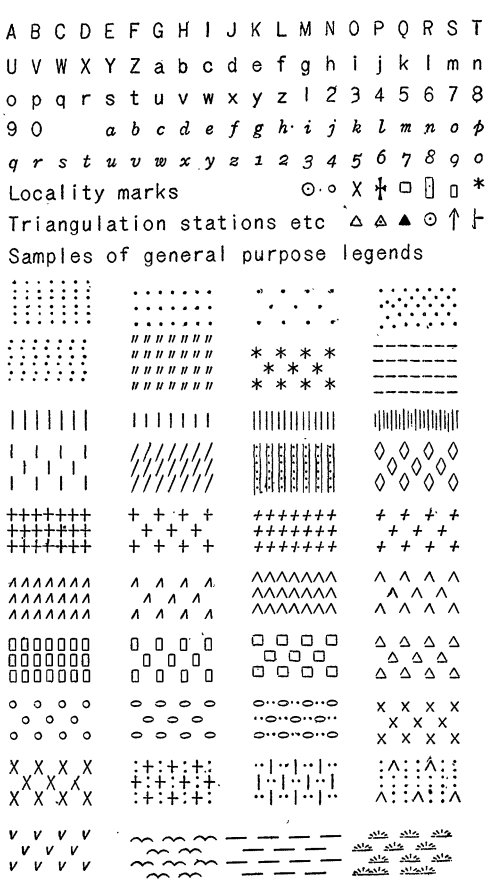
likely to start on a brief journey, going only about two inches from the edge of his scar, and returning to settle upon it again, sometimes within fifteen minutes from the time of his leaving it. In no experiment did I find a *Fissurella* homing if he had been removed more than three inches, though one which had been removed six and a half inches was nearly half way back in twenty-four hours. My departure from Bermuda prevented my learning his final fate. *Fissurella,* like *Siphonaria,* recognizes his scar and orients himself properly with reference to it as soon as he reaches it. In one instance I found a scar occupied by two animals; one was the owner, who had evidently returned from his wanderings to find that a usurper had already taken possession of half of his home. He had, however, crawled on to as much of the scar as was still unoccupied and the next day was in sole possession, while the intruder had disappeared. *Fissurella barbadensis,* then, undertakes short voluntary excursions and returns to his scar, but his power of homing when removed by some one else has not been fully tested. M. A. WILLCOX.

MACHINE-MADE LINE DRAWINGS FOR THE ILLUSTRATION OF SCIENTIFIC PAPERS.

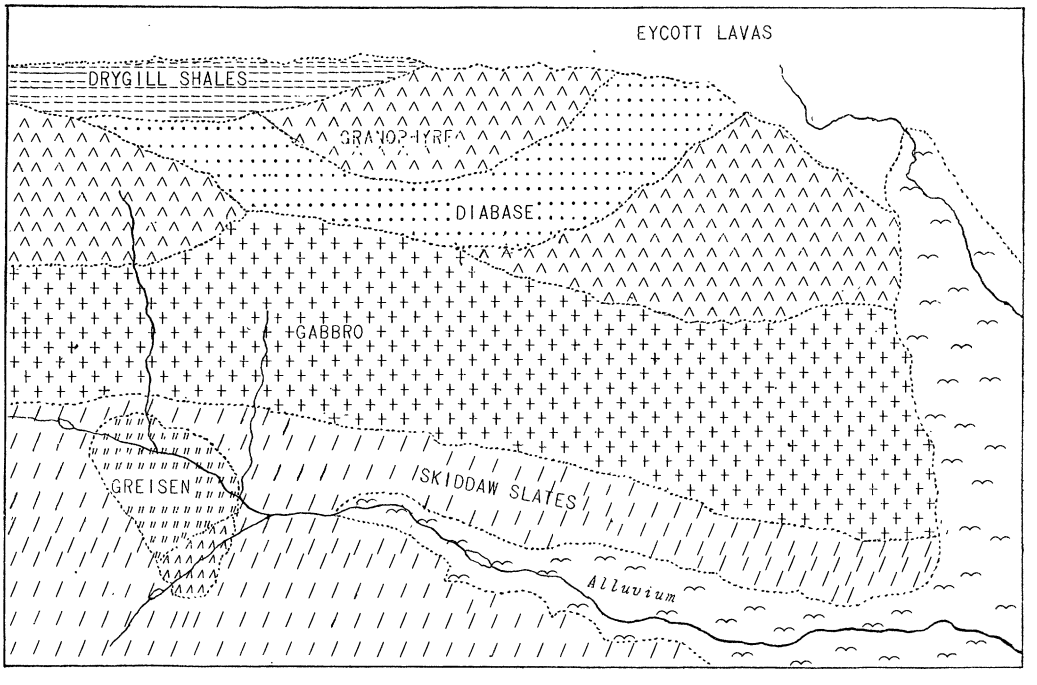
IT is safe to say that the majority of persons who from time to time publish scientific papers are seriously hampered in the preparation of text illustrations by the difficulty and expense entailed in the tedious drawing of map, section or diagram. Comparatively few authors can command the services of skilled draughtsmen or have themselves the requisite training to produce satisfactory line drawings. Yet the desirability of greatly increasing the proportion of such illustration in the thousands of scientific articles published each year is manifest. That clearness, precision and conciseness in the exposition of a theme are generally enhanced by the use of abundant, appropriate diagrams is as evident as that the blackboard is the constant friend of the teacher of any branch of natural history or philosophy; the printed page needs its blackboard.

Ideally, the author should himself be able to make the original drawing quickly, neatly and artistically. The usual execution of drawing with the pen is, to the average author, discouragingly slow and expensive, not always neat, and still less often artistic. The following note relates to some experiments made to increase rapidity and neatness in the production of line drawings by the use of a machine. At the outset the experiments were,



for obvious reasons, planned without any idea of rivaling the artistic work of the pen in a skilled hand. The aim has been to secure economy of time in execution and clear-cut precision of legend for the drawing. In both these respects enough success has been attained to warrant the recommendation of the machine method to geologists, geographers and others who desire to prepare useful text

illustrations at a minimum cost of labor. Some essays of the kind were made and published in the *Bulletin* of the Museum of Comparative Zoology at Harvard College, Vol. XXXVIII., 1902, Pls. 11, 12 and 13, in the *Amer. Jour. of Science,* August, 1903, pp. 118 and 120, and in the *American Geologist,* August, 1903, p. 66. The machine there used was an ordinary Underwood typewriter fitted with a black record silk ribbon. Recently the Hammond Typewriter Company of New York has constructed, from the writer's specifications, a typewriter provided with a carbon ribbon and with ninety special characters designed for the preparation of line drawings to accompany geological and geographical papers. The same machine can be similarly used for statistical, engineering and other diagrams of a more or less mechanical and simple composition. Of course, this method should not wholly replace the use of the pen even, for example, in the differentiation of areas in a geological map or section. The ultra mechanical look of the typewritten legend can often be pleasingly relieved by the easily and quickly applied cross-hatchings, etc., made with an ordinary drawing pen. In complex diagrams free-hand work may generally be expected to supplement the work of the machine. The subject of each diagram should thus be studied with the end of securing suitable contrasts of legend along with the maximum economy of pen work; yet some pen work is almost always necessary.



The typewriter has its most general application in lettering, that most difficult element in line drawings. The particular machine made by the Hammond Company has the advantage of making it possible to employ a great range of type styles. Using the carbon ribbon, the writer has found that any one of the one hundred and twenty-five shuttles made for the machine (each shuttle bearing ninety characters and including the lettering for one of twenty-six different languages), will give an impression suitable for photographic reproduction. Each shuttle can be placed in the machine ready for work in a few seconds. The shuttles now on the market cost $2.50 each and any new character can be supplied

by the company at the cost of fifty cents. The ordinary Hammond machine furnished with a back-spacing key can be used for manuscript diagrams up to about eight inches in diameter, but the machine No. 6, fitted with a sixteen-inch roll, permits of the preparation of diagrams fourteen inches in diameter. The usual silk ribbon gives a 'woolly' line and is far less satisfactory than the carbon ribbon. A highly calendered and high grade linen paper of medium to heavy weight, or a thin Bristol board may be recommended. Often more than one impression of the key is necessary to obtain the required depth of tint for photography; such repeated impressions can be made at great speed by employing the back-spacing key. Care must be taken not to smudge the carbon of the completed printing.

The accompanying cuts serve to show something of the method as applied to geological diagrams. The diagram of alphabets and legends has been reduced to three fourths of its original diameters. The legends are intended to represent a few examples of those possible with the machine. They can be indefinitely increased in number and varied in design by the engraving of new characters on the shuttle and by using various permutations and combinations of the existing characters. The map is reduced to two thirds of its original diameters. It was copied from Harker's sketch map of the Carrock Fell District, published in the *Quarterly Journal of the Geological Society of London,* Vol. 51, 1895, Pl. IV. Here the geological formations could have been yet more clearly differentiated by cross-hatching with the ruling pen for one of them, but this particular drawing was made to illustrate the neatness and clearness of the machine-made production rather than to illustrate an ideal diagram. So far as the typewritten part of the 'drawings' is concerned, the use of the machine in preparing these illustrations represents a saving of from seventy-five to ninety per cent. of the time required by a draughtsman to duplicate the 'drawing.'

R. A DALY.

INTERNATIONAL BOUNDARY COMMISSION,
OTTAWA, CAN.

MEETING OF THE BRITISH ASSOCIATION IN SOUTH AFRICA.[1]

THE arrangements for the forthcoming meeting of the British Association in South Africa have now been completed, and Mr. Silva White, the assistant secretary of the association, sailed for Cape Town in the *Walmer Castle,* on Saturday last, July 1. The number of members who will proceed to South Africa to attend the meeting is 385, and of these no less than 276 members have intimated their intention to visit the Victoria Falls at the conclusion of the ordinary work of the association. The official party, consisting of leading representatives of science and guests of the association, with the general and sectional officers for this meeting and the president, numbers 140 in all, and will sail by the *Saxon* on July 29. Most of the other members will proceed to the meeting by the *Durham Castle* and the *Kildonan Castle,* both of which sail on July 22.

There will be receptions and social functions, excursions, etc., at Cape Town, Durham, Pietermaritzburg, Johannesburg, Kimberley and Bulawayo. The central organizing committee for South Africa (chairman, Sir David Gill, K.C.B., F.R.S., hon. secretary, Dr. Gilchrist) has carried out the coordinating work of the program. The lists of local committees and subcommittees contain nearly one thousand names, from which it may be concluded that much interest is taken in the meeting.

Lectures of a popular character will be delivered at the chief towns visited. These lectures have now been definitely arranged as follows:

Cape Town: 'W. J. Burchell's Discoveries in South Africa,' Professor Poulton; 'Some Surface Actions of Fluids,' Mr. C. V. Boys. *Durban:* 'Mountains: the Highest Himalaya,' Mr. D. Freshfield. *Pietermaritzburg:* 'Sleeping-sickness,' Colonel D. Bruce. *Johannesburg:* 'Distribution of Power,' Professor Ayrton; 'Steel as an Igneous Rock,' Professor Arnold. *Pretoria:* 'Fly-borne Diseases, Malaria, Sleeping-sickness, etc.,' Mr. A. E. Shipley. *Bloemfontein:* 'The Milky Way and the Clouds of Magellan,' Mr. A. R. Hinks.

[1] From *Nature.*