ENGINEERS AND THE M. B. A. DEGREE

By JOSEPH F. MANILDI

Graduate Assistant in Electrical Engineering, California Institute of Technology

In a social era universally characterized by its dependence on technological developments and advancements to maintain its existence, a relatively new type of trained men is coming increasingly into demand. This is the man whose fundamental college training has been technical and who has had an intensive course of training in the basic fundamentals of business administration.

As recently as twenty years ago the makeup of a typical manufacturing or technical development concern was divided very markedly into two distinct groups. First, that group of men who had the technical knowledge and concerned themselves only with technical problems, and second, that group whose responsibility it was to handle the administration of the organization, the so-called "business men". There were few men indeed in either of these groups who could understand or were capable of doing the work of the other group. Technical training was strictly technical, and business training, with few exceptions, was only to be had by actually working in a business concern. The result was that the technical personnel were completely ignorant of the problems in economics and human relations which confronted industry, and the administrative personnel knew little of the technical problems which confronted their organization.

When competition in industry began to make itself more keenly felt in the period following the last war, this problem was brought to light. The result was that many technical schools broadened their curricula to include social and economic studies. Schools of business administration, both undergraduate and graduate, were instituted in many major universities. The demands of a fundamental technical training were such, however, that only a limited amount of time and effort could be devoted to non-technical subjects.

The non-technical subjects which began to appear on the curricula of technical schools in the 1920's, however, were directed toward the solution of a more pressing problem, from the standpoint of the engineer. This was the problem of giving the students a social and cultural education which was sadly lacking. The importance of social presentability, personality, and a mental outlook which gave the student a sound perspective on a rapidly changing social and economic structure, was realized. This problem has by no means been solved, although much advancement has been made. As late as 1938 surveys have shown that the greatest number of "failures" in technical fields could be blamed directly to the lack of the qualities mentioned above.

The direct result of this phase of the general situation was that business administration subjects could be justly given only a very small part in technical schools. The segregation of technical and administrative personnel, although really not so acute by 1930, was still an existing problem. The onset of the depression in 1930 brought this problem into increasing importance. The necessity of close analysis of operations, of operating at maximum efficiency, of maintaining satisfactory human relationships, all brought down on the shoulders of the executive group the increasing demand that they be closely familiar with, and have a basic understanding of all phases of their particular industry, including the technical.

It was about this time that graduates from technical schools began entertaining to any great degree the notion of undertaking a graduate course of study in business administration. Most of the men doing so did it with the intention of making administrative work their vocation. Some, however, did it only with the intention of supplementing their technical training.

The response of industry to men trained in this manner was immediate. Foremen, shop superintendents, cost accountants, and even finance men in industrial corporations found a technical background useful in their jobs. Salesmen for manufacturing companies had to have a technical knowledge of their product, and here again the salesmen, and sales executives with engineering backgrounds formed their place.

To appreciate fully the usefulness and applicability of a graduate course in business administration, it will be advantageous to outline briefly the type of training offered in schools similar to the Harvard or Stanford Graduate School of Business Administration. The curricula of these schools are intended primarily to give training in business methods which will be applicable in any organization, rather than to prepare an individual for any particular type of business or industry. The analytic type of approach to a business problem is stressed. In this respect, there is considerable resemblance between the technical and business training. The similarity ends here, however. Business problems are by nature closely tied in with human relations and personal factors. Hence, the analyses of these problems do not adapt themselves to invariable laws.

The course of instruction is broad and designed to cover all the essential fundamentals. Accounting, finance, industrial management, statistical analysis, and marketing are broadly covered. Text book instruction is reduced to a minimum. Case books, compiled from actual business cases, are used almost exclusively. Open discussions are carried on in the classroom, with an attempt toward segregation of the essential and non-essential factors. Emphasis is laid upon developing a systematic, logical, and open-minded method of attack on problems which are in general rather complex. Further, the analysis, to be of value, must lead to a logical set of conclusions.

Specialization in a phase of business, rather than a particular type of business, follows logically from this fundamental training. In the last year of the two-year course the student devotes a larger part of his time to some particular aspect of business activity. Having been grounded thoroughly in the essentials, he is in a position to appreciate and understand fully the specific problems he may encounter in his specific field.

This type of training is one which admittedly must be taken with the long term outlook in mind. The training is pointed toward executive positions, which of course will not in general

be obtained upon completion of the work. Initial placement and salary will not necessarily be particularly different from that of an engineering graduate. However, experience has definitely indicated that on the average advancement is much more rapid. The personal limit of attainment is considerably heightened as well. It may be very aptly pointed out that the majority of higher executives today have not had exposure to this type of formal training. However, since formal instruction of this type did not exist 25 years ago, when most of our successful business men were beginning their careers, the above mentioned fact is not pertinent. The fact is that today those men who have had the business training are overshadowing their contemporaries who have not.

It may be readily seen that in a manufacturing, or otherwise technical organization, the business man with an engineering background, or the engineer with business training, is placed at a distinct advantage. The increased intensity with which all our everyday life is becoming involved with technological advancement, be it desirable or not from the sociologist's standpoint, does exist. An immediate result of this trend is the closer intimacy in which technology and business find themselves. This has been, and continues to be, an accelerating process. These generalizations hold for more today than they did ten years ago, and ten years hence will be more generally true than today. One may say without the slightest hesitation, amidst many uncertainties, that the world after the war will be a technical one.

The placement in industry of men with engineering degrees who have graduated from schools of business administration, has been, from the beginning, almost immediate. At present the demand is tremendous. It is generally felt by many executives that when a technical engineering training is supplemented by a broad training in business administration, a man's possibilities in a technical organization are almost unlimited. There are innumerable cases which can be cited of men who have failed to be given top management positions because they have been too technically inclined, and have not obtained a proper appreciation for the sales and financial point of view. Equally important is an understanding of human relations. An understanding of the technical aspects of a business, no matter how thorough that understanding may be, is not sufficient by itself to present to an individual the possibilities of top executive positions.

Placement statistics (Table 1) from the Harvard Graduate School of Business Administration, indicate clearly the fact that more and more graduates are being placed in manufacturing concerns. The percentage of men placed in such concerns has almost doubled in the last ten years. The breakdown of figures indicate a fluctuation of emphasis from Production Engineering to Manufacturing Sales and Research. The man with an engineering background will fit ideally into either one or the other of these categories. The increasing number of men placed in these positions indicates the growing demand for men who are capable of filling positions in technical organizations since manufacturing is basically technical. These figures do not indicate clearly what the demand is, since there is always a considerable lag between a trend in demand and the supply to fill the demand. The rapid trend indicates a much stronger use in demand.

The placement figures for the year 1942 are shown in table II(A). The drop in percentage of men placed in manufacturing positions is clearly a result of the large percentage of men called into the armed services. Table II(B) shows the percentages, excluding those men who were taken into service, which gives a clearer picture of industrial demand.

TABLE I.*

PLACEMENT STATISTICS AS OF OCTOBER 1 FOLLOWING GRADUATION

(*Including Midyear Graduates*)

Percentages

	1929	*1930*	*1931*	*1932*	*1933*	*1934*	*1935*	*1936*	*1937*	*1938*	*1939*	*1940*	*1941*
Manufacturing (Total)	19.0	20.0	18.6	10.4	19.1	19.5	21.4	26.2	29.0	34.2	39.0	42.7	40.3
Production & Engineering	7.3	7.8	5.5	2.5	8.1	6.4	6.9	4.9	8.9	10.5	8.3	15.4	21.3
Manufacturing Sales & Research	9.2	7.2	7.1	5.1	6.4	7.0	7.6	13.5	9.3	12.7	15.9	14.2	6.2
Accounting & Industrial Finance	0.7	2.2	2.9	1.8	1.5	3.5	5.2	7.0	9.5	8.8	6.8	8.0	7.0
Other	1.8	2.8	3.1	1.0	3.3	2.6	1.7	0.8	1.3	2.2	8.0	5.1	5.8

TABLE II.*

PLACEMENT STATISTICS— JUNE, 1942
AS OF JULY 31, 1942

	A.	B. (Excluding service men)
Active Service	62.8%	
Manufacturing	22.7%	61.1%
Production, Engineering	15.4%	41.5%
Industrial Sales	1.2%	3.2%
Market Research	1.2%	3.2%
Advertising Dept.	.0%	.0%
Ind. Accounting	3.8%	10.2%
Other Departments	1.1%	3.0%
Other Industrial Fields (Finance, Marketing, etc.)	14.5%	38.9%

**Harvard Graduate School of Business Administration.*

The effect of the war is seen quite markedly. The placement in manufacturing concerns has increased markedly over 1940 and 1941. The emphasis, in breakdown, is seen to be definitely in Production and Engineering. This, of course, is a logical result of the nations expansion of production facilities for war effort. More than ever before, the business man with a technical background is in demand. The multitude and enormity of the problems facing industry in a period of such unusual expansion present unlimited possibilities to the technical administrator. More than ever before, the executive is confronted with the necessity of being completely familiar with the technical set up in his particular organization. Much of the criticism which has been levelled at the inefficiency of our industrial system to adapt itself to war demands has been a direct result of the lack of understanding which many administrators have of technical problems, as well as the lack of knowledge which engineers have of administrative problems.

It can be said in general at the present time that if there were ten times as many men graduating from business administration schools with engineering backgrounds as there are now, they

(Continued on page 18)

THE ENGINEER AND M.B.A. DEGREE

(Continued from page 6)

could all be placed with great facility. True, this is at present the result of an extraordinary condition—the war—but it is more than reasonable to expect this demand, relative to other demands, to persist after the war.

A question of vital interest and importance at present is the question of where engineering men with business training can best be used in the advancement of our war program. From the foregoing discussion it becomes quite evident that they may be profitably used in any field of industry which correlated directly or indirectly to war production problems. Besides the industrial demand for these men, the Army and Navy are very much in need of men of this type.

The Navy has indicated great interest in them for ordinance work and technical supply billets. A great demand exists at present for them in the Bureau of Ships. In the Army, men with engineering and business administration training are of particular interest to the Quartermaster Corps, the Ordnance Division, the Corps of Engineers, and, above all, the Army Air Forces. The individual would find his usefulness in either administrative or technical work, or a combination of both.

As far as industrial placement is concerned, during the emergency, there is a great demand for men trained in business and technical work in the fields of aviation, heavy metals and metal products field. This demand is present throughout the country. The demand is particularly acute in the west, as far as aviation is concerned, since such a large part of the industry is established on the west coast. It has been impossible, to date, to meet the demands which have been made for men with this training. There are a number of related fields where the business administration, rather than the technical training, would be a primary requisite, but where both are required. For example, the Purchasing Department of Westinghouse Manufacturing Corporation considers the combination excellent, and are on a constant lookout for men with this type of training.

Although this survey indicates the great demand for engineers who have had advanced study in business administration, it does not follow that in the present emergency, graduating or practicing engineers should plan to take extended training in business administration. Technical men are in such demand at present that they cannot be spared from present duties to broaden their training. It is advisable for men, upon obtaining their engineering degree, to offer their services immediately to industry or to technical branches of the armed forces. The war effort will undoubtedly be more benefited by this action at the present time.

The fact still remains, however, that there is a great need, both in wartime and peacetime industry, for the business administrator with a technical background, and for the engineer with an understanding and awareness of business problems. There have been many wrong decisions made and much inefficiency has resulted because executives have not been sufficiently familiar with the technical aspects of their business. Similarly, much time has been wasted in the pursuit of technical problems because the engineer or scientist was not fully aware of the financial or practical limitations to his problem in our industrial structure. This is particularly true at present when the short-term outlook of winning the war is a predominant factor.

It can be reasonably estimated that in the years following the war the need for this type of training will be realized and met. We can sincerely hope that many of the problems facing industry today can then be intelligently dealt with and solved.

POWDER METALLURGY

(Continued from page 9)

contraction is, of course, undesirable since dimensional tolerances cannot be maintained. By "trial and error," pressing and heating cycles have been developed so that dimensional tolerance may be maintained in the direction perpendicular to the direction of pressing, but the pieces have to be shaved to size in the direction parallel to pressing.

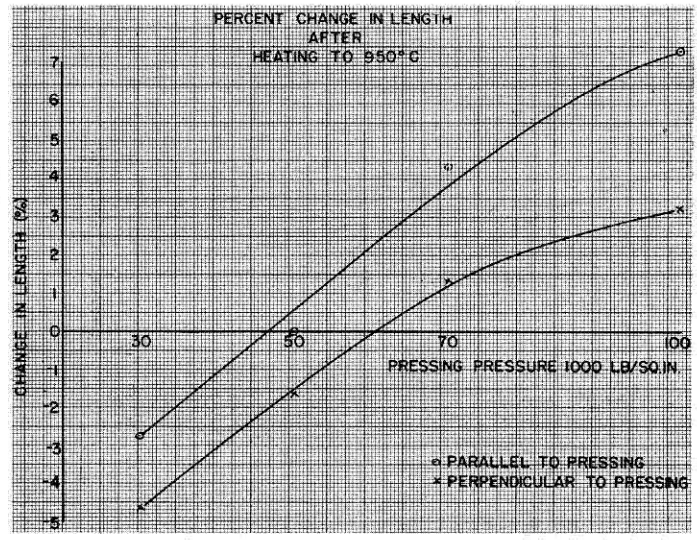

Fig. 1. Change in dimension of pressed copper compacts due to heating to 950° C.

The result of these uneven dimensional changes can be seen in Figure 1. Compacts pressed from 325 mesh copper powder were measured in all directions to 0.001 inch before and after sintering. The per cent change in dimension parallel to the direction of pressing is greater, (when expansion occurs), than the change perpendicular to the direction of pressing, but less when contraction occurs. The compacts from which the data for Figure 1 were taken were quite symmetrical, so pressure differences were small. It can be readily realized, then, that if any marked pressure differential were set up in the specimen, the change in dimensions would not be constant and any attempts by trial and error to allow for the changes would undoubtedly fail. The difficulty encountered is due to the number of factors upon which these dimensional changes are dependent. The phenomenon is dependent upon the size of the compact (larger pieces due to uneven pressure show uneven expansion or contraction), the pressing pressure (high pressures cause expansion, low pressures contraction), the particle size (small particle size causes expansion or contraction to a greater degree), and the temperature (expansion or contraction occurs within certain temperature ranges dependent upon the first three conditions).