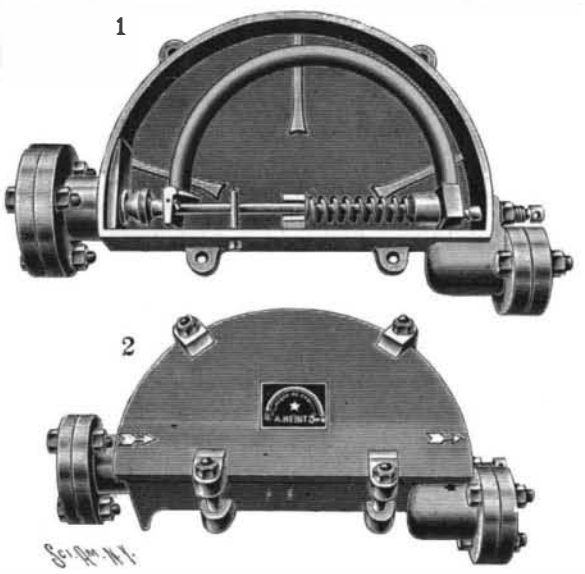
AN EFFICIENT STEAM SAVER.

The illustration represents a steam trap that works the same at all pressures, without regulating, which has no air valves or pet cocks, screws, rotating parts, etc., and which thoroughly and quickly blows out steam pipes when steam is first turned on. The Heintz steam trap has been well known for many years in Europe, where it has been used almost everywhere and has become very popular, but it is comparatively new to steam users in this country, to whom it is being introduced by William S. Haines, sole manufacturer, No. 136-S. South Fourth Street, Philadelphia, Pa. It is entirely automatic in its action, and is applicable to steam pipes, heating pipes, etc., and generally to all industrial appliances in which steam is used as a source of heat or power, being made small, light and compact, without any sacrifice of strength or efficiency. The trap is wide open when cold, and, as will be seen in Fig. 1, the valve is controlled by a curved tube spring which is partly filled with a liquid that, heated by the condensed water passing through when the trap is first put in use, completely fills the tube spring at the moment the temperature reaches 197° F. As the temperature of the water increases, the tube spring rapidly extends its extremities, and by the time a temperature of 212° is reached the valve has been forced tightly into its seat, remaining so until enough condensation has accumulated to lower the temperature 1°, when the valve opens enough to pass this condensed steam off, closing again so quickly, however, that no steam escapes. This operation is so rapid and continuous that a constant flow of water is passing off from the outlet of the trap, but no sign of steam is ever apparent. There is no pressure in the trap when at work, and the trap is blown through and cleared of deposit each time it is worked, all air and water being blown out before the trap closes. If the boiler pressure is much above 100 pounds, it may be necessary to adjust the regulating screw, but the strength of the tube spring is sufficient to close the valve and keep it tight against the pressure of 200 pounds. There is no possibility of freezing of the trap, and when the radiator size is used in steam heating systems there is no pounding or noise. No air valves are necessary, and the control of the steam in each room lies wholly with the occupant, as heat can be turned on in only one room of the entire building without its going into the radiators in other rooms, though all the radiators may be fed by the same supply pipe and drained by the same exhaust, for no steam in any radiator can get beyond the trap attached to it. The manufacturer is in the possession of many records showing material savings in establishments equipped with the Heintz traps, and a recent communication from the Massachusetts Institute of Technology testifies to its perfect working under pressures varying from 100 to 150 pounds.

WATER FILTRATION.

BY CHURCHILL HUNGERFORD, C.E.

The purification of the contaminated water supplies of many European towns and villages has long been effected by passing the water slowly through large beds of sand; and though the results attained were extremely satisfactory, both from a hygienic and an æsthetic standpoint, the manner in which the impurities were removed was but slightly understood until the comparatively recent investigations of Koch, Pasteur, and others finally demonstrated that the high efficiency of some of these filters was due mainly to at least three vegetable organisms which infested them. Two of these were found to be very similar to the nitrifying organism that exists in the soil and so ably converts the fertilizers to a form in which the plants can assimilate them. The third surrounds each grain of sand in the surface of the filter bed with a coating of a gelatinous nature, which so effectually fills the spaces between the grains of sand that the most minute particles are able to enter the filter but a slight distance indeed.



THE HEINTZ STEAM TRAP—INTERIOR AND EXTERIOR.

While the mechanical or straining office of the filter is greatly promoted by this last mentioned growth, the destruction of the dissolved organic matter, or food of the disease-producing germs, is an equally important feature and a far more complex process. Dead organic matter, whether animal or vegetable, goes through the successive stages of decay (in itself a bacterial process, the deadly ptomaines being sometimes formed) until it has reached the stages known as "albuminoid" and "free" ammonia, the first representing the organic matter on which the bacteria of decay are still working and the second the completed process. The dissolved organic matter in the water of uncovered reservoirs usually exists in both these forms, and its reduction to harmless inorganic salts is the duty of the filter.

The nitrifying organism that infests the filter bed extracts the ammonia from the water in its passage through the sand and converts it into nitrous acid. This product combines with the lime that exists in all natural waters, forming nitrites. These nitrites are again attacked by another similar organism and nitric acid is the result, which, again combining with the base, forms nitrates or the inorganic salts of nitrogen. It frequently happens that even this last product undergoes some obscure change and is entirely eliminated from the water. This, however, is not sought after, as it requires a reversal of the conditions necessary for the support of the nitrifying organism, and as the nitrates have no hygienic significance, the process is considered as having progressed sufficiently far.

In practice, the unfiltered water is maintained on the surface of the sand at a depth of from two and one-half to six feet. The bacteria that exist in the water together with the suspended impurities being unable to enter the sand, on account of gelatinous growth, form a film or slime on the surface of the filter that materially aids in the straining process, by retaining over ninety per cent of the suspended matter in the water that subsequently follows. After entering the sand, the water comes in contact with the nitrifying organism, which converts the dissolved organic matter into harmless inorganic salts and destroys any bacteria that may have penetrated the surface. The water is drawn from the bottom of the filter clear, bright, and sparkling, and practically free from bacteria.

In time the film of impurities on the surface of the sand becomes so thick that not enough water can pass through it to meet the demand, and the filters then require cleaning. This is effected by scraping the film or "blanket," as it is called, from the surface of the filter bed, care being taken to remove as little of the sand as possible; for, thanks to the gelatinous organism, the suspended impurities have been unable to penetrate the surface. The filter is then in condition to run for another period of time, ranging, under the varying conditions, from two weeks to four months. Cleaning costs from fifty cents to one dollar per thousand square feet of filtering surface. The average cost of filtering one million gallons of water in six American filter beds

METHOD OF CONSTRUCTING FILTER BED AT LAMBERTVILLE, N. J.

is about one dollar. In waters containing from ten thousand to fifty thousand bacteria per cubic centimeter (about fifteen drops), these filters commonly remove all but fifty or seventy-five and frequently all of the bacteria. Mr. George W. Fuller, biologist of the Massachusetts State Board of Health, says of the Lawrence filters: "Out of one hundred and two analyses, fifty-eight indicated that the filtered water was absolutely sterile." An experience of the writer at the Lambertville, N. J., filter beds, showed the influence of the gelatinous growth in removing the suspended matter. When the filters were first put in operation the turbid water showed only a very slight change after passing through them. As soon, however, as this growth had taken place, the water ran from the filters clear and odorless.

All properly constructed filter beds improve with age, instead of deteriorating, but it is essential that they be so constructed that all the conditions necessary for the inception and growth of the nitrifying organism are rigidly adhered to, as otherwise undesirable bacteria will infest the beds and make the water far worse after than before filtration. The bacteria grow through the bed after the manner of mildew through a bolt of linen. A properly constructed filter bed can be compared to a well cultivated garden, in which the weeds are destroyed and the plants flourish, and a poorly constructed filter to a neglected garden, in which the weeds outgrow and dwarf all other vegetation.

The popular idea regards all bacteria as disease producing microbes. The bacteria are really a microscopic growth of the lowest order of vegetable life, and many of them are essential to our existence. Some, however, are deadly, as the typhoid, cholera and bubonic plague germ; some produce diarrhea, and others impart a very objectionable taste to water or fill the pipes with their growth. Any or all of these that may exist in the water are efficiently removed by the filter, and the immediate reduction of water-borne diseases is testified to by all communities where this method has been adopted.

Government Distribution of Seed.

In the time of Cæsar, largesses of grain were frequently distributed to the populace of Rome, in times of discontent, to smooth the course of ambitious politicians. The fact is brought to mind by the great dimensions which the business of distributing seeds by our Department of Agriculture has attained. Over 20,000,000 packages of field seed and vegetable and flower seed were thus distributed by the government the past spring. In the entire distribution nearly every variety of vegetable known to the agriculturist was distributed. There were 32 varieties of beans, 10 varieties of beets, 23 varieties of cabbage, 11 varieties of carrots, 19 varieties of sweet corn, 18 kinds of cucumbers, 30 kinds of lettuce, 19 varieties of muskmelons, 17 kinds of watermelons, and 15 varieties of onions. The entire amount of seeds distributed was sufficient to plant an area of 355 square miles, or about six times the size of the District of Columbia. The distribution of seed in 1893 amounted to 8,800 packages for each member of Congress, at a total cost of $66,548; in 1894 each Congressman got 16,000 packages, the entire cost to the government being $57,000; in 1895 the number of packages of seeds distributed was the same as in the previous year, but the total cost was reduced to $47,000. In 1896 Congressmen got 15,000 packages each, and the government paid $80,500 for the whole lot. During the past spring each member of Congress has received 40,000 packages of seeds, for which the government has paid $130,000.

THE CURVE AND CROSSINGS AT FIFTY-NINTH STREET AND EIGHTH AVENUE.

EXTENSION OF THE UNDERGROUND TROLLEY SYSTEM IN NEW YORK.

Our readers will see from the accompanying illustrations that the Metropolitan Traction Company has already commenced work on the important improvements which it is contemplating on a large portion of its lines. The work which is being done at the Circle, at the intersection of Fifty-ninth Street and Eighth Avenue, marks the commencement of a costly undertaking which involves the complete rebuilding of over forty miles of the company's lines, the horse cars and light rails being removed and replaced by electric cars and the latest type of underground trolley or conduit road. The lines which are to be immediately reconstructed on the west side of the city are the Eighth Avenue line, from the Harlem River to Fifty-ninth Street, and the Sixth Avenue line, from Fifty-ninth Street to the Battery; and on the east side the Madison Avenue and Fourth Avenue lines, between the Harlem River and the Post Office. In the present overburdened condition of street railroad travel, and particularly of that on the Broadway line, the electrical equipment of two continuous lines on each side of Broadway and Central Park will go far to relieve the congestion in north and south bound travel during the busiest hours of the day.

An important feature will be the crosstown connection at Fifty-ninth Street, on which the new system will be laid down between First and Tenth Avenues, by means of which passengers may travel from upper Madison Avenue to lower Sixth Avenue, and from Eighth Avenue to Fourth Avenue, and vice versa, without change of car. We present two illustrations of the Circle, taken during the building of the conduits and the laying down of the crossings and the connecting curves, which will give a good impression of this important meeting point, at which so many leading thoroughfares of the city intersect. In the view showing the Columbus statue the thoroughfare to the right is Eighth Avenue and that to the left is the commencement of the Boulevard. In the other view we are looking south, and the broad thoroughfare to the left is Eighth Avenue. Although the continuation of the line down Eighth Avenue is not to be undertaken immediately, the crossings are being put in at once. As soon as the work is all completed at this point the whole of the Circle will be asphalted. It should be added that the

THE CIRCLE, FIFTY-NINTH STREET AND EIGHTH AVENUE, LOOKING NORTH.

CONSTRUCTION OF UNDERGROUND TROLLEY LINES IN NEW YORK CITY.