evidence for the derivation of the compound pinnate leaf, prevalent in the Leguminoseæ, from comparable Pteridosperm leaves. Then the legume may have been derived from a terminal leaflet, and other floral members from successive leaflets along a pinnule. Some of the complex inflorescences in this family correspond with a compound leaf, itself evolved from a branch system. Dr. Melville said that he differed in believing that Angiosperms are derived mainly from herbaceous ancestors, basing this opinion on the fact that the palæobotanical record consists predominantly of woody plants ; yet, so far, no fossils have been discovered that throw light on this problem.

In summing up, both Mr. Corner and Prof. Boyden further stressed difficulties in the way of arriving at a phylogenetical classification. Mr. Corner said it is not easy to decide what is primitive and what is advanced, simple organisms, such as *Wolffia*, being often not primitive but extreme examples of specialization and reduction ; and Prof. Boyden pointed out that the blood cells and other cells of the body differ from one another, though they have the same phylogeny and carry the same genes.

[1] Arkell, W. J., *Sci. Progress*, **147**, 407 (1949).
[2] Weller, J. M., *J. Paleont.*, **23**, 680 (1949).

INTERNATIONAL COMMISSION ON LARGE DAMS

CONGRESS AT DELHI

THE Fourth Congress of the International Commission on Large Dams was held in Delhi during January 11–16, concurrently with a sectional meeting of the World Power Conference (see *Nature*, March 3, p. 334) and the First Congress on Irrigation and Canals. At the joint inaugural session of the two Congresses and the Conference, the delegates from more than thirty nations were welcomed by Mr. C. Rajagopalachari, Home Minister of the Government of India. Mr. A. Coyne, president of the International Commission on Large Dams, was one among other leading personalities who addressed the joint gathering. An International Engineering Exhibition, organized by the Indian National Committees in association with the three international bodies, was opened on the previous day. This Exhibition was planned as an aid to the promotion of the objectives of the international bodies concerned with the conferences, and numerous countries and research and industrial organizations were represented. It covered not only engineering products but also numerous aspects of hydro-electric power development, irrigation, flood control and other related matters.

The papers for presentation at the four technical sessions of the Congress on Large Dams were circulated in advance, and a summarizing report on each of the four groups was prepared by a general reporter. The subjects of these sessions and the general reporters were as follows :

(1) Design and construction of earth dams and rock-filled dams with their core walls and diaphragms (W. P. Creager ; United States).

(2) Methods for determining the maximum flood discharge that may be expected at a dam, and for which it should be designed. Selection of type, capacity and general arrangement of temporary or permanent outlets and spillways and determination of their capacities (Kanwar Sain ; India).

(3) Concrete for large dams. Properties of concrete, cracking in dams, use in mass concrete of pozzolanas, blast furnace slag, hydraulic lime, etc. (F. M. Lea and H. D. Morgan ; Great Britain).

(4) Sedimentation in reservoirs and related problems (Georges Drouhin ; Algeria).

Nearly a hundred papers in all were presented, and the meetings attracted large audiences and were characterized by vigorous discussion.

The art of building earth dams is an ancient one, and indeed one of the papers presented to the Congress described some of the Indian earth dams built as far back as 1,600 years ago and still in service to-day. With increasing size, however, many new problems have entered into the design and construction of earth dams, and problems of their stability and impermeability have been a subject of vigorous work for several decades. The papers on the design of earth dams dealt with the methods of analysis used in assessing their stability and the internal stresses created in them by water pressure and other forces. While impermeable cores of puddle clay are still widely used in earth dam construction, increasing use is now found of thin reinforced-concrete core walls and of other methods for obtaining a positive cut-off. These matters were dealt with in a group of papers. Others were concerned with the protection of slopes of earth dams, whether by grassing, covering with a layer of stone, or by concrete paving and other methods ; the construction of rock-filled dams, problems arising in their design, and the location of the impervious element of the structure ; and the settlement of dams and the requirements for spillways.

The assessment of the maximum flood discharge which may be expected at a dam is one of the most critical problems that faces the designer. Local data and observation play a most important part in this assessment, but often have to be supplemented by more general climatic, meteorological and geographical information. The general reporter for this second session, in his summary, grouped the methods used for assessment of the maximum flood discharge into three categories : those dependent on probability formulæ, those on empirical formulæ, and those which depend more directly on local observation. It is evident from the papers submitted and from the discussion that general agreement has not yet been reached on the methods which most satisfactorily combine safety with maximum economy. The principles and techniques followed in spillway construction and the relative advantages of the various types for particular circumstances were discussed in a further group of papers. The problems of diversion of rivers during construction of dams, whether by coffer-dams, or diversion tunnels, were illustrated by an account of the methods used in five modern American dams.

The designer of concrete dams has to consider somewhat different factors for each of the three main types—gravity, buttress and arch. For gravity dams high strength is not required, whereas in arch dams the designer has to use high stresses, with buttress dams occupying an intermediate position. Requirement of watertightness is common to all dams. Cracking, which is one of the most serious problems, is, in gravity dams, caused primarily by the rise in temperature which takes place in the concrete after placing and the gradual cooling which occurs later. The temperature rise is a simple reflexion of the fact that the reaction of cement with water is an exothermic one. With arch dams, the volume changes in the concrete arising from drying shrinkage, and

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creep may be almost as important as the thermal effects. One group of papers presented in this session reviewed the incidence of shrinkage cracking in different types of dams. H. A. Hupner, for example, reported on some twenty-nine concrete dams in France of which twelve showed no sign of cracking. The creep of concrete, and the redistribution of stress to which it leads, is of first importance in determining the behaviour of concrete that is undergoing volume change, and several of the papers dealt with this subject from theoretical or experimental points of view.

The design of concrete mixes for dam construction and the minimum permissible cement content also came under review. Following the unfortunate experience of the Scandinavian countries with lean concrete dams built twenty years or more ago, the use of richer mixes became general. A reverse tendency is now to be found in the practice in the United States, where the cement content of the concrete has been progressively lowered over the past decade. The factor determining the minimum cement content, at least as far as gravity dams are concerned, is the permeability of the concrete, rather than its strength, and here the nature of the impounded waters becomes important. Deterioration of dams in Scandinavia has been associated with a very low hardness of the water and, in consequence, a marked leaching action on the set cement where it permeated through the concrete. With harder waters the initial permeability may decrease rather than increase with time, and it is to be noted that most of the waters stored by dams in the United States are hard. It was, nevertheless, evident that there is still a marked divergence of opinion between European and American designers on this subject. Though Portland cement is the main cementing material used in the construction of concrete dams, the use of pozzolanic cements and of cements containing granulated blast-furnace slag is increasing. These offer some advantage from the point of view of heat evolution during setting and watertightness. In India, surkhi, a powdered burnt clay, has been used as a pozzolanic admixture to lime mortars from the earliest times, and, more recently, as an admixture to Portland cement mortars. A number of papers contributed by Indian authors dealt with this material.

The last technical session of the Congress was concerned with the silting of reservoirs and related problems. The rate of sedimentation in reservoirs is of much economic importance, because of the reduction in storage capacity which ensues over the years. The papers presented dealt with the causes of erosion, the mechanism of the transport of solids by water, and the factors determining the rate of deposition. The great variation in the amount of solids carried by rivers was illustrated by figures given for the Missouri, where, at times of low water, the average percentage of materials carried in suspension seldom exceeds 0·02 per cent by weight, though at the time of high flood it rises to 1 per cent. General practice in the past has been to provide a capacity in reservoirs which leaves a margin for silting sufficient for a considerable period of years. Methods of combating silting are now attracting much more attention, and extend, for example, to control, which is so much needed for quite other reasons, over the soil erosion.

Following the Congress, a tour starting in Northern India and later proceeding across the Deccan Plateau to Southern India had been arranged. In the course of this, members of the Congress were able to see constructional work in progress on dams and irrigation projects, as well as completed structures. One notable point of call was the Bhakra project on the Sutlej River. At a point where this river breaks through the last foothills of the Himalayas, a narrow gorge is to be dammed with a concrete dam 680 ft. in height. Two 50-ft. diameter diversion tunnels, which will carry the river round the dam site during construction, were being driven at the time of the visit. The hydraulic laboratories at Pathankot and Poona and other engineering laboratories were also visited. The tour not only gave the delegates an opportunity of seeing the many large-scale civil engineering works now in progress in India, but also a cross-section of the Indian countryside. A final closing session of the three international meetings was held in Mysore on February 1.

Throughout the meetings at Delhi and the subsequent tour the members were afforded widespread hospitality and help from their Indian hosts. The combination of the large meetings in Delhi, the International Engineering Exhibition, and the tour made a memorable occasion in the history of engineering in India.

F. M. Lea

PURE FOOD LAWS IN GREAT BRITAIN

In January 1851 the *Lancet* opened a campaign against the widespread practice of adulterating food, and the campaign culminated in the passage in 1860 of the first Act of Parliament designed to control the quality of the food offered for sale to the general public. It is interesting to follow the century of progress that has been made since those times, and Dr. G. W. Monier-Williams gave an interesting review of the development of legislation to control the purity of food in a paper which he read at the opening of a symposium on "Nutrition and the Pure Food Laws" held by the Nutrition Society on March 3.

Both the first Act of 1860 and the one succeeding it in 1872 rapidly became dead letters, but the third Act passed in 1878 survived in its general form until 1938, when some of its provisions were incorporated in the Food and Drugs Act that is in force to-day. Dr. Monier-Williams laid emphasis upon the debt we owe to the energy and enthusiasm of some of the public analysts appointed under the early Acts. Their work, often carried on in the face of bitter opposition from trade interests, laid the foundation for much of the present-day legislation.

Prosecutions for the deliberate adulteration of food have fallen steadily over the years until there is now left little but the very small hard core of offenders in the retail milk trade who seem unable to resist the occasional temptation to add water to their wares. Although the early Acts stressed the desirability of laying down food standards, the powers necessary to do this were not granted until the passage of the Act of 1938. The task of carrying out the provisions of this Act has passed from the Ministry of Health to the Ministry of Food.

The next speaker, C. A. Adams (Ministry of Food), outlined the work his department is doing in regulating the standard of food retailed to the public. One most important aspect is the control of labelling, and the Ministry has organized an advice bureau to assist, quite informally, manufacturers in the design-

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