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**COVER:** Its penstocks filled with concrete, an old hydro plant at High Falls, N.Y., typifies the wasted power potential of many U.S. dams. High oil prices, however, are bringing about a hydropower renaissance, and High Falls is among the many dams that may soon be producing power once again. See story p. 42. (Photos: Solar Age)

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**LETTERS**

**Red sails in the sunset?**

William Calder's letter (SN: 5/27/78, p. 339) is, of course, correct that if Archimedes ever set fire to a ship's sails with sunlight, his array of reflectors would have defined a concave, not convex, surface. However, his remarks about the angular diameter of the sun do not address the basic issue. The effectiveness of a solar "burning glass" or equivalent depends, in principle, only upon the optical speed (or *f*-ratio) of the system, and not upon its focal length. If we suppose that the sails of the ships would have ignited at around 475°F, then an application of the Stefan-Boltzmann law indicates that, *in vacuo*, the reflecting array need only subtend, at the sail, an angle some 10 times the angular area of the sun. This would be about an *f*/36 system.

However, the real environment is not *in vacuo* but in a sea of air which remains much cooler than the sail's ignition point, consequently a faster array would be needed in practice. To generate some quantitative data, I have tested several lens *f*-ratios on the ignition of paper (which, to be sure, is not a sail). I found that at *f*/4 the paper burst into flame almost immediately—once a long enough focal length is available to make the solar image appreciably larger than the jitter in my hand-supported system; I used an 11-inch focal length. The same lens at *f*/5 produced a rapidly expanding hole in about 20 seconds, and did so at *f*/6 in a little less than a minute. *f*/7 produced only a slight char in one minute. Incidentally, if one is to make a habit of this sort of thing, he should wear some eye protection such as welding goggles.

If we put a ship a quarter of a mile from Archimedes' men, and require an *f*/4.5 reflector, this would mean an array close to a hundred yards in diameter, say on a steep hillside. This assumes the system isn't working far off-axis, otherwise a larger array could be needed. The array elements, for such a focal length, would suffer little by being flat. If they included an aiming system with each element, like the classical heliograph signaller, the thing might well have been feasible! Whether it ever did happen, I haven't the slightest idea.

C. B. Stephenson  
Cleveland Heights, Ohio

**William A. Calder's challenge** to the legend of Archimedes doesn't do the old gent justice. I once saw a demonstration where 30 plane mirrors reflecting sunlight to the same area of a wood plank easily set it on fire. If the sun's image is spread over one-half degree (about .009 radians) then a one-square-meter mirror would spread its reflected energy over  $9^2 = 81$  square meters at a distance of one kilometer. If

the defenders of Syracuse had a battery of  $30 \times 81 = 2,430$  such mirrors on their walls, aimed with the signal mirror method, they could have equaled the wood plank demonstration.

Even if Archimedes could have come up with only 600 mirrors and a burning distance of half a kilometer, he should have been able to convince the Romans to keep their distance. Surely there could have been 600 families of Syracuse that could afford a large polished mirror. When it was not in use defending the city it would make a fine addition to the hallway.

Robert W. Davis  
Gainesville, Fla.

**The child revisited**

This letter is a response to Adah Maurer's response (SN: 6/3/78, p. 355) to William Elmer's response to an article in SCIENCE NEWS (SN: 4/8/78, p. 211).

I take issue with Maurer's "enlightened" platitudes. Studies by Glueck, Strauss, Langner, Welsh (and many others) do *not* show that violence *begets* violence. They show only a correlation between antecedents and later action. Actual *causality* is buried deep (and impentrably) in the roots of human motivation.

But that's nitpicking. The real issue is what the future holds for a child who has received corporal punishment regularly versus the child who has not. It has been found that most who exhibit antisocial behavior experienced corporal punishment in their youth. I presume it would also be found that most who exhibit socially acceptable behavior also experienced corporal punishment in their youth (such studies are not made as a rule).

It is becoming apparent by now (I hope) that corporal punishment is not a central issue. What *is* central is the amount and quality of loving, of caring, of *strength* exhibited by the parent or guardian towards the child. Corporal punishment may be an expression of deep loving, caring, and considerable strength on the parent's part, or it may not.

John F. Leahy  
Gonzales, Calif.

**I agree with Adah Maurer.** In the Biblical "spare the rod and spoil the child," the rod referred to may be the parents' backbone, not a hickory switch. Children learn best by example.

Frances Ono  
Fresno, Calif.

**Male chauvinist monkeys**

In your article "A monkey blueprint for sexual boredom" (SN: 5/6/78, p. 294), you stated that male monkeys became tired of intercourse with the same females—and that this could have implications for human beings. Let me remind you that it works two ways—males should try to keep up sexual interest, too!

J. Kulczycki  
Albany, N.Y.

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