## THE HYDROLYSIS OF SAWDUST.

In a paper given recently to the Society of Chemical Industry, Professor W. P. Cohoe, of Toronto, gave an interesting resumé of his work on the hydrolysis of sawdust. The paper outlined briefly the history of the study of the reaction of various hydrolyzing materials on sawdust, beginning with the work of Bracconet in 1819. Most closely



View of Digester.

associated with the commercial study of this reaction are the names of Simonsen, Classen and Ewen and Tomlinson.

The work which the writer has done has extended over a period of two or three years, and although our attention has been chiefly confined to the action of hydrochloric acid upon sawdust, the action of many other acids has been studied.

The experimental work was conducted in three stages. In the first stage small scale laboratory experiments were made, in order to obtain in a general way the re-

which might be expected on a sults In these experiments it was larger scale. found that as high as 29 per cent. of the dry weight of the sawdust could be converted in a single operation into fermentable sugars. It was also found that by taking the material once treated and subjecting it to another operation, a further amount of this material could be converted also.

After having completed the small scale experiments, an apparatus was designed to enable the carrying out of experiments on a somewhat larger laboratory scale, under conditions more nearly approximating what would be the commercial conditions. On this scale it was found possible to treat about two pounds of sawdust at a time. On this scale the findings on the previous set of experiments were confirmed, and conditions necessary for a still larger scale anticipated.

The third stage consisted of an operation on a semi-manufacturing scale. A digester was prepared capable of holding from eight

to nine hundred pounds of ordinary sawdust. This was provided with a special lining, and also with the various necessary appliances for rotation and injection of steam and reacting materials, as shown in the accompanying diagram. The digester is filled when the manhole is in an upright position, after which it is closed. Steam is turned on, acting directly within the digester on the sawdust. The action of

the live steam is to heat up the reacting mass inside, and to prepare it for the action of the reacting agent in the final stage. When the temperature and pressure conditions desired have been attained, the digester may be blown off in order to obtain any by-products which may have been formed. This part of the operation is known as the precook.

When the blow-off is complete the digester is again closed, steam is allowed to penetrate the mass, and with the steam is forced in the reacting agent. The action of the reacting agent is immediate, with the result that a certain percentage of the sawdust is converted into reducing sugars. The amount of this conversion depends on the temperature, pressure and percentage of acid present. We were successful in controlling these conditions to such an extent that the action hydrolysis was practically instantaneous, and it was only necessary to conduct the after cook for a sufficient length of time to insure a thorough mixing of the hydrolyzing agent with the contents of the digester. When blown off the sawdust has been converted into a golden brown color, resembling coffee grounds in appearance. This material may be extracted, and the extract, which contains glucose, may be fermented and subsequently distilled, in order to obtain alcohol, or, if it is thought desirable, the extract may be purified and clarified with the production of a pure white glucose sugar as the result.

The amount of the conversion which takes place from one operation varies from 20 to 40 per cent., depending upon the adjustment of the reacting phases. In no case, however, is all the converted material reducing sugars, as these are always accompanied by a certain percentage of what is probably intermediate materials.

As the result of our investigation several conclusions were reached which may be summarized as follows:

1. It is advantageous to have the sawdust heated up to

the reaction temperature before introducing the acid. 2. A prolonged precook is not advantageous.

3. The recovery of valuable by-products, such as turpentine, is possible, using this method.

4. Coarse sawdust gives better results than fine.

5. By this method the time of conversion may be very



## SKETCH OF DIGESTER. Diagrammatic Sketch of Plant.

much shortened over that consumed in existing methods, and consequently the output for consequently the output from a given plant may be very much increased 6. Higher results have been obtained with hydrochloric much increased.

acid than with other acids used by this method.

7. Commercial feasibility of the use of other acids. 8. Commercial advantage of double cook.