heavy oil engines with electric transmission. (2) The transmission of the power of a fast-running heavy oil engine through mechanical gearing.

Sir George Goodwin has come to some conclusions regarding the future. These are as follows:

(1) The reciprocating steam engine will be the most common type in the mercantile marine for some years yet. It is not likely to be developed in power, and not in economy of fuel consumption to any marked degree.

(2) Geared steam turbines must continue to be the engine for all ships of high power, as in the Navy. Its development will be in the direction of improving its fuel consumption by use of superheated steam and by attention to its details and auxiliary machinery.

(3) The heavy oil engine, having established its reputation for reliability, will, having regard to its low fuel consumption per horse-power, be the propelling engine of an increasing number of cargo ships and ships of low and moderate power, but its rate of increase of use will be retarded while its cost remains high, and efforts will be made to reduce the cost by increasing the power per cylinder by the several stages leading to the double-acting two stroke cycle engine.

Development will require a great deal of engineering research and experimental work, and also probably fundamental research in certain branches of pure science. Co-ordination in the different fields of research and with the engineer has been accomplished in some branches of engineering in the United States, and Sir George Goodwin invites attention to the system adopted of having an intermediate laboratory separate from the fundamental research station and separate from the factory. Here the results of fundamental research are collected and sifted, and the parts promising to be of service to the engineer are co-ordinated and developed with the help of engineers who know the needs of the factory, and also with the help of others who are expert in the economical side. The results are said to be satisfactory and to justify the cost.

Dielectric Mineral Separation.

By Prof. S. J. TRUSCOTT.

IN the preparation of clean mineral from crude ore, the processes of water concentration and flotation concentration, in combination or separately, achieve all that is required with sulphide ores, the former process being particularly successful in the recovery of coarse and granular mineral, while flotation is equally successful with fine and with the finest mineral. But, with oxide or oxidised ores, though water concentration will generally suffice where the mineral grain is large and remains so during crushing, there is no equivalent of flotation to recover fine mineral or that so fine as to go into suspension. Yet in the dressing of tin and other oxide ores requiring fine crushing, a substantial proportion of the ore passes into the fine condition described as slime, from which it is at present impossible to make a satisfactory mineral recovery. Again, the recovery of the vanadium mica, roscoelite, from the sandstone in which it occurs typically in the United States is not at present possible by any dressing process, because the roscoelite is friable and light; such vanadium deposits, large as they are, at present lie idle. Even where the mineral grain is sufficiently large it sometimes happens, and particularly with minerals of the rare metals, that water concentration will yield a complex concentrate of two or more minerals with properties of density, magnetic permeability, electric conductivity, etc., so similar that no one of the presently applied methods of dressing is effective in separation. Thus, some vanadium, uranium, and molybdenum minerals occurring together largely remain inseparable; and some alluvial tin concentrates contain rare minerals from which it is difficult to free the tin.

Given this position, any new process based upon physical differences between minerals not yet used in dressing, and disclosing possibilities of useful application in the field as yet unoccupied, is welcome. Dr. H. S. Hatfield, in a paper read before the Institution of Mining and Metallurgy in February last, brought forward such a process, one based on the differences in inductive capacity between minerals and one which he termed "dielectric mineral separation," substances being dielectrics by virtue of their property to propagate electric forces through themselves by induction. The "specific inductive capacity" may be considered to be a particular range of the more general "dielectric constant." Conductors may be considered to have an infinitely high dielectric constant; but insulators are the characteristic dielectrics.

As groups, the sulphide ore-minerals are conductors, the oxide ore-minerals poor conductors, and the gangue minerals are non-conductors. Actually, the oxide ore-minerals have dielectric constants of the order of 20-30, while the constants of the gangue minerals are of the order of 5, that of air being unity. Situated in an electric field in air, the forces acting on particles of ore are such that all would be attracted to the electrode with forces so much of the same order that gangue and mineral could not be differentiated. The position is different in a magnetic field, in that gangue minerals have a magnetic permeability practically the same as that of air and accordingly behave as non-magnetics. In dielectric separation there are no non-electrics comparable to the non-magnetics of magnetic separation.

Dielectric separation therefore employs a liquid dielectric having a constant intermediate between that of the gangue and that of the mineral, in which medium the gangue is repelled and the mineral attracted to the electrodes. Water is useless, because when pure its dielectric constant is too high, and when impure it becomes a conductor. Dr. Hatfield has chosen to mix kerosene and nitrobenzene in proportions such as in each case give the desired constant, that of kerosene being about 2 and that of nitrobenzene about 36.

The necessary electric field is obtained by a single-phase alternating current of about 200 volts and 150 frequency, brought to electrodes about a couple of millimetres apart. These electrodes may be parallel wires, or one wire coiled around a straight wire, or points on parallel plates. With the field in being and the crushed ore passing, the mineral is held while the gangue falls through. When loaded the circuit is broken and the mineral drops. Conducting minerals are rendered innocuous by covering one electrode with paper.

There is difficulty in this process in that the dielectric constant of a mineral is liable to vary according to its previous treatment in crushing and in exposure; it varies also with the frequency: these are points upon which careful work is necessary. There is also economic difficulty in recovering the expensive medium which passes out both with the mineral and with the gangue, these two products having to be filter-pressed and then subjected to heat to distil the remaining liquid. It is claimed that a similar difficulty has been successfully met in removing sulphur from kerosene with added colloidal silica, the silica being recovered dry and in a condition to be used again.

The process differs, on one hand, from ordinary electrostatic mineral separation in that it is not operative by reason of charges acquired by contact, and, on the other hand, from cataphoresis in that this latter is a migration of particles towards an electrode by reason of charges they possess of themselves. In dielectric separation there is no question of electric charges; the particle in the electric field is in an analogous position to ore in a magnetic field, only that there is both attraction and repulsion in dielectric separation, whereas with magnetic separation there is rather differential attraction, magnetic repulsion being a rare phenomenon.

Obituary.

SIR MAURICE FITZMAURICE, C.M.G., F.R.S.

BY the death of Sir Maurice Fitzmaurice on November 17, the engineering world has lost a leader of outstanding ability who served the country in many capacities and whose name will always be associated with two great undertakings, the construction of the Assouan Dam on the Nile and the extension of the main drainage of London. He was also associated with railway development and harbour and dock work in various parts of the world. In 1916 he was chosen to succeed Mr. Alexander Ross as president of the Institution of Civil Engineers, from which he received the Telford and Watt Gold Medals, and three years later he was admitted a fellow of the Royal Society, a distinction also conferred upon many of his predecessors such as Telford, Walker, Sir Benjamin Baker, Rennie, Hawkshaw, Robert Stephenson, and Sir William Preece.

The son of Dr. Robert Fitzmaurice of Cloghers, Tralee, Sir Maurice Fitzmaurice was born in Co. Kerry on May 11, 1861. At Trinity College, Dublin, which has possessed a school of engineering since 1847 and where for thirty years Samuel Downing occupied the chair of engineering, he took the degrees of M.A. and Master of Engineering, and then became articled to Sir Benjamin Baker, who at that time was engaged with Sir John Fowler on the Forth Bridge. This was the first great work with which Sir Maurice was associated. During the 'nineties he was in charge of construction work in Canada and elsewhere, and then in 1898, at the age of thirty-eight, he received the important appointment of Chief Engineer to the Egyptian Government for the construction of the great Assouan Dam, with which Sir William Willcocks, Sir Benjamin Baker, and Sir John Aird were associated. This Dam, once described as "one of the grandest engineering undertakings of our time," is 6400 feet long, has 180 sluices, and contains more than 1,000,000 tons of granite. Begun in 1898, it was completed in 1902, Sir Maurice's work being recognised by the award of the C.M.G.

Returning home, Sir Maurice was appointed successor to Sir Alexander Binnie as Chief Engineer of the London County Council. In this capacity, he was responsible for the construction of the Rotherhithe Tunnel, the Embankment in front of the new County Hall, the new Vauxhall Bridge, and the subway for trams under Aldwych and Kingsway to the Embankment. During his period of office, 1902–1912, he also carried through the duplication and extension of the whole drainage system of London at a cost of about 4,000,000*l*. Until 1847 the sewage of London was discharged direct into the Thames, and it was under one of Sir Maurice's predecessors, Sir John Bazalgette, that the great sewers were carried down to Barking and Cross Ness, and in Sir Maurice's report to the Council in 1912 will be found many details of the growth of the wonderful network of sewers which carry off the drainage of London and the methods used for its disposal.

During the latter part of his career, Sir Maurice was a partner in the firm of Coode, Fitzmaurice, Wilson and Mitchell, consulting engineers to the Crown Colonies and to the Sudan Government for the Blue Nile Irrigation Works, and chief engineers of the national harbours at Dover and Peterhead. He also acted as chairman for important committees appointed by the Admiralty, War Office, Foreign Office, and Board of Trade; on two occasions he visited the British front in Flanders to advise on questions of drainage, and served on the International Technical Commission of the Suez Canal. Knighted in 1912, Sir Maurice received many honours, among which was the honorary membership of the American Society of Civil Engineers. He was the author of works on bridges and drainage, while his presidential address to the Institution of Civil Engineers contains much valuable advice to young engineers, the results of his own experience. "In looking back," he said, "over the great number of engineers whom I have come across in works and in office, I cannot bring to mind any case of a hard worker who has really failed."

WE regret to announce the following deaths:

Mr. Romeyn B. Hough, author of the "Handbook of Trees of the Northern United States and Canada," who was known also for his remarkable fascicles of sections of North American woods, aged sixty-seven.

Dr. E. König, of the photographic department of the dye-works of Meister, Lucius and Bruning, Höchst-am-Main, whose name is known in connexion with the pinatype process, and with sensitisers and desensitisers, on October 29, aged fifty-four.