# Chapter 2

# A.C. VOLTAGE REGULATORS

## LIST OF CONTENTS



## LIST OF TABLES



## LIST OF ILLUSTRATIONS



### Introduction

**1.** This chapter gives general information on a.c. carbon pile voltage regulators. For detailed information on individual regulators, and full instructions for testing, reference should be made to the relevant chapter in A.P.4343B, Vol. 1.

### DESCRIPTION

**2.** A.C. voltage regulators are used to control the output voltage of rotary inverters and a.c. generators. In general construction (*fig.* 1) and principle of operation they are similar to the d.c. carbon pile regulators described in Chap. 1 of this Section, but, as can be seen in the typical circuit diagram in fig. 2, the current for the operating coil is obtained through a full-wave rectifier which is connected across the output of the a.c. generator.

**3.** The rectifier, which is the selenium type, is housed under the base (*fig.* 3), together with the ballast and trimmer resistors. The ballast resistor is a pre-set resistor, set during manufacture to give the correct coil current; fine voltage adjustment is made by means of the trimmer resistor. Heat from the rectifier and ballast resistor is dissipated through holes in the side of the base.

### SERVICING

**4.** The information on servicing given in Chap. 1 of this Section is in general equally applicable to a.c. carbon pile regulators. The nominal voltage setting for various a.c. regulators, together with other information, is shown in Table 1; Table 2 gives details of carbon piles for each type. In addition the following points should be noted.

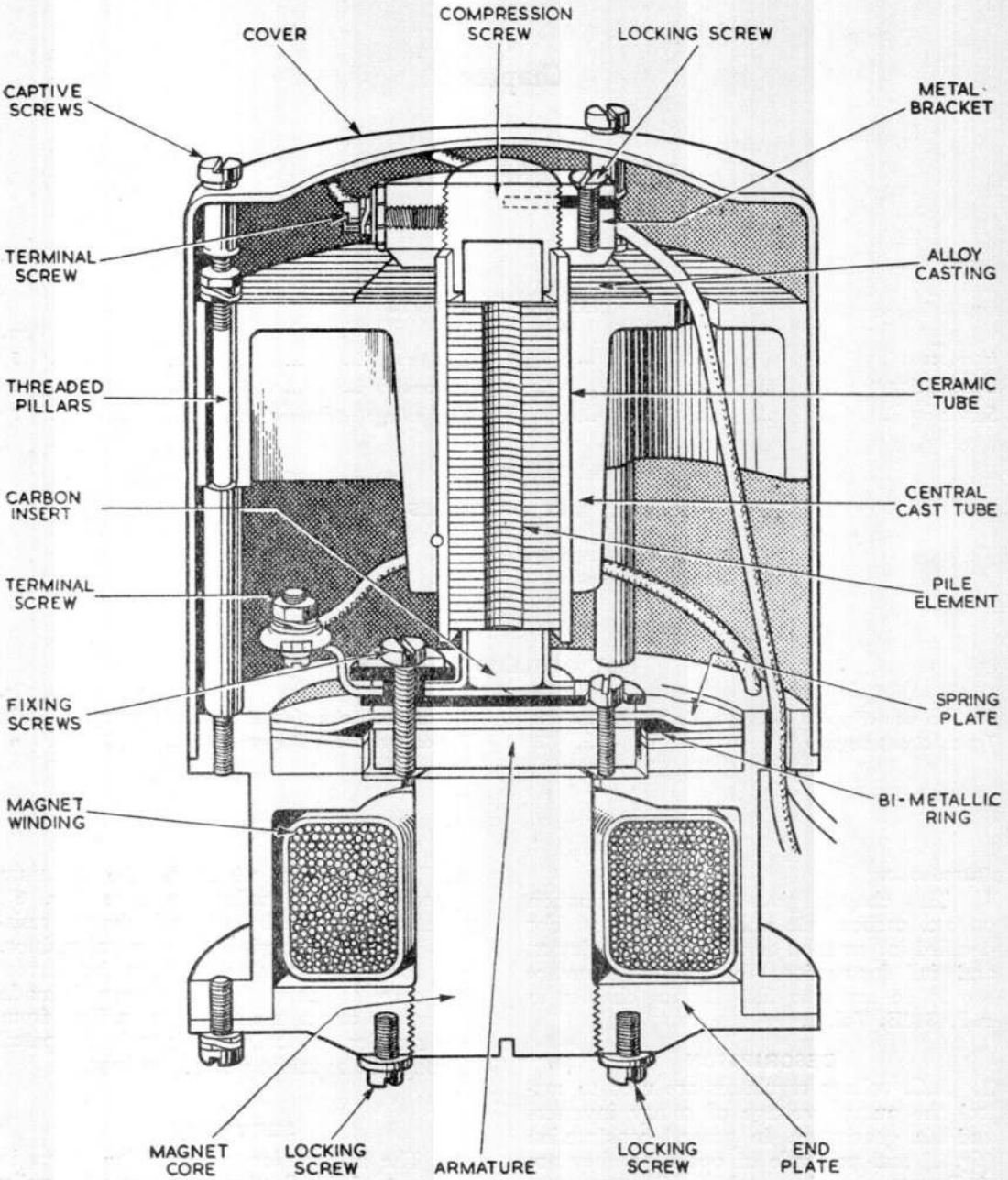


**Fig. 1. Sectional view of typical voltage regulator**

**TABLE 1**

**Data for a.c. voltage regulators**

| Regulator Type | Stores Ref. | Voltage (nominal) | Pile range (ohms) | Coil current (amp.) at nominal voltage at room temperature |
|---|---|---|---|---|
| E2 | 5UC/410 | 80 (mean) | 5—90 | 0·14—0·155 |
| E3 | 5UC/364 | 80 (mean) | 3—35 | 0·14—0·155 |
| E11 | 5UC/2966 | 80 (mean) | 4—60 | 0·14—0·155 |
| EU | 5UC/2544 | 80 (mean) | 5—90 | 0·15—0·165 |
| EU2 | 5UC/3886 | 80 | 5—90 | 0·31—0·34 |
| 26 | 5UC/2491 | 80 | 1—25 | 0·35—0·385 |
| 46 | 5UC/4625 | 115 | 0·2—1·8 | 0·041—0·051 |
| 50 | 5UC/5212 | 115 | 1—15 | 0·21—0·23 |
| 54 | 5UC/4952 | 115 | 0·2—1·8 | 0·041—0·051 |
| 69 | 5UC/6009 | 230 | 0·2—3 | 0·045—0·050 |
| 93 | 5UC/6006 | 115 | 2—32 | 0·160—0·176 |
| 97 | 5UC/6043 | 115 | 2—32 | 0·12—0·13 |
| 108 | 5UC/6274 | 115 | 2·2—34·5 | 0·115—0·125 |

**TABLE 2**

**Data for carbon piles**

| Regulator Type | Stores Ref. of pile | Pile length (in.) | No. of washers | * Dimensions of washers (mm.) |
|---|---|---|---|---|
| E2 | 5UC/1021 | 1·5 | 76 (min. ) | 10·9×5×0·5 |
| E3 | 5UC/365 | 1·5 | 38 (min.) | 10·9×5×1 |
| E11 | 5UC/3366 | 1·5 | 26 (interleaved) | 10·9×5×0·5 |
| | | | 26 (interleaved) | 10·9×5×1 |
| EU | 5UC/1021 | 1·5 | 76 (min.) | 10·9×5×0·5 |
| EU2 | 5UC/1021 | 1·5 | 76 (min.) | 10·9×5×0·5 |
| 26 | 5UC/3279 | 1·875 | 47 (min.) | 17·9×5×1 |
| 46 | 5UC/2162 | 1·5 | 13 (exact) | 10·9×5×3 |
| 50 | 5UC/ | 4 | 50 (interleaved) | 17·9×5×0·5 |
| | | | 26 (interleaved) | 17·9×5×3 |
| 54 | 5UC/2162 | 1·5 | 13 (exact) | 10·9×5×3 |
| 69 | 5UC/ | 4 | 34 | 17·9×5×3 |
| 93 | 5UC/ | 1·5 | 38 | 10·9×5×1 |
| 97 | 5UC/ | 2 | 50 | 10·9×5×1 |
| 108 | 5UC/ | 2 | 2 | 10·9×5×3 |
| | | | 44 | 10·9×5×1 |

* Outside diameter × inside diameter × thickness.

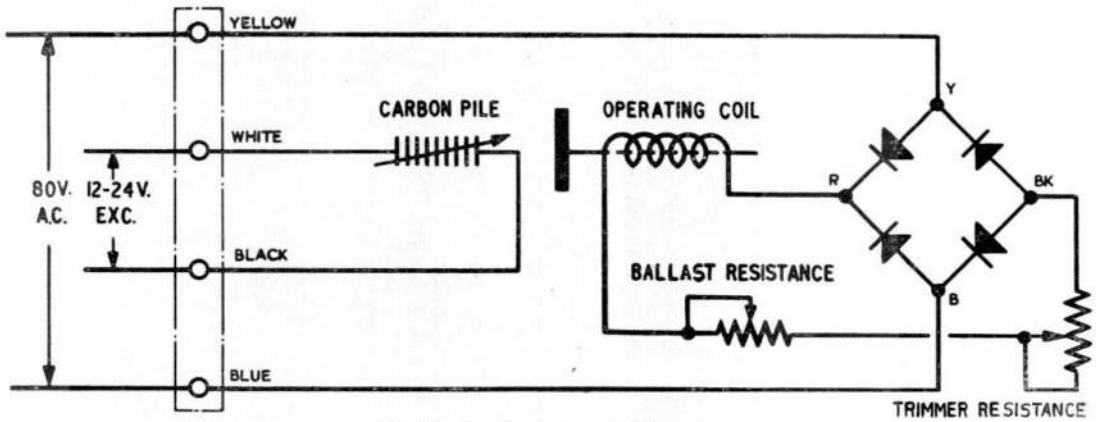


**Fig. 2. Typical circuit diagram**

**Rectifiers**

**5.** If the regulator has been in use for a number of years, it is possible that the forward resistance of the rectifier will have increased, thereby causing a proportional increase in controlled voltage. In this case it will be necessary to reduce the value of the ballast resistor in order to lower the controlled voltage to the required level. The voltage must not be reduced by turning the core "in" as this will result in a low coil current. An ammeter should be connected in the coil circuit, and if then the coil current is found to be below the specified figure, even though the ballast resistance be reduced to zero, a new rectifier must be fitted.

**Instruments**

**6.** It will be noted that in Table 1, the nominal voltage of certain Type E regulators has been shown as a mean, or rectified voltage. For these regulators the voltmeter used must be of the rectifier type, such as a testmeter, Type D (Stores Ref. 10S/10610). For other regulators, a thermal type instrument of industrial accuracy, reading R.M.S. volts, must be used, or alternatively a moving iron instrument, calibrated to the required frequency. Great care should be taken to ensure that the instrument is reading correctly; it should be checked periodically against a substandard meter which is known to be accurately calibrated.

**Final voltage adjustment**

**7.** A typical test circuit diagram is given in fig. 4. The level of the voltage in the dip position should be 80 volts $\pm$ 4 volts, 115 volts $\pm$ 4 volts, or 230 volts $\pm$ 8 volts, as appropriate. If the dip voltage is outside these limits, the line voltage must be adjusted as necessary by the magnet core, and the dip adjustment repeated until the dip is obtained within the stated limits.

**8.** After adjustment, the regulator should be tested for regulation and stability, as laid down in the relevant chapter in A.P.4343B, Vol. 1.

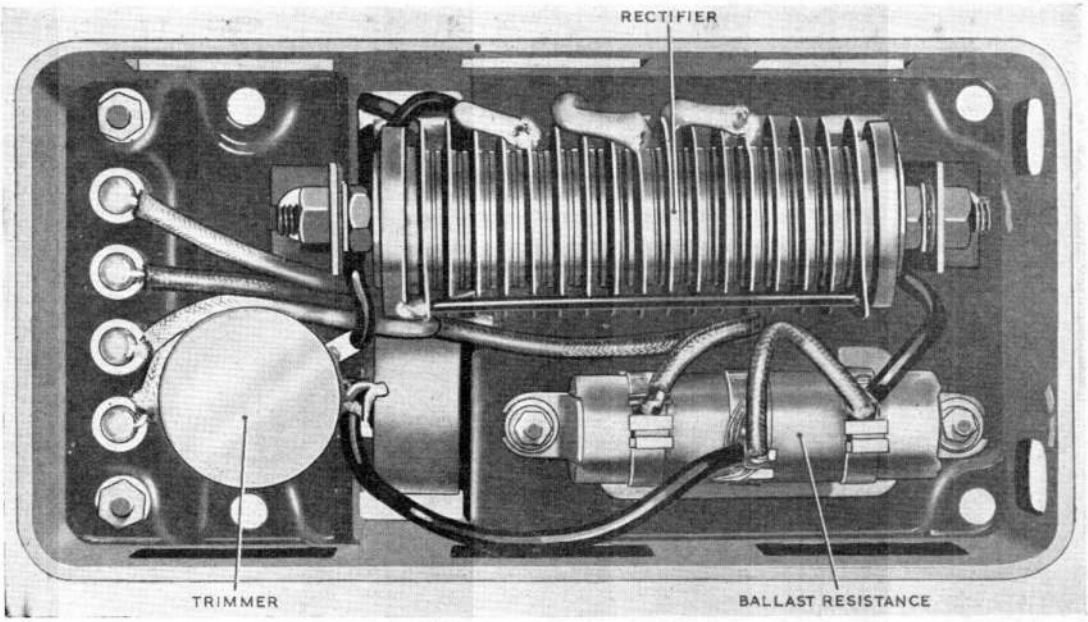


**Fig. 3. View of under side of regulator with trimmer**



54138 248568 3840 11/57 3500 CWSLtd2444 Gp539-2

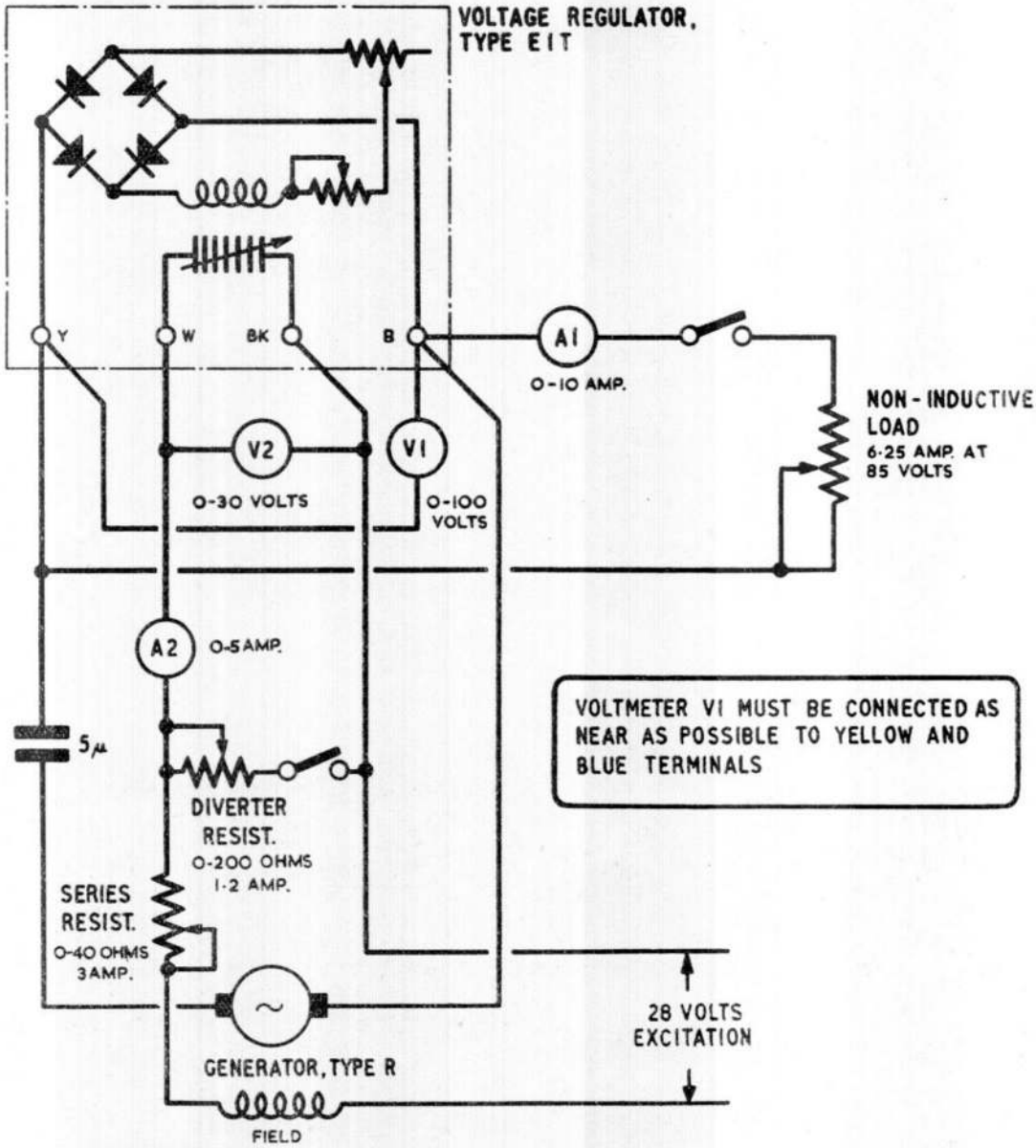


**Fig. 4. Typical test circuit diagram**

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