prevalent temperature must be on the average between the boiling and the freezing point of water, though a slight excess or defect beyond these limits is possible. This is of course the most serious limitation of all. The freezing point of water is 273° Abs.; the boiling point depends on the atmospheric pressure, but as we must not have too dense an atmosphere we shall be safe if we say that the boiling point will not lie above 500° Abs. (227° C.), which is its value under 27 atmospheres pressure. This gives us a temperature range of only 500–300 or less than one octave out of the 24 or 30 octaves that occur in nature.

The application of these conclusions to the universe is a matter for the astronomers. The conclusions are not of course confined to the solar system, though there is a difficulty in applying them anywhere else, since all the stars that we can see are too hot, and life could only occur on their planets, which are too small to be visible. As far as the familiar planets of our own system are concerned, they only confirm the views that have long been held. The moon is much too small for life to be possible; Mercury is probably too small and too hot; Jupiter and the outer planets are too cold. The only places in the solar system where life is possible seem to be the earth and our two neighbors, Mars and Venus.

OBITUARY

FREDERIC E. IVES

FREDERIC EUGENE IVES, inventor, investigator, scientist, died on May 27, 1937, at his home in Philadelphia. His achievements were many and important, and were all the more remarkable in that he was essentially a self-educated man; he never attended a formal school after he was twelve years of age.

He was born on February 17, 1856, on a farm near Litchfield, Connecticut. His parents were descendants of the early New England settlers. From his father, Hubert Leverit Ives, a hard-working farmer, he inherited a capacity for concentrated application to which may be credited much of his success; from his mother, Ellen Amelia Beach, he derived a love of the artistic which doubtless stimulated his interest in the field of investigation which he chose for his own.

When he was twelve his father died, which interrupted his schooling and forced him to earn his living. After a brief and unsatisfactory experience as clerk in a country store he became apprentice in the printing office of the *Litchfield Enquirer*. The years spent in this newspaper office formed an excellent substitute for the schooling which he had missed and also gave him valuable training in preparation for his future career.

At this time he became interested in picture making both by the process of wood engraving and the art of photography. The limitations of the former method impressed him with the advantage of the photographic process and led him later to attack the problem of photo-engraving. His spare time, which was little, was spent in experiments in photography, his first camera being made, as he tells us, of a cigar box and a spectacle lens.

After completing his apprenticeship he worked for some time as a printer but soon turned to photography as his vocation. This led to his employment in 1874 by Cornell University, where he remained for four years in charge of the photographic laboratory. His contact with this institution doubtless stimulated his interest in the scientific aspect of his work and inspired his inventive genius. It is to these years that we refer his first notable achievement, the invention and the development of the first commercially successful half-tone process of photo-engraving.

The success of this invention, which has revolutionized the art of illustration, led him to connect himself with a printing establishment in Philadelphia in which he worked as a photo-engraver, maintaining at his home a private laboratory where he busied himself incessantly in numerous investigations which many times led to important inventions. Here in 1886 he developed the cross-line screen method of half-tone reproduction which is now universally used, superseding his earlier process. Here also he carried out the extensive experiments in color photography and color reproduction by the trichromatic process. His brilliant success in the solution of this problem by the invention in 1892 of the photochromoscope, or, as he called it, Kromskop, won for him recognition in the scientific world. This was perhaps his greatest achievement, and one in which he continued to work throughout his life, developing improved methods and new applications; as for instance to the moving picture industry, where the colored films shown at the present time are largely due to his inventions.

In addition to these accomplishments the work of Ives bore fruit in many other ways. Numerous devices, mostly in the field of optics, are due to his ingenuity. Among these may be mentioned an improvement in the binocular microscope, the parallax stereogram, diffraction grating replicas, a diffraction photochromoscope and a trichromatic colorimeter. Over seventy patents were taken out for his inventions, and as many more could easily have been obtained.

With exception of a few years in London and in New York spent in exploiting his inventions, the remainder of his life was passed in Philadelphia. He

was an active member of the Franklin Institute for over fifty years and frequently reported his investigations before that body. He was also a member of the American Philosophical Society and of many other scientific organizations.

While a number of medals were awarded him for his inventions and while his work was appreciated by those who were best able to judge, still it did not receive in his lifetime the recognition which it deserved. After his death the city in which he had dwelt so long made partial amends. The 22d of July, 1937, was designated officially as "Ives Day," and a public tribute was paid to him at the Franklin Institute at which the pioneer nature of his inventions on half-tone and color photo-engraving was appropriately commemorated. On this occasion the son of the inventor, Herbert E. Ives, of the Bell Telephone Laboratories, presented to the institute the original patent in color photography and other memorials of his father.

The chief characteristic of Ives's method of work is that it was firmly based on true scientific principles and not upon a haphazard seeking for results. His cross-line half-tone process was worked out with a thorough understanding of the optical principles involved in lens aperture, line spacing, etc. Again his work in color reproduction shows a complete grasp of the trichromatic theory of Young, Helmholtz and Maxwell which was completely lacking with most of the other experimenters in this field; with the result that all subsequent work in color printing and color photography is based upon his fundamental investigations. Moreover, he possessed the skill of utilizing these scientific principles to obtain practical results with the maximum of simplicity. In consequence, much of his work has a completeness and one might say an artistic quality which left little room for improvement by his successors.

Unfortunately he did not reap the proper material reward for his ingenuity. Some of his inventions (notably his half-tone process) were unprotected by patents. Others were the subject of costly litigation or were infringed upon by his competitors. Fortunately for himself and for the world he was a type of man who—to use his own words—"will pursue his course through any amount of poverty and hardship and indifference, thinking much more about his work than about any material reward which it may bring." And he closes his autobiography with the words "I am thankful that I could find contentment in the pleasure of accomplishment."

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RECENT DEATHS

DR. MELVIN E. HAGGERTY, dean of the education department of the University of Minnesota, president of the National Association of College Teachers and an authority on educational psychology, died on October 6. He was sixty-one years old.

DR. WILLIAM KELLY, mining engineer, of Iron Mountain, Mich., past president of the American Institute of Mining and Metallurgical Engineers, died on October 1 at the age of eighty-three years.

DR. NATHAN WINSLOW, professor of clinical surgery at the School of Medicine of the University of Maryland for thirty-four years, died on October 7 from injuries suffered in an automobile accident.

LEON HOWARD WORTHLEY, of Montclair, N. J., principal administrator of the division of Japanese beetle control and Dutch elm disease eradication of the Bureau of Entomology and Plant Quarantine of the U. S. Department of Agriculture, died on October 9 at the age of sixty years.

EDWARD B. FITTS, professor of dairy husbandry at the Pennsylvania State College, died on September 27. He was sixty-six years old.

DR. LOUIS NAPOLEON DELORE, for forty-nine years professor of anatomy in the University of Montreal, died on October 3. He was seventy-five years old.

PROFESSOR ADOLF L. F. LEHMANN, from 1909 to 1930 professor of chemistry in the University of Alberta, died on September 27, aged seventy-three years.

DR. DE BURGH BIRCH, emeritus professor of physiology at the University of Leeds, died on September 18 at the age of eighty-five years.

DR. ST. CLAIR SYMMERS, from 1904 until his retirement in 1930 with the title emeritus Queens professor of pathology at Queens University, Belfast, died on October 4 at the age of seventy-four years.

DR. RICHARD VON HERTWIG, professor emeritus of zoology and comparative anatomy at the University of Munich, died on October 4 at the age of eighty-seven years.

SCIENTIFIC EVENTS

THE AUSTRALASIAN COLLEGE OF PHYSICIANS

ACCORDING to *The British Medical Journal* the Australasian College of Physicians, which now comes into existence, has been planned to some extent on the pattern of the Royal College of Physicians of London, with variations to suit the needs of a community whose professional schools and leaders are scattered sparsely through a large continent where means of communication are not yet fully developed. The *Journal* states