Chapter 3

(Completely revised)

REPAIRS TO COVERS AND TUBES

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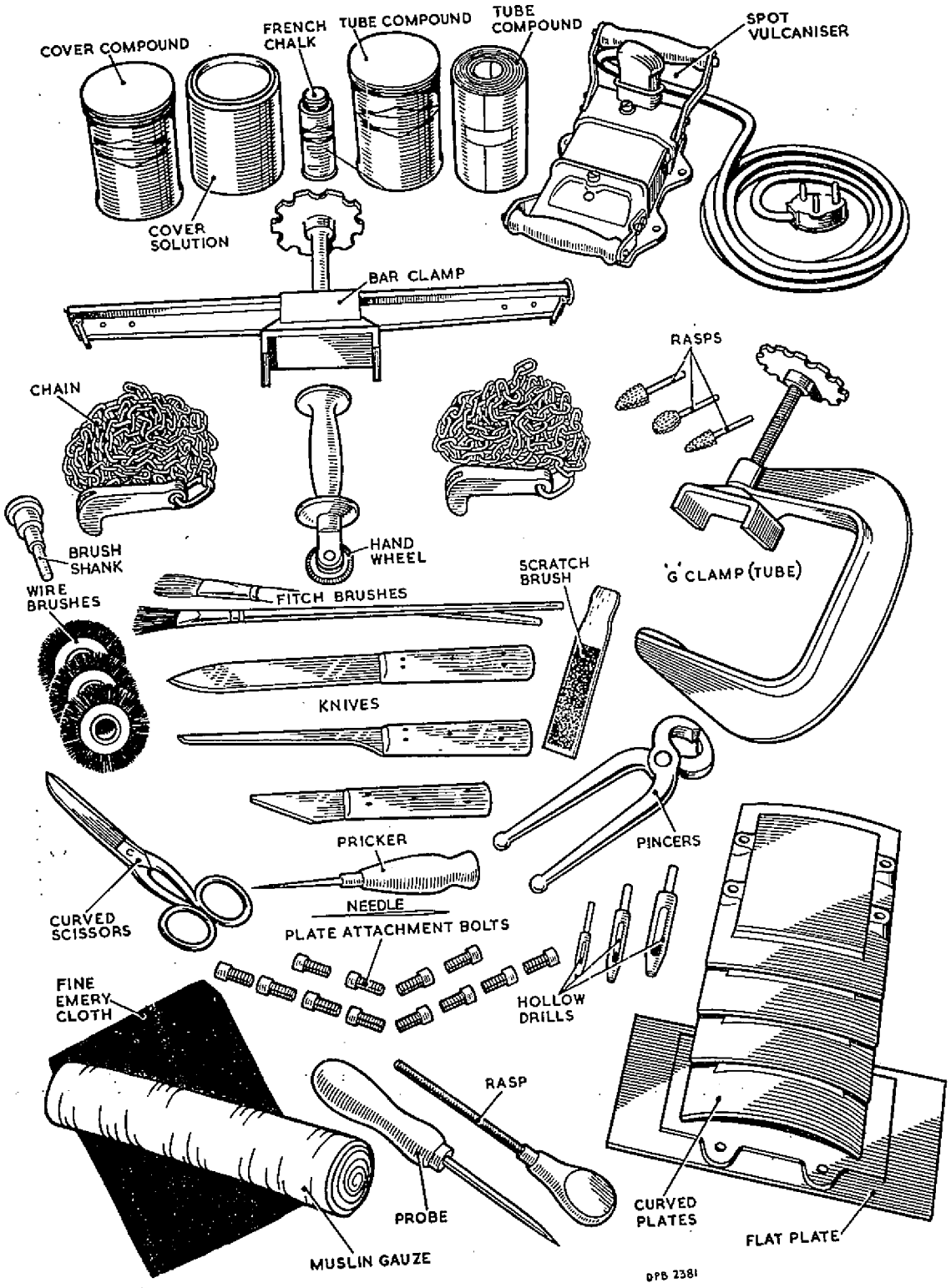

Fig. 1. Dunlop spot vulcanising equipment

DUNLOP SPOT VULCANISING PROCESS

General

1. The repairs detailed in this chapter are to be done only to tubeless tyres and covers and tubes with inflation pressures of 100 p.s.i. or less, and which are fitted to aircraft whose landing speed is 100 knots or less. All other tyres are to be returned to the factory for repair.

2. The vulcanising times given are for Dunlop materials only, and the times may vary if other materials are used. The manufacturers of these materials should be consulted for their vulcanising times.

Scope of repairs

3. This repair equipment can be used to repair minor damage to aircraft covers and tubes provided they are within the limits given in para. 1. The method of repair is to remove the damaged rubber, and replace it with unvulcanised sheet rubber repair compound which is then vulcanised to the existing rubber by heat and pressure applied by the spot vulcanising equipment. During the application of heat and pressure, the repair compound is converted into a material with properties almost identical to the surrounding rubber.

4. Minor damage to covers is damage which does not affect the casing cords, although the cords may be exposed. These repairs should be made as soon as possible, as continued exposure of the cords will permit the entry of water and grit and cause chafing and subsequent rotting. Small cuts and scores in the tread rubber which do not penetrate to the casing cords do not appreciably weaken the cover and repair is unnecessary unless the cover is so extensively cut that it gapes badly.

5. Minor damage to tubes is classified as any damage of size less than 2 in. × 2 in. to the rubber part of the tube. Repairs to the cord base of the tube are not permitted.

Equipment and materials (*fig. 1*)

6. The complete vulcanising equipment is listed in this paragraph. Sub-para. 1–19 list the items which make up the basic equipment, and sub-para. 20–25 list the expendable items.

(1) The complete kit is either the 110 volt equipment (*Ref.* 4A/1766) or the 200–250 volt equipment (*Ref.* 4A/1700). These are complete in the wooden carrying case.

(2) The Dunlop spot vulcaniser. This consists of a thermostatically controlled rectangular electric heater. The 110 volt unit is supplied under Ref. 4A/1686, and the 200–250 volt unit under Ref. 4A/1687.

(3) Curved aluminium plates (*Ref.* 4A/1682, /1683, /1684, /1685) are made to fit various tyre sections as marked on each plate. When repairs are being made, the plates are attached to the spot vulcaniser, and apply the heat effectively and shape the repair accurately.

(4) The flat aluminium plate (*Ref.* 4A/1701) is used when a tube or the sidewall of a cover is being repaired.

(5) Bar clamp and chain (*Ref.* 4A/1680 *and* 4A/1681). These are used to clamp the vulcaniser to a tyre. (Note: Tyres are always mounted on a wheel for repair).

(6) G-clamp (*Ref.* 4A/1699). This is used when the vulcaniser is applied, under pressure, to a tube repair on the bench.

(7) Rubber pressure pad (*Ref.* 4A/1704) (not illustrated). This is placed between the tube and the bench during the vulcanising process.

(8) Circular scratch brush on a shank (*Ref.* 4A/1689). Used in a $\frac{1}{4}$ in. dia. high-speed drill (minimum speed 1,000 rev/min) to roughen the surfaces to be repaired.

(9) Probe. This consists of a tapered, blunted steel rod in a wooden handle, and is used to probe and examine cuts for grit and stones. This is made up from local resources.

(10) Short tapered knife (*Ref.* 4A/1693). This is used to remove the damaged rubber during the first stages of a cover repair.

(11) Pincers. These are used to assist in the removal of the damaged rubber, but are not supplied in the kit.

(12) Long broad knife (*Ref.* 4A/1692). This knife has an 8 in. blade and is used to trim cover or tube repairs to final shape before being vulcanised.

(13) Curved scissors (*Ref.* 4A/1705). These are used to bevel the edges of the tube before vulcanising.

(14) Small bristle brush (*Ref.* 4A/1688) for painting solution on to the roughened surfaces.

(15) Hand scratch brush (*Ref.* 4A/1702). This is used to roughen the tube repair cut-out if the drill and rotary scratch brush cannot be used.

(16) Milled hand wheel (*Ref.* 4A/1697) for rolling down and consolidating the patches of the repair material.

(17) Needle in wooden handle. Used for pricking air blisters when rolling down patches. Not supplied in kit.

(18) Hollow drills (*Ref.* 4A/2279, /2280, /2281). These are issued in three sizes of $\frac{3}{16}$ in., $\frac{5}{16}$ in., and $\frac{7}{16}$ in. dia., and are used to groove the vulcanised repair and restore the tread patterns.

(19) Rough rotating rasps (*Ref.* 4A/2282, /2283, /2284). These are supplied in three sizes and are used to roughen the edges of the cuts in the cover.

(20) Cover repair compound $\frac{1}{16}$ in. gauge (*Ref.* 32C/396) and $\frac{1}{8}$ in. gauge (*Ref.* 32C/297).

Note . . .

This compound, if stored at low temperatures, may become hard and unworkable. If this happens, warm the roll of compound for three or four hours at a temperature of 90 *to* 95 *deg. F. If a small quantity only is required, it may be softened on a hot plate for* $\frac{1}{2}$ *minute.*

(21) Tube repair compound (*Ref.* 32C/643.

(22) Black repair solution for covers (*Ref.* 4A/644).

(23) French chalk (Ref. 33C/19), used for dusting cover repairs before vulcanising, and for dusting the flat vulcanising plate before vulcanising a tube repair.

(24) Muslin cloth (*Ref.* 4A/1691). This is used as a sponge to wipe patches, etc. with the solvent.

(25) Fine emery cloth for sharpening knives.

Workshop

7. The tyre repair workshop should be well lit and possess a hand inspection lamp. Two 15 amp. plug sockets are necessary, and a

TABLE I

List of materials

Solvent

The recommended solvent for cleansing and thinning purposes is in accordance with the following specification:—

Gasoline having an octane value of not less than 90. (It is essential to avoid the use of low grade gasoline having any kerosine content).

For cleaning use a cloth or rag which will leave no deposit.

The use of M.T. gasoline is inadvisable because of its kerosine content.

STORE IN A CLOSED CONTAINER TO AVOID EVAPORATION AND RISK OF FIRE.

Compound

If the compound is stored in a very warm temperature, or kept in stock for a long time, it may become partly vulcanised and consequently be of little use. It is advisable, where practicable, to keep only about six months stock, and re-order when necessary.

The compound is affected by extreme cold, becoming hard and even frozen, but can be made usable by warming.

compressed air supply is desirable although not essential. A metal covered bench is most suitable; if a wooden one is used, it must be free from grease and splinters. A vice wide enough to hold a portable electric or similar drill is required and it must also be possible to use the G-clamp on the bench. A useful locally-made tool to assist tube repairs is a wooden saddle peg. This consists of a $2\frac{1}{2}$ in. $\times$ $2\frac{1}{2}$ in. $\times$ 9 in. piece of hardwood, with its top edges radiused, attached to a piece of wood to form a 'T'. The upright part can be held in a vice, and the tube under repair stretched across the saddle whilst the trimming operation is carried out.

Preparation of the vulcaniser unit

8. Before a repair is vulcanised, it is necessary to pre-heat the vulcaniser to the correct working temperature. The 200–250 volt unit requires approximately thirty minutes to warm up, and the 110 volt unit requires approximately forty-five minutes to warm up. Before the pre-heating period, the correct aluminium plate must be fitted to the vulcaniser. If the plate is changed when the unit is at its working temperature, then the cold plate must be allowed ten minutes to warm to the working temperature. The plate selected must be for tyre sizes near the top limit of the range for the plate. If the plate appears to fit the cover before clamping pressure is applied, select the plate for the next larger tyre size range so that pressure can be exerted on the centre of the repair. Ensure that the corners of the plate do not dig into the cover.

REPAIRS TO COVERS

Inflation pressures during examination and repair

9. For repairs to covers, the tyre must be fitted to the wheel and inflated to its correct working pressure. After careful examination and marking (*para.* 10 *and* 11), the pressure for all tyre sizes is to be adjusted as follows:—

(1) For crown and shoulder repairs, 20–30 p.s.i.

(2) For wall repairs, 10–20 p.s.i.

Examination

10. Every cut is to be carefully examined and tested for depth using the probe. All cuts which extend inwards towards the casing cords must be marked, and it is advantageous to devise a system of marking which differentiates between cuts of less than $\frac{1}{4}$ in. long (not vulcanised), cuts between $\frac{1}{4}$ in. and $\frac{1}{2}$ in. long, cuts over $\frac{1}{2}$ in. long but less than 8 in. long. For cuts up to $\frac{1}{2}$ in. long refer to para. 30 and 31.

Fig. 2. Removal of damaged rubber—using a knife

Fig. 3. Removing the cut out rubber—using pincers

Repairs to cuts exceeding ½ in. but less than 8 in. long

Marking the repair area

11. Draw a chalk line around the cut to mark the area of rubber which is to be cut or rasped away. The line should be drawn approximately one inch away from the cut, and the ends of the line rounded.

Removal of rubber around the cut—using a knife (fig. 2 and 3)

Note . . .

This method to be used only when the size of the repair makes it impractical to use the rasp or hollow drill.

12. The short tapered knife is to be used to cut around the marked area (*fig.* 2). The blade edge must be kept sharp and well lubricated with water, and the cut is to be made in a clockwise direction maintaining a 45 deg. angle. When starting the cut, the tapered part of the blade is to be used, and a firm pressure applied, but as the blade penetrates, the pressure is to be decreased and final cuts are to be made using only the tip of the blade, which has previously been ground to a blunt end. During the final cutting operations care must be taken not to damage the casing cords.

13. The layer of cords beneath the rubber generally run from right to left (*fig.* 3), and it is therefore advisable to remove the rubber by gripping the right-hand edge of the cut rubber with pincers, and gradually levering it towards the operator, that is, towards the centre of the repair. Once started, the strip of rubber can be pulled straight out, but care must be taken not to undercut the tread rubber at the cord surface, as this will form an air pocket and prevent a successful repair.

Removal of rubber—using a rasp (fig. 4)

14. If the cut is small, the cavity may be made using a conical or round rasp mounted in a portable drill having a speed of at least 1,000 rev/min. Ensure that the edges of the cavity are bevelled at 45 deg. Detailed repair of minor cuts is given in para. 30 and 31.

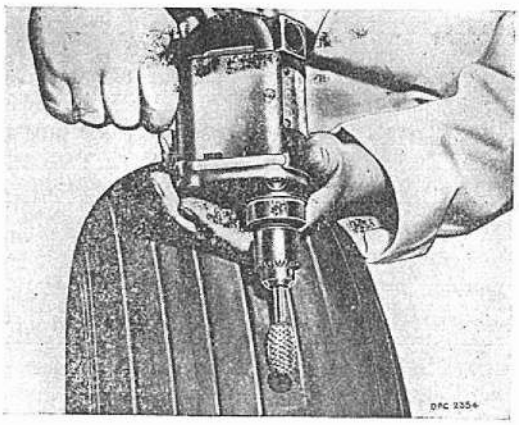

Fig. 4. Removing damaged rubber—using a rasp

Preparation of the cavity (fig. 5)

15. Mount the rotary wire brush in a portable drill having a speed of at least 1,000 rev/min, and roughen the walls of the cavity as shown in fig. 5. Also roughen the surrounding tread surface for a distance of approximately ¼ in. from the edge of the cavity. Using the brush, remove all rubber remaining on the cord surface, then remove all traces of rubber dust. Finally, clean the prepared surface using a little solvent on the muslin gauze. The solvent to be used is as specified in the list of materials (*Table* 1).

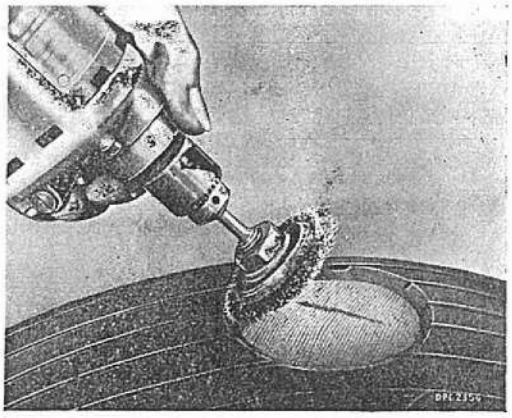

Fig. 5. Using the rotary wire brush

16. The roughened surfaces and the exposed cord are to be given two thin coats of black repair solution. The first coat must be worked in thoroughly with the brush, then allowed to dry to a state of dry tackiness. The second coat must then be applied lightly and allowed to dry to the same state.

Application of repair compound (fig. 6, 7 and 8)

17. While the solution is drying, cut a piece of black vulcanising compound, with its plastic backing still attached, from the roll. This piece is to be cut to the size and shape of the top of the cavity into which it is to fit. When the solution is dry, remove the plastic backing from the piece of compound, and apply the clean exposed surface to the cavity. If the compound is not perfectly fresh and clean, it is to be lightly rubbed with a piece of muslin gauze moistened with solvent, until it is tacky, then allowed to dry.

18. Apply the centre of the patch to the centre of the cavity, and using the milled hand wheel, roll it down from the centre outwards to the sides (*fig.* 6); this ensures that there is good contact between the surfaces. Check that no air is trapped under the patch and that it is perfectly bonded to the cover. During the filling-in process any blisters appearing between the layers of compound should be pricked with the needle to release trapped air.

Note . . .

If a patterned cover is being repaired, refer to para. 28 *for additional procedure.*

19. Clean the top of the patch with solvent and allow it to dry.

20. Cut another patch, slightly smaller than the first, from the roll. Apply it to the first patch as detailed in para. 18. Add further layers of repair compound until the centre of the last patch is slightly higher than the original material (*fig.* 7). The finished application of repair compound to a rasped repair is shown in fig. 8.

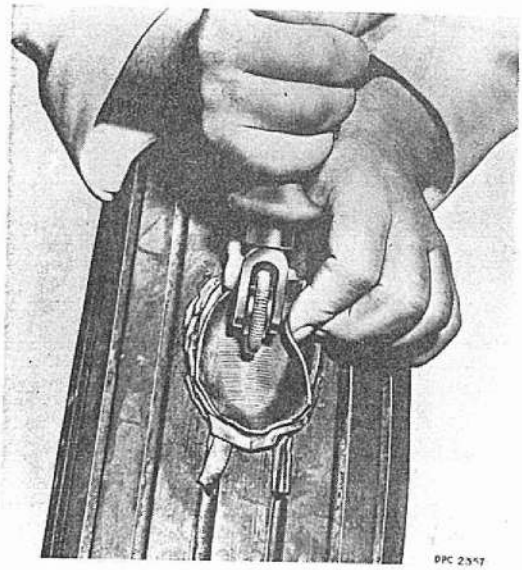

Fig. 6. Applying repair compound

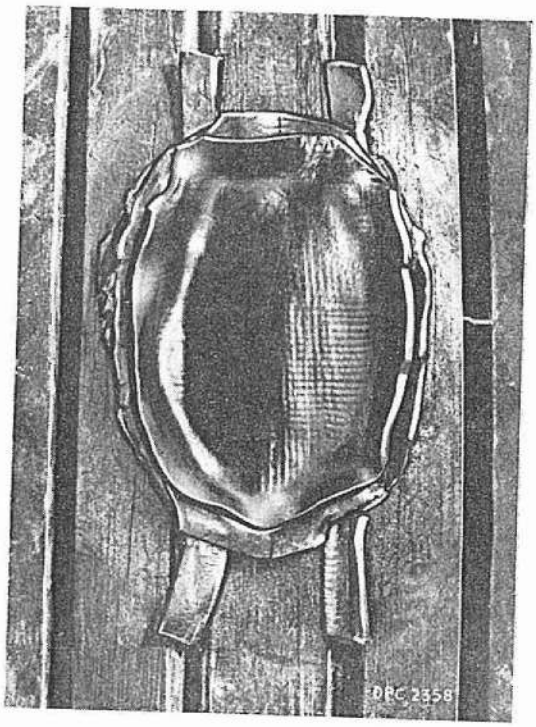

Fig. 7. Finished application of repair compound—cut out repair

Removal of surplus compound (fig. 9 and 10)

21. Remove all surplus repair compound so that a crown is left in the centre (fig. 9). To do this, use a long broad knife, keeping it very sharp and well lubricated with water, and make long cutting strokes working from the edge of the patch upwards to the centre. When the edges of the repair are trimmed flush with the surrounding rubber, ensure that the surface is clean and dry, and lightly dust with french chalk. Indicate the centre of the repair by a chalked cross making the lines long enough to show when the vulcanising unit is in position (*fig.* 11).

Vulcanising (fig. 11 and 12)

22. Place a shackle in the bar clamp hole appropriate to the width of the tyre and thread the chain through the hub of the wheel. Pass a piece of rubber tube over the chain so that the oil seals and hub are protected (*fig.* 11). Pass one end of the chain through the shackle and link it through the slot in the end of the bar. Pass the other end of the chain through the other shackle and secure it in the other end of the bar. Enough slack is to be left to allow the vulcaniser to be slipped under the bar.

23. Position the pre-heated vulcaniser unit centrally on the repair and place the screw saddle on the unit. Take up any slack in the chain. Check that (a) the bar is parallel with the base of the unit, (b) that the chain angles are equal, (c) that the corners of the plate do not dig into the cover, and (d) that the valve cap is fitted.

24. Rotate the centre screw until the pressure is sufficient to make the aluminium shoe flush with the tread. The indicator light should appear occasionally, denoting that the current is still on. Check that the area is free from draughts otherwise the operating temperature will be reduced.

25. The vulcaniser unit must now be left in position for the correct vulcanising time. These times may vary according to the thickness of the repair, and Table 2 gives the necessary times for the various thicknesses. Mark the time at which the unit was positioned and the time at which it should be removed from the tyre, as shown in fig. 11 and 12.

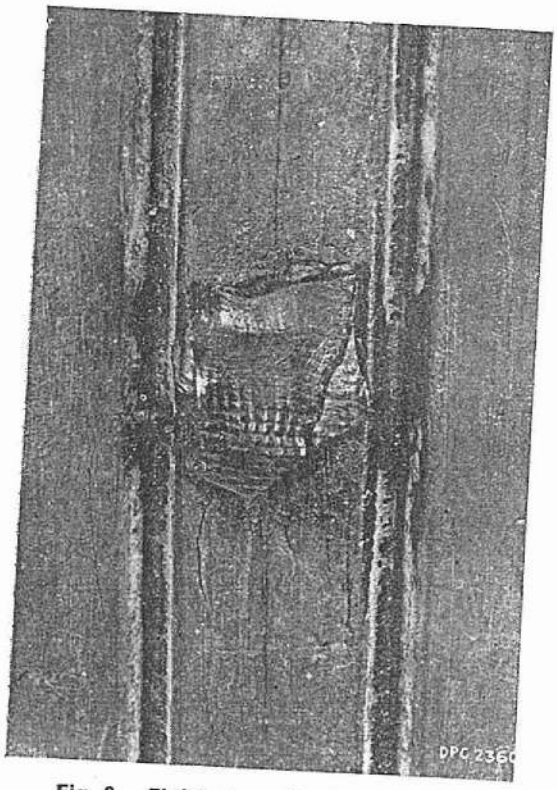

Fig. 8. Finished application of repair compound—rasped repair

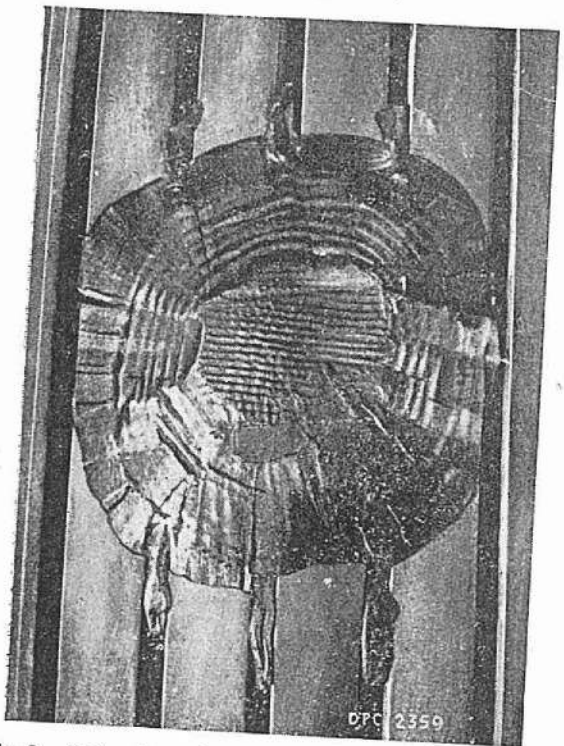

Fig. 9. Cut out repair trimmed ready for vulcanising

TABLE 2

Vulcanising times—covers

Thickness of repair	Time (minutes)
Up to $\frac{1}{8}$ in.	20
Over $\frac{1}{8}$ in. and up to $\frac{1}{4}$ in.	35
Over $\frac{1}{4}$ in. and up to $\frac{3}{8}$ in.	50
Add 15 minutes for each additional thickness of up to $\frac{1}{8}$ in.	

26. The vulcaniser unit must never be removed from the repair before the specific time, otherwise the work may be ruined. If, on the other hand, the specific time is slightly exceeded, little harm will be done. At the end of the vulcanising period, the unit must be removed completely and not merely switched off, and the repair must be allowed to cool naturally. Fig. 13 and 14 show repaired areas after the vulcaniser has been removed.

Testing the repair

27. Check the effectiveness of the repair by probing the vulcanised area with a blunt pencil point. If the pencil springs back and no indentation is left on the surface, then the vulcanisation is correct. If an indentation is left, the repair is under-vulcanised, so replace the vulcaniser unit for a further 15 minutes and again check for effectiveness.

Patterned tread covers (*fig. 15 and 16*)

28. When patterned covers are being repaired, fill in the cavities for approximately one inch around the repair with compound to give temporary support to the repair whilst vulcanising. After vulcanising, reform the grooves using the hollow drill (*fig.* 15) or with a thin long sharp wet knife.

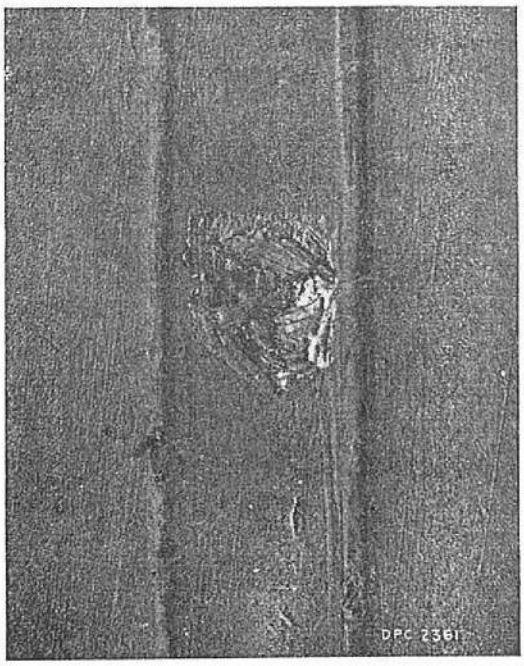

Fig. 10. Rasped repair trimmed ready for vulcanising

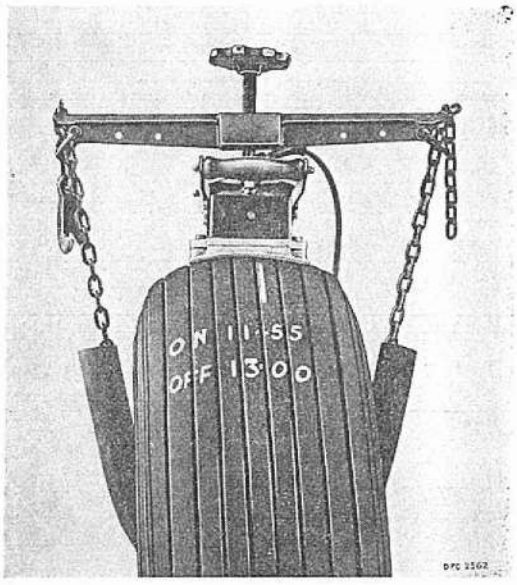

Fig. 11. Repair being vulcanised—crown repair

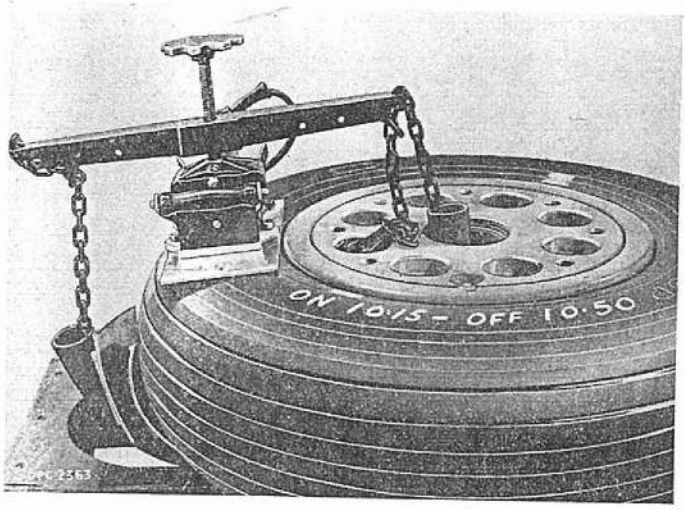

Fig. 12. Repair being vulcanised—side wall repair

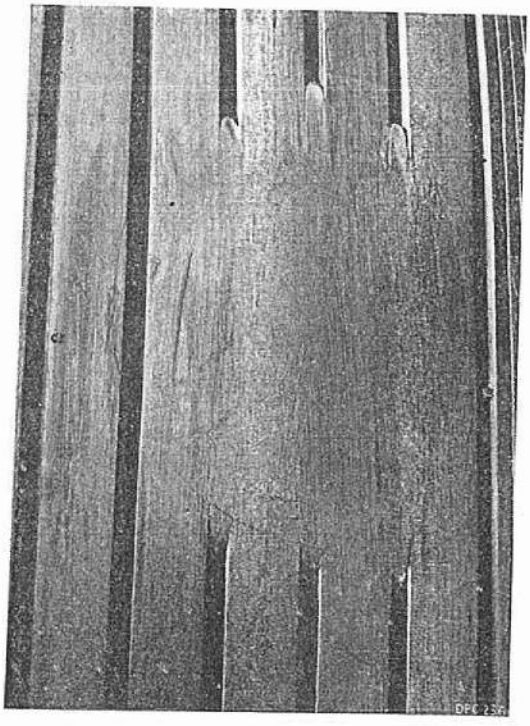

Fig. 13. Cut out repair after being vulcanised

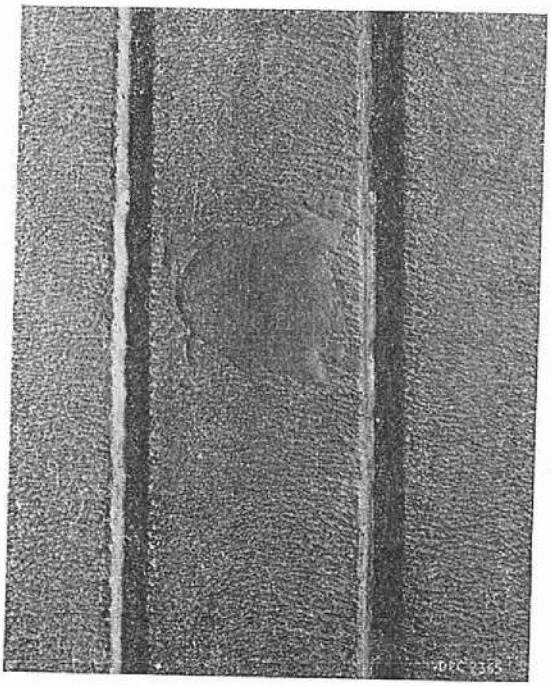

Fig. 14. Rasped repair after being vulcanised

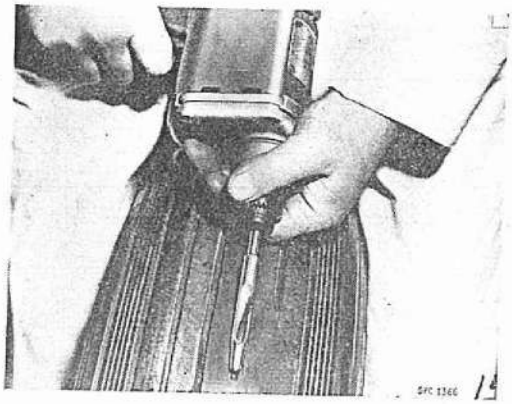

Fig. 15. Reforming grooves using a hollow drill

Twin contact covers

29. This type of cover is to be repaired in the same manner as a patterned tread cover (*para.* 28), and the vulcanising compound is to be built up in the centre groove so that the material will not flow away under the pressure of the vulcaniser unit. Reform to pattern as before.

Cuts up to $\frac{1}{4}$ in. long *(on surface of rubber)*

30. These need not be vulcanised. Roughen, clean, solution and fill in with vulcanising compound. Prick air blisters and roll down. Trim level and dust with french chalk.

Cuts from $\frac{1}{4}$ in. to $\frac{1}{2}$ in. long *(on surface of rubber)*

31. Must be vulcanised. Procedure as in para. 30, followed by vulcanising. Time as in Table 2.

REPAIRS TO TUBES

General

32. Tubes may be repaired where the area of the damage is less than 2 in. × 2 in. Holes of $\frac{1}{8}$ in. dia. or less may be repaired by plugging with compound as detailed in para. 45. The larger cuts are to be repaired using a piece of sheet repair compound. Both methods are to be completed by vulcanising.

Preparation of solution

33. Cut thin strips of tube repair compound. Place in a tin, cover with solvent (see materials), stir well and replace lid. Leave for twenty-four hours, stir again before use, adding more solvent as necessary to make solution the consistency of thin paint. This solution is a volatile mixture liable to rapid deterioration and should be mixed in small quantities as required.

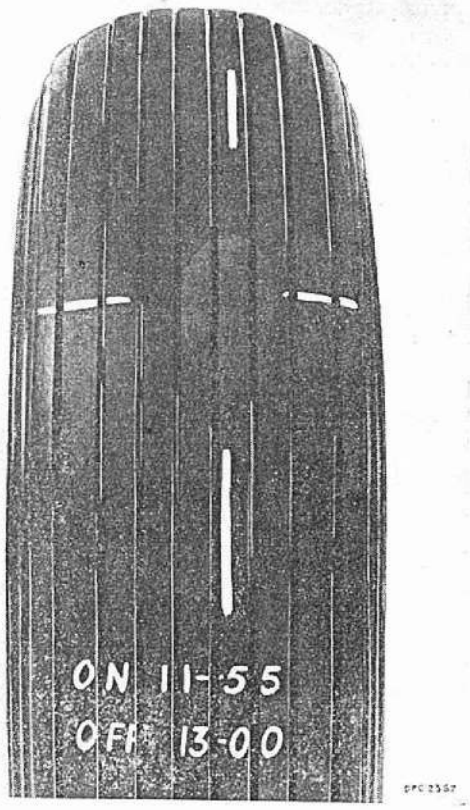

Fig. 16. A completed repair

Fig. 17. Typical tube cut

(A.L.73, Nov. 58)

Marking

34. A typical cut is shown in fig. 17. Before repair is commenced, remove any foreign matter from inside the tube and mark a circular hole around the damage.

Bevelling and roughening (*fig. 18, 19 and 20*)

35. Cut and simultaneously bevel the edges of the hole to a 45 deg. angle (*fig.* 18). Using the curved scissors this can be done by cutting in a clockwise direction with the blade held flat on the tube. The edges and the area $\frac{1}{4}$ in. around the hole must then be roughened. If the rotary wire brush is used for this purpose, the drill must be clamped down to the bench, the drill must be clamped down to the bench, protected with rubber pads above and below as shown. For safety the tube must always be applied to the lower left-hand side of the brush (*fig.* 19). Fig. 20 illustrates the finally prepared edge.

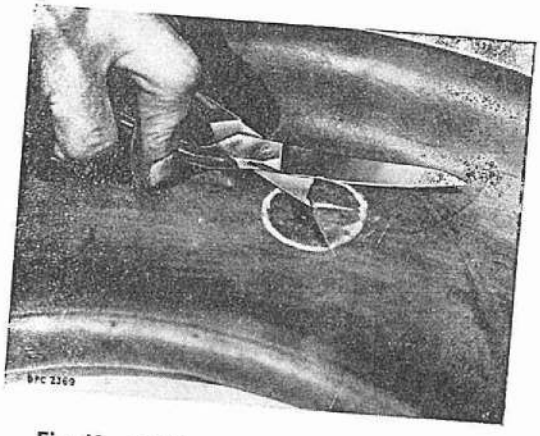

Fig. 18. Cutting out damaged rubber

Cleaning

36. All traces of rubber dust must be removed, and the roughened surface must be kept free from chalk or dust. The surface may be cleaned with a piece of muslin cloth moistened with solvent.

Application of repair compound (*fig. 21 and 22*)

37. Cut a piece of thin paper slightly larger than the hole, and insert it through the hole to prevent the inner surfaces of the tube from being solutioned and vulcanised together. Apply solution to the top of the paper and the prepared part of the tube, and rub well in. Allow to dry to a state of dry tackiness.

38. While the solution is drying out, cut a piece of the tube repair compound of size and shape of the hole, and when the solution is dry, remove the plastic cover from the compound and apply the newly-exposed surface to the tube, centrally over the hole. Roll the compound on to the bevelled edge using the milled hand wheel. If the compound becomes dirty before it can be applied, it is to be wiped over using a piece of muslin cloth moistened in solvent.

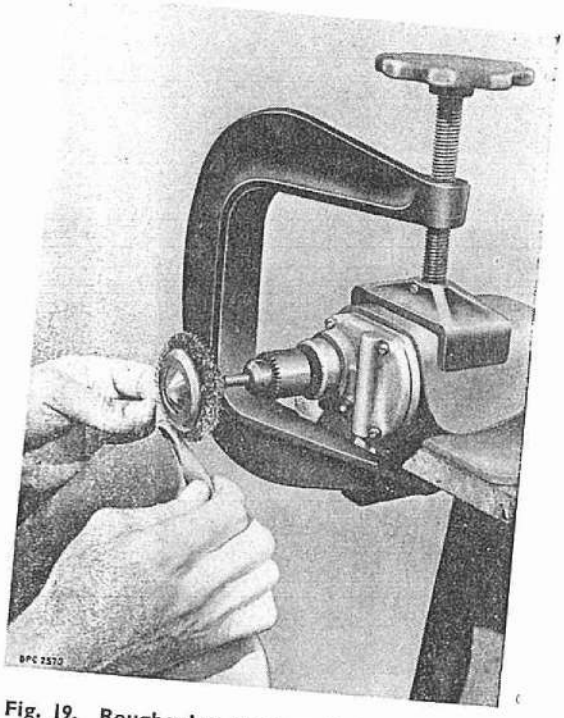

Fig. 19. Roughening the bevelled edges using a rotary wire brush

39. If the thickness of the tube makes it necessary to apply a further layer, a slightly smaller patch is to be cut, applied centrally, and rolled from the centre to the sides using the milled hand wheel (*fig.* 21). This will ensure full bonding, and will prevent air from being trapped between the layers.

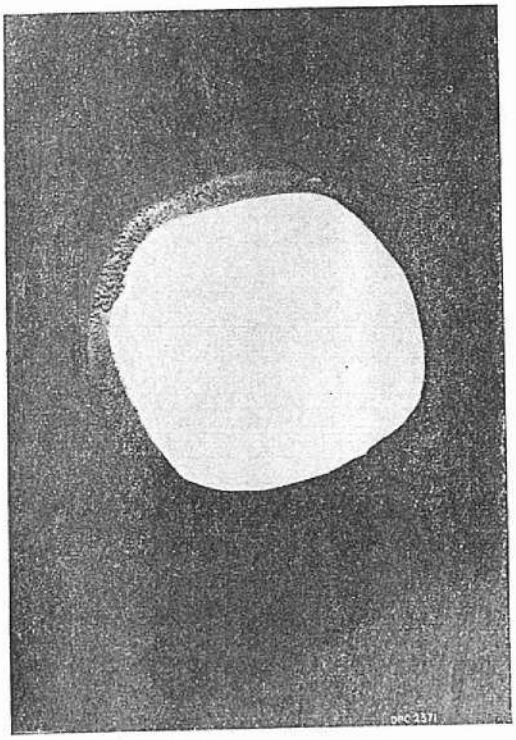

Fig. 20. A prepared edge

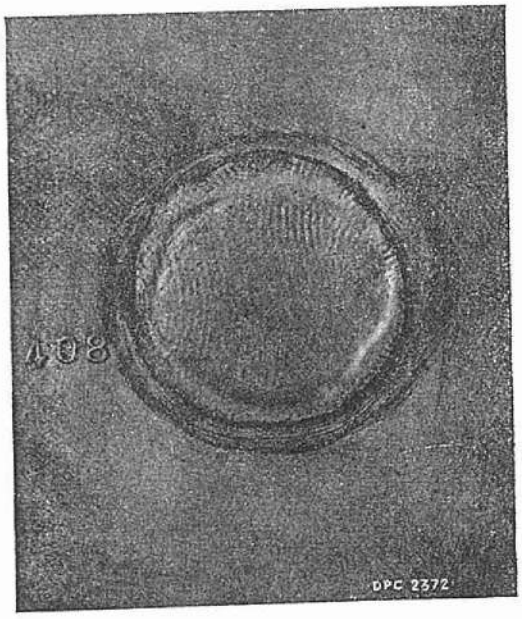

Fig. 21. Application of repair compound

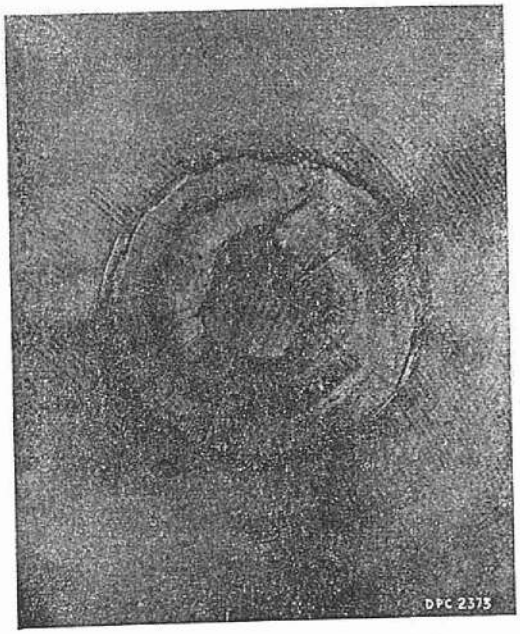

Fig. 22. Tube ready for vulcanising

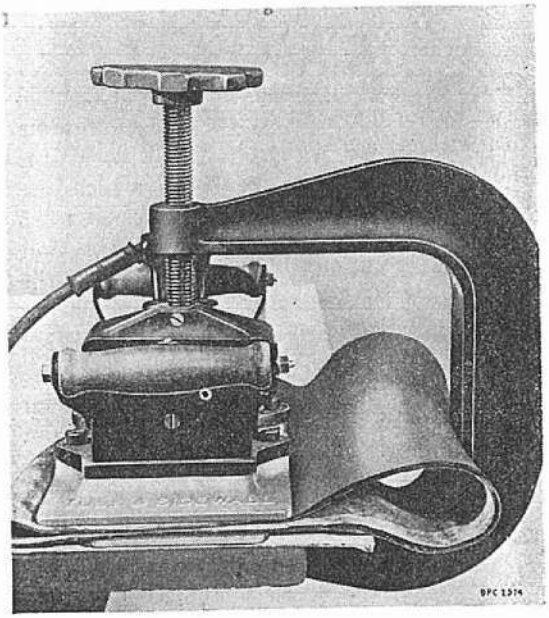

Fig. 23. Vulcanising large tubes

(A.L.73, Nov. 58)

40. The edge of the repair is to be trimmed flush with the tube using a sharp wet knife. Fig. 22 shows a repair trimmed for vulcanising.

Vulcanising large tubes (*fig. 23*)

41. Place the rubber pressure pad, or a double thickness of scrap tube, on the bench. Place the part of the tube to be repaired centrally on the pad with the repair uppermost, ensuring that the folds of the tube will not be pinched when the aluminium plate is clamped down. Dust the plate with french chalk, and clamp the vulcaniser unit in position as shown in fig. 23. Ensure that the repair is central, and that excessive pressure is not used.

Vulcanising narrow tubes (*fig. 24*)

42. When tubes which are narrower than the aluminium plate are being repaired, a thin piece of wood, narrower than the tube but wider than the repair, and with the rubber pressure pad on top, is to be positioned immediately under the area to be repaired. This method will prevent any sharp creasing of the tube folds, and will enable an even pressure to be applied to the repair.

43. The vulcaniser unit is to be left in position for a period which varies according to the thickness of the repair. Table 3 gives the various vulcanising times which are based on a unit temperature of between 295 and 300 deg. F. (*para.* 48). If the unit operates at a lower temperature, then the vulcanising times are to be increased. For example, $\frac{1}{16}$ in. repair at 295 deg. F. takes six minutes, but at 281 deg. F. it takes nine minutes. After vulcanising, switch off and remove vulcanising unit. Allow to cool naturally.

Testing and repair

44. The effectiveness of the vulcanising process is to be checked as detailed in para. 27.

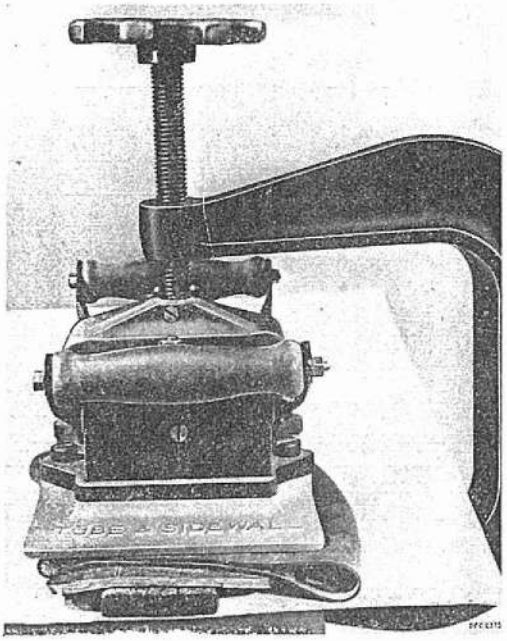

Fig. 24. Vulcanising narrow tubes

TABLE 3

Vulcanising times—tubes

Thickness of repair	Time (minutes)
Up to and including $\frac{1}{16}$ in.	6
Over $\frac{1}{16}$ in. and up to and including $\frac{1}{8}$ in.	12
Over $\frac{1}{8}$ in. and up to and including $\frac{3}{16}$ in.	18

Note . . .

It is possible that the above times may be amended. Refer to times given on tube compound container. Work to these times if they differ from the above.

Repairs to holes up to $\frac{1}{8}$ in. diameter

45. Roughen the cavity right through. Clean the cavity and surrounding area with solvent. Solution and plug with compound cut into a thin strip and feed through the hole with the aid of a blunt probe. Trim off slightly higher than the surrounding material and roll down. Vulcanise as before.

SPOT VULCANISING UNITS

Description (early type) (*fig. 25 and 26*)

46. The heating unit consists of a thermostatically-controlled device which is set between 295 deg. and 300 deg. F. Units suitable for 250 or 110 volt supply are available.

47. Two elements are incorporated, one at 50 watts which is permanently in circuit, and one at 250 watts which operates in conjunction with the thermostat. From this element the pilot light is tapped.

48. The pilot light is automatically extinguished when a temperature of 295 deg. F. (vulcanising temperature) is attained. Satisfactory functioning of the thermostat is indicated by intermittent operation of the warning light during use.

49. The earliest units of this type are fitted with a thermostat housed in a glass container. This is held in position by a brass clip and lies in a gap in the centre of the heating element. Units which have been returned to the manufacturer for overhaul or repair may be fitted with the improved thermostat illustrated in fig. 27.

Servicing (early type)

General

50. The vulcanising unit must always be kept dry, as entry of water into the unit will cause a short circuit. Never inflate a tyre when the vulcaniser is still attached, or serious damage may result.

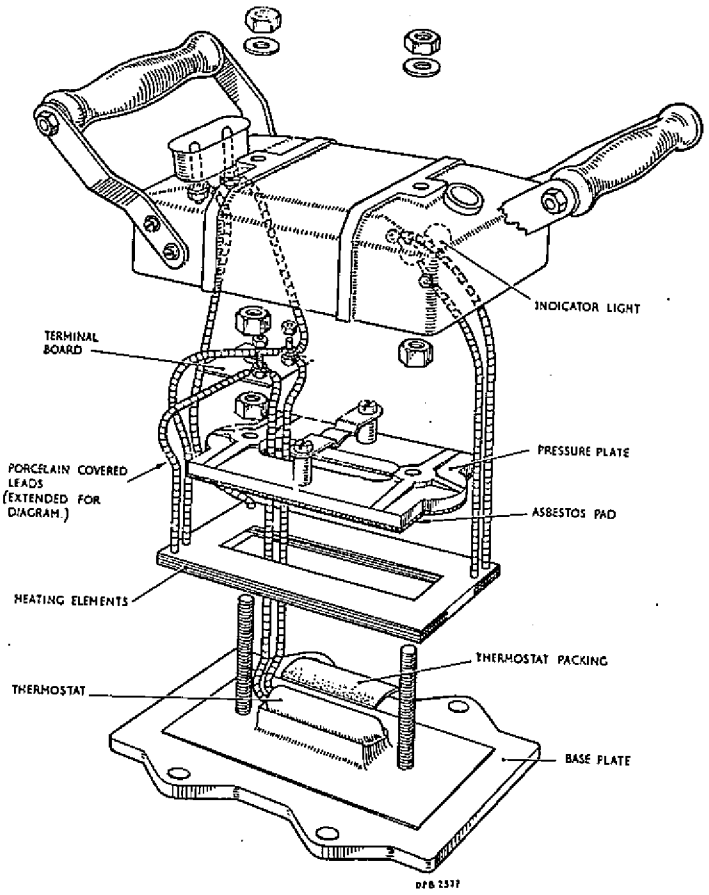

Fig. 25. Exploded view of vulcaniser (early type)

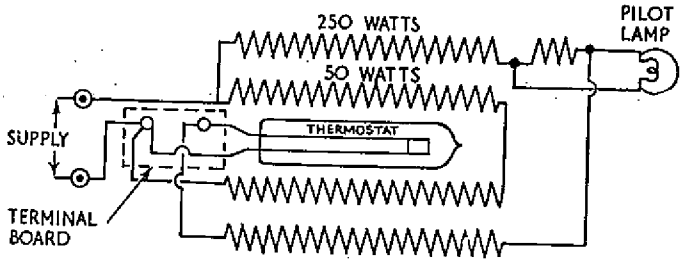

Fig. 26. Circuit diagram of vulcaniser (early type)

Fitting the plates

51. The aluminium plates are attached to the lugs on the steel base by cheesehead set-screws. To ensure efficient functioning of the vulcaniser, there must always be a good fit between the base of the unit and the plate, and this fit must always be checked when the plates are changed. If, when holding the unit against the light, no clearance is visible between the unit and the plate, the fit is satisfactory. If the fit is unsatisfactory, check for loose screws, distorted plates, or the presence of foreign matter between the plate and the unit base.

Indicator light

52. The indicator light is in the circuit of the larger heating element, and is tapped off a part of the resistance; the smaller heater element is permanently in circuit. The light indicates the action of the thermostat, and bears no direct relationship to the temperature at the surface of the aluminium plate. Should the light not appear during the operation of the vulcaniser unit, the following tests are to be made:—

(1) Check the bulb, and if faulty renew; the correct bulb is 6 volt, 0·18 amp. (Ref. 5LX/951208).

(2) If the bulb is serviceable, check the connections and circuit.

(3) If the circuit is broken, check the heating elements and the thermostat for continuity.

(4) If either the thermostat (*Ref.* 4A/1743) or the heating elements (*Ref.* 4A/1740 for 110 volt and 4A/1741 for 200/250 volt) are unserviceable, they are to be renewed. After installing the replacement component, make a temperature check as detailed in para. 55.

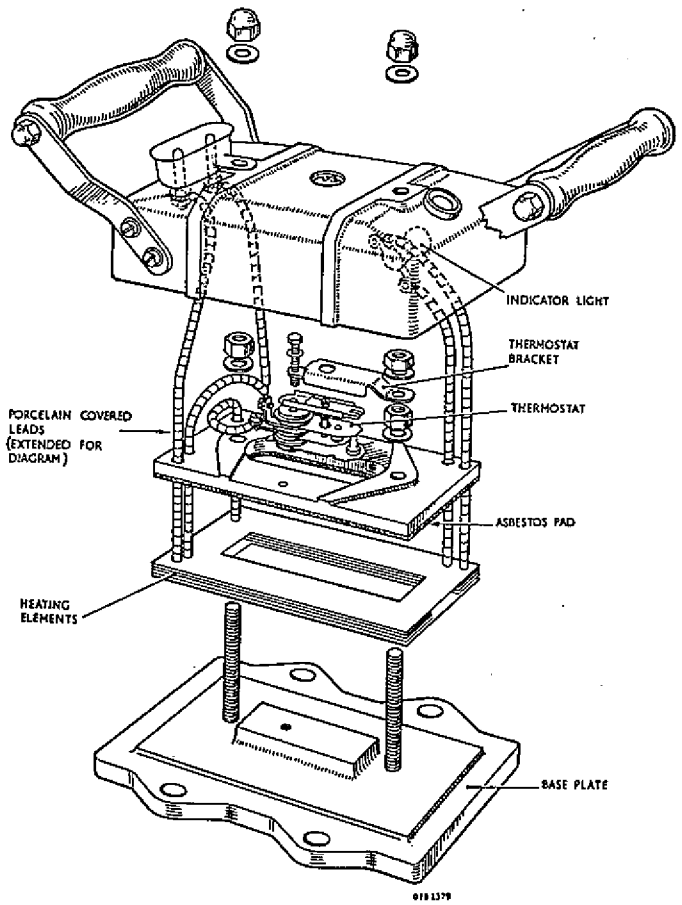

Fig. 27. Exploded view of vulcaniser (new type)

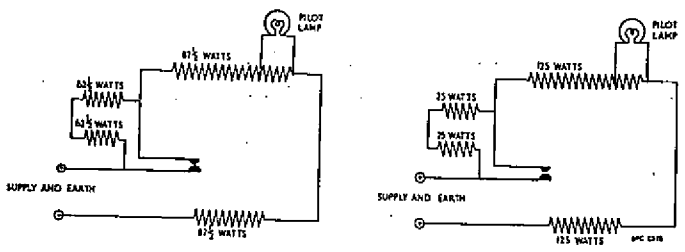

Fig. 28. Circuit diagram of vulcaniser (new type)

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53. The vulcaniser unit must not be subsequently used if the indicator light fails to cut out during a vulcanising operation, as a continually-burning light indicates that the thermostat is not functioning. To ensure that the light is always clearly visible the red tinted glass (*Stores Ref.* 4A/1742) must be fitted.

54. If the light fails to cut out, check the circuit for continuity and ensure that it is correctly connected. If the circuit is correct, examine the thermostat for failure; this may be indicated by burn marks on the glass, or broken glass. A faulty thermostat is to be renewed, and a temperature check of the unit made.

Temperature check

55. To make a temperature check, use a simple thermocouple with a galvanometer calibrated, with the thermocouple, in degrees F. Place the thermocouple between two 1 mm. thick unvulcanised rubber sheets. Attach the flat aluminium shoe to the vulcaniser. Place two thicknesses of scrap tube rubber on the bench, place the two rubber sheets with the thermocouple between them on the top, then clamp the cold vulcaniser unit in position. Switch on the unit, and leave on test for one hour. At the end of this period, check the temperature, and ensure that it is between 295 and 300 deg. F.

Description (new type) (*fig. 27 and 28*)

56. Basically similar to the earlier versions, this unit incorporates an open, adjustable thermostat and an improved element design. Minor component differences are covered in the parts list.

57. The thermostat is set to control the temperature between 295 deg. F. and 300 deg. F. There are two versions suitable for voltages of 250 and 110. Each unit incorporates two elements, and in each case the lower wattage element is permanently in circuit while the higher wattage is controlled by the thermostat.

58. As shown in fig. 27, the 250 volt unit employs elements of 50 watts and 250 watts; the 110 volt unit 125 watts and 175 watts.

Servicing (new type)

59. The notes given in para. 50 to 55 are equally applicable. When testing as in para. 55 it should be remembered that the open type thermostat is adjustable. Minor inaccuracies in the setting of the enclosed type can be allowed for when vulcanising (*see para.* 43), but it is recommended that faulty units are returned for repair by incorporation of the open thermostat. Under normal conditions the open type thermostat is unlikely to fail, but periodic cleaning of the control points is recommended.

SERVICING THE TOOLS

60. Knives and scissors must be kept in good condition. Knives are to be ground thin, and except for the point the last inch of the blade must be constantly sharpened. The point should be rounded off and blunted to minimise the risk of cutting cords. The scissors must be kept sharpened. Knives and scissors must not be used for any other purpose.

61. The grooving cutter may be sharpened by rotating on an oilstone or smooth emery cloth.

62. Rasps must be renewed when blunt to avoid burning the rubber.

TABLE 4

Spotter repair faults

The following is a list of defects which may be encountered, with possible causes and remedies.

Defect	Cause	Remedy
Repair soft after vulcanising or white bloom on surface	(*a*) Spotter not sufficiently heated before use	If repair does not show a porous surface, replace spotter and allow 15 minutes, then re-check. If repair is porous, strip out and repair again
	(*b*) Plates changed on Spotter without allowing unit to regain vulcanising heat	As above
	(*c*) Wrong times noted	As above
	(*d*) Working in draught	As above, and cover Spotter to exclude draught
	(*e*) Dirty or badly fitting plate	As above. Check Spotter and plate by holding up to light to see if in firm contact
	(*f*) Faulty thermostat	Remedy as for (*a*) but use a fresh Spotter
	(*g*) Low voltage of supply	As (a) above
Note . . . *Do not use cover or tube until repair has cooled to atmospheric temperature—do not attempt to cool it by immersing in water.*		
Repair bulging but properly vulcanised (*see fig.* 29A)	Insufficient trimming before vulcanising	Trim with long sharp wet knife on finished job
Vulcanised but spongy (*fig.* 29B)	(*a*) Not enough pressure during vulcanising, due to insufficient volume of rubber	Strip out and repair again
	(*b*) Curvature of plate too small	Change plate and repair again
	(*c*) Air pressure in cover not sufficient	Adjust and repair again
Layers tearing away (*fig.* 29C)	Dirt on solvent between layers	Strip out and repair again. Dry out the solvent. Do not handle clean surfaces of compound
Repair tears out in service (*fig.* 29D & E)	Poor bonding due to:— (*a*) Wrong angle of cut (*b*) Insufficient buffing (*c*) Solution not dry (*d*) Insufficient pressure during vulcanising (*e*) Insufficient vulcanising	As above and avoid faults
Small holes on edge of bevel (*fig.* 29F) Small holes between layers	Due to trapped air	Strip out and repair again. Be sure air is not trapped in succeeding repairs
Distorted repair (*fig.* 29G)	Bad adjustment of Spotter or bad trimming	Strip out and repair again. See that chain angles are correct. Trim correctly

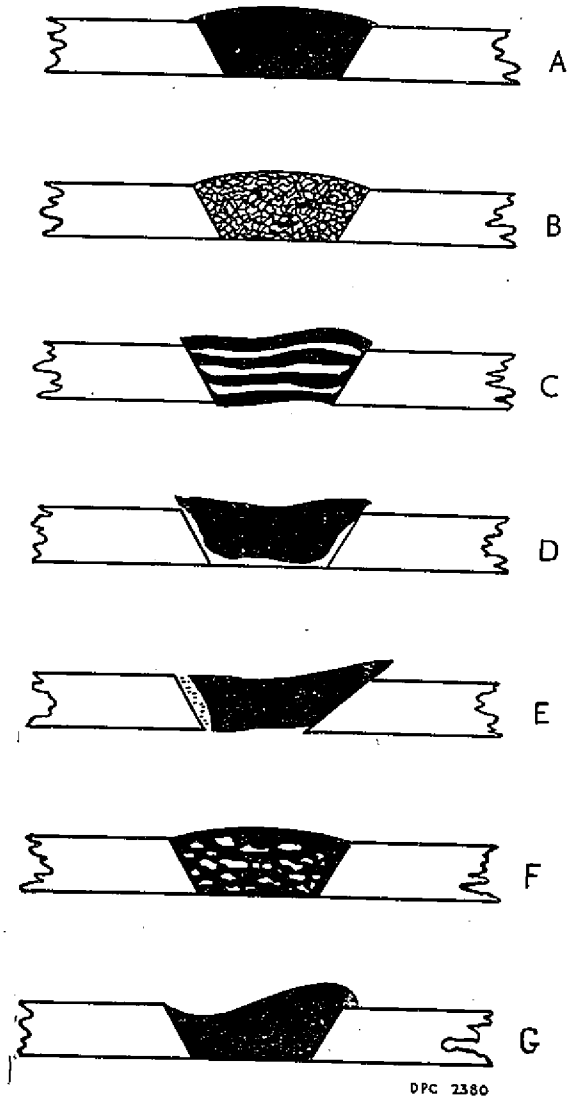

Fig. 29. Defective repairs

TABLE 5

Recommended Spares List for Vulcanising Units Part Numbers AH.50703 and AH.50813

Description	Part Number
Element 200/250 volts 50/250 watts (for AH.50703)	250V/D300
Element 110 volts 125/175 watts (for AH.50813)	110V/D300
Thermostat	ADJ 5a
Lamp holder and bracket assembly	SA.1196 M.E.S.
Bulbs	4V, 0·3 amp. M.E.S.
Insulating bush	AHO.36410
Signal light window bush	D190/RED/G
Mica strip	AHO.36416
Mica washer	AHO.36281
Mica washer	AHO.36415
Locating bush	AHO.36418

BOWES SEAL FAST PROCESS

General

63. The Bowes Seal Fast process is used for the repair of holes in the tread of a cover where the holes do not penetrate into the casing cord, in circumstances where the Dunlop Spot-Vulcaniser is not available, or cannot be used owing to the lack of a suitable power supply. To determine the extent of any damage, the cover should be examined as detailed in Chap. 1 of this Section. If there is the slightest possibility of the casing cord having been cut, repairs by this method must not be attempted. The process is a cold, chemical, self-vulcanising one, and entails the use of plastic rubber or tyre dough which is forced into the cut by a gun similar to a grease gun.

Equipment

64. The main items of equipment required for this process are shown in fig. 22 and the full list is as follows:—

(1) Dough gun (*Stores Ref.* 4A/1650).

(2) Cartridges of tyre dough (*Stores Ref.* 4A/1654).

(3) Rat-tail rasp and probe (*Stores Ref.* 4A/1652).

(4) Wire brush (*Stores Ref.* 4A/1648).

(5) Trimming knife (*Stores Ref.* 4A/1651).

(6) Buffer and edge-wheel (*Stores Ref.* 4A/1649).

(7) Solvent cleaner (*Stores Ref.* 4Z/1653).

(8) Small hammer.

Charging the dough gun

65. To charge the gun for use, proceed as follows:—

(1) Unscrew the nozzle of the gun.

(2) Unscrew the plunger as far as possible.

(3) Remove the sealing band and the cap from the end of the dough cartridge, then insert the open end of the cartridge into the nozzle of the gun.

(4) Screw the nozzle on to the barrel of the gun until the end of the plunger is very tight against the end of the cartridge; it will then break the seal at the end of the cartridge.

66. A charged dough gun, and the cartridges, must be kept in a temperate place, to prevent the dough from drying up and becoming useless.

Preparing the cover for repair

67. The cover should be examined thoroughly for cuts, and for abrasions which require filling. The positions of the cuts should be marked with chalk, and each cut probed to ensure that it is free from flints, nails, etc. The repair operation can be carried out more easily if the tyre is in

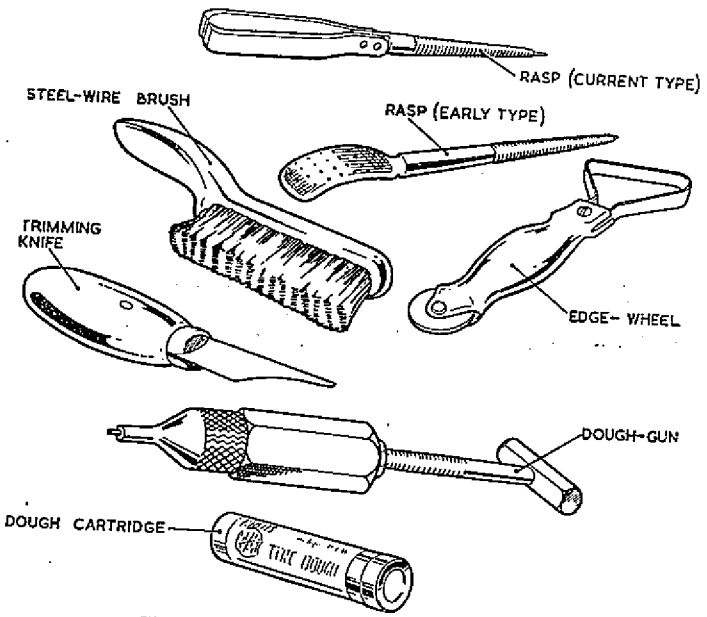

Fig. 30. Bowes seal fast equipment

position on the wheel and inflated to its normal working pressure.

68. To prepare the cut for the application of the dough, proceed as follows:—

(1) Trim off any loose rubber and bevel the edges of the cut to 45 deg.

(2) Roughen the edges of the cut with the rasp.

(3) Apply solvent to the roughened area, and whilst still wet, scrape the area until it dries off. Transfer any dirt from the knife to a piece of clean rag, and, after the operation, do not handle the prepared cut.

Applying the dough

69. A thin layer of dough should be forced into the cut from the dough gun and well hammered in with a clean hammer. A period of thirty minutes must be allowed for this layer to dry after which it must be rolled down with the edge wheel, and again hammered. Successive layers are applied until the dough is brought up to the level of the surrounding area. Each layer must be treated in a manner similar to the first.

70. The tyre must not be put into service until approximately eight hours after the completion of repair, but this period may vary according to the depth of the filling. The period allowed for drying between layers, and the existing atmospheric conditions. Under favourable conditions, the period may be reduced to four hours. If after repair, a tyre has been taken into service prematurely, the repair must be examined as soon as possible to ensure that there is no loosening of the dough.

71. As each application of the tyre dough is made, a small pip of the dough should be left on the tip of the gun to act as a seal; this pip should be broken off before making the next application. If during the application of the dough, the cut is inadvertently soiled, it must be painted over with solvent and scraped quickly before applying more dough.

72. The success of this process depends almost entirely on the cleanliness of the tools and of the cuts in the tyre; on no account should the tyre dough be handled during the process. The cleaning solvent is highly volatile and the container cap must be kept tightly in position when the solvent is not being used. Gasoline must not be used as a substitute.

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