AN ELECTRIC ALARM TRY-COCK FOR STEAM BOILERS.

A very ingenious arrangement for sounding an electric alarm when the water in the boiler has fallen below a safe level, has been introduced by the Electric Boiler Protection Company, of 9-13 Maiden Lane, Manhattan, New York city. The device is a safeguard against explosions or injuries to any steam boiler made.

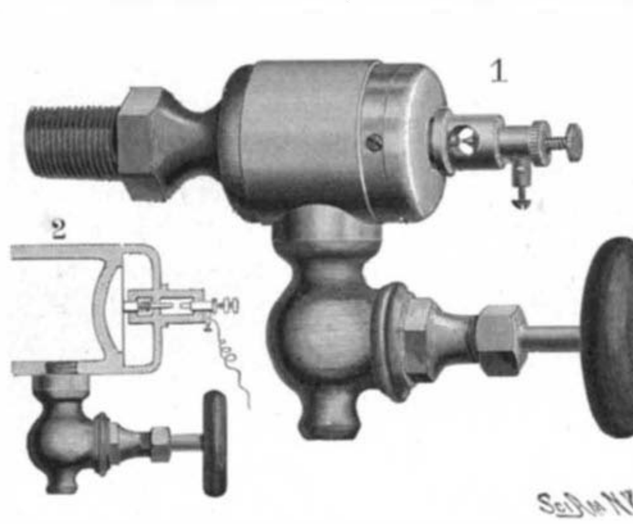
Fig. 1 represents the apparatus in perspective. Fig. 2 is a partial section.

The lower try-cock is provided with an expansion chamber, composed of a concave wall and a diaphragm hermetically sealed together. The diaphragm is designed to engage a spring-pressed plunger carrying a contact point, which, when it touches the opposite contact point of binding post, completes the electric circuit.

When the water in the boiler is above the level of the try-cock, the parts will be in the position shown in Fig. 2. But when the water in the boiler sinks below the normal level, steam enters the try-cock, heats the air in the expansion chamber, forces the diaphragm against the plunger, which in turn completes the circuit as it touches the contact carried by the binding post. The alarm sounded will immediately inform the attendant engineer that the water in his boiler has sunk dangerously low. The cooling of the air in the expansion chamber returns the parts to their normal positions.

As many alarms as may be desired can be disposed about the building. A group or nest of boilers protected in the manner described, may be wired to an annunciator, thereby showing which boiler needs attention. Switches can be provided to cut off the alarm, until the cocks cool off, thus saving battery current and the unnecessary noise of incessantly ringing bells.

The device takes the place of the lower try-cock, and can be attached to any boiler in a few moments.



ELECTRIC ALARM TRY-COCK FOR STEAM BOILERS.

THE CREEPING OF RAILS ON THE EADS BRIDGE, ST. LOUIS.

In response to our inquiry as to the exact amount of rail creeping on the Eads Bridge and the means adopted to accommodate it, we have received the following very interesting letter from Mr. N. W. Eayrs, the superintendent of structure, who replies as follows:

"I have your letter of the 8th inst., making inquiry about the amount of rail creeping on the Eads Bridge. This movement of the rails occurs not only upon the spans, but also upon the east approach trestle; the movement on the latter is, however, considerably less now than it was before the trestle was reconstructed. The original structure was very light, and in consequence there was an unusual amount of elasticity in the floor. The creeping occurs always in the direction of the traffic; that is to say, the west-bound track runs west and the east-bound track east, and varies in amount with the variation in tonnage passing over the rails. The movement is dependent on the elasticity of the track supports; with increased stiffness in the floor system the amount of rail movement is decreased; in fact, several years ago a portion of the east approach trestle, a wooden structure about 1,000 feet in length, was filled and the track put on the ground. In this portion the rail movement almost entirely disappeared. As corroborating my opinion that the rail movement is caused by the elasticity of the road-bed, I may mention a section of track on the Canadian Pacific, which was laid on a soft marsh. If my memory serves me rightly as to the amount, this section of track moved two feet under a single train.

In the month, April 15 to May 15, 1899, some measurements of the movement were made at two points, one on the center span of Eads Bridge, and one at the west end of a 5° 43′ curve on the east approach. The movements were as follows:

	Eastbound Track.		Westbound Track.	
	North Rail.	South Rail.	North Rail.	South Bail.
Center span....	17 ft. 10½ in.	19 ft. 4½ in.	19 ft. 9⅝ in.	12 ft. 7½ in.
East approach..	25 " 9 "	47 " 7 "	33 " ½ "	34 " 2¼ "

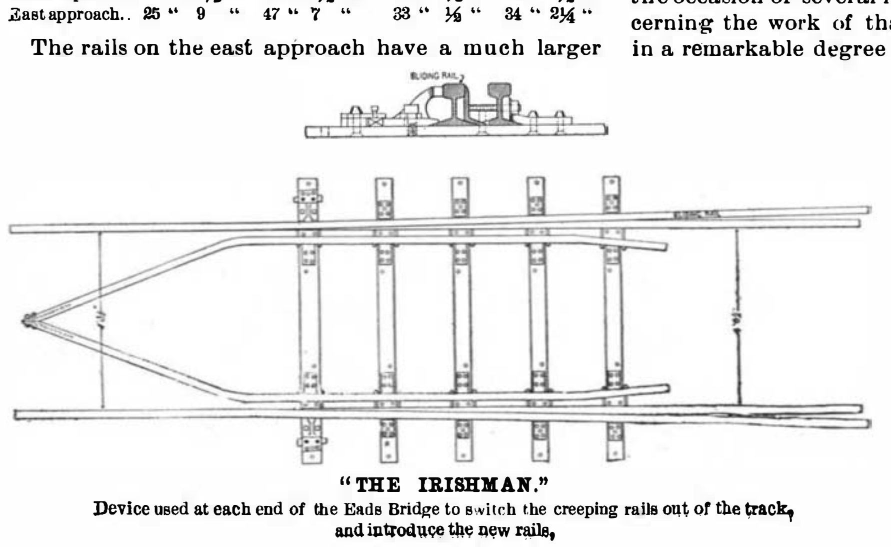
The rails on the east approach have a much larger run between creeping points than on the bridge, which accounts for the increased rail movement.

Attempts were made at one time to check this movement, but it was found inadvisable to continue the experiment, as the strain on the fastenings was sufficient to tear fish-plates in two, or to shear off a ⅞-inch track bolt. Accordingly the track was kept continuous by inserting pieces of rail of various lengths at the end where the movement commenced, and removing corresponding pieces at the other end. At either end of the bridge there are cross-overs which of course must be kept in line; at these points, therefore, the rail movement required control; there are also two points on the east approach on each track which require protection. Accordingly there are eight "creeping plates" as we call them, in the track.

In order to avoid the necessity of keeping a supply of pieces of rail from 2 inches long to 30 feet long at each place, and to dispense with the necessity of keeping a trackman to watch these places, we put in, about fifteen years ago, a device which is shown on the accompanying drawing. This device consists of a pair of switch points, rigidly held to gage by forming part of an iron frame which is bolted to the ties. The main rails of the track which is ahead of the device—that is, in the direction of the traffic—extend outside of the switch points. A full rail is coupled on to the main rail, which, in the case of a trailing point, drags the rail through the jaws, or, in the case af facing points, shoves it through the jaws. In the former case, when the rail has nearly passed through, a new rail is coupled on, and in the latter case the rail is uncoupled as soon as it has passed through the creeper (or the "Irishman" as the trackmen call it, since it takes the place of the Irishman formerly employed). The rail which has been shoved through the creeping plate and has been taken off, is carried across to the opposite track to be used to feed into the creeping plate, and begins to travel back again.

The force impelling the rail is so strong that it will drive a straight 70-pound steel rail through a 5° 43′ curve, curving the rail during the passage and straightening it again after the rail comes through.

The movement on the spans can probably never be entirely overcome, as the deformation of the arched ribs under the action of a moving load intensifies the action of the elasticity of the track."



"THE IRISHMAN."

Device used at each end of the Eads Bridge to switch the creeping rails out of the track, and introduce the new rails.

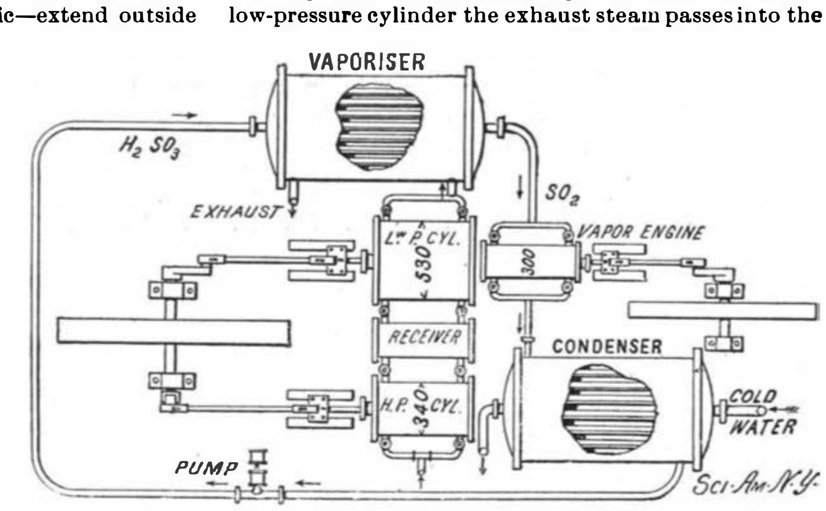
A NOVEL FORM OF STEAM ENGINES.

The recent centennial anniversary of the Royal Technical High School at Charlottenburg was made the occasion of several important announcements concerning the work of that institution, which embodies in a remarkable degree the advanced technical science which has done so much to push Germany forward into the front rank of manufacturing nations. Among these is the paper of Prof. E. Josse, head of the mechanical laboratory, in which are described with elaborate detail the results of his experiments with an original and highly interesting process for increasing the efficiency of steam engines by utilizing the heat of the exhaust steam for evaporating another liquid having a lower boiling point than water. This paper is made the subject of a special report by Consul-General Frank H. Mason and we take pleasure in publishing an abstract of his paper.

The process is the joint discovery of Mr. G. Behrend, a Hamburg engineer, and Dr. Zimmermann, of Ludwigshafen.

It is plain that, with all progress which has hitherto been made in steam engine practice through higher pressures, superheated steam, economical cut-offs, or successive cylinders, there is always an important and inevitable loss of heat energy when the steam, having done its work, is discharged into the open air or changed back to water by contact with cold water in a condenser. When the exhaust is into the open air, the steam has a temperature of about 100° Celsius (212° F.); when it passes into a condenser, the steam has a temperature of 60° to 70° Celsius (140° to 160° F.), according to the vacuum. The corresponding latent heat of steam, given up upon change of form from steam to hot water, has hitherto run to waste in the condensing or cooling water, or in the air. Messrs. Behrend and Zimmermann attacked the problem of utilizing this wasted caloric by employing it to create a new supply of steam by evaporating some liquid which has a lower boiling point than water, and for this purpose they chose, after many experiments, sulphurous acid (H_2SO_3), which is not only cheap and easily obtained, but has the further advantage of a viscous consistency and lubricates the inner working surfaces of the machinery without corroding them. Their demonstrations, although not practically conclusive, were so promising that Prof. Josse, as a technical authority on this subject, took up the problem, and, after several months of highly satisfactory laboratory experiment, caused to be constructed and connected with an ordinary working steam engine of the compound type an additional condenser and auxiliary engine, the power of which could be exactly measured. The whole working apparatus is shown in the engraving herewith submitted, and the technical details will be explained by the drawing, and may be thus described.

Referring to the diagram, in which dimensions are given in millimeters, the high and low pressure cylinders of an ordinary compound steam engine are represented, with a stroke of 500 millimeters (19·69 inches) and a speed of 41·5 revolutions per minute. From the low-pressure cylinder the exhaust steam passes into the surface condenser, called in the diagram the "vaporizer." In this vaporizer, or condenser, the cooling medium used, instead of water, is liquid sulphurous acid (H_2SO_3), which has a boiling point so low that it is immediately decomposed by the heat of the exhaust steam, whereby the sulphur dioxide gas (SO_2) is liberated, which passes over into the cylinder of the auxiliary engine where its work is done as in an ordinary steam engine. The auxiliary cylinder has a diameter of 300 millimeters (11·81 inches) and a stroke of 500 millimeters, with a speed of 77 revolutions per minute.



NEW TYPE OF STEAM ENGINE OF HIGH EFFICIENCY.

After passing through this cylinder, the sulphurous vapor enters the surface condenser, around the tubes of which cold water flows as in an ordinary steam plant. Here the sulphurous vapor is condensed to liquid and is forced by the pump back into the vaporizer, where it begins its cycle again, the same SO_2 being used over and over again indefinitely. There are, therefore, in fact two condensers, the first serving, as it were a boiler or steam generator for the auxiliary engine; and this boiler, instead of being fired by coal, obtains all its heat from the exhaust of an ordinary steam engine, and instead of converting water into steam, evaporates a liquid which is much more volatile—i. e., has a far lower boiling point.

In the long series of recorded tests with the plant shown in the engraving herewith transmitted, the following results were attained:

The steam engine is of the compound type, of good, modern construction, and, being given a steady load, developed 34 indicated horse power, with a consumption of 8·6 kilogrammes (18·96 pounds) of steam per indicated horse power hour. The auxiliary machine working with the sulphurous vapor indicated 19 horse power—that is, an increase of 56 per cent and yielding, instead of 1 horse power, 1·56 horse power for the same steam consumption and reducing the steam consumption from 8·6 kilogrammes to 5·5 kilogrammes (from 18·96 to 12·13 pounds) per indicated horse power.

The experiments showed on the average that for every 15 kilogrammes (33·169 pounds) of steam passing through the main engine, 1 horse power could be gained in the auxiliary machine. Applied, therefore, to an ordinary single cylinder steam engine, exhausting into the air at high temperature, the percentage of power saved by this new device would be very much higher than the economy reached in these experiments, which, as has been shown, were made with a highly improved compound engine. From the average of these experiments, it may be broadily stated that given a fairly economical compound engine, using 7½ kilogrammes (16·5 pounds) of steam per indicated horse power hour, half an indicated horse power could be produced in the auxiliary machine for every indicated horse power developed in the main engine. Assuming an average vacuum of 60 centimeters (23·62 inches), corresponding to a temperature of 60° Celsius (140°F.), the saving of heat must be accomplished by using a liquid which can be vaporized to a high pressure at or below that temperature. Assuming, further the upper and lower limits of temperature within which the operation is confined to be 60° and 20° Clesius (140 and 67° F.), the pressure of the sulphurous vapor would range from 10·05 down to 2·35 atmospheres above open air pressure. A working pressure as high as ordinary steam boiler pressure is therefore readily obtained at a comparatively moderate temperature. Moreover, the volume of sulphurous acid vapor necessary to contain the number of heat units corresponding to the work to be performed is much smaller than the volume of steam which would be required for the same purpose. As the saving to be effected by the auxiliary engine depends directly upon the difference between the highest and lowest temperatures involved, the greatest gain will therefore be made either when the water in the surface condenser is as cold as possible or when the heat of the exhaust steam from the engine is at a maximum, as is the case with a single cylinder steam engine without condenser, which may be anywhere up to 212° F.

The expense of this improvement is practically all in the construction cost of the vaporizer, condenser, and auxiliary engine itself, and its economy may be realized from the fact that the exhaust steam from a 2,000 horse power central-station engine should furnish power to drive an additional 1,000 horse power engine, which can be connected as an extra cylinder to the steam engine or run independently, and thus increase by 50 per cent the power developed without adding a pound to the quantity of fuel consumed. When, in view of the present coal famine throughout Europe, it is remembered that the steam engine energy of Germany alone, afloat and ashore, is not less than 3,717,264 horse power, the commercial importance of such an improvement will be readily apparent.

The Telegraph at Victoria Nyanza.

The completion of the telegraph from the Indian Ocean to Victoria Nyanza puts the world in communication with the sources of the Nile. The telegraph line has been completed as far as Ripon Falls, which is the point where the White Nile leaves the lake. The people of Lower Egypt will not be able to tell what the water conditions of the Lower Nile will be for months in advance, so that they can regulate the quantity to be taken from the Nile for irrigation purposes. Information as to the state of the water in the Upper Nile would at times be worth millions of dollars to Lower Egypt. At present despatches from Victoria Nyanza will have to be sent by steamer to be put on the cable at Zanzibar. This will, of course, delay messages for several days, but five years ago, says The New York Sun, when the building of this line and the railroad alongside of it was commenced, the shortest time in which the news from the lake could reach Europe was about four months.

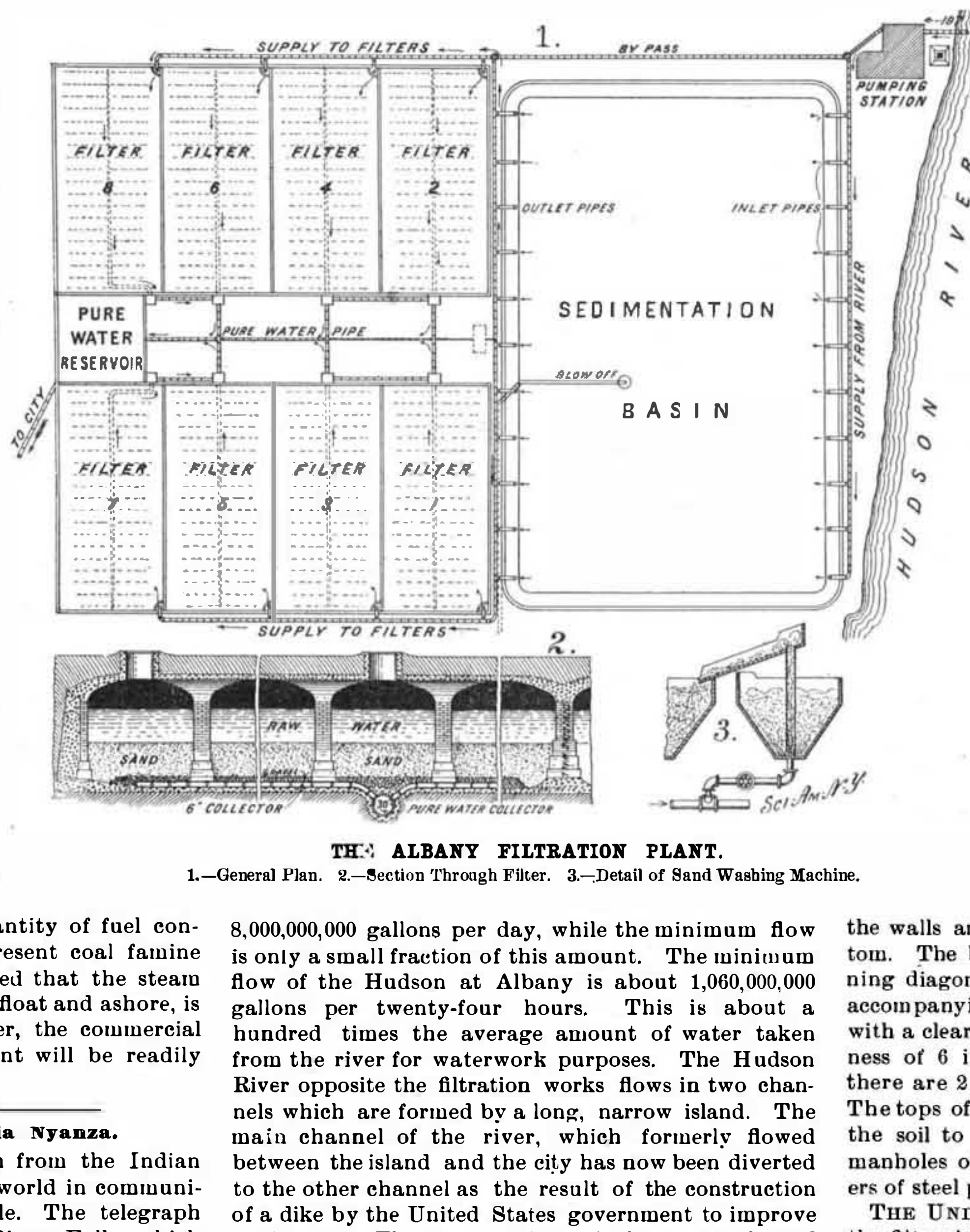
ELECTRICAL properties have been recently seriously damaged by storms. In Cleveland, Ohio, the street car lines were tied up for a day, and 8,000 telephones were put out of service and 4,000 miles of wire was down the day after the storm.

FILTRATION PLANT FOR THE ALBANY WATER SUPPLY.

The water supply of the city of Albany, which was originally obtained by gravity from certain reservoirs on small streams to the west and north of the city, was augmented in 1873 by taking water from the Hudson River through an intake in the river, opposite the heart of the city. In recent years the amount of water drawn from this source has greatly exceeded that obtained from the reservoirs above mentioned. At low water stages, owing to the tidal currents, considerable sewage is carried up-stream to the intake, and the sewage of the city was thus present in a very considerable amount in its own water supply. In addition to the local source of pollution the river received the sewage of Troy, Schenectady, Utica, Rome and many other towns further up the river. Under such conditions it is not surprising that the death rate in Albany was excessive.

As a result of the investigation by the Water Board made in 1896 by its superintendent, Mr. George I. Bailey, C.E., and by Mr. Allen Hazen, C.E., a report was presented in February, 1897, which recommended that the present intake be abandoned, a new one established at a point about two miles further up the river, clear of the local source of pollution, and a filtration plant established at that point. This important work has been carried through and forms the subject of the accompanying illustrations.

SOURCE OF SUPPLY.—The Hudson River at the point of the intake has a drainage area of 8,240 square miles, the average annual flow of the streams amounts to at least 1,000,000 gallons per square mile per day, or over



THE ALBANY FILTRATION PLANT.

1.—General Plan. 2.—Section Through Filter. 3.—Detail of Sand Washing Machine.

8,000,000,000 gallons per day, while the minimum flow is only a small fraction of this amount. The minimum flow of the Hudson at Albany is about 1,060,000,000 gallons per twenty-four hours. This is about a hundred times the average amount of water taken from the river for waterwork purposes. The Hudson River opposite the filtration works flows in two channels which are formed by a long, narrow island. The main channel of the river, which formerly flowed between the island and the city has now been diverted to the other channel as the result of the construction of a dike by the United States government to improve navigation. The investigation of the water showed that that in the back channel was considerably better than the water in the main channel, and the intake was accordingly located in the former. The intake consists of a simple concrete structure in the form of a box with an open top covered with rails placed 6 inches apart, and from the box a 36-inch pipe leads to a well in the pumping station. Before going to the pumps the water passes through a screen with bars 2 inches apart. The centrifugal pumps at the pumping station have a guaranteed capacity of 16,000,000 gallons per twenty-four hours against a lift of 18 feet or of 12,000,000 gallons per twenty-four hours against a lift of 24 feet. The pumping station building, to a point above the highest flood level, is of massive concrete construction without any openings. Upon leaving the pumping station the water passes through a 36-inch Venturi meter, which records the quantity of water pumped, and is also arranged to show on gages in the pumping station the rate of the pumping.

AERATION.—After leaving the meter the water passes to the sedimentation basin through eleven outlets, which consist of 12-inch pipes stood on end, the tops of which are 4 feet above the nominal flow line of the sedimentation basin. Each of these outlet pipes is pierced with 296 ⅜ inch holes, extending from 6 inches to 3 feet 6 inches below the top of the pipe. The area of these holes is so computed that when 11,000,000 gallons of water per day are pumped, all the water will pass through the holes, the water in the pipes rising until it is just flush with the tops. The water is thus thrown out in 3,256 small streams and becomes thoroughly aerated. When more than the above amount is pumped, the excess flows over the tops of the outlet pipes in thin sheets, which are broken up by the jets. Although no observations have been taken on the Hudson River, experience with the Merrimac at Lawrence, where the conditions are in many respects similar, shows that since the water is at all times more or less aerated, and during the greater part of the year is nearly saturated with oxygen, aeration is not necessary. During low water, in the summer season, however, there is much less oxygen in the water, and at these times aeration is a distinct advantage. Another advantage of aeration is that it tends to remove the slight odor which is liable to exist in river water.

SEDIMENTATION BASIN.—From the outlets the water falls into a large basin measuring 382½×600 feet, which is located with its longer side approximately parallel to the banks of the river. The basin has an area of 5 acres, and is 9 feet in depth. To the overflow line it has a capacity of 14,600,000 gallons, and to the flow line of the filters 8,900,000, the reserve capacity being, therefore, 5,700,000 gallons. The basin, which is close to the river bank, is built largely above the natural surface of the soil. The embankments are made of the clay obtained in excavating the filters, mixed with gravel from the river, these materials being put down in alternating layers and well rolled. The outside of the embankment is covered with soil, the inside and bottom with 16 inches of puddle, which is protected from frost on the sides by a covering of gravel, above which is a rough bluestone pavement.

The water enters the sedimentation basin from eleven inlets along one side, and is drawn out from eleven inlets directly opposite. The floor of the basin is built with even slopes from the toe of each embankment to a sump, from which a 24-inch pipe leads to a large manhole in which there is a gate through which the water can be drawn, in emptying the basin.

THE FILTERS.—The filters, which are built of masonry, are covered to protect them from the severity of the winter weather. The piers, cross-walls and linings of the outer walls, entrances, etc., are of vitrified brick, while all other masonry is concrete. The average depth of the excavation for the filters was 4 feet. The floors consist of inverted, groined, concrete arches, arranged to distribute the weight of the walls and vaulting over the whole area of the bottom. The bottoms were put in alternate squares, running diagonally with the pier lines, as shown in the accompanying illustration. The vaulting was designed with a clear span of 12 feet, a rise of 2¼ feet and thickness of 6 inches at the crown. Above the vaulting there are 2 feet of earth and soil, grassed on the top. The tops of the manholes are carried 6 inches above the soil to prevent the entrance of rain water. The manholes of the filters are provided with double covers of steel plates to exclude the cold.

THE UNDERDRAINS.—At the bottom of the floor of the filters between each line of piers, is a line of transverse 6-inch vitrified pipe collectors, laid with open joints, which connect with a main underdrain, laid beneath the floor of the filter and extending throughout its whole length, as shown in the accompanying plan. Tho main drains were put in before the construction of the filters was commenced. They are entirely surrounded with concrete. The main effluent collectors are 30-inch vitrified pipes reduced to 20-inches at the outlets.

FILTER GRAVEL.—The gravel surrounding the under drains is of three grades. A coarse grade of gravel of from 1 to 2 inches diameter is laid immediately over the 6-inch drains; the second grade which is laid immediately above it is from about ⅜ of an inch to 1 inch in diameter, while the finest gravel forms a third layer whose grains are from $\frac{3}{16}$ to ⅜ of an inch in diameter.

The coarse gravel entirely surrounds the 6-inch pipe drains and is carried slightly above their tops. The second grade fills up all the spaces on the floor to within 2½ inches of the finished surface of gravel; the finest grade being applied in a layer which is about