DISCUSSION.

Mr. Auldjo said:—The thanks of this Association are due to the Author for having put before us a paper giving actual practical experience of the working of the Carbonic Machine, we have had papers and discussions on Cold Air and Ammonia Refrigerators, but this is the first opportunity given us to criticise the actual working of this particular machine.

One thing had always struck him as rather strange, and that was that there was practically only one builder of this type of machine in the market. The original patents under which these machines were built were taken out by a German named Windhausen, and to him all credit is due in connection with the use of Carbonic Anhydride Gas.

In America alone, there must be not less than 50 firms building Ammonia Machines, besides a number in other parts of the world. Then why is it if Carbonic Gas is so good as it seems to be that other builders have not taken it up? No doubt the theory advanced by the University Professors as to the supposed loss of efficiency at the higher temperatures in comparison to Ammonia had a good deal to do with it. Also, the very high pressure required to liquify this gas has frightened engineers from attempting to handle it.

Ammonia gas liquifies under ordinary working conditions at say 150lbs pressure, whereas Carbonic Gas requires say 1200 lbs pressure to liquify it.

A few builders of Ammonia Machines build them compound and advocate it as an advantage over the single compression system. The majority, however, still believe in, and stick to, the single compressor, as they do not think that the extra expense and complication are warranted by the results obtained in actual working.

All the Carbonic Machines he had seen had only single compressors, that is the whole of the compression is done in the one cylinder. If it will pay to use compound compressors for Ammonia Gas at 130lbs., it certainly should pay even better with Carbonic Gas at 1200lbs.

It seems to him that the carbonic machines could also otherwise be very much improved in design. The Author states, that with carefully selected leathers, the pistons will last from four to six weeks. This was certainly the very best results he had heard of, as he thought a few days and very often a few hours, were the usual lifetime of these leathers. But why should leathers be used at all? It was quite possible to design and make a metallic piston to do the work required. He had Ammonia pistons with ordinary cast iron rings, which had been in use for two or three years without any perceptible wear, so he did not think that there should be any great difficulty in designing and making a similar piston to handle carbonic gas.

Another very weak point in the machine was in making it double acting consequently the full condenser pressure comes on the piston rod gland at one end of the compressor, and every one knows that Ammonia gas gives quite enough trouble there with only 150lbs pressure, though the majority of Ammonia Compressor builders build their compressors single acting to avoid the condenser pressure with its oil system. This oil system has, he noted, to be adopted with the carbonic machine. He would like to ask how long does a charge of carbonic gas last? He would mention that a small ammonia plant put up by him at Newcastle ran for two seasons with the original charge, and when going to start the third season, the owner wrote to ask if he thought it required any ammonia. This held the record so far as he knew, and of course was an exceptional case.

He believed that a carbonic machine could be designed and built to give very much better results than the one at present

in use, and he had no doubt it would have been done before if the practical man had not been misled by the Professors with their supposed theory. He trusted that this discussion would tend to throw more light on the subject of refrigeration.

If we take the export of fruit from these colonies, and see the way in which it is attempted to be carried out, it makes one wonder what is the use of an engineer. Why any one knows that dry air was very much more essential to the preservation of fruit than low temperature. And yet we find our newest and largest mail steamers fitted up with Cold Air Machines, which produce air saturated with moisture, this air being circulated directly amongst the fruit.

As an engineer he stated that there was no difficulty in obtaining a perfectly dry atmosphere with any type of refrigerating machine, and he often wondered how long our fruit growers and exporters would stand being fooled as they were at present.

Mr. A. E. Lea said:—He quite agreed with the Author in most parts of the paper, especially as to the great importance of mechanical refrigeration to these Colonies; also as regards a machine doing good work with condenser water at a high temperature, as he had a good deal of experience in this. He had frequently had cooling water as high as 100deg. Fah., and had then got along fairly well. He thought there was room for great improvement in these machines, and he had not the slightest doubt but that there would be in a short time a very much improved style of Carbonic Anhydride Machine to that at present in use here. There is one point that he could not agree with the Author on, and that was in reference to the leathers. The Author stated that they last from four to six weeks. Well, it may have been the Author's good fortune to have his leathers stand so long; but, unfortunately, he had never experienced such good results. His leathers with continual running night and day, last from six (6) to nine (9) days, and he thought

it would repay any engineer to replace them with new ones, as a very small leak in the gland leather kept the attendant constantly at the glycerine pumps so that the gland box will be kept full, and so keep the CO_2 from escaping. Now, if we take into consideration a machine with a stroke of eighteen inches (18in.) working at 90 revolutions per minute—that is 16,200ft per hour, 388,800ft per day of 24 hours, 2,332,800ft per week of six days. And bring these figures to miles for four weeks running we find that the Compressor piston rod has travelled the great distance of 1767 miles through two leathers, these having to resist a pressure of, at least, 1300 lbs. per square inch at the same time, and he thought that many would agree with him that it is hardly to be expected for a leather to stand so long. There was one point he would like to touch upon and that was the suction valves in the compressors. The seats of these valves project into the cylinder of the compressor with a perforated guide for valve, and the piston head working with only 1/32nd of an inch clearance. The slightest twist in the rod, or looseness of brass in connecting rod, causes seat to be struck, and so fastens the valve down and prevents it from working.