plain that the year is by far the more important of the two. The only inconvenience that could arise from not knowing the volume would be that in the case of those journals in which the volume does not begin with the year it might sometimes be necessary to take down from the shelf two books instead of one before the right place is found—an inconvenience of the very slightest kind. Of course every really virtuous scientific writer now gives his full references at the end of his paper, with year and volume both, and refers to them in the body of his paper thus — Déjerine-Klumpke, '94, III.— when the reference is to the third paper issued by Déjerine-Klumpke in the year 1894. Pending the attainment of perfect virtue on the part of writers (and also for the convenient reading of all articles of the past), I submit that a table of cross-references, such as I have described, would be a work deserving of heartfelt gratitude on the part of an overworked scientific world.

C. L. F.

[A chronological table giving the year in which each volume of 550 scientific journals was published is included in the 'Catalogue of Scientific and Technical Periodicals,' by Dr. H. Carrington Bolton, the second edition of which was published by the Smithsonian Institution in 1897.—Ed. Science.]

THE INTERNATIONAL CONGRESS OF MECHANICS.

To the Editor of Science: M. Marcel Delmas, 10 Boulevard Emile Augier, Paris-Passy, has charge of the report of the 'Congress de Mecanique de l'Exposition universelle,' in the department of applications of electricity to the various apparatus of haulage, hoisting, etc. (including cranes, elevators, winches, swing-bridges, pumps and other such mechanisms), and particularly desires information regarding the economic side of the matter. He requests that all, whether intending exhibitors or others, who are willing to assist in the collection of this data, send him, at the address given above, statements of costs of installations, of exploitation and incidental expenses, especially where a comparison can be made with costs of the older systems under similar circumstances. All publications and illustrations will be welcome, if authentic and exact in statement of facts and data.

R. H. Thurston.

NOTES ON PHYSICS.

LIQUID AIR.

C. Linde gives some interesting data on liquid air in the *Physikalische Zeitschrift* for January 6, 1900. He calls attention to the fact that the commercial use of liquid air depends in the first place upon the amount of energy consumed in its production and upon the length of time that the liquid can be kept before it is used. With small machines from 3 to 4 horsepower—hours are used per kilogram of liquid air, while the largest machine hitherto built, produces fifty kilograms of liquid air per hour and consumes about 100 H. P. This latter corresponds to an efficiency of 15% as compared with what a perfect thermodynamic machine would accomplish.

Small quantities (about one liter) of liquid air in vacuum jacketed and silvered vessels are lost by evaporation in about 14 days. In large tin vessels (50 liters) covered with hair felt about two liters per hour is lost by vaporization. The author gives data concerning the use of liquid air for refrigeration and for power. When extremely low temperatures are desired liquid air is perhaps the best possible means for producing it. On the other hand from twenty to forty times as much energy is consumed in producing moderate refrigeration by liquid air than is required in the ordinary ammonia refrigerator. Thus a kilogram of liquid air evaporated in a room reduces the temperature of the room only about as much as the melting of two kilograms of ice, and two kilograms of ice may be produced by the evaporation of 1/20 horsepower-hour or less.

When liquid air as evaporated at ordinary temperatures and used to drive a motor, the work developed by the motor is only about three or four per cent. of the energy consumed in the production of the liquid air. The author however points out special cases where the use of liquid air for power might be desirable.

The author mentions some experiments which have been made in the Simplon tunnel, now building, to test the usefulness of a mixture of liquid air or liquid oxygen and mineral oil