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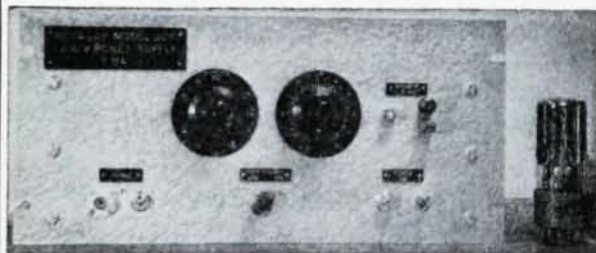
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Letters to the editor

Physics and the Great Frontier

In the September issue of *Physics Today*, an article entitled "Physics, History, and Fate" by Walter Prescott Webb presented the hypothesis of the "Great Frontier" and the role physics has played during the "Great Frontier" epoch of Western history. Dr. Webb's theory that the expansion of Western civilization into the New World played a dominant role in forming this civilization during the last 450 years seems very sound to me; but I feel that his attitude toward physics, and the natural sciences in general, is a very modern one which does not adequately portray the role of the natural sciences during most of their history. Until the second quarter of the 20th century, workers in the natural sciences, as well as the general public, did not believe that the natural sciences were "shaping the civilization". Rather, the physicists of that era were the logical successors to the medieval theological scholars. When the Renaissance broke the bonds of medieval authoritarianism, the scholarly mind first questioned Aristotle and then began to question the ideas which it substituted for those of the authorities of medieval Europe. The whole thing snowballed, since every "answer" to a question uncovered a host of additional questions requiring further answers. In general, throughout most of their growth, the natural sciences were harmless games in which the players, in an all too anthropomorphic fashion, ascribed order and regularity to natural phenomena, basing their conclusions on observation, instead of authority.

The inventors of the late 19th and early 20th centuries who developed our present highly mechanized civilization (in which the rate of utilization of irreplaceable natural resources has grown so great) did not feel that they owed a direct debt of gratitude to the pure scientist; and, in that same period, the average scientist would have been shocked to be considered a major factor in the shaping of civilization. It is only now, toward the close of the "Great Frontier" movement, that the natural sciences are being recognized as cultural leaders, and it is only during the last several decades that physics has been directly concerned with the so-called practical problems of mankind.

Rather than facing the melodramatic doom envisaged by Professor Webb, I imagine that physics and the other natural sciences will become greatly venerated in the society of the post-expansion future and will join those outmoded social institutions which linger on in

their outward form alone. Presumably, when we have wasted all of our easily obtainable natural resources, the people will look to the physical sciences to return to them "the good old days of their forefathers". By this time, however, these sciences will be so weighted with civic responsibility that no move can be made without approval from authority, and they will thus have irrevocably lost all the vigor and life-blood of their youth. The public airing of the divergent views held by Drs. Oppenheimer and Teller concerning the hydrogen bomb may be a foretaste of what the future has to offer. Such a prospect of the future role of "science" is interestingly presented by Aldous Huxley in the *Brave New World*.

John R. Van Wazer
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Ice

I read with considerable interest Mr. Zapffe's article in the October issue. His speculations are open to some criticism. In particular, the formula for the straight line in Fig. 4 would appear to be approximately

$$\log_{10} I = 0.787 - 0.43 \log_{10} t$$

rather than

$$\log_{10} I = 2.68 - 0.465 \log_{10} t$$

as given in the article. The principal reason for pointing out this is that the figure implies that at some future time, the interglacial epoch will become very small. As examples, for $I = 10$, $\log_{10} t \simeq -0.5$, or $t \simeq 0.316$, i.e., about 3000 years, and for $I = 17$, t is about 1000 years. Since Fig. 2 shows the glacial epochs likewise decreasing in duration, the extrapolation of the line of Fig. 4 results in a prediction of ever more rapidly occurring cataclysms.

Secondly, when a logarithmic function is plotted as in Fig. 3, the choice of the origin is quite important. There would appear to be no reason other than theological for choice of the origin. We may note that the year zero does not occur in our chronology, but even so the years A.D. are not plottable on the logarithmic scale. If it were sought to achieve a logical choice, on the cataclysmic theory, for the era from which time should be measured to be logarithmically plottable, this presumably would be that future time when the occurrence of cataclysms becomes very frequent, i.e., when they are separated by times such as a thousand years which are inadequate for either glaciation or deglaciation to occur. Such a choice would certainly destroy the linearity of Fig. 3. Is it not possible that the occurrence of logarithmic relationships is simply a result of the increasing incompleteness of our knowledge of the past as we recede from present time? On this view, the logarithmic relationships are essentially subjective.

Chester J. Calbick
Murray Hill, N. J.

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