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NEW FUNDAMENTAL FREQUENCY STANDARD

The bureau has recently installed equipment which materially advances the accuracy of the frequency standard. The new equipment comprises essentially a group of four piezo oscillators, each having the frequency 100 kilocycles. Three are alternative standards, the fourth is a reference point against which to check the others. Beats between each of the first three and the fourth are automatically counted by three telephone message registers. An automatic camera takes a picture of the counters each 1,000 seconds, from which record the number of beats per 1,000 seconds of each standard against the reference point can be obtained. In 1,000 seconds each oscillator makes 100,000,000 oscillations, so that variations in frequency within the group can be measured to 1 part in 100,000,000.

To obtain the absolute frequency, the output of one oscillator is fed into a submultiple generator from which currents of 10 kc and 1 kc may be drawn, these frequencies being as accurate as the original oscillations. The 1 kc frequency drives a synchronous motor clock, which is geared to keep exact mean solar time when the input frequency is exactly 1,000 cycles.

The rate of the clock is obtained by checks with Arlington time signals. The percentage gain or loss then is numerically equal to the deviation of the oscillator from 100 kc; that is, if the clock gained 1 second per day, it would be fast 1 part in 86,400, so the frequency of the piezo oscillator is 100,001.16 cycles per second.

The crystals are of 30° cut and vibrate on a thickness frequency. They are doughnut shaped, that shape being chosen as giving a low temperature coefficient. The temperature and atmospheric pressure in which the crystals operate are carefully regulated, as are the filament and plate voltages. Stand-by batteries take care of power failures.

Measurements show that the average short-time variations of each of the crystals are less than 1 part in 10,000,000. The standard maintains an absolute value of frequency which is known to 1 part in 10,000,000.

AERONAUTIC RADIOBEACON IMPROVEMENTS

Recent work at the bureau has led to improvements in the characteristics of the vibrating reed course indicator, resulting in a 20 per cent increase in sensitivity and at the same time reducing the required constancy to which the modulation frequencies at the beacon station must be held. A variation of ± 0.75 per cent in these frequencies is now permissible. These improvements have been obtained through the use for the reed material of a high-permeability nickel-steel alloy, called "A" metal, rather than elinvar, which was previously employed.

A small filter unit was designed permitting the simultaneous connection of

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