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.

CHARLES SCHWARTZ
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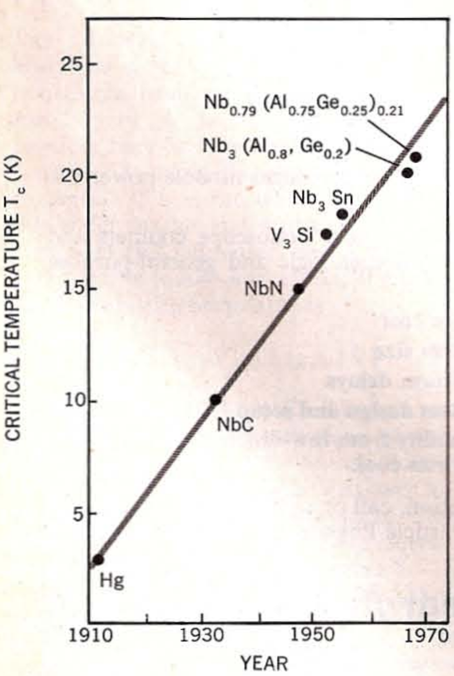
Superconducting progress

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 corresponding 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.



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

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.

BRUCE W. FRIDAY
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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-

The new standards in discriminators

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cussed provision is made for properly moving the water in the vicinity of the power plant. Even if the heat exchangers and internal components are capable of producing large output power, an unfortunate eddy-current may be set up between the efflux and intake, resulting in a low output equilibrium condition.

Of course, my comments are primarily intuitive, since I have not analyzed the hydrodynamics and thermodynamics of the situation. It is possible that such a detailed analysis would predict some sort of stable flow that could overcome the eddy-current tendency and could confine efflux and intake flows to the appropriate strata. If so, this result would be of immense importance and should have been mentioned in the article. I have little doubt that if the "large-volume problem" were conceptually solved, then funds would rapidly become available for research, development, test and engineering in this area.

In closing, I would like to point out a real need for physicists, not to design boilers or heat exchangers, but to understand and solve the problems of working with very large volumes. In most cases where geophysical power sources are currently used (for example, hydroelectric or tidal electric generators) the large volumes of material are moved through the apparatus by Nature. What is needed to utilize some of the other natural power sources is a means for interacting with reservoirs that are not so cooperative.

HOWARD S. MARSH
Nashua, N.H.

THE AUTHOR COMMENTS: Howard Marsh is quite right in calling attention to the problem of mixing of efflux and intake. As he has suggested, this problem may be resolved by taking advantage of naturally occurring ocean currents. If L is the distance between the boiler intake and efflux, D the diameter of the condenser, and V the velocity of the intake and efflux, the condition for negligible mixing is

$$(D/L)^2 < (V_{\text{ocean current}}/V)$$

We have considered the Caribbean as a most suitable site for solar sea power plants. Here the currents are sufficiently strong, greater than ½ ft/sec, to satisfy the above condition up to the optimum size plant we have envisioned, namely 200 000 kW output.

Because of ecological reasons, the cold efflux of the condenser should not mix with the warm layer above the thermocline. This cold efflux must therefore be discharged into a layer considerably below the top of the thermocline. The density stratification of the thermocline will then prevent the unwanted mixing.

CLARENCE ZENER
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Utah effect obituary

According to your report (November, page 20), Jack Keuffel and his collaborators have after nearly five years finally given up their discovery of the so-called W-particle. Estimates of the rest mass (≈ 45 GeV) and of the production cross section ($\approx 10^{-28}$ cm^2) of Utah's W-particle were made from the data in which one important point was suppressed (the data point around 5.5×10^5 cm^{-2} of ground depth in figure 2a).[1] Inconsistency of this point with other Utah data was previously discussed,[2] and is clearly shown in figure 1 of the latest Utah paper.[3]

"Farewell to Utah's W-Particle" is not necessarily the death of intermediate vector boson theory and of the 37.3-GeV boson, but should simply be regarded as an indication that the production cross section of this particle is not as large as previously claimed.[1] Detection of this particle should be pursued further, because the existence of a 37.3-GeV boson, if it is proved, has a profound significance in the field of weak interactions.[4] The detection, however, will not be by time-consuming and inaccurate underground experiments but by far more accurate detectors, hopefully with the help of accelerators and of intersecting storage rings.

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Mothers with PhD's

In commenting on my letter (June, page 15) in which I advocate the establishment of permanent part-time faculty positions at colleges and universities, M. Rothenberg takes me to task for having a sexist bias in terminology (October, page 67), that is, for referring to physicists as "he" or "him" and speaking of the physicist's "wife" rather than "spouse." He suggests that