Rebuilding the Lucas HF1748 Horn

Written by: Domenic DeZan, January 26, 2021

Reference: Lucas Workshop Instructions (Appendix of this article)

And;

https://www.bobine.nl/jaguar/13-electrical/lucas-high-frequency-horn-hf1748-on-jaguars-1953-to-1961/

Evaluation of condition:

After removal from the vehicle, inspect the horn for rust and corrosion. If the rim, also known as the bezel is corroded and/or fractured, these can be purchased new from Terrence Jones (taffthehorns.com) in the U.K. (terrybinns1957@gmail.com).

There are two areas of concern that can lead to disappointment with the project. The first is the six cheese head screws that retain the rim. These are ¼-28 BSF screws which have a slightly different thread shape and size as compared to standard ¼-28 UNF threads. If these look like they may be rusted to the aluminum housing, then several days of soaking with penetrating fluid combined with a heat gun may get them loose. These are available from Britishfasteners.com or the threads, if damaged, can be repaired with a Helicoil and a standard ¼-UNF cheese head screw from a supplier like McMaster-Carr.

The second issue is rusting of the cone nut to the guide rod and will be addressed in the following section.

Disassembly of Horn

All part names are listed in Figure 3 of the Lucas Workshop Instructions and is reproduced below.

Read through the Lucas instructions prior to starting.

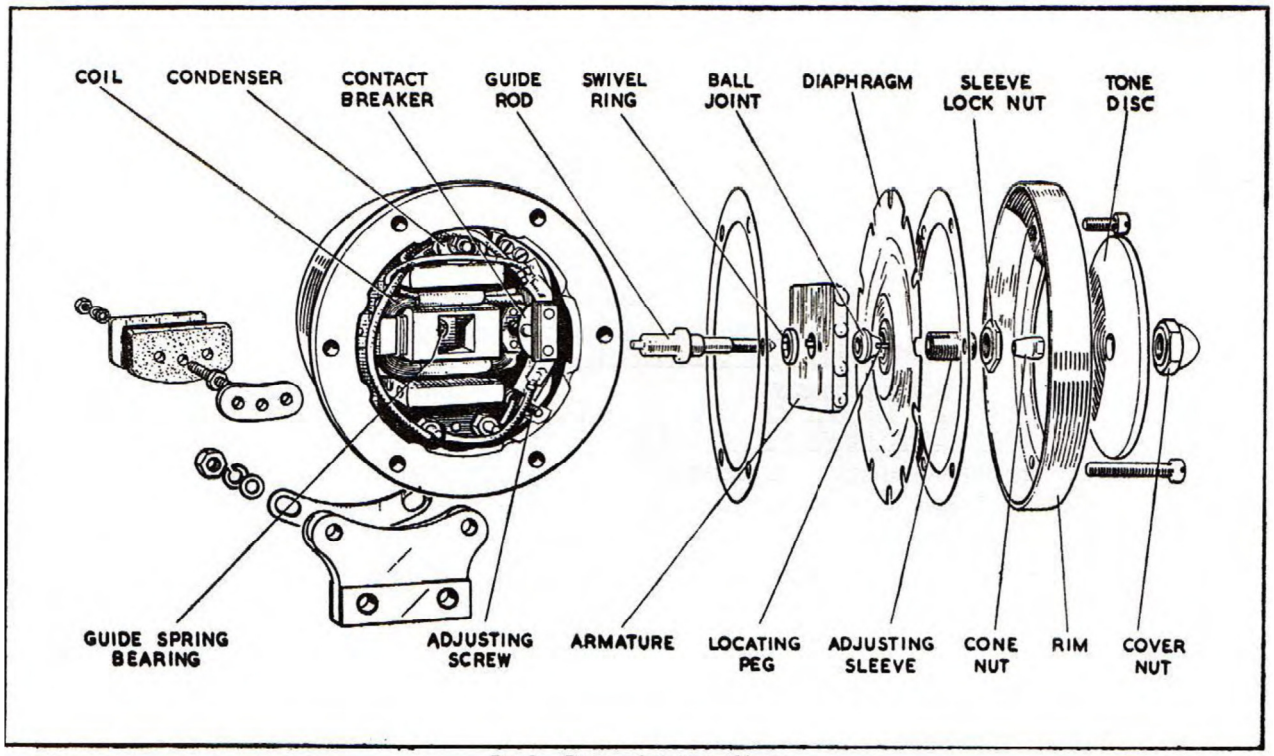


Fig. 3. Dismantled view of horn.

Remove the cover nut and the magnesium tone disc

Now you can evaluate the condition of the cone nut, adjusting sleeve and sleeve lock nut.

If there is rust of any amount on these parts then do not attempt to unscrew the cone nut. If it is rusted tight, the threaded portion of the guide rod will break off.

Remove the six cheese head screws and remove the rim.

Now remove the diaphragm assembly complete with the armature. There is a paper gasket on either side of the diaphragm. Save one if possible to use as a template when making a new gasket.

If the assembly is corroded on the above mentioned parts, then soak those areas on both sides of the diaphragm for several days and use a heat gun prior to removal. If the cone nut is rusted tight, the guide rod will break when you try to remove it. These parts are not available.

If the guide rod does break then it can be repaired with the use of a drill press or lathe.

Cut off the shank portion and drill a .159 inch diameter concentric hole approximately 5/16 deep and cut 10-32 UNF threads with a tap. It is important to ensure the hole is concentric and in-line with the guide rod axis.

Install a new threaded portion using a long 10-32 screw and make it about .10 inch longer to fully engage the cone nut. Use a bit of Loctite on the threads before fully bottoming the threaded portion in the new hole.

The broken threaded portion of the guide rod still in the cone nut can be drilled out and removed with an easy out. Tap with a 10-32 UNF thread. The guide rod is just mild steel so drilling and tapping is easy.

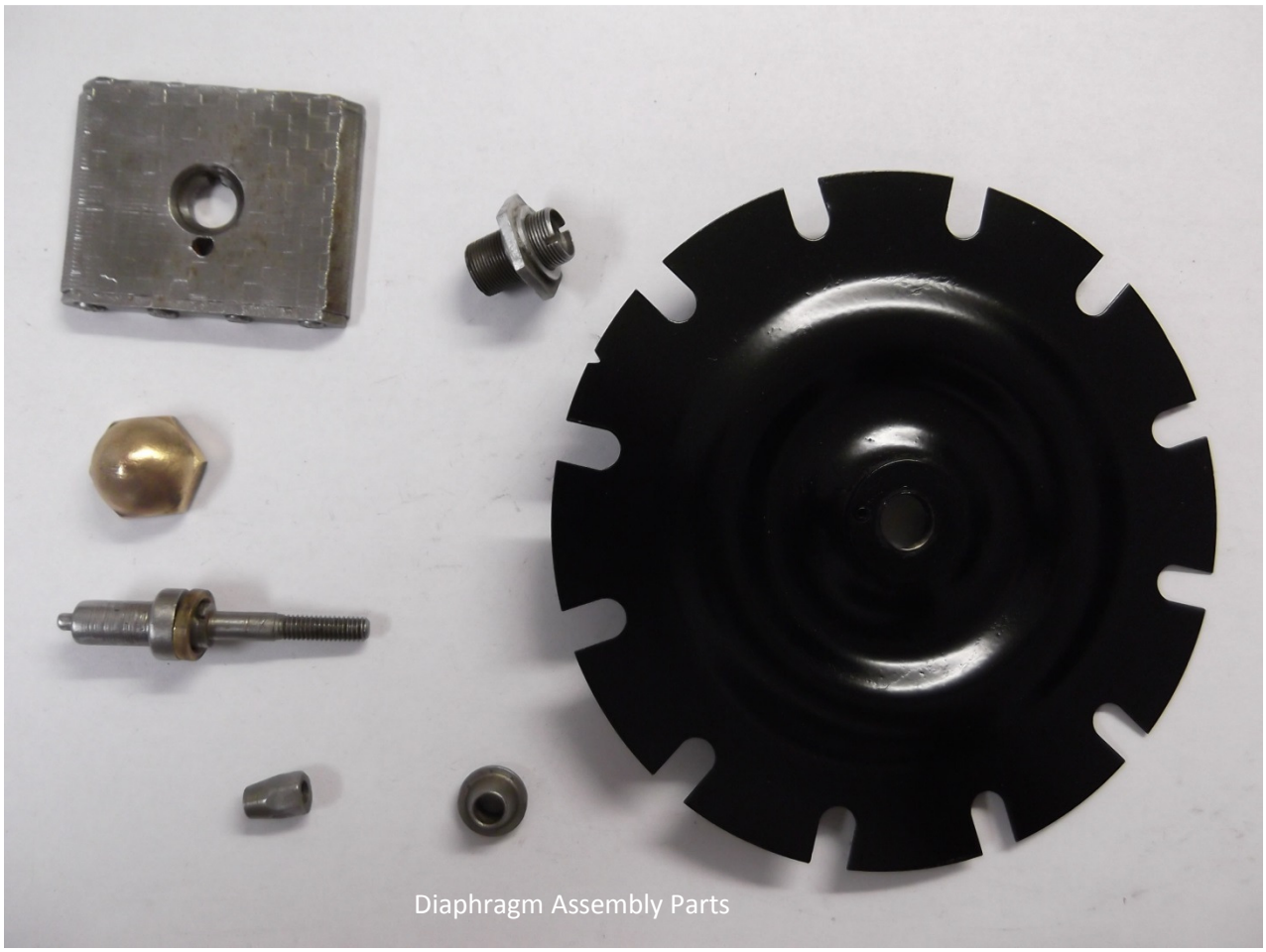
Proceed to disassemble the diaphragm assembly by placing it in a vise and gently clamping down on the sides of the armature. Slightly loosen the sleeve locknut with a wrench and then unscrew the cone nut. At this point the diaphragm complete with the adjusting sleeve, locknut, and ball joint should come off as one assembly. Do not use excessive force and apply more penetrating fluid if necessary.

Note the orientation of the ball Joint and the swivel ring on the guide rod.

Unscrew the sleeve locknut and remove the diaphragm, adjusting sleeve, and ball joint.

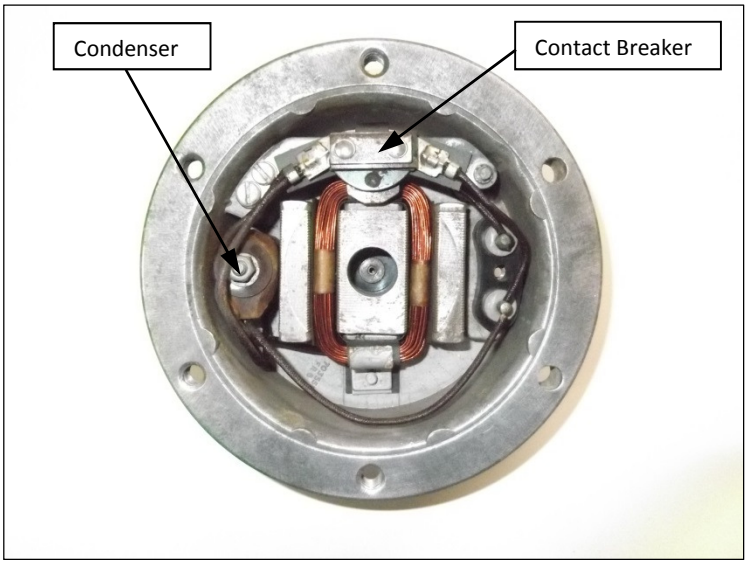
It is likely that the locating peg has sheared off. This is easily fixed by using a 3/32 x .50 long spring roll pin available from Ace Hardware. Use a punch to remove the broken piece in the diaphragm and then re-drill the hole with a 3/32 drill bit before installing the new spring pin.

The figure below shows the part layout after disassembly and cleaning. The parts can be immersed in diluted Muriatic acid for 30 seconds to clean off any rust. Cleaning with a bench grinder wire wheel also does a good job, although the threads on the adjusting sleeve should not be wire-wheeled. Note that the high note diaphragm is painted black and the low note diaphragm is painted silver.



Diaphragm Assembly Parts

Main Horn Housing Assembly Repair

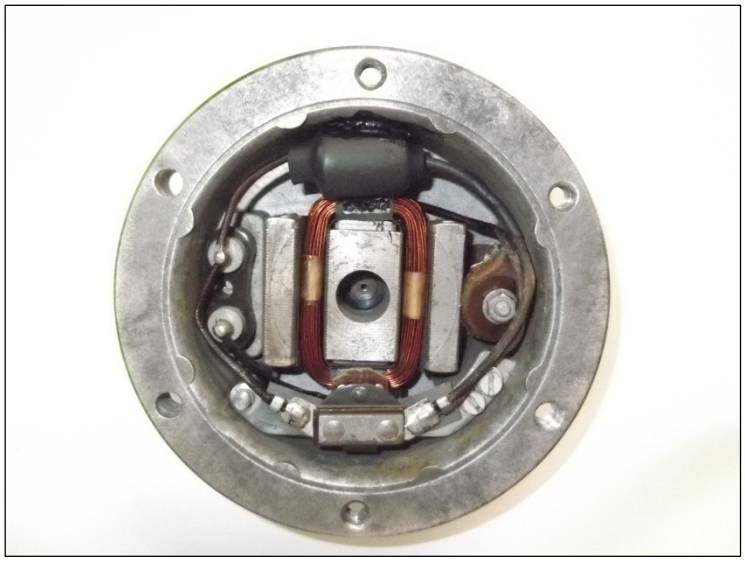


If you are lucky it will look as clean as this one. Do not attempt to remove the two screws from the back holding the coil in place otherwise the guide spring will have to be re-centered. Blow out the housing using compressed air and evaluate for corrosion.

Count the number turns while unscrewing the adjusting screw on the back to disengage it completely from the contact breaker; then remove the two small screws holding the other end of the contact breaker. Examine the points and clean them with a point file or appropriate grade of wet-dry sandpaper. Re-install the contact breaker and install the adjusting screw the same number of turns.

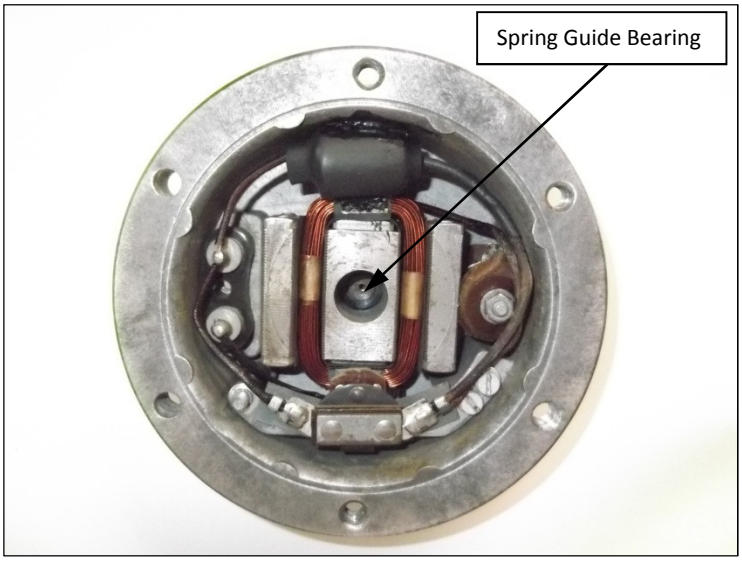
After 50+ years the dielectric in the condenser will have deteriorated and a replacement condenser will have to be installed. The original is not available and can be replaced with a standard condenser used in the engine distributor for the Austin Healey 3000. This condenser can be purchased from AutoZone for $5 and is part number LU506.

Cut the old original condenser leads close to the condenser body. These ends will be soldered to the new condenser. One wire is soldered to the wire lead of the new condenser and covered with shrink tubing. The second wire is soldered to the metal body of the condenser. Use large diameter shrink tubing to encase the entire condenser to keep it from touching the inside of the horn body.



The figure to the right shows the final configuration with the new condenser installed. A small amount of black RTV was used to retain the condenser in place.

Clean the spring guide bearing shown in the figure. Use an appropriate sized flat round punch wrapped with Scotch-Brite on the end to remove the corrosion likely present. Blow out with compressed air.



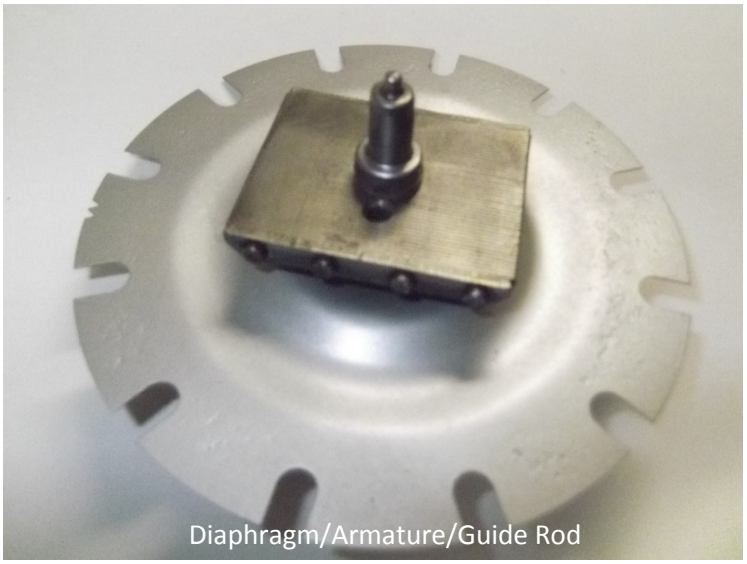
One of the original gaskets can be used as a pattern or make a pattern using the horn body itself.

Cut the new gaskets using FEL-PRO KARROPAK 1/32 inch thick gasket paper. For those inclined to want to fine tune the horn frequency, Terrence Jones sells these gaskets in a set of various thicknesses which will slightly alter the horn sound.

Re-Assembly of the Diaphragm Assembly

Re-assemble the diaphragm assembly parts previously cleaned/repaired/painted.

Use the exploded diagram on page 2 as a guide. The locating peg will insert into the corresponding hole in the armature. Note the how the armature is beveled on the sides and that the bevel faces the diaphragm.


Diaphragm/Armature/Guide Rod

The brass swivel ring is beveled on one end and this end mates to the bevel on the guide rod.

Apply a light coat of grease on the operating surfaces of the ball joint, guide rod tip, and guide spring bearing in accordance with page 4 of the Lucas instructions.

Start by threading the adjusting sleeve into the diaphragm until it is flush with the back face of the diaphragm. Install the adjusting sleeve lock nut until it bottoms on the diaphragm and tighten finger tight only.

Install the swivel ring on the guide rod with the bevel first. Then install the armature and the ball joint on the guide rod. Install the diaphragm and then the cone nut finger tight.

Insure that the locating peg is inserted properly into the armature hole.

The diaphragm assembly is now complete.


Locating Peg Detail

Re-install the Diaphragm Assembly into the Horn Body

Before doing so note that the armature is a rectangle. When the horn is activated, the back face of the armature will pull in to the coil and this face will then impact the lever on the contact breaker, thus opening the points to allow the diaphragm to return back to its starting point.

The armature is installed exactly as shown in the exploded view on page 2. The longer side mates to the side that has the contact breaker.

Install the two gaskets, rim, and the mounting bracket with I.D. plate. Secure with the six cheese head screws/nuts/washers. Do not over-tighten the screws. It is recommended to allow the assembly to sit overnight and then tighten the screws a bit more to make up for the gasket compression.

It should look like the figure to the right.

Horn Adjustments

Read through the Lucas Workshop Instructions to get familiar about the process in Section 4a and 4b. It is necessary to make the special tool as shown in Figure 2 of the instructions. This will be used to rotate the Adjusting Sleeve to set the air gap of the Armature and coil core face.

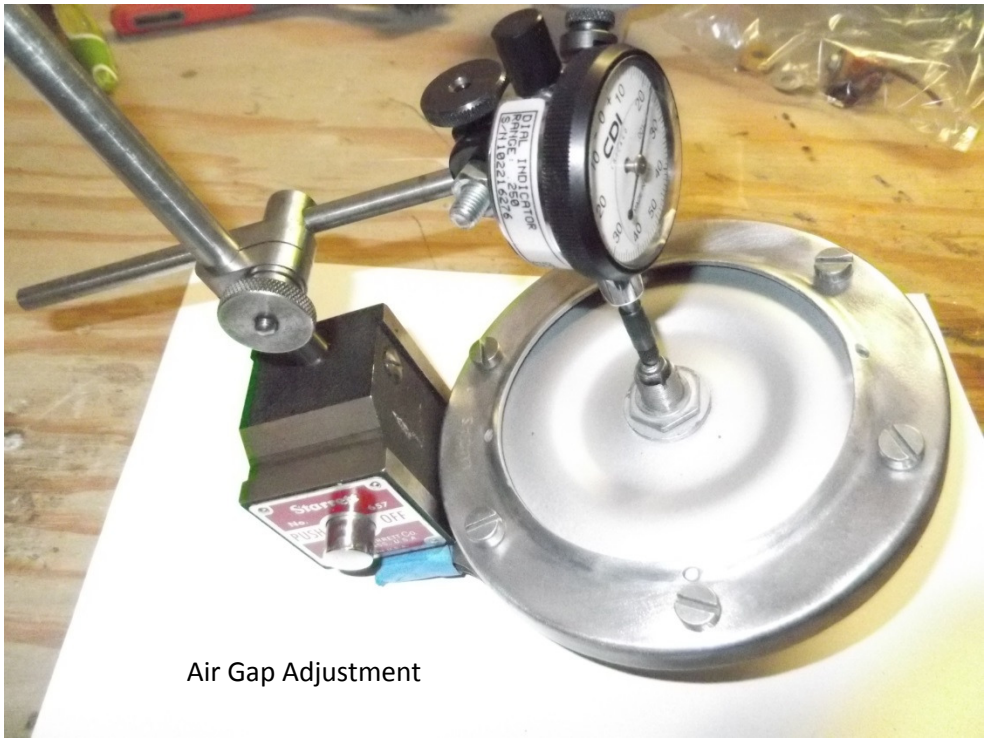
You can make it from a ½ inch diameter bolt using a drill press, bench grinder and file. The idea is to make two protruding tabs that will fit into the slots on the end of the Adjusting Sleeve with a bore that allows the cone nut to enter.

In order to perform the adjustments, the horn will have to be hooked up to a 12v power source of at least four amps capacity. Connecting to a 12v car battery does the trick. Do not apply power to the horn for more than five seconds at a time while doing these adjustments.

Reset the alignment of the armature and the core faces by performing the operation described in 4a. Only energize the coil long enough to tighten the cone nut lightly with a wrench. Do not re-install the tone disc or verify the tone of the horn at this point.

Now perform operation 4b, setting the armature to core face air gap. Note the different air gap values shown in the instructions for the low note and high note horns. It is necessary to use a dial indicator and magnetic base to accomplish this task. These can be sourced from Harbor Freight for about $30. The magnetic base is installed onto the horn mounting bracket. Note that the adjustment screw on the back of the horn must be turned several turns clockwise to ensure that the contacts remain closed during this operation. Apply power to the horn and verify the movement of the indicator. Use the tool to rotate the adjusting sleeve to obtain the correct value. Lightly tighten the adjusting sleeve lock nut and the cone nut while energized.

After the air gap has been set, repeat operation 4a with the cone nut slightly loose. Then tighten the cone nut while energized. Tighten the adjusting sleeve lock nut fully and then repeat operation 4b to verify the air gap is still correct. Repeat 4b completely if the air gap has changed.



Air Gap Adjustment

Final Assembly and Testing

Install the tone disc and the cover nut.

Now it is time to test the horn function.

Turn the adjusting screw several turns counter-clockwise to undo the previous setting during the air gap setting procedure.

To deliver the proper tone, the horn must be restrained by its mounting bracket. The bracket solid section can be clamped in a vise or to a bench.

Apply power to the horn connections.

The horn should make a sound. If it just engages and clicks as it did during the air gap setting procedure, then turn the adjusting screw several more turns counter-clockwise. If you rotate the screw too far in the CCW direction, then the horn will do nothing since the contacts will be open all the time.

Adjust the screw to obtain the best tone and volume. In general the best results are obtained within a small range of the adjusting screw travel. Connect an amp meter to the leads to verify the current draw. The instructions state a value of 4 amps for the 12v horn, but I have only been able to obtain readings in the 2.5 – 3.5 amp range, although the horn sounds excellent.

Painting

Once you are satisfied with the operation of the horn it can be painted.

Online documentation states that the original Lucas paint color is a close match to 1976 Volvo beige metallic. This paint color is not available pre-mixed unless you have it done through a local paint shop or online.

The closest color I could find is Duplicolor Ford Arizona Beige. You can see the comparison in the figure with the original paint on the backside of the Tone Disc.

The electrical connection on the back of the horn was masked off. The entire horn was primed with Duplicolor lacquer primer and then painted with several color coats. Two coats of Duplicolor clear lacquer was then applied for additional protection.

APPENDIX

LUCAS WORKSHOP INSTRUCTIONS

SECTION K-4
ISSUE 1, APRIL 1953

LUCAS

Quality

EQUIPMENT

VOLUME 2

WORKSHOP INSTRUCTIONS

HORNS

MODELS HF1746-47-48

JOSEPH LUCAS LTD · BIRMINGHAM 19 · ENGLAND

Printed in England

HORNS

MODELS HF1746-47-48

GENERAL

These horns are of the high frequency type and their construction and method of operation is as follows:— The vibrating armature is coupled to a flexible diaphragm and to a rigid tone disc. The diaphragm vibrates at a relatively low frequency (280-360 cps.) and the impact of the armature on the core face sets the tone disc into vibration, at a high frequency determined by its size and the rigidity of its material. These two sets of vibrations combine, together with their various overtones, to give the horn its characteristic note.

The horn operates electrically on the same principle as the electric bell, i.e., when the horn push is pressed, current flows through the coil windings and causes the core to be magnetized, whereupon the armature is pulled downwards and impacts on the core face. The contact breaker opens each time the armature is pulled down to the core, de-energising the magnet system and causing the cycle to be repeated at a frequency determined by the characteristics of the diaphragm.

To prevent sparking and consequent wear of the contacts, a condenser is connected across the contact breaker circuit.

SERVICING SUMMARY.

Symptoms	*Possible Causes*	*Reference*
Note unsatisfactory or operation intermittent.	(i) Horns loose on mounting.	Para. 1
	(ii) Faulty wiring.	Para. 2
	(iii) Horn out of adjustment.	Para. 3
	(iv) Internal fault: (*a*) Misalignment of armature and core faces. (*b*) Incorrect armature-to-core air gap setting. (*c*) Worn contact set.	Para. 4
Horns fail to operate.	(i) Faulty wiring.	Para. 2
	(ii) Horn out of adjustment.	Para. 3
	(iii) Internal fault: (*d*) Faulty condenser. (*e*) Faulty coil.	Para. 4

SERVICING

Before making any adjustments to the horn, make certain that the battery is in a good state of charge. These high output horns will not sound correctly unless they are securely clamped in a vice or other heavy fixture while they are being tested.

Do not dismantle the horn until the external checks and adjustments have been made.

Dismantling and re-assembling procedure is given in Para. 5.

1. HORN MOUNTING

The bolts securing the horn bracket must be tight and the body of the horn must not foul any other fixture. Check that any units fitted near the horns are rigidly mounted and do not vibrate when the horn is operated.

2. WIRING

Examine the cables of the horn circuit, and renew any that are worn or chafed. All connections must be clean and tight and connecting eyelets and ferrules making good contact with the cables. Complete failure of the horns can be caused by a blown fuse. If the fuse has blown, examine the wiring and horns for evidence of a short circuit. Check also associated circuits protected by the same fuse. A horn badly out of adjustment and taking excessive current may cause the fuse to burn out.

3. HORN ADJUSTMENT

Check the voltage at the horn with the horn blowing. A clear 'High Frequency' note should be heard over the following voltage ranges:—

6 volt	... ...	4—8 volts
12 volt	... ...	10—16 volts
24 volt	... ...	20—28 volts

Adjustment will not alter the tone of the horn. It merely takes up wear of the moving parts, which if not corrected, will result in loss of power and roughness of tone. Before making an adjustment, connect an ammeter (0—10 amps. scale) in series with the horn.

The current consumption should be:—

6 volt model	...	5 amps.
12 volt model	...	4 amps.
24 volt model	...	3 amps.

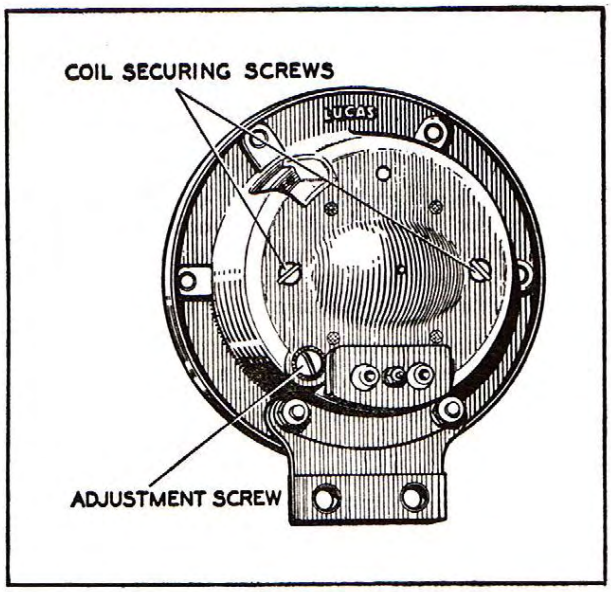


Fig. 1.
Rear view of horn showing adjustment screw.

If necessary, connect the horn to a battery of appropriate voltage and adjust as follows:—

Turn the adjustment screw (Fig. 1) not more than 3 notches in an anti-clockwise direction to reduce the current. Check horn performance. Repeat adjustment until the best performance is obtained with approximately the current consumption quoted above.

4. INTERNAL FAULTS

(*a*) **Mis-alignment of Armature and Core Faces.**

To check and reset the alignment of the armature and core faces:—

Remove the cover nut and tone disc. Turn the contact breaker adjusting screw several turns in a clockwise direction, so that the contacts remain closed when the armature is pulled flat against the core face.

Loosen the cone nut, and energise the coil from a battery of correct voltage.

Tighten the cone nut while the armature is pulled flat against the core face.

Replace the tone disc and cover nut.

Whilst energising the horn, turn the adjustment screw anti-clockwise until the correct horn note and current consumption is obtained.

NOTE: Do not energise the coil for longer than a few seconds while the contact breaker is rendered inoperative (i.e., is not operated by the armature movement). If a continuous current is allowed to flow through the coil for long periods the coil may be damaged.

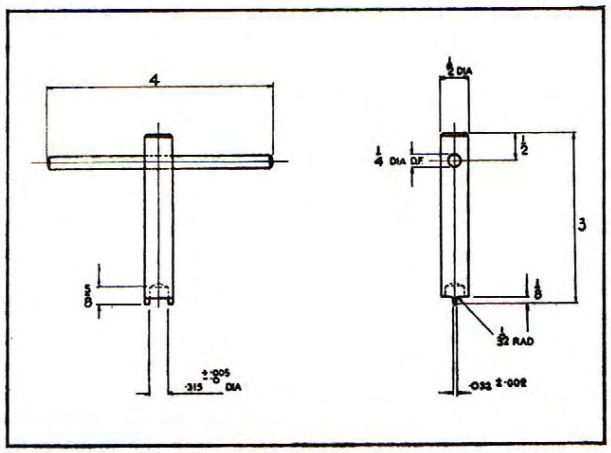


Fig. 2.
Tool for adjusting air gap setting.
(Measurements in inches)

(*b*) **Incorrect Armature-to-Core Air Gap Setting.**

Before the air gap setting can be checked, remove the cover nut and tone disc. Ensure that the cone nut and sleeve lock nut are tight, then proceed as follows:

Turn the adjustment screw several turns clockwise so that the contacts will remain closed when the armature is pulled against the core face. Measure the movement of the armature by mounting a clock indicator gauge to bear on the armature sleeve and momentarily energising the coil. The correct air gap settings are:—

6 volt model	High Note	0.019 ins.—0.022 ins.
	Low Note	0.019 ins.—0.022 ins.
12 volt model	High Note	0.019 ins.—0.022 ins.
	Low Note	0.024 ins.—0.026 ins.
24 volt model	High Note	0.019 ins.—0.022 ins.
	Low Note	0.024 ins.—0.026 ins.

If the air gap setting is incorrect, loosen the cone nut and sleeve lock nut. Turn the adjusting sleeve in a **clockwise** direction to **reduce** the gap, **anti-clockwise** to **increase** the gap. Use the tool shown in Fig. 2 to make this adjustment.

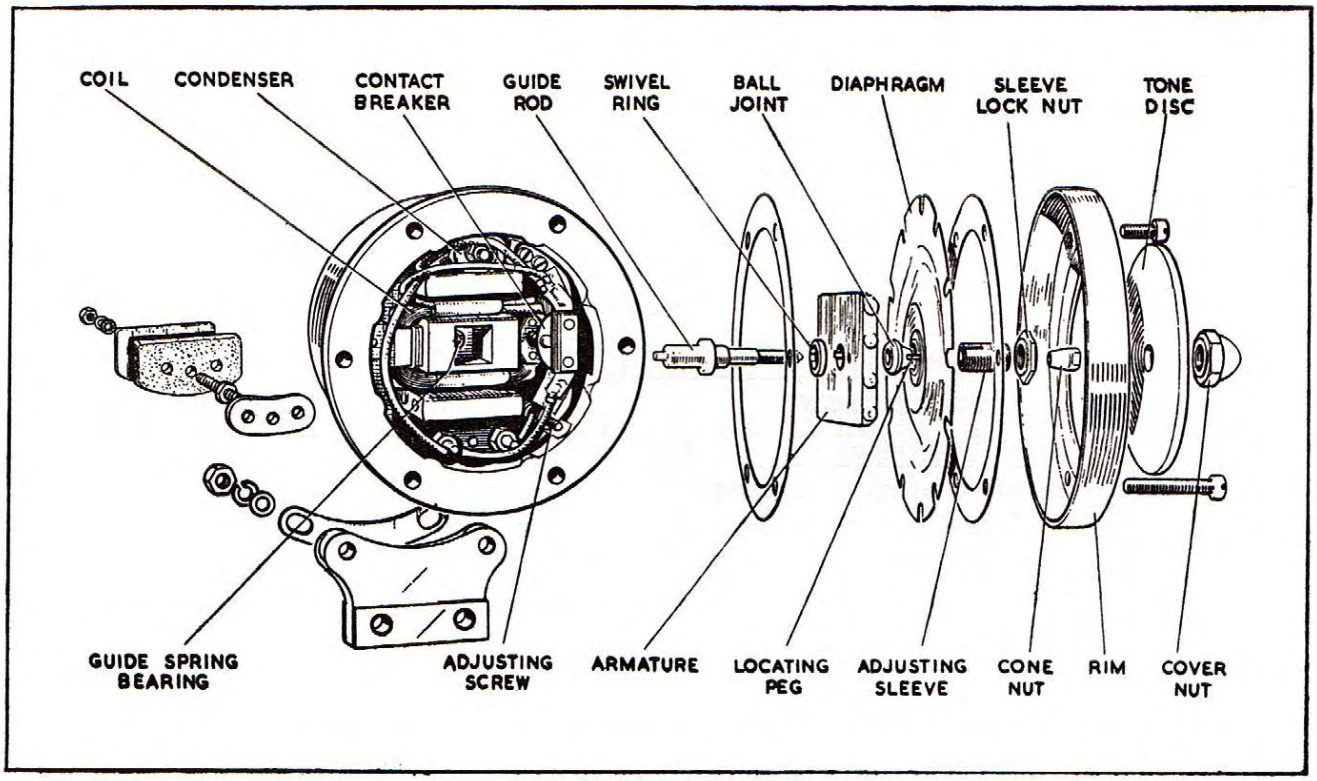


Fig. 3. Dismantled view of horn.

Lightly tighten the sleeve lock nut. Energise the coil, and tighten the cone nut. **Never** tighten the cone nut before the sleeve lock nut or the diaphragm locating peg may shear.

Then recheck the gap with the clock indicator gauge as described above and, if the air gap is still incorrect, repeat this procedure until satisfactory.

Replace the tone disc and tighten the cover nut.

Adjust horn adjustment screw until correct note and current consumption is obtained.

(c) Worn Contact Set.

If the contact breaker points are badly worn the operation of the horn may be intermittent and a new contact set must be fitted. If the contacts are badly pitted (this might be caused by a faulty condenser) they can cause an open circuit and complete failure of the horn. The pressure required at the end of the contact spring to just open the contacts, must not be more than 50 ozs. and not less than 42 ozs. If the spring pressure is outside these limits, it is necessary to fit a new contact set.

(d) Faulty Condenser

Should the horn 'click' when energised, but not produce a note, turn the adjustment screw anti-clockwise. If the horn still does not sound when the head of the screw disengages from the serrations in the body then the condenser may be short circuited internally. Remove cover nut, tone disc and securing rim, and withdraw the diaphragm assembly. The condenser may now be checked with a 500 volt megger. Disconnect the lead from the condenser terminal, and connect the megger between the condenser terminal and case. The megger reading should not be less then 3 megohms. Replace condenser if faulty, reassemble horn and adjust for correct note and normal current consumption.

(e) Faulty Coil.

If, after checking the contact breaker as in (c) above there is still an open circuit in the horn, the coil continuity must be checked. To do this, connect an ohmeter across the supply terminals with the contact breaker points closed. The correct coil resistance should be:—

6 volt model	...	0.22—0.26 ohms
12 volt model	...	0.70—0.75 ohms
24 volt model	...	2.0 —2.4 ohms

If the readings do not compare favourably with these figures the coil must be replaced. Reassemble the horn, and adjust for normal current.

5. DISMANTLING AND RE-ASSEMBLY PROCEDURE

A partly dismantled horn is shown in Fig. 3 and the sequence of removal operations is laid down in Fig. 4.

Do not bend the guide spring more than is necessary, or the spring steel may be damaged.

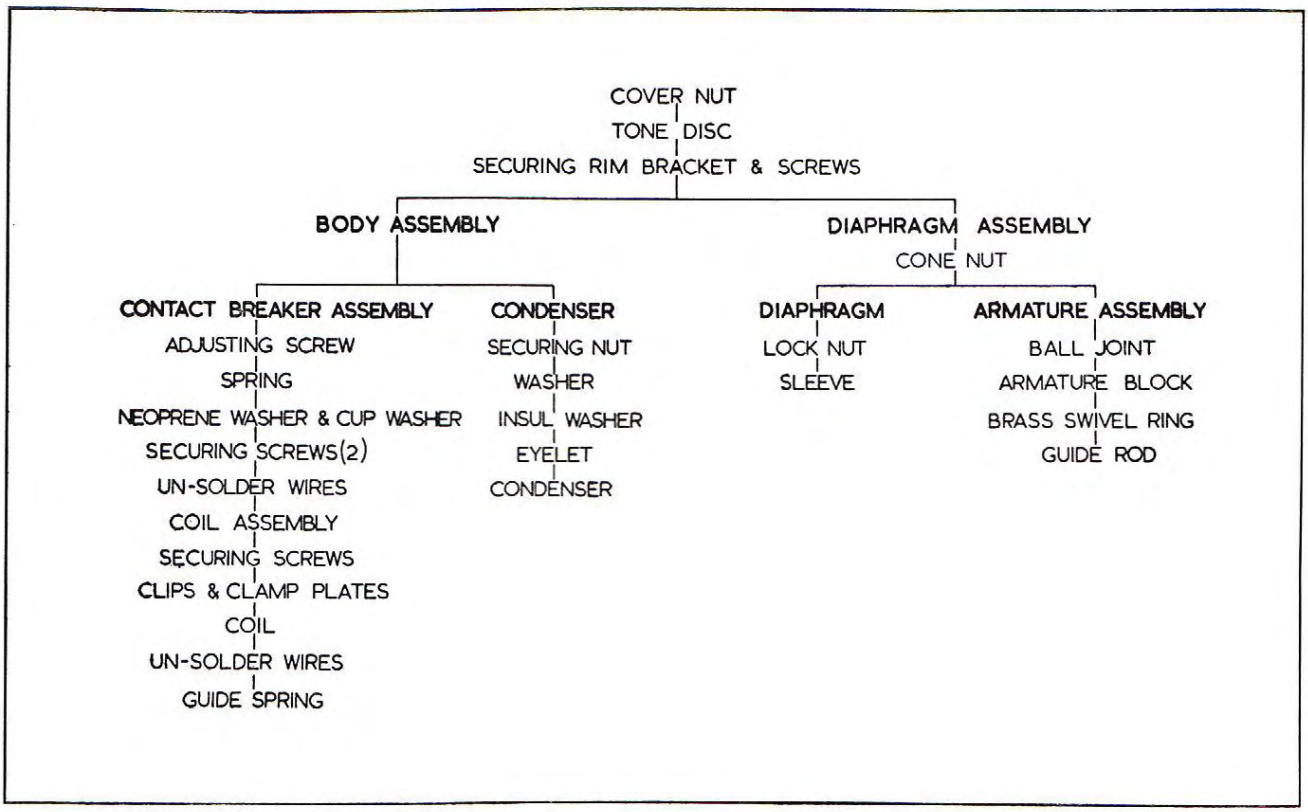


Fig. 4.
Sequence of dismantling and reassembly.

The assembly procedure is a reversal of the dismantling operation. The following points must be observed when the horn is being assembled:—

(*a*) Before tightening the screws securing the coil assembly, the guide spring bearing must be centralised in the horn body. Place the centralising jig (Figs. 5 & 6) over the horn body, with the central peg located in the guide spring bearing, and tighten the coil securing screws. Make sure that the coil clamping plates are square to the windings, and that the coil is firmly clamped around the former and not moveable by hand.

(*b*) To avoid short circuits due to chafing of cable insulation through vibration, the cables from the coil, contact breaker and condenser must be coiled smoothly to follow the curve of the body, but not to touch it.

(*c*) All operating surfaces of the ball joint, guide rod tip and guide spring bearing must be thinly coated with Duckham's H.B.B. grease.

(*d*) When building-up the diaphragm assembly, leave the cone nut and sleeve lock nut loose until the securing rim has been replaced and the horn is ready for setting.

(*e*) After the horn has been completely assembled and tested, it is advisable to paint over scratched parts. This will prevent rust attacking the horn.

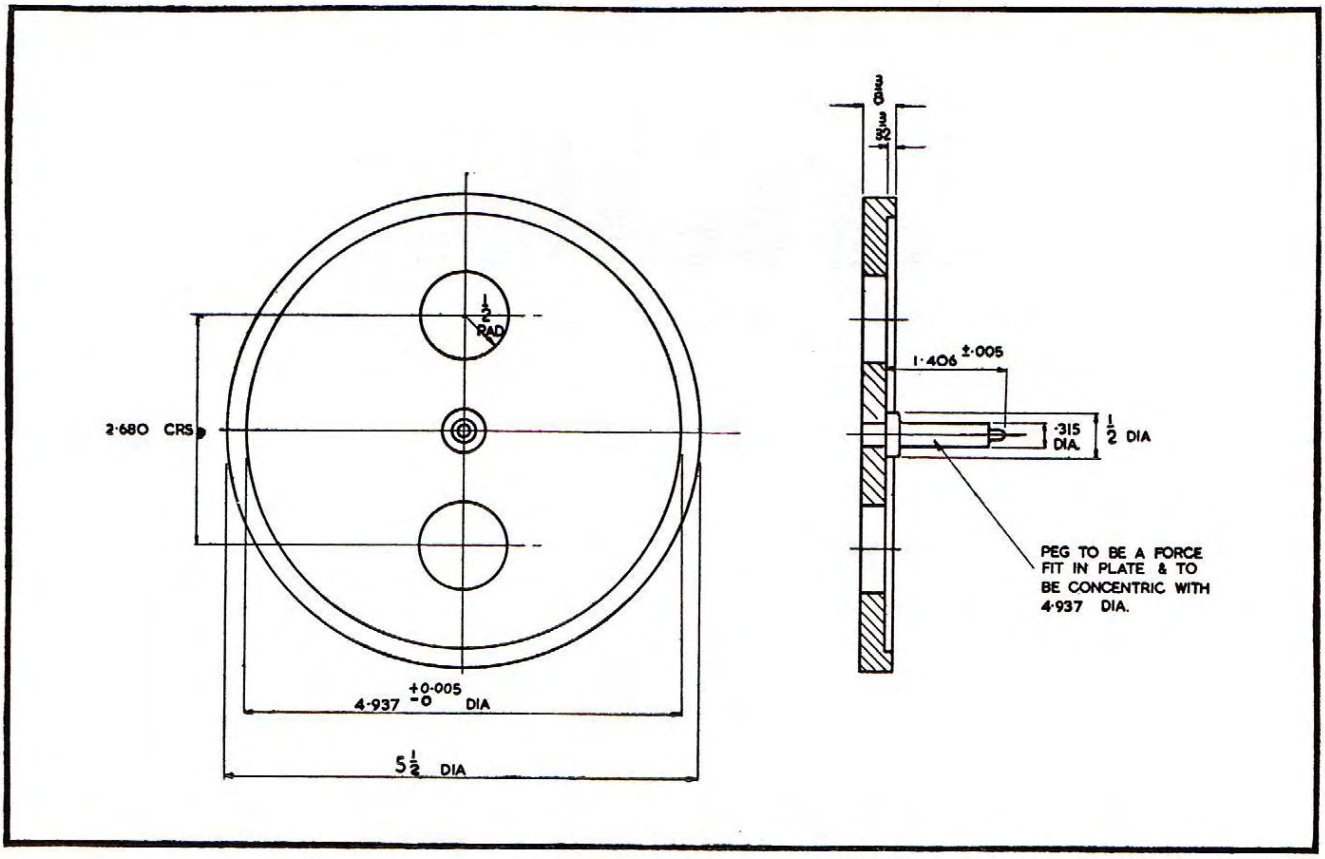


Fig. 5.
Plan view of centralising jig.
(Measurements in inches).

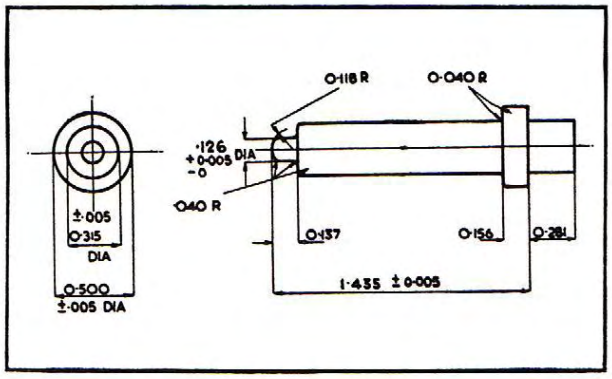


Fig. 6.
Details of peg for centralising jig.
(Measurements in inches).

The air gap adjusting tool (Fig. 2) and centralising jig (Figs. 5 and 6) must be made under local arrangements. The correct material for both tools is mild steel, case hardened.