

HELPING IT TICK—Rear view of the National Bureau of Standards seconds pulse generator and time interval selector used in the time control equipment of the Bureau's radio station WWV.

PHYSICS

Crystal Clock Broadcasts

National Bureau of Standards uses crystal clocks with electronic circuits to tell time to the world in only service of this kind.

► THE WORLD'S only continuous time signal service uses crystal clocks with electronic circuits to answer the question, "What time is it?" with accuracy down to a millionth of a second.

The crystal clocks' scientific time-keeping is broadcast throughout the world from the National Bureau of Standards radio station, WWV Beltsville, Md. If you think your watch is keeping accurate time, you can check it with the Bureau's shortwave time signals 24 hours a day on one or more frequencies.

A flawless crystal of quartz with series resonance of approximately 100,000 or 200,000 cycles per second is the heart of the clocks. Electron-tube circuits oscillate the crystal continuously, and the resulting frequency is divided into 60 cycles per second with no loss of accuracy.

Automatic announcement equipment

for the time broadcasts at intervals of one minute, five minutes and 30 minutes comes from a synchronous motor powered by the 60-cycle frequency. The motor, through gear trains, drives the contacts which control the time interval announcements.

A highly accurate seconds pulse is broadcast using a one-second contact which opens an electrical gate. These pulses are determined by the crystal oscillator frequency which has an accuracy within a few parts in 100,000,000. Phase shifts and other difficulties cause the actual broadcast second to slip to an accuracy of one microsecond, one-millionth of a second.

Conditions affecting the accuracy of the quartz crystal of the clock include temperature, pressure and humidity. The pressure and humidity are kept constant by sealing the quartz plate in a metal or glass enclosure, while the plate and cer-

tain important parts of the circuit arrangement are put in a constant-temperature oven.

Two important differences between the electronic crystal clock and the conventional pendulum clock are the fact that changes in the gravitational constant do not affect the crystal clock's accuracy, and it is possible to compare crystal clocks at high frequencies to determine erratic behavior accurately. Equipment used to compare the clocks will accurately note a difference equal to one second in 50 years. Differences between absolute time and the broadcast time signals are constantly being checked by the Naval Observatory.

Science News Letter, January 11, 1947

MEDICINE

Radium Aids Hearing In Adenoid Defect Cases

► A NINE-YEAR-OLD boy was failing in school. He had a speech defect and was thought to be mentally defective. His identical twin brother was leading the first division of his class in school. The dull child had not had any ear trouble, but at times his family felt he had some deafness. He had had his tonsils removed and two operations for adenoid removal.

Examination showed a mass of adenoid tissue which had completely overgrown the Eustachian opening and an abnormal condition of the ear drum. Another operation for removal of the adenoid tissue did not improve his hearing.

He was then given radium treatment and within six months there was not only improvement in his hearing, but his speech defect had disappeared and he was with his twin in the first division of his class.

This dramatic case history was reported to the American College of Surgeons by Dr. John E. Bordley, of the Johns Hopkins Medical School, to illustrate the results that can be obtained with the use of radium in conductive deafness due to obstruction of the pharyngeal end of the Eustachian tube with lymphoid or adenoid tissue.

This method is not effective in other forms of deafness. It is more effective when started early and best results are obtained in children.

No single serious reaction has followed any of the thousands of these radium treatments given at Hopkins nor any of the 14,000 given in the Army Air Forces aerotitis control program.

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