

The work is divided into three parts. In the first and longest of them the object is to fill, subject to certain rules, a defined area by polygons all of the same shape and size, but each coloured or numbered, like dominoes, according to a different scheme. In the second part arrangements made according to the methods expounded in the first part are "transformed" so as to give a number of pieces of the same colour but of shapes which are all different; the result is the production of a jig-saw puzzle. In the third part we deal again with pieces all of the same size and shape, and the object is to design repeating patterns which can be used to cover an area.

The first part of the book involves the consideration of how to fill in a certain way a prescribed area with wood or cardboard polygons, which may be regarded as super-dominoes. The shape of an ordinary domino is a rectangle (the breadth of which is immaterial) with two ends or faces, on which numbers or pips can be inscribed, and, if we like, each number may be taken to indicate a particular colour: by using n numbers we can get $n(n+1)/2$ different linear dominoes. If our dominoes are triangular in shape, and from some central point within the triangle we draw lines to the angular points, we get dominoes with three faces, on each of which numbers or pips can be inscribed, and as before each number may be taken to indicate a particular colour: by using n colours we can get $n(n^2+2)/3$ different triangular dominoes. Similarly, by using n colours we can get $n(n+1)(n^2-n+2)/4$ different square dominoes, $n(n^4+4)/5$ different pentagonal dominoes, and so on. With each of these sets we can make up puzzles.

A particular instance will illustrate the kind of questions treated. Consider the case of equilateral triangular dominoes. If four colours are used we get a set of twenty-four different dominoes, and these can be put together (preferably fitting in a shallow box cut to the right size) to make a regular hexagon. Naturally the point in each domino from which the lines radiate to its vertices will be taken at its centre, thus dividing each triangle into three equal compartments, and facilitating the formation of symmetrical patterns. A consideration of what conditions can be imposed for arranging the dominoes next arises. For example, we may require the arrangement to be such that the colours of adjoining faces shall be alike, as also those of all the exterior faces; the solution, subject to this condition, is, among others, given.

The patterns formed are elegant, and the puzzle of fitting the dominoes together according to some imposed condition is sure to interest a good many people, some of whom are likely to become enthusiasts

in the game. In the book the colours are indicated by numerals, and thus the results appeal to the mind rather than to the eye; this is a loss.

If the dominoes are right-angled triangles, we get a hexagon arrangement of a different shape. Further, we can play with sets selected from a particular full set and arranged in suitable geometrical figures. Similar problems arise from the use of square dominoes, hexagonal dominoes, etc.

In the second part, the author concerns himself with "transformations," necessarily unlimited in number, of arrangements like those above described. This is, in effect, an exposition of a method of making jig-saw puzzles of a certain type. Probably this has never before been reduced to a system, and it may be doubted whether those who cut out such puzzles will care to proceed by rule in the matter; but, if they do, here are hints and directions for their use.

In the third part, the previous investigations are applied to the formation of "repeating patterns," built up by arranging sets of pieces which fit together. Here the author enters on a field of decorative work in which there are already excellent technical books. He says that he has developed this subject much further, and that he has in hand a work entirely devoted to it. The subject is of importance to architects and pattern-makers, and is a recognised branch of arts and crafts.

The results of the problems set out in the first part of this book are singularly effective when colours are used, and provide numerous novel and interesting recreations of a certain type. We share the author's disappointment that the cost of printing nowadays has rendered it impossible to produce the book in colour. The questions considered in the second and third parts are of a more technical character, and are likely to appeal to the specialist rather than to the general reader: to the former they will open new and interesting lines of development.

The Fishing Industry and Scientific Research.

Ocean Research and the Great Fisheries. By G. C. L. Howell. Pp. 220 + 20 plates + 3 charts. (Oxford: At the Clarendon Press, 1921.) 18s. net.

THE reconstruction spirit of the years 1918-9 was nowhere more evident than in its relation to the fishing industry. Even before the date of the armistice the owners of trawling and drifting vessels had met repeatedly and prepared a very noteworthy memorandum, which was presented to the President of the Board of Agriculture and Fisheries later on. At that time emphasis was very

naturally placed on the importance of a highly trained fishing population in regard to questions of national defence, and the immediate object of the memorandum was to interest the Government in this and other purely economic questions. In 1919, however, a series of committees met at Fishmongers' Hall under the presidency of Sir Edward Busk, and detailed recommendations dealing with administration, publicity, education, and scientific research were prepared, printed, and circulated. A beginning was made with the work of consolidating the statutes relating to fishery. Later on the British Trawlers Federation was formed, and proposals for the creation, by Royal Charter, of a British Fisheries Society were drafted. The author of the book under notice was mainly responsible for all this organisation. Throughout the whole movement scientific research was kept in the foreground, and its absolute necessity in any possible scheme of fishery reconstruction was recognised by everyone concerned. It was understood that the industry itself was prepared to back financially a sound programme of scientific and industrial research, and, without doubt, such programmes of education and research would now have been in practice but for the wholly unexpected partial collapse of the fishing industry that occurred in 1920.

These remarks will make clear what is the attitude taken up by Mr. Howell in writing his book. It is an account of the life-histories and economic significance of the various species of marine fishes, and it is very well done indeed. Apart from a few errors, inevitable, perhaps, in a work of this kind, it is a trustworthy account of the material of the marine fisheries, written in a plain but very attractive manner, fortified with clearly constructed statistical statements, very well illustrated and beautifully printed. But, much more than all that, it is a plea, on almost every page, for the further prosecution of marine research in relation to the fisheries, and it aims at the communication of the results of such work to the fisherman and owner of fishing vessels. It is a useful protest against the pedantry of the fisheries investigator. Little of what has been discovered has ever been presented in such a manner as to be understood by the industry in general—though this is quite practicable, as the book itself proves. Men of science almost always write for other men of science, though sooner or later their results must receive application, and this application would come all the more quickly if there were a true *liaison* between the administrators, the scientific workers, and the industry. The furtherance of such a working agreement is, all the way through, the main object of Mr. Howell's admirable book.

J. J.

Wegener's Displacement Theory.

Die Entstehung der Kontinente und Ozeane. Von Prof. Dr. Alfred Wegener. *Die Wissenschaft: Sammlung von Einzeldarstellungen aus den Gebieten der Naturwissenschaft und der Technik.* Herausgegeben von Prof. Dr. Eilhard Wiedemann. Band 66. Zweite gänzlich umgearbeitete Auflage. Pp. viii + 135. (Braunschweig: Friedr. Vieweg und Sohn, 1920.) 30 marks.

THIS book makes an immediate appeal to physicists, but is meeting with strong opposition from a good many geologists. This opposition is to be expected, for the author replaces the whole theory of sunken continents, land bridges, and great changes of earth temperature by a displacement theory.

Prof. Wegener's thesis is that the continents are of lighter material, and float like icebergs on a heavier plastic which reaches its highest level at the bottom of the oceans; the poles are not fixed relative to the plastic, and have occupied widely different positions, as, for instance, when Central Europe was a Sahara, or, again, when the great coal fields were laid down along a great circle (equator); land masses under gravitational influence move away from the poles and westwards.

Thus the Americas in their westward drift have heaped up the Andes and the Rockies. The South Atlantic opened early, but the northern portion did not exist until much more recent times. At the great Ice age, in fact, the glaciation in both hemispheres was due to an ordinary polar ice cap. India once stretched down over the Indian Ocean, being united to Africa and Australia. Since that time the Himalayas have been piled up, and Australia has left New Zealand far behind.

Actual measurements of continental and sea levels establish the fact that instead of there being a random distribution about one level there are two well-marked averages, a fact difficult to explain on any subsidence theory. Again, it was shown by Wilde that the earth's magnetic field can be closely imitated on a globe where iron sheets are placed over the ocean areas. On the present theory this is due to the plastic interior being richer in iron and rising higher under the oceans, where there is thus a thicker layer below the temperature at which iron loses its magnetic properties. Recent astronomical work has shown that the latitude of North American and European stations is increasing, but in the absence of measurements from the Far East we cannot prove that this is not due to a displacement of the pole.

The book brings forward a mass of geological