(a) *Natural* or *Native Asphalt* occurs in many parts of the world in either a pure (or moderately pure) condition or associated with a large proportion of mineral matter such as limestone, shale, etc., and known as *rock asphalt*. It is found in liquid form in springs, liquid or semi-liquid condition in lakes, and in impregnated rock formation. As there are no deposits in this country, asphalt has to be imported, the chief supplies being obtained from the British West Indies, France, Switzerland and Germany.

Natural asphalt is one of the most efficient materials employed for damp resisting purposes; it is black in colour, very durable, tough, elastic and noiseless.

One of the largest deposits of asphalt exists on the Island of Trinidad, British West Indies. It is a lake, known as Trinidad Asphalt Lake, approximately circular, of 2,000-yd. in diameter and nearly 300-ft. deep. Whilst large quantities of asphalt have already been obtained from it, it is estimated that there still remain some 10 to 15 million tons. The consistency of the asphalt is such that it will permit men to work on the surface.

The chief supply from France comes from a large deposit in the Seyssel region and is commercially known by that name. Another source is that from a deposit mined in the south (St Jean de Maruéjols, Department of Gard). These are rock asphalt deposits, the limestone having a maximum asphalt impregnation of 12 per cent. It is both quarried and mined.

The largest deposits occuring in Switzerland are in the Val de Travers region, west of Lake Neuchatel, and well known as Val de Travers and Neuchatel asphalts. This is asphalt-impregnated limestone, the asphalt content varying from 8 to 12 per cent.

The principal deposit in Germany is situated at the village of Limmer (in the province of Hanover) and is marketed as "Limmer Asphalt." This is limestone which is impregnated with 8 to 20 per cent. of asphalt.

Winning and Refining.—The methods employed to obtain asphalt depend upon the nature of the deposits. Thus, Trinidad Lake asphalt is hand-picked by men working on the surface, loaded into trucks which are hauled by cable over rails either to the refiners or to the shore (about $\frac{3}{4}$-mile distant) and loaded for direct shipment. Deposits of rock asphalt near the surface are open-quarried, blasting being resorted to. Deep deposits are mined.

Water is present in most natural asphalts. That from Lake Trinidad, for instance, has nearly 30 per cent. of moisture content. This must be removed. Dehydration is effected by heating the asphalt in open metal tanks, after which it is passed through a fine screen (to remove pieces of wood, etc.), and poured into barrels. Rock asphalts are crushed, ground and screened before being either heated in tanks or dried by exposure to the atmosphere.

Preparation of Natural Asphalt Mastic.—This is recognized as one of the most reliable materials for the damp proofing of walls, floors and flat roofs. As, for this purpose, most rock asphalts are deficient in bitumen, it is necessary to enrich them by the addition of Trinidad Lake asphalt. The rock asphalt or aggregate used in the preparation of the mastic should contain at least 90 per cent. of calcium carbonate and not less than 8 per cent. of bitumen. This rock is reduced by grinding to a powder so that the whole will pass a No. 8 sieve (mesh of 0·081-sq. in. aperture) and at least 15 per cent. will pass a No. 200 sieve (mesh of 0·003-sq. in. aperture). The required amount of Trinidad Lake asphalt is added and thoroughly incorporated by mechanical agitators with the powdered aggregate in a tank at a temperature of from 350° to 400° F. The total bitumen content should be at least 16 per cent. In order to stabilize the mastic and render it suitable for marketing, up to $12\frac{1}{2}$ per cent. by weight of fine grit such as sharp-grained sand is added during the mixing process. Finally, the mastic is discharged from the tank and cast into flat blocks weighing approximately $\frac{1}{2}$-cwt. each. It is thus in a convenient form for handling.

(b) *Artificial Asphalt* is a cheap and inferior substitute for the natural product. The composition is a mixture of *tar* with aggregates such as sand, pulverized chalk and *pitch* (see below). It is liable to deteriorate and become brittle. Therefore, when used as a damp proof course, cracks may appear through which water may penetrate. The composition of artificial asphalt varies, a common mixture being 1 part tar (or tar and pitch), 1 part sand and $1\frac{1}{4}$ parts crushed chalk. These are boiled in a tank and thoroughly incorporated by stirring before being run into blocks.

Tar, a black, thick, oily, strong-smelling liquid, is obtained by the destructive distillation in a closed retort of bituminous coal, wood and certain other organic substances.

Coal tar is the largest group, and is recovered as a by-product in gas manufacture. The gases produced when the coal in the retorts (long vertical or inclined vessels of circular or D-section) is heated proceed through the hydraulic main (a large pipe), condensers (pipes in which the gases are cooled), tar extractor and scrubbers (where ammonia and impurities are removed) to the gasometer. During the process, tar is deposited in the hydraulic main, condensers, extractor and scrubbers, collected and mixed.

Valuable oils are obtained by subjecting the tar to fractional distillation. The process consists of heating the tar in a still (metal cylinder) and collecting the condensed vapours. Benzene, toluene, naphtha, carbolic acid, cresol, creosote, naphthalene and anthracene are some of these oils.

Pitch is the residue in the still after the oils have been evaporated. This black coloured material has a variable consistency, becoming brittle in winter and softening when subjected to heat in the summer, hence the reason why this is an unreliable material for damp proofing (see above).

(c) *Fibrous Asphalt Felt* (see p. 18, Vol. I).—The continuous process is one of several used for manufacturing this material. The felt or hessian forming the base is passed in a continuous stretched sheet through a machine and successively (1) pre-heated as it travels over and under steam-heated cylinders, (2) impregnated with asphalt by being passed under and over a series of rollers in a tank containing hot liquid asphalt, (3) air-cooled as it traverses rollers, (4) passed through a second tank containing hot asphalt mastic and surface coatings of the liquid applied to each side of the sheet, (5) on emerging, sprayed by compressed air with grains of talc or similar material (to prevent the sheets from sticking together when coiled up) on the upper surface, (6) passed between a pair of rollers to embed the particles of talc and coiled by traversing air-