Impressions of the Royal Botanic Garden, Kew, London.

By K. P. Biswas, M.A., F.R.S.E.,
Royal Botanic Garden, Calcutta.

THE glorious spring beauty of the Royal Botanic Garden, Kew, prompts me to give a brief account of these famous gardens. A 'Host of golden Daffodils', Narcissus, and Tulips growing in the lawns and mounds are a feast for the eyes. The Magnolias, the Japanese Cherries, and the Azaleas are harbingers of the spring which reaches its climax in the blooming of Rhododendrons in their full splendour. The artistic beds of annuals in front of the Palm House with the background of the lake and its fountain at the centre is the favourite spot of the visitors. The display of colours in these flower-beds, stretching from one end of the lawn to the other, illustrates the high standard of modern horticultural skill (Fig. 1).

The Royal Botanic Garden, Kew, maintains a highly trained Staff of horticulturists, arboriculturists, alpine gardeners, propagators and so on, whose activities are in these days becoming more and more specialised, like those interested in other branches of Science and Art. These members of the Staff are responsible for upholding the standard of gardening reached at Kew during its evolution for a period of one hundred and seventy-seven years.

Frederick, Prince of Wales, secured the help of Kent, the celebrated landscape gardener, and made a successful attempt to convert here, at Kew, his private garden into a good model for a garden in those days. After his demise his widow Princess Augusta of Saxe Gotha, mother of George III, commenced laying out, in an area of nine acres, a botanic garden in 1760, with the aid of John Stewart, 3rd Earl of Bute as Scientific Director, William Aiton as Head Gardener, and Sir William Chambers as Architect. King George after his mother's death in 1772 enlarged this area considerably and with Sir Joseph Banks at his service he introduced many foreign plants. In 1840, the Garden was given to the nation by Queen Victoria. In 1841 Sir William Hooker, the then Professor of Botany at Glasgow, was appointed Director of the Botanic Garden at Kew. During Sir William Hooker's period the Garden attained an area of 250 acres, and subsequent additions brought the Garden to its present area of a little over 280 acres. The Garden thus secures the reputation of being the largest Botanic Garden in the World.

The Royal Botanic Garden, Kew, like the Royal Botanic Garden, Calcutta, lies along the bank of a river stretching from North-East to South-West. Kew Garden has six gates. The main gate on Kew, Green, the cumberland, the Victoria and the Lion Gates on Kew Road; and two Brentford and Isleworth Ferry Gates, on the side of the river Thames.

Kew Garden, associated as it is in its earlier period with the Royal family, retains still in its Kew Palace (built in 1631) a monument of English history. Kew Palace was erected on the foundation of "Dairy House" by Samuel Fortrey. Dairy House belonged to Dudley, Earl of Leicester, favourite of Queen Elizabeth and the husband of Amy Robsort. Dudley was staying here when his ill-fated wife met her tragic death at Cumoron on September 8, 1580. George III acquired the property in 1781 and after the Kew House, was pulled down, it was used as a Royal residence. Queen Victoria's father, the Duke of Kent and his brother Duke of Clarence, afterwards William IV, were both married in July 1818 and their mother Queen Charlotte died in one of the rooms on the first floor, in the following November. The sundial on the lawn in front of the Palace marks the spot where in 1775 Bradley, the Astronomer Royal, made two important discoveries—the aberration of light and the nutation of the earth's axis. His discoveries and astronomical observations are commemorated by this sundial placed by H. M. the King, William IV.

The Queen's Cottage near the Isleworth Ferry Gate is a small thatched cottage. This is another historical place which, as its name suggests, used to be a summer tea-room of George III and Queen Charlotte. It was built by George III in 1760. The grounds were given by Queen Victoria to the public in 1897 with the expressed desire that they should be maintained in their present wild state. This is one of the favourite spots of the visitors when bluebells are in full bloom during the middle of May. The long association of Kew Garden, ceased with the death of the Duke of Cambridge in 1904. The Duke, like his father, resided in Cambridge Cottage, part of which building is now Museum No. IV.

Museums and other buildings.—The Royal Botanic Garden, Kew, possesses four large museums of great educational value. In these museums are arranged exhibits representing various useful aspects of Botanical Science. Museum No. I (Fig. 2) in its exhibits elucidates the uses of Dicotyledonous plants such as Quinine (cinchona), rubber (*Havea brasiliensis*), etc. Museum No. II was opened in 1848, ten years earlier than Museum No. I, to illustrate the economic uses of Monocotyledonous plants. In Museum No. III are displayed various samples of foreign timber, models of indigo plantations in India in olden days, a model of Taitokuin Shrine or Mausoleum of the second Shogan of Japan, many examples of wood craft and various other botanical specimens of public interest. Museum No. IV is mainly devoted to illustrating British Forestry and various uses of British timbers. The Pagoda (built in 1761–62), Temple of Aeolus (1760), Temple of Bellona (1760), Ruined Arch (1759–1760), are objects of antique interest. The Japanese Gateway is a piece of remarkable carving presented to Kew by the Japanese. It is a replica of the famous gateway at Kayoto in Japan, known there as "Choku-Shi-Mon", the Marianne North Gallery contains a collection of 848 paintings executed by Miss Marianne North. The scenes and vegetation of the tropics were painted on the spot. She made a gift in 1882 to Kew Garden of all her lifeworks, together with the building that houses them. King William's Temple

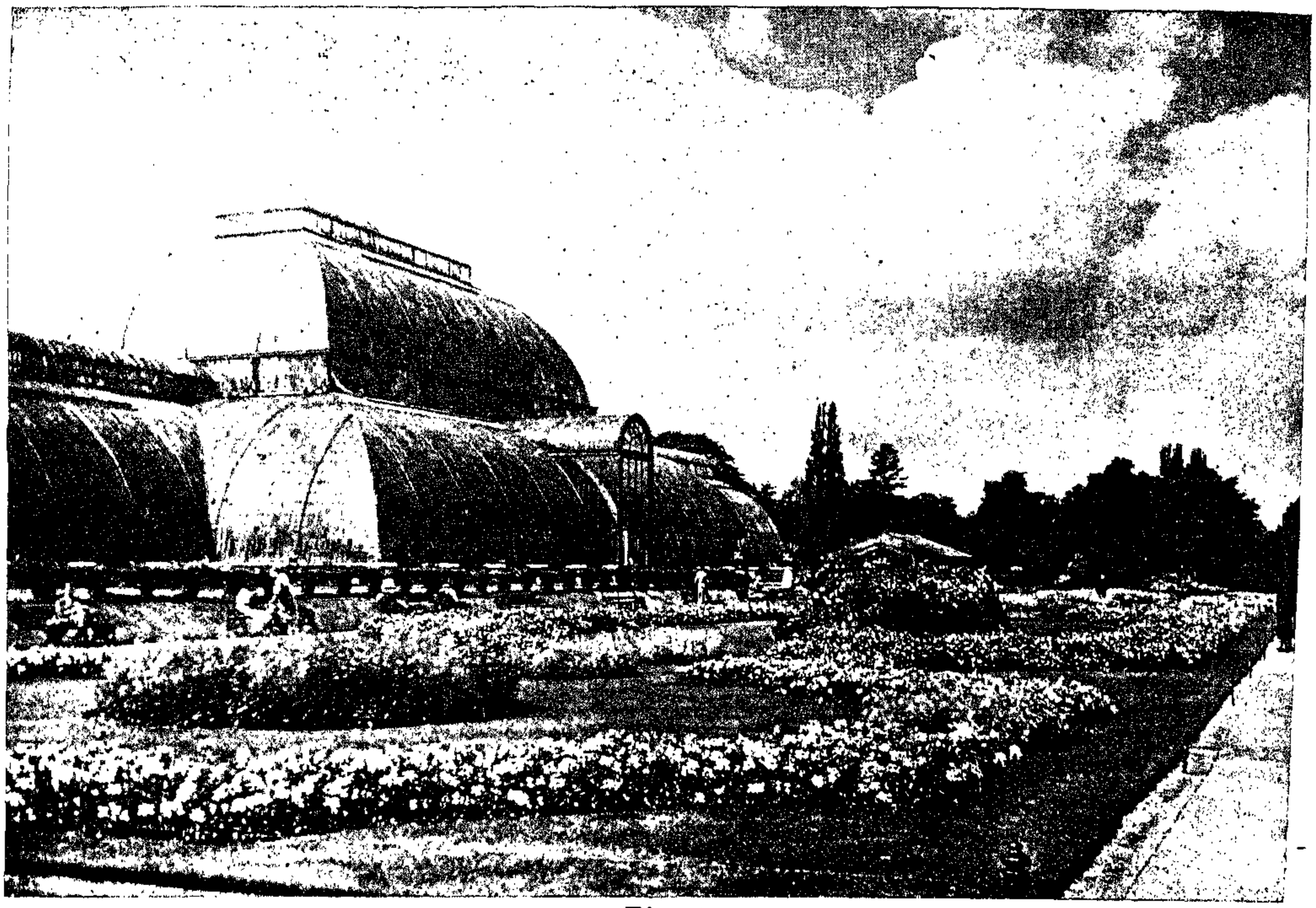
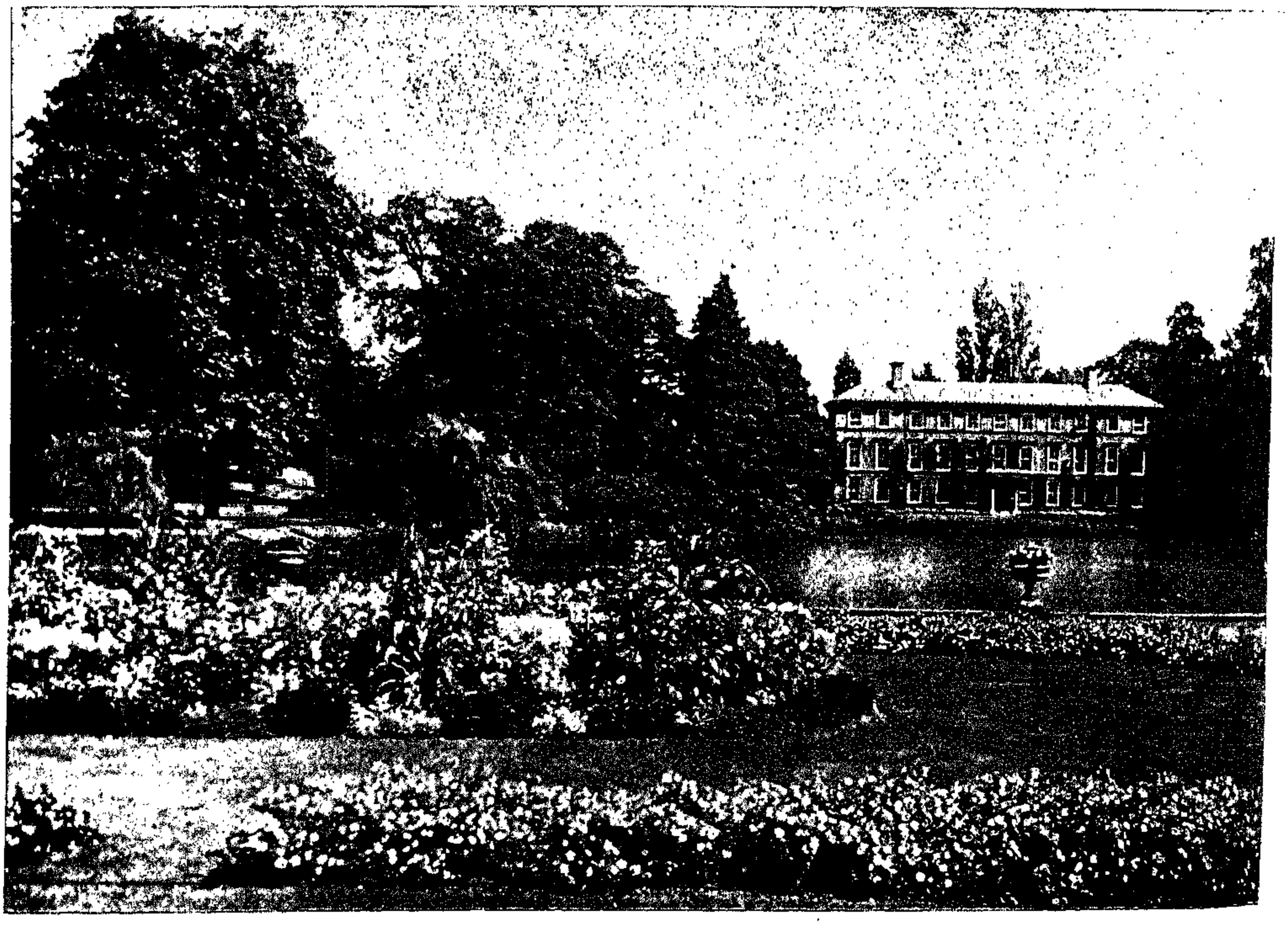


Fig. 1.
The Palm House and the Flower-beds in front of the Palm House.



was built in 1837 and in its vicinity is found the attractive group of heath plants of the family of Ericaceæ. The flagstaff of Kew is 214 feet high, cut of Douglas Fir of the Forest of Vancouver Island. The tree itself was 280 ft.-300 ft. high when it was felled.

Kew is equally rich in having a large number of hot and cold houses and ferneries for growing plants coming to Kew from all over the world. The Aroid House provides shelter for many of our familiar Indian Arums. The tropical Fern House is a repository of many rare ferns including the well-known gold and silver ferns and the famous Malayan stag-horn fern. The Temperate Fern House represents among others the rare Gleichenias of Australia, West Indies and New Zealand. The large Palm House is a proud possession of Kew (Fig. 1). In this Palm House are cultivated various species of palms including cocoanut palm, double cocoanut, screwpines (pandanus) and others. Among plants of Indian interest are seen Hemp, Bananas, Mango, Coffee, Cocao, Bael (*Aegle Marmelos*) and others. The travellers tree of Madagascar (*Ravenala madagascariensis*) is also seen in its proper form here. A number of Conservatories are stocked with a good variety of plants displaying the flowering period of the different species in different seasons. About 1800 species of Orchids are grown in the Orchid Houses. Among the common European and American species are found many Northern Asiatic and Himalayan species. Extensive horticultural manipulations are carried out on these much-prized plants by growing them from seeds and bulbs and producing many rare hybrids exhibiting a wide range of variation in colour and texture of the flowers. The Orchidologists differentiate these delicate varieties by coining queer and romantic names and keeping their trade secrets and trade marks to themselves. Similar horticultural operations are practised on other popular flowering plants such as Rhododendrons, Azaleas, Cherries, Prunus, Begonias, Calceolaria, Cyclamen, etc. The Himalayan House, forming a part of the Temperate House or Winter Garden, stocks many alpine species of Rhododendrons, Camelias from China and Japan, Primulas and a few other Northern Asiatic species (Fig. 3). The Begonia House is set apart for specialisation of many rare and gorgeous garden varieties and forms of considerable commercial importance. Cape House, among many of its plants from the Cape of Good Hope, offers good accommodation to the queer plant known as Mesembryanthemums of much interest to botanists. The Succulent and the South African Houses contain many succulent prickly pears and other species of Cactus. Some of the succulents mimic each other and also the pebbles among which they grow (Fig. 4). These xerophytes are grown under conditions resembling their natural habitats. Adjoining this House is situated another popular House—The Sherman Hoyt Cactus House called after Mrs. Sherman Hoyt of California. This American lady presented to Kew many of the Cacti brought from California. This House has a scenic background which represents the Mohave Desert of California.

The red, blue and white Nymphæs and our Sacred lotus among the Papyrus plant of Egypt decorate the Water-lily House. The *Victoria regia* House accommodates the largest water lily which is called after Queen Victoria. This giant water-lily of the Amazon is grown in a large rectangular tank from seeds produced in the Garden every year. By the middle of summer, this lily—one of the vegetable wonders reaches its full growth and adult leaves at Kew measure about 7 ft. with 1-6 in. deep upturned rims. Flowers are 12 in. in diameter at first white and fragrant but later changing to purple pink before drying up. Rice, sugarcane, cotton and a few other tropical plants are also grown in this aquatic House.

Adjacent to this House are cultivated the other vegetable wonders the insect-eating plants. The insectivorous Sarracenias, Sundews, Venus, Flytrap, are all seen here in their full splendour. In the Nepenthes House are seen various species of Pitcher plants grown in hanging baskets with their long tender leaves, suspending at its apices pitchers of various sizes and shapes. The midribs are prolonged and dilated into pitchers, the tips of their leaves being modified into lids for covering the mouth. The insects when they slip into the pitchers are captured by the mouth of the pitcher being closed, due to the ingenious mechanism of the lid. The nutritive material produced after the decay of the insects in the digestive juice of the pitcher is absorbed by the plants which thus recoup their nitrogen deficiency.

The æsthetic side of the Kew Garden mainly consists in its maintaining what may be called —the general character of English gardening. Its spacious lawns, its long vistas, its well plotted shrubberies and herbaceous borders, its well proportioned mounds and dells, in proper order of sequence all add to the unique beauty of the Kew Garden. The different aspects of the Garden have their proper display too. The herbaceous grounds with their classified beds are instructive to the students of Botany. The Rose Pergola represents a section of the best varieties of climbing roses. The Berberis Dell accommodates selected species of Berberis. The Rhododendron Dell presents in May and June a glorious sight when the plants go on blooming one after the other. Their grandeur is further enhanced by bushes of Azaleas and Camelias in between also bursting out in full bloom at this time. The bamboos and grasses on one side and the taller conifers, oaks and beeches on the other side forming good background create in an Indian mind an impression of Himalayan surroundings. The Arboretum stocks a rich collection of conifers. The woodland with all tall European and American trees, neighbouring to Queen's Cottage, fulfils the forest side of the Garden. The Rock Garden, much extended and rennovated of late, is very rich in Alpine species of the different parts of the globe. Saxifragas, Primulas, Gentians, Sempervivum, Sedum, Campanulas, Veronicas, Dianthus, Silene, Aubrietias and others all flower profusely —displaying amazing delicacy in colour and grace. The advantage of diverse species in a small compass exposing *en masse* a riot of colours makes

Fig. 3.

The Alpine House in Spring with many Interesting and Rare Alpine Himalayan Species.

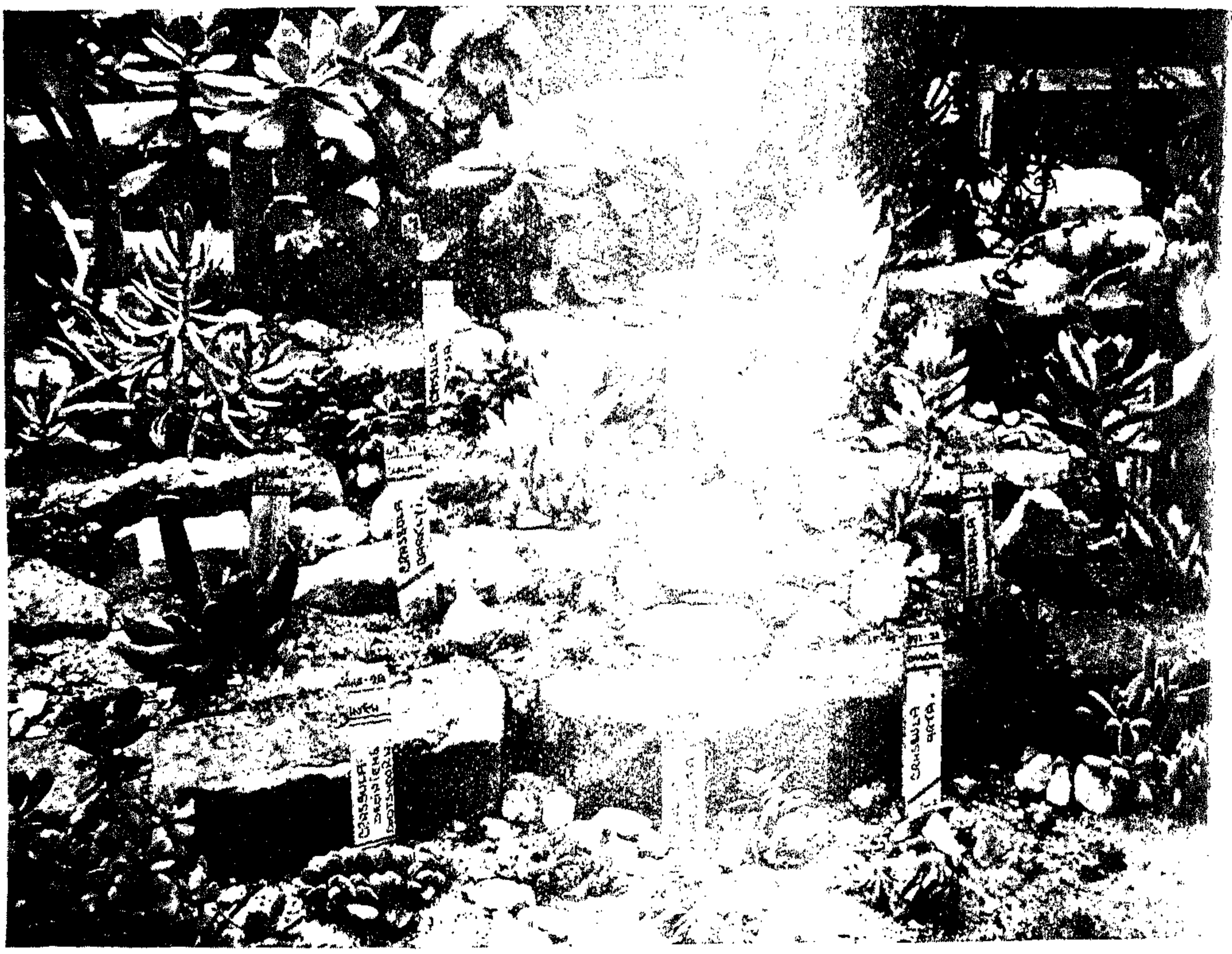


Fig. 4.

a rock garden more and more popular in these days.

Attached to this garden is a Herbarium where are kept in classified order, in its three spacious wings, dried specimens of plants occurring in different parts of the globe (Fig. 5),—More than

Fig. 5.
The Herbarium, Royal Botanic Garden, Kew.

4 million sheets represent the whole plant kingdom. Specimens for determination and numerous enquiries pour into the Herbarium and form the major part of the work of the Systematists. The naming of plants grown in the Garden, their distribution, economic uses, etc., are all dealt with at this sanctuary of Systematic Botany where flock in specialists from all over the world to solve their doubts with the help of the type sheets and the literature—the richest in the world, available here. Anatomical investigations are also carried on in the Jodrell Laboratory by a small band of workers.

The Head of this great British Organisation is Sir Arthur Hill, K.C.M.G., M.A., SC.D., D.SC., F.R.S., F.L.S., F.R.N.Z., V.M.H., of world-wide reputation. To him I offer my grateful thanks for giving me every possible facility to study various problems of gardening, to carry on my researches in the Herbarium, and for his permission to publish some of the photographs of the Garden.

The Herbarium,
Royal Botanic Garden,
Kew. London,
August 16, 1937.

The Liquid State of Matter.

THE Sixty-fifth General Discussions of the Faraday Society centred round not any special recent discovery, but about a most common and general phenomenon, *viz.*, the nature of the liquid state. As is well known the striking aspect of this condensed state of matter is its obvious isotropic character and the consequent very suggestive close resemblance to a gas. This suggestion has indeed been so strong, and has been so much supported by the Van der Waals theory and by the initial successes of the osmotic theory of solutions, that until recently, the significance of other equally important characters of the liquid state was overlooked. For instance the molecules in the liquid state are usually just only ten per cent. less densely packed than in a crystalline solid, *i.e.*, with but a three per cent. increase in the order of intermolecular distance. One should expect from this, that the forces between the molecules must be nearly of the same order as in the crystalline state and should therefore lead to some structural arrangement with more or less permanent neighbours, while at the same time this arrangement cannot possess the regularity which characterises the crystalline