibrated scale by bending it slightly so that it will hold the scale firmly.



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## PART 4

## INSTALLATION OF TIME-RITE

## OPPOSED AND INVERTED ENGINES

1 When used in the top spark plug hole of horizontal or flat opposed engines such as Franklin, Continental or Lycoming, Time-Rite is correctly installed with the calibrated scale to the left. When installed in the bottom plug hole, note that scale will be to the right. The diagrams on Figures 4-1 through 4-3 illustrate these positions as well as the correct position when installed in inverted engines.

## CONTINENTAL ENGINES

2 Use Arm D, hook end up. Screw the indicator in tightly and then turn the cap so that the "T" slot is in line with the rocker box screw, as illustrated. The scale is to the left when indicator is correctly installed. Indicator is shown installed in #1 cylinder, but if necessary, can be installed in any other cylinder.

## FRANKLIN ENGINES

3 It is recommended that Time-Rite be

installed in the top spark plug hole whenever possible, see Part 1, para. 3.

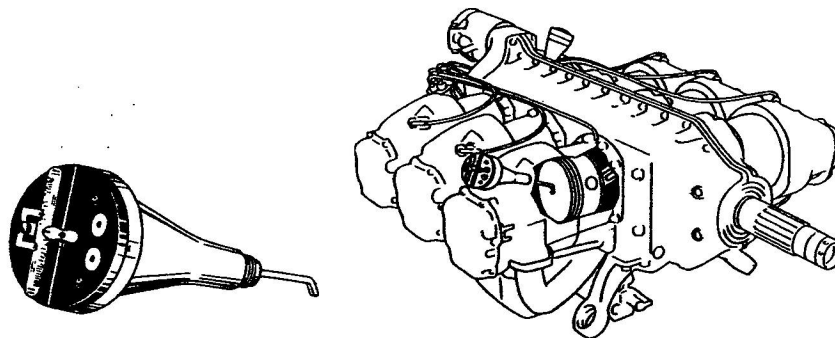
## ROLLS ROYCE PACKARD V-1650

4 Use pivot arm I-205-J with bent end pointing down and calibrated scale I-209-1. Install in the outside of cylinder A-6, left front bank, 14 mm body assembly required

## WRIGHT ENGINES, R-3350

5 Time-Rite may be used for all timing operations on R-3350 engines. Its use is advocated to correctly time fuel injector units thus ensuring fuel injection to all cylinders at the proper position of piston travel. For full details, the engine manufacturer should be consulted. On R-3350 engines, Time-Rite should be installed in the front spark plug hole. Interference with the intake pipe does not permit its use in the rear plug hole.

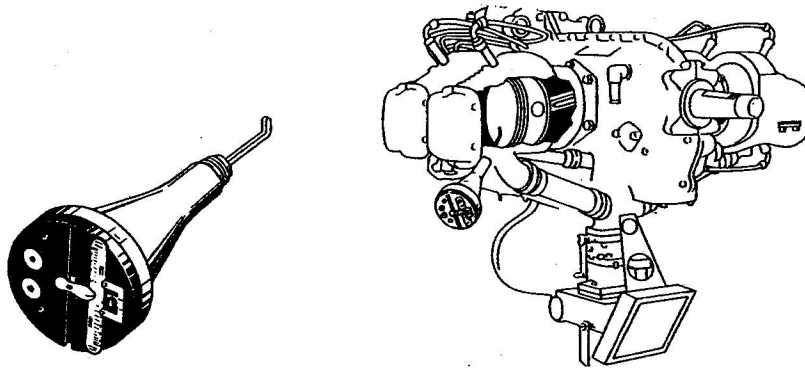
PIVOT ARM "A" INSTALLED IN INDICATOR WITH HOOK END DOWN. (WITH RELATION TO INDICATOR, NOT TO THE ENGINE.)



TIME-RITE INSTALLED IN TOP SPARK PLUG HOLE OF TYPICAL OPPOSED ENGINE

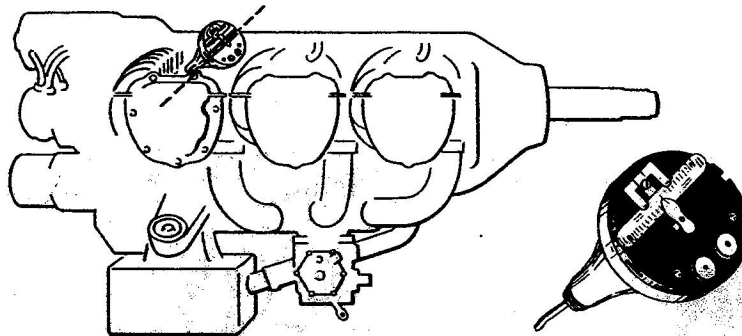
Figure 4-1

PIVOT ARM "A" INSTALLED IN INDICATOR  
WITH HOOK END UP. (WITH RELATION TO  
INDICATOR, NOT TO THE ENGINE).



TIME-RITE INSTALLED IN BOTTOM SPARK  
PLUG HOLE OF TYPICAL OPPOSED ENGINE

Figure 4-2



TIME-RITE INSTALLED IN CONTINENTAL ENGINE

Figure 4-3



## PART 5

## PIVOT ARMS AND SCALES

1 Each pivot arm is lettered (A, B, C, etc.,) and each scale bears one of these letters to designate the proper arm to be used with it. Figures 5-2 through 5-8 illustrate these arms and give a list of engines in which each of the arms will operate. Arms are readily changed by lifting the pivot arm retainer and return spring from the hole in the pivot arm.

2 The arm illustrations, see Figures 5-2 through 5-8, are to scale and should be used to compare the actual arm in cases where it is suspected that the arm has been bent.

3 Each indicator kit is equipped only with scales and pivot arms as initially ordered.

4 Typical pivot arm positions with relation to indicator, not with relation to its installation in engine, see Figure 5-1.

PIVOT ARM USAGE AND APPLICATION,  
see Figures 5-2 through 5-8

## Pivot Arm "A"

5 Use with HOOK END UP on the following engines, see Figure 5-2:-

- (a) P and W R-985 Wasp Jr.
- (b) R-1830 Twin Wasp.
- (c) R-2800 Double Wasp.

6 Use with HOOK END DOWN on the following engines:-

- (a) P and W R-1340-H1 Series Wasp.

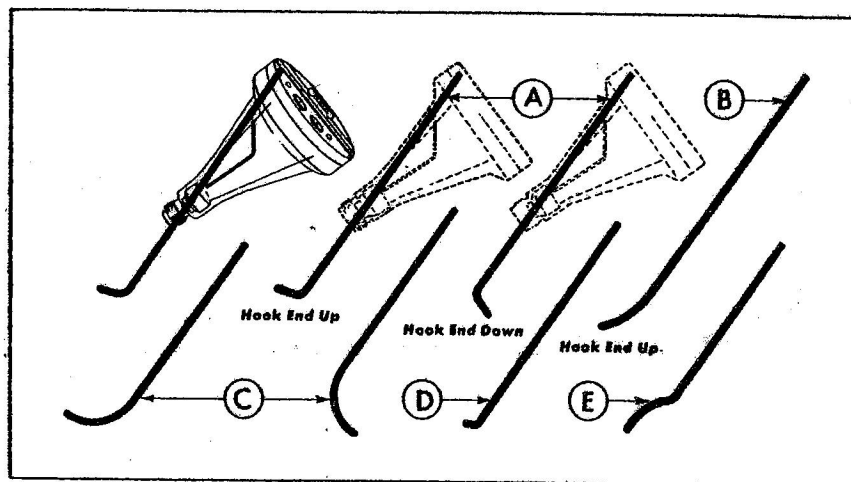


Figure 5-1

Pivot Arm "B"

7 Use with HOOK END UP on the following engines, see Figure 5-3:-

- (a) Wright R-1820 84, 103-,
- (b) R-2600.

Pivot Arm "D"

8 Use with HOOK END UP on the following engines, see Figure 5-4:-

- (a) Continental 0470-11, 0-470-L.

Pivot Arm "E"

9 Use with HOOK END DOWN on the following engines, see Figure 5-5:-

- (a) Continental 0470-13.
- (b) 14 mm, body assembly required.

Pivot Arm "G"

10 Use with engines

DELETED

- 335, YO-335, -5.
- ., adapter.

Pivot Arm "J"

11 Use with BENT END DOWN on the following engines, see Figure 5-7:-

- (a) Rolls-Royce (Packard) V-1650.
- (b) 14 mm, body assembly required.

Pivot Arm "M"

12 Use with BENT END UP on the following engines, see Figure 5-8:-

- (a) Wright R-3350-32W, -EA1, -85.

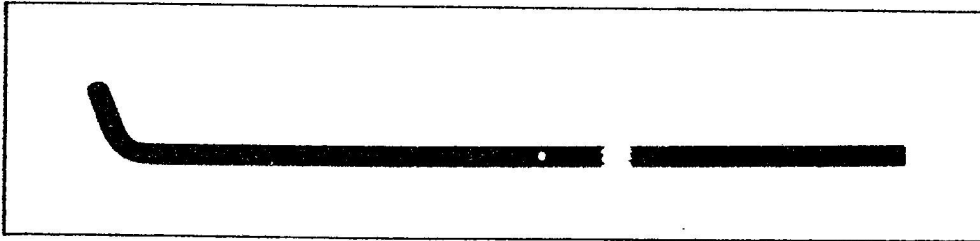


Figure 5-2

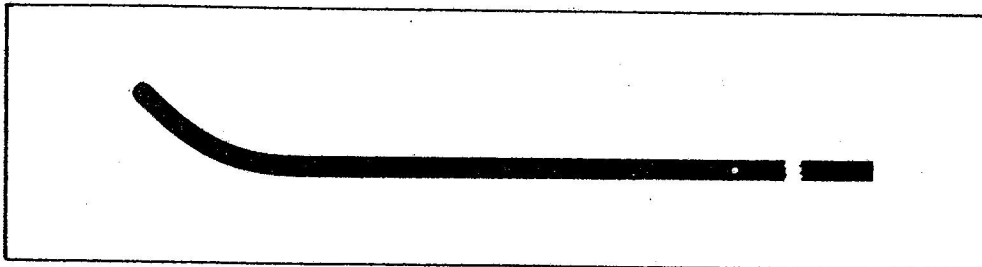


Figure 5-3

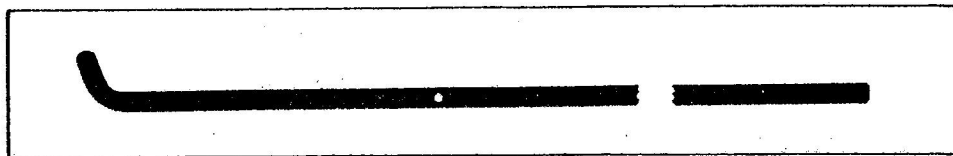


Figure 5-4

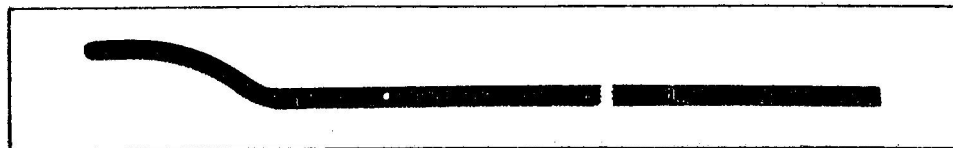


Figure 5-5

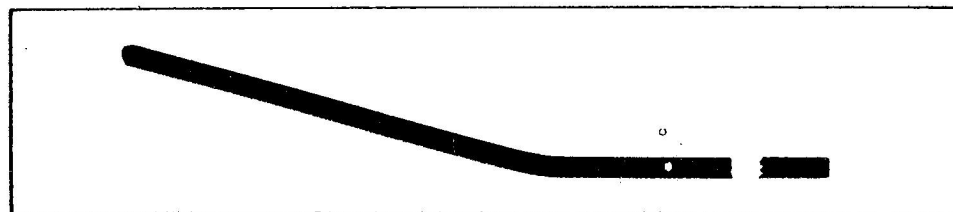


Figure 5-6

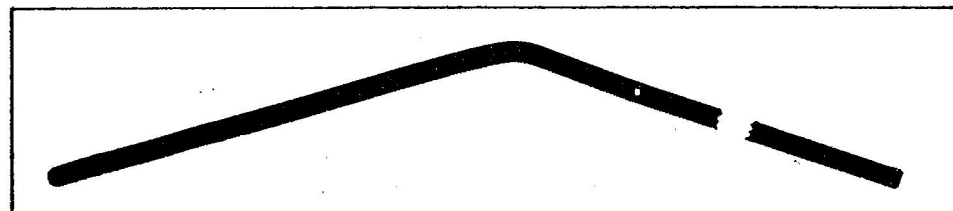


Figure 5-7

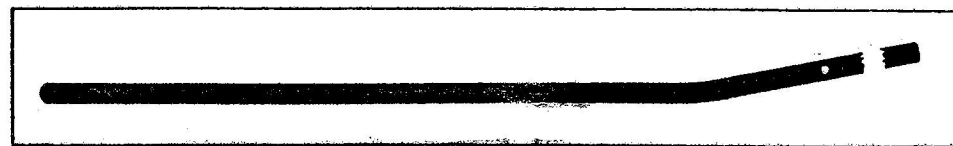


Figure 5-8

## SCALE AND ARM APPLICATION

Mfg. and Engine	Scale Part	Arm Part	*Arm Position
CONTINENTAL	I-209	I-205	
0470-11, 0-470-L	-10	--D	Hook end up
<b>DELETED</b>			
*MERLIN	-15	--J	Bent end down
PRATT AND WHITNEY			
R-985, R-1830, R-2800	-1	--A	Hook end up
R-1340	-1A	--A	Hook end down
R-1830 (Note: For use on ignition analyser installation)	-22	--A	Hook end up
WRIGHT			
R-1820, -84, -103	-2	--B	Hook end up
R-2600	-2	--B	Hook end up
*These engines require 14 mm body assembly.			
R-3350, -32W, -85, EA 1	-14	--M	Bent end up

PART 6

PART LIST

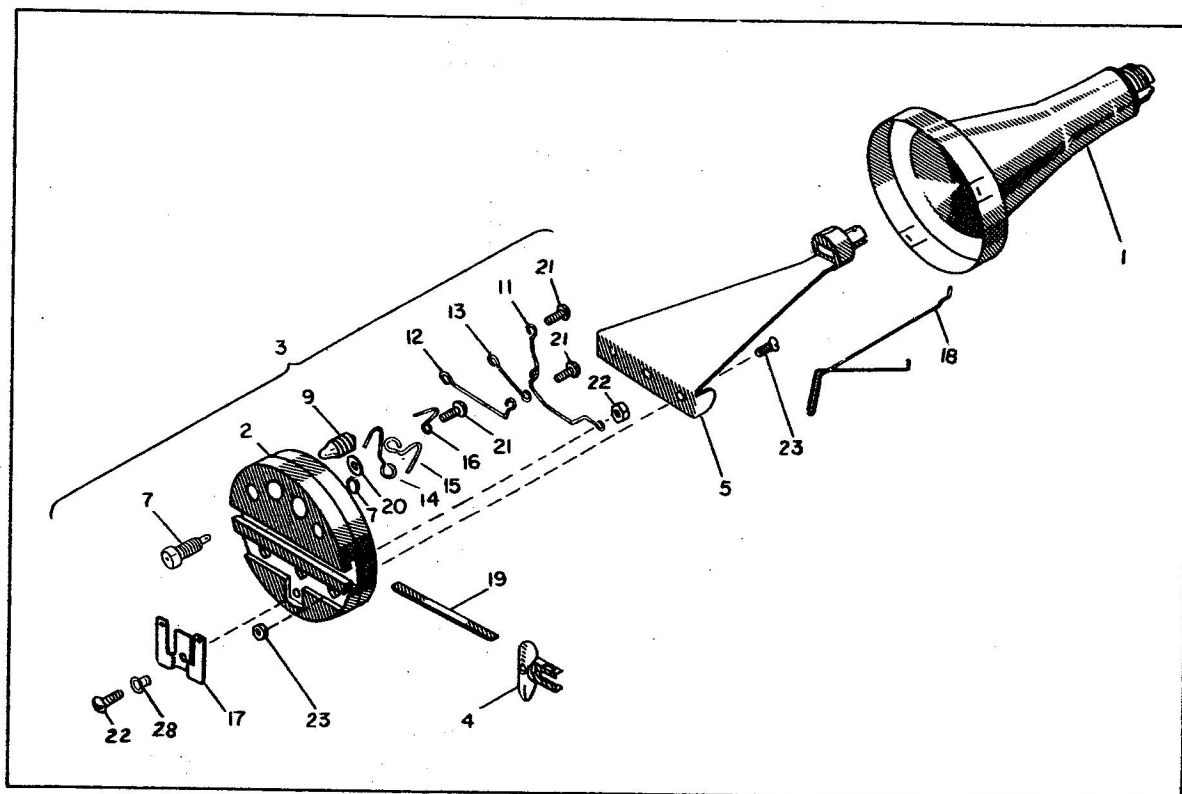


Figure 6-1

Item	Manufacturer's Part Number	Description	RCAF Sec./Ref.
6-1		Time-Rite Piston Position Indicator Complete	35/10070
1	I-201	Body assembly 18 mm or 14 mm	35/10123
2	I-202	Cap only	NP
3	I-202a	Cup assembly complete	35/10124
4	I-203	Slide pointer assembly	NP
5	I-204	Plate and pivot plug assembly	NP
6	I-205	Pivot arms (see Scales and Arms)	NP
7	I-206	Red jacks and nuts	NP
8	I-207	Pin light battery	NP
9	I-208	1.1V bulbs Mazda No. 112	NP
10	I-209	Scales (see Scales and Arms)	
11	I-210-1a	Battery connector	NP
12	I-210-1b	Connector	NP
13	I-210-2	2 bulb connector	NP
14	I-210-31	Jack to bulb left	NP
15	I-210-3	Jack to bulb right	NP
16	I-210-4	Insert to bulb	NP
17	I-210-5	Scale friction	NP
18	I-210-6	Pivot arm retainer and return	NP
19	I-210-7	"T" slot insert	NP
20	I-210-8	Slide friction	NP
21	I-211	3 Slide friction	NP
22	I-212	Scale friction screw and nut	NP

Item	Manufacturer's Part Number	Description	RCAF Sec./Ref.
6-1 (Cont'd)			
23	I-213	(3) Plate screw and nuts	NP
24	I-214	Magneto leads (5 ft.)	NP
25	I-215	Supplemental battery leads 1 ft.	NP
26	I-216	Supplemental battery	NP
27	I-217	Carrying case	NP
28	I-218	Eyelet	

## ARMS

Manufacturer's Part Number	Description	RCAF Sec./Ref.
I-205a	Arm position for R985, R1340, R1830 and R2800	35/10107
I-205b	Arm position for R1820-84-103, R2600, 13, 29	35/10112
I-205d	Arm position for Continental 0470-11	35/10118
I-205e	Arm position for Continental 0470-13	35/10119
I-205g	Arm position for Franklin YO-335-5 or 6V4-200	35/10120
I-205m	Arm position for Wright R3350-32W-85, EA. 1	35/10121
I-205j	Arm position for Rolls Royce V-1650	35/10122

## SCALES

Manufacturer's Part Number	Description	RCAF Sec./Ref.
I-209-1	Scale position R985, R1830 and R2800	35/10106
I-209-2	Scale position R1820-84-103, R2600, 13-29	35/10111
I-209-8	Scale position Franklin YO-335-5, 6V4-200	35/10113
I-209-10	Scale position Continental 0470-11	35/10114
I-209-13	Scale position Continental 0470-13	35/10115
I-209-14	Scale position Wright R3350-32W-85, EA. 1	35/10116
I-209-15	Scale position Rolls Royce V-1650	35/10117
I-209-1A	Scale position R1340	35/10125
I-209-22	Scale position R1830	35/10230

