A Historian's View of the Gould Laser Patent Controversy

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Gould's 1958 work on the laser was distinguished by its fecundity. He discussed both non-resonant cavities—which he believed would be useful as a test bed for maser materials, for setting frequency standards, for spectroscopy, and for distance measurements—and resonant cavities incorporating Fabry-Perot structures, with uses in communications, radar, and heat processing. He explored a large variety of laser media and methods of excitation, including optical pumping, excitation by impact with energetic electrons in a gas discharge, and excitation through the transfer of energy from an excited "sensitizing" atom or molecule to an atom of the lasing substance ("collisions of the second kind"). As for laser media, Gould made calculations for sodium, sodium with mercury as sensitizing agent, and helium. He discussed, among other possibilities, zinc and thallium vapors excited by transfer of energy from krypton and xenon, molecular iodine pumped by sodium light, and optically excited europium sulfate in water solution. He supplemented these discussions with an enumeration in tables of other atoms that might be led to lase. He talked about parallel mirrors, curved mirrors, and 90º prisms as reflecting elements for the Fabry-Perot. Many of his analyses were, properly speaking, merely suggestive, with the physics not thoroughly worked through. There were many errors. Nevertheless, for sheer inventiveness, Gould's 1958 laser writings were a tour de force.

Gould filed a patent application in April 1959. When the Schawlow and Townes patent on behalf of Bell Laboratories, filed in July 1958, was granted in March 1960, Gould and TRG brought a challenge against it before the U.S. Customs and Patent Appeals Court, on the grounds that although Gould had filed later, he had conceived of the invention first. Since Townes and Gould had both been at Columbia University and had had direct interactions, questions were naturally raised as to whether one of them might have appropriated the ideas of the other.

Conscious, unacknowledged, and unscrupulous borrowings are a fact of scientific life. So are situations in which the same idea occurs independently to several people. There are, moreover, a whole range of cases that lie between these two extremes. Ideas only take root in prepared minds, and it is not always easy either for the outsider or the inventor to separate the preparation from the new seed. How can we make historical sense of this controversy? Let us begin by considering the problem of invention more generally.

It is a common opinion among historians of science and technology that it is usually a mistake to try to link an invention or a scientific discovery to a single individual or instant in time. In a recent study of early radio, Amherst College professor Hugh G. J. Aitken wrote: "We are inclined to think of invention as an act rather than a process because of the bias built into our patent laws. If property rights in a new discovery are to be secured, it is important to be able to establish priority in time… This bias, however, should not be allowed to corrupt our historical interpretations…invention [is] a process with considerable duration in time, one to which many individuals contribute in a substantial way."

Thomas S. Kuhn, in an article entitled “Energy Conservation as an Example of Simultaneous Discovery,” pointed out that for most of the period from 1830 to 1850, no two of the twelve scientists who enunciated forms of the concept of energy conservation were saying substantially the same thing. “What we see…is…rather…the rapid and often disorderly emergence of the experimental and conceptual elements from which [the theory of energy conservation] was shortly to be compounded.” In a 1962 article, Kuhn built on this analysis and identified the existence of a “structures within the history of a scientific discovery. There are, he suggested, inherent uncertainties in the date of a discovery and the identity of the person to be associated with it that can be analogized to the uncertainties that quantum mechanics decrees for the position and momentum of a physical particle.”

In the specific case of Townes, Schawlow, and Gould, I have no evidentiary base for judging whether or not Gould had already been thinking about the laser before Townes summoned him to discuss thallium lamps for optical pumping. But once Gould had the idea, then I believe that the documents leave no doubt that he developed it in a unique way. The differences between his work and that of Townes and Schawlow had to do with the differences in background, style, and knowledge that obtained among the three men.

Gould’s master’s degree at Yale had been in optics, whereas Townes was a microwave physicist. It is therefore not surprising that Townes’s first sketch of a resonant cavity for an optical maser, in September 1957, resembled a microwave cavity, whereas Gould’s sketch, in November 1957, was of an optical element, a Fabry-Perot etalon. Gould was primarily an inventor, whereas Schawlow and Townes were primarily physicists. Moreover, the three were working within very different literary forms. Gould was writing first an idea notebook, and later a proposal for a contract, while Schawlow and Townes were writing an article for a refereed journal. Therefore it is not surprising that Gould sent up a fireworks of partially developed suggestions, whereas Schawlow and Townes published a general discussion of the physics of optical masers, followed by a carefully worked through particular case. Only at the end of their article did they permit themselves a few suggestions, notably for a helium-pumped cesium laser, and a comment on the possibility of solid-state lasers. Townes and Schawlow were by far the more accomplished and knowledgeable physicists. This is reflected in the thoroughness of analysis in their paper as compared with Gould’s notebook.

Like the work of Kuhn’s twelve pioneers in energy conservation, the contributions of the Schawlow-Townes collaboration and of Gould in 1957 and 1958 were not entirely coextensive. The sum of the two was greater than either one. It is important to note, however, that that sum was still not big enough. This is proven by the fact that Townes’s group was not able to build a potassium laser and was, in fact, to abandon potassium for another working substance, while TRG was to succeed in reducing one of Gould’s suggestions to practice only in 1962, two years after the first laser had been operated. To build working lasers by the year 1960, the contributions of others would be needed. That is to say, the uncertainty in inventors would turn out to be larger than the trio of Schawlow, Townes, and Gould.