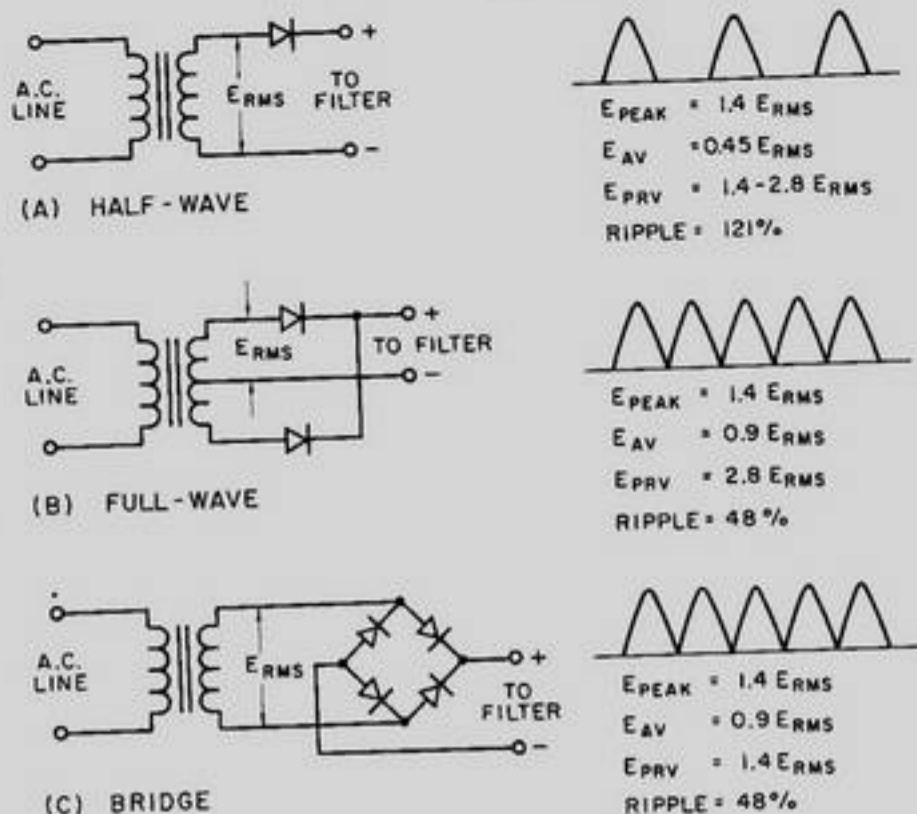Fig. 12-1—Fundamental rectifier circuits. A—Half-wave (E_{PRV} = 1.4 E_{RMS} with resistive load, = 2.8 E_{RMS} with capacitor-input filter). B—Full-wave. C—Full-wave bridge. Output voltage values do not include rectifier voltage drops.

(A) HALF - WAVE

E_{PEAK} = 1.4 E_{RMS}
E_{AV} = 0.45 E_{RMS}
E_{PRV} = 1.4 - 2.8 E_{RMS}
RIPPLE = 121%

(B) FULL - WAVE

E_{PEAK} = 1.4 E_{RMS}
E_{AV} = 0.9 E_{RMS}
E_{PRV} = 2.8 E_{RMS}
RIPPLE = 48%

(C) BRIDGE

E_{PEAK} = 1.4 E_{RMS}
E_{AV} = 0.9 E_{RMS}
E_{PRV} = 1.4 E_{RMS}
RIPPLE = 48%

ing of each rectifier need be only half the total load current drawn from the supply.

Two separate transformers, with their primaries connected in parallel and secondaries connected in series (with the proper polarity) may be used in this circuit. However, if this substitution is made, the primary volt-ampere rating must be reduced to about 40 per cent less than twice the rating of one transformer.

Full-Wave Bridge Rectifier

Another full-wave rectifier circuit is shown in Fig. 12-1C. In this arrangement, two rectifiers operate in series on each half of the cycle, one rectifier being in the lead to the load, the other being in the return lead. The current flows through two rectifiers during one half of the cycle and through the other two rectifiers during the other half of the cycle. The output wave shape (C), to the right, is the same as that from the simple center-tap rectifier circuit. The maximum output voltage into a resistive load or a properly-designed choke-input filter is 0.9 times the r.m.s. voltage delivered by the transformer secondary; with a capacitor-input filter and a very light load the output voltage is 1.4 times the secondary r.m.s. voltage. The peak reverse voltage per rectifier is 1.4 times the secondary r.m.s. voltage. Each rectifier in a bridge circuit should have a minimum load-current rating of one-half the total load current to be drawn from the supply.

Other Rectifier Circuits

The basic rectifier circuits shown in Fig. 12-1 are the ones generally encountered. Variations of these, and a family of "voltage-multiplying" circuits, will be treated later in this chapter.

Semiconductor Rectifiers

Selenium and silicon rectifiers are finding increasing application in power supplies for amateur equipment, and they will eventually supplant high-vacuum and mercury-vapor rectifiers. The semiconductors have the advantages of compact-

ness, low internal voltage drop, low operating temperature and high current-handling capability. Also, no filament transformers are required.

In general, selenium rectifiers find their primary application at relatively low voltages (130 r.m.s. or less) and for load currents up to about one ampere.

Silicon rectifiers are available in a wide range of voltage and current ratings. In peak inverse voltage (p.i.v.) ratings of 600 and less, silicon rectifiers carry current ratings as high as 40 amperes, and at 800 p.i.v. the current ratings may be 500 ma. or so. The extreme compactness of silicon types makes feasible the stacking of several units in series for higher voltages. Standard stacks are available that will handle up to 10,000 p.i.v. at a d.c. load current of 500 ma., although they are comparatively expensive and the amateur can do much better by stacking the rectifiers himself. To equalize the p.i.v. drops and to guard against transient voltage spikes, it is good practice to shunt each rectifier with a half-megohm resistor and a 0.01-μf. capacitor, as shown in Fig. 12-2. Silicon rectifiers carry surge-current ratings, and
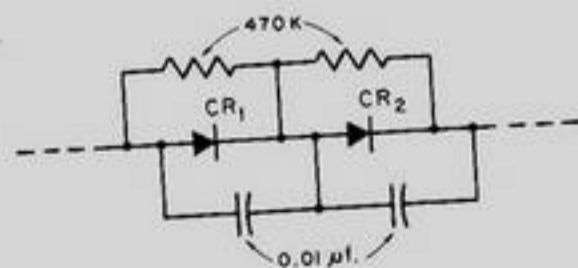

Fig. 12-2—When silicon rectifiers are connected in series for high-voltage operation, the reverse voltage drops can be equalized by using equalizing resistors of about one-half megohm. To protect against voltage "spikes" that may injure an individual rectifier, each rectifier should be bypassed by a 0.01-μf. capacitor. Connected as shown, two 400-p.i.v. silicon rectifiers can be used as an 800-p.i.v. rectifier, although it is preferable to include a safety factor and call it a "750-p.i.v." rectifier. The rectifiers, CR_1 and CR_2, should be the same type (same type number and ratings).