

strength; also that the motive power by which the plant was driven should be equal to developing considerably more power than was actually required. The reason for this was that elevating and conveying machinery designed for a certain load was frequently overloaded, and as the load in many cases was delivered to the plant by ordinary labor, so long as there was room for more material to be loaded on to the Elevator or Conveyor it was put there irrespective of what the results might be, and further engineering knowledge not being required to operate this class of machinery the plant often did not receive proper attention.

Discussion.

Mr. J. W. Bragg, in moving a vote of thanks to Mr. Jones for his paper, said he thought the author was to be congratulated upon his selection of the various types of Conveyers he had shown members that evening. He had described and illustrated material being handled in bulk, from small coal up to big wool bales, and there seemed to be practically no limit to the extent to which such conveyers as he had described could be adapted.

Conveyers such as they had seen on the screen appeared to be very simple contrivances; they consisted of, apparently, a chain and some wood slats, buckets, or material of that kind; but they would probably all agree with him that when they came into closer touch with the handling of bulk material, it would be found that such had little ways of its own which required very careful handling indeed. Occasionally it appeared to be possessed of an evil spirit. Things appeared to do that which they should not do. They all knew how inanimate objects

sometimes seemed to possess the characteristic of contrariness and uncertainty. The skill rested not only in knowing how to erect the plant, but largely in knowing how to circumvent the little idiosyncrasies possessed by bulk material.

Lord Macaulay at one time being desirous of showing to some friends the perverse nature of inanimate objects said, as he was sitting in his library, "Now I want to show you how perverse things can be. I have here twelve volumes of Shakespeare. Now we will select any play you like out of Shakespeare; say 'Hamlet.' Now I want to find that play amongst these volumes, and almost certainly it will be the very last volume of all." On opening the first volume he found the play mentioned. "There you are!" said Lord Macaulay. "Is not that a good illustration of the perverse nature of inanimate objects. The play happened to be in the first volume just because we hoped it would be in the last one."

He had to repeat that the skill of the expert in Conveyer work lay, not only in knowing how to build the conveyer, but also in knowing how to ensure the material being handled taking the course desired.

He thought Mr. Jones had excellently illustrated the application of conveying machinery, and he maintained that special knowledge was required in connection with such work just as much as in connection with gas-engine work or electric work, or any other similar class of engineering. It was only years of experience and actual contact with machinery such as had been described that would enable a man to decide at once without experimenting what was the proper type of machine to instal for any particular purpose.

Mr. R. R. Ferrier, in seconding the vote of thanks to Mr. Jones, remarked that Elevating and Conveying machinery had always been interesting to him, and Mr. Jones had certainly furnished them with many illustrations of the practical adaptation of Elevators and Conveyers in many different industries in Australia and elsewhere.

Mr. Bragg referred to the fact that the design of conveying machinery appeared very simple on the surface, and he agreed with him that if any one of them were to set about designing and erecting any of these very simple things, they would very soon come in contact with many problems which they had not anticipated. The question of the type of chains, speeds, horse powers, and so on, had to be considered, and he was sure they all felt very grateful to Mr. Jones for giving them the benefit of his practical experience in connection with this very interesting subject.

Mr. W. Sinclair wished to know in regard to the speed of chains, apart from conveying work, whether there was not some limit to the amount of power that might be transmitted by means of driving chains.

There was very little that he could criticise in Mr. Jones' paper, although obviously it contained much useful information. He expressed a desire that more papers of a similar nature might be read before the Association in the future.

Mr. B. Holland said that he also quite understood what Mr. Bragg said when he stated that conveyers had peculiarities of their own, for they often went wrong just at the time when it was expected they would go right. Conveyer designing required a great deal of experience, judgment, and actual knowledge and contact with that

particular class of machinery, extending over probably a number of years. He understood that in America at the present time they were introducing carriers fitted with ball bearings which would have the effect of greatly reducing the horse-power required.

A type of conveyer that Mr. Jones had not dealt with was the ordinary gravity roller conveyer. This consisted of an arrangement of ball bearings and rollers arranged in sets on steel framings, the whole set being fixed at a slight angle, so that the materials could be run from one part of the factory to another by means of gravity. Of course, where long Conveyers were used, it would be necessary to have plenty of head room. He had once witnessed a very ingenious arrangement called a "Booster Elevator." Apparently small packages of similar size had to be handled over considerable distance, and the length and angle of the runways depended entirely upon the head room. After running by gravity some little distance, the lower end of the Conveyer reached the ground, and the "Booster Elevator" was then so arranged that it would elevate the packages and deliver them at a certain height to another gravity runway, and so on. A series of these "Booster Elevators" practically rendered it possible to have the material carried over any length. Conveyers of this kind appeared to him to possess very great advantages.

Mr. G. A. Julius remarked that there could be no question in Australia that was of more vital importance than that of handling machinery. The increased wage-bill in many industries was rendering these very difficult to carry on—in fact, the cost of handling was, in many cases, having a crippling effect on such industries.

The only solution, so far as he could see, was to have the handling done by machinery. In view of all this he thought it must be apparent that a paper such as they had heard read that evening was of very great value indeed.

He might mention that he had under consideration at the present time the erection of a plant, the first cost of which would amount to something like £9,000, and which would eliminate the necessity for the services of some thirty employees.

He was sure that every member present that evening would agree with him when he said that the benefit derived from hearing papers such as the one read by Mr. Jones was not to be realised immediately, but would become more and more apparent in the future.

Mr. Jas. Shirra considered that a paper such as it had been their privilege to listen to and discuss that evening revealed what engineers were doing in connection with the expeditious handling of raw material; and it might also be an opportune time to mention that Mr. Griffin, the successful competitor in the Federal Capital Design scheme, paid a great compliment to the engineers of this State when he said that they were making far better progress than the architects, and that the latter would have to make an effort to keep themselves in line.

In listening to the paper he could not help feeling how important the question of lubrication was, and how the use of the oil-can would greatly assist in prolonging the life of the conveyers and elevators handling gritty materials.

He would like to ask Mr. Jones whether he had had any experience with oil-less bushes. He thought it would be a very good thing if an automatic lubricator could be devised for use in connection with these machines.

Mr. B. Giles said that he agreed with Mr. Julius that probably the most absorbing question that could exercise the minds of heads of departments in this country was the cost of handling material.

The paper which had been read to them that evening pointed to a very large number of ways in which the cost of labour could be reduced. Recently he was away from Sydney—and perhaps one was more observant when away from home—and he was surprised and impressed by the labour-saving appliances in use in the various factories he had visited.

He did not think it would be possible for them to have heard a paper which contained more complete information than that which Mr. Jones had given them that night, and in view of the fact that he had himself carried out a great deal of that kind of work, the author's remarks must be regarded as of the utmost value.

Mr. H. Orams said that he felt sure they had all been impressed with the scope of the paper read that evening, and also the skilful way in which the author had treated such an extensive subject.

He agreed with Mr. Jones that the method of feeding the material on to the belt required very careful consideration. It had been his experience that if the belt was slightly hollowed at the charging end, it increased its capacity. It was also beneficial to regulate the feed in such a way that the wear and tear was minimised as much as possible, when coal, or other sharp-edged materials were being handled.

In regard to bushed rollers, and the exclusion of grit, he might mention that the Commonwealth Oil Company had installed a system of apron conveyers at Newnes, for the purpose of conveying coke to the trucks. The

coke was drawn from the ovens by a steam-operated rake, whilst a jet of water was played on the coke. The water washed grit through to the working parts, and in less than twelve months the edges of the apron plates were worn down almost to knife-edge sharpness by the friction on the angle-bars.

Pneumatic conveyers were becoming extensively used in the handling of grain, but he expected that Mr. Jones purposely refrained from mentioning this type in his paper.

THE AUTHOR'S REPLY.

Mr. Jones, in reply, said, in reference to Mr. Sinclair's remarks regarding the speed of chains, he thought it depended very much upon the construction of the chain itself, but 300ft. to 400ft. per minute might be taken as a fair average speed for running a conveying chain.

The Booster and roller conveyers referred to by Mr. Holland were very largely used, but he was unable to deal with them in the time at his disposal.

The lubrication of chains was, as Mr. Shirra remarked, a very important matter, and that was why the rollers were sometimes constructed in such a way that they had a steel thimble bush passing through the roller, which permitted of the chain being automatically oiled.

In connection with the feeding of belt conveyers remarked upon by Mr. Orams, when flat belts were being used to convey material which would not stay on a flat belt, the latter was "troughed" at the point most suitable to enable the delivery to be increased, which, of course, increased the capacity of the belt.

When in Canada recently he had the privilege of seeing one of the very large grain elevators, or storage installations, at Montreal, and the system there consisted almost solely of belt conveyers. On inquiring into the reason for this he was informed that it was due to the excessive amount of power required in other types of installation, and especially the pneumatic.

Mr. Jones said he had to thank members for the way in which they had received his paper.
