motors, were instituted. The theory of the various types of motor next follows and a brief study is made of the several forms of motor now coming into use, with more or less success, in the impulsion of these 'horseless vehicles.'

The body of the work is devoted to a description of the construction of the new 'automobile' carriages which have within a few years become known on the road, and this includes an account of the forms of American as well as European apparatus which have been brought into competition in long-distance trials and races. Some valuable matter is also given in the form of reports, embodying data of interest and value to the constructing engineer.

The concluding portion of the book deals with details of construction. This is a good time to bring out such a work, and the author appears to have made a success of his part. The book is the work of an expert, and no doubt reliable as to fact as well as correct in its descriptive matter. It is well worth its price.

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SCIENTIFIC JOURNALS.

AMERICAN CHEMICAL JOURNAL, DECEMBER.

Investigations on the two Isomeric Chlorides of Orthosulphobenzoic acid: By Ira Remsen, S. R. McKee, J. R. Hunter and W. J. Karslake. These articles contain the results of investigations carried on during the last two years on the preparation and behavior of the chlorides of orthosulphobenzoic acid. They have been obtained in pure condition, the high-melting one by treating the mixture with ammonia, which destroys the low-melting one, and crystallizing the product from ligroi ; and the low-melting one by fractional crystallization of the mixture. When treated with water both give the same product, orthosulphobenzoic acid. Phenol and resorcinol were also found to yield the same products with the two chlorides. When treated with aniline the high-melting chloride yields only the fusible anilide, while the low-melting one yields both the fusible and and infusible anilides. When these anilides are treated with phosphorus oxychloride they both yield orthosulphobenzodianil, from which the infusible anilide can be regenerated by boiling with glacial acetic acid, and the anil of orthosulphobenzoic acid by treatment with concentrated hydrochloric acid. The evidence shows that the infusible anilide is derived from the unsymmetrical chloride by the replacement of the two chlorine atoms by the aniline residues. When the high-melting chloride is treated with ammonia the product is the ammonium salt of benzoic sulphinide, while the low-melting one forms ammonium orthocyanbenzenesulphonate. From all the data available it seems to be hardly possible to explain the formation of the latter compound, except from the unsymmetrical chloride. The first action probably leads to the formation of an imide which by an intramolecular change passes over to orthocyanbenzenesulphonic acid. The product formed by the action of benzene and aluminium chloride was the same from both chlorides.

On the Non-existence of two Orthophthalic Acids: By H. L. Wheeler. An article was published, in the May number of this Journal, by W. T. H. Howe, on the existence of two orthophthalic acids. The work has been repeated by H. L. Wheeler, who found it impossible to prepare the new acid described by Howe. He says the experimental work is absolutely incorrect, and that only the ordinary orthophthalic acid was obtained, although the experiments of Howe's were carefully repeated a number of times.

A Pure Carbide of Iron: By E. D. Campbell. The author has succeeded in obtaining a pure carbide of iron of the formula CFe_3 by carefully annealing steel bars and then suspending them in an acid solution and passing a current through the solution. The steel-gray powder formed on the surface was removed each day with an aluminium brush, and washed and analyzed. When treated with hot concentrated hydrochloric acid the substance was dissolved, forming the chloride of iron and hydrocarbons. The latter consisted both of paraffines and olefines; but their exact composition was not determined.

The Alkali Trihalides: By C. H. Herty and H. V. Black. The authors have tested the rubidium trihalides to determine whether they are isomorphous mixtures or true chemical compounds. Repeated crystallizations failed to produce any change in the composition of the

crystals, thus showing that the substance belonged to the latter class.

Action of Water of the Hubb Coal Mine upon Cast Iron: By F. W. DURKER. This mine was flooded and was filled with water for several years. When it was pumped out the iron work was found to have undergone a considerable change. The form was the same, but the substance was now porous, soft and easily cut with a knife. The changes which had taken place are explained as follows: the iron pyrites in the coal had been converted into ferrous sulphate, sulphuric acid and sulphur. The acid dissolved in the water and attacked the castings, forming the sulphates of the metals, hydrogen and hydrocarbons. The oxygen and carbon dioxide dissolved in the water formed oxides of iron, and the bars then consisted largely of silicon with oxides of iron on the outside.

The Action of Sulphuric Acid on Anisol: By W. B. SHOBER. Various results are found recorded concerning the action of sulphuric acid on anisol. The author studied the reaction under different conditions and found that anisol disulphonic acid is formed in every case in which anisol and sulphuric acid were heated to 92°; but not if they were heated above 125°. Paranisolmonosulphonic acid was always formed, while the ortho compound was formed when the substances were brought together at the ordinary temperature. This number also contains reviews of the '*Journal of Physical Chemistry;*' '*Jahrbuch der Electrochemie;*' 'Foods, their composition and analysis,' A. W. Blyth; 'The Elements of Electrochemistry,' M. Le Blanc. J. ELLIOTT GILPIN.

SOCIETIES AND ACADEMIES.

ZOOLOGICAL CLUB, UNIVERSITY OF CHICAGO. MEETING OF DECEMBER 2, 1896.

THE meeting opened with a papr by Dr. O. P. Hay, on 'The Structure and Mode of Development of the Vertebral Column,' of which the following is an abstract:

A vertebra is in most, if not all, animals a composite structure, both in the early stages of ossification and in the preceding cartilaginous stage. The notochord, around which the vertebral centrum is developed, at a very early period secretes two sheaths, an outer one, the elastica, and an inner thicker one, the proper chordal sheath. Any segmentation of the notochord or of its sheaths is due to the development of structures lying primarily outside of the sheaths and arranged metamerically. The skeletogenous cells arise from the lower half of the protovertebra, Gadow and Abbott to the contrary notwithstanding; from these cells arise the upper and lower arches and the intercalated cartilages. In the sharks, cells from the bases of the arches pierce the elastic and enter the chordal sheath, thus giving rise to the centra of these fishes. In the bony fishes, as Gegenbaur and Balfour have shown in *Lepidosteus*, Lotz in the salmon and Hay in Amia, the elements of the vertebral centra are developed wholly outside of the elastica. In the tail of Amia there are for each myomere eight cartilages resting on the elastica, the two halves of the upper arch, the two halves of the lower arch, the two upper intercalated cartilages, and the two lower intercalated cartilages. In the dorsal region these are all present except the lower intercalated cartilages, which seem to be missing.

A deposit of bone is formed in each of the eight pieces of each segment of the tail. The four bases of the upper and lower arches are thereby joined into one of the two rings found there in each segment, the so-called hypocentrum or intercentrum; similarly the four intercalated cartilages are joined to form the other ring, the so-called pleurocentrum. In the dorsal region the bases of the upper arch take no part in the formation of the centrum, being crowded upward on the top of the enlarged intercalated cartilages. Bone spreading from the latter cartilages meets bone advancing from the bases of the lower arch. Hence the vertebræ of the dorsal region are called pleuro-hypocentra.

In *Lepidosteus* the intercalated cartilages appear to be fused into a ring around the notochord and thus fused with the bases of the upper and lower arches. Later this ring of intercalated cartilages is divided, one-half going to the vertebra behind, the other half to the vertebra in front, and these, becoming ossified, form the articular ends of the adult vertebra.

In the Urodeles the two sheaths of the notochord are enveloped as in bony fishes. Hasse