



WHY THE TIME-CLOCK KNOBS ARE BLACK

By EDWARD M. HONAN

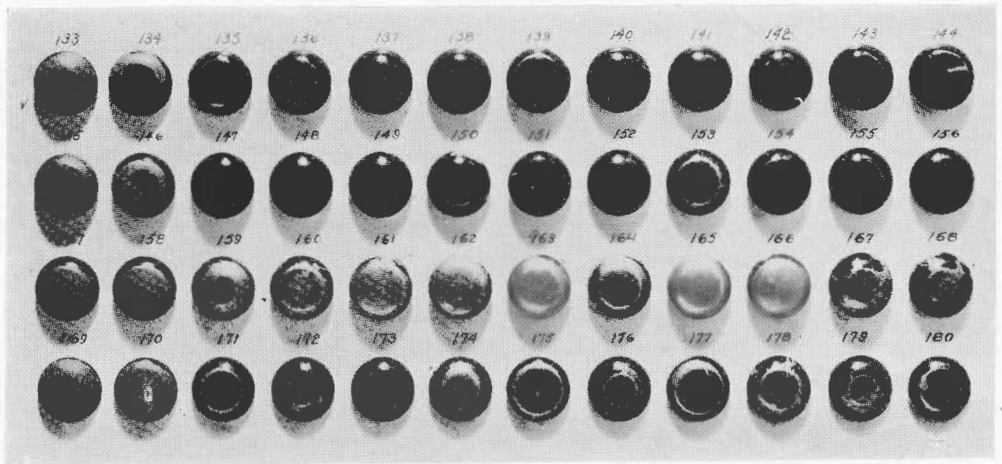
THE starting of a series of tests in our laboratories ordinarily does not cause particular excitement nor arouse any general curiosity. But one summer's day almost three years ago, when a life-test study was begun on the black baking japan that is used to make the telephone black, there was not a little wondering and questioning. On that day, as many of us recall, the bright nickel knob on the handle of the time clock was replaced by a black one. And for what reason? Nobody seemed to know why, except possibly Mr. Carr, the clock man, whose picture appeared in a recent issue of the RECORD. Mr. Carr did know, and so did several people in the Building Department, together with the members of the Chemical Research Department who were actually conducting the test. The life-test study on japans is still going on and the clock knobs are still black.

A japan, by the way, is a variety of metal finish, partly paint in nature, and partly varnish. The peculiar thing about it is that, as a rule, the finish is baked in an oven instead of being allowed to dry of its own accord, as paint does. The usual procedure is either to dip the article to be finished into the liquid japan or to spray the liquid japan onto the article by an atomizer. The article is then placed in an oven and heated until the coating is sufficiently dry and hard. Although the process appears

very simple, much time and study have been spent in determining the most desirable temperature of baking, as well as the most satisfactory time. When one remembers that this baking operation, which requires approximately two hours, dries the finish as thoroughly as if the article were exposed to the ordinary sunlight for several days, it is easily seen that a great many difficulties may be encountered in the baking. The first thing that happens in the oven is the removal by evaporation of the "thinner" which was used to render the japan sufficiently liquid for application. After the solvent has been evaporated, the temperature is raised to bring about the actual drying or hardening of the finish. If this temperature is raised too quickly and the drying becomes too rapid, an unsatisfactory finish is produced; conversely if the temperature is too low the finish is under-baked, and does not give suitable service.

There are many other interesting stories which could be told about japans: how the name originated from covering-materials used for centuries by the Japanese; how water-soluble japans are applied; the story of crystalline japan finishes. But we started to tell why it is that the knobs of the time clock are black.

The telephone desk stand is the point of most intimate contact between the Bell System and the subscriber. It is particularly desirable



Time-clock knobs used in testing japan finishes

that the finish on this article remain neat and serviceable. Black baking japan has been used for many years, but sometimes this finish becomes soft and presents a bad appearance. The telephone engineers have spent much effort to find the cause of the trouble and to remedy it.

Remedies seemed easy until one thought about it for a while. Then a multitude of questions assailed the thinker on all sides and angles. Was an inferior grade of liquid japan being used? Did the shop clean the metal properly? Was the baking correctly done? Was the failure due to the wear alone, or due to perspiration on the hands of the subscriber? Was a japan the proper kind of a finish to use in this service? These questions and others of similar nature could not be answered until there was available a standardized and sensitive test to prove the correctness of the various ideas.

When trial lots of desk stands were put in ordinary service the results only added to the confusion. It was apparent that the trial stands received a wide variety of treatment.

Some were used much; others little. A few were sadly banged about and the rest treated with due consideration. Some were used exclusively by a single individual who might or might not be fair, fat and forty, and who might or might not perspire freely. Other stands were handled by many individuals whose hands were clean, dirty, or oily, according to their several occupations and habits. Various test pieces were suggested; door knobs, typewriter or comptometer keys or bars, brass railings, bell buttons, or special test devices with which boys in the laboratory might entertain themselves by handling all day long. None of these suggestions compared with the happy thought of using time-clock knobs. Each knob receives a recorded number of contacts with the hands of a number of individuals who may be expected to represent a fair average of the public at large.

The results obtained have been gratifyingly consistent and instructive. W. R. Erickson, W. H. Strain, and R. E. Waterman, who with the author were responsible for the

work, have had to commiserate each other on only one defect: some people's curiosity apparently overcomes them and knobs are occasionally found showing the effects of attacks by nail files. Also apparently a belief is current that scratching the knobs will serve to tell paste diamonds from the genuine. In the interest of truth and science it should be said that this is not the case.

It was not the intention to use time-clock knobs indefinitely for testing japans, since chemical tests might be devised which would be more rapid and convenient, and applicable directly to a variety of parts of the desk stand and subscriber's set. The time-clock knobs were used to indicate the possible chemical tests and to verify the truthfulness of the chosen test. An excellent test is one carried out with a solution of phenol (carbolic acid), a sort of varnish remover which will evaluate japans in a few hours almost as well as the time-clock service can do in months. Either the chemical test or the time-clock test will tell whether the metal is properly cleaned and whether the japan is well chosen and suitably baked—in short, whether the finish will endure in service.

The accompanying photograph shows a set of knobs which have been removed from the time clocks after a seven-months' test. The japan on the two upper rows was baked under conditions which, it was expected, would produce a very satisfactory finish. The finish on the two lower rows of knobs was baked under conditions which, it was expected, would give a finish that would not last in service. The two left-hand knobs

in each row were subjected to the phenol test. It will be noted that the finish of each of these knobs has been removed by the action of the testing solution. However, the time required to remove the finish from knobs numbered 133, 134, 145 and 146 was two and one-half times as long as the time required to remove the japan from knobs 157, 158, 169 and 170. These results of the phenol test, therefore, checked quite well with the service test as represented by the entire group of knobs. The conditions under which the next-to-the-bottom row of knobs was baked were considered to be least desirable of the four. It can readily be seen that in practically every case the finish on this group of knobs was entirely removed in seven months' service, whereas the finish on the knobs in the two upper rows was practically perfect after that same period of test. Also, the time required to remove the finish from knobs 157 and 158 in the phenol solution was just one-fifth of that required to remove the finish from knobs 145 and 146. The finish on each of these knobs was two coats of japan, and each coat was baked for the same time and temperature.

Events have proved that most of the ideas regarding the causes of failure were partly right, and that there are a number of factors affecting the life of the japan finishes. However, none is more important than the degree of baking. During last year the Development Branch at Hawthorne has greatly improved the control and manufacturing methods. To a great extent this has been due to the testing methods described.