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43
Miscellaneous
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REGULATIONS
FOR
ARMY ORDNANCE SERVICES

PART II

PAMPHLET No. 23

1941

Instructions to Guide Assembly and Adjustment of E/R Converters and D/C Correctors for Range and Bearing Receiver Gears of B.L. 9·2-inch Mark VII and 6-inch Mark V Mountings.

By Command of the Army Council,

THE WAR OFFICE,
June 11th, 1941.

CONTENTS

SECTION I

SECTION II

SECTION III

SECTION IV

INSTRUCTIONS TO GUIDE ASSEMBLY AND ADJUSTMENT OF E/R CONVERTERS AND D/C CORRECTORS

MOUNTING, 9·2-INCH, MARK VII
MOUNTING, B.L. 6-INCH, MARK V

SECTION I

GEAR, RANGE RECEIVER, FOR F.P. DIALS

Instructions to guide assembly and adjustment with reference to drawing D.D.(C)875A/2549 which shows an arrangement of the converter E/R for a 9·2-inch mounting and is typical for a 6-inch mounting.

NOTE.—The numbers in parenthesis relate to detail drawings D.D.(C)875A. which should be obtained, if and when required, from the C.O.O., Donnington, through the usual channels.

ASSEMBLY OF CONVERTER, E/R

1. Before placing the M.V. correction cam (2411) with bevel wheel attached into position on the bearing spindle, the conversion quadrant pivot arm (2356) must be in the position shown on the drawing, *i.e.*, with the retaining catch (2394) accurately engaging the conversion quadrant (2359) and locking it in position for changing the conversion cam. The M.V. correction cam is then assembled so that the registering holes in the cam and its bearing (2417) are in line and No. 72 artillery tool (or a 0·3-inch dia. pin) will enter both holes.

2. When assembling the M.V. dial gear, care must be taken that the pin (2389) of the adjustable slide (2388) is accurately in line with the axis of the rocking arm (2362).

CONTENTS

SECTION I

SECTION II

SECTION III

SECTION IV

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SECTION I

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ASSEMBLY OF CONVERTER, E/R

1. Before placing the M.V. correction cam (2411) with bevel wheel attached into position on the bearing spindle, the conversion quadrant pivot arm (2356) must be in the position shown on the drawing, *i.e.*, with the retaining catch (2394) accurately engaging the conversion quadrant (2359) and locking it in position for changing the conversion cam. The M.V. correction cam is then assembled so that the registering holes in the cam and its bearing (2417) are in line and No. 72 artillery tool (or a 0·3-inch dia. pin) will enter both holes.

2. When assembling the M.V. dial gear, care must be taken that the pin (2389) of the adjustable slide (2388) is accurately in line with the axis of the rocking arm (2362).

This is determined by rocking the M.V. correction link (2381B) with the conversion and M.V. correction cams removed, without resultant movement of the receiver coupling (2454). In this position the adjustable slide pinion (2365) must so engage with the teeth of the slide that the " Charge Temp." and " M.V." readers coincide with the normal graduations indicated by the arrows.

ERECTION OF CONVERTER ON MOUNTING

3. When the converter is erected on the mounting the vernier coupling (1061) must be adjusted so that the conditions at para. 1 obtain when the gun is accurately at the angle of depression indicated on the conversion cam cover (2404) + elevation to compensate for droop. CAUTION. On no account must the angle of depression or bearing of the gun be altered whilst No. 72 artillery tool is in the registering holes of the M.V. correction cam and its bearing.

4. When the converter is erected on a " displaced " mounting the three screws securing the displacement eccentric (2430) must be slackened and the eccentric adjusted so that the engraved arrows coincide when the gun is at the bearing engraved on the eccentric, *i.e.*, the bearing at which the gun points to the pivot mounting. The eccentric must then be clamped tightly by the three screws.

5. After the above adjustments have been made the " Range Receiver " can be secured in position and the dials of the receiver adjusted to read as accurately as possible the ranges for elevation given in the Tables referred to in para. 6.

The method of adjusting for backlash is described in **SECTION III.**

TO TEST CONVERTER

6. After the converter has been set up as above, the M.V. dial must be set at the M.V. engraved on the conversion cam in use and the charge temperature scale to 60 degrees.

The correspondence between the ranges shown on the range receiver dial, as indicated by the mechanical pointer and the Q.E. at which the gun is laid should be as shown on the Converter and Corrector Tables of Angles, supplied by Woolwich, appropriate to the cam in use, making due allowance for the backlash as described in **SECTION III.**

The cams used for this test must be full charge, preferably 5/10 C.R.H. for 9·2-inch and 6 C.R.H. Mark XXIVB for 6-inch.

TO CHANGE CONVERSION CAMS

7. Place the gun at the depression angle shown on the cam cover (2404) by clinometer. This causes the conversion quadrant pivot arm (2356) to attain the position shown on the drawing thus pressing the cover locking pin withdrawing catch (2392) which in turn withdraws the locking pin (2390). At the same time the retaining catch (2394) engages the conversion quadrant (2359) and locks it in position for changing the conversion cam. Slacken back the cover locating screws (2406) by means of No. 3 key.

Turn the cam cover anti-clockwise and remove.

The conversion cam may now be removed.

SECTION II

GEAR, BEARING RECEIVER

Instructions to guide assembly and adjustment with reference to drawing D.D.(C)875A/2550 which shows an arrangement of the corrector D/C for a 9·2-inch " displaced " mounting and is typical for a 6-inch mounting.

NOTE.—The numbers in parenthesis relate to detail drawings D.D.(C)875A. which should be obtained, if and when required, from the C.O.O., Donnington, through the usual channels.

ASSEMBLY OF CORRECTOR, D/C

8. **" Displaced " Mountings.**—Before erection on the mounting the gear must be assembled as shown on the drawing and adjusted as follows :—

(*a*) With the drift cam wheel driving spur pinion (2456) removed, turn the drift and convergence cams by means of the elevation drive transmitter spur pinion (2467) and drift cam driving wheel (2460) so that the No. 72 artillery tool (or a 0·3-inch dia. pin) can be inserted into the registering holes R of both cams when in the position shown. The drift cam wheel driving spur pinion can now be placed in position and the driving wheel (2460) secured by tightening the four bolts.

(*b*) The bearing arrows at D must be made to coincide by turning the traverse drive spindle (2436). In this position the convergence pinion actuating slide rack (2499) must be approximately central with the correction spur pinion (2449).

(*c*) The elevation drive transmitter bevel pinion (2466) and the adjustable coupling for traverse drive spindle (2436) must be left free at this stage.

NOTE.—The corrector is issued with the keep pin of the nut securing the coupling removed and the securing nut slackened.

9. **" Pivot " Mountings.**—Before erection on the mounting the gear must be assembled as shown on the drawing but without the convergence gear (coloured red). The elevation drive transmitter bevel pinion (2466) must be fixed before assembly. As the convergence gear is not required the slide (2490) must be secured by a screw at S.

With the No. 72 artillery tool (or a 0·3-inch dia. pin) in the registering hole R of the drift cam (2534) the convergence pinion actuating slide rack (2499) should be approximately central with the correction spur pinion (2449).

Before placing the corrector in position on the mounting the drift cam wheel driving spur pinion (2456) must be removed.

ERECTION OF CORRECTOR ON MOUNTING

10. **" Displaced " Mountings.**—Lay the gun at 5-degrees depression for 9·2-inch Mark VII mounting or 8-degrees depression for a 6-inch Mark V mounting by clinometer.

Hold the drift and convergence cams in position by means of the No. 72 artillery tool. Tighten the elevation drive transmitter spur pinion (2467) by means of the securing nut, taking care not to strain the gears and to insert the keep pin.

CAUTION.—On no account must the angle of depression or bearing of the gun be altered whilst the No. 72 artillery tool is in the registering holes of the drift and convergence cams.

The adjustable coupling (under 2436) must be locked with the gun bearing agreeing with the engraved angle when the two arrows at D coincide. If the gun cannot be traversed to this position a relative setting at right angles can be made. Thus for the typical bearing shown on the drawing the rotatable arrow must be in the position shown for 261° 30′ bearing of the gun or in the position X for 171° 30′ bearing of the gun.

11. After the above adjustments have been made the " Bearing Receiver " can be secured in position. The dials

on the receiver must then be adjusted to give the gun bearing corrected for convergence and drift as follows :—

With the gun fully depressed, the drift correction given by the cam is 0 for all heights of emplacements. With the bearing at which the displaced gun points to (or 180 degrees from) the pivot gun the convergence correction becomes zero. Under these conditions the dials can be adjusted to give the gun bearing without correction.

If the gun cannot be traversed to this position a bearing at right angles to the above can be chosen and the dials adjusted to give the maximum convergence angle given by the cam when the rocking bar pivot pointer (2495) is clamped to the appropriate position on the convergence scale plate.

Taking the example given on the drawing (with the convergence rocking bar pivot set at the 5/10 C.R.H. graduation, the gun at depression and bearing of gun 171° 30′) the dials must indicate an angle of 169° 41′ so that when the gun is traversed to give 171° 30′ on the dial it will converge towards the pivot gun 1° 49′.

12. **" Pivot " Mountings.**—Lay the gun at 5-degrees depression for the 9·2-inch Mark VII mounting or 8-degrees depression for 6-inch Mark V mounting, by clinometer.

Hold the drift cam in position by placing the No. 72 artillery tool in the registering hole. Replace the drift cam wheel driving spur pinion (2456), adjust driving wheel (2460) to mesh and secure it in position by the four bolts.

13. After the above adjustments have been made the " Bearing Receiver " can be secured in position. Then with the gun depressed the dials must be adjusted to indicate the gun bearing. In the case of " Pivot " mountings only, the dials may be adjusted by means of the adjustable coupling under the traverse drive spindle (2436).

14. **Drift settings.**—The arrow on the rocking bar pivot pointer must be set to the " A " graduation appropriate to the type of shell and charge according to the table supplied on the corrector. It must be noted that these values do not agree with the figures obtained from the " deflections due to drift " given in the Range Tables, as the engraved tables include a correction for latitude (Rotation of the earth).

TO TEST CORRECTOR

15. After the bearing dial has been set as described above, the bearing readings must be checked by training on to distant

objects whose ranges and bearings to the pivot gun and the displaced gun are accurately known.

Line the gun on to the distant object by observation through the bore, using cross wires.

Without disturbing the traversing handwheel elevate the gun to the Q.E. corresponding to the range of the object, using the mean M.V. of the full charge conversion cam in use.

Clamp the convergence rocking bar pivot at the graduation for the conversion cam in use and clamp the drift rocking bar pivot at the appropriate " A " graduation.

The bearing dial gun pointer should then indicate the bearing of the pivot gun to the distant object plus drift for the elevation used.

NOTE.—This test must be carried out for as many positions as is possible both landwards and seawards.

SECTION III

TO SET DIALS

16. The dials must be set after fitting to the gun.

Remove the front cover.

Slacken off the six screws on the movable hub, lay the gun to a definite range or bearing, as the case may be, and shift the ring which carries the red dot round to the corresponding range or bearing, setting the high speed dial first.

Clamp up, recheck and replace front cover.

Select the amount of backlash to be allowed for as laid down in **SECTION III** and reset the dial as indicated.

SECTION IV

TO DETERMINE THE MEASURE OF BACKLASH IN THE GEARS

17. When calculating the accuracy of the gear by means of a clinometer on the gun allowance must be made for tilt (if any) of mounting.

18—(*a*) Dials to be previously adjusted as laid down.

(*b*) Gun to be loaded.

19. Range and bearing to be transmitted by TFD or PF at rates corresponding to reasonable target conditions.

20. Lay the gun to each range shown on the Woolwich Table of Angles over the full range of elevation with the range alternatively

(*a*) increasing,

(*b*) decreasing,

taking a wide sweep on to each point.

The bearing may be changing either way but if it is increasing for (*a*) it must also be increasing for (*b*) and *vice versa*.

21. Record the Q.E. of the gun, measured by clinometer, on each occasion and tabulate the results.

The difference, converted to yards, between the Q.Es. obtained in (*a*) and (*b*) is the measure of the backlash. A hypothetical example is appended.

22. Repeat the above trial at three normal ranges at one bearing, moving the gun to and from the loading angle at normal " action " speeds using hydraulic power.

NOTE.—It is not expected that any appreciable difference in the error will be found due to the repeat trial but if some difference is found it should form the subject of a special report.

23. The amount of backlash which will best satisfy service conditions, *i.e.*, for the normal ranges over which the gun is used, can then be selected for the purpose of adjusting the F.P. dial.

24. A suitable range must be selected from the Range Table and the clinometer, set to the corresponding Q.E. adjusted for index error, tilt of mounting and droop, placed on the gun. The mounting must first be laid for line and then for Q.E., the latter being applied by a decrease in range.

The mechanical pointer of the range dial must be adjusted to read the selected range plus half the backlash as determined in paras. 20 and 22.

EXAMPLE OF BACKLASH CALCULATION

NOTE.—Data in columns 1 and 2 below have been extracted from Woolwich Table of Angles.

Range	Q.E. of gun		Q.E. measured with range increasing		Q.E. measured with range decreasing		Backlash	
1	2		3		4		5	
Yds.	Deg.	Mins.	Deg.	Mins.	Deg.	Mins.	Mins.	Yds.
2,200	−4	32	−4	34	−4	30	4	36
2,400	−3	59·7	−4	4	−3	56	8	56
2,600	−3	31·7	−3	35	−3	30	5	40
2,800	−3	6·4	−3	10	−3	4	6	54
3,000	−2	43·8	−2	50	−2	40	10	100
3,500	−1	55·7	−2	0	−1	50	10	120
4,000	−1	16·1	−1	22	−1	14	8	96
4,500	−0	42·2	−0	45	−0	39	6	84
5,000	−0	11·5	−0	15	−0	10	5	80
5,500	+0	17·0	+0	15	+0	20	5	90
6,000	+0	43·8	+0	40	+0	45	5	105
7,000	+1	34·1	+1	32	+1	38	6	114
8,000	+2	22·2	+2	18	+2	25	7	140
9,000	+3	9·4	+3	6	+3	14	8	160

Assume normal fighting ranges from 4,000 to 6,000 yards suitable backlash therefore is 90 yards.

Adjust dial as laid down.

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26
Regulations
2106

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REGULATIONS FOR ARMY ORDNANCE SERVICES, PART II

PAMPHLET No. 23, 1941

AMENDMENTS (No. 1A)

1. Page 2. Last line. *For* " 17-24 " *substitute* " 17-28."

2. Page 4.

Para. 4. Line 6. *For* " pivot mounting " *substitute* :—

Amdt. 1A Mar., 1942

battery pivot; this may be a mounting or the D.R.F.

26 Regulations 2106

Para. 5. Last line. *For* " **III** " *substitute* " **IV** ".

Para. 6.

Line 9. *For* " **III** " *substitute* " **IV** ".

For lines 10, 11 and 12 *substitute* :—

Amdt. 1A Mar., 1942

The cams used for this test must be for service shell with full or super charge for 9·2-inch, and with full or high velocity full charge for 6-inch equipments.

26 Regulations 2106

3. Page 5. Para. 7. *Add* new paragraph at end :—

Amdt. 1A Mar., 1942

When a conversion cam is changed the range dial must be re-set.

26 Regulations 2106

4. Page 7. Para. 11. Lines 6 and 19. *For* " pivot gun " *substitute* " battery pivot," in each case.

5. Page 8.

Para. 15.

Lines 1 and 12. *For* " pivot gun " *substitute* " battery pivot," in each case.

Add new paragraphs at end :—

Amdt. 1A Mar., 1942

The final setting of the bearing dials should read as accurately as possible bearings in the arc of fire at ranges most likely to be used, making allowances for backlash as described in **SECTION IV.**

When charges are changed, care will be taken to re-set the rocking bar pivot pointers to the appropriate drift and convergence graduations, but the bearing dials should not require re-setting.

26 Regulations 2106

Para. 16. Line 9. *For* " **III** " *substitute* " **IV** ".

26 Regulations 2106

6. Page 9.

Para. 20. *Delete* lines 1, 2 and 3 and *substitute* :—

GEAR, ELEVATION RECEIVER.

26 Regulations 2106

Amdt. 1A Mar., 1942

20. Lay the gun to each range shown on the Converter E/R and Corrector D/C Table of Angles with the range alternately.

Insert new paragraphs :—

GEAR, BEARING RECEIVER.

26 Regulations 2106

Amdt. 1A Mar., 1942

25. Lay the gun through the bore to a plumb line on a bearing approximately at right angles to the pivot bearing alternately (*a*) clockwise, (*b*) anti-clockwise, taking a wide sweep each way.

The elevation may be changing either way, but if it is increasing for (*a*) it must also be increasing for (*b*) and vice versa. The gun must be brought to rest at the same elevation on each lay.

26. The difference between bearings recorded on the dials is the measure of the backlash.

27. Repeat the trial for, say, three elevations, traversing the gun at normal action speeds.

28. Select a suitable bearing, traverse on to it anti-clockwise, and adjust the mechanical pointers on the bearing dials to read the corresponding pivot bearing, plus drift for the elevation used, plus half the backlash as determined in paras. 25 to 27.

7. *Delete* page 10 and *substitute* :—

10

Amdt. 1A
Mar., 1942

EXAMPLE OF BACKLASH.

26
Regulations
2106

NOTE.—Ranges in column 1 are extracted from the appropriate Converter E/R and Corrector D/C Table of Angles.

Range	Q.E. of gun		Q.E. measured with range increasing		Q.E. measured with range decreasing		Backlash	
1	2		3		4		5	
Yds.	Deg.	Mins.	Deg.	Mins.	Deg.	Mins.	Mins.	Yds.
5,216	0	45	0	43	0	46	3	98
8,188	2	45	2	42	2	47	5	134
11,025	4	45	4	44	4	46	2	50
16,613	9	45	9	44	9	47	3	45
24,067	19	45	19	43	19	46	3	27
28,982	29	45	29	42	29	48	6	33
30,735	34	45	34	44	34	46	2	6

Assume normal fighting ranges from 11,000 to 28,000 yards, suitable backlash therefore is 40 yards. Adjust dials as laid down.

By Command of the Army Council,

THE WAR OFFICE,
25th March, 1942.

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