enemies with the same ruthlessness and neglect of all scruples as their military operations."

Prof. Fleming pointed out that as yet we have made scarcely any progress in the creation of a disciplined army of workers which shall embrace all the abilities in the Empire. We are still in the stage which by comparison with an army is that of a mob of civilians equipped for war with shot-guns and sticks. Although the individualistic method of research in which each scientific worker takes up whatever kind of research he pleases has produced good results in the past and is in agreement with our national characteristics, it is a serious question whether we shall not have to put limits to it in the future.

Much greater advances might be made in purely scientific research in many departments of knowledge if we were to adopt more extensively the custom of associated work, by forming committees of workers, not too large for expeditious decisions, but charged with the duty of investigating certain formulated problems. It is in this respect that our learned societies might do much more than they do. Their proceedings are mostly a record of isolated, disconnected pieces of work of very different scientific value. But if properly organized discussion were brought to bear on the question, it would be possible to induce investigators of reputation and ability to associate themselves more in conjoint work to the great advantage of our common knowledge.

In our observations on the attitude of engineers towards their national institution we had occasion to point out the demand for a generous contribution of their knowledge for the welfare of the profession generally. This is assuredly the most certain means of advancing the profession as a whole. It means co-operation just as much as Prof. Fleming calls for that element in business. Manufacturers are not free from the tendency to circumscribe the research work of men engaged in the factories by limiting the funds for that purpose and generally refrain from co-operating with those engaged in similar business, lest their rivals might get a step in advance. German firms, however, do not hesitate to pool their knowledge if so doing enables Germany to get ahead of other nations, for they have been educated in the value of co-operation. In our issue of October 7 we drew attention to the need for more co-operation between manufacturers and the universities and pointed out the value of these latter institutions, both for education, experiments and research.

The present destructive war will be short in comparison with the competitive struggle that will take its place, and which will demand that the universities, scientists, engineers, manufacturers, boards of trade, departments of commerce and others interested, join in a determined effort to withstand the onslaught of the intensified scientific research and highly technical training of their contemporaries in Germany. To shelter behind a high tariff may afford some protection, but low wages, conservation of energy, avoidance of waste, utilization of by-products, determination to re-establish international commerce, will render tariffs of slight moment to German business men. Sentiment counts to-day, but when customers can save dollars and cents, sentiment may soon vanish. Business will be run for dividends as usual, and if these are attacked and reduced then prolonged obeisance to sentimentality may be considered as a doubtful virtue.

How, then, are Canadian interests to be preserved? It must be by adopting the same methods as our future competitors. Manufacturers and universities must meet, the former must provide the dynamic force and the latter the knowledge. Manufacturers must sooner or later combine to furnish the pabulum for the universities to digest. The technical societies must encourage investigation by every means and afford incentives to the members to think out and develop new processes, new ideas, and new industries. The Government must offer inducements for the development of Canadian resources; raw materials must receive attention, as bonanzas may be buried in them and only wait to be dug out. Universities and other scholastic institutions must give facilities for their students to carry on researches, and inculcate in their minds that education is not only what they acquire in the class rooms, but also what they themselves learn by common effort in succeeding years. Engineers have their part to play in the international competition, for there is scarcely a process or a development which can be carried on commercially without their aid, intelligence and organizing powers.

WINTER MANUFACTURE OF CONCRETE PIPE.

Since 1909 all sewers in Hamilton, Ont., larger than 24 in. in diameter have been constructed either of reinforced concrete or of sectional concrete pipe. In Concrete-Cement Age for November, Mr. A. F. Macallum, the city engineer, states that in the winter of 1914-1915 in order to give work to the unemployed because of conditions caused by the war, they constructed in the east end of the city a trunk sewer system, using reinforced concrete pipe from 30 in. to 66 in. in size. These pipe were made in an open field during nearly all conditions of winter weather and cured by means of steam, from pipes running under the molds and with canvas tarpaulins over the pipe. Rejections of pipe under these conditions were not greater than would have been the case under good working conditions of the summer season.

These pipe were made on contract by A. L. McAllister, Toronto, who rented forms for the work from the Chicago Concrete Pipe Co. A 20-h.p. portable boiler was hauled to the curing ground and a shed built around it for shelter. Two-inch galvanized pipe were laid along the ground in three parallel lines with T connections and stop cocks at 10-ft. centres. These pipe connections were directly beneath each pipe that was cast. The mixture was brought alongside the mold that was to be filled and hot sand, gravel and water were used. Just as soon as a mold was filled burlap was placed over it and a canvas tarpaulin, 10 ft. wide and 100 ft. long, covering a series of these casts, was placed on top of the burlap. Steam was turned into the interior of the molds and kept on continuously night and day until the pipe had hardened. They also laid last winter some rectangular sewer, 6 ft. x 8 ft., in section having the span of 8 ft., and dry weather half channel in the bottom.

The materials were mixed hot and covered over with canvas tarpaulins until sufficiently set, when fresh manure to the depth of 1 ft. was placed on top and salamanders inside. This worked out in a very satisfactory manner and they had no failure whatever with any part of the work.

In connection with handling the pipe: the 54-in. pipe was used on a street having an electric railway track not in use. It was rolled onto flat cars, hauled to position and by means of block and tackle with rope around the pipe allowed to run slowly down skids to the ground.