MUNICIPAL DEPARTMENT

MUNICIPAL ELECTRIC LIGHTING.

By George White-Fraser, A. Am. Inst. Elec. Eng.

Having decided upon the purchase of an electric lighting plant, and obtained the money necessary, the next important steps are the general design of the entire system, from building to transformer and lamps, and the selection of the make of machinery to be employed. Persons inexperienced in the management of electric lighting business do not, and cannot, appreciate the extreme importance of the original designing of a system; nor the fact that any little inefficiency at this stage will have the effect of imposing a permanent burden on the enterprise that no amount of careful, experienced supervision afterwards can remedy or diminish. This design will decide whether the business can be economically carried on; whether it is, for good and all, to have saddled on to it all sorts of defects. An electric light station is a factory for the manufacture of electric current; and the lines are the means whereby the current is distributed. Every manufactured article has a minimum cost of production. It cannot be made for less than this minimum, and the object of every intelligent manufacturer is to produce it as near as possible to the minimum cost, which is made up of the following items. the article's fair share of interest on the first cost of the machinery and plant required; its fair share of cost of raw materia'; wages, depreciation, maintenance and so on; and a reduction in any one of these items results in reducing the cost of the article. Of these items, some are purely operatives, while others are purely capital charges. Anything that tends to reduce the amount of capital necessary to be employed, reduces the share of interest on capital which the article has to pay back; and the only way to reduce the amount of capital employed is to have every individual piece of machinery or detail in the factory proportioned for its work. We must have no men doing boy's work, or vice versa, otherwise capital will be wasted. An electric lighting system must be regarded as an entirety; as one harmonious whole, in which the various parts work together easily and economically, for the attainment of a common object, and if recognized principles of designing and proportioning be not studied and applied, the result is simply waste of money. It includes every piece of machinery or apparatus, from building, boiler, engine, dynamo, lines, poles, transformers, right down to the little incandescent lamp, which, as being the means for the utilization of the current is a very important article indeed, and doesn't receive half the consideration it should. The sizes of each of these details should be proportioned with regard to the general result. The size of the wires, the location of centers of distribution, have just as much influence over the ultimate efficiency of the plant as has the size of engine or dynamo; and if the design of the system be not according to intelligent consideration of local conditions, and be not based on this necessary unity or fitness for a purpose, but be loose and incoherent, it simply means waste of money to begin with, and increased expense to follow. For instance, the purchase of an engine of 125 H. P., where one of 100 H. P. is sufficient means, first, the needless investment of 25 H. P. worth of capital; and second, interest, maintenance and depreciation on the same; and third, an unnecessary increase of engine friction, requiring a corresponding increase in the consumption of fuel; all of which might have been saved by proper design, but which now will be unnecessary expenses while the engine continues to run. The same illustration will apply to every detail. The conclusion is—Design entire system most carefully, and decide what is necessary. The consideration of this question will involve investigation of the amount of lighting; class of lighting; whether commercial or residential; and in what proportions; churches, halls, etc.; kind of fuel; hours of lighting; and so on. It is not to be expected that a proper determination can be arrived at of these important factors by inexperienced persons, but there are plenty electrical specialists who can be referred to. The passing of this stage brings us to the question of what kind of machinery to select, and the decision must be arrived at on grounds both purely commercial and purely technical; proper weight being given to commercial, as distinct from electrical excellence. Business principles must guide in this, as in all other matters. Make up your mind what you want—how much you want; and go into the open market for it. So little attention has been given by the public to electrical affairs, and so general is the utterly mistaken impression that electrical machinery is yet "in its experimental stage," that a special article on the commercial and technical considerations governing the selection of electrical and steam machinery will be given next.

THE VENTILATION OF SEWERS.*

By W. F. Van Buskirk, A. M. Can. Soc. C. E.

The best modern practice aims at making sewers so perfect in alignment and grade that sewage will be kept moving at a nearly uniform rate of flow from the house drain to the main outlet, without depositing solids in any part of the system, and will reach the outlet before decomposition sets in.

Owing, however, to the impossibility of making perfectly smooth joints, etc., and of maintaining a uniform depth of flow at all times, a certain amount of the solids in suspension will be deposited in the system; and when decomposed or partially dried upon the walls of pipes will form gases, and impregnate the air with bacteria.

To mitigate this evil, flushing at frequent intervals aud the admission of large quantities of fresh air to the sewers must be resorted to.

Automatic flush tanks located at the heads of all branch sewers liberate large volumes of water at once, filling or nearly filling the smaller-sized sewers and scouring the walls and bottoms of pipes. The air in front of these volumes of water is, of course, forced out at manholes, etc., and fresh air is drawn in through all openings both in main sewers and house systems immediately in rear of them. It will be seen, therefore, that unless fresh air inlets are provided on sewer side of cut-off traps on house drains, the seals of traps will be broken, and a clear way will be provided for foul air and bacteria from street mains to interior of houses.

Exactly similar action takes place in each house system whenever a large quantity of water is discharged from a fixture, so that it is necessary to provide ventilators for the admission of air upon the sewer side of all traps in use. These ventilators should all be carried above roof line, since they will both admit and discharge air with every change in density of air in pipe system. Manholes with perforated covers will, if built at short intervals on line of sewer, admit and discharge a sufficient amount of air for ventilating purposes; and as they are generally located in the centre of streets at intersections are far enough removed from dwellings to prevent any injurious contamination of air.

It is important that any deposit on the walls of sewers be not allowed to dry before removal by flushing, for the reason that the number of bacteria and their spores that can be taken up by air from dried sewage is much greater than that from sewage in the liquid state.

In order to prevent deposits becoming at all dry, flush tanks should be timed to discharge after the period of maximum daily flow, since it is not advisable, owing to the large quantity of water required, to discharge them more frequently than once in twenty-four hours.

I am aware that my contention in regard to the danger of disease germs being carried by sewer air is at variance with the opinions of many engineers; but, on the other hand, I am supported by the great mass of the medical profession, whose opinions are worthy of consideration, although they are much inclined to blame "sewer gas" for "all the ills that flesh is heir to." In the discussion of this question, engineers generally have in mind sewers of the most approved construction, accurate grades and alignment, smooth walls, etc.; while doctors have in mind the sewer as it unfortunately is in many cases. As an example of the article which the doctor has in mind, I quote the description of a sewer recently examined by me:—

"A badly-constructed, foul-smelling stone box drain, located below the centre of the roadway, and having its outlet in the heart of the business part of the town.

"The box drain is constructed of stone, with open joints, has rough flag top and bottom, is two feet wide, and two and one-half feet deep, but is now nearly half filled with gravel and dirt. This drain is connected directly to cellars, sinks, etc., without traps, and has no openings for ventilation, and is never flushed except by heavy rainfalls."

Who will say that disease germs cannot escape from these "sewers"? Our friends, the physicians, have many cases on record in their numerous periodicals and reports which, upon examination, will convince almost anyone that diseases are communicated by sewer air.

The want of a reasonable explanation as to the manner in which the organisms are carried from one point to another has been the stumbling block in the way of engineers. The recent experiments with the bacilli of typhoid fever performed by David Arthur, M. D., King's College, London, will, I think, go far towards removing this block. After describing several experiments in a report to the recent sanitary congress, he says:—"This, in my opinion, is one of the principal ways sewage microbes find access to sewer air. The bacteria of the sewage may creep like those of typhoid up the walls of the damp nutrient sewers, so that they may be literally alive with them. Moulds here also grow with great proliferation. In their struggle for existence they will often be covered with bacteria, and in shooting forth their spore stalks must carry some bacteria with them. When the spore stalks are sufficiently long to project from the damp sewer walls, and have become ripe for dissemination, the clinging bacteria and their spores will become liberated, mould spores and bacteria and their spores will be wafted with every air current; many will gravitate to the sewage, others will stick to the damp sewer walls, others will be carried up the ventilators to the outside air, while others, again, may gain access to dwelling houses."

I am strongly of opinion that all wastes known to contain germs of contagious or infectious diseases should be burned immediately, and should in no case be discharged into sewers.

*Abstract of paper read before the Engineering Society of the School of Practical Science, Toronto.