can only orient the particles at or near the maximum of the current waves. This seems to indicate that a certain very low value of the magnetizing force is sufficient for the orientation or alignment of the particles. Retention of vision by the eye may also cover up any very short interruptions in the luminous effect itself.

Use has been made, since the publication of the original descriptions, of the new effect for rendering visible to the eye a rotating field produced by biphase, three phase, or polyphase currents. The effect is unique, and naturally quite interesting. It can be photographed.

If we provide a box with a glass front and back and means for introducing the iron arc smoke, a beam of light sent in from the back with no excitation or magnetic field present, there is no marked result. We may now place on the box a coil lying flat on the top and conveying current. In this case there is clearly displayed a luminous effect; the field of the soil has been depicted. In each case, of course, iron arc smoke has been within the box at each trial. It can be allowed to enter through a hole at the bottom of the box provided therefor.

It is surprising, too, how long a time it takes for the fumes to settle out of the air within the apparatus.

We have constructed a device for rendering visible a rotating field, such as that of a three-phase motor. The structure is, in fact, a three-phase field winding, as in a motor. As the ordinary frequencies would be too high for observation, there is provided a small motor driving at reduced speed a small generator of the three-phase currents needed for the excitation of the field. Usual arrangements are provided for varying the speeds, and thus the cyclic rate or frequency of the currents in three-phase winding. The open field space, as in an alternating current motor with the rotor removed, is arranged with glass ends so that it may receive and retain iron arc smoke. In this way, the revolving field inside the structure becomes distinctly visible as a luminous glow revolving within it.

The direction of revolution may also be instantly changed by the switches provided for reversing two of the phases, and the speed of revolution of the field may be made slow, or so fast that retention of vision results in a continued interior luminosity.

It is probable that with further development such arrangements may be designed as to make use of this magneto-optical phenomenon in the study of distortions in alternating fields by the introduction of closed circuits in the form of rings, plates and various forms of conductors, or even to compare the distortions produced by the material as well as the form of conductors in alternating fields. Perhaps, also, the distortions of field lines produced by revolving or moving conductors even in direct current fields may be exhibited or investigated. My time has not permitted such work, interesting as it may be, to be carried on.

ELIHU THOMSON

THE EUROPEAN LARCH CANKER IN AMERICA[1]

IN April, 1927, members of the Harvard Forest School brought to the senior writer's attention specimens of a trunk of European larch bearing several cankers in the thin smooth bark of the younger parts. The appearance instantly suggested the European larch canker disease and it was quite evident that it was acting as a parasite. Fortunately perfect fruiting bodies were present and the fungus was found to agree in general with the microscopic characters published for *Dasyscypha calycina* (Schum.) Fuckel. Examination of the plantation from which the specimen came showed abundance of cankered trunks and branches. The fungus occurred on dead twigs and branches as well as on living bark of younger parts of the trees. Since that time investigations have been carried on to determine how serious the disease is, and how extensively it is distributed in that vicinity. It has been found attacking European larch (*Larix europaea* DC.), Japanese larch (*L. leptolepis* Gordon), eastern American larch (*L. laricina* (DuRoi) Koch), Douglas fir (*Pseudotsuga taxifolia* (LaMarck) Britton), pitch pine (*Pinus rigida* Miller) and Scotch pine (*P. sylvestris* Linn.) and on four different estates situated in the three towns, Hamilton, Ipswich and Danvers, Massachusetts. In Europe it is reported to attack the additional species which are native or generally introduced here; *Larix occidentalis* Nuttall, *L. sibirica* Ledebour, *Picea excelsa* Link, *P. sitchensis* Carrière, *Pinus nigra austriaca* Asch. & Graeb., *P. cembra* Linnaeus, *P. laricio* Poiret, *P. mugho pumilio* Zenari and *Abies pectinata* DC. The origin of the disease is quite conclusively indicated by the fact that the European and Japanese larches on two of the estates were imported as seedlings from Scotland in 1904 and 1907. Old cankers are located within a foot of the ground on wood which must have been formed when the trees were imported. Some of the diseased Douglas fir is also known to have been imported as seedlings. The amount of infection in European larch runs up to one hundred per cent. of the trees; Japanese larch is relatively resistant, but Douglas fir infection near diseased European larch is about eighty per cent., with

[1] Published by permission of the U. S. Secretary of Agriculture.

numerous cankers similar to those on the larch. There is no reason to suppose that this locality is the only one where the disease occurs; indeed the reverse is practically sure to be the case, as it is well known that European larch was imported widely and quite generally twenty to fifty years ago. The fact that it can go onto so many different American species, which are important timber trees, makes this discovery of very serious importance to all parts of this country. Further scouting is being done to see if it is widely distributed.

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THE DEFICIENCY OF ENGLISH UNITS OF MEASURE AND WEIGHT FOR SCIENTIFIC AND TECHNICAL USES

THERE are certain deficiencies in the English measures and weights which may be ascribed to historical causes and which have been imperfectly supplied by the use of troy and metric small denomination units. But the troy and metric units are not commensurable with the common or English units. The cause of this deficiency is that the English units were developed for the uses of trade, construction and manufacture, to which purposes they are perfectly adapted. The demand for technical, scientific and precision units is a relatively modern demand.

The English measures have no unit lower than the inch, whereas the metric system has seven such units, *viz.*, centimeters, millimeters, microns, angstroms, millimicrons, milliangstroms and micromicrons, of which the inch contains 2.54 centimeters, 25.4 millimeters, 25,400 microns, 254,000 angstroms, 25,400,000 millimicrons, 254,000,000 milliangstroms and 25,400,000,000 micromicrons.

Likewise the English weights have no unit lower than the ounce, whereas the troy and metric weights have 12 such units, *viz.*, drams, pennyweights, scruples, grams, carats, metric carats, decigrams, grains, centigrams, milligrams and micrograms, of which the ounce contains 7.2916 drams, 18.229 pennyweights, 21.875 scruples, 28.3502 grams, 138.449 carats, 142.045 metric carats, 437.5 grains, 2835.02 centigrams, 28,350.2 milligrams and 28,350,200 micrograms.

To supply the deficiency of our common units in the field of technical and scientific measures and weights, it is proposed that the foot be divided on the decimal scale into 100 lines and 1,000 points and that the ounce be divided into 8 drams, 100 centos and 1,000 moits, the ounce being the cube of the tenth of the foot, the dram the cube of the twentieth of the foot and the moit the cube of the hundredth of the foot of water at the maximum density. The common eight-ounce cup is the cube of two tenths or of one fifth of the foot. This will supply the deficiency of common units lower than the inch and the ounce, made necessary by modern refinements in measuring dimensions, volumes and masses.

For definitive purposes it is proposed that the foot be taken as the length of 473,404 waves of red cadmium light, that the ounce be taken as the weight of 28,316 milligrams and that new material standards or master bars and weights be constructed from these definitive values.

The avoirdupois pound was anciently regarded as equal to 7,002 troy grains. In 1844, however, after the burning of the parliamentary standards, the pound for the sake of certainty was defined by parliament as the weight of 7,000 troy grains, which produces 437.5 grains to the ounce.

The proposal to define ounce as 28,316 milligrams recognizes 28,316 grams as the weight of the cubic foot of water under the definition of the foot as 473,404 red cadmium waves. This takes 34 milligrams off the ounce, which for practical purposes may be regarded as one-half grain of 32.4 milligrams, thus reducing the ounce roughly from 437½ to 437 grains.

It is quite as legitimate to give the ounce a definition in milligrams as it was to give the pound a definition in troy grains, as was done more than eighty years ago. This is the one way to coordinate the ounce with the cubic foot of water and to correlate common volumes and weights.

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"WASHBOARD" OR "CORDUROY" EFFECT DUE TO THE TRAVEL OF AUTOMOBILES OVER DIRT ROADS

THE interesting account of the so-called "washboard" or "corduroy" effect due to the travel of automobiles over dirt roads calls to mind an experience which the writer had last summer in the northern part of Minnesota.[1] Professor Dodd's explanation is very much to the point and on the whole I think plausible, but I am not sure that the explanation has gone far enough. In the single instance observed, my motor car was following a "grader" over a newly graveled stretch of road and, since I had myself advanced several theories concerning the cause of this

[1] Dodd, L. E., "'Washboard' or 'Corduroy' Effect Due to the Travel of Automobiles over Dirt Roads," SCIENCE 66, 1927, 214–216.