

How Science Helps The World Along

Radio Benefits from Bureau of Standards

Unquestionably, one of the most interesting and thought provoking talks ever given over the air from 1YA was that by Mr. J. W. Collins, secretary of the Department of Industries and Commerce, upon the subject of the Bureau of Standards, Washington. This Bureau is acknowledged to be one of the most outstanding scientific organisations of the world, and its direct and indirect influence upon many

MR. J. W. COLLINS,



Secretary for Industries and Commerce.
—S. P. Andrew, photo.

It was my privilege just a year ago to visit Washington. My radio talk could easily be fully occupied with a description of the beauty of this city, but my particular purpose to-night is to speak of a great Department of State, the Bureau of Standards, a branch of the Department of Commerce. This bureau was established in 1901. It was placed under the control of the Secretary of Commerce, and has always functioned with a considerable degree of independence. Its director, Dr. Burgess, is appointed by the President, its staff is under Civil Service regulations, who are protected to an almost unique extent from political pressure. Its early duties related mainly to the erection of suitable scientific standards for weights and measures but in these later days the bureau is a large, complex, and exceedingly important institutions—one of the nerve centres of the Federal Government machinery.

THE BUREAU'S HOME.

The Department's staff occupies many buildings of four stories, and clustering laboratories, and in its 25 acres of ground situated some 5 miles from the centre of the city looks like a huge university. Nearly \$600,000 has been invested in plant and equipment, and its annual appropriation amounts to \$400,000. It possesses some of the most delicate and powerful testing equipment ever built; for instance, there is a balance accurate to one hundred millionth of a pound, and there is a large machine capable of exerting a pressure of ten million pounds weight.

The present staff is composed of 800 scientists and technicians, including the separate services of 65 research associates detailed to the bureau's laboratories by outside groups. Nearly 600 technical publications have been issued. There are 11 scientific and technical divisions besides the office operation and construction divisions. Each of these major divisions is made up of several sections which deal with a definite class of problems. I was privileged to inspect some of the work of the bureau under the guidance of Dr. F. C. Brown assistant director. I also had the pleasure of meeting and conversing with Dr. Burgess, director of the bureau itself, who, by the way, was keenly interested in the research work being established in New Zealand.

HOW BANK NOTES WEAR OUT.

One of the first operations that I inspected was in the paper pulp department. Dr. Brown informed me that the printing of the paper currency for the Treasury Department involves the use of hundreds of tons of specially made paper per year. The Treasury reported to the bureau that replacing worn and dirty notes during the past

few years had involved greatly increased expense. The bureau officers were asked if they could solve the difficulty by providing a paper of more lasting qualities.

The officers of the bureau did not immediately set about making a new paper, but sent out a staff to inquire as to the reasons why the very excellent paper then in use was not standing up to the usual wear and tear. These officers, after a close investigation reported that owing to the increased use of paper money by motorists the old paper would need to be replaced. Now that appears to be a very extraordinary reason, but a little reflection will show that the circulation and use of paper money has changed very materially because of the motor-car. This is particularly true in a country where the money values of paper are lower than our own—in other words, the dollar is spent as freely as a silver shilling is with us. In the United States, with its 120 million inhabitants, and with practically one car to every five persons, it can be easily imagined what an enormous sum is handled from day to day in payments for petrol and lubricating oils. The constant handling of this paper money by the oily fingers of the garage hands, of the petrol-stained fingers of the men in charge of bowlers, had an immediate and ruinous effect upon the paper dollars. Added to the effacement of the printed ink by the petrol and the marking of the note by oily fingers, the paper had also to stand up to constant folding and unfolding, with the result that the notes rapidly became unfit for use.

When I made my visit to the bureau the difficulty had just been solved, and I inspected the new paper which had been manufactured for the purpose. It was a plain, glossy, white paper, and, after dipping my fingers in grease and oil, I could not make a mark upon its surface. Fold after fold, and fold after fold, made no permanent creases. Even the petrol stain would not take away the gloss on the surface of the paper itself. This research alone has saved the United States Government the printing of many thousands of dollars per day.

THE TESTING OF SAFES.

Next I was shown how steel safes used for the storage of valuables and books were tested. Every type of safe purchased by the Government has to pass a definite and crucial test. The safe is first subjected to an intense fire for one hour, after which it is dropped 30 feet from a scaffold on to a concrete or hard surface. Subsequently it is again put into fire for another hour, and is then opened in the presence of experts. If the contents are charred or spoilt in any way a report is made to the manufacturer, who is expected to provide an article which will withstand the tests. It is comforting to know that manufacturers have learnt their lesson, and now turn out safes which will withstand what is, after all, a test to which safes may be subjected by any fire in an ordinary public building.

Hundreds of thousands of pairs of boots are required annually by the United States Government for its Army and Navy. No leather is used until

it has been tested by the Bureau of Standards. A machine was, therefore, devised to test the leathers, and I saw sole leather being tested by a rotating drum, which rubs the samples against a friction surface. With the equipment it was found that more than 100 per cent. variation existed in the wear of leather from different parts of the hide. Likewise the process of tanning also produced 100 per cent variation.

ACCURATE THERMOMETERS.

Then, again, there was a great public outcry about the variation in the thermometers used by medical men in caring for the public health. Many types of thermometers were not worth a cent, and were a positive danger to the general health of the community. In 1925 the Bureau of Standards tested 38,000 thermometers. This test, and a certificate which is given, assures a fixation of accurate measurement of temperature, and there need be no fear of a mistake in judging a patient's condition.

In the building of bridges and huge structures generally it is considered to be of the greatest importance to have accurate knowledge concerning the strength of materials involved. This necessity for strength of cement, bricks, and of steel girders can probably be more readily realised when it is considered that many of the buildings erected in the cities of the United States run from thirty-five to fifty stories in height. On the one hand is involved economy of construction, and on the other hand is involved safety to life. A machine like a huge ram, which will give a thrust up to ten million pounds in weight, was being used during my visit to test walls built of bricks and cement. Several walls which had been constructed by bricklayers in various heights and widths were being experimented with. The designing engineers of buildings or bridges were assured by these tests of the soundness of the material and its component parts. Just prior to my call parts of a new railway bridge were tested to bear a load of one million pounds.

TESTING RADIO EQUIPMENT.

Washington has a special building for tests of radio appliances. Hundreds of millions of cells are made annually in the United States, and, in conference with manufacturers, specifications were drawn up by the Bureau of Standards and adopted. These specifications involved laboratory performance tests. The quality level of the entire industry has been raised, and, as an illustration, one maker of the common B batteries has steadily increased the performance of his cell, until it is now three times as good as the original cell, and he is able to make it for about two-thirds of the cost of the inferior product. In this connection it is rather interesting to know that in October last year there were 2000 applications for patents pending for improvements in radio appliances.

"SAFETY FIRST."

The testing of motor car brake linings has improved the material used very greatly in recent years. It is claimed that perfection has been reached in providing a lining which is twenty times as good as the best made five years ago. In fact, the life of the average brake lining has been increased more than fifteen fold. Easily six million pounds a year saving in the cost of brake linings has been made possible by the standard wear testing apparatus of the bureau. Think what this means in the safe driving of a car. Formerly, a driver of a car, owing to the material being subject to wear, did not have proper control. Every improvement, therefore, made in brake linings saves the lives of people.

In regard to motor-car tires, it is a matter of common knowledge that the tires are more than twice as good as they were a few years ago, and the cost is less. The tires tested for Government requirements are tried on an electric dynamo meter testing apparatus, which applies high speeds and constant bumps to the running surface of the tires, and the actual mileage recorded by aid of the tires under test is watched by an expert, and on the results achieved so the purchases are made.

The drawing up of specifications for the United States Government is quite a big feature of the work of the Bureau of Standards. Their collection, analysis and test takes up a great deal of time, but it is found to be eminently worth while, for when the Government has

phases of modern development is very marked.

Mr. Collins, in his official position, recently visited Washington, and secured information which provided listeners with a very interesting glimpse of the very forefront of scientific civilisation. In radio an outstanding service has already been rendered listeners by the Bureau and it is unquestioned that further efficiency will be attained as the result of the Bureau's oversight of standardised equipment.

found a specification to be good, States, cities, and private organisations are quick to adopt it. The specifications for cement, first formulated by the bureau, are now generally observed by all engineers throughout the United States. The bureau devised a new door ball-bearing hinge, which has proved sixty times better than any the Government had formerly used. The manufacturers quickly accepted the new standard, and it can now be purchased at a lower price than any of the types hitherto made.

Even naval officers' uniforms are bought on a specification. Like New Zealand woollen productions, virgin wool alone is specified, and it is recorded that an overcoat bought in 1914 for a naval officer, was found in 1926 to be in good condition, unfaded, and of a fine appearance, after the equivalent of more than 50 months continuous winter wear.

EXAMPLE OF VALUE TO NEW ZEALAND.

What I have spoken about to-night is a mere sketch of some of the work done by this great institution—it would take hours to give a detailed survey. I hope I have said sufficient, however, to interest you, and to express satisfaction as a New Zealander that our Government is giving increased attention, through the new Department of Scientific and Industrial Research, to the matters discussed. New Zealand's work must necessarily proceed cautiously and keep pace with the requirements of the Dominion; deal with essentials first and in co-operation with the Research Departments of our own Empire, apply the results for the benefit of our citizens.

I would now like to refer to another important branch of the bureau's activities—that relating to simplification. Simplification practically means reduction of industrial waste by the elimination of unnecessary diversity in size, types, and other varieties of manufactured products. In reducing superfluous varieties and styles of goods, great work has been done for the benefit of the nation. Manufacturers are invited to co-operate with the bureau in reducing the number and styles of various commodities, and, as an instance of the work accomplished by this co-ordination of effort, I might illustrate that ordinary paving bricks have been reduced from 66 varieties to 4, sheet steel from 1319 to 261, range boilers from 130 to 13, business forms from 4500 to 3, builders' hardware from 74 to 50, and timber yard sizes have been reduced 60 per cent.

In eight important sections an estimated saving of \$60,000,000 has been made, and for better or worse modern industry has entered the field of mass production. Mass production has given us motor-cars at greatly reduced cost, and of improved quality and utility; mass production has given us reasonably cheap electric light globes; 55, watches and clocks; and a multitude of other supplies. It has, in fact, revolutionised industry. If, with the watchful care of the Bureau of Standards, the aim is to give quality at the lowest costs, and not cheap and nasty goods, the benefit of mass production must be highly beneficial to the world at large.

SIMPLE RECIPES AND SUPPLIES.

Another phase of the bureau's work relates to the preparation of specifications or recipes for supplies purchased

by Government. Manufacturers are asked to quote prices on a definite formula submitted by the Department. It is entirely uninfluenced by the flamboyant claims of an advertisement that a certain toothpaste or toothbrush is the best in the world, or that someone's paint or soap is the last word for the particular purpose required. The Bureau of Standards takes no risk in this connection, and as an example I quote a simple but old specification for making a floor wax polish: 4lb. beeswax, 1lb. paraffin, 4-pint raw linseed oil, and 14 pints turpentine. The instructions for preparation are: Melt the beeswax and the paraffin, then add the linseed oil and turpentine, but do this away from the stove. Use hot water, not flame, as the source of heat for melting the wax, so as to avoid igniting the turpentine—it will take about 15 minutes to prepare.

EVERYBODY BENEFITS.

I have said sufficient to show, I think, that every citizen benefits by the scientific work and practical tests made by the bureau. It has been made clear that the State benefits by securing quality goods at a minimum cost, that the manufacturer is able to avoid enormous economic waste of excess varieties of goods, and benefits by improved methods of manufacture at lower cost, and that the public gains in lower costs, in improved facilities, and in general education and entertainment. In half a century the general happiness of the individual has surely been enhanced by the cheapness, utility, and service rendered by the telephone, the radio, the gramophone, the motor-car, the moving pictures, and by the application of electricity in the home for cleaning and cooking and preservation of foods. Public health has been improved by more efficient architecture, more sanitary surroundings, and by the invention of improved surgical appliances, discoveries in X-rays and radium, and the broader knowledge of the properties of matter generally. All these advances have contributed to the elimination of plagues, pestilences, and the like; improved transportation by speedier and more luxurious trains, by dependable and swift motor power, and lastly by efficient aeroplanes and airships, have all been made possible by the research work conducted by institutions such as the Bureau of Standards.

In the near future we may look for even more wonderful progress. In wireless telephony, with its promise of television, we shall wake up to the fact soon that we shall be able to circle the world by our voices, and, wonder of wonders, each speaker will be able to see the person to whom the message is addressed. We are even promised with certitude travel to Great Britain by airships in ten days within the next decade.

Let me express the hope, in conclusion, that these great services, these great inventions and facilities will be used to promote peace, happiness, and good-will among the nations of the world.

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