

if that was done the heat would not go through it quickly. With a smaller boiler the plate was thinner. The thickness of the plate and the diameter affected the heating efficiency of the boiler. With regard to the length of the boiler, the length of tube available governed that and 20 feet was the limit so far as he knew. So far as water tube boilers were concerned he did not know what the limit was but they were very large. One water tube boiler may equal ten multitubular boilers.

Mr. Pullar mentioned that in Germany they were faced with a difficult combustion question through using lignite coal, etc., and he had seen designs of furnaces where the fuel was fed in through a hopper and before it got on the step grate the fuel had a portion of the actual product of combustion withdrawn from the furnace. By so doing it saved the trouble of evaporating the water and raising it to

the temperature of the furnace gases and flue gases. He would like to see that tried with bagasse experimentally. That would probably be a simple method of increasing output and efficiency.

Mr. J. Murray stated that if they would look at the diagram number 4 they would see that at the top of the step grate there was a chamber with a fire bar in it. That could be used either with the gases from the chimney or coal or wood or anything else. That particular furnace was to dry the bagasse at the top of the step grate.

Mr. Pullar pointed out that there was no withdrawing of the vapour or gases.

The Chairman in thanking Mr. Pullar and Mr. Murray remarked on the very good work which the Sugar Technologists' Association had already done, and hoped that they would continue the good work. (Applause).

THE USE OF BAGASSE AS A RAW MATERIAL FOR MANUFACTURED GOODS.

By A. T. SCURR.

The war of 1914-18 stimulated research into the utilisation of by-products or waste of industries, and indeed, waste of any kind to previously unknown lengths, particularly on the part of the Central European Powers, who were at times hard pressed for feeding stuffs for their animals, as well as raw materials for their munitions of war. The Allies themselves, though not having to find substitutes for their usual feeding-stuffs had to utilise materials other than those previously used for some of the products needed for the carrying on of warfare, as instance the use of horse-chestnuts for the production of alcohol. Since that time economic conditions have demanded, that industry make use to the fullest extent of any possible economies, and the exploitation of its waste material.

This note, then is merely to put forward, the possible uses of one of the waste materials of the cane sugar industry, i.e., Bagasse. They are not all new and some, like the manufacture of paper from this material was suggested many years ago. Confining ourselves to Natal and Zululand all the bagasse is at present used as fuel for steam generation and as such has a low monetary value. The preparation or manufacture from it of a fertiliser—an artificial or synthetic manure, paper, and latterly "celotex" products seem to be the best uses to which bagasse could be put, though to a limited extent it may and has been used in a ration for feeding stock and also in the composition of magnesium chloride cements for floorings, its incorporation in these latter making them more resilient.

The conversion of bagasse, or indeed almost any vegetable matter of a similar nature, into an organic nitrogenous fertiliser is accomplished by its fermentation in heaps in contact with an insoluble or difficulty soluble, but hydrolysable compound of nitrogen, whereby new insoluble organic compounds of nitrogen are formed, by the action of the organisms in the fermented mass. The finished manure is a damp soft mass which is comparable in nitrogen fertilising properties with well matured farmyard manure and which it resembles in appearance. It cannot be said, however, that the bagasse will make as good a manure by this method as cane trash, for instance, owing to its more woody nature.

The most promising uses of bagasse, however, are on lines where its fibrous nature is utilised, namely, as a raw material for the manufacture of paper or straw-board and similar materials. Unfortunately it does not seem an easy matter to treat bagasse satisfactorily for paper making as owing to the distribution of the fibres in the cane they are not all of equal strength when the cane is ripe for cutting and so they respond differently to the chemical treatment necessary for their conversion into paper. The fibres in the outer part of the cane, are of good strength and firm, while those inside are weak, and as they all must receive the same treatment, either such treatment must be severe enough to reduce the outer fibres completely and this will destroy the inner fibres with consequent reduction of yield, or it must be more gentle, a proceeding which will result in no loss of fibre, but which will only partially re-

duce the stronger outside fibres. In either case the product does not bleach well and only the commonest papers can be made from it, and it is doubtful if it could be used alone, but would require to be mixed with a more uniform material. On the whole bagasse is more suitable for use in the manufacture of straw-board and in this connection during the past two or three years a material named "Celotex" has been made in the United States in large quantities. This product is different from straw-board and as its name suggests is of a more open structure. Apparently the uses to which it can be put are numerous and varied. The African Sugar and Cotton Planter in the March issue of this year contains an article on Celotex, in which it is stated that in the form of $\frac{1}{2}$ in. board it weighs only little over half a pound per square foot, while it possesses considerable tensile strength. It is remarkable for its insulating properties, a statement having been made that it has been found to render a house 15° to 20° F. cooler in the Summer and that it capable of saving one-third

of the fuel necessary to maintain a given temperature in the Winter.

Among its uses may be enumerated the following:-

- (1) Insulation either inside or outside of building and as it can be treated like fibre boards now on the market, this means it can be used in place of various ceiling and wall lining materials and that it might possibly be used for small portable buildings.
- (2) Boxes and packing cases, e.g., for fruit shipping.
- (3) Cold Storage buildings.

It is also a good sound deadener hence will be useful for partitions in all sorts of cases.

Another claim for it is that it is not attacked by white ants.

Finally it would seem that in the near future there is every possibility that bagasse will be replaced by coal or other fuel for the generation of steam in the sugar mill and that bagasse will come into its own as a raw material instead of being a waste product.

DISCUSSION ON THE USE OF BAGASSE AS A RAW MATERIAL FOR MANUFACTURED GOODS.

Mr. Tucker asked if Mr. Scurr could tell them anything about sugar containers being made out of the fibre.

Mr. Scurr replied that he did not know whether anything definite had been accomplished in that direction, although coarse paper of that nature could be made from bagasse and would be suitable for sugar containers or even as linings for the ordinary bag.

Mr. Dodds stated that he had been very interested in the paper. It seemed to him that although bagasse was generally termed a waste product, it looked as though in the future there would be less difficulty in disposing of the bagasse than of the sugar. There were a great many outlets which had been opened up in recent years for the use of bagasse. They had been told during the morning that there was no limit to the amount that could be used as a fuel. They could use it to increase the extraction to any possible extent, but that of course was merely a matter of relative cost.

The cost of bagasse as a raw material for alternative purposes was largely a question of replacing the bagasse to the miller by a fuel at less cost per calorific unit. When he was in Louisiana two or three years ago, he was informed at one factory that all the bagasse was sold for "Celotex" manufacture and that they were using oil as a source of fuel both for the factory and refinery. They were getting two dollars per ton for the bagasse and they considered it was not worth more than one dollar per ton as fuel.

The other uses of bagasse which Mr. Scurr had mentioned were of great potential importance also. They had heard of the experiments that had been carried out at Umbogintwini of the conversion of cane trash into vegetable manure. This manure being in organic form was what the soil very largely required. This formed another very promising outlet for the use of bagasse.

There was also the use as a paper mulch. Whether that would come into this country remained to be seen. He believed that one factory in Hawaii used much of their bagasse for conversion into paper mulch for the fields, which was spread on as soon as the cane was planted and was left there. It had the effect of smothering the weeds as well as conserving soil moisture. That was only one of many uses of bagasse. It may be that in time to come it would become a most important factor in sugar manufacture.

A few years ago coal tar was considered a waste product of coal distillation, but it was now one of the most valuable products, and it was quite conceivable that the same would occur with bagasse, particularly with the growing scarcity of vegetable fibres in the world for such purposes as making newspapers. There was no doubt that the forests were rapidly becoming exhausted and the huge demand for paper would have to be met in other ways, probably by the supply of fibre from tropical plants.

The Chairman thanked Mr. Scurr for his interesting paper. At 4.40 p.m. the Congress was adjourned until the next day.