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METHOD OF CLEANING SEWER SYSTEMS

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This invention relates to a method of cleaning storm sewer systems or combined sewer systems for rain water as well as effluent and santiary sewage from homes and industry.

The method of the present invention is designed primarily for sewer systems that have as essential parts thereof catch basins. Such systems also include lift stations, diversion tanks and storm sewer crocks, pipes or conduits. The present invention will be discussed primarily in conjunction with a storm sewer system having one or more catch basins but it should be understood that the method is equally applicable to a combined sewer system having catch basins throughout the system.

Catch basins are utilized in a storm sewer system for the purpose of catching objects heavier than water and thereby permitting the objects to settle out into an area where the objects can be spooned out or removed by mechanical means. Catch basins may therefore be considered as compartments of the sewer systems intended to catch the grit, twigs, etc., admitted through street inlets and to prevent such material from passing into the storm-water drains. To be of value, catch basins require frequent cleaning, and the increase in street flushing as a means of cleaning street surfaces has resulted in filling catch basins quickly and making them ineffective until the next period of cleaning.

At the present time a long handle type of shovel which is called a spoon in the trade is utilized to clean catch basins. The spoon is operated manually. In addition, an educator truck, which is in effect an overgrown vacuum cleaner, is also utilized. The eductor truck includes a large tank which is located on the back end of a truck. The tank is provided with a large hose which has tremendous vacuum power associated therewith. The hose is inserted into a catch basin or in another appropriate place of the storm sewer system where the heavy objects have settled. The application of the vacuum is effective to pull or suck the heavy objects through the hose into the back end of the truck thereby cleaning the receptacle or catch basin. Under either system of spooning or through the use of an eductor truck, the heavier objects removed from the sewers are hauled by a truck to a dumping area at a considerable cost involving time and labor. It will be appreciated that if the heavier objects were permitted to be transmitted through the sewer system in their natural state, the heavier objects would settle out either in a catch basin downstream of the first catch basin or in the sewer pipe or conduit therebetween. It will further be appreciated that the heavier objects, if permitted to be transmitted through the sewer system without any sort of treatment, will gradually build up and form a restriction in the sewer pipe which could cause considerable damage to adjacent property, as an example, by flooding the street above the sewer.

The normal accumulation in a storm sewer system includes leaves, twigs, wood, decomposed organic material, assorted small objects, sand, silt, dirt, mud, and stones. The general practice in the majority of the communities throughout the United States is to permit the storm sewer catch basins to accumulate much of the aforesaid accumulations and to permit the accumulations to remain in the catch basins for years. Such practice is not recommended due to the fact that the catch basins are not effective when filled but is accepted due to the excessive costs involved in manually cleaning the catch basins. The leaves, twigs, wood, and other organic materials decompose after a period of time and therefore as a general rule a great deal of decomposed organic material is maintained in the catch basins.

It is highly desirable therefore that a commercially feasible method be developed for exclusive use in a storm sewer system whereby accumulations of the type just described may be effectively and easily removed without the worry of the accumulations settling out downstream of the catch basin and causing a restriction in the system. By using the method of the present invention it has been found that economical advantages are obtained including a substantial reduction in labor and cost required for maintaining the storm sewer systems according to the mechanical methods mentioned previously.

The present invention relates to a method whereby flocculatable accumulations and buoyant materials held from flowing in the sewer by the accumulations therein are removed from the storm sewer system without encountering the various difficulties inherent in the previous mechanical methods employed. The present invention treats the flocculatable accumulations with a flocculating agent, preferably a polyelectrolyte as will be subsequently described, whereby the flocculating agent suspends the individual particles and prevents classification. Such action is effective to reduce the viscosity and increase the flowability of the mixture so that the flocculatable accumulations may be easily removed after suspension from the storm sewer system by the natural effects of a subsequent rain. The present invention utilizes the natural effects of rain water to provide the necessary agitation for the mixing of the flocculating agent in solution with the flocculatable accumulations in the storm sewer system.

It has been found that the introduction of a flocculent into the catch basin of a storm sewer system will cause all matter susceptible of being flocculated, which is a matter of weight, to become flocculated or put into a form of a lattice type of structure expanding the size of the particle being flocculated to a point where the movement of the resulting suspension or aqueous solution will cause the flocculated mass to pass through the system because of its expanded type of structure. The flocculating agents act on any particle capable of being flocculated including decomposed organic materials, mud, sand, and silt. The combination of the decomposed organic materials plus the sand, silt and mud acts as a binding agent to the leaves, twigs, and other matters not yet decomposed. The addition of the flocculating agent to the catch basin permits the rain water retained in the catch basin to help in flocculating the material and in addition to free the buoyant material retained by the binding agent.

An object of the present invention is to provide an economically and commercially feasible and convenient method for removing from a catch basin of a storm sewer system flocculatable accumulations and buoyant materials held from flowing by said accumulations.

Another object of the present invention is to provide a method of the aforementioned type wherein the rain water subsequently entering the storm sewer system is effective to provide the necessary agitation for flocculating the materials and to serve as a vehicle for transmitting the flocculatable materials and the buoyant materials to points downstream of the catch basin.

Still another object of the present invention is to provide a method of the aforementioned type wherein the unused flocculating agent in solution in the catch basin is carried by the subsequent rain water through the system to flocculate accumulations downstream of the catch basin and to likewise free any buoyant materials held

from flowing by the last mentioned flocculatable accumulations.

A further object of the present invention is to provide a method of the aforementioned type wherein the flocculating agent most effective for flocculating the material is a soluble polyelectrolyte organic polymer in solution.

Broadly speaking, the flocculating agent such as a polyelectrolyte affects the surface chemistry of the various components in such a way as to cause the formation of a dispersed floc which prevents classification of the solids and causes them to remain in a fluidized suspension which may be subsequently removed from the storm sewer system by a subsequent rain.

In the present application, flocculation is defined in general terms as the aggregation of minute particles into a number of larger composites or flocs. Flocculation is an action markedly contrasted to deflocculation in that a deflocculating action or dispersion is one which suspends particles, thereby dispersing them into a colloidal suspension.

Flocculating agents

In an unflocculated system, the aforesaid denser particles or objects settle to the bottom of the catch basin while the less dense particles remain in suspension for extended periods of time but finally settle into other catch basins downstream of the first mentioned catch basin. Under the influence of a flocculating agent placed in a catch basin, the colloidal particles are aggregated or collected randomly into flocs and both the dense and the less dense particles in the catch basin settle together. Because of the fact that the flocs are relatively large in size as compared to the individual particles from which they are comprised, the flocs cannot pack or cake together as closely as can the unflocculated individual particles and, therefore, produce a fluffy sediment of large volume which is, by comparison to the unconditioned accumulation, much easier to remove from the catch basin. Experience has indicated that long chain high molecular weight polymers, in general, when added to a colloidal suspension of particles, have the ability to form the colloidally suspended particles into flocs. The flocculatable particles in the catch basin or in other parts of the storm sewer system, when influenced by the polymer molecules, are induced to join themselves to the polymer chain, thereby forming a floc.

Among the flocculating agents useful for the fluidizing of the aforesaid flocculatable deposits are the polyelectrolytes represented by polymers of compounds having the formula:

$$>C=C-R$$

wherein R is selected from the group consisting of nitrile, amide, and carboxyl radicals, COOM where M is a lower alkyl radical preferably of 1 to 4 carbon atoms, and the water soluble salts thereof. Elements such as halogens, particularly chlorine, or alkyl or aryl groups as well as hydrogen may be present on the backbone hydrocarbon chain of the polymer.

Particularly suitable polyelectrolytic polymers for use in the present invention are the polymers of acrylic or methacrylic acid derivatives, for example, acrylic acid, the alkali metal and ammonium salts of acrylic acid, methacrylic acid, the alkali metal and amonium salts of methacrylic acid, acrylamide, methacrylamide, the N-alkyl substituted amides, the N-aminoalkylamides, and the corresponding N-alkylaminoalkyl substituted amides, the aminoalkyl acrylates, the aminoalkyl methacrylamides and the N-alkyl substituted aminoalkyl esters of either acrylic or methacrylic acids. These polymeric compositions may be homopolymers or they may be copolymers with other copolymerizing monomers, such as ethylene, propylene, isobutylene, sytrene, a-methylstyrene, vinyl acetate, vinyl formate, alkyl ether, acrylonitrile, methacrylonitrile, vinyl chloride, vinylidene chloride, the alkyl acrylates, the alkyl methacrylates, the alkyl maleates, and the alkyl fumarites, and other olefinic monomers copolymerizable therewith. The copolymers of this type, having at least 50 mole percent of the acrylic or methacrylic acid derivatives, are preferred, and especially when the co-monomer is hydrophobic or has no ionizable groups. Polymers of this type may be prepared directly by the polymerization of suitable monomers, or by the after chemical reaction of other polymers, for example, by the hydrolysis of acrylonitrile or methacrylonitrile polmyers.

In connection with the various types of polyelectrolytic polymers suitable for the practice of this invention, the hydrophilic polymer may be prepared directly by the polymerization or copolymerization of one or more of the various available organic monomers with aliphatic unsaturation, if the said compounds contain a hydrophilic group, for example, carboxyl groups. Generally, more types of polyelectrolyte polymers can be prepared by subsequent reactions of polymers and copolymers. For example, polymers containing nitrile groups may be hydrolyzed to form water-soluble amide and carboxy containing polymers or hydrogenated to form amine containing polymers. Similarly copolymers of maleic anhydride and vinyl acetate may be hydrolyzed to form polymers containing hydrophilic lactone rings. Other hydrophilic polymers may be prepared by the hydrolysis of copolymers of vinyl acetate wherein the acetyl groups are removed leaving hydroxy groups which promote the solubilization effect of polyelectrolytic groups present. By other reactions non-hydrophilic polymers may be converted into lactam or amide containing polymers which are more hydrophilic. Polyvinyl alcohol, not in itself a polyelectrolyte, may be converted into polyelectrolytes by esterification with dibasic acids, one of said carboxylic acid groups reacting with the alcohol radical and the other providing the hydrophilic characteristics by a carboxy group on the side chain. Still other types of polymers may be prepared by reacting halogen containing polymers, for example, the polymers or copolymers of vinyl chloroacetate or vinyl chloroethyl ether, with amines to form amine salt radicals and quaternary ammonium radicals whereby hydrophilic characteristics are introduced into what otherwise would be an insoluble polymer. Other soluble polymers may be prepared by the ammonolysis of ketone containing polymers, for example, polyvinyl methyl ketone. Similarly active halogen atoms may be reacted with bisulfite to substitute sulfonic acid group for the reactive halogens.

Thus, the various polyelectrolytes of the types described above are ethylenic polymers having numerous side chains distributed along a substantially linear continuous carbon atom molecule. The side chains may be hydrocarbon groups, carboxylic acid groups or derivatives thereof, sulfonic acid groups, or derivatives thereof, phosphoric acid or derivatives thereof, heterocyclic nitrogen groups, aminoalkyl groups, alkoxy radicals and other organic groups, the number of which groups and the relative proportions of hydrophilic and hydrophobic groups being such as to provide a water soluble polymeric compound having a substantially large number of ionizable radicals. The length of the said continuous carbon chain must be such as to provide compounds having a weight average molecular weight of at least 10,000.

Among the various polymers as described above and water-soluble salts thereof useful in the practice of the present invention, there may be mentioned hydrolyzed polyacrylonitrile and polyacrylamide, sulfonated polystyrene, acrylamide-acrylic acid copolymers, polyacrylic acid, ½ calcium salt of hydrolyzed 1:1 copolymer of vinyl acetate-maleic anhydride, hydrolyzed styrene-maleic anhydride copolymer, ammonium polyacrylate, sodium polyacrylate, ammonium polymethacrylate, sodium polymethacrylate, diethanolammonium polyacrylate, guanidinium polyacrylate, dimethylaminoethyl polymethacrylate, acrylamide-acrylonitrile copolymer, methacrylic acid-

dimethylaminoethyl methacrylate copolymer, methacrylic acid-dimethylaminoethyl methacrylate copolymer, sodium polyacrylate-vinyl alcohol copolymer, hydrolyzed methacrylic acid-acrylonitrile copolymer, vinyl acetate-maleic anhydride copolymer, vinyl formate-maleic anhydride copolymer, vinyl methyl ether-maleic anhydride copolymer, isobutylene-maleic anhydride copolymer, styrenemaleic anhydride copolymer, ethyl acrylate-maleic anhydride copolymer, vinyl chloride-maleic anhydride copolymer, hydrolyzed acrylonitrile vinyl acetate copolymer, hydrolyzed acrylonitrile - methacrylonitrile copolymer, hydrolyzed acrylonitrile-methacrylonitrile-vinyl acetate terpolymer, hydrolyzed acrylonitrile-methacrylic acid copolymer, vinyl pyridine-acrylonitrile copolymer, etc. Polymers containing cationactive groups are also useful. Suitable compounds are, for example, ethyl acrylate and acrylamidopropylbenzyldimethylammonium chloride, copolymers of methylolacrylamide and acrylamidopropylbenzyldimethylammonium chloride, copolymers of butadiene and 2-vinyl pyridine, and certain quaternary compounds such as polydimethylaminostyrene quaternized with benzyl chloride, allyl chloride, etc., and quaternized copolymers of vinyl alcohol and morpholinylethylvinylether and the like.

The molecular weight of these polymers is fairly ambiguous. Molecular weights as low as 100,000 are useful as are molecular weights which range over 5 to 15 million. As long as the polymers are sufficiently low in molecular weight so as to be water soluble they have the characteristics required. Polymers of molecular weights of well over 2 million have such solubility. The difficulty of measuring molecular weights in the range of 2 to 20 million causes the numerical values to be somewhat ambiguous. Viscosity measurements particularly intrinsic viscosity determinations are particularly effective in attempting to determine the molecular weights in this range.

The polyacrylamides are particularly useful in the present invention. Polyacrylamide having a molecular weight of approximately 4 to 5 million gives good results.

Polyelectrolytes have centers of electronic activity along the chain. Polyacrylamides for instance usually have at least a few polyacrylic acid links along the chain and whereas for a molecular weight of a million or two, the percentage of such acid links is very small, still there are enough acid links or other centers of electronic activity to bridge between two or more particles and in effect cause various centers of electronic activity on the same long molecule to interact with more than one particle. Without being limited to the above or the following theories as to the operations involved in the present invention, the results which occur are consistent with these theories.

It is important to note that flocculation in a given colloidal system cannot be increased indefinitely beyond a particular optimum polymer concentration. The various physical laws which explain this phenomenon are rather involved, and the most technical aspects of them are beyond the scope of this application. It may be said, however, that up to the optimum concentration nearly all of the polymer added to the colloidal system is absorbed on the surfaces of the silt particles and very little is left in the solution itself. The point beyond which complete adsorption fails to take place corresponds generally to the optimum polymer/silt ratio. If the flocs formed in the presence of excess polymer are agitated they degrade faster than those formed in the presence of the optimum polymer to silt ratio. If the flocs are broken apart, fresh surfaces are exposed upon which the polymer is rapidly adsorbed. The flocs then cannot reform as well as before because the new polymer molecules have insulated the portions of the surface which had previously served as so-called "bridgeheads."

The existence of the optimum ratio indicates the presence of two competing processes when polymer is added to a suspension. These processes are (1) the formation of polymer bonds to a single particle, and (2) the formation of polymer bridges between particles. Both mechanisms must always occur because 2 is simply a second step, which can occur only after Reaction 1. The extent to which 2 occurs depends upon the frequency with which the particles approach closely enough to form the second bond which in turn depends upon the pulp density, the surface charge of the particles, the temperature and the polymer concentration. Large numbers of collisions, and hence a dominating bridging will occur when the pulp density is high, when the number of silt particles per unit weight of silt aggregate is high and when the repulsive surface charges are low. These effects with the polyelectrolytes, particularly polyacrylamides, are effective over the range of pH normally found in the operations of sewer systems. Up to a point, increasing the polymer usage is beneficial because more bridges are formed. However, excessively high polymer concentration is detrimental because the excess material tends to cover or insulate the exposed surfaces before interparticle collisions needed for bridging can occur.

Higher rather than the lower molecular weight polymers are generally but not always more effective flocculating agents because of the fact that a larger portion of the high molecular weight polymer present in a system in excess of the optimum ratio previously mentioned can be utilized in floc formation, while a smaller portion of the lower weight polymers in excess of the optimum ratio is adsorbable because of the detrimental phenomenon of insulation previously discussed. Therefore, the degree of flocculation is lessened by the addition of excess lower weight polymers.

Polymer adsorbed on mineral surfaces may be held by at least three distinctive types of bonding. Any one, or a combination of the three, may be operative in a given system. The principal mode of attachment of polyacrylamide type flocculant is by hydrogen bonding. This is a common type of bonding exhibited by organic acids, amides, alcohols, amines and others which contain a hydrogen atom attached to a strongly electro-negative atom. In these compounds the hydrogen atom has lost much of its electronic atmosphere, and is ready to accept electrons donated by the surface atoms of the silt particles or solids. The hydrogen is then shared between the surface atoms (usually oxygen) and the oxygen or nitrogen in the polymer.

Specific electrostatic site-bonding is another type of bonding which occurs when the polymer forms a salt-like attachment to specific groups or sites on the particle or solid surface. Examples of this type of bonding are found in the adsorption of polyacrylic acid on clay, limestone and the like in which the surface calcium atoms essentially precipitate a calcium acrylate on the particles. Similar bonding occurs between such reagents as mercaptans and heavy-metal ore surfaces. In general, bonding of this type is limited to solids having metal ions in their lattices. In practice the number of functional groups forming such bonds is limited to carboxylates, phosphates, sulfonates and mercaptan derivatives.

The last of the three types of bonding is known as nonspecific, double-layer interaction. This is an electrostatic interaction which occurs between a charged mineral surface and the ions in solution. The charge on the ion rather than its chemical nature primarily determines its attraction to the surface. Since most solids are negatively charged when suspended in water, positively charged polymers will be attracted to the surface, and will enter the ionic double layer. For this reason variations in the degree of flocculation in a given system may be obtained by making the flocculating agent either cationic or anionic.

The effectiveness, then, of a given flocculating agent in a given colloidal system is dependent on a number of factors. Among these factors may be included the pH of the system, the type and molecular weight of polymer added to the system, the presence or absence of electro-

lytes, the chemical and physical state of surfaces of the silt particles, and the charge of the flocculating agent. It should be remembered, however, that in any event the degree of flocculation which may be obtained is primarily a function of the polymer chain length and weight.

The flocculating agents listed previously are available in a dry form or state. It has been found through considerable experimentation that more adequate results and effects are obtained in storm sewer systems if the flocculating agents are introduced into the system in liquid form. The chemicals can be controlled much better as to results when the chemicals are introduced into the system in a liquid form.

By way of illustration only, we add to a normal polyacrylamide and salt of polyacrylic acid mixture, a solid carboxy methyl resin. Carboxy methyl resin when combined with a standard polyacrylamide salt of polyacrylic acid in certain proportions and under certain conditions creates a multiplication effect as to flocculating power, creating a chemical which gives a flocculating power far in excess of the chemicals individually. It should be understood that good results are also obtained when a flocculating agent in a dry state is added to a catch basin.

Catch basins—storm sewer systems

A catch basin acts as a natural receptacle in a storm sewer system and is usually full of water. A catch basin is generally eighteen inches or more below the lowest level of the adjacent pipe or sewer crock. Catch basins are located from six to twelve feet below the surface of the ground and vary as to location from community to community. Generally, an iron grate is located above each catch basin where rain water normally flows from the street into the catch basin. Each catch basin has a conduit connection to the catch basin upstream thereof. This connection is normally referred to as a sewer line. When it rains, water pours into each catch basin in the area that is under the rain. As a result, there is a falling of water from the ground surface down to the water level of the storm sewer through the iron grate plus the action of the water coming from the catch basin upstream. Thus the rain water passes through the catch basin below the grate and out again on the other side to points downstream thereof.

Practicing the invention

It has been found that the most efficient way of cleaning sewers and catch basins and receptacles throughout the entire sewer system after the introduction of the flocculating agent is through the normal action of rain for the chemicals mentioned previously works on any type of agitation. We first attempted to clean the storm sewers with the aid of fire hoses after the introduction of the flocculating agent, but found that it was not possible to obtain sufficient agitation except in the immediate area of the fire hose and by the time the agitation reached one or two inches into the accumulation at the bottom of the catch basin, the chemicals provided therein were by that time carried off and passed on through the sewer system without cleaning the catch basin. Therefore, minimal results were obtained by using the fire hose as a source of agitation.

In the present invention, the flocculent is applied in liquid form to the catch basin. The flocculent remains in the catch basin for any period of time without losing its effectiveness. When it subsequently rains, the turbulence created by the rain flocculates the masses susceptible to being flocculated and the flocculated mass passes on into the sewer system to points downstream of the catch basin. If the rain is of sufficient duration, the flocculated material will be carried directly out to a river or other point of discharge wherever the storm sewer empties. While the agitation is being provided for by the rain water, the buoyant masses which are not capable of being flocculated but are capable of flotation, such as leaves, twigs, wood, and the like, will have the binding agent therebetween washed away so that the bouyant masses are then capable of flowing with the rain water through the sewer system. The flocculating agent will continue to work chemically in the system until it has expended itself and there is nothing further that it can flocculate or until the flocculating agent has completely flocculated itself. In other words, the flocculating agent continues to work while it passes through the storm sewer system. Because of the construction of the storm sewer pipes there may be a depression in a pipe line, or there may be sediment in a pipe line or there may be a crack in a pipe line which will cause a certain amount of sediment which will sometimes pick up and collect solid objects and cause the solid objects to stick in the pipe or conduit causing further backup in the system. In such cases, though a person may not be particularly aware of a buildup or a blockage in the system, it has been found that the flocculating agent will work on the restriction caused by the buildup of material as the agent passes through the system. The chemicals will remain in each catch basin but once the flow of the rain water through the sewer system occurs, the flocculating agent is carried along the system by the flow of water and continues to work as it is carried on beyond the catch basin where it was introduced. Therefore the flocculating agent continues to work in the pipe and then into the next catch basin, then in the next pipe and then into the next catch basin, etc., until the chemical flocculating agent has dissipated itself.

A storm sewer system may also include diversion tanks or settlement tanks of a larger size than catch basins and lift stations which are used, generally, in viaducts or sunken highways where the storm sewer system is located below the normal storm sewer level. As the name implies, the lift stations lift up water to a level where the water is passed into the normal storm sewer system which is at normal street level. A lift station is the equivalent of a sump pump only on a vastly larger scale. The lift station accumulates various materials and objects which are the normal things ending up in the catch basins. Therefore lift stations have to be cleaned periodically and much more frequently than catch basins.

Because of the number of catch basins it is almost economically prohibitive for any community to constantly clean the catch basins and, therefore, the residues are allowed to accumulate for many, many years. The normal situation is that catch basins are not cleaned until street flooding has occurred. This occurs when the accumulation reaches a point where it restricts and completely blocks off the sewer crock which carries away the water from the catch basin. Once the sewer crock is sealed on the upstream end thereof with accumulations there is no place for the water to go. There is water coming into this catch basin from the one above it and, of course, water falling from the street. As a result thereof the catch basin fills all the way up to the street level and floooding occurs in the street. Normally after a rain where street flooding has occurred, the department of public works utilizes a spoon to break the accumulations around the exit sewer crock to thereby permit the water to pass through the system. As a rule, the sealing does not occur immediately. Generally the accumulation increases and increases and when a large rain occurs, if the opening is not sufficient to carry away the water, then, of course, street flooding results. In other words, more water is coming into the catch basin than is being carried away. Initially a small amount of street flooding occurs which if not corrected will, naturally, increase with every successive rain thereafter.

With the present invention when street flooding has occurred the particular catch basin or series of catch basins are treated with the flocculation agent. Simultaneously a spoon is used to agitate the mass near the exit

opening so that the mass will definitely flocculate the immediate deposit adjacent the upstream opening of the pipe or conduit to permit free flow of water. It has been found that the faster the water flows the greater is the agitation. The greater the agitation, the more effective is the chemical action of the flocculating agent.

In order to use the method of the present invention properly, an inspection is initially made of the storm sewer system to determine the amount of residues to be removed. The tests have indicated that excellent results are obtained when between one-tenth of a gallon to one gallon of a liquid flocculating agent is added to a catch basin. The amount of agent utilized will vary somewhat depending upon the capacity of the particular catch basin and storm sewer system.

For purposes of the present invention, certain specific examples are meant to be illustrative only. Obviously, a number of variations may be made with respect to the particular polymer or other flocculating agent employed, the particular amounts of polymer or other flocculating agent utilized and the like, without departing from the spirit of the invention and the scope of the appended claims.

What we claim as our invention is:

1. A method of removing flocculatable accumulations and buoyant materials held from floating by the accumulations from a sewer system which comprises adding to a catch basin of the system an effective proportion of a water soluble polyelectrolytic organic polymer, subsequently mixing said polymer with the flocculatable accumulations and the buoyant materials by utilizing the rain water entering said system to form a flocculent mixture which frees the buoyant materials, whereby the flocculent mixture and the buoyant materials are carried by the rain water through the system to the point of discharge.

2. The method of claim 1 further characterized in that the polyelectrolytic organic polymer has a molecular weight ranging from about 100,000 to 15,000,000.

3. The method of claim 1 further characterized in that the polyelectrolytic organic polymer is prepared from a compound characterized by the formula C=C—R wherein R is selected from the group consisting of nitrile, amide, and carboxyl radicals.

4. The method of claim 3 further characterized in that R is a carboxyl radical characterized by COOM wherein M is a lower aliphatic radical having 1 to 4 carbon atoms per molecule.

5. The method of claim 1 wherein the polyelectrolytic organic polymer is in solution.

6. The method of claim 1 wherein carboxyl methyl resin is mixed with the polyelectrolytic organic polymer.

7. The method of claim 6 wherein an effective proportion of the polyelectrolytic organic polymer in solution from about 0.1 gallon to 1.0 gallon is added to the catch basin.

8. A method of removing flocculatable accumulations and buoyant materials held from floating by the accumulations from a sewer system which comprises adding to a catch basin of the system an effective proportion of a water soluble polyelectrolytic organic polymer in solution, subsequently mixing said solution with the flocculatable accumulations and the buoyant materials by utilizing the rain water entering said system to form a flocculent mixture which frees the buoyant materials, whereby the flocculent mixture and the buoyant materials are carried by the rain water through the system to the point of discharge, any unused polyelectrolytic organic polymer in solution in the catch basin being carried by the rain water through the system and being effective to flocculate accumulations downstream of the catch basin and free any buoyant materials held from floating by the last mentioned accumulations until the polyelectrolytic organic polymer is dissipated.

9. The method of claim 8 further characterized in that the polyelectrolytic organic polymer has a molecular weight ranging from about 100,000 to 15,000,000.

10. The method of claim 8 further characterized in that the polyelectrolytic organic polymer is prepared from a compound characterized by the formula C=C—R wherein R is selected from the group consisting of nitrile, amide, and carboxyl radicals.

11. The method of claim 10 further characterized in that R is a carboxyl radical characterized by COOM wherein M is a lower aliphatic radical having 1 to 4 carbon atoms per molecule.

12. The method of claim 8 wherein the solution contains carboxy methyl resin.

13. The method of claim 12 wherein an effective proportion of the polyelectrolytic organic polymer in solution from about 0.1 gallon to 1.0 gallon is added to the catch basin.

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MORRIS O. WOLK, *Primary Examiner.*