DISCUSSION.

MR. NORMAN SELFE, in opening the discussion, said that he was surprised that the principle of the apparatus designed by the author had not been applied years ago. Its great merit was its simplicity, and there would no doubt be a very wide scope for its application in the industrial arts. He would like to know if any experiments had been made with a view to determine the speed with which the heat from the steam travelled downwards into the liquid contained in the apparatus. There were no recorded experiments, as far as he was aware, giving the time that a given quantity of heat would travel downwards in a body of water, and the device under discussion, he thought, would give the required information.

Mr. A. D. Nelson said that the author had laid great stress on the angle of the cone being 75°, and he (the speaker) would like some further information on this point. Regarding the cyanide process of extraction, it had been extensively tested in the Pambula district, and found wanting; and he could not conceive of what value the author's apparatus would be if the cyanide and chlorination processes were not successful.

Mr. Hector Kidd wished to point out, in reference to the last speaker's comment on the angle of the top cone, that this was a matter of no moment. At the Colonial Sugar Refining Company's Works the principle adopted by the author was used in what was known as the "monte-jus," for elevating the sugar juice to the upper portions of the buildings, and with them it was found that the shape of the vessels or the angle at the top had nothing whatever to do with their efficiency. He considered that the author would find it more economical to use compressed air.

Mr. A. Christie said he had listened to the reading of Dr. Storer's interesting paper with great pleasure, on the patented quick-action filter, as applied to the wet process of gold-saving, and in witnessing the trial of the filter given before the members of the Association, which he (the speaker) thought fully testified to the correctness of the statements given by the author as to the speed at which the filter worked. It was a great pity that the paper did not describe the whole process of the chlorination or cyanide methods of gold-saving, so as to enable members to grasp the immense importance of quick filtration. The author assumed that all the members knew as much about mining and mining machinery as he did himself; but this was a mistake, as comparatively few of us had had the opportunity of being intimately connected with gold-saving appliances, and having had to contend with the great difficulties that stood in the way of saving gold when in a very fine state of division, or being coated so as to withstand amalgamation with mercury. When the gold in the ore was in a metallic state, and not too fine, the ordinary stamper battery would do the work of reducing the ore and saving the gold at a much cheaper rate than any other machine now in existence; but when the gold was fine, or a mixture of fine and coarse gold, then it was necessary to add grinding and amalgamating pans. The mistake in the past had been in expecting stamper batteries to do too much. We could not expect a machine to do both rough and fine work well, and there was no doubt that fine reduction in a stamper battery must be, and was, accompanied by a heavy loss of gold, even when free and in a fit state for amalgamation. The proper course was to do the rough work in the rough machines, and the fine reduction in machines suitable for the purpose, each machine saving the class of gold it was best adapted for. But some classes of ores contained gold in such a fine state of division, or were so coated with other matter, that the saving of it by amalgamation was almost an impossibility; in which case some other method had

to be resorted to. The processes most in general use were known as the chlorination and cyanide methods; and it was in these and similar methods that the subject of Dr. Storer's paper was probably destined to play a most important part. In these processes the ore had to be reduced to a fine powder—the finer the better—then roasted, if necessary, so as to drive off the sulphur, arsenic, &c. It was then ready to be acted upon by the chlorine or cyanide of potassium, as the case might be. In the chlorine process it was put in a chlorinating vat or barrel, and acted on by the chlorine gas until such time as the gold contained in the ore was changed into chloride of gold, which was soluble in water. The ore was then put in the leaching vat or filter, as described in the paper, and thoroughly washed through with water, which of course dissolved the gold and was thus carried away from the tailings. The liquor was afterwards acted upon by some reagent, which precipitated the gold, which was thus recovered and melted into ingots. Under ordinary conditions, this filtration was a very slow process indeed, and required a very large and expensive plant to treat large quantities; in fact, in some ores filtration was so slow that the gold returned again into its metallic state and was consequently lost. With Dr. Storer's filter this could not happen. Further, the number of filters required could, he thought, be divided by ten to do the same work, and one pressure cylinder could be arranged to work a number of filters. It would thus be seen that a much smaller and less expensive plant on the author's principle could be made to do the work of the larger and more expensive plants now in use, besides being able to manipulate ores which could not now be successfully treated by ordinary gravitation filters. The author's device for forcing the solution or leaching water through the powdered ore was very simple and ingenious; but, from a mechanic's point of view, he (the speaker) could not say that he admired the whole of the details. There was no doubt that the amount of condensation which would take place by the contact of the

steam with the surface of the water would be comparatively small—much smaller than one would at first sight anticipate, as it was a rather difficult matter to heat water from the top. But the fact of the water keeping its normal temperature right up to the top was a serious matter for the walls of the pressure cylinder. Suppose that steam used had a pressure of 65lbs. to the square inch, the temperature of which was 312°, and the leaching water had a temperature of 62°, the difference being 250°. This difference of temperature would stretch the iron plates $\frac{1}{870}$th of its length if free to move. The amount of stress necessary to elongate an iron bar $\frac{1}{870}$th of its length was about 13 tons per square inch. It would thus be seen that if the division between the two temperatures was sharply defined, then there must be a stress on the iron plates of which the cylinder was made equal to 13 tons per square inch, besides that due to the steam pressure. Of course he was aware that the boundary between the temperatures must have a certain breadth, but it was not much in this case, so that the amount of jostling that was going on amongst the particles of the iron must be very serious. The riveted joints would also, through this unequal expansion, give trouble, He considered that a cylinder of this description should be made of the very mildest quality of steel plates, say 22 tons tensile, and welded; and perhaps it would be better still if made corrugated, similar to a Fox's furnace. Speaking generally, there was no doubt that the filter possessed great merit, and it was to be hoped that the mining public would appreciate this new invention in the way it deserved.

Mr. H. Kidd stated that the "Monte-jus" vessels used by the Colonial Sugar Refining Company were of cast-iron, 5ft. diameter, the working pressure being from 50lb. to 75lb., and sometimes even as high as 100lb., per square inch; and although the thickness of metal was in some cases light, they had never had any trouble with them due to stresses set up by unequal expansion.

Mr. W. D. Cruickshank said that, from a mechanical point of view, he failed to see why so much stress should be laid by the author on the upper portion of the apparatus having a certain specified angle, as a baffle plate would answer the purpose equally well, and Mr. Kidd's remarks endorsed this opinion. One of the principal advantages of the apparatus was its simplicity, and that it could be applied in any part of the country where a steam boiler was available. If compressed air was used, the efficiency would no doubt be considerably increased, but the plant would thereby be made much more costly, complicated, and cumbersome. The remarks of Mr. Christie were of a most interesting character, and the facts stated could not be disproved; yet Mr. Kidd's experience with similar vessels showed that they could be worked without any difficulty at even much higher pressures. There was a very great deal of difference between the expansion of iron, such as a boiler shell when under steam pressure, and the stress which took place when at normal temperature. According to the laws of expansion and the formula, with steam at 60lbs. pressure, equal to a temperature of 307° Fahr., the section of metal above the water, if free to expand, would be a quarter of an inch longer than that which was below, and at a temperature of about 60° Fahr. If, as Mr. Christie had stated, this was equal to a stress of 13 tons per square inch, it would be beyond the elastic limit of the material, and would produce a permanent set in it. It was in this that the difference in the results obtained by the testing machine and boilers under steam pressure came in. If a weight were suspended from a bar of corresponding length and section to the shell, the whole of the particles would be in tension but in the case of a boiler in actual use a portion only would be in tension, and the remainder in compression; from which it would be seen that it was a very difficult question to find out and express in a simple manner what this increased length due to the increased temperature would be equal to.

The President (Mr. R. Pollock) wished to suggest to the author's consideration that the steam or heat absorbed would be proportional to the area of cold fluid in contact with it. It might be found desirable to reduce the diameter of the vessel and increase its length. He would like to know whether any experiments had been made with a view of arriving at the amount of condensation that went on. This would be valuable information, and could be very readily arrived at by measuring the quantity of water put into the vessel and that discharged from it. When observing the action of the apparatus at Messrs. Parke and Lacy's works, it had been suggested by some of the members that the filtration of the latter half of the charge would be much slower than the first, owing to the packing of the material due to pressure; and he wished to know whether such was the case.

Dr. J. Storer, in reply, stated that the apparatus had never shown any sign of leakage or straining. A similar apparatus had been in constant work in America for over two years with perfect success. With regard to the line of demarcation between the two temperatures, it should be remembered that it was not localised in one particular spot, but was constantly moving downwards. The application of the device was not confined to the filtration of sulphide ores, but would, he was certain, prove of value to many metallurgical and chemical works. With reference to the particular angle of the top of the apparatus, it was unquestionably of service, as had been proved by actual experiment. He had made no experiments as to the amount of steam that was condensed, but intended doing so, and would have much pleasure in communicating the result to the Association. The cyanide process had been known for over fifty years; but it was only within the past six years that it had been worked commercially, and had given good results. An English syndicate had undertaken to treat the Pambula ores, guaranteeing 65 per cent. against 42 per cent. obtained by crushing and amalgamation, but they eventually gave up the

contract. His firm then took the matter up, and had obtained working results as high as 82 per cent.; but it was ultimately relinquished, in consequence of the report of an expert, representing the company whose ore was being treated, who, although he confirmed the results obtained, stated that the process was in a purely experimental stage—a most incomprehensible statement to make, considering that the New Zealand Government returns stated that 90 per cent. was recovered by the cyanide process, and in South Africa 50,000 ounces per month were being recovered by the same process.