

Invention or Innovation?

It seems with greater regularity these days that I notice the announcement of some new development that strikes me as being rather familiar. I commented on this some years ago on my Web site, when I wondered if this was a new phenomenon, or whether I had just become old enough to recognize when I am hearing again about a development that had already been reported many years earlier. Since this appears to have become a trend, I now believe the latter. Not that it is necessarily a bad thing that many of the most worthwhile developments are destined to be rediscovered every 20 years or so.

I am often called upon to develop some new magnetic product or device and occasionally I am able to invent something new, maybe even proprietary and patentable. More often, though, the end-product is an innovation using some principle, technology or topology that has already found success in a different, even unrelated application. However, when one fails to look back far enough or thoroughly enough into the history of similar products, one might quite inadvertently fall into the trap of re-inventing a perfectly viable solution.

What started me thinking about this topic for my column was a recent television commercial concerning something as basic as the electric motor. What caught my attention was a description of proprietary technologies embodied in vacuum cleaners, in which Mr. Dyson mentions the problem of brush wear in conventional mechanically-commutated electric motors, and announces the brushless motor with the words: "Faraday had a good run...but after nearly 200 years we've finally moved on!" Notwithstanding that the conventional means of using a commutator and brushes continues to provide a simple and economic solution which is very popular, brush wear and the associated dust are

potentially only a problem in applications which require the motor to run for relatively long periods. The automotive guys seem to understand this; for example, replacing a brush-type motor with a brushless one may make sense for a fuel pump, but probably not for a window lift. And the brushless motor has been around ever since the mid-1970s, when samarium-cobalt magnets became commercially viable enough for brushless technology to be applied to industrial drives.

We tend to look to our professional institutions as arbiters of original scientific ideas, which for magnetics is typically the Institute of Electrical and Electronics Engineers (IEEE). So, I was then even more surprised to find a similar announcement in the IEEE's *Spectrum Magazine* (02/08, p36). An Australian company describes its discovery as a "freak motor" that "did away with brushes, and instead, rotated its permanent magnets and used power electronics to reverse the direction of current flow," which sounds like a brushless motor to me! But furthermore, this motor "is distinct because it produces flux in an axial direction, rather than radially, (so) the engineering behind it is extremely tricky because everything must be figured out from scratch." I am sure this fact can be attested to by Mavilor Motors, which worked out this tricky engineering and has been successfully manufacturing axial flux brush-type or brushless motors in Spain for more than 30 years now. And when the Australian company tried to apply the axial flux motor to an electric bicycle, they recognized that new ideas are often years ahead of their enabling technologies. This was the case when this author demonstrated his own axial field motor driving an electric bicycle at Cambridge University in 1976 (see photograph). But this application didn't catch on until well after sintered



neodymium-iron-boron had been commercialized - now China consumes around 10 million electric bicycles a year, as I reported in the Dec 07/Jan 08 issue of this column.

To find the optimum approach to a design or application problem, you might want to look back in the relevant literature much farther than you would have thought. There may well be an existing solution (or even an expired patent) which has not yet been widely practiced, maybe because it needed a subsequent enabling technology. But let's call this innovation rather than invention, to achieve which a broad experience of a diverse range of products is also of great value. And the proper citation of prior work would certainly help future generations to do their research more effectively.



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