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John W. Alvord

THE PRACTICAL OPERATION

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SEWAGE PURIFICATION PLANTS

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INTRODUCTION.

The revolution in sewage purification processes which has taken place in the last six or eight years has brought to the front a good deal of intelligent discussion on the proper design of sewage purification plants based on the new biolitic methods, and there has been a large amount of investigation into the chemical and biological processes involved, both by experiments in the laboratory and by means of miniature installations. All of this has been extremely necessary, interesting and valuable. But it must always be realized that much more valuable information as to the real nature of the problem has been already secured and will be secured from the study of the actual operation of full sized working plants than will be obtained from any other one source of information.

Our great difficulty has been to obtain full enough and complete enough reports with this kind of information which is assuredly reliable, for most of the plants in this country are comparatively new, and the English plants are worked under somewhat different conditions.

It may be interesting in the outset of this paper to note some of the difficulties which the art of sewage purification labors under at the present time, and some of the reasons why it is so seldom possible to obtain accurate and reliable information about it. Some of these difficulties are as follows:

FIRST. ITS FINANCIAL DISADVANTAGES.

The purification of sewage is not generally a popular municipal project. It is very often undertaken as the result of long litigation, and by reason of some adverse court decision compelling action. A sewage purification plant produces no revenue, and it cannot be said to be a paying investment financially, except when viewed in the most indirect manner. Unlike waterworks plants, sewage plants cannot grow in value with added years through the increase of municipal business, but must rather become year after year an added burden to the city officials, not only for proper maintenance, but for important and necessary extensions as well. It therefore generally happens that officers charged with the care of such plants are desirous of cutting down the expenses and economizing in various ways in the endeavor to show that they may save their city expenditures which predecessors in office had not found possible. Often the curtailment of necessary appropriations results in practical abandonment. Certain plants may be pointed out today in which official mismanagement, and not poor design, is responsible for apparent failure, when with proper care and maintenance they ought to produce satisfactory results. In many cases, appropriations are narrowed down to the point where although the plant may be operated after a fashion, it is done in such a perfunctory manner that its results cannot be said to be efficient. This latter condition is a too common condition of plants which have been in operation for any number of years. Scarcely ever may the plant be found which is properly financed after the first year or two.

SECOND. THEIR PHYSICAL UNATTRACTIVENESS.

The subject of sewage purification is not an attractive one to the average citizen. A plant has usually to be located out of sight so that it may be out of mind. The idea is prevalent that it is a sort of municipal eyesore to be hidden if possible, and which may be a necessary evil, but never a source of interest. Common imagination credits it as being a place of bad odor and revolting conditions, which must be avoided when one walks or drives. The idea that it can be a place of interest and source of information is only acquired after it has proved its inoffensiveness, and the slightest relaxation from a good record creates a prejudice which weeks of good conduct cannot possibly overcome. It follows that officers are not ordinarily found who like to be associated with it, or who take pride and interest in learning what they can of its principles and mastering its regulation. If for a time the mysterious action of bacteria interest the imagination of a few citizens or officials, the careful and patient observation required to understand each varying phase and study its cause is not generally obtainable among those who are entrusted with its care, and an actual repugnance to the work is not unusual.

The result of this is that well-designed and efficient plants often suffer from the most astounding and disastrous neglect on the part of those who should show interest and intelligence in them. And often the municipality itself after making an investment of thousands of dollars will fail to reap the benefits from it, and at times no amount of urging will awaken it to its plain duty in rendering an investment of general value and usefulness. If to this condition there follow bad odors due to negligence or lack of attention, the plant is for the time doomed, for no one will be found who is willing to admit anyone can be blamed but the original designer.

THIRD. TERMINATION OF EXPERT SUPERVISION.

The termination of the expert supervision of sewage purification plants usually takes place a few weeks after their completion. The engineer who had their inception and formation, and who has studied every phase of their environment, who knows what kind of sewage is to be dealt with and its quantity and variations, who understands how such variations are to be met, and who will be equal to any emergencies, drops out, is paid off, and the plant is turned over to the tender mercies of a place-hunter perhaps, or is forced on the unwilling care of some city officer with other duties which already fill his time. This is wrong, and to this condition can be traced many cases of dissatisfaction on all sides. The engineer who has carefully designed and constructed a sewage disposal plant should be retained to supervise its operation for at least a year after it is started. He is the one of all others who can successfully launch it on a successful career, and meet the problems of control.

Here and there one will come across an official in charge who is intelligent, studious, and has a mind open and receptive, and is willing and interested to do what is necessary to make sewage purification a successful part of the municipal business, and it is a fortunate plant that falls into such intelligent hands.

FOURTH. TENDENCY TO OVER-CONFIDENCE.

One does not have to be long interested in sewage purification to observe the tendency to undue optimism among those engaged in planning and promoting sewage works. Not only is this the case with those connected with patented or proprietary processes, which would be only natural, but even engineers designing or constructing plants are prone to enthusiasm over prospective operation performances. This is noticeable particularly in the many descriptions of new plants which are published. It is, of course, interesting and valuable to have these published accounts and know how each designer proposes to meet the problems he has to face. But new plants do not add to our information as to how sewage purification should be operated. A plant should be six months old before it is interesting, and a year old before it is valuable from the standpoint of operation. Two years' operation ought to enable one to form an opinion of it, and three years ought to decide its merits if carefully worked all of that time. But quite too often, the plant is pronounced a success by its originator in the first few weeks it is put in use, and if a few good analyses, not difficult to obtain in a new plant, can be added to the statement, so much the better. One must not be deceived by this overconfidence. It is natural and inevitable. But in forming opinions, it is always best to visit plants long in operation. And if your visit can be made without prior notice to the authorities, so much the better, you will see things as they are.

PROPRIETARY CLAIMS.

The endeavor to obtain a monopoly of the field of sewage purification by the owners of proprietary processes and patented claims has for some time past made it difficult for the sanitary engineer to hold his field of activity in this line of work, without some embarrassments. It is not easy to convince city officials that sewage purification is a matter where thoughtful study and constant care in operation will tell in the long run better, than the acceptance of a proposition from a strongly financed company guaranteeing operation to certain standards for a given length of time. It is not that the art can be patented; it cannot be, and there is not a patent now in the field that is particularly useful or valuable, as has been well shown by Mr. Leonard Metcalf in his paper before the American Society of Engineers, but the opposition of company promoters to regularly engaged engineers, developes much mis-statement and unfair aspersion on both sides, which is necessary and inevitable if companies are going to try to drive engineers out of this legitimate field of activity.

One cannot reflect long on this subject without coming to believe that this is a stage which will soon be a thing of the past; indeed, certain and sure signs are now existent that proprietary claims are not holding their own in the newer biolytic process.

And the difficulties which are overcoming proprietary claims are the difficulties of satisfactory operation. It is coming to be seen that in large plants skilled operation is vitally necessary, fully as necessary as intelligent design and construction, and must be counted on in advance.

NEW PROCESSES.

The consideration which we have given to the general disadvantages which sewage purification plants labor under have operated in a marked manner in the older chemical and intermittent filtration and land methods. Newer processes, especially those utilizing automatic appliances for regulating and distributing the flow, would seem on the face of it, to have greatly lessened the difficulty of supervision. This, however, is not wholly the case. Automatic appliances to a certain extent do away with an inferior class of labor, but do not at all dispense with that thoughtful care and study which is more than ever necessary in the biolytic processes.

SEPTIC TANK.

As an illustration of this, take for instance, the care of the septic tank. It is assumed for the most part that the septic tank once installed needs no particular supervision; that it operates wholly without attention, save perhaps a yearly cleaning. Now, it has been well demonstrated that this is not true; that the septic process is like all sewage processes a sensitive and delicate process, amenable to control, and subject to natural fluctuations, which must be watched and governed if the best results are to be expected. The particular function of a septic tank is break down the suspended matter to a manageable state, either by resolving it partially into gases and finely divided sediment, or if possible, wholly into impurities in solution. That this latter result can more or less be attained by properly designed tanks carefully operated has already been fully demonstrated. The compartment system of control, original with the writer, allows the operator of a plant to adjust the fermentation period of the sewage to its quality, the temperature of the weather, and the volume of flow, regardless of the total capacity of the tank. This is accomplished by dividing the tank into a number of compartments of unequal size opening into each other by troughs and gates, so that one, two, three or more may be combined together as may be desired. Thus, if a large tank has been constructed for large future requirements and the early sewage reaching the plant is small in quantity and weak in quality, indicating the desirability of a brief rest period in the tank, enough compartments may be cut out to produce the desired result.

The colder temperature of winter invariably lengthens the fermentation period, and in such cases, an added compartment may be thrown into use to lengthen the time of fermentation. A thick and concentrated sewage requires a longer fermentation period than a thin and dilute one. An increasing flow of sewage, due to growth of the city or increased number of connections may be provided for accordingly by the use of an increased number of compartments.

EVIDENCE OF PROPER REGULATION.

To one who has watched the effect of this method of regulation on the character of the effluent of the septic tank, no question could arise as to its importance and necessity if the highest efficiency is to be obtained. The addition or deduction of one compartment in a five compartment tank will ordinarily produce an effect on the effluent easily determined by the unaided eye to anyone who has had experience in judging sewage effluents. An effluent which is producing a marked odor of sulphuretted hydrogen has usually been too long within the septic tank, and as is well known, is a difficult effluent to treat in the second or aerobic stages. It has been clearly shown by competent authorities that the nitrification of such effluents is exceedingly difficult or impossible and the theory is advanced that the anerobic bacteria have created toxins inimical to their own life and activity.

A septic tank whose effluent shows advanced decomposition is plainly too large for the quantity then happening to flow through it, and the best results cannot be expected or obtained in the further or secondary treatment of the impurities. On the other hand an effluent from the septic tank containing large quantities of suspended matter suggests that there is not a proper length of fermentation period to break down the suspended particles, and that additional fermentation period is necessary. The writer has frequently observed that the addition or deduction of a compartment will show a distinct and marked influence on the suspended matter coming over from the septic tank.

Some septic tanks are subject to the fault that the sewage enters them in such a way that it evidently traces a path through the center, so that the stay of the liquid and its accompanying particles of matter is not well averaged in its relation to the total capacity. This difficulty can only be obviated by modifications in design which will more evenly distribute the incoming sewage on the entering side. By the experimental use of coloring matter it has been observed that great improvements may be made in evening the flow by mutiplying the number of inlets and carefully arranging that the liquid shall be as evenly divided between them as possible, thus avoiding the difficulty of having a certain quantity pass through the tank in a fourth or third of the time denoted by the ratio of the capacity to the entering volume.

EFFECTS OF PROPER REGULATION.

The proper regulation of the septic tank is of great importance, not only because it produces high efficiency for the tank itself, but because it also enables the secondary stages to be operated with equally high efficiency. A septic effluent as has been said before, which is in advanced stages of decomposition, is not easily reducible in the secondary application, and on the other hand an effluent containing much suspended matter will readily check and clog the secondary filters in a short time. The ideal septic tank effluent is one in which the organic matters in suspension have been resolved into the constituent gases or dissolved in solution and in which no suspended matter is present or no serious decomposition observable. This result is usually obtained with average domestic sewage in this country with from four to eight hours rest or fermentation periods, that is to say, the ratio of the volume of entering sewage to the liquid capacity of such portion of the tank as are in use is such that theoretically it would follow that the entire contents of the tank would be changed in a given length of time. This is not actually the case, nor indeed is it practically necessary. Some particles of suspended matter may from various causes be detained in the tank many days while others are hurried on to the outlet.

But, nevertheless, there seem to be to all practical intents and purposes a governing relation by the use of some such ratio as this which if watched and regulated is an index to the proper management of the tank. Where septic tanks are followed by intermittent filtration, proper regulation of this character insures a minimum of labor in looking after and raking off the beds, and it is also observable from actual experience that such tanks properly run do not accumulate sludge to any considerable extent on their bottom or an undue thickness of scum at the top. Of the 17 tanks which the writer has so far installed and watched, in some cases over four years only one has had to be cleaned so far, and in this case the occurrence was due to an only partial familiarity with this principle since satisfactorily demonstrated.

THE FALLACIES OF ANALYSES.

Contrary to the usually accepted opinion, the proper operation of sewage purification plants, does not at all require that analyses be taken in order to understand and govern operation. There are many signs by which one may judge of the efficiency of a plant without resorting to the tedious and delicate work of the chemist or bacteriologist. For instance, flaky black matter in the effluent is an evidence of more or less completed decomposition, and quantities of white humus are likewise indications of insufficient anerobic bacteriological action. Ordinarily in plants which are not imperilling a neighboring water supply it is thought sufficient if secondary decomposition be prevented. This is easily demonstrated by sealing a small quantity of sewage in a bottle and letting it stand for two or three days. The appearance of black flakes by this time denotes that the impurities in solution were not by any means removed from the effluent by the action of the plant, while on the other hand, the non-appearance of black ash, and the absence of any odor of ammonia when the bottle is uncorked would ordinarily denote very good work on the part of the plant, entirely sufficient in all ordinary practice.

Analyses are so often misleading in sewage purification work, especially when published for advertising purposes that one may well grow wary of being influenced by them. The enthusiasm which leads the designing engineer to look with hopeful assurance upon his newly created work seems to infect with the same optimism the judgment of those who publish analyses showing the work of purification. Too often is it the fact that very large inferences are drawn from exceedingly slender data and among those whose knowledge of the subject is slight or superficial, widespread misrepresentation often results. If one were shown several buttercups and informed that they came from a distant meadow which he had not seen, he would hardly venture the opinion that the whole field grew buttercups all the year round. Yet some of our sanitary engineers and chemists will take a few samples of an effluent and build up a whole theory of the percentage of purification which the plant is doing, generally leaving it to be inferred that this remarkable result is proceeding year in and year out.

An engineer not long since took two samples of water from one of the bays of Lake Michigan, plated them and counted the colonies, and thereupon in his published report developed a complete theory of the contamination of that part of the Great Lakes. It is hard to properly characterize such methods as this in considerate language, and moreover it is entirely too common an occurrence.

About four years ago, while studying sewage purification for a city of considerable size, attention was attracted to some exceptionally good results produced by a new and novel plant whose analyzed effluent was reported in the engineering press. A journey followed as the result of the article, and the Mecca was reached; the odor from the plant could be detected perhaps a half mile away. It was a severe lesson, but an efficient one, and since that time analyses unless frequently made, long continued and well certified, have lost their weight and infleunce with the writer.

PERCENTAGES.

Another of the falacies which often deceive the student of sewage purification work is the determination of the results from any given plant in percentages of organic matter removed. A plant is reported as removing 99-99-100 per cent. of the organic matter in the original sewage. This naturally seems to be excellent work. Another plant is reported as removing but 80 per cent. of the organic matter, which according to the point of view may or may not be supposedly poor. As a matter of fact, the 80 per cent. plant may actually be doing a great deal better work than the 99-99-100 per cent. plant, and the fallacy lies in this; it is comparatively an easy matter to obtain large percentages of removal from a strongly concentrated sewage, while it is an exceedingly difficult matter to obtain such a like large percentage from a very thin, weak, or very dilute sewage. Therefore, it may be possible that the removal of 80 per cent. of organic matter from a very slightly polluted water may produce an effluent which is relatively much purer than the effluent from the plant removing the 99-99-100 per cent. of organic matter from a very thick concentrated sewage. It is therefore always necessary to know the relative strength of the original sewage before deciding from percentage figures that a plant is doing very high class service.

CONTACT BEDS.

A great deal has been written on the proper managemnet of contact beds, especially from English sources. Presumably we are in possession of many of the facts necessary to successfully operate contact beds, and it must be admitted that so far a good deal of the information is derived from the working of full-sized plants, and is well demonstrated. There are, however, many things about the working of such plants which may be profitably investigated. It may first of all be pointed out that arbitrary lengths of time for the sewage to remain in contact with the grain of the contact filter is not in accordance with what we know of the fluctuations in the character of the sewage.

The fineness of the grain of the filter, the character of the liquid to be treated, the amount and fineness of the suspended matter which it carries, the temperature of the air and of the sewage, all must reasonably be expected to have some bearing on the length of time which the sewage is kept in contact, and yet almost every automatic device now available fixes the time of contact by the quantity of inflow. The rate of inflow may and usually does vary with wide limits, and in a way which may be quite different from the operator's ideas of the correct contact period required. Indeed, as usually operated, there is no chance at all for experiment as to what the correct contact period should be in any particular case. It is as evident here as it is with the septic tank, that if the proper and most efficient contact period for any given strength of sewage, temperature of air or liquid, and fineness of grain could be experimentally determined, the efficiency of the plant might be largely increased. There is room for great improvement over present methods of control.

LEAKAGE.

One of the minor difficulties in the operation of contact beds in the smaller plants is the question of leakage. A slight leakage of the valves of the automatic device, or of the contact bed itself, is generally sufficient to greatly retard the contact period, and even altogether defeat the operation of the beds. An engineer cannot be too careful in superintending the construction to be certain that the contact bed is thoroughly water-tight before putting in the contact material. The best form of automatic device for preventing leakage seems to be that which relies upon an air cushion for opening and shutting off flow. Ordinarily valves will often either work very stiffly after a while and finally stop the automatic device from working at all, or else will be so loose and leaky as to allow a large portion of the incoming flow to escape before the bed is filled.

SUPERVISION.

In installing automatic devices of any kind, and making recommendations for their management, it is a great mistake to assume that they do not need some supervision.

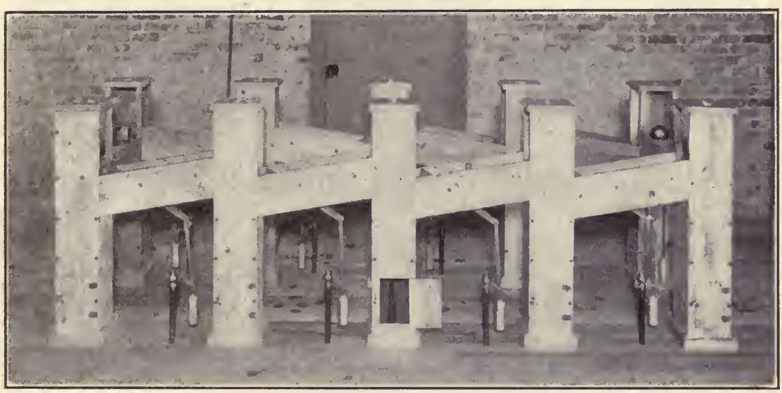
Much has been expected in the practical operation of sewage purification plants from the many automatic features which have recently been introduced. It has been thought that with the newer biolytic processes supplemented by automatic devices of intermittent filtration or double contact work, little or no annual operating expenses would result. That this is true must not be denied, and that it does and will result in a more large adoption of sewage purification processes in the near future is certain. But it must be pointed out that there is a great danger in going from one extreme to the other, and for the designing engineer to intimate to the city authorities that he is about to give them an automatic plant which will require no renewals, and which will practically run itself year in and year out, is at once to create the impression that no expense at all will be necessary, and that the city is purchasing something which can be put off in the most remote ravine adapted to the purpose, and there left to be forgotten by everyone connected with the municipal responsibilities. No plant, however automatic it may be, however perfect its appliances for preventing manual labor, can be left alone, unless possibly one might except the small plants for household service. And yet it is quite remarkable how very generally this is the impression where automatic devices have been adopted. The result usually is that the elements begin their destructive work, mischief makers visit the plant and do damage, and that the changes in temperature, and the changes in the seasons, provide means whereby stoppages or breakages may occur which though small in themselves, if neglected, result in serious damage, as well as loss of prestige.

INTERMITTENT FILTRATION.

In the operation of plants consisting of septic tank followed by intermittent filtration as a second stage, great gains have been made by the introduction of automatic devices by which the effluent from the septic tank may be rotated on to the intermittent filtration beds. Such devices are operated by the falling sewage. This not only dispenses with the services of a man who must divert the flow from day to day, but makes the action of the beds much more regular and systematic, eliminating the contingencies of night, Sundays and holidays, which would naturally prevent uniformity in operation by hand. Then, too, the greatly lessened area of filter bed required for septic tank effluent means that there is the necessity for much more rapid diversion of the sewage from one bed to another than was formerly the case in intermittent filtration practice, and this almost puts it out of the question to employ manual labor for this purpose. Nowhere is the necessity for careful regulation of the septic tank more evident than it is in a plant of this character. If the septic tank effluent is filled with suspended matter evenly divided, and the sand of the bed is of fine grain, very careful management is necessary.

LAKE FOREST PLANT. ILLINOIS.

The Lake Forest plant, which has been under the supervision of the writer during the past year, consists of a septic tank of about 50,000 gallons capacity, divided into five compartments. The tank is neither light nor air-tight. It has no patent arrangements for inlet or outlet and is an open tank, housed over with a light structure, giving ample ventilation and opportunity for inspection, while preventing the hot sun of summer and the cold winds of winter from varying the temperature of the sewage to any unusual degree. After leaving the septic tank the sewage passes into a dosing chamber holding 7,000 gallons of liquid, and by means of an automatic device operated by the falling liquid, it is delivered in rotation on to ten intermittent sand filter beds, consisting of the natural sand of the beach of Lake Michigan as found at that place. The beds are of 3,200 square feet area each. At the present rate of flow these beds are working at the rate of 300,000 gallons per acre per day, their total area being three-fourths acre. This sand is quite fine, 85 per cent. passing a sieve of 40 mesh, and 42 per cent. passing 60 mesh to the inch.



Automatic Controlling Device, Sewage Purification Plant, Lake Forest, Ill.

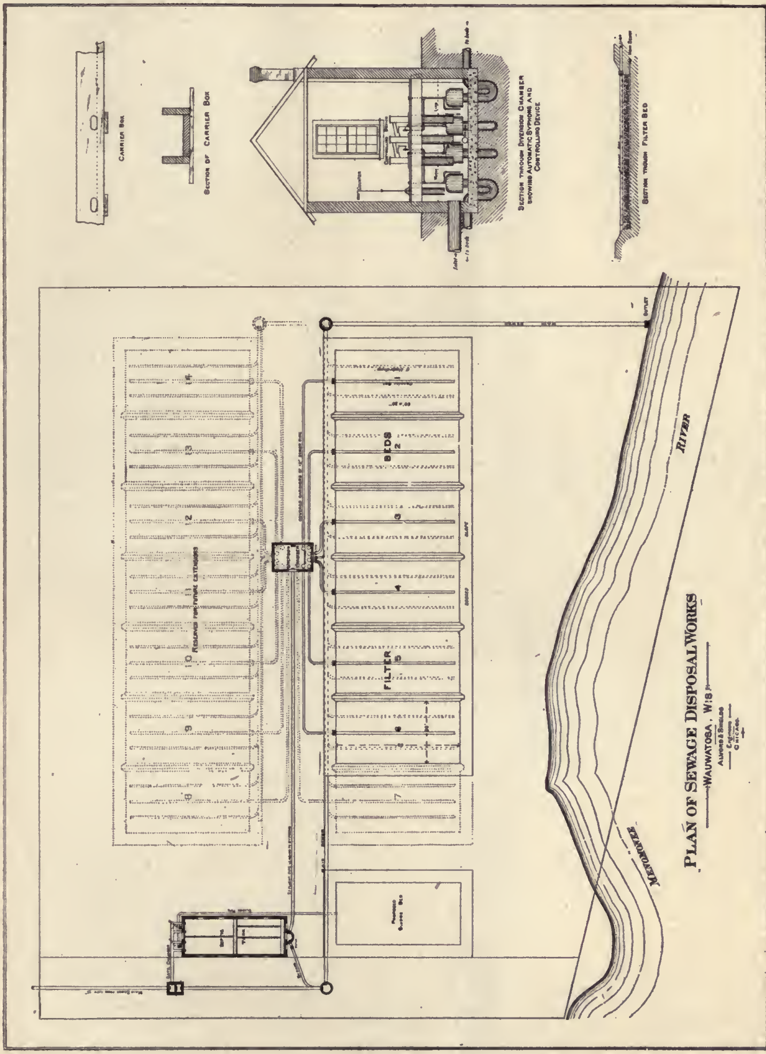
In practical operation it has been found that unless the septic tank was working at a maximum of efficiency, finely divided suspended matter coming over from the tank, would in the course of time seal the surface of the filters and render it necessary to hand-harrow them after the application of five or six doses. As each bed receives abou two doses per day, this meant that the total area would have to be raked over twice a week.

In the early operation of the plant the man in charge failing to rake the beds at all, reported that there must be something the matter with the under-drains, as the sewage would not go through the beds. A visit to the plant at once revealed that the difficulty was due to negligence, and a little application of the rake soon broke up the surface skin and put the beds in normal shape again. Later, after the septic tank was better regulated, much less suspended matter came over on to the filters, and a great improvement was seen in the amount of care which the beds had to receive With fine sand used at this plant, it is probable that there will always be from ten to twelve hours of labor per week necessary to keep the beds in good condition. The septic tank is now operating with 6½ hours rest period, the longest of any of the plants under notice, the sewage being thick and concentrated. The tank has not been cleaned during the year, and no perceptible deposit has occurred.

Interior of Sewage Purification Plant at Lake Forest, Ill., Showing Automatic Regulating Device.

WAUWATOSA PLANT (WISCONSIN).

The Wauwatosa plant is constructed on the same lines as the Lake Forest plant. A septic tank holding 40,000 gallons of sewage is operated on the five compartment system, is constructed of concrete and housed over with a plain brick house. The effluent is delivered to a dosing chamber in a separate structure containing about 6,000 gallons, which by an automatic device is delivered in rotation on to six filtration beds about 3½ feet in depth. The sand of which these beds is composed is much coarser than that used in the Lake Forest plant, consequently it has not needed so much attention. One hand-harrowing each week for each bed has kept the plant up to its maximum efficiency, and the effluent is clear and odorless after being kept in closely stoppered bottles for several days. The automatic device has been satisfactory and has operated without stoppage for over a year. The tank is operated with about four hours rest period, and, with



Details of Wauwatosa Sewage Purification Plant. Capacity 100,000 gallons daily.

General view of Sewage Purification Plant at Wauwatosa, Wis., in operation since September, 1901.

the exception of removal of surface scum once or twice has not needed cleaning. The filter beds are operating at the rate of 300,000 gallons per acre per day. When high water prevails in the river they are discontinued. The sewage is growing stronger. The plant has been in competent hands from the very beginning, and is excellently managed.

SEPTIC TANKS, HOLLAND, MICH.

Two septic tanks at Holland, Michigan, have been in operation over one year. The effluent is emptied into Black Lake. The sewage is not strong, as the sewer system is not yet extensive, but the tanks are exercising a marked improvement on the impurities, and so far have kept free

40,000 gallon Septic Tank at Holland in use since 1901.

from deposit. The main tank is constructed with three compartments and has rest period at present of about two hours. The plant is not closely watched.

GLEN VIEW, ILL.

This plant, originally constructed in 1898, has not been under the writer's observation for two years. One year it was entirely neglected. The last season it has had some attention. The septic tank is only a single compartment, and the secondary stage consists of contact beds of coke. The writer is informed that during the past season these contact beds have been successfully operated as continuous filters. About 10,000 gallons of very concentrated sewage a day is cared for. When the plant is supervised the effluent is good. The tank has had to be cleaned at least once every year and one year (1899) it was cleaned four times.

DE KALB, ILLINOIS.

A septic tank of 60,000 gallons capacity has been in operation since the middle of the summer. It is as yet too soon to speak of its effectiveness. It is not as yet followed by any secondary stage. It has not yet required cleaning.

PRINCETON, ILLINOIS.

A 60,000 gallon septic tank has been in operation about one year. It is built on the five compartment system and housed over. It does not re-

One of three Sewage Purification Plants built at Danville, Ky., in 1901.

ceive special attention, but good results are reported. If so, they are probably accidental. It has never been cleaned, but some deposit on the bottom is reported. The rest period is not known. The plant was designed with intermittent filtration as a secondary stage, but the city is now hoping that the first stage will be sufficient to avoid nuisance. It remains to be seen if this hope will be realized.

DANVILLE, KENTUCKY.

Three septic tanks have been in operation here over one year. The largest is 40,000 gallons capacity, and is followed by intermittent subsoil filtration. It is reported to be working well, but receives no special attention. It is perhaps too early to draw conclusions concerning it. It has not required cleaning as yet.

HIGHLAND PARK, ILLINOIS.

A small septic tank has been in operation on the West district for two years. It has received no attention whatever, and has caused no complaint as yet, it has never been cleaned. It is said not to be unduly filled with deposit. The effluent is reported as good, but the sewage it receives is not strong. It is noticed, as a matter of experience, that weak or thin sewage is not generally exacting in its treatment.

CONCLUSION.

The above data of some of the larger plants recently put into operation shows how little the majority of such plants are cared for after installation. If they avoid being obnoxious, it is often throuh their good fortune, and if they do become nuisances, it is often no argument that they may not be properly designed.

That this state of affairs is discouraging must be admitted, but with the over-confidence that has come in the newer biolytic process, it would seem to be inevitable.

The Sanitary Engineer, working in the line of Sewage Purification, must for some years to come in the future as he has in the past, educate his public up to a just appreciation of the state of his art. It is a tedious and thankless process in many respects, but the revolution in the art in the past few years, and the great possibilities of sewage purification for the future entails this responsibility upon him, and he cannot avoid it. The only thing to be done is to keep prominently before the public the enormous possibilities for civic cleanliness in this line of work, while yet discussing them from a conservative standpoint, frankly admitting limitations of knowledge, as well as limitations of a physical character that he or others may from time to time discover.