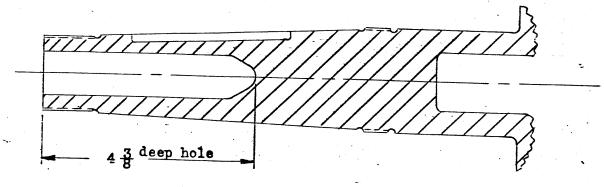
September 14, 1942

SERVICE LETTER A-11

Subject: Periodic Inspection of Crankshafts on Warner Scarab 125 H.P. Engines.

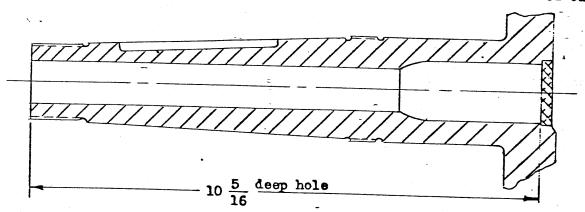
To: All owners of Scarab 125 H.P. engines.
All authorized Warner Aircraft service representatives.

1. Check which type of crankshaft is used in your engine. If the shaft has a 4-3/8" deep hole in the front end of the crankshaft as indicated in Sketch No. 1 below, then the contents of this service order are not applicable to the engine and no 50 hour inspection of the shaft is required. It may be advisable to occasionally take off the propeller and check for galling and to relap the hub on the shaft as outlined below in paragraph 10 if the shaft is found galled.



SKETCH No. 1

-2. If the shaft has a 10-15/16" deep hole as shown in Sketch No. 2, the instructions of this service letter are applicable and must be carried out.



SKETCH No. 2

3. The National Bureau of Standards upon examination of broken tapered shafts came to the conclusion that high stress concentrations may be induced by both a high clamping stress and galling at the rear of tapered sections, such as tapered shaft ends. It is considered that inadequate maintainance may provide the galling through a looseness and poor seating of the hub. Additional stress at this point may then be the result of propeller unbalance, loose engine mount fastening, or other factors which would cause roughness in operation.

- 4. It is recommended that any definitely rough periods be indicated on the aircraft instrument panel with a general warning to all the pilots to avoid continued operation in that speed range. Due to tachometer inaccuracies and differences between aircraft it is desirable that each aircraft be investigated by the owner or operator in this connection.
- 5. In order to preclude failure due to the stress concentration and/or galling the following inspection is to be carried out every 50 hours and corresponding entries are to be made in the engine log book for future reference of the Civil Aeronautics Authority Inspectors.
- 6. The propeller and hub are to be removed from the crankshaft to determine if a fatigue crack has started. A fatigue crack is likely to start under the rear end of the propeller hub or at the four holes in the crankshaft for the thrust bearing retaining nut lockwire. It is recommended that this nut be removed for the inspection.
- 7. The shaft should be cleaned thoroughly for the inspection. If the shaft is oxidized or looks suspicious, it should be washed with gasoline and the section to be inspected should be etched with a weak nitric acid solution (one part of nitric acid to ten parts of water). This solution can be purchased for a few cents ready-mixed at any drug store and is best applied to the shaft by means of some cotton wrapped around a wooden stick. After the acid has been left on the shaft long enough to cause a dulling of the surface, it should be washed off thoroughly with hot water to stop the action of the acid. After carefully inspecting the etched section, oil thoroughly to prevent rusting. If there is any doubt regarding the condition of the crankshaft, it should be magnafluxed.
- 8. It is recommended that wherever available, magnetic inspection be applied to the shaft in place of etching with acid. This magnetic inspection can be made on the airplane without disassembling the engine by licensees of the Magnaflux Corporation. The following overhaul stations are licensees of the Magnaflux Corporation:

Aircraft Industries, Inc., Glendale, California
Aircraft Sales Co., Fort Worth, Texas
All American Aviation, Inc., Pittsburgh, Pennsylvania
Badgett Flying School, Shreveport, Louisiana
Booth Henning, Inc., Dallas, Texas
Bruening-Winans, Inc., Rochester, New York
Caldwell Wright Airport, Caldwell, New Jersey
Calkins Aircraft Co., Spokane, Washington
Cincinnati Aircraft Service, Cincinnati, Ohio
Delta Air Lines, Hapeville, Georgia
Engine Air Service, Inc., Garden City, New York
Mineola, New York

C. Foley Company, Inc., Garden City, New York
General Airmotive Corporation, Cleveland, Ohio
Gill-Dove Airways, Inc., Martin, Tennessee
Hangar Six, Inc., Houston, Texas
Harrington Air Service, Mansfield, Ohio
Higley Aircraft Corp., Denver, Colorado
Inter City Aviation, Inc., East Boston, Massachusetts
Johnson Flying Service, Missoula, Montana
Kansas City Flying Service & Air College, Inc.,
Kansas City, Missouri

8. Continued - Magnaflux Corporation licensees.

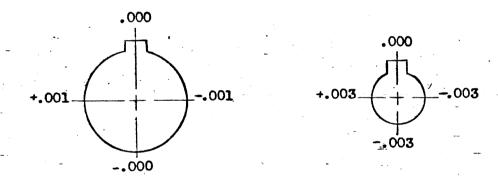
Lewis School of Aeronautics, Lockport, Illinois Lincoln Aeronautical Institute, Lincoln, Nebraska Milwaukee Airways, Inc., Milwaukee, Wisconsin Northeast Airlines, Inc., East Boston, Massachusetts Northwest Air Service, Inc., Seattle, Washington Pacific Airmotive Corp., Los Angeles, California San Francisco, California Parks Air College, Inc., East St. Louis, Illinois Piedmont Aviation, Inc., Winston-Salem, North Carolina Precision Aeromotive Corp., Houston, Texas St. Louis School of Aeronautics, Inc., St. Louis, Missouri Snyder Aircraft Corporation, Chicago, Illinois Southern Air Services, Inc., Memphis, Tennesses Southwest Airmotive Co., Dallas, Texas Spartan School of Aeronautics, Tulsa, Oklahoma Springfield Flying Service, Inc., Springfield, Missouri Texas Aviation School, Inc., Fort Worth, Texas Van Dusen Aircraft Supplies, Minneapolis, Minnesota Wallace Air Service, Spokane, Washington A. W. Whitaker, Portland, Oregon

- 9. This magnetic inspection can either be done with a small coil operating on alternating current or with battery current and two special nuts for the attachment of the electrodes. The Warner Aircraft Corporation will gladly furnish the necessary information to all licensees of the Magnaflux Corporation.
- 10. If the crankshaft shows any signs of galling from the propeller hub, it should be relapped using a small amount of fine grain grinding compound (Clover No. 1A or equivalent). Lap the surfaces together by periodically oscillating the propeller and relieving the load to obtain a good fit. After lapping, check the fit by using pencil lines axially along the taper. Remount the propeller, oscillating it several times and remove to check fit. When both bearing oscillating it several times and remove to check fit. When both bearing surfaces show a good fit, apply a very small amount of the lapping compound to the small front end of the crankshaft and lap a slight amount more, using only oil on the larger rear bearing surface. Clean all surfaces thoroughly, only oil on the larger rear bearing surface. Clean all surfaces thoroughly, wount Re-install the key and after oiling the shaft and hub thoroughly, mount the propeller. It is advisable to ascertain, that the keyway in the hub is deep enough so that the hub assembly does not ride on top of the key in the shaft. This has been found to be the cause of a failure in at least one instance.
- 11. At all times during the operation of the airplane particular attention should be paid to the following factors which introduce fatigue stresses in the propeller end of the crankshaft.
 - (a) The propeller should be periodically checked to determine that it is in balance and track and is properly mounted on the crankshaft.
 - (b) The motor mount must be kept in the same condition as when it left the factory. If the ship is equipped with a rubber motor mount, it is so designed that the unavoidable resonance points fall outside of the operating range. Deterioration of the rubber mount will cause the rate of deflection of the rubber to change so that the motor mount resonance may creep into the operating range. A motor mount resonance point can be detected by seeing and/or feeling vibration at a given R.PM. which vibration decreases as the engine

11. (b) Continued.

speed is raised or lowered. Whenever the resonance range with rubber motor mounts has changed, new rubber bushings must be installed on the motor mount.

- (c) For criusing, the engine should always be operated at a speed at which it operates smoothest and at which the least wibration is felt and/or seen.
- (d) If your airplane has been involved in an accident which may have bent the crankshaft, it should be checked with a dial indicator at the small and large ends of the taper. For this purpose a dial indicator should be mounted on a rod which is securely fastened to a thrust bearing cover attaching stud. For a crankshaft checked without ball bearings on a surface plate, the allowable runout at the small end is .004 if the checking procedure outlined on page 21 of the third edition of the Warner Engine Handbook is followed. When the engine is installed in the airplane slightly higher readings may be observed due to the eccentricity limits of the ball bearings. When in doubt, make a rough sketch of the indicator readings obtained at the large and small ends of the taper in relation to the keyway as seen from the front and submit it to the Warner Aircraft Corporation for comments. To clarify this matter, a sample sketch is shown:



At no time should a crankshaft, which is found to be bent, be straightened.

- (e) If, at any time, there is a noticeable roughness in the engine, the cause of the roughness should be ascertained and corrected.
- 12. The Warner Aircraft Corporation is undertaking these steps for the best interests of its customers and to insure the greatest safety for them.
- 13. In order to get our records on Scarab engines up to date, we would appreciate it if all the owners will fill out the enclosed questionnaires and return them in the enclosed postage-paid envelopes.

Yours very truly,
THE WARNER AIRCRAFT CORPORATION
20263 Hoover Avenue
Detroit, Michigan