11TH OCTOBER, 1888.

DISCUSSION ON MR. J. B. HENSON'S PAPER ON THE WESTERN SUBURBS SEWERAGE SCHEME.

MR. TREVOR JONES stated that Mr. Henson, before writing his paper criticising the proposed system of sewerage for the Western Suburbs, had conferred with him (the speaker), and asked his advice as to whether such a course could be considered obtrusive and likely to give offence, especially as Mr. Stayten had published his ideas with the avowed object of eliciting criticism before its execution rather than after. His (Mr. Trevor Jones) answer was to encourage him to proceed, as no one could well help commending friendly discussion on a subject so fraught with importance to the enormous communities concerned.

Mr. Henson, in reviewing Mr. Stayten's work, had incontinently adopted the most modern thesis on sanitary matters, and one that was gradually gaining favour with the advanced school of sanitarians, though it must be admitted was opposed in its strict sense by first-class men, viz., the separate system, pure and simple, which meant that the sewers should be designed as small as possible consistently with their being just adequate to convey the sewage of a locality without any admixture of rain water.

As contrasted with this, the older parts of Sydney are sewered on the combined plan, *i.e.*, the sewers are designed of sufficient capacity to convey both storm water and sewage.

Between the two extremes there exists a system known as the "Partial System," which has been adopted by Mr. Clarke in his recommendation for the southern parts of Sydney, and was being carried out under the directions of W. C. Bennett, Esq., Engineer-in-Chief, Roads and Bridges.

It was this system that has been adopted by Mr. Stayten in the work under discussion, and which forms the subject of Mr. Henson's remarks.

He wished to preface his remarks by stating that he was, and had always been, in favour of the separate system, especially for this climate where we experience so many rainless days, admitting perhaps only the rain from the roof and paved surfaces, at the upper levels of sewers.

In his experience among municipal bodies and practical men he had found the following sentiments had taken firm hold of them, and were next to impossible to remove: The first was that it was an economy to utilise storm water ducts to convey the sewage of a locality; the second, that it was in the last degree desirable that the sewers should have the benefit of the scouring and cleansing effect of the rain.

Certainly the reasoning was plausible, it appealed at once to the common sense of a listener, and would carry conviction to a popular assembly; he felt sure that some of his hearers who had not given special thought to the matter would hardly be able to resist so plain a mode of reasoning.

Some engineers of standing still adhered to the combined system, but nearly all the sanitary engineers of Europe admitted varying proportions of roof and yard rainfall into their sewers.

In Europe, however, they had not the number of fine warm days we had here, and he held that if the sewers depended for being flushed on the rain, the flushing would be too infrequent to keep them cleansed; he would, therefore, prefer to design the sewers for sewage only, and by means of flushing chambers at the summit extremity of every branch construct a flushing chamber, into which he would have means of letting fresh water from pipes, or, if available, local roof and bath water could be run in, when flushes could be given at stated times. He would ask his hearers to reflect for a moment if our larger sewers were to depend upon the rain for a scour, how foul they must become during our never-ending series of fine warm days when sewage gave off its maximum of gases.

The sewage in them would be a sluggish shallow stream, and their sides which are occasionally smeared with the grime of the sewage would offer a large surface for throwing off vile odours, while the capacious spaces above the sewage afforded room for them to collect.

On the other hand, if the sewers were adjusted in capacity so as to be nearly full with the ordinary flow, no room would be found for gas to form or accumulate.

Moreover, where a liberal supply of water was given, as in Sydney, what with the lavish use of the bath and other sanitating operations, the scouring and flushing of the smaller sewers necessary under the separate system would be effectual, and, what was more, it would be constant instead of precarious, as it otherwise would be, depending on the rainfall.

Then the velocity would be considerably improved for the reason that difference between the height of the larger sewer of the partial system, and the smaller diameter of the pipes ordinarily used under the separate system would be added to the fall in the length of sewer, and fall meant velocity.

Mr. Henson had very justly laid great stress upon the desirability of securing a velocity of flow, this was a paramount necessity in the case of sewage, to allow it to stagnate was to allow it to secrete and emit poison in all directions, while a certain velocity would give it no time to ferment and give off its noxious gases.

The separate system required for its application chiefly glazed stoneware pipes, while the combined or partial system demanded a larger proportion of brick or cement surfaces, which were more or less porous, retaining the liquids. It needed no argument to prove the superiority of pipes over brickwork in this respect, the joints only being of cement or any partially absorptive material.

He did not intend to strongly combat the partial system, knowing what excellent conditions had been produced by it, and being at the disadvantage of knowing of no actual experiment of the purely separate system (indeed, he thought there had been no

such experiments made) he was in a measure theorising, but with confidence that if tried scientifically success must follow.

Mr. Henson had touched upon the subject of the inverted syphons, especially the series of three such contrivances which it had been found necessary to construct on the line between Balmain and the intercepting sewer. He (Mr. Jones) was aware that if the sewage of the localities named was to drain into the ocean at Bondi, they are indispensable.

Each one of those must of neccessity be always full of sewage; during rainy days the flow in them would practically be the same as in the rest of the sewer, but during fine days, when the flow was at its minimum, the water or sewage which flowed in them was so small that the whole body of it would not change without considerable delay. He had not computed what time, but the stagnation which was imposed on the minimum flow by the series of three syphons must be considerable and very objectionable.

Whereas if the sewer had been designed of a size to convey only the sewage, the flow would have been uniform, or nearly so, in the syphon with that in the rest of the sewer.

These facts with that of the lesser cost inclined him to favor the separate system theoretically.

It would probably be disputed that the separate system entailed the construction of a duplicate series of pipes, one for sewage, the other for rain; but that argument failed when the design directs that rain water shall flow on the surface channels, only entering storm-water culverts at short distances from the outfall.

He had that day been called upon to give evidence as to the adaptability of a scheme, the combined design of Messrs. W. C. Bennett and Stayten, for the drainage of North Shore, and although that plan was on the partial system, he had in a general way nothing but good to say of it, feeling that to introduce a new theory at that late hour would be to divert the issue, perhaps to the effect of delaying this much required work, and that the work in question came nearer to his ideas as regards exclusion of rain, combined with small sewers than any scheme he knew of.

It was also to be noted that when the main trunk or intercepting sewer is a tunnel, there was a limit to the minimum size it could be excavated, as a certain sized orifice was necessary for the operation of driving the tunnel.

A short time since Mr. HENSON gave an interesting paper on the Shone system, and he (the speaker) was glad to find that this system was gaining ground daily, its adaptability to Sydney should be well considered in relation to the sewage of low levels. It would, in his opinion, be a more effectual and cheaper means than any other form of sewage pump, and he was pleased to see that its adoption was under the consideration of the authorities.

Mr. G. Fischer said that at the last meeting he had moved the adjournment of the debate, but his object in doing so was to give an opportunity to Mr. Stayten to reply to the remarks made by Mr. Henson. He (Mr. Fischer) gave Mr. Henson great credit for having brought forward the subject, and for the way in which he had substantiated his figures.

Mr. W. Cruickshank said that all he could say in connection with the paper was very little, as he knew little about this particular branch of the business of engineering, a profession divided into so many branches that it took all a man's time to look after his own section. Mr. Henson in his paper had made some sweeping and decided statements. As far as he (the speaker) could judge from the paper, it affirmed that the foundations were in many parts unstable, and he considered, as did all practical men, that if the foundations were wrong the deductions obtained from them must necessarily be wrong also. It appeared to him that a system of sewage must be based upon certain conditions which must exist, and the great objection advanced by Mr. Henson was that this system was dependent on conditions which could not not take place until about twenty years hence. Another maxim which he considered illogical was that the inhabitants of the western suburbs must consume a certain amount of water to facilitate the working of the sewers and to make them healthy if this scheme were to be successful. Mr. Stayten had also in his scheme depended to a certain extent upon local rainfall for the efficient flushing of the

sewers and he (Mr. Cruickshank) could say, from an experience of twenty-six years in the country, that if such was Mr. Stayten's intention it would prove eminently unsatisfactory. He was very sorry that Mr. Stayten could not be present, as he would be the best man to answer such severely critical statements.

Mr. Cowdery thanked the Association for allowing him to make a few remarks on the question under discussion. He quite agreed with Mr. Henson in his statement regarding the velocity of flow in this sewer, but he did not point out the means of remedying the very flat gradients (gradients on which for many years it would be impossible to keep the sewer clean), the velocities being not more than 100 feet per minute. The Adelaide sewers varied from 1 in 300 to 1 in 600, with a velocity ⅓ full of 162 to 199 feet per minute, and the outfall 1 in 1,000, velocity ⅓ full, 213. These were gradients considerably better than Mr. Stayten's, but the object of keeping them so flat in the proposed scheme was evidently to reduce the pumping as much as possible. This he (the speaker) considered a mistake.

The western sewer should not be carried to the north of Liverpool road, or any attempt made to drain that portion of the western suburbs that had a watershed towards the Parramatta River, as it would be found much better to carry the sewage by gravitation to suitable farms sufficiently large for the future requirements of the areas. There would be no difficulty in finding suitable areas on the Parramatta River which would be greatly improved thereby. On sanitary grounds a number of small farms were to be preferred to one large one, and that no objection could be raised against this proposal was proved by Mr. Stayten's scheme not being carried beyond Strathfield, which involved the necessity of another scheme for the populous districts of Auburn, Granville, and Parramatta.

Why should not Strathfield, Burwood, Concord, Five Dock, etc., be treated independent of the Botany scheme, and thus allow the gradients on the Cook's River watershed to be improved? The whole of the places on the Parramatta River could then be drained with glazed pipes, which do not absorb sewage matter

and gases like brick or cement sewers. By taking each watershed by itself, and making the farms sufficiently large for the increase of population, they would not be overtaxed, and no difficulty would be found. It was not on small farms where difficulties had to be contended with, but only where large quantities of sewage had to be dealt with, as in London, where it was found almost impossible to treat it; in fact, very little was done, as could be seen from the state of the Thames. It would be, therefore, better to keep as much sewage as possible away from the large farm at Botany, or, in course of time, as the population of Sydney increased, Botany Bay would be found in a similar state to the Thames. In laying out sewers in this climate, they should be designed so as to be self-cleansing, independent of the rainfall which, coming at such uncertain times, and in such quantities should be excluded altogether. The whole of the roof water should be conducted to the water channels, and from thence allowed to find its way to the nearest stream, or else by a separate system of pipes. The inhabitants of the neighbourhoods should also be considered, and an expensive scheme should not be adopted where constant pumping was required, when an equally good or better method could be devised where the whole could be disposed of by gravitation. Mr. Stayten in his estimate should have given the total cost of the work, including subsidiary sewers, and the proportion on which interest would have to be paid by the different municipalities. If this had been done he (Mr. Cowdery) felt sure the different authorities would not have given their approval so readily. To give an idea of the cost, Burwood might be taken as an example—Main sewer, £56,776; subsidiary sewers, £25,000, making a total of £81,776, or an annual cost to this municipality of £3,993. The total cost of the whole scheme at this rate would amount to £1,195,000. By the other system it could be carried out at a total cost to Burwood of £62,450, or an annual expenditure of £2,178 12s. 7d., thus saving £1,814 7s. 5d., or nearly 6d. on the present rateable value. He was of opinion that the whole of the sewage now going out to sea by the Bondi sewer would eventually have to be treated before passing to the

sea. This would probably at some distant time be carried out to the Botany farm; it would thus be much better to keep as many of the suburbs as possible out of the Botany scheme.

FLUSHING.—This was a very essential thing and should be automatic. At the upper ends of all sewers he would recommend an automatic flushing chamber, fitted with one of Messrs. Doulton and Co.'s or Adams' automatic flushing valves, which retained the water until it had reached a given height, when it discharged the whole through the sewer in a very short time. The chamber could be fitted in several ways, either from the water mains with a small pipe constantly running, and regulated to flush once per day, or the waste water from drinking fountains could be utilised for that purpose, or from local streams or springs; but in no case should it be left for the rainfall to keep the sewers flushed. A great source of sewage gas arose from the dirty state of the private house connections, and they should always have a small automatic flushing chamber, say, of 20 to 30 gallons capacity, which should be fitted with a grease interceptor, and could be charged with the waste water, from bath or sink; this would be found to keep the drains clean.

VENTILATION.—This was a point that required a great deal of attention. There was no doubt, from a sanitary point of view, that it would be better to keep the sewers open and discharge their contents as soon as possible, but as this was not practicable we must do the next best thing—give as much ventilation as possible. The best way to do this was to admit air through the manhole and lamphole covers, and have every house connection carried up full size, above the house, with a pipe not used for rain water or other purposes. It was advisable to cut the main sewers up into sections by means of flap valves at certain manholes. In no case should private drains be taken inside a house; but all sinks, baths, &c., must be taken through the walls and discharge over a trap on the outside. One great advantage in using as many small farms as possible would be, that the work could be begun and completed at once, and long before the outlying places could be reached by the larger scheme; and perhaps this might be the

means of saving us from some outbreaks of fever, the suburbs being in such a very insanitary state. Sewerage works should be begun without delay in most of these suburbs, several of which could be carried out in from six to twelve months. Mr. Stayten stated the sewage was discharged under his system in three hours. He (the speaker) calculated that it would take nearly five hours; in fact, some of it could never reach there unless it was carted, for owing to the excessively flat gradients on the smaller or upper end of sewers, a great quantity of the sewage would be deposited, and would have to be removed by other means.

Dr. Ashburton Thompson said he had read Mr. Henson's communication with great care and close attention; and he (the speaker) found that he dealt with a good many technical points very fully. Upon many of these he (the speaker) had not the least intention of saying much before this Association. But his criticisms were so sweeping and so energetic—in some cases, even so novel—that he must mention one or two of these points which, in fact, passed his comprehension. He was at a loss to conceive, for instance, what was meant by a standard velocity of 180. It was impossible to refer to a standard velocity except in relation to a sewer of specified dimensions. As far as he could remember no engineer with whose works he was acquainted had recommended a velocity of 180 sewers at all resembling in their dimensions those of Mr. Stayten's plan. Nor did he at all understand, for another instance, the objections raised to the employment of syphons. He failed entirely to feel their force on the one hand, while on the other he knew very well that syphons were successfully used in several parts of the world, and indeed that in some situations they were practically indispensable. At the same time it was not shown how they could be dispensed with here, the objections raised were purely theoretical; and this being the case a most serious omission had been made in neglecting to refer to the working of a syphon which might easily be watched, and in failing to tell us what amount of practical support to those objections was furnished by this contrivance as it stands in use to-day on the southern outfall sewer. Now, Mr. Henson concludes with a very judicious