

Chapter Eighteen
EXHAUST SYSTEM
SERVICING AND MAINTENANCE

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THIS CHAPTER contains instructions for examining removing and refitting the exhaust system. The general information contained in chapter 5 should be referred to as necessary.

FIREGUARD, REMOVAL, EXAMINATION, REFITTING

Before the exhaust cone can be examined in situ or removed for any purpose, it is necessary to remove the fireguard as described in the following paragraphs.

Cut the locking wire and unscrew the $\frac{1}{2}$ " B.S.P. union nut which connects the fireguard drain pipe to the connection on the fireguard drain trough. Remove the set-bolt which secure the clip on the drain pipe to the fireguard and draw the pipe downwards until clear of the engine. Using a suitable tubular box spanner inserted through the drain connection sleeve in the fireguard unscrew the $\frac{1}{2}$ " B.S.P. union nut and remove the short section of drain pipe from the drain connection on the outer exhaust cone drain trough. These drain pipes are airframe components.

Remove the thermocouple cover from the flange on the fireguard — there are three flanges and covers to provide alternative thermocouple positions but the top one only will be fitted with a thermocouple and require to be removed. Unscrew the union nut which secures the thermocouple to the exhaust cone and remove the thermocouple complete with its cable.

Unscrew the four set bolts and remove the spring washers, blanking plate and washer from the heater pipe housing in the bottom of the fireguard. Repeat the operation and remove these parts from the housing in each side and in the top of the fireguard.

Carefully draw the complete, one-piece, fireguard off the rear of the engine and place it in a safe place.

The fireguard should be examined for dents, broken welds, and tears. Damage to this assembly can usually be rectified by normal sheet metal methods.

Refitment of the fireguard is practically a direct reversal of the removal instructions given already. New washers (Part No.25874) should be fitted under the blanking plates if the original washers are in any way unserviceable.

EXHAUST CONE ASSEMBLY, EXAMINATION IN SITU

In order to examine the exhaust cone assembly in situ, the fireguard must be removed as described already.

Examine the outer cone front flange, which is bolted to the turbine shroud, for cracking from the bolt holes to the periphery of the flange. Cracking is unlikely but, if discovered, the component is acceptable provided that the cracks run from the bolt holes to the periphery of the flange only; cracking from hole to hole is not permissible. At the same time examine the mating turbine shroud flange as described elsewhere. Examine for gas leaks along the periphery of the exhaust cone/turbine shroud joint. If there are any gaps between the mating faces of the flanges into which feeler gauges can be inserted, the exhaust cone or the turbine shroud must be changed for a serviceable component according to which flange is distorted.

Thoroughly examine the outer cone for cracks paying particular attention to the point at which it is welded to the front flange. Examine all welded seams for soundness or indications of gas leaks.

Ensure that the thirty six $\frac{1}{4}$ " B.S.F. bolts and nuts which secure the propelling nozzle to the rear of the outer cone are tight. Thoroughly examine the spacer strip (Fig.2) which connects the venturi cuff to the propelling nozzle for security of the welding and signs of cracking at the bends. Not more than six cracks can be permitted and no two adjacent 'top hat' sections must be cracked. The most common damage found on these components will be dents and distortion. Damage beyond this is usually caused by negligence.

Use an electric light to examine the rear (trailing) edge of each of the fairings between the inner and outer cones for signs of cracking. Check the security of the inner cone by grasping the apex of the cone and shaking it. Buckling and dents up to a depth of $\frac{3}{4}$ inch may be ignored during examination in situ providing that a careful examination does not reveal any cracks. Where buckling is apparent on the inner cone adjacent to the fairings in line with the support tubes, the clearance between the front end of the inner cone and the turbine disc should be checked as described elsewhere.

EXHAUST CONE ASSEMBLY, REMOVAL AND DISMANTLING

Instructions for removing and refitting the fireguard have been given already. To remove the exhaust cone assembly for any purpose, proceed as follows. Remove the fireguard. Taking each air cooling pipe in turn, unscrew the two $\frac{1}{4}$ " B.S.F. set-bolts which secure the elbow at the rear of the air cooling pipe to the boss on the outer cone, draw the rear section of the air cooling pipe out of the sleeve in the air pipe support bracket which is bolted to the turbine shroud, and remove the pipe complete with elbow and the copper washer. Having removed the four air cooling pipes, remove the thirty $\frac{7}{16}$ " B.S.F. nuts and bolts which fasten the outer cone to the turbine shroud — the exhaust cone assembly must be properly supported whilst the last few bolts are removed — and carefully remove the exhaust cone assembly. Where mod.111 has been

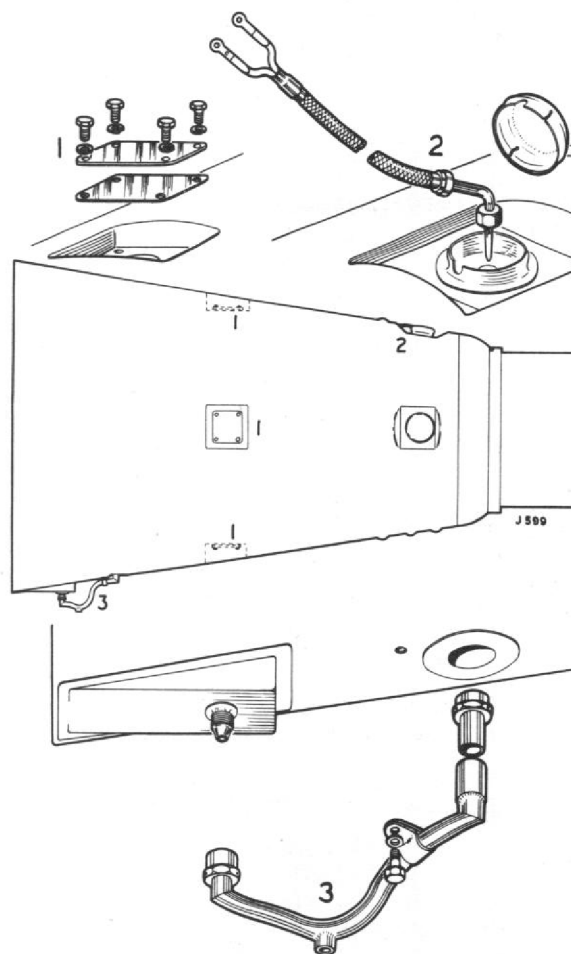


Fig. 1. Fireguard connections.

1. Set bolts and blanking plates securing fireguard to exhaust cone.
2. Thermocouple. 3. Fireguard drain.

embodied, the thirty bolts will have been chromium plated to reduce the risk of seizure, and in any case these bolts should have been treated with the recommended anti-seize preparation before assembly. If, however, the bolts are at all difficult to loosen, they should be soaked in penetrating oil for about two hours before attempting to remove them and they should then be turned slowly as hurried removal may cause them to be broken.

In order to examine the exhaust cone thoroughly it will be necessary to dismantle it as follows:

Certain precautions should be taken before dismantling the exhaust cone assembly. Due to the heat to which rear portions of jet propulsion units are subjected all nuts, bolts, and studs become affected and there is considerable danger of shearing bolts and studs if dismantling is not carried out correctly. All nuts, bolts and studs should be soaked in penetrating oil for a minimum period of two hours before attempting to remove them and they should be turned slowly as hurried removal may also result in fracture. In many cases if a bolt or stud should break it is a matter of some difficulty to remove the sheared portion. If, during assembly, such parts are lightly smeared with an anti-seize compound this will reduce the likelihood of fracture during future dismantling to a minimum.

Commence dismantling the exhaust cone assembly front end downwards on a suitable wooden base. Remove the thirty six $\frac{1}{4}$ " B.S.F nuts and bolts and lift off the propelling nozzle assembly.

Reverse the exhaust cone assembly so that it stands on its rear end. After releasing the tab washers, remove the sixteen screws securing the front baffle to the inner cone and lift off the baffle. There are two pairs of fairing assemblies and, as the two fairings in each pair are different, it is advisable to mark all four fairings with chalked numbers and to chalk the same numbers on the inner and outer cones adjacent to the position of the respective fairings. Cut the locking wire and remove the four cap nuts and C & A washers from the ends of the two rear support tubes. Using a suitable brass or copper drift drive out the four support tubes. As the second of the two front support tubes is removed, the air tube which is in the centre of the inner cone will be released and should be taken out. Lift out the inner cone. Cut the locking wire and remove the four set-screws and washers which secure each of the fairings and take out the fairings. If required, unscrew the blanking nuts from the redundant pressure point and thermocouple connections.

EXHAUST CONE ASSEMBLY, EXAMINATION AND REPAIR

In the following paragraphs an attempt has been made to indicate the 'wear' which may be found after a period of running and to give some guidance in classifying 'serviceability' during routine examination. It is, of course, only possible to indicate quite broadly the points to be inspected and the defects likely to be encountered. Each instance must be considered in the light of the particular circumstances, hours run, period before next complete overhaul, etc. and the final decision as to the serviceability of each component must rest on the individual tradesman's experience and knowledge of gas turbine engines of this type. Where a background of this experience is lacking, frequent reference should be made to an experienced specialist.

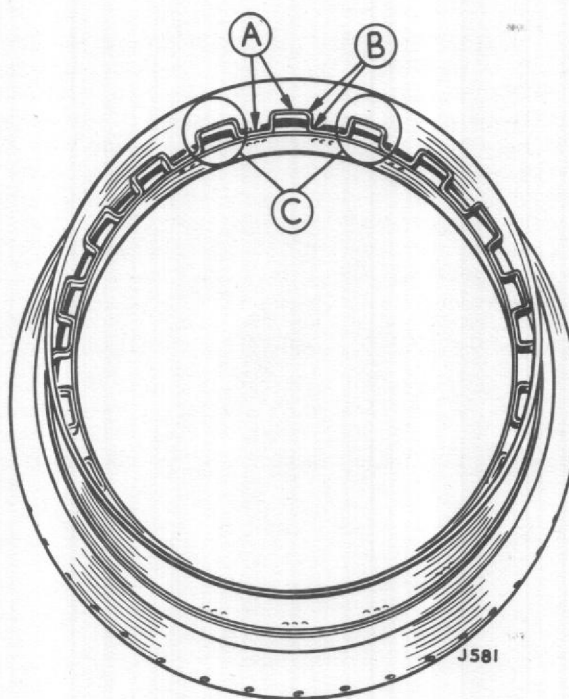


Fig. 2 Examination of propelling nozzle/venturi cuff spacer.

- A. Examine spot welding for signs of failure.
- B. Examine for cracks at bends.
- C. If crack or failure is observed adjacent 'top-hat' sections must be free from cracking or failure.

Extensive experience on Goblin engine overhauls has shown that only on rare occasions need parts of the assembly, covered in these paragraphs, be rejected and then usually because of fatigue or distortion. The extent to which these parts may be considered repairable is, therefore, indicated in these paragraphs. It is recommended that all welding repairs be carried out by the argon-arc process. When repairs have been completed by this method the weld is cleaned with a rotary wire brush and only blended where stated in the text. Oxy-acetylene welding should only be used if argon-arc equipment is not available.

Where repairs are to be carried out by oxy-acetylene welding process, the appropriate Salvage Scheme must be closely followed.

OUTER EXHAUST CONE. BUCKLES AND SKIN DISTORTIONS.

Dents must not exceed 0.25 in. in depth or 30 sq.in. in area if the outer cone is to be considered serviceable. All larger dents and buckles to the skin can be removed by normal sheet metal methods. Such work must be carried out by skilled personnel and care taken that metal is not 'made' which cannot be subsequently 'lost'.

FRONT FLANGE AND REAR END

Some degree of ovality and distortion can be expected at both ends and the method used in checking this distortion and ovality is shown in Fig. 3.

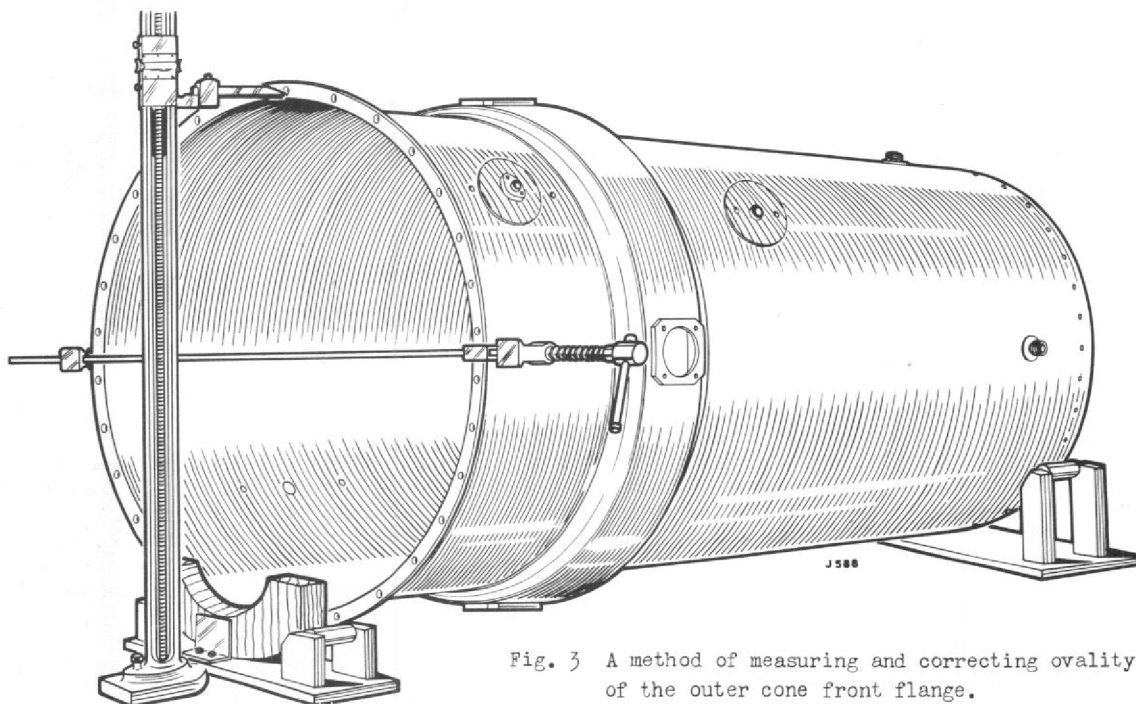


Fig. 3 A method of measuring and correcting ovality of the outer cone front flange.

This consists of rotating the exhaust cone on rollers while checking the flange bolt holes with a large height gauge. Distortion and ovality are then removed by the use of a shaped wooden block and clamps as shown in Fig. 3 and 4. Ovality of the sheet metal portion must not exceed a total indicator reading of 0.200 in., and of the flange 0.050 in. (total dial indicator reading 0.100 in.). Cracks in the flange are unlikely but if discovered, cracking from the flange bolt holes to the periphery of the flange is permissible but cracks from hole to hole justify rejection of the component.

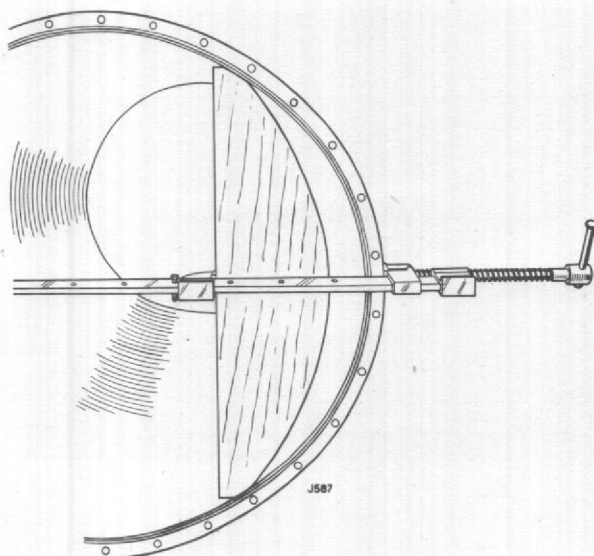


Fig. 4 Using wooden block and clamp to correct local distortion of outer cone front flange.

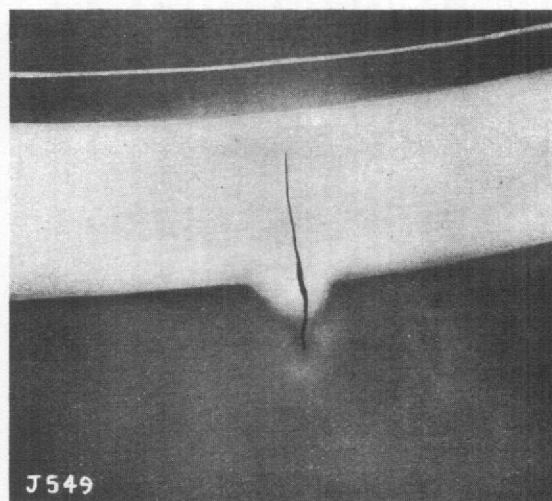


Fig. 5 Dent accompanied by crack in heater muff, which is repairable by welding.

HEATER MUFF (WHERE FITTED)

The most common failures on the outer exhaust cone assembly occur on the gun heater muff, and are generally caused by thermal expansion and contraction and appear as severe dents. These dents will often be accompanied by a small crack, shown in Fig. 5 which may be repaired by welding. Should a crack not be present the dent should be welded as shown in Fig. 6 as cracks will otherwise develop with subsequent operation. Damage may often extend to the stitch weld on the flange of the heater muff. However, in the majority of cases this type of crack can be repaired by argon-arc welding as shown in Fig. 7 which shows a repairable crack of this nature. Where damage is severe and extends across the stitch weld it will be necessary to weld a patch over the weak point and to extend the patch to the outer cone skin. The method of carrying out this repair is shown in Fig. 8 and the finished repair in Fig. 9.

THERMOCOUPLE ADAPTERS AND SUPPORT TUBE BUSHES.

Damage will also be occasionally found to support tube bushes and thermocouple adapters. Thermocouple adapters which have sheared due to the cap nut becoming seized can be rectified, as shown in Fig. 10 by grinding the adapter back until the base is approximately 0.020 in. thick and a new adapter welded to this base.

Failure of the support tube bush is caused by seizure of a cap nut causing stripping of the internal thread. This necessitates the complete removal of the bush and the fitting of a new one, preferably by use of the argon-arc welding process.

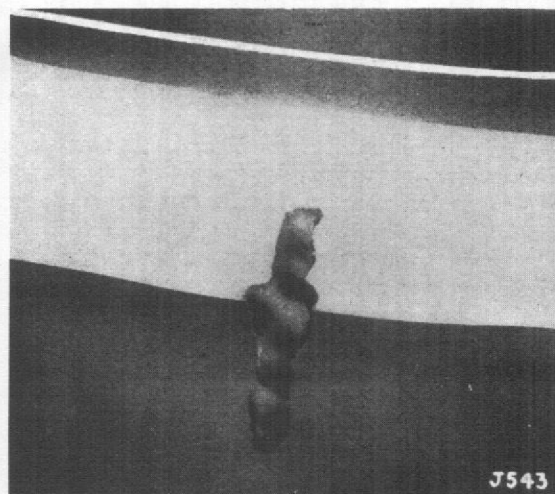


Fig. 6 Dent or crack in heater muff after welding which is cleaned with a rotary wire brush but not otherwise blended.

PROPELLING NOZZLE ASSEMBLY. DAMAGE DUE TO
NEGLIGENT HANDLING.

The most common damage found on the propelling nozzle assembly will be dents and distortion. Damage beyond this is usually caused by negligence, Fig. 11 showing a typical instance, and this can be removed by normal sheet metal methods. The propelling nozzle stiffener (Fig. 2), or spacer strip, which is between the propelling nozzle and the venturi cuff must be thoroughly examined for cracking particularly at the welds and bends. Up to six cracks may be permitted but no two adjacent 'top-hat' sections must be cracked.

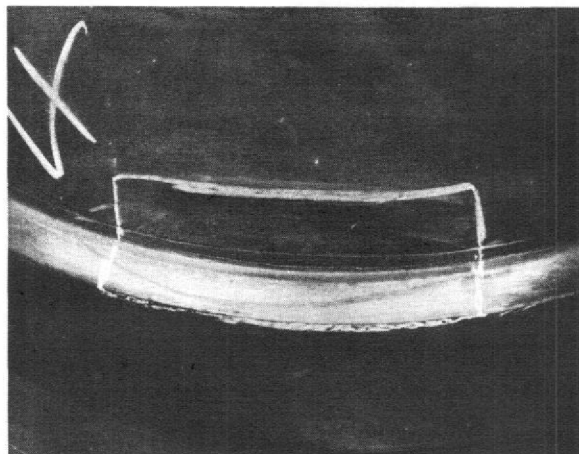


Fig. 7 Crack in stitch weld on flange of heater muff, which is usually repairable by welding.

OVALITY

Ovality in the assembly must be rectified in the following manner. Two gauges manufactured from flat stock 2 in. by $\frac{1}{8}$ in. should be made to the dimensions applicable.

Fig. 11 shows the position in which these gauges are used. Ovality can be removed by the use of wooden formers and clamps in a similar manner to that previously stated for the exhaust cone flanges.

INNER CONE. DENTS AND BUCKLES TO SKIN.

Dents are permitted in the vicinity of the larger diaphragm (i.e., towards the base of the cone) to a maximum depth, of each dent, of 0.25 in. and a maximum area of 25 sq.in. In the vicinity of the smaller diaphragm (i.e., towards the apex of the cone) the maximum depth of each dent must not exceed 0.125 in. and the maximum area covered by each dent must not exceed 15 sq.in. On this assembly the removal of dents and buckles, various types of which are shown in Fig. 13 require the use of normal sheet metal tools. The only exception is shown in Fig. 12. A special anvil, shaped to fit the cone behind the small diaphragm, is welded to a standard 'H' section beam (or girder), the beam is then solidly mounted on a suitable bench.

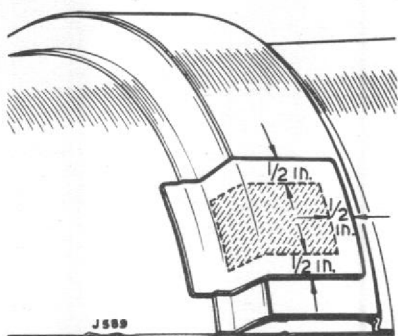


Fig. 8 Patching severe damage to heater muff; damaged portion cut away as indicated by shading; patch must overlap $\frac{1}{2}$ inch all round.

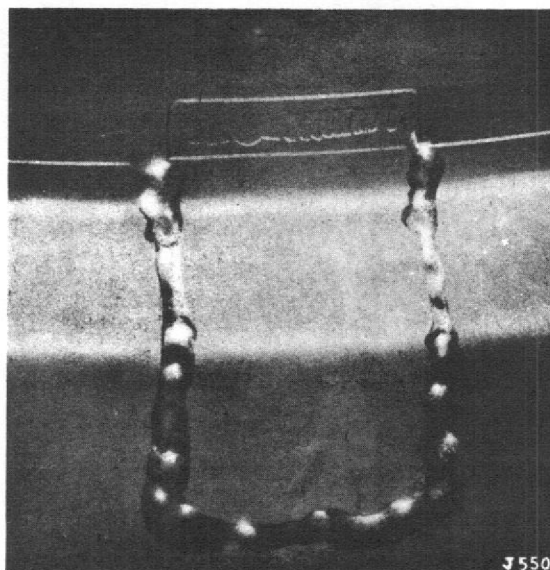


Fig. 9 Patch welded over severe damage extending across heater muff stitch weld.

CRACKING OF SUPPORT TUBE HOLES

This is unlikely but the support tube holes and reinforcing flanges should be examined and if found cracked may be welded, preferably by the argon-arc process, providing the cracks do not exceed 2 in. in length.

LARGE AND SMALL DIAPHRAGMS

The large and small diaphragms will also need careful examination, the most common point of failure being cracks at the head of the 'key-hole' slot and the spot welding parting from the inner cone. These types of failure are shown in Fig. 15. The cracks at the 'key-hole' slot should be welded, preferably the argon-arc process, the weld being cleaned by rotary wire brush and not blended. Parting of the diaphragm from the skin may be repaired in the following manner. The number of spot welds on each section between the 'key-hole' slots of the large diaphragm is increased to six and the size of the spot increased to $\frac{3}{16}$ in. diameter. The small diaphragm is re-spot welded but retains four spot welds and the $\frac{1}{8}$ in. diameter spot.

BAFFLE PLATE AND STIFFENERS.

Failures on the baffle plate will occur at the stiffeners as shown in Fig. 16 and will need a number of small weld repairs. If the fracture occurs completely (Fig. 17) across the stiffeners they are no longer serviceable and should be removed and replaced.

STRIPPING OF BAFFLE FLANGE NUTS.

Great care must be taken when removing the baffle from the inner cone as the bolts are easily broken in the flange as previously mentioned. Later type inner cones have threaded plates secured by rivets and new plates can be fitted quite easily.

SUPPORT TUBES AND FAIRINGS. BENT SUPPORT TUBES

In the majority of cases support tubes will be found slightly bent and must be straightened before reassembly. This can be achieved by blows with a rubber mallet, the tube being placed between two blocks of wood, the tube should afterwards be checked in the usual manner on a surface table.

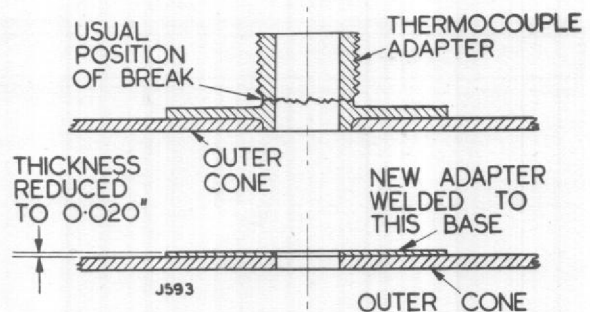


Fig. 10 Method of repairing broken thermocouple adapter.

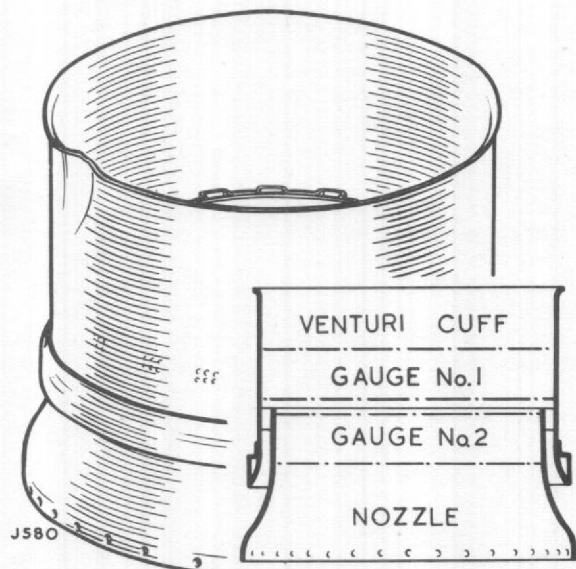


Fig. 11 Typical damage which may be found on propelling nozzle and venturi cuff, with inset showing where locally-made gauges are used when checking and correcting ovality.

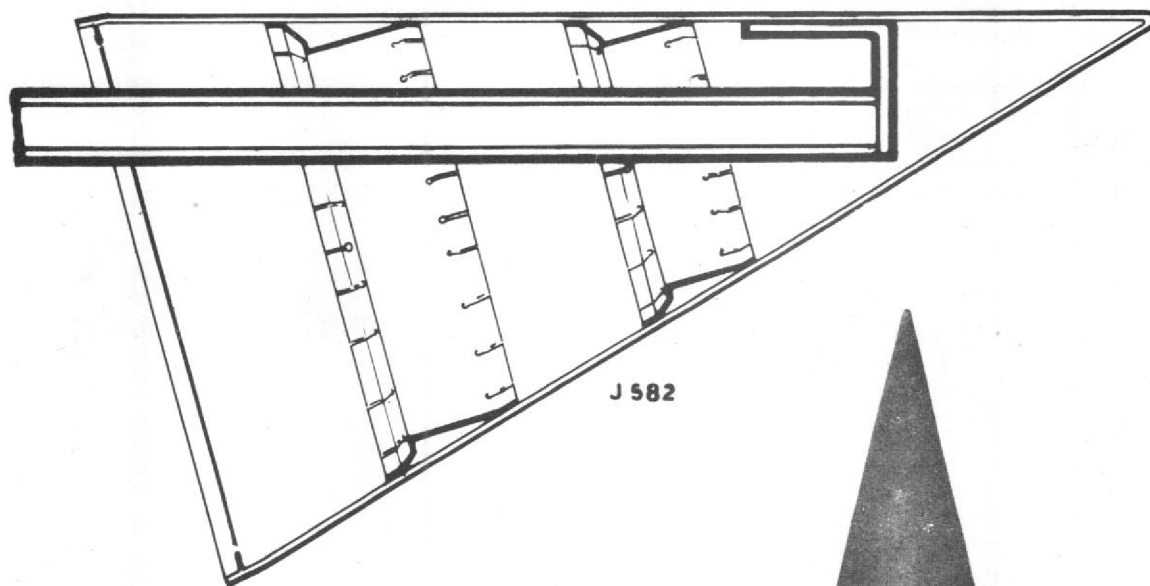


Fig. 12 A girder fitted with a suitable anvil as used when rectifying dents and buckles in the small end of the inner cone.

INDENTATION AND FRETTING

Support tubes should also be examined for indentations and fretting, caused by the fairings as the tube is 'floating'. The maximum permissible depth of fretting is 0.010 in. and when within this limit can be blended to remove the sharp edge, but above this limit the tube should be discarded. An example of this type of damage is shown in Fig. 18.

CRACKS AND DISTORTION TO FAIRINGS.

The fairings can be repaired by welding preferably by the argon-arc process. Repairs are confined to the rectification of weld failure at the formers and to small cracks on the corner joints as shown in Fig. 19.

Where repair can be carried out, the skin should be pressed back into position and a number of small welds made. The welds should then be blended in order to fit smoothly to the cone and case.

SET-SCREWS SHEARED IN FAIRING.

Sometimes the set-screws shear during dismantling of these fairings, but the broken ends can often be removed by a further penetrating oil treatment.

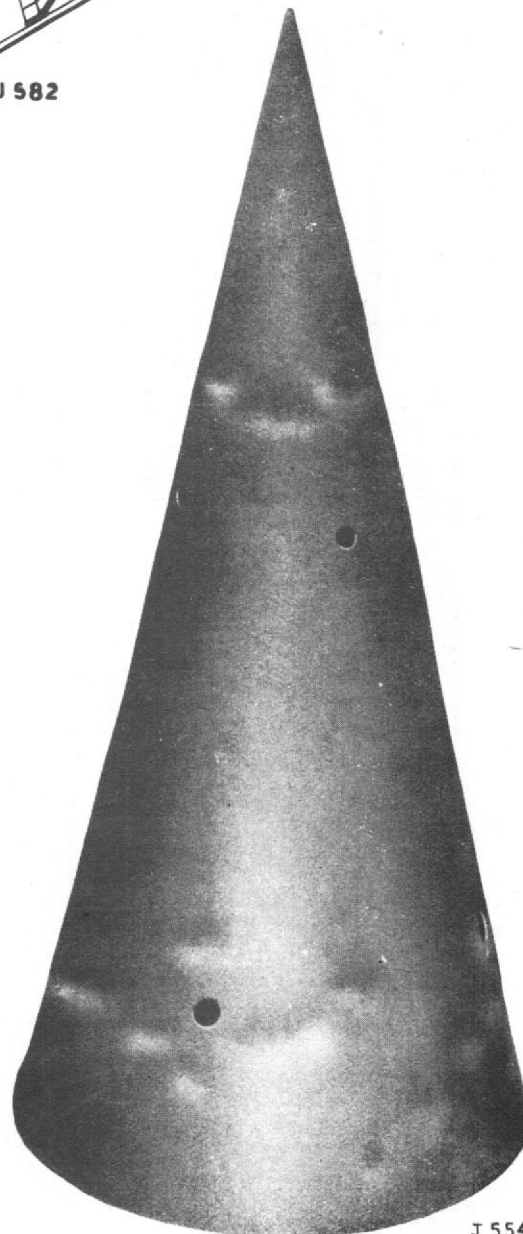


Fig. 13 Typical dents and buckles in inner cone, which are repairable by normal sheet metal methods.

EXHAUST CONE ASSEMBLY, REASSEMBLY AND REFITTING.

The dismantling instructions advised that the components should be marked with chalk to indicate their relative positions and as far as possible the original correlation of components should be preserved. Most of the assembly operations can be best carried out with the outer cone on a wooden board on the floor, standing it first on its rear end and then on its front flange as convenient. All screw threads should be coated with Whitmore's Compound No.5 or anti-seize grease D.T.D.392 to reduce the risk of seizure and thus facilitate dismantling at a later date.

Ensure that the four fairings are free from dents and that the threads in the set-screw holes are perfectly clear; check by screwing in a set-screw, or a bolt having the same thread. Ensure that the four support tubes are free from burrs; one of the front support tubes is slightly longer than the other and must be assembled nearer to the front flange of the outer cone. New support tubes are supplied over-length and must be trimmed on assembly.

Loosely assemble each of the four fairings and the sixteen washers and set-screws to the outer cone, tightening the four set-screws which secure each fairing until finger-tight only. Slide each of the support tubes through the outer cone and the fairings, align the fairings with the support tubes, and tighten the fairing set-

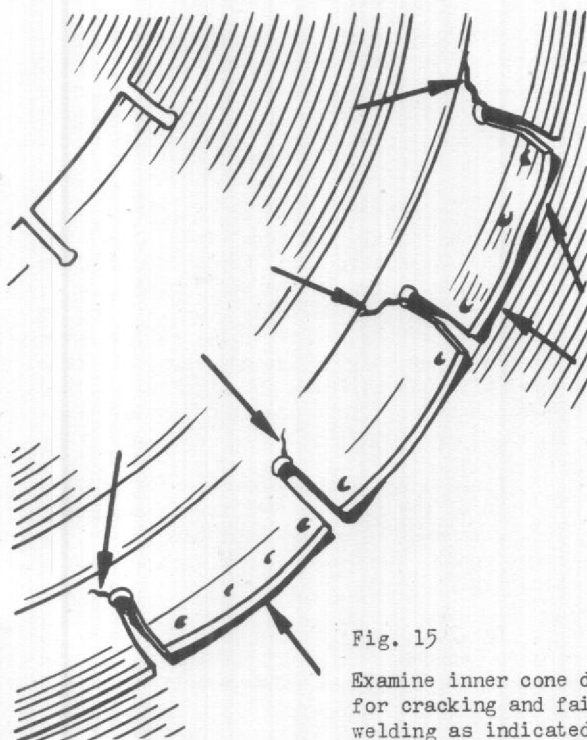
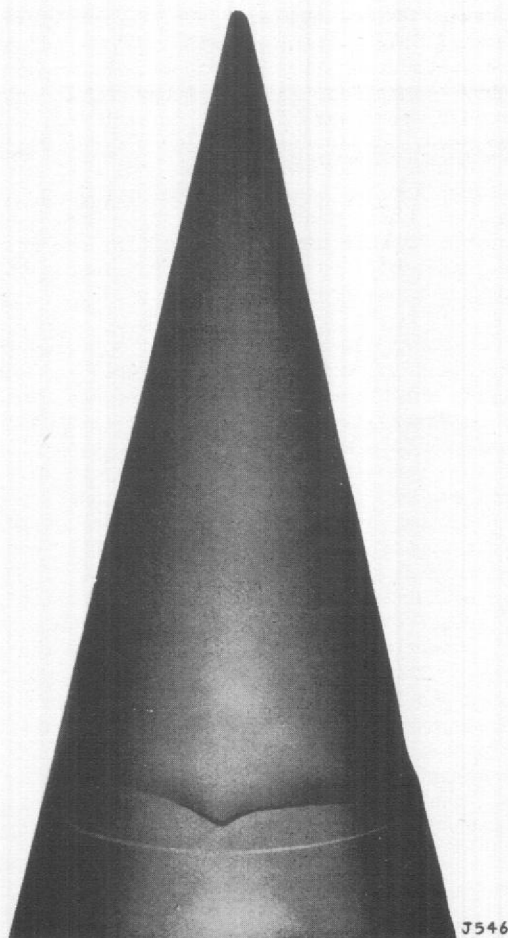


Fig. 15

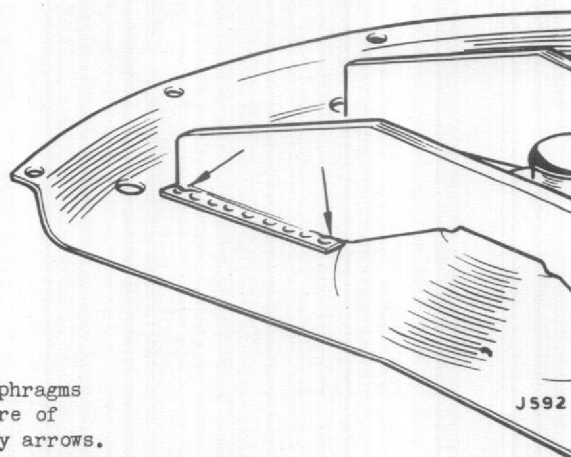
Examine inner cone diaphragms for cracking and failure of welding as indicated by arrows.



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Fig. 14 Extensive cracking and buckling of inner cone apex such as this is not repairable and a new inner cone must be fitted.

Fig. 16 Small cracks in baffle plate stiffeners may be repaired by welding.



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screws. Wire-lock each pair of set-screws with 22 S.W.G. stainless steel wire. Adjust the protrusion at each end of the support tubes; the front support tubes should not project more than 0.240 in. at each end, and the rear support tubes should project 0.150 in. above the bosses at each end. If necessary, correct the protrusion by filing the support tube. Mark the outer cone and each support tube with chalk to identify the correct assembly relationship and remove the support tubes from the outer cone.

Before assembling the inner cone, ensure that each support tube slides freely in the bosses which are inside the inner cone and, if necessary, mark the inner cone with chalk to facilitate assembly. Apply a thin film of the recommended anti-seize compound to each support tube. Position the inner cone inside the outer cone and slide one of the front support tubes through the outer cone and fairing until it enters the first of the two bosses inside the inner cone. Similarly slide one of the rear support tubes through the outer cone and fairing into the inner cone. The remaining front and rear support tubes should be slid into position in the same manner. Using a brass or copper drift to protect the ends of the support tubes, progressively tap each support tube through the inner cone and the opposite fairing attached to the outer cone.

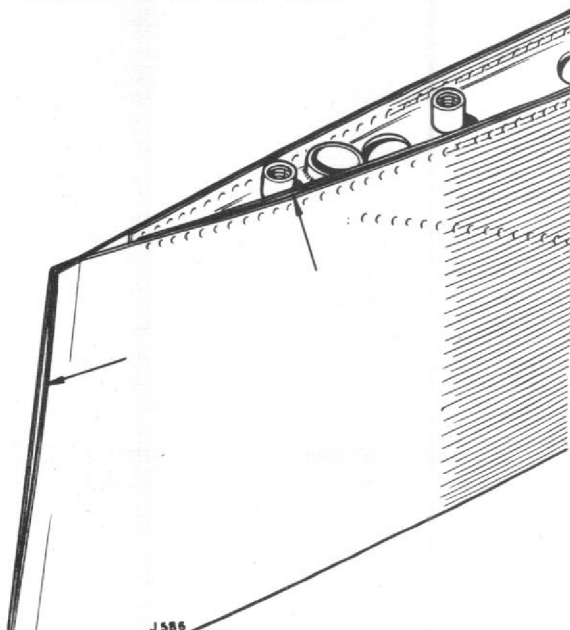


Fig. 19 Failure of seam weld at trailing edge of exhaust cone fairing and at spot welding which secure skin to formers as indicated by arrows is usually repairable.

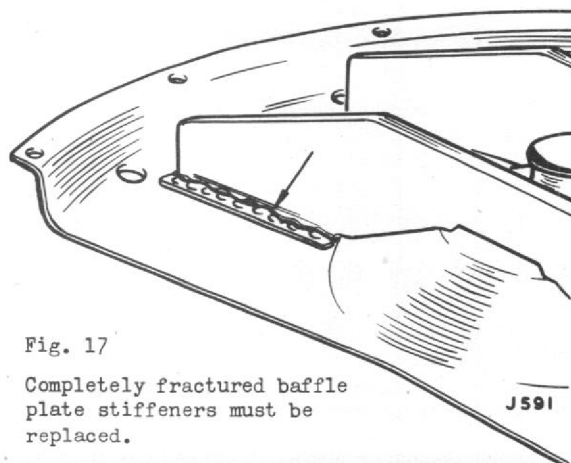


Fig. 17

Completely fractured baffle plate stiffeners must be replaced.

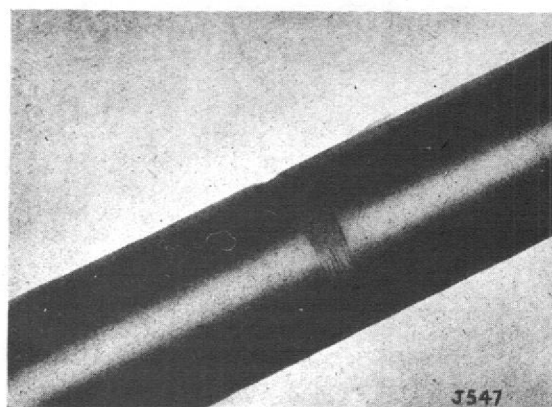


Fig. 18 Indentation and fretting of support tube caused by fairings.

Withdraw each front support tube a little over half way from the assembly, support the air tube in position in the centre of the inner cone and lightly tap the support tubes back through the air tube and the outer cone.

Before assembly ensure that the inner cone front baffle is free from burrs and that the set-screws will screw freely into the threaded holes in the stiffening ring at the front edge of the inner cone. Position the sleeve at the centre of the baffle over the air tube and, aligning the set-screw holes with the holes in the stiffening ring, push the baffle into position in the front of the inner cone.

Place a new tab washer (Part No.N3746) on each of the sixteen set-screws and screw in the screws to secure the baffle to the inner cone. Tighten and lock each set-screw securely.

The following checks must be made to ensure concentricity of the inner cone in the outer cone. If the results of the

checks do not satisfy the Schedule of Fits, Clearances, and Repair Tolerances, it will be necessary to select another inner cone. Set the assembly horizontally on a surface table with the front and rear flanges resting on roller brackets; it will be necessary to place packing under the rear roller bracket until the outer cone front flange face is square to the surface table. Set the stylus of a dial test indicator on the surface of the inner cone at a distance two inches from the apex, then rotate the exhaust cone assembly about its horizontal axis. Ensure that the front flange face of the outer cone remains square to the surface table and take continuous readings of the dial test indicator to check that the eccentricity of the inner cone is within the limits. Set the stylus of the dial test indicator to the outside surface of the forward end of the inner cone, rotate the cone and take continuous readings of the dial test indicator to check that the eccentricity of the forward end of the inner cone is within the limits. The apex of the inner cone should be concentric, in relation to the outer cone, within 0.200 in. The forward end, or base, of the inner cone should be concentric within 0.075 in. Using feeler gauges check that the clearance between each fairing and the inner cone is within the limits; 0.060 to 0.200 in. Stand the assembly rear end downwards on a wooden base board, place a straight edge across the front flange of the outer cone and using a slip gauge and feeler gauges, check that the gap between the straight edge and the flange of the inner cone is 0.300 in.

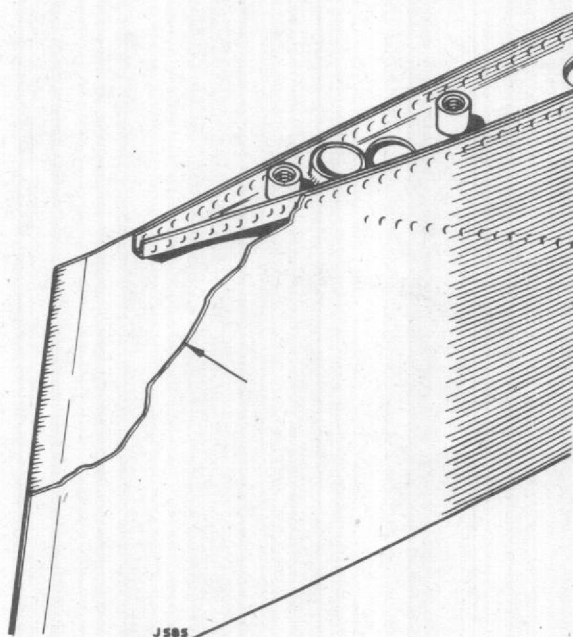


Fig. 20 Fatigue failure of exhaust cone fairing skin which is beyond repair.

Before assembling the support tube cap nuts, pressure point and thermocouple blanking nuts, ensure that all threads are free and that the support tube ends are free from burrs. Place a copper washer Part No. N1494, on each rear support tube, apply the recommended anti-seize compound to the threads and screw the four cap nuts into the outer cone over the ends of the support tubes. Screw the pressure point and thermocouple connection blanking nuts to their bosses and wire-lock them.

Position the propelling nozzle on the rear of the outer cone, and secure it by fitting the thirty-six $\frac{1}{4}$ " B.S.F. bolts and nuts, these bolts must be fitted with the heads inside the exhaust cone. Check that the dimensions of the propelling nozzle are within the limits. The size of propelling nozzle fitted to each individual engine is decided whilst the engine is being bench tested; the larger, alternative nozzles being selected where necessary to correct excessive jet pipe temperature. Once an engine has been passed for service a different size of propelling nozzle must not be fitted, except as a result of subsequent bench testing. When an engine is tested on the bench with an adjustable propelling nozzle, the size of the nozzle and the radial position and number of trimming strips required to give the specified performance are recorded in the engine log book. If the propelling nozzle is changed 'in the field' the exact positions may be disregarded provided that the correct number of trimming strip segments are fitted in a propelling nozzle of the correct diameter. If an adjustable nozzle is not available and it is necessary to fit a fixed nozzle, or if an engine previously fitted with a fixed nozzle is to be fitted with an adjustable nozzle, reference should be made to the table which shows the equivalent fixed nozzle sizes in relation to the number of trimming strips removed.

Diameter of adjustable nozzle	Number of trimming strip segments in position	Equivalent fixed nozzle diameter
$18\frac{5}{8}$ in.	4	$18\frac{1}{2}$ in.
$18\frac{3}{4}$ in.	None	$18\frac{1}{8}$ in.
$18\frac{1}{2}$ in.	8	$18\frac{3}{8}$ in.
$18\frac{1}{8}$ in.	4	$18\frac{3}{4}$ in.

Each detachable trimming strip takes the form of a segment one-eighth of the circumference of the propelling nozzle in length, and is secured in the propelling nozzle by three 2 B.A.

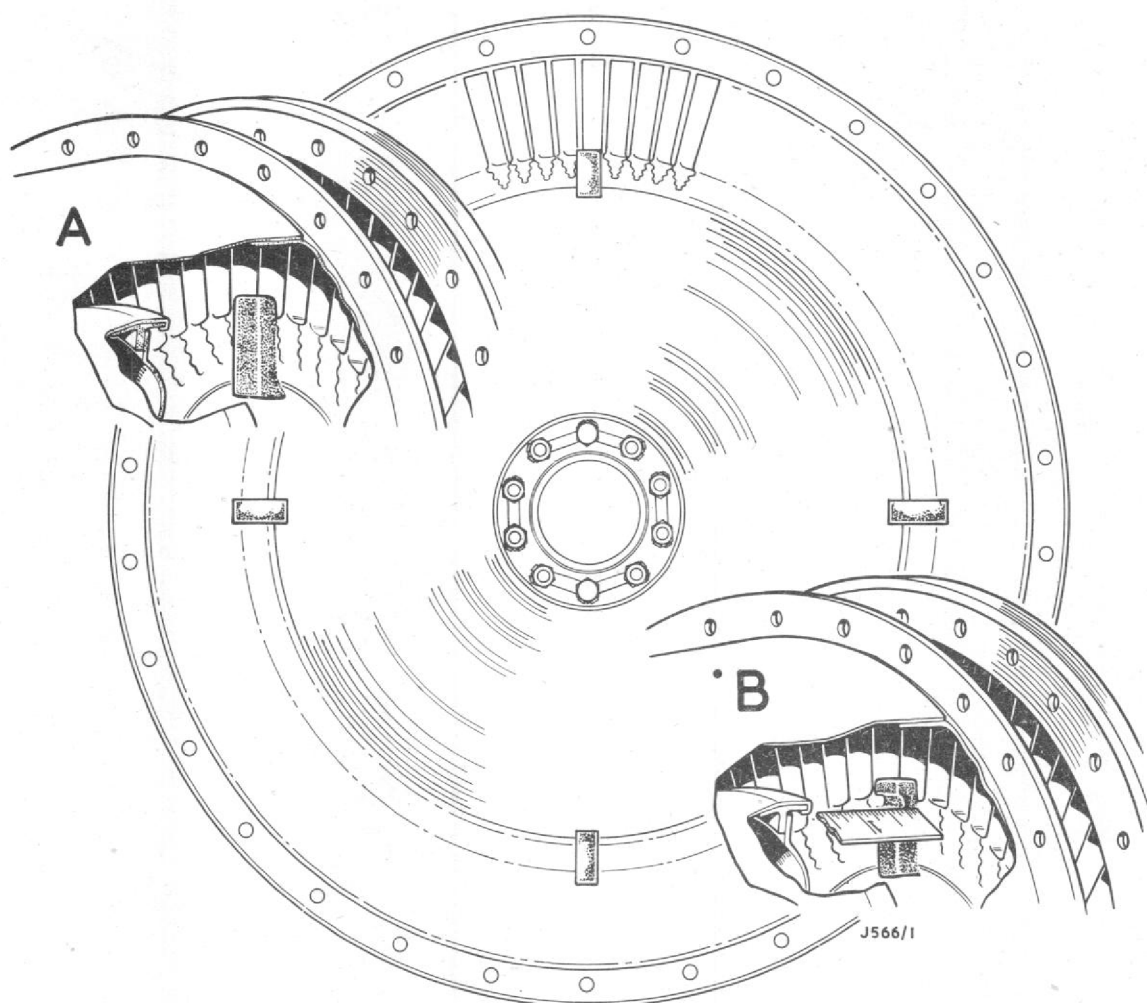


Fig. 21 Method of checking exhaust cone/turbine clearance.

- A. Appearance of plasticine before exhaust cone is fitted. B. Measuring thickness of plasticine after exhaust cone has been fitted and removed.

countersunk socket screws, spring washers and plain nuts; the screws being fitted so that the heads are inside the propelling nozzle. Each trimming strip must be fitted so that its radiused edge faces the front of the engine; offset holes in the trimming strips prevent their being fitted incorrectly.

Before a new or reconditioned exhaust cone is fitted to an engine, the clearance between the baffle at the front of the inner cone and the turbine disc must be checked as described elsewhere.

To refit the exhaust cone to the engine proceed thus. Treat the thirty 7/16" B.S.F. bolts and nuts with the recommended anti-seize compound. Position the exhaust cone at the rear of the engine so that the drain connection is at the lowest point and insert the thirty bolts, from the front, through the turbine shroud and outer cone flanges. Use thirty tab washers, Part No. N5103 to lock the bolt heads and the nuts. Securely tighten the thirty nuts. The short air cooling pipes connect up with the forward of the two front support tubes and the long pipes with the rearward of the front support tubes. Place a copper washer over the support tube and carefully enter the air cooling pipe in the sleeve in the bracket attached to the turbine shroud, at the same time positioning the elbow over the end of the support tube. Secure the pipe by refitting the two 1/4" B.S.F. set-bolts. To reduce the risk of these bolts seizing and being sheared during subsequent dismantling; first, check that each bolt enters the tapped hole

freely and can be screwed in fully using the fingers only; second, ensure that the bolts will not 'bottom' in the tapped holes when tightened fully; finally, coat the thread of each bolt with Ragosine L.M. paste before finally assembling and tightening them. Refit the other three air cooling pipes in a similar manner. Refit the fireguard.

EXHAUST CONE/TURBINE CLEARANCE

The method of removing and refitting the exhaust cone has been described already. Before a new or reconditioned exhaust cone is fitted to an engine, the clearance between the baffle at the front of the inner cone and the turbine disc must be checked as follows:

Affix four strips of plasticine equidistantly around the rear of the turbine disc as indicated in Fig.21 avoiding those positions where portions of the balancing rim have been removed. Each strip of plasticine should be approximately $\frac{5}{8}$ inch wide and $\frac{5}{8}$ inch thick, that is slightly thicker than the maximum permissible clearance between the disc and the inner cone. The strips should be positioned to cover the 'fir-tree' roots of the turbine blades, and should radiate inwards towards the centre of the turbine disc for a distance of about two inches. Smear the rear surface of the plasticine with French chalk, or oil, so that it does not adhere later to the baffle at the front of the inner cone. Inset A on Fig.21 shows the appearance of the plasticine at this stage.

Secure the exhaust cone to the turbine shroud by three or four of the bolts and nuts. Remove the exhaust cone and measure the thickness of the plasticine at the points of minimum clearance. Inset B shows the appearance of the plasticine after the exhaust cone has been fitted and removed. The clearance must not be less than 0.250 inch. This clearance is to be measured at the point between the rim of the inner exhaust cone and the trailing edge of the turbine blade roots. Clean off all traces of plasticine before refitting the exhaust cone finally.

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