the principal forms of bowls employed. The evolution of the forms and decoration is worked out in a most lucid and interesting manner. The chronological value of this development is further described in chap. vii., and in chap. vi. we have an interesting discussion of the origin of the decorative designs. The figure-subjects are mostly to be traced to the art of the Augustan period, and the decorative motives in many cases to earlier phases of Greek art. It seems a little doubtful,

FIG. 2.—Vase of La Graufesenque ware (Form 30) combining scrolls with figure subjects (about A.D. 60).

however, whether motives and methods of decoration which were employed in early Greek art, and disappeared in the sixth century B.C., or even earlier, can have actually influenced the Roman potter. An instance is the "nautilus" ornament found on the Arretine vases and some early Gaulish wares of the first century after Christ. The nautilus certainly occurs in Minoan pottery, but its use was localised, and it is not known in Greek art. It is possible that this pattern is really intended to represent a fern-frond.

Chap. viii. is devoted to a discussion of the plain wares which have only potters' stamps without decoration, and chap. ix. to other methods of decorating *sigillata* ware by painting, incising, or *en barbotine* (patterns produced in relief by thick layers of liquid clay). The final chapter deals with the origin and evolution of *terra sigillata*, and is a general summing up of the whole subject.

There are no fewer than eighty-five excellent plates, all drawn by hand, with adequate biblio-

FIG. 3.—Vase of Lezoux ware (Form 37) with panel decoration (about A.D. 100).

graphical references, and a useful map of sites forming the frontispiece. The general and detailed bibliographies on pp. 245 ff. will also be invaluable to the student of the subject. We should have been glad to discuss this admirable work in much fuller detail, but space forbids, and we can only recommend those who have any interest in the subject to lose no time in becoming acquainted with its contents.

Our illustrations reproduce three typical forms of Gaulish vases with decoration.

Industrial Research Associations.

VII.—THE RESEARCH ASSOCIATION OF BRITISH MOTOR AND ALLIED MANUFACTURERS.

By H. S. ROWELL.

NO branch of engineering is so much the creature of taste and fashion as the automobile industry. No industry of anything like the same dimensions is so much dependent on the views, almost the caprices, of the layman. Almost certainly no industry in this country has had such a meteoric or rather rocket-like post-war career as that responsible for the manufacture of motor vehicles. These facts must be borne in mind in considering the development of the Research Association of British Motor and Allied Manufacturers.

After the armistice the release of petrol supplies, the diversion of manufacturing agencies from war work, and the natural desire of an overworked public for convenient locomotion and healthy relaxation gave the motor-car trade an unprecedented boom. Motor-car manufacturers were not only confronted with all the distracting problems of reconstruction, but, in addition, they had pros-

pects of—several firms, indeed, had orders for—some years of work. While one or two other research associations were formed as a vital necessity to preserve the existence of the corresponding industries against foreign competition, the motor trade had at the time of the incorporation of this association in May, 1919, no such incentive. At that time to many in the motor industry it must have seemed a luxury, if not an extravagance. Those who have had to do with the inauguration of new societies, especially of societies novel in form or object, know how much work and time are involved in seeking, and often in reconciling or converting, the views of busy men. Even then much preliminary work is necessary before staff can be appointed for the necessary executive work. The Research Association of British Motor and Allied Manufacturers was formed under the ægis of the Association of British Motor Manufacturers, and it is largely to the energy and enthusiasm of

Mr. H. C. B. Underdown, president of the latter body, that the daughter association owes its existence.

The active work of the Research Association of British Motor and Allied Manufacturers began on June 1, 1920, with the appointment of the present writer as technical secretary. Since that time considerable progress has been made in organising committees and arriving at a policy by which to guide future work. A bureau of information has also been established from which are issued classified abstracts of most of the important papers dealing with matters relevant to the automobile. There is in many quarters a rooted and well-founded objection to the collection of information in this way; it is often asked: "Where will it end?" The answer to this question is neither easy nor necessary, but the fact remains that already the information bureau has been of great value. The needs of various industries are different, and the organisation of the research association must fit in with its own particular industry. In the case of one textile industry there was little or no scientific foundation on which to build, and thus the first task of its research association was to gather information. In the motor industry, on the other hand, there is a wealth of information, but it is widely spread and often hard to come at; as one example out of many we have the transmission of heat across a plate between two moving fluids. This problem has been investigated by many engineers in many countries, generally with reference to the steam boiler; the same principles must govern the radiator and heated induction pipe of the motor-car. The abstracts sent out to the members of the association not only keep their technical and design staffs in touch with new developments at home and abroad, but as they are carefully classified they will in course of time provide a basis on which research work may be founded. Moreover, they will become a work of handy reference.

Time teaches, and the views here presented are naturally subject to modification by experience. At present the tasks in front of the association may be set out as follows:—

- (1) Collecting, recording, and disseminating to members accurate technical information.
- (2) Consultative and advisory work for members of the association.
- (3) Original research and investigation into matters of importance to the industry of which knowledge is at present unsatisfactory.
- (4) Co-operation with allied industrial and scientific workers.
- (5) Examination of new inventions, and, in promising cases, their experimental development.
- (6) Impartial tests and verdicts.

A few words of explanation on these brief headings are fitting.

The bureau of information has already been discussed.

Regarding consultative work, it must be clear that a highly trained scientific staff is able to help works engineers and designers in many ways.

There are, in any case, two main advantages to be derived from consultative work in a research association quite apart from the immediate solution of any difficulty; not only are the obstacles encountered by one firm brought to the notice of other firms in the association, thus showing them what to avoid, but also the scientific staff is kept in touch with the men in the works, thus learning their needs, their outlook and point of view, and possibly some of the manifold experience which is rarely formulated.

Co-operation with allied trades is especially necessary in motor-car research, for no other product, except perhaps that of the shipbuilder, involves so many handicrafts and sciences as the automobile. As examples, we have spring-making; lamp manufacturing; electrical apparatus for starting, lighting, and ignition; rubber tyres; upholstery; body building; and all the general work implied by mechanical engineering. It would clearly be unjust that the Research Association of British Motor and Allied Manufacturers, an association at present of chassis builders, should, even if it had the necessary resources, embark on such a wide sea of troubles. Thus the title and aims of the association have co-operation in view, and it is pleasant to know that there are now prospects of firms in the allied trades joining the association very shortly. With those allied industries that have already formed research associations close collaboration will be encouraged.

The examination of new inventions may seem to many a piece of unwisdom, since it may be concerned more often with design than with research. On the other hand, it must be admitted that an unbiased and scientific view is necessary to do justice to the inventor; nor may we forget the epoch-marking innovations which we owe to non-technical people; the textile industry, for example, owes much to a barber and to a clergyman.

The views of men are the product of their experiences, and in the hurry and bustle of practical life notions and prejudices are acquired which time and leisure for reflection would dispel. Or, on the other hand, the natural bias of paternity may lead the designer to retain his devices when better substitutes are available. In such cases a research association can serve a useful purpose in giving an impartial, or at least a different, view. Later, as the organisation develops, it may be that the field of judgment will be extended in order to expose or confirm the various claims of blatant advertisers. In this way the true interests of the public and of the automobile industry will be served.

The objects set out above are probably not the same as those of other research associations, but the needs of various industries are different; it was sound statesmanship that led the Department of Scientific and Industrial Research to give each industry its freedom in the research movement. In considering the list of objects given above, it must not be assumed that the order adopted is

that of relative importance. The great difficulty in securing suitable premises, and the congested and overworked state of university institutions, have temporarily displaced original research from its deserved place of priority. The collecting of information, on the other hand, was at once useful and feasible.

Much emphasis has been given, both in this country and in the U.S.A., to the view that industrial research associations should seek after fundamentals. Quite recently in an important publication appeared the sentence: "It cannot be stated too strongly that the main object of research associations is fundamental research, and that consequently results will usually be slow in coming." With a full sense of the profound respect due to the authors of this statement, the present writer begs leave to disagree. In his view, the main object of industrial research associations is profit, for without profit no industry can live. Disregard by men of science of this vital fact is probably responsible for much of the apathy shown towards science by men in commerce and industry. Here it must be added that the profit point of view is not necessarily a short view; let the vista be as long and as broad as economic conditions warrant, and in cases of doubt let the error lie in distance and in breadth.

The membership of the Research Association of British Motor and Allied Manufacturers represents at present only about one-third of the British motor industry, but it is the object of the council of the association to build up an organisation which shall become a representative national body in the automobile world, and, by working on a practical yet progressive policy, fully adapted to the present temper of the trade, it is hoped to convince not only the entire British motor industry, but also the various allied and accessory trades, of their interest in research. It is clear that the larger the membership becomes, so much the greater are the resources of the association and the benefits of membership. Until the entire British motor industry is included, strict secrecy will be observed in regard to any results of advantage to

the trade. At the same time, the interests of research workers (in the pay of the association), to whom credit is an important form of reward, will be assured by publication of their results after members of the association have had, say, three or five years' start of non-members.

There is one difference between pure science and technical science which it is believed has not been emphasised before. When a technical worker is given a problem by industry, the answer or solution is, as a rule, wanted at once, whereas a worker in pure science has, or should have, unlimited time at his disposal. This cardinal difference imposes a totally different solution in the two kinds of work. The technologist may be called upon to eliminate a wasteful process or a dangerous condition. He is not authorised to spend twenty years in finding out a perfect process or in determining exactly what condition is just safe. He is asked to cut out as much waste as possible at once, and, if advisable, to go on improving the process, or in the other case his task is to find out what is safe enough with a reasonable margin for the various probable errors to be expected. The great majority of technical problems cannot be enunciated precisely; only a more simple analogue can, as a rule, be considered. The end in view is an immediate solution sufficiently accurate for the work in hand.

When the technical worker has solved his problem and passed the solution to the designer, he will see, as a rule, unless his scientific curiosity be dwarfed and shrunken, many interesting paths which invite his investigation had he but the needful time and equipment. It is here that he can serve pure science by handing on his boundary problems to the specially gifted men who devote their lives to the development of science as distinct from its applications. How much is handed on in this way and how much retained for investigation by the research association will depend on the ability, vision, and other resources of those concerned; the experience of industrial research organisations in Germany and in America seems to show that the short view does not pay in the long run.

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Obituary.

SIR D. E. HUTCHINS.

THE death in New Zealand was announced in the *Morning Post* of December 3 of Sir David Hutchins, the well-known forester, at seventy years of age. Sir David (with eleven contemporaries, including the late Prof. W. R. Fisher, Mr. E. C. Hill, late Inspector-General of Forests in India, and Mr. E. P. Popert, late Forestry Adviser to the Commissioners of Woods and Forests) was appointed a probationer for the Indian forest service in the spring of 1870, and sent to France for instruction in forestry. Shortly afterwards, on the outbreak of the Franco-German War, he returned and studied, with the

other probationers, botany and other auxiliary subjects in Scotland under the supervision of the late Dr. Cleghorn, himself a retired distinguished Indian forest officer. After the end of the war in 1871 Sir David returned to France and studied forestry at Nancy until the autumn of 1872. He joined the Indian forest service at the end of that year, and remained in it until the end of 1885. Owing to ill-health, he was then transferred to the forest service of Cape Colony. During the latter part of his service in India Sir David was occupied with the measurement of *Casuarina* plantations which had been established along the Madras coast. From the statistics thus obtained,