discusses the geographical distribution of the west German Unionidæ, including extinct forms.

The manner in which spiders make their webs forms the subject of editorial notes in the December number of *The Country-Side*. It is stated that all the published accounts which have come under notice describe spiders as constructing their webs in narrowing circles from the periphery towards the centre; but first-hand evidence of the opposite mode of procedure (that is, working from the centre outwards) is cited, and the writer concludes that the published descriptions refer only to the repair of broken webs.

In the introduction to an elaborate monograph of the crinoids of the Indian Ocean, forming part 7 of "Echinoderma of the Indian Museum," published at Calcutta, Mr. A. H. Clark dwells on the extreme richness of the crinoid fauna of this area, which he regards as representing the stock that has given origin in the past to similar faunas in many other parts of the world. Nearly 400 Indian forms are now known, of which about 250 are comatulids and the remainder stalked types. They are arranged in nineteeen families, with eighty-two genera, all the species being peculiar to the Indian region. The only family absent from this is the monogeneric Holopidæ. "All the genera of the Atlantic, Antarctic, and Arctic Oceans are closely related to East Indian genera, from which they were evidently derived in the remote past; but in many cases a single East Indian genus has apparently given rise to two or more Atlantic genera, all nearly equally related to the parent stock." It is also stated that crinoids may be utilised for obtaining an idea of the nature of the plankton of the seas in which they grow, thus affording a clue as to the suitability, or otherwise, of any given area for the support of food-fishes, sponges, coral, or pearl-oysters.

The fifth part of vol. x. of the Annals of the South African Museum is devoted to an account by the Rev. T. R. R. Stebbing of the local representatives of the group of small marine crustaceans known as Sympoda, or—if we follow the Cambridge Natural History—Cumacea. Although the members of the group are readily distinguishable from other crustaceans, their classification is a matter of difficulty, owing to the interlacing of characters and the existence of fine gradations. The author, who recognises a larger number of families than is adopted in the work cited, describes nine genera and fourteen species as new.

The pseudo-scorpions of the country form the subject of vol. x., part 4, of the Annals of the South African Museum. According to the author, the Rev. E. Ellingsen, less than half-a-dozen local representatives of the group were known at the beginning of the century, but the list is now very large, and has been increased in the article before us. The type genus, Chelifer, it is pointed out, will ere long have to be divided.

R. L.

FOAM STRUCTURE OF METALS.

IN a paper on the "foam structure" of metals, in *The International Journal of Metallography* (iii., 1), Prof. Quincke gives a summary of the conclusions which he states as the result of researches dating from 1858 to the present day. While Prof. Quincke's views may well claim respectful consideration, his statement of them in the present paper is far from convincing, and his effort to extend to metals his theory of foam structure of matter appears to be singularly strained. To begin with, there is the fundamental assumption that before solidification commences even in a "pure" metal the liquid becomes heterogeneous, being divided into foam-cells by minute cell-walls differing in viscosity and surface-tension from the cell-contents. Quincke supposes these to be so minute that experimental evidence of their existence cannot be obtained, and he depends for the justification of his assumption upon the power of his theory to explain all the known phenomena of the structure and properties of metals. The present paper gives an outline of this explanation, but while it is distinctly ingenious it suffers from the defect that its author is obviously incompletely acquainted with the modern developments of metallography. As a result, one finds again and again that the proffered explanations are incompatible with well-established facts. One example, out of many which might be given, must suffice.

According to Quincke, the growth of crystals during annealing is due to the collapse of a foam-wall lying between two adjacent foam-cells, and forming what is usually termed an intercrystalline boundary, with the consequent coalescence of the two adjacent crystals into a single crystal. Direct observation of the process of crystal growth has, however, definitely shown that this is not the true *modus operandi*. The crystals do not grow by the bodily absorption of their neighbours, but by a process which may be likened to gradual invasion and conversion. The growing crystal gradually pushes its boundary outward into its neighbours, and frequently does so by pushing out one or more arms which gradually spread laterally as well as advance longitudinally. Nothing could be more unlike the picture suggested by Quincke's explanation, and similar difficulties can be raised at every turn.

On reading the paper, however, while those intimately acquainted with the behaviour of crystalline aggregates will scarcely be disposed to accept the "foam-cell" theory, they will yet be struck by the fact that the forces of surface-tension upon which Quincke lays such stress must powerfully affect the structure of metals and alloys—forces the importante of which has not perhaps been sufficiently recognised by current metallographic theories. In eutectic alloys particularly one constantly meets with structures which bear strikingly close resemblance to those assumed by films of liquid under the action of surface-tension. It has even been thought that the constituents of such eutectics may assume their actual forms just before solidification, in the shape of bags or sacks of the kind imagined by Quincke as foam-cells.

Experimental evidence is, however, against this view. The experiment has been tried of allowing eutectic alloys to solidify slowly under the action of centrifugal pressure in a powerful centrifuge, and the resulting structure is entirely unaffected. Had liquid sacks or "foam-cells" really been formed they must have been flattened or deformed under this treatment, but such was not the case. On the other hand, recent metallographic researches seem to indicate that the intercrystalline boundaries of a metal are of the nature of cell-walls formed by very thin layers of the same metal in the amorphous or undercooled liquid state, and here there is a decided approximation to Quincke's ideas, only that these cell-walls are regarded as the result of the meeting of adjacent growing crystals, and not as the primary limitations to crystal growth. Still, although Quincke's theory of foam-cells can scarcely be accepted as being in reasonable accordance with the known facts of metallography, a study of his views should be useful and suggestive to all those interested in the physics and physical chemistry of crystalline aggregates.

W. ROSENHAIN.