Importance of Patents and Information Services to Research Workers†

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There are three areas in which the patent literature impacts upon R&D activities: it can be a very fruitful source of information regarding the economic and technical potential of existing or near future art; it can be a teacher of the art involved in practicing in a field; and, to some extent, it can act as a guide to application areas for marketing activities.

The research department that provides technical support for Amoco Chemicals is probably typical of those found in the major companies in our chemical industry. We have approximately 300 professional employees who are supporting about $1 billion in chemical sales. Our major functions are to identify technical opportunities for innovation, to develop new and maintain existing technology, and, very importantly, to assure that these products of our efforts get into the hands of our customers. The tools that we use and the routes that we follow to discharge our responsibilities are varied, and no single one is sufficient. However, one of the more significant information sources is the patent literature. It plays a principal role in our process evaluations, product developments, and marketing technical service.

PROCESS EVALUATIONS

When we elect to acquire new process technology, whether by purchase from without or development from within our department, we must assure our management that the selected process can compete with existing and near future ones. We are also responsible for maintaining an information bank regarding existing processes that border on our own so that we may advise our purchasing and marketing departments of possible responses on the part of customers or competitors or suppliers. We find also that we are much more sensitive to the value of new discoveries after we have made these process reviews.

The single most valuable source of information upon which these reviews are based is the patent literature. In almost all cases, we will make a detailed patent-by-patent review of those that pertain to the particular system under consideration. We also subscribe to the various consulting group reports that might review a particular field or set of processes. These reports tend to be quite extensive and list most of the pertinent patents for each major process. They usually involve a critical review of each process and can provide a valuable introduction. I would urge, however, that they not be the only source of information. The reviewers are rarely experts in the field but rather have a very broad industry background. They can provide a very wide prospective but may very well overlook significant details. We have found that journal articles are probably the least important for this type of work. They tend to be somewhat dated and rarely contain significant process information.

When we initiate a study of this kind, our first step is to request a patent search from our Information Center. Although a few of our staff prefer to do their own searching, we generally find that the art has become so specialized that professionals in this area do a far better job than the casual searcher which our technical people must be. I would certainly encourage all of you to form, within your own organizations, a group of people to carry out these searches. There is absolutely no question in my mind that the average chemist or chemical engineer cannot achieve a level of performance anywhere near that of a good professional searcher.

We also specify an ad hoc group to carry out the evaluation. Selection of individuals for this group is extremely important. A diversity of viewpoint and background is probably the single most valuable characteristic to consider. We usually have one chemical engineer skilled in both process design and economic evaluation and one or more chemists who can provide the necessary background in reaction chemistry. It is almost always important that the group have competence in thermodynamics and chemical kinetics. Experience in a number of process areas is highly desirable and is a major consideration. Interestingly enough, experience in the specific process area appears to have a much lower priority.

This group reviews one by one the patents uncovered in our search and proceeds to develop a process configuration and a set of preferred operating conditions for the process or processes under review. We find that the process configurations described in the teachings and claims are generally pretty reliable. The principal problem occurs when two or more configurations are specified, and we must select which of them appears to be the more desirable. Preferred operating conditions are quite another matter. The ranges stated in the claims are generally so broad that they are of little help in selecting a basis for the process. The conditions specified in teachings generally, but not always, represent a real set of conditions. One of the major tasks of the review group is to estimate the location of the optimum set from the many examples reported. A thorough knowledge of thermodynamics and kinetics can be of enormous help in interpolating between these reported values.

Once the process configuration is laid out and a set of preferred conditions established, the rest of the evaluation tends to be relatively straightforward. An investment and operating cost statement is prepared, and measures of investment worth are determined. We tend to use machine computations to prepare such information because of the large number of cases required for sensitivity studies. Where we have been able to compare our estimates with actual construction costs, we usually find that our estimates are within 20% of the actual value. Estimates of process yields based on studies of the patent literature tend to be fairly good—certainly adequate for this type of study. We are probably not very good at estimating cases where especially severe operating conditions may require extremely high maintenance costs or where environmental considerations require an unusual cleanup process. This is an area where we must do a great deal of work in the near future. We believe that the overall precision of our estimates is now pretty good. In at least one case, we were able to predict the bid prices for a large volume commodity contract within 0.5¢/lb. I hasten to add that this level of precision is somewhat better than our normal performance.

The level of effort assigned to this type of activity varies considerably depending upon the nature of the product and industry practices but usually falls between 5 and 10% of our

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total technical effort. The cost of such evaluations is very high. We will spend between one and three man months per process reviewed and incur costs between $10,000 and $40,000. In spite of these high costs, we believe that our efforts are amply rewarded and that such evaluations are mandatory for successful operations.

In summary, I would argue that a *critical*—and I emphasize the word critical—review of the patent literature is one of the most fruitful sources of information for the evaluation of new or current process technology. Although such reviews are expensive, particularly in terms of the experienced manpower they consume, the benefits derived from them provide ample compensation.

PRODUCT DEVELOPMENTS

In the development of new products, I include not only those intended for sale but also those which might be utilized in the production of other materials, particularly catalysts. The emphasis in this area is quite different from the one I have just described. We are not nearly so concerned with the results of other developments as we are with the techniques used. This is particularly true when we are entering a new field or trying to become knowledgeable in a new development in an existing one. In these cases, we find the teachings are the most valuable source of information we have. Given adequate persistence and basic skills, we can usually duplicate the examples in the art section of a patent.

There is, however, a very long road between the statement of a chemical reaction on paper and the demonstration that such a reaction does indeed take place. This is particularly true in the preparation of polymers and catalysts where very minor changes in processing conditions may result in gross differences in the final product. Don't be discouraged if the first few efforts to duplicate the teachings fail. In one particularly difficult catalyst case, one of our better chemists spent over three months trying to duplicate an example. He finally succeeded and, in doing so, acquired enough understanding to allow us to develop a different route to essentially the same end result.

Because of the difficulty in acquiring art in this area, we find that the most successful practitioners are quite different from those assigned to the evaluation process. We endeavor to locate those who have a very detailed and intensive knowledge of a specific field rather than very broad industry backgrounds and knowledge of procedures. We feel that it is very necessary for our staff to be balanced so that we have access to both types of technical personnel.

For these product development cases, our sources of literature tend to be somewhat different from those of the process evaluation cases. Our principal source is the various alerting bulletins either published by outside houses (e.g., API or various consulting groups) or developed by our own Information Center. When the area is properly described, we have found these bulletins to be very specific for pointing out patents that pertain to processes or products that we are currently considering. Not only are they effective in picking up patents that pertain to a specific area, but they are also very effective in rejecting those that do not. Consequently, the individual who is responsible for examining them may focus his attention on a relatively small number of documents rather than having to scan a very large number. The probability of detecting significant developments is greatly enhanced.

MARKET TECHNICAL SERVICE

In providing technical support for our customers, we generally find that patent related activities fall into two general areas—in-house development of application techniques and bars to the use of our products because of patents held by others, particularly competitors. The development of formulations or processes for using our products is in many ways similar to the development of products. We initiate a study by requesting a patent search from our Information Center and then proceed to develop our knowledge of the art by duplicating these examples. The technology is usually less difficult in these areas, and we find that we can develop an adequate knowledge of the field rather rapidly.

As a rule, we do not patent our own developments. We find that the cost of obtaining patent protection is much higher than can be justified. We achieve freedom to operate by publishing our results either in product bulletins or in the open literature.

From time to time, we receive queries from our customers regarding patents directed at specific application areas. Such queries present us with an exceedingly difficult problem. Although we may feel quite confident that a patent does not restrict access to a particular application, there is a very real question of propriety in advising others of our position in such matters. A specific course of action is decided upon only after the most thorough discussion with our legal staff. We generally feel much more comfortable when we can point out optional routes that we have developed in our laboratory.