GRID-CONTROLLED RECTIFIER CIRCUITS

Numerical Relationships Among Electrical Quantities

E = Trans. Sec. Voltage (RMS)
E_{av} = Average DC Output Voltage
E_{bmi} = Peak Inverse Anode Voltage
E_m = Peak DC Output Voltage
E_r = Major Ripple Voltage (RMS)
f = Supply Frequency
f_r = Major Ripple Frequency
I_{av} = Average DC Output Current
I_b = Average Anode Current
I_p = Anode Current (RMS)
I_{pm} = Peak Anode Current
P_{al} = Line Volt-Amperes
P_{ap} = Trans. Pri. Volt-Amperes
P_{as} = Trans. Sec. Volt-Amperes
P_{dc} = DC Power ($E_{av} \times I_{av}$)

Note: Conditions assumed involve sine-wave supply; zero voltage drop in tubes; no losses in transformer and circuit; no back emf in the load circuit; and no phase-back.

RATIO	Fig. 1	Fig. 2	Fig. 3	Fig. 4	Fig. 5*	Fig. 6	Fig. 7	Fig. 8
Voltage Ratios								
E/E_{av}	2.22	1.11	1.11	0.854	0.854	0.427	0.785	0.74
E_{bmi}/E	1.41	2.83	1.41	2.45	2.45	2.45	2.83	2.83
E_{bmi}/E_{av}	3.14	3.14	1.57	2.09	2.09	1.05	2.22	2.09
E_m/E_{av}	3.14	1.57	1.57	1.21	1.05	1.05	1.11	1.05
E_r/E_{av}	1.11	0.472	0.472	0.177	0.04	0.04	0.106	0.04
Frequency Ratio								
f_r/f	1	2	2	3	6	6	4	6
Current Ratios								
I_p/I_{av}	1.57	0.785	0.785	0.578	0.289	0.578	0.5	0.408
I_b/I_{av}	1	0.5	0.5	0.33	0.167	0.33	0.25	0.167
Resistive Load								
I_{pm}/I_{av}	3.14	1.57	1.57	1.21	0.52	1.05	1.11	1.05
I_{pm}/I_b	3.14	3.14	3.14	3.63	3.14	3.14	4.5	6.3
Inductive Load■								
I_{pm}/I_{av}	—	1	1	1	0.5	1	1	1
Power Ratios								
Resistive Load								
P_{as}/P_{dc}	3.49	1.74	1.24	—	—	—	—	—
P_{ap}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
P_{al}/P_{dc}	2.69	1.23	1.24	—	—	—	—	—
Inductive Load■								
P_{as}/P_{dc}	—	1.57	1.11	1.71	1.48	1.05	1.57	1.81
P_{ap}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.29
P_{al}/P_{dc}	—	1.11	1.11	1.21	1.05	1.05	1.11	1.05

* Bleeder current of 2% full-load current will provide exciting current for balance coil and thus avoid poor regulation at light loading.

■ The use of a large filter-input choke is assumed.

GRID-CONTROLLED RECTIFIER CIRCUITS

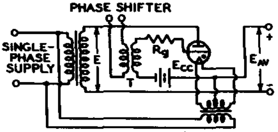

FIG. 1 HALF-WAVE SINGLE-PHASE

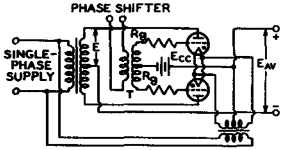

FIG. 2 FULL-WAVE SINGLE-PHASE

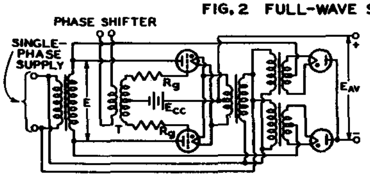

FIG. 3 SERIES SINGLE-PHASE

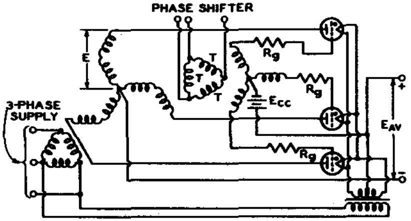

FIG. 4 HALF-WAVE THREE-PHASE

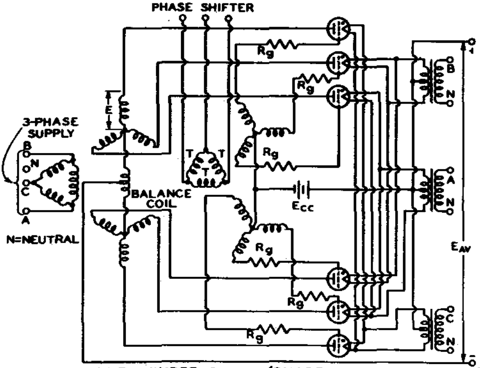

FIG. 5 PARALLEL THREE-PHASE (QUADRATURE OPERATION)

GRID-CONTROLLED RECTIFIER CIRCUITS

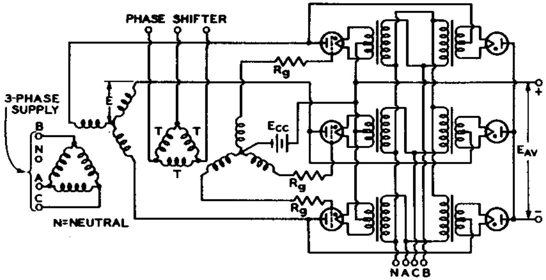

FIG. 6 SERIES THREE-PHASE (QUADRATURE OPERATION)

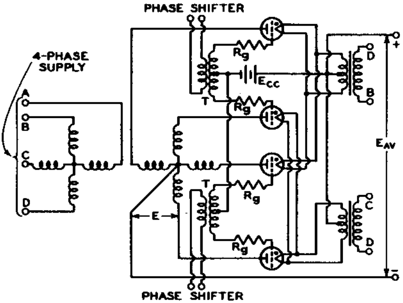

FIG. 7 HALF-WAVE FOUR-PHASE (QUADRATURE OPERATION)

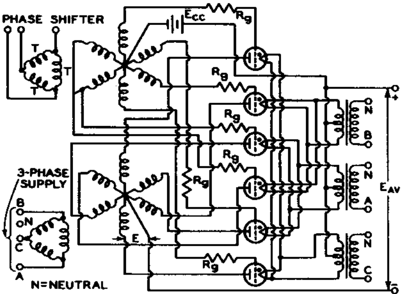

FIG. 8 HALF-WAVE SIX-PHASE (QUADRATURE OPERATION)

NOTE

T=PEAKING TRANSFORMER

92CL-8340