In a stabilized power supply the dissipation in the stabilizer may become very high when the difference between input and output voltages is large. This phenomenon occurs particularly in stabilized mains supplies, and can be remedied by lowering the secondary voltage before the stabilizer. The suggested circuit here does this in a neat manner by making it possible to select either the full or half the secondary voltage. And that with only a few components!

dissipation limiter

switches transformer secondary

Z. Paškvan

The stabilizer in a power supply may get very hot indeed when the output current is high and the output voltage is low, because it alone has to dissipate the difference between the input and output voltages. It should therefore not come as a surprise when the device gives up the ghost. Some supplies are fitted with a switch that enables the lowering of the secondary transformer voltage, $u_s = u_1 + u_2$, in such situations, so that the stabilizer need not dissipate so much power.

The proposed circuit shown in figure 1 also makes it possible to lower the secondary transformer voltage but in a rather special way. With a centre-tapped transformer it is possible to halve the output voltage, u_O, by switching the rectifiers from full-wave to half-wave rectification. The switching is effected without the use of a mechanical switch: all that needs to be done is to give the correct instruction and even that could be automated!

From full-wave to half-wave and vice versa

The two parts of the secondary winding of the transformer must be in series to give $u_s = u_1 + u_2$. All that is necessary to ensure this is to apply a voltage of 1...10 V to the base of T2. Both that transistor and T1 then conduct: silicon-controlled rectifiers (SCRs) Th1 and Th2 are consequently switched on via R1, R1', D4, and D5. The SCRs together with D1 and D2 now form the wanted full-wave rectifier in a simple Graetz circuit as shown in figure 3. Diode D3 ensures that in this configuration the secondary windings are not short-circuited via the centre tap and one of the SCRs.

When it is required to halve u_s, the base voltage of T2 should be made zero. The SCRs are then off and rectification is carried out by D1 and D2 only: this is half-wave rectification. This situation is shown in figure 4 and illustrated in figure 2. You will see that the peak value of u_s rises appreciably when a base voltage is applied to T2, and drops to $u_1 = u_2$ when the base voltage is removed.

No values have been given in this article because these will of necessity depend on the type of supply used. All component ratings, particularly those of D1 and D2, must, of course be chosen to comply with your particular requirements.

1

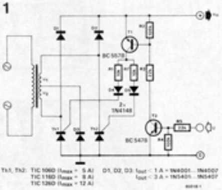

Figure 1. Switching from half-wave to full-wave rectification is effected by applying a suitable voltage to the base of T2.

2

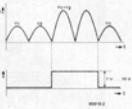

Figure 2. This diagram shows the effect on the voltage applied to the rectifier circuit when a base voltage, U_B, is applied to T2.

3

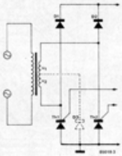

Figure 3. To get the full secondary output voltage, a voltage of 1...10 V must be applied to the base of T2. Rectifiers D1, D2, Th1, and Th2 are then connected in a bridge configuration.

4

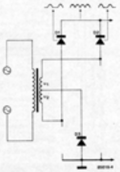

Figure 4. When Th1 and Th2 are off, D1 and D2 function as half-wave rectifiers. As the two halves of the transformer secondary are effectively connected in parallel, the pulsating voltage applied to the rectifiers is $\frac{1}{2} u_s$.