Chapter 5
LOOP AERIALS, TYPE 3 AND 4

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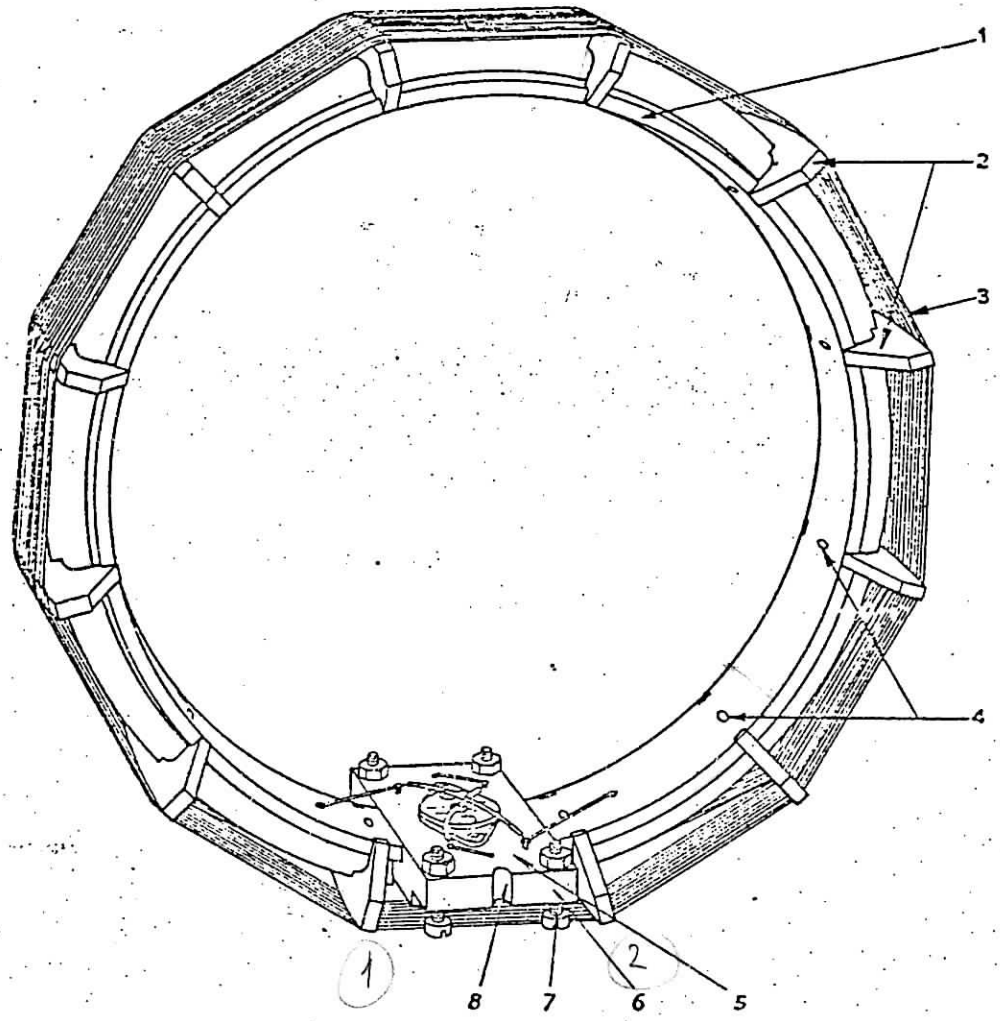
LIST OF ILLUSTRATIONS



1 FORMER
2 SEGMENTS
3 WINDING
4 ASSEMBLY SCREW HOLES
5 TERMINAL PLATE
6 END PAINTED RED
7 CRADLE FIXING SCREWS
8 LOCATING SLOT

FIG. 1. LOOP AERIAL, TYPE 3: SHOWING WINDING ON FORMER

INTRODUCTION

1. The loop aerials, Type 3 and 4, are designed for installation in aircraft. The two types are electrically similar, but the Type 4 is smaller and, in general, is for use in smaller aircraft. The loops are used in conjunction with a suitable radio receiver, usually the R.1155, to obtain D/F bearings, or for homing on a fixed station.

2. The loop consists of a circular former around which is a winding which forms the loop aerial. The loop aerial is mounted on a rotatable base. It is usually mounted externally on top of the aircraft fuselage in a suitable streamlined insulated housing. In a few cases the loop, without its housing, is mounted within an insulating portion of the aircraft structure, but external to the metalwork. The Type 4 loop is provided with an electrostatic screen. The ends of the loop winding are carried through the base by suitable conductors and connected to the receiver.

3. The loop is rotated from within the aircraft, either through a handwheel directly connected to the rotatable part of the base, or by means of a mechanical remote control device. Where such remote control is fitted, a bearing indicator is usually provided at the control position, so that the orientation of the loop at any particular moment is known to the operator.

4. When the loop aerial is connected to the radio receiver, the operator is able to rotate the loop while listening to signals from a distant transmitter. The orientation of the loop giving minimum signal strength is noted. The bearing indicator then gives the apparent bearing of the transmitter, or its reciprocal, relative to the heading of the aircraft. After certain corrections have been applied, the bearing of the distant transmitter may be laid off on a chart or map.

CONSTRUCTIONAL DETAILS

Loop aerial, Type 3

Loop construction (fig. 1, 2)

5. The loop is mounted upon a former (1) 10 in. in diameter made of moulded composition. This former has a cylindrical section with a supporting base and terminal plate (5) moulded integrally to it. Upon the periphery are mounted 12 slotted segments (2) which carry the loop windings. These segments are held in position temporarily by a single screw (4) at the mid-point of each. The screws are removed when the former has been wound. The former, with segments attached, supports two sets of loop windings (3) which consists of a total of 16 turns of 18 S.W.G. tinned copper wire. These windings are disposed so that 8 turns are held in the slots on each side of the central position. The total inductance of the loop windings is about 100 microhenries which with the capacitance of the installed system gives a natural frequency of about 3·5 Mc/s. The ends of the two sets of windings are brought to the terminal plate (5) at the base of the loop former and are attached by soldering to connection spills which are fixed in the terminal plate. The two windings are connected in series. The wound loop has an approximate overall diameter of 11 in. and is 3 in. wide. It is carried on a cradle of cast aluminium (9, *fig.* 2), to which it is attached at its base with four screws and nuts (7). A slot in the base of the former and a pin on one leg of the cradle, both of which can be seen at (8, *fig.* 2), locate the loop former with respect to the cradle. The edge (6) of the loop former base in which the slot is provided is painted red.

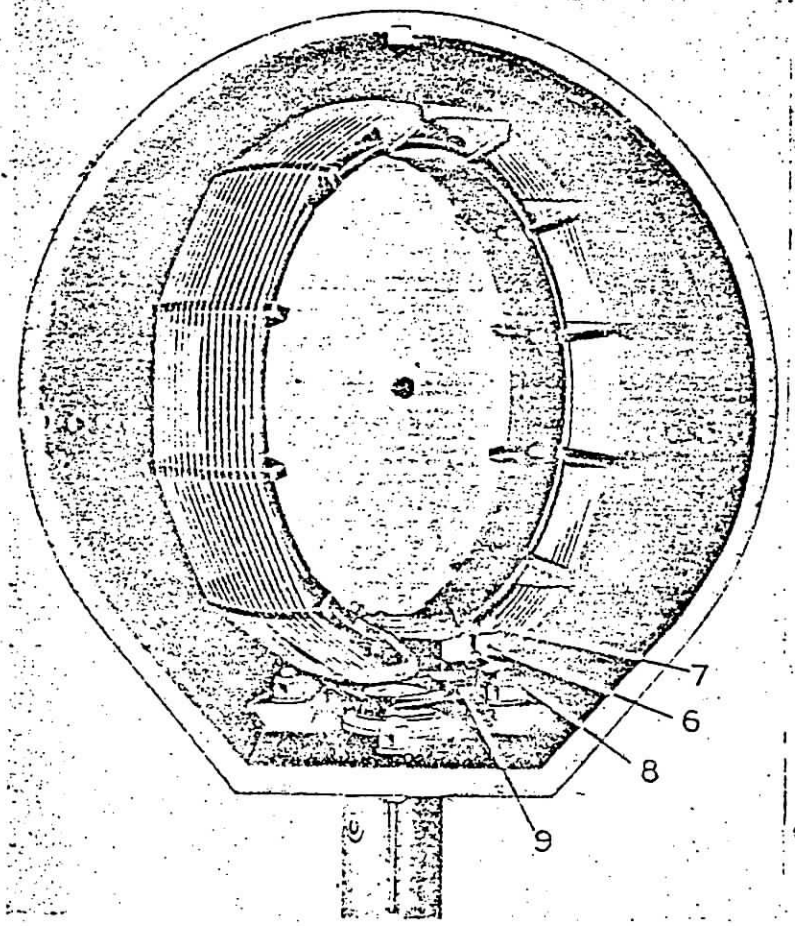
Support arrangements (fig. 3, 9)

6. The requirements for mounting the loop are that it should be supported rigidly in position in the aircraft, whilst at the same time it is capable of being rotated about its verticle axis. In the majority of aircraft installations this is achieved as shown in *fig.* 3 by means of a tubular unit comprising an outer support tube assembly (4) which is rigidly fixed to the aircraft by a suitable clamp, not shown in the illustrations, and an inner drive tube (5) supported in the outer tube assembly by two ball bearings, the lower of which can be seen at (3, *fig.* 9). These ball bearings are packed with non-freezing grease and are suitably spaced to give vertical rigidity to the inner tube. In certain installations, the outer support tube has been dispensed with, and the loop is mounted directly on a shorter drive tube, thus eliminating the upper ball bearing. The tubes are steel, 2 in. and 1·25 in. outside diameter, respectively. The loop is mounted by its cradle on to the end cap (8) which is brazed on to the drive tube (5). To the other end of this tube the driving mechanism is attached with any

necessary registering scales or remote control device which may form part of the particular installation. The cradle and tube mountings are fitted with dowel pins, slots and holes to locate them with respect to each other. This is to keep the correct sense of the assembly when orientated with respect to the aircraft.

Electrical connections (fig. 3)

7. A short length of Dumet 4 cable (2) connects the loop windings to the cable run which in turn connects them to the receiver. The Dumet 4 cable is clamped into the terminal plate at the base of the loop and passes down through the cradle and drive tube to a plug connection (1). It is essential that the length of this cable does not exceed 4 ft. 6 in. from the loop to the plug. The cable is connected directly to the radio receiver if possible. If, however, the distance is greater than 4 ft. 6 in. a length of Duradio 20 cable, with a suitable plug and socket is added; this type of cable is used to reduce capacitance effects to a minimum. Sockets and plugs have register guides and slots to enable the right polarity to be maintained throughout in the electrical connections. The sockets must be bonded to the metal frame of the aircraft. All cable connections must be made colour for colour throughout the whole cable run, that is, the same colours of the cable cores are connected together at cable joints, whether by plugs and sockets or direct connection.

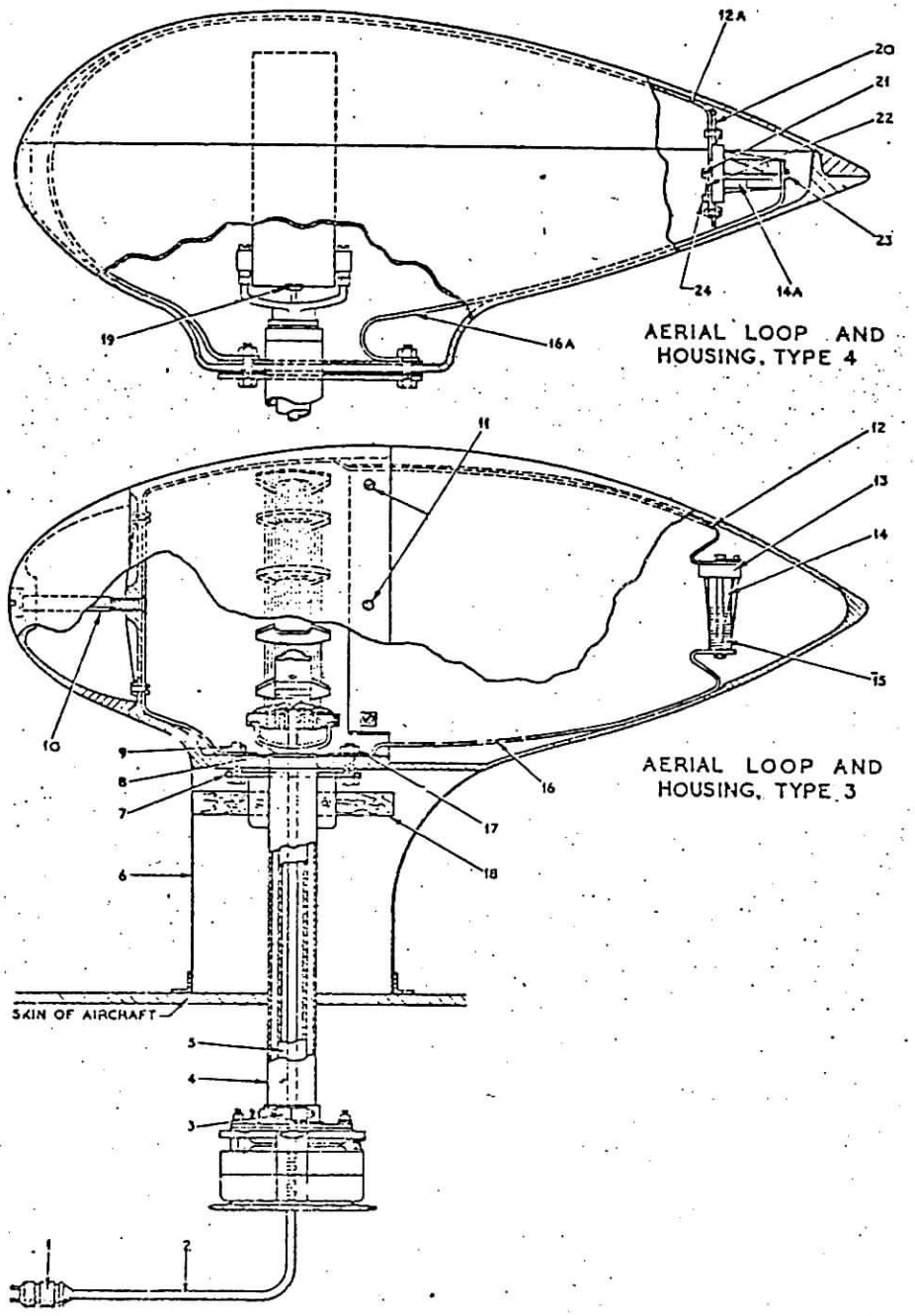


6 END PAINTED RED
7 CRADLE FIXING SCREWS
8 LOCATING SLOT
9 CRADLE

Fig. 2. Type 3 loop mounted in housing

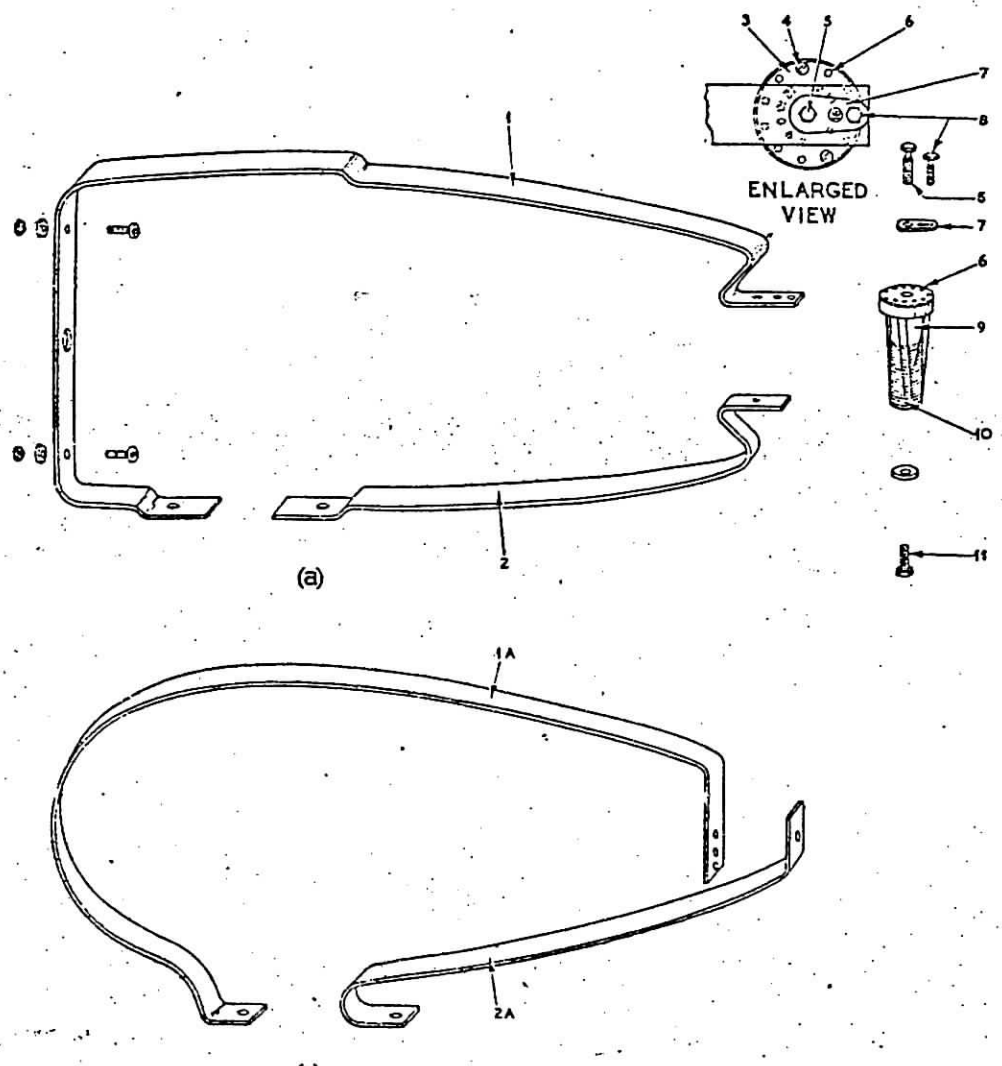
Mounting and housing of loop (fig. 2, 3)

8. The loop is mounted either in a streamline housing on the fuselage, or within the structure of the aircraft. In the latter case it must be mounted on and surrounded only by insulating material; it must not be enclosed by the metallic skin. Within specified limits and the requirements set out in this Chapter, aircraft contractors are given a certain latitude in the manner in which the loop is



1 PLUG
2 DUMET 4 CABLE
3 BOX DRIVE CLAMP
4 SUPPORT TUBE;
5 DRIVE TUBE'
6 FAIRING
7 METAL PLATE
8 END CAP
9 FIXING BOLTS
10 NOSE BOLT
11 TAIL SECTION SCREWS
12, 12A LONG Q.E. CORRECTION STRIP
13 FLANGE OF Q.E. COIL
14 Q.E. COIL FORMER
15 Q.E. COIL WINDING
16 16A SHORT Q.E. CORRECTION STRIP
17 FIXING BOLTS
18 FAIRING FORMER
19 CLAMP PLATE
20 SUPPORT DISC
21 FIXING SCREWS
22 BRASS PLATE
23 FIXING SCREWS
24 TAPPING SCREWS

FIG. 3. LOOP AERIAL IN HOUSING AS MOUNTED ON AIRCRAFT



1, 1A LONG Q.E. CORRECTION STRIP
2, 2A SHORT Q.E. CORRECTION STRIP
3 FLANGE
4 ASSEMBLY SCREWS
5 FIXING SCREWS
6 TAPPINGS
7 BRASS PLATE
8 TAPPING SCREWS
9 FORMER
10 WINDING
11 FIXING SCREWS

Fig. 4. Quadrantal error corrector: (a) for Type 3; (b) for Type 4

mounted on the aircraft. This includes also the actual mounting of the loop upon the tube assemblies which carry it and allow it to be rotated.

9. When the loop is mounted in a streamline housing on the fuselage of the aircraft, this housing has to be of special design. Its general outline and design is shown in *fig.* 3. The housing has a length of 3 ft. and a maximum diameter of 13 in. It is made of reinforced bakelite in three portions, nose, centre and tail, which are fastened together. The centre section is illustrated in *fig.* 2. The centre and tail sections are coupled by screws round their periphery. The nose is clamped to the centre section by a single moulded composition screw (10) through the nose. The housing is mounted on the aircraft parallel to the line of flight with the nose facing forward.

Quadrantal error corrector (fig. 3, 4)

10. The quadrantal error corrector for the Type 3 loop is illustrated in *fig.* 4 and it is shown in position in *fig.* 3. The corrector consists of two metal strips (12, *fig.* 3) forming a single-turn loop, which is mounted in the streamline housing and surrounds the D/F loop. A variable inductance (14) is in series with these strips, which are made electrically

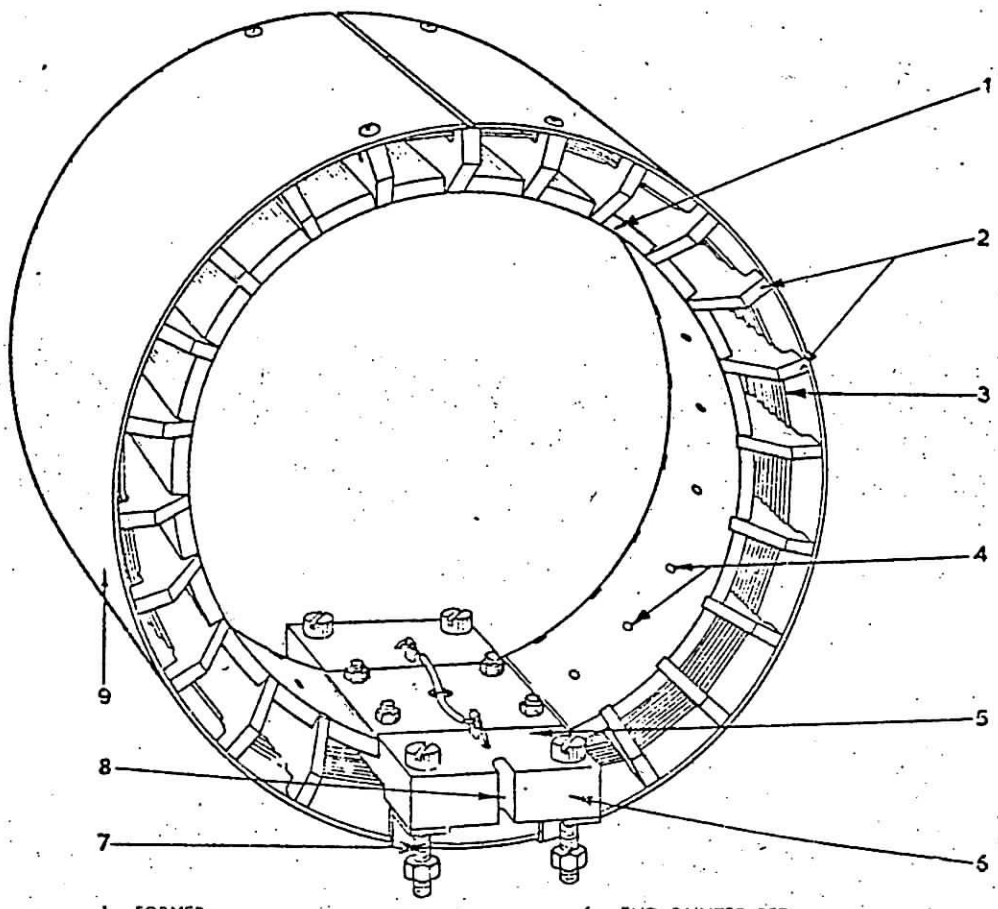


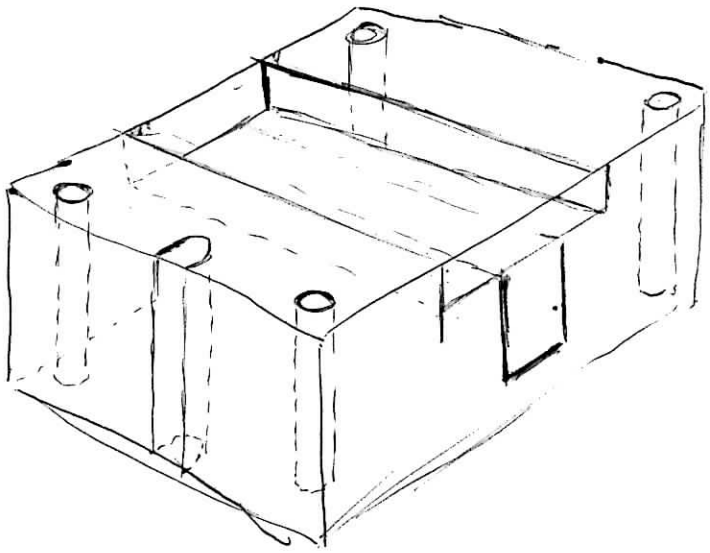
Fig. 5. Loop aerial, Type 4: showing winding on former

continuous and earthed through the metal plate (7, *fig.* 3) and bolts which clamp the tube assembly to the housing. By adjusting the value of the variable inductance, the local field is modified in a manner which corrects, within 2 deg., the quadrantal error due to the distortion of the field by the metallic structure of the aircraft.

11. The quadrantal error correction coil (9, *fig.* 4) consists of an ebonite former about 1 in. dia. and 3½ in. long. The winding of copper wire (10) around the cylindrical portion has tappings at 8 selected points; each tapping is connected to a stud (6) in the flange at the end of the former. The studs are set in recesses and each has a screw thread, so that by means of a hexagon-headed screw (8) electrical contact may be made to the brass plate (7). This plate is attached to the upper correction strip (1) by a screw (5) through the larger hole. Through the centre hole can be seen markings denoting the tapping to which connection is made. These read in degrees in anti-clockwise sequence: 0, 10, 12, 4, 14, 16, 6, 2, 8. The other end of the winding is connected to the screw (11) at the remote end of the former.

12. The strips which are of brass of cross-section 1 in. by 0·036 in. are shaped to fit the housing and are attached to it at the flat portion behind the nose and at the bolts fastening the loop mounting to the housing.

13. The coil is fitted in a vertical position between the spring ends of the strips. The method of installation and adjustment of the tappings is explained in *para.* 37, 38 and 69 (3).



the position of the loop by fitting into a slot (4) in the base of the loop former (*para.* 5).

35. The connection of the cable to the Type 4 loop is shown in *fig.* 13 (b). Here the cable is first screwed through the hole in the clamp plate (1A), allowing 2 in. to project. Then 1 in. of braiding should be removed from the end of the cable and spread out over the surface of the clamp plate. The leads are fed through the hole in the centre of the former base and the hole in the screen. The clamp plate is screwed down, thus securing the strands of braiding against the underside of the screen. The red lead (5A) is then soldered to the tag (2A) nearest the end of the former painted red and the blue lead (6A) to the tag at the other end. The loop assembly can now be fitted to the cradle as described in *para.* 32. Instructions for adjustment are given in *para.* 42.

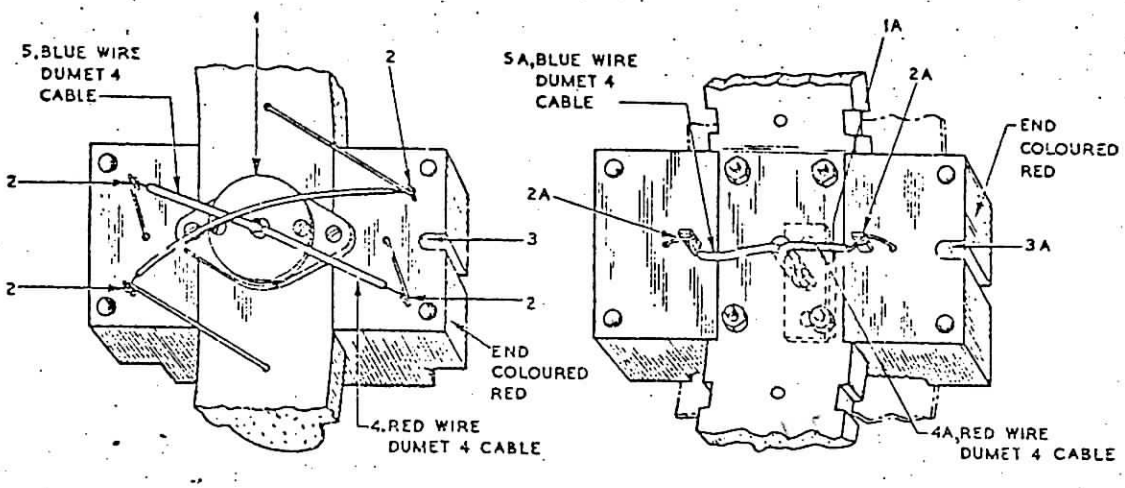
Loop with housing (*fig.* 3)

36. The support tube of the tube assembly is attached to the aircraft by a suitable clamp at the end of the tube assembly which enters the aircraft structure. This tube is then also attached to the housing fairing former at the loop end. Reference to *fig.* 3 will show the general features of this assembly and attachment. The housing fairing former (18) is of spruce and in two portions, split along the centre line. These two portions are clamped together, and grip the support tube. The drive tube is then passed up into the support tube until its shoulder is against the ball race of the bearing. The cradle is fitted in position, and the loop, with cable fitted, attached to the cradle.

Quadrantal error corrector (*fig.* 3, 4)

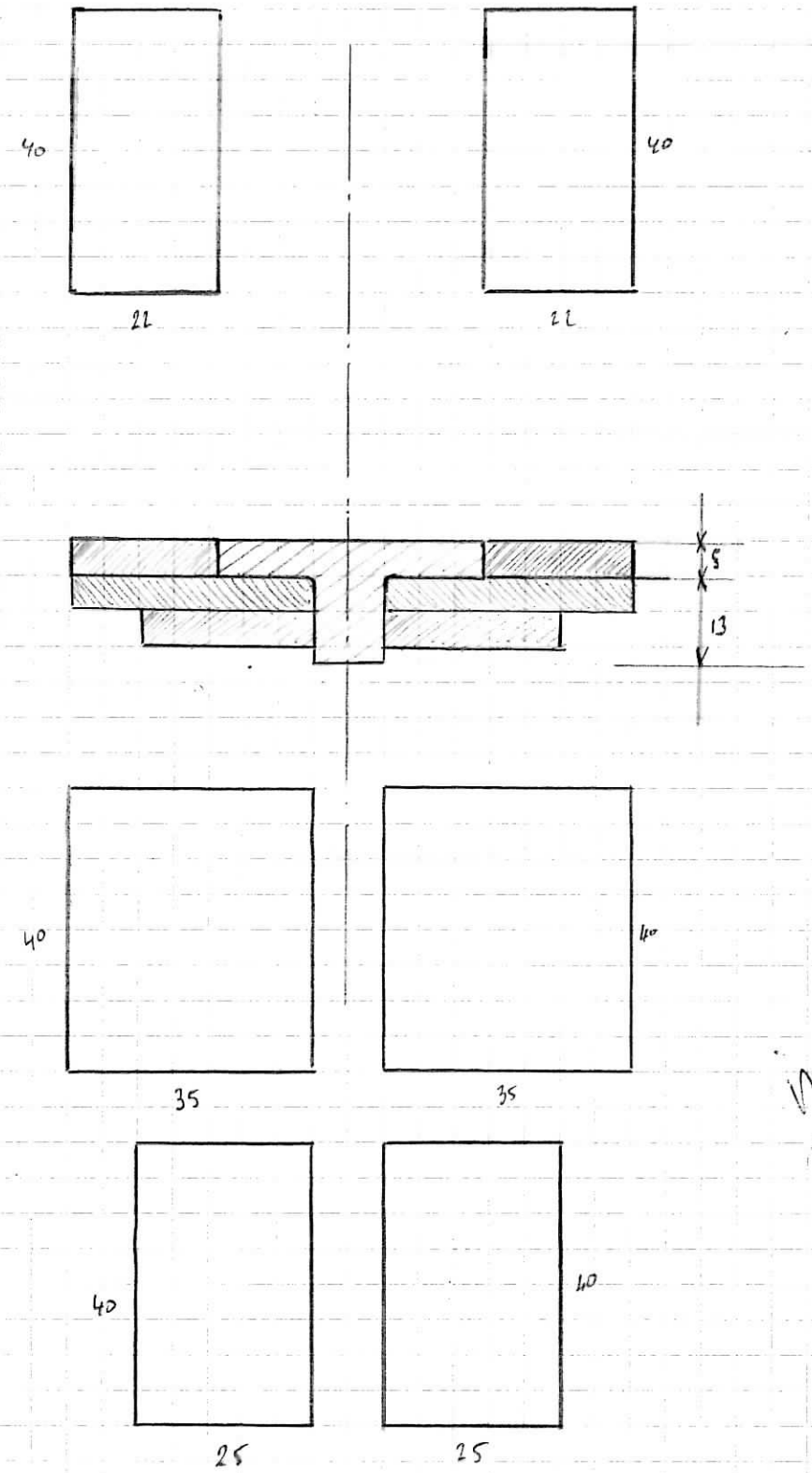
37. The quadrantal error correction device can now be fitted. Its general disposition in the housing is shown in *fig.* 3. The wooden spacing piece, which is sometimes in position on delivery, should be removed from between the tail ends of the strips of the corrector, and the coil fitted into this space, i.e. between the free ends of the strips. The supporting disc must be placed in position at the flange end of the coil in Type 4. The coil is fitted with the marked head at the tail end of the long strip by means of the two larger screws (5) and (11) *fig.* 4, which should be loosely fitted at this stage. Two soft metal washers are placed between the strips and the screw heads.

38. The coil can be rotated between the strips and when so rotated, the markings 0, 8, 2, 6, 16, 14, 4, 12, 10, on the top of the coil, appear in turn in the hole in the long strip. These details can be seen in *fig.* 3. The coil should be rotated until the marking 0 appears, when the selector screw (8) should be inserted into its socket. In this position the correction device is inoperative. When the selector screw has been tightened, it should be locked by turning up the end of the plate (7) against one of the sides of the hexagon head of the screw.

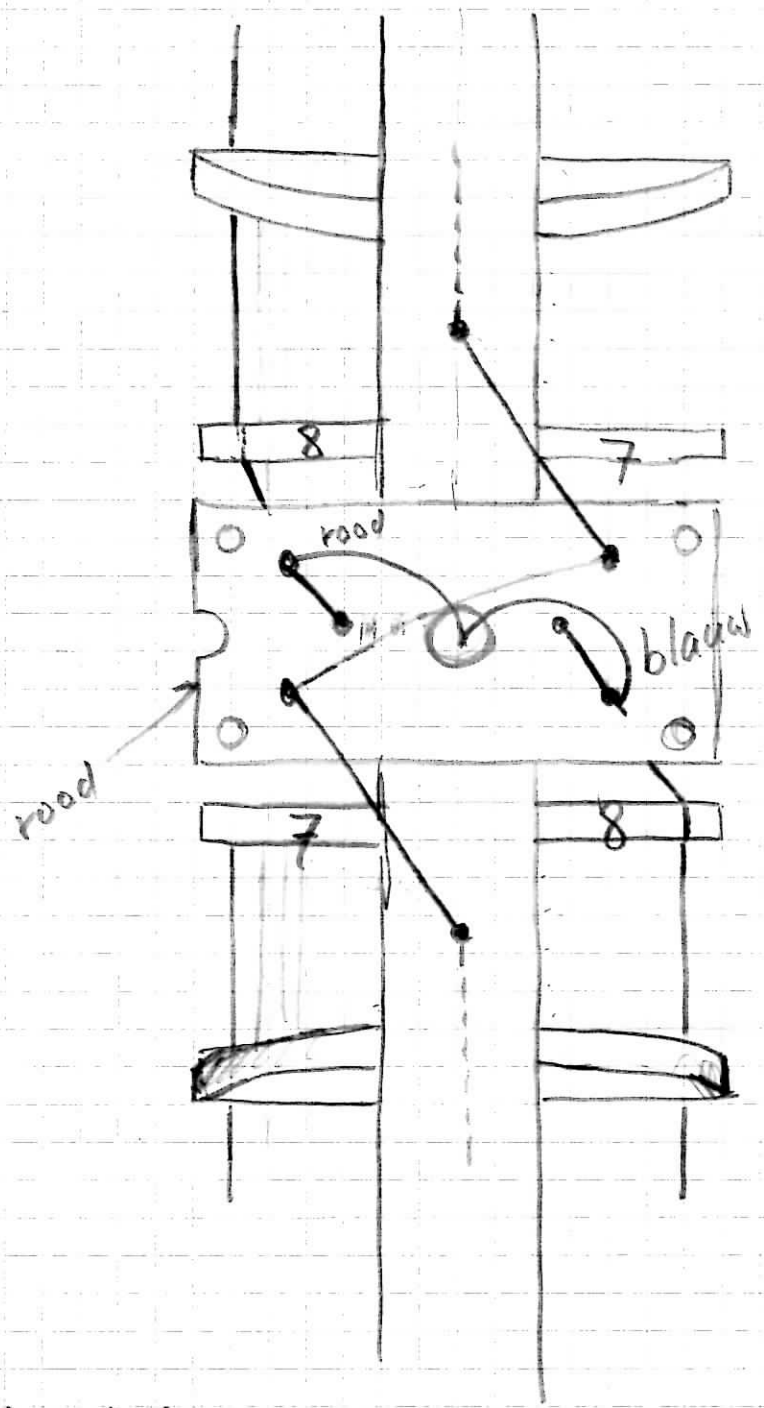


1, 1A CLAMP PLATES
2, 2A BINDING POSTS
3, 3A LOCATING SLOTS
4, 4A, 5, 5A } CABLE WIRES

Fig. 13. Terminal plate connections: (a) Type 3; (b) Type 4



in inches ??



Altijd met de buitenzijde beginnen te winkelen per Windrichting ca 8 meter draad.

Draad aan één zijde vast maken en met de andere de winkelingen opwinden

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