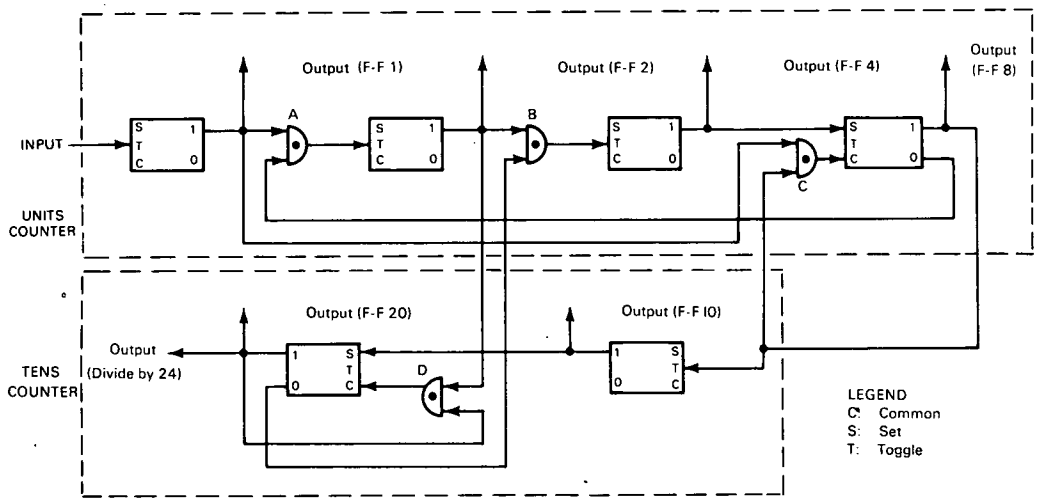
NASA TECH BRIEF

Simple BCD Circuit Accurately Counts to 24



The problem: BCD (binary-coded-decimal) divide-by-24 counters are frequently used in digital control clocks to register hours and give a daily output signal. Such counters have been unnecessarily complicated and in some cases produce false output spikes in the transition to the 24th count.

The solution: A ripple-through counter using commercially available digital modules that incorporate *and* gates with flip-flops (bistable multivibrators). The counter requires only 6 modules and generates the transition from 23 to 00 (the 24th count) by means of feedback loops.

How it's done: Flip-flops 1, 2, 4, and 8 provide a BCD count to nine in the normal manner. The transition of flip-flop 8 from the "one" state to the "zero" state generates the carry to the following stage. When the 8th pulse is registered, normally closed gate C is opened and normally open gate A is closed. The 10th pulse, therefore, resets flip-flop 8 but does not set flip-flop 2 as it normally would. The resetting of flip-flop 8 causes flip-flop 10 to be set. The same process occurs when the 20th pulse is encountered, except that flip-flop 10 is reset and flip-flop 20 is set. At the same time, normally open gate B is closed and normally closed gate D is opened. When the 24th pulse arrives, it resets flip-flop 20 but cannot set flip-flop 4. The 24th pulse, therefore, resets the entire counter and produces the divide-by-24 output pulse.

Note: Inquiries concerning this invention may be directed to:

Technology Utilization Officer
Goddard Space Flight Center
Greenbelt, Maryland 20771
Reference: B65-10225

Patent status: NASA encourages the immediate commercial use of this invention. Inquiries about obtaining rights for its commercial use may be made to NASA, Code AGP, Washington, D.C., 20546.

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