

letters

These powerful agencies are the ones responsible for the harmful uses of science; they are also the main sources of financial support for science. If physicists were seriously to shun the harmful avenues of scientific work, they would assuredly incur severe economic hardship for themselves. I do not expect physicists to volunteer for martyrdom; but I do think that the truth in this situation should be openly acknowledged.

Thus, the APS membership may be expected to vote down the proposed amendment because the majority is fundamentally dedicated to "the enhancement of the quality of life" for themselves first, and concern for "the welfare of mankind" is secondary.

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Superconducting progress

The curve below provides an amusing perspective on current efforts to find superconducting materials with higher critical temperatures. A survey of researchers would probably yield the opinion that this progress is rapidly saturating. In point of fact, however, the accompanying curve suggests that the progress made since the discovery of superconductivity has been more or less constant. This is a curve of the maximum known critical temperature plotted throughout the years since the discovery of superconductivity. Data were obtained by starting with the most recent data point and working backwards using references in the cor-

responding article. There is some "fuzziness" in the curve around the early 1940's when data were slow in coming out of Germany, where some of the research was being done.

Notice that the recent materials are becoming increasingly more sophisticated, indicating that it is perhaps becoming more difficult to discover them. Although linear extrapolations are always dangerous the curve suggests 2140 and 2840 AD as dates for achieving superconductivity at 77 and 300 K, respectively.

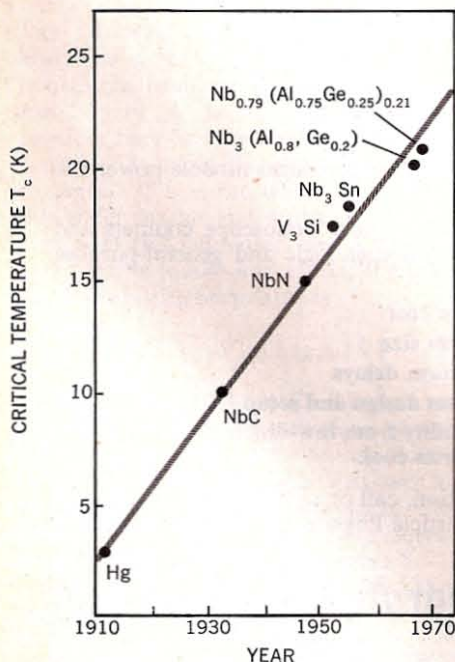
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Large-volume problem

Clarence Zener's article "Solar Sea Power" (January, page 48) was interesting both in what it said and in what was omitted. It is quite likely that most physicists have at one time or another considered the vast amount of energy stored in the thermal gradients that exist in the oceans or in other geophysical systems. One always concludes, as Zener illustrates, that the potentially available energy is sufficient to satisfy the most inflated estimate of our power needs. Even at the low conversion efficiencies that result from small temperature differences, the total amount of power that may be extracted is huge.

The major problem that arises when one contemplates extraction of power from a source such as the ocean's thermal gradient is not in designing an engine to operate across small temperature differences, but rather in finding some way to make thermal contact with the required enormous volume of each thermal reservoir. This is very important, because the volume density of available power is small; it is the tremendous volume of the ocean that results in the great size of this resource. Hence, one is forced to gather water from many square miles of ocean surface, and the generator's effluent must similarly be distributed over many square miles of ocean area. This input/output process must be accomplished in such a way that the effluent does not return to the intake before it has been heated sufficiently by solar radiation.

Unless the generator is situated in a natural current, it is difficult to see how the efflux will be sufficiently isolated from the intake. Putting it another way, it would appear as if a natural, strong current is needed to bring the required volume of water into thermal contact with the generator. The artist's impression on page 49 shows a vertical structure that may not utilize an ocean volume much greater than the cube of its length (or an order of magnitude larger) unless some undis-



Progress in attaining higher maximum critical temperatures since the discovery of superconductivity.

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