ON "A METHOD OF REGULATING THE MAXIMUM DISCHARGE OF SEWERS."

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IN designing a system of drainage, it is frequently required to limit the quantity which one or more of the sewers shall be capable of discharging at their outfall.

In the case of the formation of joint boards, for dealing with the sewage of several separate districts, it is usual for the Local Government Board to prescribe two hundred and fifty gallons per house per diem, as the quantity which the joint board shall make provision for receiving into the main intercepting sewer from each branch or district sewer.

Also, in the case of the drainage of only one district, it becomes necessary to limit the quantity which the sewers shall discharge at their outfall or

diameter being unity), after which, as the sewer becomes further filled, this quotient diminishes, and the quantity discharged becomes less.

If, however, the form of the sewer above the line of the maximum discharge is modified in such a manner that, as the sewage continues to rise in the sewer, the quotient obtained by dividing the cube of the area filled by the wetted perimeter remains constant, then the quantity discharged by the sewer will also be constant—neither increasing nor decreasing—although the height of the sewage may vary between certain limits.

The accompanying drawing, Fig. 1, exhibits the form to be given to a circular sewer above the line of maximum discharge in order to render the discharge equal in quantity, although the sewage may rise above that level; and the following table gives the width of the sewer at each successive hundredth

Figure 1.
Section of Regulating Sewer
Between A and B

Figure 2
Plan

junction with the main sewer, as the case may be; not only because in the treatment of the sewage, whether on land or by chemical process, it would be impossible to deal with the whole of the discharge from the several tributary sewers in times of heavy falls of rain, but further because the main intercepting sewer would become of inconvenient dimensions if made capable of receiving the aggregate maximum discharge of all the sewers which it intercepted.

It is proposed to fulfil this requirement in the following manner:—

The discharging capacity of a sewer is always proportional to the cube of the transverse sectional area filled by the sewage, divided by the wetted perimeter. This quotient gradually increases as the depth of the stream in the sewer increases, until it reaches a certain height (which, in the case of a circular sewer, is equal to 0.9496, the whole

of the diameter above the line of maximum discharge the diameter of the sewer being unity, namely:—

Width at the line of maximum discharge	...	0.4376
" 1 hundredth of dia. above the same	...	0.3984
" 2 hundredths	"	0.3632
" 3 "	"	0.3317
" 4 "	"	0.3037
" 5 "	"	0.2790
" 6 "	"	0.2574
" 7 "	"	0.2386
" 8 "	"	0.2225
" 9 "	"	0.2090
" 10 "	"	0.1979
" 11 "	"	0.1891
" 12 "	"	0.1824
" 13 "	"	0.1777
" 14 "	"	0.1748
" 15 "	"	0.1735
" 16 "	"	0.1724
" 17 "	"	0.1714
" 18 "	"	0.1706
" 19 "	"	0.1699
" 20 "	"	0.1693

Having determined the maximum quantity which it is required for the sewer to discharge at its outfall, such dimensions must be adopted for the sewer, for a certain length from such outfall, as shall enable it to discharge that quantity when the sewer is filled to the line of maximum discharge, and above that level the sides of the sewer must be made of the form shown in the diagram.

At the upper end of this length of sewer, an opening is made in the side of the sewer forming an overflow weir, the level of the lip of which is the same as that of the line of maximum discharge, that is to say, the same as the lower limit of the height of the stream having the constant rate of discharge; and this sewer is made of such a length that, when the stream rises to the upper limit of such constant rate of discharge, the quantity which will flow away over the weir, shall be equal to the maximum quantity which the upper portion of the sewer can bring down, after deducting from the same the constant quantity which can be conveyed away by the lower length of the sewer with the modified form of section. This discharge from the weir is conveyed away by an independent channel provided for that purpose.

Fig. 2 illustrates the practical application of the method. If, for example, the diameter of the lower or regulating length of the sewer is two feet, with a fall of 1 in 500, its maximum discharging capacity would be 590 cubic feet per minute; and if the diameter of the upper portion of the sewer above the weir is three feet, with the same fall, its maximum discharging capacity would be 1,643 cubic feet per minute; consequently, 1,053 cubic feet per minute would require to be discharged over the weir; and if the length of the weir is 22 feet, this quantity would be discharged with a depth of 4.42 inches flowing over the lip of the weir. Therefore, with the maximum quantity which the upper sewer could bring down, the sewage could never rise in the regulating sewer above the upper limit of constant discharge.

If the upper or regulating portion of the sewer were made in stoneware, moulded to the required form, as shown in fig. 1, no special skill or care would be required in the construction of the sewer.

OPHTHALMIA AT HANWELL.—The Local Government Board has authorized the managers of the Central London School District to borrow £24,000 to enable the managers to erect a new ophthalmic hospital at Hanwell, where ophthalmia has been on the increase for a considerable time past.

THE VITALITY OF TRICHINAE.—M. Paul Gibier has submitted trichinae to a temperature of 25° C. below zero for two hours, but this great degree of cold had no effect on their vitality—hence frozen meat, if trichinous, may be as dangerous as fresh meat. (Compt. Rend. T. CIX. No. 14, 1889, p. 534).

Public Health.

PROGRESS OF SANITATION IN INDIA.

ACCORDING to the Report of the Sanitary Commissioner with the Government of India for 1887, the average strength of the European troops on service in India in that year was 63,515. The troops enjoyed better health than in 1886, the admissions into hospital per 1,000 of average strength having declined from 1,514 to 1,370, the daily sick-rate from 75 to 70, the invaliding-rate from 23 to 21, and the death-rate from 15.18 to 14.20. Compared with the decennial average of 1870-79, the admission-rate of 1887 was 105 per 1,000 less, and the ratio of mortality 5.14 per 1,000 lower. Enteric fever, though less prevalent than in 1886, continued to rank as the chief cause of death, the ratio being 3.76 per 1,000 against 5.08. In all three presidencies the mortality under this head was smaller in the year under notice than in 1886. Statistics continue to demonstrate the liability of young and unacclimatised soldiers to this disease. Amongst men in the first and second years of their residence in India the number that died from enteric fever equalled 7.13 per 1,000, while the deaths among those in their sixth years were 2.37 per 1,000 of strength. On the other hand, cholera was much more prevalent and fatal, the death-rate reaching 2.00 per 1,000, against 0.49 in 1886. Of 183 admissions to hospital from this disease 127, or 69 per cent., died, and of the total deaths 92, or 72 per cent., occurred in the Bengal Army.

The number of men invalided during the year amounted to 1,443, equal to 22.57 per 1,000 of average strength, against 1,303 or 21.10 per 1,000 in 1886. This, however, is not an exceptional ratio, and the slight increase was due to a larger number of invalids under twenty-five years of age, the percentage at this age having risen from 43.92 to 49.41. All three presidencies contributed to the increase, but it was most marked in Madras, owing chiefly to venereal diseases, injuries, and dysentery. Of the total number invalided 37 per cent. were discharged as unfit for further service, against a percentage of 41 in 1886.

Native Army.—On the whole the health of the native army of India in 1887 was more satisfactory than in the previous year. There was a slight increase in sickness, the admission and daily sick-rates having risen from 973 and 31 per 1,000, respectively, of average strength in 1886 to 1,045 and 33, while the death-rate declined from 13.27 to 11.68. The increased sickness was chiefly due to intermittent fever, the admissions from which rose from 388.9 per 1,000 to 472.6. Notwithstanding the serious prevalence of cholera during the year, the native troops suffered very little more than in the previous year, the deaths having increased only by three, viz., from 135 or 1.27 per