Close control of the amplitude of vibration is necessary to assure a uniform flow of abrasive and a constant rate of abrasion. Recent studies have shown that the amplitude of vibration changes with the gradual drop in the level of abrasive as operation continues, because of a shift in the center of gravity of the electromechanical vibrator system. Since the change is gradual, it can be compensated by periodic readjustment of the regulated line voltage applied to the vibrator, in order to maintain the standard abrasion rate on the reference panel. Undesirable turbulence and interference effects in the abrasive storage chamber have been minimized by redesigning the chamber so that the abrasive particles sift into and are propelled along a straight tube instead of through a circular chamber. Use of a more free-flowing abrasive (aluminum oxide) than was formerly employed also has improved the uniformity of operation.

New devices for setting and adjusting nozzle-to-coating distance have been added with which distance is quickly and easily set to within 0.002 in. Several subtle sources of error in the original method have been identified and eliminated. Practical operating limits have been established within which good precision can be expected over a wide range of test conditions.

Studies have shown that the method is ited to the organic coating materials f it was originally designed. It is also a to ceramic, porcelain, and anodic coa well as films and tapes when attached t substrate. Sheet metal of aluminum, b steel may also be tested: their rates of a are of the same order of magnitude as t the more resistant types of organic coatin good qualitative correlation has been o between test results and the service perfo of protective coatings applied to military

The speed and simplicity with which th urements are made, the reproducibility of and the opportunity for calibration and ardization afforded by employing a practi erence panel are features of the improved that offer a promise of considerable useful the field of abrasion testing.

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[1] *For further details, see* Improved NBS abr jet method for measuring abrasion resistan coatings, *by A. G. Roberts, ASTM Bul. No. 48 (1960).*

[2] Abrasive jet method for measuring resis of organic coatings, *by A. G. Roberts, W. A. Cr and R. S. Pizer, ASTM Bul. No.* **208**, *36 (19 and NBS Tech. News Bul.* **39**, *33 (1955).* Appa for measuring abrasion resistance, *U.S. Pate 2,907,200, Oct. 1959.*

Experimental Timing Code Added to WWV Broadcasts

AN EXPERIMENTAL timing code has recently been added to the regular broadcasts of the Bureau's radio station WWV. This code provides a standardized timing basis for use when scientific observations are made simultaneously at widely separated locations. For instance, to analyze the information from a satellite or to track its position requires that radio signals received by a tracking station be identified by the time and date of the observation. The code designates the day, hour, minute, and second (Universal Time) and will indicate the broadcast accuracy (at the WWV transmitter) within one thousandth of a second.

This experimental code and broadcast were developed by a number of organizations and individuals, including the Inter-Range Instrumentation Group, the National Aeronautics and Space Administration, Convair Astronautics, and NBS. The new time-code generator that pulse modulates the WWV signal was designed and built by the Electronic Engineering Company of California. The experimental broadcast is being monitored and controlled by the Radio Broadcast Services Section of the NBS Boulder Laboratories.

As the code is experimental, the details of its transmission are subject to change. Currently however, the code is broadcast for 1-min interv 10 times per hour. It immediately follows th standard audiofrequencies of 440 cps and 600 except at the beginning of each hour. The stand ard frequencies are given alternately as be but their duration, when the code is given min instead of 3 min.

The code is a 36-bit, 100-pulse-per-sec binary-coded system. A complete time frame 1 sec. Nine binary groups per second appear the following order: 2 groups for secon groups for minutes, 2 groups for hours, groups for day of year.

The binary groups follow the 1 sec or t frame reference marker. The least signif binary group and the least significant nary digit in each group appear first. Thus is necessary to read only as much of the code desired and the rest can be ignored. "On tim (the exact point of time being indicated) occ at the leading edge of all pulses.

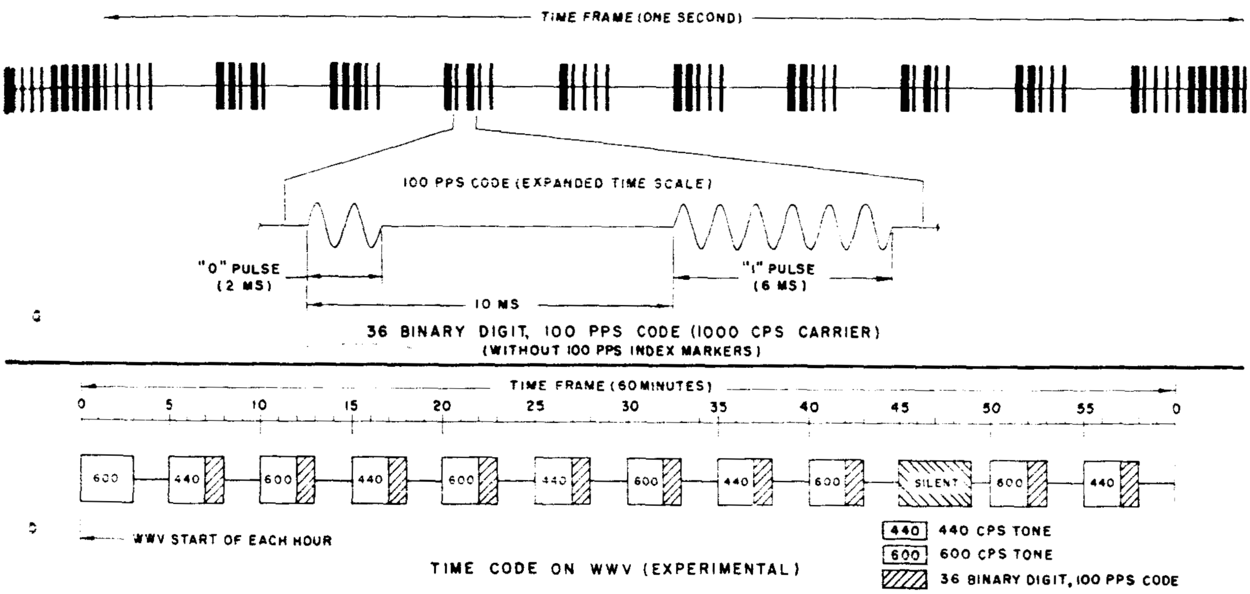
A coded reference marker is being used inste of an extra wide reference marker as it requ pulses of only two different widths and thus plifies the circuit logic for machine transl

The pulse width ratio of 3 to 1 provides a good tolerance margin when less than ideal timing signals are being processed.

The experimental code also contains blank spaces which may be used to transmit additional types of information in the future.

Time Code on WWV (Experimental)

1. National Bureau of Standards radio station WWV is now broadcasting an experimental time code of 36 bits at 100 pulse per second (PPS) on 2.5, 5, 10, 15, 20, and 25 Mc.
2. The code is broadcast for 1-min intervals and 10 times per hour. Except at the beginning of each hour, it immediately follows the standard audiofrequencies of 440 cps and 600 cps. The latter frequencies are given alternately as before except the duration is 2 min instead of 3 min when the code is given.
3. The code contains time of year information (UT) in seconds, minutes, hours, and day of year.
4. The code is binary coded decimal (BCD) consisting of nine binary groups each second in the following order: 2 groups for seconds, 2 groups for minutes, 2 groups for hours, and 3 groups for day of year. Code digit weighting is 1–2–4–8 for each BCD group multiplied by 1, 10, or 100 as the case may be.
5. A complete time frame is 1 sec.
6. The least significant binary group and the least significant binary digit in each group occurs first. The binary groups follow the one second or time frame reference marker.
7. "On time" occurs at the leading edge of all pulses.
8. The code contains 0.1-sec. index markers and a 1/sec time-frame reference marker in addition to the 100/sec clocking rate of the code pulses. The 1,000-cps carrier is synchronized to the code pulses so that millisecond resolution is easily obtained.
9. The 0.1-sec index markers consist of "1" pulses preceding each code group except at the beginning of the time frame where it is a "0" pulse.
10. The 1-sec reference marker is made up of five "1" pulses followed by a "0" pulse. The timing frame begins at the leading edge of the "0" pulse.
11. The code is a spaced code format, that is, a binary group (BCD) follows each 0.1-sec index marker. The last index marker is followed by an unused four-bit group of "0" pulses just preceding the 1-sec time-frame reference marker.
12. The unused four-bit group may be used in the future to transmit other types of coded information, such as the last digit of the year, station number, etc.
13. Width coding: "0" pulse, 2 m wide (2 cycles of 1,000 cps); "1" pulse, 6 m wide (6 cycles of 1,000 cps). The time code is amplitude modulated on a 1,000-cps carrier. The carrier is coherent with the time code so that the leading edges of the time code pulses coincide with a positive going zero axis crossing of the carrier.
14. The code is being transmitted on a 1,000-cps carrier as shown in a (see below). Time allotted to the code, on WWV, is shown in b.



TIME CODE ON WWV (EXPERIMENTAL)