

algebra, geometry, trigonometry, philosophy, chemistry, etc. This, in order to supply the present want that is felt by men who have to earn their daily bread, and have not had opportunity to study those subjects which they should have had at the common schools. In this connection it would be necessary to establish and continue night schools until they were found unnecessary, as the common schools would then have imparted the knowledge required.

It might also be advisable to endow scholarships, which would not only stimulate the student to greater effort, but enable him to obtain a course in the Art School, which otherwise would be beyond his reach.

The teachers or instructors for the night school might then be obtained from among the pupils of the School of Science at a much less expense than otherwise, and equally beneficial to both instructor and pupil.

A committee might also be appointed to wait upon the Mayor and Corporation to impress upon them the importance of the subject, and solicit municipal assistance to aid the work.

The Technical School, as established in 1878, is not adapted for industrial pursuits. The laboratory, tools, appliances, etc., are not extensive enough for the work intended to be carried on. Civil engineering, in part, is taught there; also the rudiments of mining engineering, neither of which branches of science can be fully imparted without practical work in the field or mine. But what is essential for mechanical engineering is the knowledge of drawing, construction and application of machinery, and to be able to handle steam, wind and electricity to the best advantage, together with the methods and ways of testing the different metals as to strength, durability, adaptability, hardness, ductility, etc. The expert use of tools can be obtained in our several machine shops. To do all this it is necessary to have an engine, boiler, scales, indicator, and all tools essential for such work. To measure power, test the nature of materials and ways of applying power, machines must be provided; and in the course of time chemical apparatus might be added.

Professor Galbraith has visited several of the schools in the United States and took notes or memoranda of the appliances, tools, machines, etc., found in them, and found that thousands of dollars had been spent for machines, etc., which were of little value or use. We may profit from their experience and avoid unnecessary expense. Such a school would prepare many young men to fill positions that are now filled by men imported from other countries.

Applicants for such training are numerous, and are directed to those countries where they can be educated. And it is usually the case that they accept permanent positions in those countries, and are lost to Canada. It is also found that when public work is to be done it is necessary to import men from other countries to do the work that our own men are doing in foreign countries, where they had been drawn to obtain an education that had been denied to them at home.

After discussing the subject thoroughly, it was

Resolved—That this meeting unanimously endorse the opinion that it is highly important and desirable to establish the School of Practical Science on a complete and thorough technical footing, including the teaching of science as applied to industrial pursuits; and that this resolution be presented to the Minister of Education by Mr. William Polson at the meeting on the 19th of December, 1888.

WILLIAM J. ALLEN, *Secretary*.

BOILER EXPLOSIONS.

THE following remarks anent boiler explosions were made by Mr. R. D. Munro, engineer of the Scottish Boiler Insurance and Engine Inspection Company (Limited), Glasgow, Scotland, and apply to the ordinary internally-fired boilers in use at the more extensive factories, where more than two boilers are employed.

"Since the introduction of the Boiler Explosion Act in England in 1882, 223 boiler explosions have been reported to the Board of Trade, which, besides damage to property and other loss, have caused 146 deaths, and serious injury to upwards of 300 persons. In addition to the explosions thus recorded many boiler accidents have occurred which, though unaccompanied by any serious results, have been the means of causing stoppages of work, with consequent loss to employers and employed.

"The investigations made show that the majority of the explosions which have occurred cannot be viewed as accidental, inasmuch as they were due to deterioration and other defects which could have been detected by careful inspection long before their condition became dangerous. The whole history of boiler explosions points to the fact that there have been, and in all probability still are, many boilers at work, which if examined by competent inspectors, would

be found deficient in what experience and rule have proved to be necessary for safety. That a steam boiler should be of good construction and material, properly mounted and set, is of the first importance; but to insure safety it is necessary that all boilers should be carefully attended to when at work and thoroughly examined by qualified inspectors at least once a year. Under such conditions durability and economy will be secured, and the chances of accident or explosion reduced to a minimum.

"Incompetency and neglect on the part of attendants, although amongst the causes assigned for boiler explosions, are charged with a very small percentage of these. This feature is creditable enough in face of a statement still commonly made that no explosion could have occurred unless the fireman allowed his boiler to run dry. Whilst boiler attendants are accredited with satisfactorily performing these duties, for which they are generally held responsible, it must be apparent that the number of explosions would be reduced if the men in charge were trained to take an interest in the working of their boilers beyond the mere mechanical duties of feeding, firing and cleaning. It is not to be expected that attendants should be skilled in boiler construction, but there is no reason why they should not be competent to draw attention to defects before they become dangerous, and to form fairly sound conclusions as to how the safety of boilers is affected by deterioration and other evils to which they are subject. Referring to the training of attendants as a means of obtaining improved supervision of boilers, it has been said that many of them know too much already, as they display great ingenuity in the matter of overloading safety valves and otherwise tampering with boilers, in such a manner as to increase the dangers attending their use. Actions such as are here referred to, however, can only be attributed to ignorance of the dangers involved, and tend rather to prove that if the ability of which such ingenuity is evidence were properly guided, the number of explosions would be reduced and the efficiency of boilers increased. The responsibilities of boiler attendants are variously estimated. According to one aspect it would appear that a fireman has done all for which he can be held responsible when he keeps up the required supply of feed water and throws into the furnace the amount of fuel necessary to evaporate it into steam. According to another, however, the responsibilities of a boiler attendant are of a very high order. Instances of firemen being allowed to give instructions as to repairs and other important matters are by no means uncommon, they being in many steam-using establishments the only individuals who can claim to possess a mechanical knowledge of any kind. Instances are often given of boilers left to the sole management of the attendant, even to the supervision of repairs and alterations, and resulting in such a reduction of strength that they have exploded at the ordinary pressure. The responsibility assigned on the one hand to those in charge of boilers is evidently as far short of what it should be, as that placed upon them by certain steam users is beyond it. Many explosions are the results of defects so palpable that even the most casual inspection should have detected them; and in these cases, if the attendants were made to understand that it was part of their duties to look for and refer all such defects to the judgment of qualified parties, there is no doubt many explosions would be prevented. On the other hand, it is quite evident that the opportunity of safe pressures and giving orders as to repairing and alterations, are duties which none but those who are thoroughly conversant with the strength and construction of boilers are competent to perform.

"Steam users in getting new boilers should first have a detailed specification prepared by qualified persons, who should also be entrusted with the inspection of the material and workmanship during construction. Second, boiler attendants should be made to understand that, in addition to the ordinary stoking duties, it is their business to exercise a general supervision over the boilers and fittings; and all defects observed when boilers are under steam or being cleaned should be carefully noted and reported for the attention of the inspector; and third, all boilers should be examined in every part at least once a year by a thoroughly competent inspector, whose business it should be to apportion safe pressures, give instructions as to repairs, and generally to advise the steam user and attendant in all matters relating to the boilers under their charge."

MESSRS. GEO. F. HAWORTH & Co., Toronto, inform us that they have just supplied a large main driving belt for the Dominion Show Case Works of Messrs. Wagner, Zeidler & Co., at West Toronto Junction, this city. This belt is made of Hoyt's pure oak leather manufactured expressly for Messrs. Haworth & Co., which, as they say, is "known the world over." The main driving belt which was in Mr. James Shearer's saw and planing mill in Montreal, which was destroyed by fire in February last, was of Hoyt's make, and had been in constant use for thirty-three years.