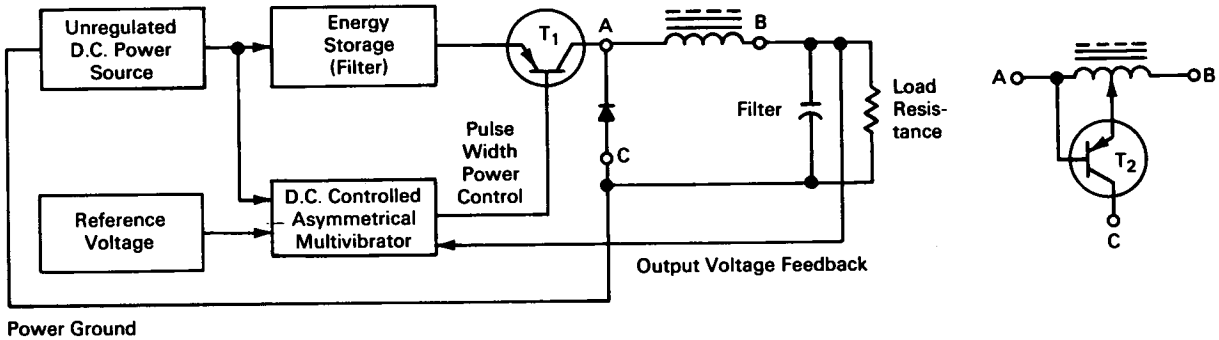
NASA TECH BRIEF

Substituting Transistor for Diode Improves Rectifying Means



The problem:

In rectifiying an alternating current, prior art has used silicon diodes which have exhibited a forward voltage drop and relatively slow turnoff time. The former disadvantage is important when the forward voltage drop is a significant proportion of the total load voltage. The latter disadvantage restricts the repetition rate of the alternating voltage to a low value.

The solution:

An unusual transistor connection that substitutes for the diode and allows significantly higher repetition rates without increasing power loss.

How it's done:

The improvement is made by substituting circuit A-B-C in the right figure for circuit A-B-C in the left figure. In operation, T_1 is pulsed on. This creates a magnetic field in the transformer and supplies the load current. Transformer action also reverse biases T_2 at this time. As T_1 turns off, the magnetic field in the transformer collapses and turns on T_2. The current from the collapsing field flows into the collector, which is the inverted connection of T_2 that is employed to get good voltage breakdown characteristics for T_2 when T_1 is on. Saturation voltage is very low in this configuration and results in an equivalent diode of very low forward voltage drop.

Notes:

1. Operation speed is improved by a factor of 10 or more when a given diode is replaced by this transistor circuit.
2. The circuit on the left, when converting 28 volts to a load voltage of 4 volts, operated at less than 69% efficiency. When it was replaced with the circuit A-B-C in the right figure, an efficiency of 80% was achieved.
3. This circuit should be beneficial for use in power converters where the load voltage is low.
4. Inquiries concerning this invention may be directed to:

   Technology Utilization Officer
   Goddard Space Flight Center
   Greenbelt, Maryland 20771
   Reference: B66-10295

(continued overleaf)

Patent status:

Inquiries about obtaining rights for the commercial use of this invention may be made to NASA, Code GP, Washington, D.C. 20546.

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