

**THE EAST ORANGE SEWAGE SYSTEM AND WATER WORKS.**

The township of East Orange may be accepted as a representative suburban community. It is to a great extent inhabited by those who are in business in New York. It is rapidly increasing in population, and the problem of sewage disposal, as well as of water supply, has assumed, of late years, considerable importance. It is situated near the opening of the Orange Valley, a region whose drainage offers peculiar difficulties owing to its remoteness from tide water. Improved water works have recently been constructed, and as the need for drainage was thereby increased, an improved system of sewerage was introduced.

In August, 1886, the plans for the sewerage system were practically completed. They had been designed by Mr. Carrol Ph. Bassett, who had just made a special study of the subject in Europe, with whom was associated the eminent sanitary engineer Mr. Rudolph Hering. The works comprise a pipe system and disposal works. Contractors originally undertook the work, but abandoned it, and it was completed by the city, with Mr. Bassett acting as manager and engineer. The disposal station, which is the most original and interesting portion of the works, was designed entirely by him and was constructed under his supervision.

The lines of the sewer are laid in vitrified pipe, forming a complete pipe system. They vary in diameter from 8" to 24", and comprise, with their connections, some 25 miles of conduit. The grades vary from 1 in 800 to 1 in 30, according to inequalities of the ground. In some cases rock cuttings had to be made 22 feet deep; in other cases tunneling was resorted to, the depth in places being 31 feet. The ground, for the most part, lies in a series of parallel ridges, making the determination of most of the lines a comparatively easy one.

To the south, however, is a low region which had to be tapped by a special line which was carried thence to the disposal works as a transit sewer. Where the pipes were very deep, vertical shafts were carried up to receive the house connections, or an overlying secondary main was carried near the surface, communicating by shafts with the pipe below it. Every kind of difficulty from quicksand and other obstructions was encountered in the progress of the work.

The sewage collected by the pipe system is conveyed to the disposal works, illustrated on the first page. They comprise a dual system of sewage disposal by chemical treatment combined with intermittent soil filtration. Works are established on a low piece of ground, along one of whose margins is a brook which ultimately runs

into the Passaic River. The sewage is received at the side of the main building. Within the main building are tanks, in which the chemicals are prepared. These are essentially milk of lime and sulphate of aluminum. Mixing with the sewage, the familiar reaction takes place between them, by which alumina is precipitated, carrying down with it all solid matter. The two mixtures are delivered to the stream of sewage as it

comes to the works. It then runs through a square brick main to the tanks. This main is about 100 feet long, and is broken up continually by partitions running part way across, so as to resemble a fish ladder, by which name it is colloquially known. The object of the partitions is to break up the stream of sewage and mix the chemicals thoroughly with it. After running through this conduit it enters the tanks. Of these there are two, divided by low walls into separate compartments. The sewage is first received in two small square compartments, which are in free communication with the main tanks, except that a wooden sliding gate is provided between each of them and the main tanks, which floats upward as the water rises, so as to keep back the surface water, whereby bottle corks and all

floating matters are kept within this division, to be removed from time to time. Under the gate the liquid flows, beginning at once to precipitate, and as it reaches the large tanks, where the current is, of course, slower, it precipitates still more. Two low walls run across each tank.

The sewage runs over the tops of these, from compartment to compartment, so that a progressive precipitation of the solid matter takes place in the three divisions. When it reaches the third it is perfectly clear, and thence it is allowed to run out to the filtration beds. Through the entire length of the three tanks

through the opening of the floating pipe, which sinks with it, and through the conduit connected therewith to the filter beds.

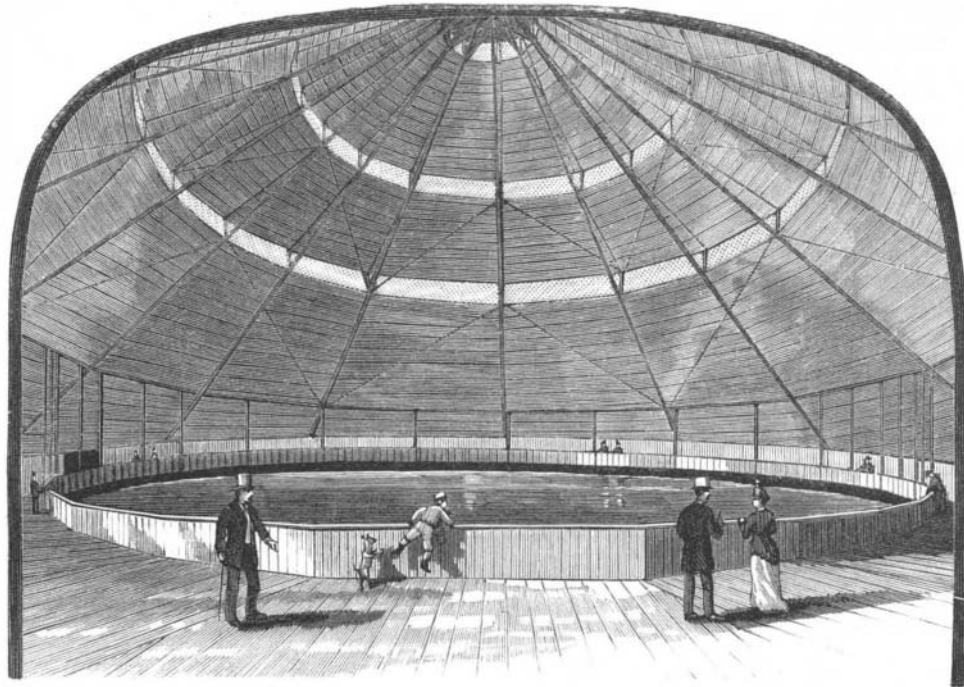
From the end of the tank house a long rectangular open conduit is carried within a few feet of the surface of the ground. It is provided with sliding gates, which can be entirely removed or put in place to check the flow of the water, and it communicates with lateral canals, also provided with similar gates. By means of these the stream of water can be turned over any space desired. The entire farm is, moreover, provided with subsoil drains laid five feet below the surface and communicating with the brook before alluded to. The area, which includes many acres, is cultivated, and grass and various vegetables are grown thereon. Irrigating trenches are run at right angles to the open conduit. The general operation consists of diverting the outflowing stream of clarified, purified sewage to different areas where it may be required. The rest of the operation is entirely automatic; the almost odorless liquid spreads over the ground, is absorbed to a great extent by the vegetation, and any which soaks through is received by the subsoil drains and delivered to the brook perfectly clear. The area irrigated under this new system is considerable, and is to be gradually extended and developed until it is converted into a model farm or vegetable garden. It is anticipated that the richness of the soil will render the return from the crops very lucrative, and it is expected that the revenue from this source will go far toward paying the running expenses of the works. Of course at present this is in an ex-

perimental state, and no figures can yet be given which would have any bearing in determining the value of the experiment as regards this feature.

The works have now been running some five months, and of course have not yet been subjected to the trials of winter. Should any difficulty arise in disposing by filtration of the liquid matter, on account of frost, it will be treated more thoroughly with chemicals, so as to be perfectly clear and inoffensive, and then will be delivered directly to the brook.

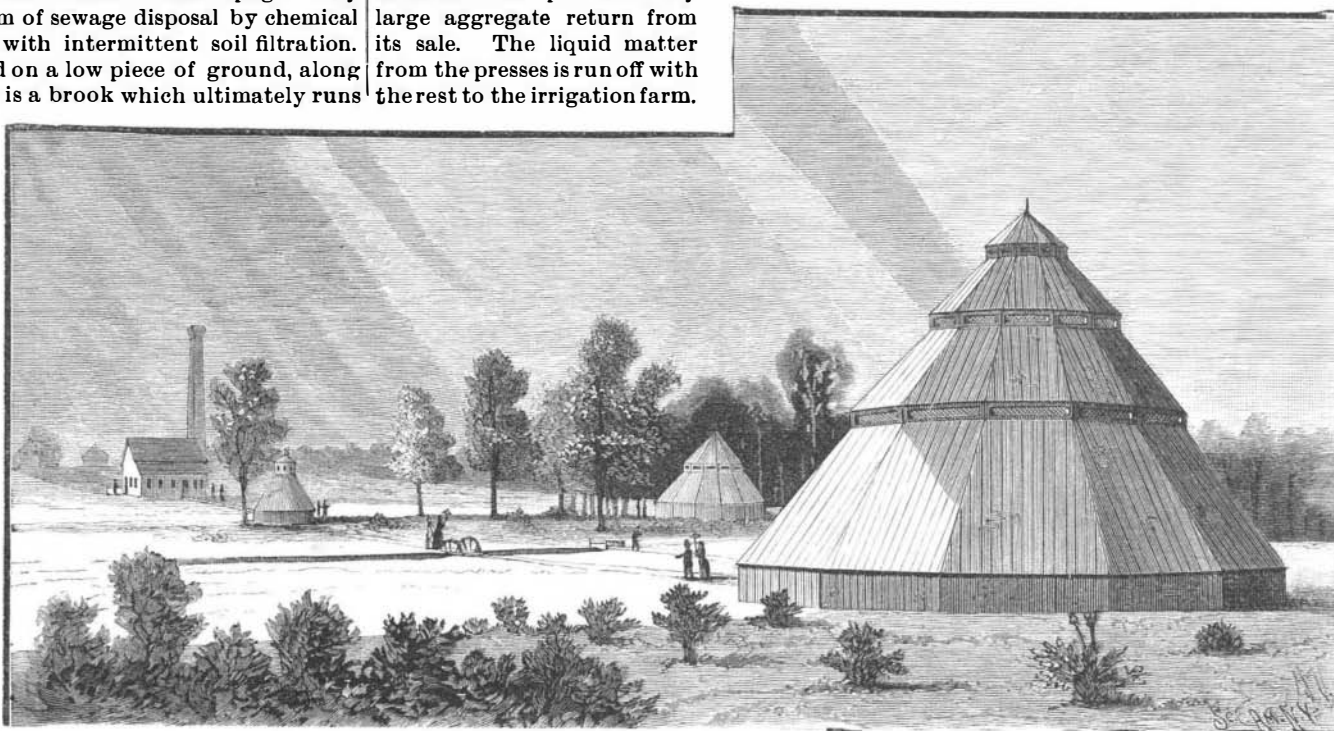
The water works are of special interest as possessing one of the largest wells in the world, which is illustrated in the cuts. It is excavated in the solid rock to a depth varying in places, but averaging about 25 feet, and is 100 feet in diameter. This is not the

only source of supply. There are two more wells, one 25 feet the other about 50 feet in diameter, which contribute their share. The locality selected for them was low and characterized by the presence of springs. The pumping is done directly from the 25 foot well. Communication is maintained between the 100 foot and 25 foot well by a siphon. From the bend of the siphon, where it enters the smaller well, a small pipe connection is made to the suction tube, so that a continual suction is exerted upon the



INTERIOR VIEW SHOWING GREAT WELL 100 FEET DIAMETER

and under the cross walls an open drain is carried, called the sludge channel, in which the precipitate settles. The semi-liquid mass is pumped thence into vacuum pans in order to avoid any contact between it and the pumps, and when the pans are full, the mass is forced by pneumatic pressure into multiple filter presses of the standard type, now extensively used in chemical works. Here it is filtered through canvas, the clear water passes out, and the chemically precipitated matter remains behind and is collected as cakes of a general disk shape and quite hard. As yet no analyses have been made of this material to determine its value from the agricultural point of view. It is proposed to sell or use it as it accumulates, for a fertilizer. Its value will undoubtedly be quite high, though the small quantity collected will preclude any large aggregate return from its sale. The liquid matter from the presses is run off with the rest to the irrigation farm.



EAST ORANGE WATER WORKS.

Still one more operation is to be provided for, and this is the independent emptying of the tanks, which has to be done from the surface in order to avoid carrying off the solid matter. A low-level main is therefore carried to each of the first divisions. At the bottom of the tanks it is provided with a valve. At the point of its entry into the bottom a pipe is connected to it by a joint, so that it can be swung up or down. At the top the swinging pipe is provided with a filtering arrangement to secure the exclusion of the coarser particles of matter, and floats are attached near its mouth, so that it is always kept at the surface level of the water in the tank, wherever that level may be. When it is desired to empty the tank, the valve at the bottom is opened, the water immediately runs out

siphon. It has been found by experience that the siphon never needs recharging, owing to this ingenious arrangement. A compound Gaskel pump engine pumps the water directly into the mains, where a pressure of a specified head of water is continually maintained.

The large well, filled with crystal water, through which the bottom of red sandstone can be clearly seen, is a most interesting object. The level of the water changes very little, however great the drain upon it may be, and is independent of the level in the other wells. Its temperature is also nearly constant in summer and winter. The analysis shows the water supplied by the group of wells to be of remarkable purity.

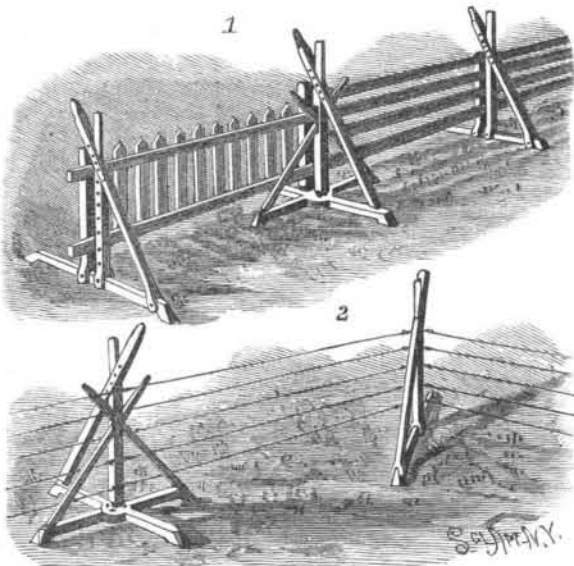
The water works are the property of a private corporation; the sewage works belong to the township. With these two improvements added to its beautiful residences and macadamized and telfordized roads, East Orange may claim to be a model community. Not the least striking feature is the fact that these improvements were executed when it was only a township, possessing the simplest forms of administration, not having reached even the dignity of a village charter.

#### Coffee and its Effects.

Coffee owes its stimulating and refreshing qualities to caffeine. It also contains gum and sugar, fat, acids, casein, and wood fiber. Like tea, it powerfully increases the respiration; but, unlike it, does not affect its depth. By its use the rate of the pulse is increased and the action of the skin diminished. It lessens the amount of blood sent to the organs of the body, distends the veins and contracts the capillaries, thus preventing waste of tissue. It is a mental stimulus of a high order, and one that is liable to great abuse. Carried to excess, it produces abnormal wakefulness, indigestion, acidity, heartburn, tremors, debility, irritability of temper, trembling, irregular pulse, a kind of intoxication ending in delirium and great injury to the spinal functions. Unfortunately, there are many coffee tipplers who depend upon it as a drunkard upon his dram. On the other hand, coffee is of sovereign efficacy in tiding over the nervous system in emergencies. Coffee is also, in its place, an excellent medicine. In typhoid fever its action is frequently prompt and decisive. It is indicated in the early stages before local complications arise. Coffee dispels stupor and lethargy, is an antidote for many kinds of poison, and is valuable in spasmodic asthma, whooping cough, cholera infantum, and Asiatic cholera. It is also excellent as a preventive against infectious and epidemic diseases. In districts rife with malaria and fever, the drinking of hot coffee before passing into the open air has enabled persons living in such places to escape contagion.—*Journal of Commerce (Boston)*.

#### AN IMPROVED FENCE.

A fence of novel construction, which may be set plumb on rolling or sloping lands, and readily erected or removed, is illustrated herewith, and has been patented by Mr. John M. Fellows, of Burlington, Ind. The main posts, and the intermediate or corner posts, are adapted for use either with rails or pickets or wires. The base of the main post has four arms, the extremities of the arms being bent down to form feet, and at the center of the base is an eye bolt engaging loosely the lower end of the upright, or post proper, the upper end of which is cut away to form a tenon, and on the shoulders thus provided on the main post rests the upper slotted end of an inside side brace. The tenon passes through the slot in the upper end of the brace, and is connected therewith by a nutted bolt or pin, passed through one of a series of holes in the brace, to allow of the latter being set at different angles, according to the nature of the ground. Other braces, pivoted to the opposite base arms which lie parallel with the fence, have their upper ends passed

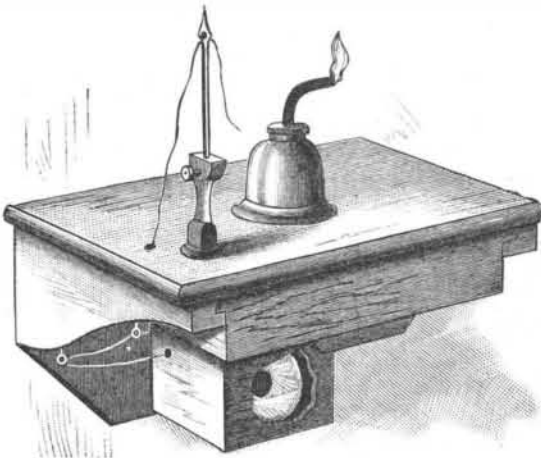


FELLOWS' FENCE.

through a slot in the post, where they are adjustably held in position by a pin passed through one of a series of holes in both braces, whereby the post may be set plumb both ways, and locked in position by the pinned braces. A post to be alternately used has a cross piece or base ranging transversely to the fence, this post having a pivoted upright, a pivoted inner brace, and an outer pivoted face post or upright. All parts of these posts are preferably to be made of cast or wrought metal, to be light and strong, and give substantial support to the rail or wire stringers of the fence.

#### AN IMPROVED NEEDLE AND TWINE CUTTER.

A simple and effective device, whereby packages of paper, money, etc., may be expeditiously punctured and tied, is illustrated herewith, and has been patent-



WOOD'S NEEDLE AND TWINE CUTTER.

ed by Mr. Fremont E. Wood, of Yucca, Arizona Ter. It is designed for use preferably in connection with a little stand or bracket, to support a lamp for sealing purposes, and a drawer for wax, pens, cord, etc., the body of the device having at its lower end a threaded stud or pin adapted to be screwed in the support. It has a neck essentially diamond-shaped in cross section, making opposing cutting surfaces, above which is a longitudinal aperture, and a set screw, whereby a needle with spear-like head, in which is an eye, may be firmly held in vertical position. With this device twine or ribbon may be conveniently used, and readily cut off at the desired length after the package has been tied.

#### He Fastened Down the Safety Valve.

It is almost incredible that a man in his senses should walk up to a boiler which is discharging steam through its safety valve, and deliberately close that only avenue through which the surplus steam might escape to prevent a dangerous over-pressure.

And yet this thing is done with a frequency which is alarming. Only a few days since, we learned from an inspector that he had found a battery of boilers, every safety valve upon which was wedged down by a pine plug, "to keep them from leaking;" and now come the particulars of an explosion in this State, reciting that one Arthur Leavitt, annoyed because the escaping steam from the safety valve of his boiler made his horses restless, fastened the valve down with a heavy weight. The natural consequence ensued, and, although swift retribution was meted out to the offender, he carried into eternity another and innocent man, while as a result of his criminal act two men are suffering serious injuries, a pair of valuable horses and a large factory are destroyed, and a prosperous business seriously interrupted.

The man who will deliberately tamper with the safety valve of a steam boiler is a first-class rascal. If the consequences of his act reverted upon himself alone, he might be forgiven, but there is no knowing how widespread and disastrous may be the results of his folly, and he should be placed in the same category as the man who would put a fuse to a power magazine or lay the train to incite a conflagration.—*Power and Steam*.

#### What Constitutes a Faithful Employee.

An exchange says: Every faithful employe will constitute himself the guardian of his employer's property. The man who will either willfully waste what is intrusted to his care, or encourage such waste in others, is unworthy of confidence, and, should he ever become the head of a business, will deserve to be treated in the same way.

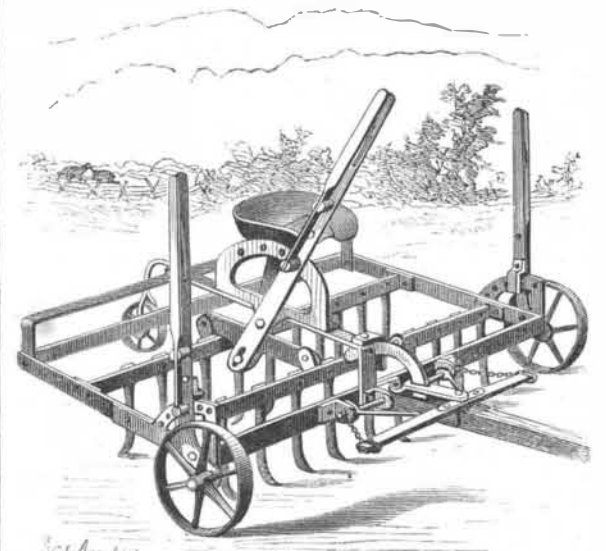
There is a vast deal of truth in the above, adds the *Industrial World*, and yet how many workmen there are who willfully squander not only the property of their employers, but, what is equally valuable, the time which the latter pays for.

Workmen do not seem to know that the prosperity of a manufacturing concern oftentimes depends upon the observation of closest economy. The enlargement of the wage fund depends on this economy, and any fair-minded employer would rather expend in wages the amount saved by economical observance than have the amount wasted. The little waste here and there that seems so trivial to the workman, when scattered through a great number of hands amounts in the total to a large sum. When a workman, sees the first evidence of a machine getting out of order, by drawing the attention of the proper parties he may save an expensive bill of repairs and also a considerable loss consequent upon the idleness of the machine while undergoing repairs. The careless workman says, "It is none of my business whether the machine gets out of repair or not," and so he lets it run on until it is entirely disabled. A workman observes a quantity of material

carelessly left where it will deteriorate or be spoiled. Instead of taking care of it, or notifying the manager or superintendent, he allows it to remain and be destroyed or injured, consoling himself with the thought that "it is none of his loss any way." Perhaps he observes a brother workman willfully wasting or injuring the material upon which the latter is working. Duty would tell him to inform the foreman of such a dereliction on the part of his fellow laborer, but he does not, for lack of interest in his employer's welfare. He may see where a saving could be made in the manipulation of the material upon which he is working, yet for lack of interest he refrains from making any suggestions leading to the discovery of that fact. Not infrequently the workman refrains from protecting his employer's rights and property because by so doing it will entail additional labor or care upon himself, or impose a responsibility which he does not wish to assume. Some seem to think there is no obligation incurred by them when engaging themselves to work except such as is included in the rule of "doing the least work for the most pay." Such men shuffle through their labors, slighting the work here, wasting material there, squandering all the time they can, and thinking of no one's interest save their own. This class of workmen are the first to be dismissed when hard times come. When wages fall, theirs are the first to be lowered. If the force of the shop, by reason of slack trade, has to be curtailed, they are the ones selected to leave. Self-interest teaches the manufacturer to give the best places and the largest remuneration to his most faithful workmen. This is not only natural, but right and commendable. The employe who thinks most of doing his work well and of subserving his employer's interests, and less of combinations and strikes, will succeed the best and rise the highest and the most rapidly in the scale of prosperity.

#### AN IMPROVED HARROW.

A harrow adapted for conveniently adjusting the teeth to enter the ground any required depth, or at any angle, or in which they can be raised out of action as desired, and readily locked in any of their adjustments, is illustrated herewith, and has been patented by Mr. James M. Ulsh, of Steelton, Pa. To the outside of the side beams of the frame, near its front ends, are pivoted elbow levers, the shorter arms of which project forward and form at their ends bearings for the axles of the main supporting wheels, the longer arms projecting upward and forming handles, whereby the wheel bearings can be adjusted at any desired height, and the frame thus caused to travel at any desired height above the ground. Segmental plates are provided with which the elbow levers can be readily locked in any position to which they may be adjusted. On the front end of a central elevated brace is a keeper, receiving adjustably a segmental bar fixed to the draught tongue, by which the frame of the machine may be rigidly connected to the tongue at any height. In bearings on the inside of the side beams are mounted to turn the end pivots of two transverse tooth bars, the teeth being beveled and curved at their ends. The arrangement is such that the points of the teeth of each row will alternate in position with those in the other, and, by turning the tooth bars on their pivots, the teeth can all be swung up into the frame of the machine, so as to



ULSH'S HARROW.

be inactive, or held downward in an approximately vertical position, to cut the ground edgewise, or into any intermediate desired. The transverse tooth bars have upwardly projecting arms, connected together by a longitudinal bar, the latter connected to a lever pivoted to the elevated brace, and forming a handle by which the two rows of teeth can be easily adjusted together in any of the positions described, the handle lever having a segmental plate-locking device. A model of this machine may be seen at the office of Messrs. Bonner & Murguiondo, No. 186 Remsen Street, Brooklyn, N. Y.