The Chemist and His Part in Canada's Industry

T. LINSEY CROSSLEY, M.Sc., C.E.

The story was told in a recent magazine of a negro who was asked whether he would enlist in the infantry or the cavalry. "I'se gwine to jine the infamy. When de general give me de order for retreat, I don't want ter be bodered with no boss." Up to a regrettably recent date the view of many manufacturers was very similar with reference to the chemist. When things were going well, they didn't need him, and when there was need to curtail expenses they didn't want to be saddled with the extra salary.

Owing to conditions existing up to the end of the nineteenth century, there may have been something to say for this theory. Profits were fair and labor comparatively cheap. For a short time that policy can be carried on. It has a historic precedent in the assassination of the auriferous goose. When competition is keen, labor high, and quality requirements exacting as they are today, much greater attention must be given to the little things. Slight deviations from the regular process by careless or ignorant help; attention to atmospheric conditions and temperature; detection of fake short cuts; exact specifications in tendering; all these at time have been the secrets of failure or success.

We can consider the industrial chemist as being concerned in three functions: control of plant and process; detection of fraud or fake; assisting in the activities for new business.

In certain industries simple forms of test are employed, such as the determination of specific gravity by the use of the beaume hydrometer. Anyone can make such a test as far as manipulation goes. A glass spindle weighted with mercury or shot, having a bulb at the lower end, and a printed scale on the side, is floated on the liquid to be tested and the point on the scale which is at the surface of the water is read off.

Let us look at this test. It is based on the principle enunciated by Archimedes that "the apparent loss of weight of a body immersed in a fluid is equal to the weight of the fluid displaced." Water is the standard fluid. It is said to have a gravity of 1.

When substances are dissolved in water, any state volume of it will weigh more than the same volume of pure water. A substance, sinking in a solution of salt, for example, would displace its own weight of the solution, which would be less in volume. It would not sink so far. Hence several forms of floating spindles, called hydrometers, have been devised to show specific gravity, that is the weight of a body compared with the weight of an equal volume of water.

The operator fills a jar of sufficient depth and the hydrometer is floated in it. When it comes to rest the reading is taken, very simple, but not so simple as it looks. Temperature makes a great deal of difference; the angle at which the observation is made; the presence of foreign matters on the stem above the surface. All these things require knowledge beyond the mere manipulation. Many plants have relied on this form of test in the hands of uneducated help. The results so obtained were probably "nearly" right, but could not be depended upon to give the exact information demanded to-day. We knew of one case where a wily man who had charge of the making of a certain liquor, used to add a little salt to his test when it was low. The superintendent depended on this test and looked in once or twice a day. The faked test got by and troubles, were rampant until someone caught the faker. The test would give the same reading with a solution of anything that had the same specific gravity. That plant shortly afterward engaged a chemist.

Almost every form of routine chemical test might be performed by an intelligent boy, but it is absolutely necessary for correct results that the manipulator be controlled by some one with a fair working knowledge of chemistry and physics.

These subjects are on the curricula of our schools, but how many men may be met who think it rather a joke to say, "We had chemistry in school but I've forgotten all I ever learned." This is a serious indictment for his teacher. A recent letter from the head of a large firm indicated that he was ignorant of the fact that soda ash was alkaline, or even of the meaning of that term. His ignorance materialized itself into a large number of dollars.

Many fakes deceive even the faker. Most of these violate the law of the conservation of energy, for instance, one which was perpetrated on a plant which actually had a chemist. The scheme was very simple and the manager was a university graduate who remembered just enough chemistry to become an easy victim. This was the idea. Hydrogen and oxygen when burned together in the right proportions give a flame producing intense heat. Water consists of hydrogen and oxygen in exactly the right proportions. When water vapor is heated to a high temperature it is broken up into its constituents. Good. We have a fire burning under our steam boiler with forced draft. It develops intense heat; enough to break up water into its parts. We introduce a jet of steam at the point of greatest intensity of heat, break it up into its parts, the hydrogen and oxygen are burned under the boiler and coal is saved. So our manager bought a fire brick affair, placed it in the fire box and got the pipe-fitter to connect it up. The chemist noticed the curious contrivance one day and was given the explanation. It made him feel neglected because he could have earned two or three months salary by informing the manager that "e nihil nihil fit" was still in operation. The water vapor consumed as much heat to break it into constituents as was later given out in their reunion.

We give these two instances in detail as being typical of the pitfalls into which even the wise may stumble.

The chemist is not a magician. His mission is to apply common sense and experience to certain facts belonging to a class of phenomena which he has had the opportunity to observe. He only contributes to the general well being certain specialized knowledge.

The engineer, bookkeeper, electrician, millwright and foreman are of equal importance. The chemist without the others would be like a half-back without a scrimmage.

We have had a look at the working chemist's functions in a plant. Our text is really concerned with a wider view.

The chemist has made Canada the pioneer in the carbide industry. From carbide the chemist is to-day making cyanamide in Canada, from the only plant operating in North America, using the nitrogen which constitutes eighty per cent. of the air we breathe. From cyanamide, ammonia and nitric acid can be made for our fertilizers and explosives.

The metallurgical chemist has made Canada the premier nickel producer of the world, not of course neglecting to give due credit to Providence for placing the nickel and producing the chemist.

The work of the chemist in the past has been at times spectacular and will be so doubtless frequently in the future. The same may be said of the electrician, the engineer, or the auditor. The trouble has often been that the chemist is expected to function in the way that Nebuchadnezzar expected of his wise men, and we have few Daniels.

The chemist does not advertise himself. When a Philadelphia cobbler discovers a method for utilizing ashes for fuel, or an Adirondack prospector discovers a method for finding "green" gold, there are large type write-ups, but when Gayley, after working eighteen years on the question of water in the air used for blast furnaces, was able to remove this water, and saved the American Iron and Steel industry some fifteen or thirty million dollars a year, mighty few people outside the industry heard of it. His method is illuminating and of general application. He put accurate men to work getting exact information about everyday occurrences and did it for five years. He found that in February the air he was putting into his blast contained were about two barrels of water per hour and that in June he might have five barrels of water in the same time. To remove this water from 40,000 cubic feet of air per minute was his problem and he solved it after eighteen years. As a result his blast furnaces produced 15% more metal with 15% less fuel. Ye Cobblers!

How many people know who made Canadian oil marketable. Herman Frasch did, and he did is thus: first he