SCIENCE NEWS

TESTS OF LOCOMOTIVES

Science Service

RAILROAD officials, representing a majority of the leading railroads of the country who went to Erie, Pa., to witness a demonstration of new types of electric locomotives and were thrilled to see one of the powerful Mikado type steam locomotives pulled backwards in a spectacular tug-of-war by an electric giant, and to see another type of electric locomotive glide over the rails at 105 miles an hour, found great interest in another device known as the otheograph, which accurately measures the stress or action on the rails of each separate wheel of a locomotive or motor car.

This new instrument, as explained by A. F. Batchelder, designing railway engineer of the General Electric Company, shows by a graphic chart the extent and characteristic of both the vertical and sideways thrust of all the wheels on each rail. The vertical weight is carried by heavy springs underneath the rail and the sideways thrust is carried through similar springs set vertically and bearing against the head of the rail. The deflection of these springs on the passage of the locomotive is recorded through a lever having an 8 to 1 ratio, with a pointer at the end which traces a record on paper wrapped around a rotating cylinder.

The otheograph ties may be installed in place of the regular ties, either singly or several grouped together, and on curves or straight tracks. The present installation at Erie comprises 25 of these ties grouped together covering a distance of fifty feet of straight track. The revolving mechanism provides for moving all of the recording cylinders on each side of the track simultaneously so that as many records may be taken of each side of the locomotive as the number of ties that are grouped together. The movement of the operating mechanism for the recording cylinders is independent of the speed of the locomotive.

The record from a slowly moving locomotive shows the equalized distribution of the weight, and such a record serves as the basis for comparison with a record taken at high speed. The effect of side thrust in changing the vertical component, and any variations due to dynamic unbalance, are quite noticeable. The effect of a wheel with a flat spot shows very clearly. The record is not necessarily limited to that of a locomotive only, as by moving the paper slowly the record of all wheels of an entire train of a hundred or more cars may be taken.

NAUTICAL TIME

Science Service

BY agreement of the United States, England and France, the U. S. Nautical Almanac and the corresponding publications in the other countries are going to suffer a revolutionary change in the interest of safety at sea, beginning with the issue for 1925, now about to be issued.

The change is in the method of expressing time. It is now given in astronomical time, the day beginning and ending at noon. In the almanac of 1925 it will be given in civil time, the day beginning and ending at midnight. In each case the time is that of Greenwich Observatory, the time standard for all astronomical observations. Hours will be counted from 0 to 24 as in the present almanac.

The change will do away with an endless amount of confusion and danger, navigators say. The astronomical day begins 12 hours later than the civil day of the same date; that is, January 1, astronomical time, begins at noon of January 1, civil time. This difference frequently causes confusion, navigators neglecting to note the change or figuring it as just the opposite. Errors from this cause might amount to as much as 10 or 20 miles in working out the position of a vessel at sea. This danger will be ended by the new system, which has been recommended by navigators for years and which will finally be put into effect.

Incidentally, the change will require a new edition of that handbook of every navigator, Bowditch's American Practical Navigator. All the problems in the book are worked out according to the old system, and there is a lengthy section instructing the novice how to convert civil into astronomical time. This will all have to be changed, the burden of the work falling on the U. S. Hydrographic Office.

FORECASTING AT SEA

Science Service

FRANCE is leading the United States and the world in weather forecasting on the sea. According to the annual report of the chief of the U. S. Weather Bureau, French meteorologists and forecasters have been making regular trips across the Atlantic on their naval training vessel Jacques Cartier, have been collecting weather reports by radio from all parts of the North Atlantic and have been using them as the basis for forecasts sent out daily for the benefit of mariners.

But this vessel makes only about three voyages a year, and so the U. S. Weather Bureau has prepared plans for a service similar but continuous which may be given from vessels operated by the U. S. Shipping Board. That organization has approved the plans and has offered cooperation in the way of providing facilities on Shipping Board vessels on the northern transatlantic routes. Three vessels would be needed for continuous service. The need for such a service was demonstrated last winter, since storms on the Atlantic were unusually frequent. Its value would be, "to keep vessel masters informed at all times as to weather conditions which might cause damage or retard progress; enable them to avoid such storms as far as possible; to lay out ship work *en voyage* and

take advantage of smooth seas and fair weather for outside work; and to give information as to weather conditions to be expected on their arrival in port. The bureau is alert to the inauguration of service of this character at the first opportune occasion.''

SYNTHETIC SOFT DRINKS

Science Service

THE use of synthetic foods or drinks containing pure acids such as the acetic acid of vinegar, rather than the acids made in Nature's own laboratory, was condemned on scientific grounds by Dr. Henry Leffmann, of the Philadelphia College of Pharmacy and Science, in an address before the Franklin Institute on December 13. It has been found that in natural fluids such as milk, blood, fruit juices and fermented liquids, there are substances which modify the irritating effect of the acid and cause what is known as the ''buffer effect.'' So-called stainless steel is not affected by malt vinegar, but is corroded by a solution of acetic acid of equal strength, although the acid is the same in both cases.

The determining condition in the effect of acid solutions on living things is not merely the chemical acidity, but what is known as the ''hydrogen ion concentration,'' a term rapidly coming into use, Dr. Leffmann said. This merely means the relative number of electrified hydrogen atoms or ''ions'' in the solution. All acids contain ''hydrogen ions'' which are the cause of its greatest acsplit off in an electrified form from the rest of the molecule of the acid.

The lecturer contrasted ordinary vinegar of four per cent. acidity, with nitric acid of the same acidity. The former may be eaten without ill effect, the latter is corrosive. The reason for the difference in behavior is that the nitric acid solution has a greater proportion of ''hydrogen ions'' wnich are the cause of its greater activity. ''Modern investigation has shown,'' said Dr. Leffmann, ''that in the case of the nitric acid a large amount of it has been changed by the water with which it is mixed in such a manner that its hydrogen (to which its acidity is largely due) has been in great part given an electric charge which has made it very active, while in the case of the acetic acid only a very small portion of the hydrogen has been so electrified.''

The concentration of hydrogen ions in the water in the soil, upon which plants depend for growth, has been found to have a most important effect upon such growth. Rhododendrons were cited by Dr. Leffmann as a plant which requires a high concentration of hydrogen ions in order to thrive, and some diseases of the potato may apparently be controlled by growing it in a soil where the concentration is high enough to kill the disease but not to injure the plant.

CROP ROTATION

Science Service

CROP yields may be increased about as much by the practice of crop rotation without fertilizers as by the use of fertilizers without crop rotation, Dr. Milton Whitney, chief of the Bureau of Soils of the U. S. Department of Agriculture, told the American Institute of Chemical Engineers in session in Washington on December 7. If both crop rotation and the use of fertilizers is practiced, the yields are nearly equal to the sum of the increases obtained by rotation and by fertilizing.

Before the war, Germany was the greatest user of commercial fertilizer, with a consumption of 188 pounds to the acre of land in crops, Dr. Whitney stated. The consumption in this country was 40 pounds to the acre on the average, ranging from practically nothing in the western grain districts to 150 pounds to the acre in Maryland and 345 pounds in Florida. At present the cotton crop west of Alabama is practically unfertilized and the commercial crops of grain and hay are produced without artificial fertilization.

Dr. Whitney said the abandonment of the medieval system of agriculture in England, the development of individual farm holdings, the introduction of crop rotation, fertilization, and better methods of tillage, had increased the average yield of wheat in that country from 6 to 32 bushels to the acre in about 700 years.

ERADICATION OF GRASSHOPPERS

Science Service

MAN-POWER, money and arsenic are the best weapons in the fight of northwestern farmers against the grasshopper pest which caused millions of dollars damage to grain crops last summer, said Dr. George A. Dean, of the Bureau of Entomology, U. S. Department of Agriculture, in an exclusive interview with Science Service. Dr. Dean recently returned from a tour of inspection which included most of the states west of the Mississippi.

The grasshoppers breed in the unplowed pasture land of the cattle ranges, he said. Where, as in Kansas and Nebraska, the proportion of such land is small as compared with that of the thickly settled and well tilled farm land, the pest may be more readily controlled. In the Northwest the grasshoppers so outnumber their human enemies that they can eat up all the poison which the few inhabitants of a large area can afford to provide for them, and then can sweep on over the bodies of their ''shock troops'' into the luscious crops awaiting them.

The two direct methods of attack on the grasshoppers are by the use of branmash bait poisoned with arsenic, and the cultivation of the soil, as plowing and disking, disturbs their egg pods buried there to await the coming of spring. In Kansas, cooperation has made possible the practical control of the pests for the past five years. In Montana and Wyoming there are too many breeding grounds and too few enemies, so the grasshoppers flourish. Weather conditions during several seasons were ideal for them and for their depredations, since the dry weather favored their breeding and dried up their natural food, the pasture grass, and so directed their attack upon the farmers' crops.

A pest doing great damage in the Southwest, Dr. Dean found to be the alfalfa-seed chalcis fly which lays its eggs in the immature seed of the plant. As much of the

southwestern crop of alfalfa is raised for seed, this creature is an enemy to be feared. The best methods of control are clean culture and close cropping, which do not permit stands of the plant to be abandoned, and in this way furnish attractive homes for the pest.

THE SURFACE AREA OF ANIMALS

Science Service

THE problem of working out a formula for the determination of the surface area of the skin of cattle and swine, a matter of considerable interest to students of animal husbandry and possibly to buyers of hides, has been worked out by Professor Albert G. Hogan and Charles I. Skouby, of the College of Agriculture, University of Missouri.

The smaller any object is, the greater surface area it has in proportion to its weight. Cattle and other animals are no exception to this general principle, and since the amount of heat they radiate depends largely on their surface area and the source of the heat is the food they eat, the knowledge of just what is the extent of surface is of importance to students of how much food is needed to keep the animal machine in good working order.

By application of this new formula, all that is needed to know is the length of the body of the animal, its weight, and a certain number called a constant which enters into the equation and is the same for every species. With these the area of the beast may be figured out. Results are accurate to less than five and a half per cent.

The length of the body of the animal is measured from the point of the withers to the root of the tail. The "point of the withers" is defined as the point above the junction of the second and third thoracic vertebrae. If any portion of the neck of the animal is included, measurements are likely to be inaccurate and no reliable formula can be worked out, since a change of position would affect the result and, as the experimenters state, "it is impossible to secure any cooperation from the animals in taking these measurements."

AUTOMOBILE ACCIDENTS AND TUBERCULOSIS

Science Service

ONE person died from an automobile accident during October to five who died from all forms of tuberculosis, according to a report just issued by Dr. Louis I. Dublin, statistician of the Metropolitan Life Insurance Company, on the mortality during that month among the 14,500,000 industrial policyholders of that company. Auto fatalities were at the record-breaking figure of 19.4 per 100,000, never equalled in any previous month. Fatal accidents of all sorts showed an increase of 25 per cent. over the corresponding month of last year. Commenting on these figures, Dr. Dublin said:

"The almost constant comments made on the high automobile fatality rate by those concerned with the health and safety of the American people may seem like ceaseless repetition. However, they merely fulfill the obligation to keep emphasizing this deplorable condition until we are successful in turning the tide. In August we stated that little doubt remained that the 1923 automobile fatality rate would be higher than ever before; now no doubt whatever remains. In this group of more than 14 million persons, the leading cause of death during October, organic heart disease, was responsible for only six deaths for every automobile fatality; and all forms of tuberculosis combined caused only five deaths to one from an automobile accident."

The death rate among the industrial policyholders for October was eight per 1,000, which is substantially the same as that for October of last year. The 1923 year-to-date death rate is only a very little higher than the 1922 rate at this time last year. It thus becomes more and more probable as the year draws to a close that unless health conditions change sharply for the worse in December, the death rates for 1923 and 1922 will be practically the same. The year opened with the most unfavorable first quarter since 1920, but this has been followed by the best eight months in the health history of the industrial policyholders.

ITEMS

Science Service

CODFISH No. 231 has been caught three times by the same fishermen at least twenty miles from land on a fishing ground many square miles in extent. This is a fish story vouched for by the scientific records of the U. S. Bureau of Fisheries. Experts on the government boat *Halcyon* caught this cod on Nantucket Shoals, Mass., on June 28, and promptly clamped a metal tag bearing the number 231 upon his tail. He was turned loose, but on October 3 was again caught by the *Halcyon* while continuing its experimental work in the same waters. The number was noted and the fish again released. On October 15, No. 231 was again back with his old acquaintances on the *Halcyon*. This is the record of one of the 128 fish tagged by the bureau off the New England and Canadian coasts in an effort to learn more of the migration routes and habits of valuable food fish. Since October 15 fish tagged off Massachusetts have been taken off the New Jersey coast, and the records indicate that they are migrating toward the south. It is expected that a comparatively large number of fish tagged this summer will be caught in the vicinity of New Jersey during the coming winter and spring.

DR. P. S. HENCH and Miss Martha Aldrich, of the Mayo Clinic, report to the American Medical Association a method of examining the saliva which yields valuable information regarding the function of the kidneys. After the saliva is collected the amount of urea that it contains is determined by a chemical test using sodium carbonate and mercuric chloride. Tests on more than five hundred persons showed that the salivary urea definitely paralleled that of the blood. Urea is a waste product formed in the body by the chemical processes of living. It is carried by the blood to the kidneys and the amount of it present in the blood is a measure of the efficiency of those organs. The new method of testing saliva may make blood tests for this purpose unnecessary.