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Liverpool Section.

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MR. MAX MUSPRATT IN THE CHAIR.

THE INDIVIDUAL AND THE CORPORATION IN THE CHEMICAL INDUSTRY.

BY MAX MUSPRATT.

There is one phase of Chemical Industry which, though touched upon indirectly, has not been fully treated in addresses to this Society, but which nevertheless requires specific consideration. It is the decline of the individual and the necessity of his resurrection and the rise of the corporate system and the necessity and manner of its continuance.

What must strike one is the diversity of the individualist pioneers of our industry: absolutely opposite methods seem often to have led to success. Here science succeeded, there rule of thumb paved the way to fortune; the dreamer of dreams met with practical success, the practical man founded an ideal business. There was no royal road to success, even in those days, and, though naturally we hear little of them now, there were men, both scientific and rule of thumb, who failed. Personality was everything in the early days of chemical industry.

As elsewhere, development led to acute competition, and acute competition to co-operation or amalgamation, and to-day conditions are sufficiently long established upon a corporate basis to allow of their being analysed, criticised, and improved.

Whether the supersession of the private firm by the public company is desirable or not need not be discussed; probably inevitable, at any rate it is an accomplished fact. But what are its effects?

Manufacture.—The keystone to the heavy chemical industry is cheapness of manufacture and excellence of product. The individualistic era, with its fierce competition, was a more fertile soil for improvement; but the corporate era, with its large scope for capital expenditure and experiment, has also its advantages. In the early days of development the field of improvement was very great and the immediate advantage of improvement was patent. This showed itself within the individual works, where the principals were themselves on the spot, either creating or daily watching and appreciating the creations of their staffs, and it produced a class of itinerant genius who found ready bidders for any real improvement of processes. Possibly in no other way could a great industry be moulded; but a point comes where the possibilities of improvement become so small in comparison to the capital cost that, under an unlimited competitive system, the private firm either shrinks from the responsibility or undertakes a burden too great to bear. At this point amalgamation becomes inevitable, with bankruptcy as the alternative.

The immediate results of amalgamation are almost bound to be good on the manufacturing side: each works has its individuality, its special features of excellence and indifference, and a systematic comparison should result theoretically in raising the worst to the standard of the best or even higher. In practice, an undoubted raising of the average standard is effected, and the way is clear for the refinements of manufacture, often entailing big alterations and capital expenditure for small and sometimes hypothetical gains.

It is here that the loss of the individual is felt, and the potential strength of the great corporation is often vitiated by the inertia of its size.

Under the complex conditions of modern manufacture, even with the most accurate system of cost sheets, both improvements and weaknesses are apt to be masked. Thus a works or a department with some appreciable

weakness may, by some geographical advantage, luck with regard to raw materials, or exceptional energy of its staff, produce as good or better results than another with more recent equipment or improved plant, with the not unnatural result that disappointment is felt with the improved plant and its extension is discontinued.

It is here that the individualist characteristics of intuition and perseverance, which have done so much to build up our industry, are strongly needed, and one of the problems of the time is how to regraft them on the corporate system.

While reckless love of change is to be condemned, modern industry demands the systematic adoption of the most modern contrivances, unless there is irrefutable evidence of their unsuitability to the particular conditions. The sum of small improvements is in the end enormous and far-reaching, while the policy of contentment leads to atrophy, imperceptible at first, but liable to lead to disaster in emergency.

Labour.—The kind of work required in the chemical industry varies from the heaviest to the lightest, from the crudest to the most skilled. In some of the manual branches skilled labour was in the past highly paid, owing to its very special nature and the demand exceeding the supply. The modern tendency is towards simplification, with a consequent lowering of high individual wages. At the same time there has been a certain almost imperceptible averaging up of medium and low wages in sympathy with industrial conditions generally, and in the most modern works a vastly larger number of men are employed at wages well above the minimum living wage of a generation ago, but the plums are fewer. On the other hand, there are larger openings: the foremen, heads of departments, and supervisors of processes are more and more likely to be recruited from those who work with their brains as well as with their hands.

The labour question in the chemical industry is always complicated by the necessity of continuous labour. The excessive hours physically possible to the raw countryman available 30 to 40 years ago, in return for wages which to him were great wealth, are now an anachronism. Much has been done, but the last word is not yet spoken, and there must be give and take on both sides to place industry on a satisfactory basis in this respect.

Sales.—It is doubtful if the transition from the individualistic to the corporate era entails greater changes anywhere than in this department. In theory the conditions are revolutionised. Under the competitive system the ideal is to place the whole of a limited make at a margin of profit which will give a maximum return on the capital invested: to do this the principal conditions, apart from cheapness, are quality, good-will, and promptness. Quality must be of two kinds: the real, consisting of uniformity of strength and reliability of standard; the artificial, resting on appearance, style of package, and convenience for consumer. Goodwill depends upon enterprise in securing markets either by being the first in the field or assisting consumers by recipes or other information suited to their special needs. Promptness in execution of orders is also vital, and much intelligent foresight is required to strike the happy mean between too heavy and too bare stocks. A single indiscreet manufacturer might ruin, and has ruined, prices for all for long periods by a too optimistic estimate of what he could reasonably place.

Under the corporate system in theory competition ceases and the ideal is to obtain the highest price which will not check consumption. But, apart from the impossibility of really eliminating competition, a powerful factor in keeping prices down is possible competition. Producing corporations have to deal with consuming corporations, who are always having attractive estimates dangled before them tempting them to produce instead of to buy their own requirements. We all know the results that can be obtained by an inventor on paper, and plausible processes are the great protection for the consumer from fancy prices, for once plant has been erected, though the results

may be disappointing, the consumer rarely comes back. Some of the principal aims of a manufacturing corporation should therefore be a moderate selling price, but uniformity of price is most desirable. Rapid fluctuations are most embarrassing, both to producer and consumer, and although unpopular at times, the sound policy is to be slow to raise prices in good times, but stiff-necked in lowering prices in bad times. After all, in almost all consuming industries the item for chemicals is not a controlling one, and the consumption of these industries cannot be stimulated by heavy sacrifices on the chemical side, while the absence of fluctuations characteristic of the corporate system has a steadying effect on the trade of the whole world.

A danger of the corporate system in selling is over-centralisation. In old days large bodies of competing sellers specialised in various articles in various markets: on the manufacturing side one works acts as a standard of comparison for another: in selling, centralisation is necessary, but the intimate touch and specialised knowledge of the consuming industries and the various markets is in danger of being blurred, to the prejudice of the seller. Subject to general control of policy, the individual requires rehabilitating in this branch.

Buying, which includes the whole question of raw materials, is undoubtedly facilitated by the corporate system. In purchasing articles where there are competing sellers the very lowest prices are obtainable, partly because of the largeness of the quantities and partly from the sellers having to bid against unknown competitive tenders. The only obvious difficulty is that of quality: the works manager likes the best quality at the lowest price, the buyer aims at the greatest common denominator of the two factors, and it is quite impossible that the two views shall always harmonise. Intimate touch, with frequent visits to the works, should reduce this difficulty to a minimum.

In many raw materials sellers meet the stringency of corporate buying by rings or corners, while in certain articles the supplies may be so limited that monopoly prices can be exacted. The ring or corner where there is no natural monopoly can usually be broken by facing temporary loss for ultimate gain, but the natural monopoly can only be met by fresh sources of supply. For its chief raw materials a large manufacturing undertaking will therefore sooner or later usually acquire its own supplies, and the power of doing this is a great source of strength in the corporate system.

Administration.—With the aggregation of business rendering impossible the daily individual touch, a substitute has to be found, and this is called administration. It has been too readily assumed that commercial administration would follow as a matter of course if sufficient individualist business men were landed together in a board room. Indeed, one big amalgamation started with no less than 80 directors, of whom probably not one knew anything of administration, for the simple reason that such knowledge scarcely exists. A spirit of administration suitable to the new conditions must be developed, which is to combine all that is best in both the individual and the collective. Administration is to the large company what nerve-system is to the human body, all-pervading, all-influencing, but under normal conditions invisible and intangible. It is not vested in a board or in this or that official, but in the spirit running through the whole body corporate, producing harmony and co-operation while developing individuality and creative power. But this metaphysical conception of administration must of course be associated with suitable machinery, and in practical industry a machine is invented and set in motion long before the last theory of its ultimate development is understood. We have therefore in every company a board of directors, the majority free from all routine work, a minority with a certain amount of routine work of a non-departmental nature, and in conjunction with the secretarial department, general supervisory and executive control of the whole undertaking.

There are other departments and activities of an advisory and initiatory nature closely allied to the administration. The principal of these is the Research and Scientific Department, which keeps the administration in touch

with scientific developments affecting the specific industry; criticises new processes and compares them with the old; reviews the whole subject of patents, past, present, and future, and evolves the new processes required. The corporate system can keep a highly qualified staff fully equipped in these departments, chemical, engineering, and statistical, and it is here that the scope of the individual most closely touches the corporate system. At the same time over-concentration must be avoided. Scientific men of high standing must be distributed so as to have actual daily touch with manufacturing routine, while inventive genius, which springs up here and there irrespective of great scientific training, must be encouraged and developed. The necessity of strong individualism in this sphere of work is so obvious that it is the corporate that must be accentuated. In industry research is a means, not an end, and as inventive genius cannot be forced, it is incumbent on the individual to keep himself in close touch with the necessities of his industry. Constant intercommunication and personal touch with his more routine colleagues is therefore one of the paths to success.

Another important though not numerically large department is that of Commercial Intelligence, which by systematic study of what is happening in all parts of the world, by both reading and travel, helps to keep the administration both up to date and forewarned as to industrial dangers.

It is essential, however, for attaining the maximum efficiency that the idea of water-tight compartments should be entirely eliminated. While the pure routine of a department should never be interfered with from outside, each department should have good relations with the others.

What then is the future of the individual within the corporation? Material gain is probably the most potent incentive, and this is one of the most difficult to apportion.

Payment by results and profit-sharing are obvious suggestions, and deserve sympathetic attention. At the same time, many of the tentative steps in this direction have led to dissatisfaction on one side or the other, because, owing to the complexity of modern industry and the interdependence of departments, it is well nigh impossible to accurately distribute credit when expressed in £ s. d.

The one department where this method is possible, and is a partial success, is in rewarding successful invention. But even here there is too great an element of chance, and a system, which rewards the maker of thousands and ignores the maker of tens of thousands, because the one is an inventor and the other an adapter, is arbitrary and unsatisfactory. To my mind, the ideal justice to the individual is to be found in rapid and intelligent promotion, both with regard to status and remuneration. The corporations which adopt this method systematically, steering between the Scylla of parsimony and the Charybdis of favouritism, are the most likely to draw the best men and develop their individuality.

The personal relation is, however, also a vital one, and everything possible should be done to develop good fellowship and camaraderie.

The modern industrial corporation is a little state, and the individual and the corporate will attain to the highest pitch of development when, adapting Macaulay's words—

None are for a section
But all are for the State.

DISCUSSION.

Dr. CAMPBELL BROWN said that in years past, when individual management gave place to limited liability, in the course of ten or twelve years, the manufacture generally went down in quantity and quality, but it was to be hoped that would not be the rule in the future. Early failures were merely the result of the sudden withdrawal of the head and nerves of the manufacturers from their duties without supplying the necessary substitute.

While the personal head of a manufacture was closely interested financially and in reputation with the success and the efficient performance of the work at every stage, in the corporate system there was not that close dependence of everyone upon the perfection of his own work and the performance of his own duty. In this connection

he might cite the wonderful Zeiss Company in Jena, which appeared to have solved the problem of getting every person rewarded according to his deeds, and of making him feel that he was so rewarded; and it was not exactly the fair allotment of promotion and other advantages that told, but the making the man realise that his advancement depended upon his work.

Mr. EUSTACE CAREY said that the interesting and suggestive address they had heard that evening, reminded him of Professor Tyndall's celebrated one at Belfast many years ago upon the use of the imagination in science. He was sure Mr. Muspratt's paper would lead to others of a similar character. The cessation of individual management and individual ownership had some drawbacks—a very obvious one was that there was less personal touch with the workpeople and the staff—but the balance of advantage was largely on the side of the corporation.

Mr. T. W. STUART cordially agreed with all that Mr. Muspratt had said. He had very definite views as to the advantage of a corporate company against a private firm in the old days. When they had the opportunity of comparing costs of manufacture, quality of manufacture, and other things which constitute good management, it was a very great surprise to many of them to see in the case of many firms who had high reputations, and other firms who had small reputations, what a revelation there was when they were put together side by side. One of the great advantages of a corporation was the fact that they had combined together clever men in the shape of directors, officials, and foremen in a way which was quite impossible in the old days. They had now the opportunity of seeing for themselves the point of perfection to which cost and quality of manufacture could be brought, and of not only comparing one works with another, but also of applying a manufacturing tonic to each works, and all the works were thus brought to a level basis. In that way great corporations could manufacture at an enormously decreased cost compared with individual firms. Thus one of the great advantages of a corporate system was the extreme cheapness of manufacture. There were men in that room who would support him in saying that when they looked upon the costs of 20, 30, 40 years ago, it was perfectly marvellous what perfection could be obtained by a corporation, as the result of its combined capital, skill and resources.

London Section.

Meeting held at Burlington House on Monday, November 9th, 1908.

DR. J. LEWKOWITZ in the Chair.

CELLULOSE AND CHEMICAL INDUSTRY.

BY C. F. CROSS AND E. J. BEVAN.

ON many previous occasions we have engaged the attention of the Society upon some special point in the Chemistry of Cellulose. Our present task in response to the invitation of the Chairman of the section, is to address ourselves to the wider text under which this contribution appears. Such a review as we can give of the present position of Cellulose Industries in relation to Chemical Science is necessarily based upon familiar facts, but it may perhaps serve a useful purpose to set out these facts as a retrospect of progress, to appreciate which is to forecast in some measure the problems of the future.

This Society must have a particular interest in movements which are rapidly extending the domain of the chemist and the extensions which are being realised are much wider in their import than has perhaps been generally recognised even by chemists.

As a basis of our present enquiry, we may remind ourselves of the preponderating importance of the cellulose industries in the trade and commerce of the United Kingdom.

The few statistics we may introduce in illustration of the point involve figures so colossal that it requires an effort to fix their exact significance.

The staple raw material handled in our textile and paper-making industries, are for the most part imported, and we give figures from the Board of Trade Returns for 1907.

Approximate values in pounds sterling.

	£
Cotton	70,458,000
Flax	3,042,000
Hemp	4,238,000
Jute	8,165,000
Wood Pulp (cellulose).....	2,400,000
Esparto	740,000

It is to be particularly noted that as these, our raw materials, are of foreign origin, our cellulose industries rest on an entirely exotic foundation.

The manufactured products from these raw materials are in large proportion sold in competitive markets and their selling prices represent the appreciated values by the work put upon them.

It would be difficult to fix average figures to represent this ratio of values. We may select a few typical instances in general illustration.

Thus in the case of cotton yarns we arrive at the following figures:—

Type of Cotton yarn, per lb.	Raw cotton cost		Labour, &c., cost
s. d.	s. d. s. d.		s. d. s. d.
2/150's 5 4	1 0 to 2 0	Sea Island	3 4 to 3 10
2/100's 2 10	0 10 to 1 0	Egyptian	1 4 to 2 0
1/100 1 10	0 8 to 1 0	" combed	0 10 to 1 2
1/100 1 8	0 8 to 0 10	" carded	0 10 to 1 0
1/60 1 1½	0 0 to 0 1	" carded	0 ½ to 0 7½

In the case of flax yarns the figures for costs show very similar relations, raw material representing 40% of the costs of production, in relation to 60% made up of labour, steam, and general factory costs.

We are leaving out of consideration special or "fancy" products, but we may mention one or two instances to show to what limits costs of production and selling prices are carried in fine yarns—thus in cotton yarns:—cotton yarns are manufactured up to 600's, which represents 500,000 yards per 1 lb. For commercial purposes 420's is a usual limit. As regards value, the current selling price for the range 360's—400's is 60 shillings to 80 shillings per lb.

In flax yarns the finest count usually spun is "300 lea," of which a specimen is submitted. The bundle of this yarn, i.e. of 60,000 yards, weighs 10½ oz. and sells at 28s. These facts are not without their special significance, and they represent fundamental technical relations.

They may appear to be irrelevant to the subject, but only if we assume that there is an essential antagonism between science and balance sheets, and that science must detach itself from quantitative results when these take the form of money values.

The subject of cellulose involves the consideration of a wide range of such relations and values and we shall make no further apology for touching on economic questions as an essential aspect of the evolution of chemical industry in this field.

In the spinning and weaving industries, the chemist plays but little part and the appreciation of value expresses mechanical work performed in preparing and refining the raw material.

We can understand that the chemistry of cellulose does not interest the cotton manufacturer; his raw material is chemically inert, and is handled without any regard to its being a "chemical substance" with a definitive, if, for the present, problematical constitution, and with definitely ascertained properties and reactions.