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NASA TECH BRIEF

Marshall Space Flight Center

Cardiotachometer Displays Heart Rate on a Beat-to-Beat Basis
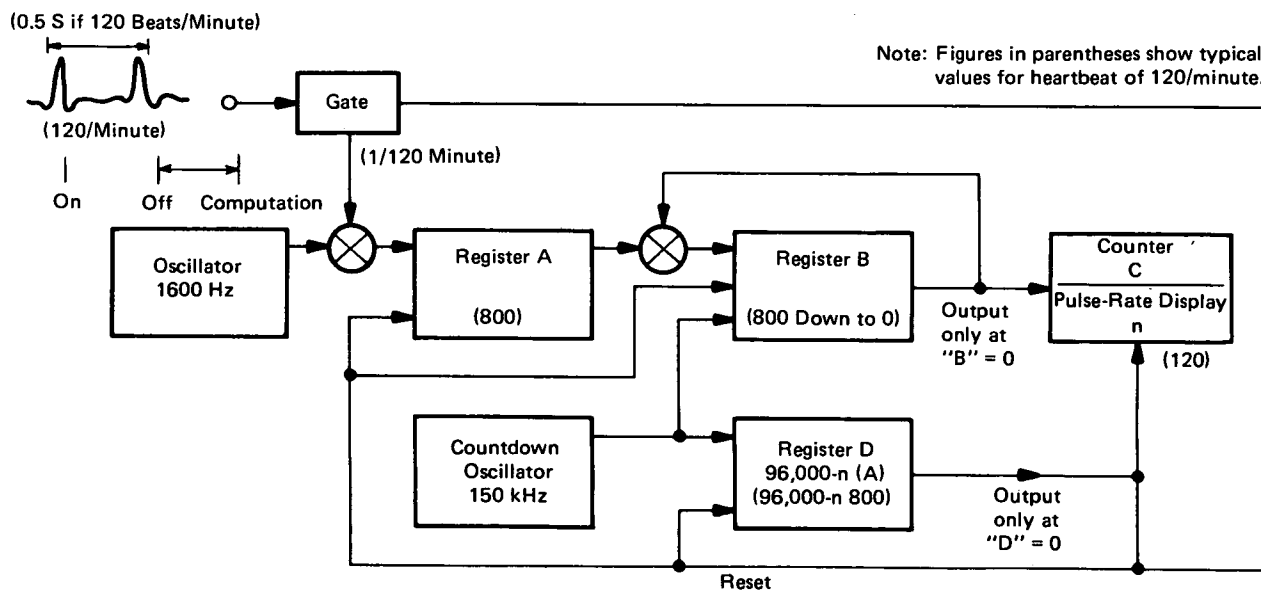
Cardiotachometer Block Diagram

The problem:

There are frequent times or instances in hospitals and during medical examinations when it is desirable to have a continuous numerical display of a patient's heart rate. To date, analog devices have been available for this purpose, but they are subject to drift and are susceptible to noise.

The solution:

A cardiotachometer has been developed which provides a direct digital display of a patient's heart rate.

How it's done:

The cardiotachometer block diagram is shown in the figure. In this case, the processing is illustrated for a heart rate of 120 pulses/minute. As shown, the input is fed to the gate which turns on for one heartbeat interval and passes pulses from the oscillator to register

A, during that interval. At the end of this interval after the gate is off, register A dumps into register B. Register B automatically counts down to zero, at which time the $B = 0$ pulse is counted in counter C, and also causes register A to dump into register B.

Register D is preset to 96,000 at the beginning of each complete computation period. It is counted down at the same rate as register B and so limits the number of cycles to 96,000-n (A). Thus, the system cycles n times before being reset (n = 120 in the example). Counter C counts the number of cycles (n) and displays this figure as the pulse rate. The relatively long display period used eliminates the rapid flicker that would result, if the rate were displayed on a beat-to-beat basis for a patient with rates above 100 beats/minute.

The electronics for this system may be chosen so that the complete calculation and display may be accomplished in a few milliseconds, far less than even the

fastest heartbeat interval. Accuracy may be increased, if desired, by using a higher-frequency timing oscillator, although this will require large capacity registers at increased cost.

Since variations in heart rate may be of interest, an additional C* counter or register can be included, which will hold the previous heart rate. This could be counted down by the new heart-rate counts to counter C, so that at the end of the calculation counter C* would hold the difference in beats/minute. This difference can be read from a digital display or supplied to a simple digital-to-analog converter, and the resulting voltage displayed by a meter or as a trace on a recorder. If desired, the heart rate displayed in counter C can also be converted to an analog voltage.

Note:
Requests for further information may be directed to:
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Patent status:
This invention has been patented by NASA (U.S. Patent No. 3,773,038). Inquiries concerning nonexclusive or exclusive license for its commercial development should be addressed to:
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