NASA TECH BRIEF

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Phase Inverter Provides Variable Reference Push–Pull Output

The problem:
To design a circuit that will provide a push–pull output referenced to a dc potential which can be varied without affecting the signal levels.

The solution:
A dual-transistor difference amplifier which provides the push–pull output, coupled with a feedback circuit which can vary the operating points of the transistors by equal amounts to provide variable reference potentials.

How it's done:
The difference amplifier consists of Q1 and Q2 and their associated components. The output signals, E1 and E2, appear at the collectors of the respective transistors and are 180° out of phase. The operating points of Q1 and Q2 with respect to either +V or −V are varied by varying R1. If R1 is varied in a direction that increases the positive bias on the base of Q2, it will make Q2 conduct less and cause E2 to become more negative. Moving R1 in this direction also increases the emitter resistance of Q3 which causes Q3 to conduct less, and decreases the current flow through the common resistor R2. The voltage drop across R2 and R3 will therefore decrease, and E1 will become more negative. The reference potentials, E1 and E2, have therefore varied in the same direction with respect to +V or −V, but the gains of Q1 and Q2 have not changed.

Notes:
1. This circuit was designed to drive a dc-coupled push–pull deflection amplifier, using R1 as a centering control.

(continued overleaf)
2. Inquiries concerning this invention may be directed to:
   Technology Utilization Officer
   NASA Headquarters
   400 Maryland Avenue, SW
   Washington, D.C. 20546.
   Reference: B66-10344

**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: Radio Corporation of America under contract to NASA Headquarters (HQ-23)