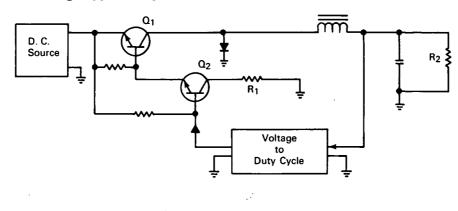
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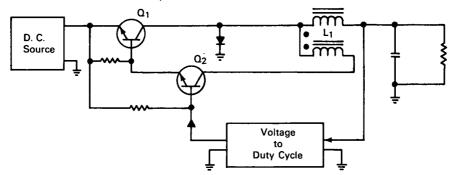
# NASA TECH BRIEF



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## Switching-Type Regulator Circuit Has Increased Efficiency





#### The problem:

Switching series regulators have required control networks for the transistor or electron tube switching element. Such control networks are usually operated by the source supplying power to the load and draw considerable amounts of power which is dissipated in the form of resistive losses. Such resistive losses must be removed from the regulator by means of bulky heat sinks for the switching element to operate in a stable manner. These losses result in reduced efficiency of the regulator circuit.

## The solution:

A switching series regulator circuit in which substantially all of the current applied to the control circuit is fed to the load via an inductive network.

## How it's done:

The significant increase in efficiency of the new circuit over that of the old may be seen by comparison of the two circuits. In the upper figure, the driver transistor  $Q_2$  derives its collector  $K_c$  current  $I_c^2$  through  $R_1$  which causes a considerable power loss

(continued overleaf)

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 $I_c^2R$ . In the lower figure, collector current  $I_c$  is obtained from secondary winding, or tap, on inductance  $L_1$  which is otherwise unchanged. In this way, current  $I_c$  is obtained from a low impedance circuit with resultant low  $I_c^2R$  losses. Additionally,  $I_c$  contributes to the load current flowing through  $R_2$  by transformer action of the modified inductance L as load current increases. Thus,  $Q_1$  base driving current increases as load current is increased and this causes  $Q_1$  saturation voltage to remain low.

### Notes:

- 1. By this approach, the overall efficiency of a regulator has been raised from a measured 83.8% to 94.5%.
- With virtually no increase in complexity or cost, appreciable reduction in size is achieved by elimination of the previous heat sink requirement.

3. Inquiries concerning this invention may be directed to:

Technology Utilization Officer Manned Spacecraft Center Houston, Texas 77058 Reference: B67-10190

#### Patent status:

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

Source: William M. Clapp of Sanders Associates, Inc. under contract to Manned Spacecraft Center

(MSC-1063)