THE KNICKERBOCKER AVENUE EXTENSION SEWER, BROOKLYN, N. Y.

[SEE FIRST PAGE ILLUSTRATION.]

The city of Brooklyn is now building a sewer, having an area equal to that of a circle 12 feet in diameter, from the junction of Knickerbocker and Johnson Avenues, through Johnson Avenue and South 5th Street, to the East River. The necessity for the work is apparent from the fact that the present outlet sewer for this section of the city, which drains an area of about 2,800 acres, some of which is very low and flooded by every rain, is discharged upon the low lands at the head of Newtown Creek, making a nuisance greatly detrimental to public health and damaging to valuable property in the vicinity. Frequent complaints from people living near this outlet and by the Department of Health rendered the construction of a new outlet absolutely necessary.

Although there is nothing new either in the sewer itself or the duty it is designed to perform, the method of building one section of about three-quarters of a mile in length is certainly unique and interesting. Owing to the depth of the grade lines of the sewer below the street surface, in the greater portion of section one (next the river), and the danger to heavy buildings on both sides of South 5th Street, it was thought better to prosecute the work by means of tunneling rather than by open trench. Our frontispiece is composed of views showing the manner of prosecuting the work, both in the tunnel and in the open cuts.

The section of the sewer for almost its entire length is circular, 12 feet in diameter inside; and where it has been essential to alter this form, the sectional area has been made the same. The sewer is built of brick laid in cement, and the minimum thickness is 12 inches. At some points a foundation was made of transverse and longitudinal timbers, and the brick invert was reduced in thickness to 8 inches, between which and the timber was a bed of concrete. Where necessary, retaining walls, 3 feet thick at the bottom, 2 feet thick at the top, and extending a short distance above the center line of the sewer, were built. For the greater part of the tunnel section, the work passes through sand, and the sewer is a simple ring of brick. At each crossing street is a manhole, 3 feet in diameter, where it joins the arch, 2 feet in diameter at the surface, and in height varying with the depth of the sewer below the street. The outer end of the outfall is 18 feet in width and 6½ feet in height, measured from the center of the invert, the curve of which has a radius of ~~41 feet; the sides are vertical, and on~~ them rest iron I-beams, 12 inches deep, and varying in length from 20 feet at the outer end to 13 feet where the outfall sewer joins the circular one.

The general method of prosecuting the tunnel portion of the sewer has been to sink shafts at about every 700 or 800 feet, and then drive the headings each way. Fig. 1 represents the shaft on South 5th Street near 5th, which is 64 feet in depth to the bottom of the invert. The sides are held by sheet piling, and extending through the center are guides for the cage, the machinery for operating which is in the building shown at the right. A track is laid down each tunnel to the heading, as shown in Fig. 5. The cars filled with the excavated material are run to the bottom of the shaft, raised to the surface, and run to the dumping ground. Just east of 5th Street it was necessary to build a short section (Fig. 3) by open cut, and after this had been completed, the earth for filling in was obtained through the shaft shown. Fig. 2 shows the dumping car here used. The faces of the forward wheels are narrower than those of the rear ones, thereby permitting them to pass between the ends of the rails, which are inclined upward at a sharp angle, and rest in the curved parts of inner rails. The rear wheels mount the inclined rails, thus tilting the car and dumping the load.

Fig. 5 is a view looking into the heading, and Fig. 6 is a longitudinal sectional elevation of the same. The pilot tunnel here used is the invention of Mr. J. F. Anderson, and was first used upon the Hudson River tunnel; the duty it performs in its present location is precisely similar to that it performed under the river. The pilot is 5½ feet in diameter, and is made up of interchangeable flanged iron plates, bolted together. It is kept as near as possible in the center of the tunnel, and is extended some distance ahead of the finished masonry, the advance being made by removing the rear plates, carrying them forward, and bolting them to those already in place. The forward end of the pilot being in undisturbed ground, and the rear end being firmly held by radiating struts resting against the masonry, there is formed a rigid center or hub from which the work can be braced.

In the heading, the earth at the crown is removed and an iron plate inserted; this plate is bolted to the one already in, and is held by a strut against the pilot. These plates, unless the earth is very treacherous, are only carried about half way down each side. After the plates have been put in far enough, the section next the masonry is cleared, and a portion of the brickwork built.

This method of tunneling not only gives an exact idea of the nature of the material in advance of the main work, but also serves to firmly hold the sides of the excavation, preventing caving in; and where the route extends through a street lined upon each side with houses, and, as in this case, at an unusual depth below the surface, it has many advantages over the ordinary open cut. In addition, it occupies the street only at the shafts, so that travel is not much interfered with.

Fig. 4 shows an open cut portion of the work. Before beginning operations, the old sewer was removed and a new one built under each sidewalk, as a temporary measure during construction. A platform carrying the hoisting machinery extends across the trench, and is mounted upon wheels running upon tracks laid at the edge of the opening. The sides are held in the usual way by sheet piling braced by timbers extending across the opening, and which also carry the gas and water mains.

It is estimated that the total cost of the sewer—which will be finished in a short time—will be $575,000.

IMPROVED CORK ATTACHMENT.

The art of bottling liquids has attained quite large proportions as a distinct business. The machinery and appliances for driving and fastening the corks have been well studied, and brought to a considerable degree of perfection. But the reverse process, that of unbottling, has received less attention. It is usually left to the individual to struggle with the wires and a corkscrew as best he can. If the cork be of good quality, and not too tightly wedged, he succeeds fairly well; but it often happens that this is not the case, and numerous fragments of cork, perhaps the largest portion on the inside of the bottle, is pretty sure to be the result. We illustrate the cork attachments devised by Mr. John W. Hayward, of St. Johns, Newfoundland, which makes it as easy to get a cork out of a bottle as it is to drive it in. An ordinary cork, O, of the required size, has a piece of strong non-corrosive twine, 1, let into its sides. A button or shield, 5, also non-corrosive, is placed on the inner end of the cork to prevent the twine cutting through it. A hand metal tag, 2, is secured on the twine where it is knotted, or in case a capsule is placed on the end of a piece, 4, which hangs below the capsule.

HAYWARD'S IMPROVED CORK ATTACHMENT.

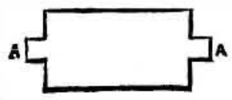
A rubber button, 3, placed on the outer end of the cork, has a hole or slit through which the twine passes. In 6 is shown the wire attached to the bottle neck, 6^1 representing the hook, and 6^2 the manner of locking it in place. 7 gives the appearance of a bottle when corked and the twine secured on the wire hooks. In 8, a capsule has been placed over the cork, and the tag is seen protruding beneath its edge. 9 shows the manner of securing the twine over the wire by stretching the elastic button, 3, and 9^1 the top view of the bottle when the operation is completed.

When the cork is being driven into the bottle, the rubber button is turned over on the twine and tag, as shown in 10, to protect them from injury. The button is then reversed, one loop of the twine passed under the wire hook on one side, and by stretching the rubber button the other loop secured on the opposite hook. The process of unbottling is shown in our last figure. The tag is grasped, and by an upward twist the capsule is torn open. The twine is disengaged from the wires, and, by passing the first and second fingers through the loop, the cork can be readily drawn. This system does away with the corkscrew entirely, each cork carrying its own means of release. It is applicable for any liquids, medicines, liquors, inks, etc., and as the corks are not injured they may be used a number of times. Mr. A. B Cohu, 197 Water Street, New York city, has the agency for this attachment.

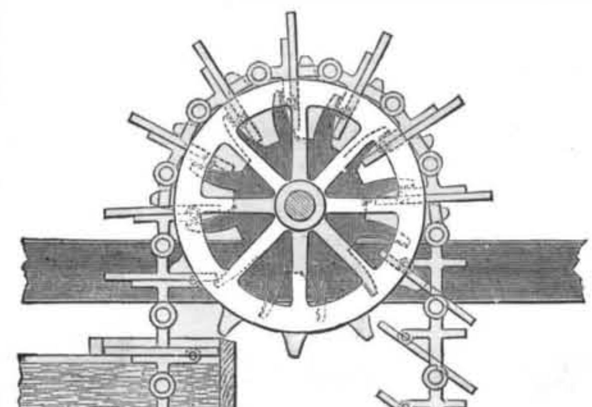
BALANCED WATER MOTOR.

At the Inventions Exhibition, London, Sealey Allin, Queen Victoria Street, shows a patent balanced float water motor, with which he claims to obtain a working efficiency of over 90 per cent. Our illustration is from the *Engineer*. It consists of a series of feathering floats, hinged to a chain which works over a pair of drums, the floats on the descending side being inclosed in a casing, so as to form a series of moving chambers, which are successively filled with water as they enter the casing.

A cross section of the casing is shown in the annexed sketch. A A are planed grooves, in which slide projecting pieces forced on each link of the chain, the clearance being limited to one-sixty-fourth of an inch. The clearance of the floats themselves can, therefore, be made very small, and the inventor states that in this way he has been able to reduce the loss from leakage to a comparatively insignificant amount.



The feathering of the floats is automatic, and is regulated by the level of the tail water; for so long as the pressure of water behind is greater than the resistance in front, the chain is pushed forward. As soon, however, as the resistance exceeds the pressure, the floats fall away from the chain, and rise nearly vertically out of the water. The power is taken off from the top drum, which is provided with specially formed teeth, which take each link of the chain as it passes over. The speed of the chain is about 180 feet per minute. Assuming that the difficulties of construction have been overcome, there seems no reason to doubt that the efficiency of such a motor as this will be much greater than that of even the best waterwheels, as a greater percentage of the fall can be utilized.



ALLIN'S WATER MOTOR.

It must not, however, be forgotten that hitherto, in the majority of cases where waterwheels have been applied, economy of water has been a secondary consideration, and there is, after all, something very fascinating in the simplicity of a waterwheel. What it may be in the future is, of course, a different matter. Probably, if any serious attempt is made to take advantage of the power to be derived from natural falls of water, or, as Mr. Allin proposes, of the rise and fall of the tide, more attention will be paid to efficiency; and if, as is stated, about 93 per cent of the actual energy can be given off in useful work, there may be a considerable field for Mr. Allin's invention.

The Colorado Oil Field.

According to the *Petroleum Age*, Mr. David Kirk, President of the McCalmont Oil Company,lately visited the oil field which is located on the plains of Florence, ten miles southeast of Canon City, on the Denver & Rio Grande Railroad. The four wells now producing are owned by three different companies, and have an aggregate production of ten barrels. They are situated on a stretch of ground about three miles in length and with its width undefined. One small well was drilled north of the better ones, but no dry holes have been found, and the extent of the territory is a matter of conjecture. The wells produce the maximum amount of oil when they are pumped by heads twice a day. When the walking beam is kept constantly wagging, the wells do not produce any more oil than when they are pumped by heads.

The best well is owned by the Arkansas Valley Oil Company. It was placed on exhibition for Mr. Kirk's benefit, and pumped five barrels per day. A well which has been shut down for a month or more will not produce any more oil when started than it would if it had been worked steadily. For some unexplained reason, the wells do not fill up. The oil comes from a shale rock about 1,200 feet below the surface. It is of a beautiful yellowish-green color, and about 30 gravity. Local representatives of the Standard Oil Company report that it will afford 40 per cent of illuminating and 12 per cent of lubricating oil. The question of transportation is a perplexing one to the oil operators beyond the "Father of Waters." The oil produced must be taken to Pueblo, 40 miles away, before fair freight rates can be obtained through competing lines. Cleveland parties are now building a refinery at Canon City, which will bring the oil produced here in competition with that brought across the plains. Mr. Blake, who represents the Standard at Denver, is authority for the statement that the States and Territories of Colorado, New Mexico, Montana, Wyoming, and Utah have a daily consumption of refined which is equivalent to 200 barrels of crude oil.

A Remarkable Drainage Enterprise.

Few people are probably aware of the great engineering undertaking, in which Russia has been engaged for years, of draining the Pinsk marshes. These are so extensive as to secure special designation on the ordinary map of Europe, being, we believe, the only case of the kind; and, in point of area, are very much larger than Ireland. Situated on the Russo-Polish confines, they have become famous in Russian history as a refuge for all manners of romantic characters, and have remained an irreclaimable wilderness in the midst of a prosperous corn-growing region up to within the last few years.

In 1870 the Russian Government first took in hand seriously the abolition of this wild expanse, which, owing to being perpetually more or less submerged and covered with a jungle growth of forest, prevented not only communication between the Russian districts on either side, but also between Russia and Austro-Germany. Consequently, a large staff of engineering officers and several thousand troops were draughted into the region, and these have been engaged upon the undertaking since. Up to the present time about 4,000,000 acres have been reclaimed, thanks to the construction of several thousand miles of ditches and of canals so broad as to be navigable for barges of several hundred tons burden. Just now the engineers are drawing up the programme for next year, which comprises the drainage of 350,000 acres by means of the construction of 120 miles of ditches and canals.

Of the 4,000,000 acres already reclaimed, 600,000 acres consisted of sheer bog, which has been converted into good meadow land; 900,000 acres of "forest tangle," which have been prepared for timber purposes by cutting down all the underwood and thinning the trees; 500,000 acres of good forest land—forest oases in the midst of the marshes—hitherto inaccessible, but which have been connected more or less by navigable canals, and thereby with the distant markets; and finally 2,000,000 acres have been thrown open to cultivation, although only 120,000 acres have been actually occupied up to now. Besides making the canals and ditches, the engineers have built 179 bridges, bored 152 wells from 40 feet to 80 feet deep, and 425 from 20 feet to 40 feet, and have made a survey of 20,000 square miles of country hitherto unmapped. When their task is finished, Russia will have effaced from the map of Europe one of the oldest and toughest bits of savage nature on the Continent, and a few years will suffice to render the Pinsk marshes undistinguishable from the rest of the cultivated region of the sources of the Dnieper. From an engineering, geological, and scientific point of view, generally, the work is one of special interest, and capable globe trotters, anxious for a novel theme, might do worse than spend a few months amidst the fading Pinsk marshes, describing the changes.—*Engineering.*

A NEW DOMESTIC MOTOR.

Our readers are already acquainted with the many efforts that have been made to devise a motor adapted to the requirements of the smaller industries. We have from time to time described such motors—run by steam, gas, hot air, or water—and we now propose to speak of one which is interesting from the problem that the inventor proposed to himself to solve, as well as from the means he took to solve it. The inventor,

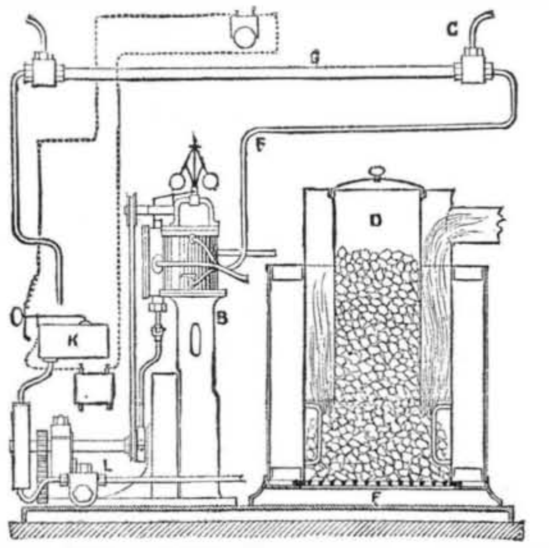


Fig. 2.—DETAILS OF THE MECHANISM.

Mr. A. Pifre, set out to construct a motor that should be capable of being used everywhere, even in the city or the village, be easy to set in motion, and keep in repair without special knowledge, and combine the simplicity of gas motors with the economy, etc., of the steam engine.

In order to solve this problem, which is one that has often attracted the attention of engineers, and is of great importance, Mr. Pifre had recourse to steam. His idea was that since the steam engine, raised to its highest power, has centralized motive power to the profit of the greatest enterprises of our epoch, it might become its province to likewise act as a domestic motor. As the chief defect of small steam engines is that they require more care and watchfulness than are demanded by large ones, M. Pifre has changed the usual mode of producing steam and converting it into work, and has devised an apparatus which is capable of running automatically for several hours without any supervision on the part of its owner. Hence the characteristic name of "Automotor" that has been bestowed upon it.

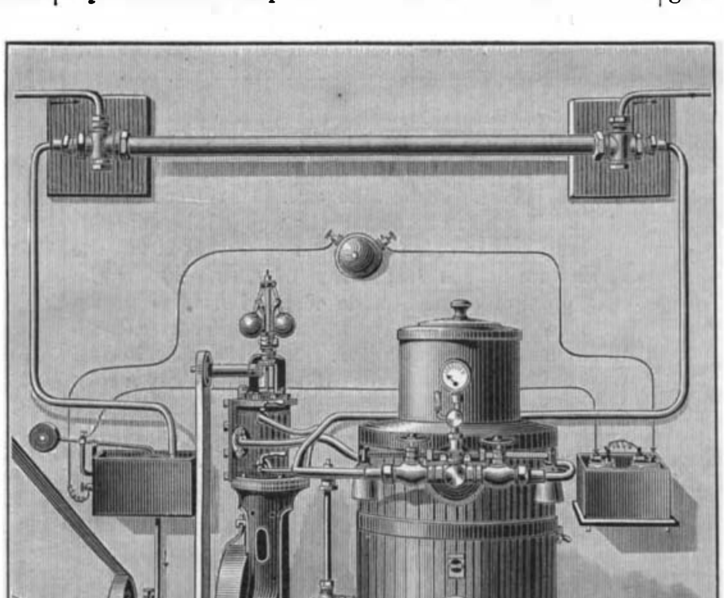


Fig. 1.—PIFRE'S DOMESTIC MOTOR.

The generator and motor are united upon the same base, and the condenser is located wherever most convenient.

The generator, A (Fig. 2), has some resemblance to a hot air stove, but one that has been changed internally in such a way as to produce an abundance of steam. The fire is lighted at the base of a central cylinder, D, which is afterward filled up to the top with fuel. The combustion proceeds upon the grate, E, at the base of the cylinder, and is absolutely constant so long as any coke remains. Fuel is put in at distant intervals to make up for what has been burned. This suffices to render the production of steam constant and regular, without any of those disturbances that take place in the usual boilers of small size. The intensity of the fire is regulated through the door of the ashbox and the damper in the chimney.

The motor, B, is of the vertical type. Its cylinder, its piston, and its valves operate without ever being lubricated with any fatty matter. As for the condenser, C, that consists of a pipe, G, that surrounds the escape pipe, F, to a certain distance, and permits of the circulation of cold water around it.

The steam produced in the generator passes into the cylinder, and, after moving the piston therein, escapes through the pipe, F, is condensed in the pipe, G, and falls in the form of water into the small reservoir, K. From this latter the distilled water is taken up by the feed pump, L, and introduced again, well aerated and free from grease, into the generator, A, whose level remains constant. This constancy in the level of the water and the automatic feeding of fuel in the furnace are characteristic traits of this new motor, the surveillance of which is thus reduced to it simplest limits.

The automotor shown in Fig. 1 is the smallest size that Mr. Pifre constructs. It is of one-quarter horse power, weighs 770 pounds, and occupies a space of but 3¼ x 2 feet. Its height is 2¼ feet. Notwithstanding its small dimensions, it is provided with all those safety apparatus that are found in large engines. The small reservoir for condensed steam is surmounted by an electric telltale, which makes itself heard whenever anything wrong occurs.

Aside from the applications already made by Mr. Pifre in various Parisian industries, one of these little motors has recently been very ingeniously applied to the running of a steam launch twenty feet in length, which it takes but one man to maneuver.—*La Nature.*

The Miller Process for Refining Gold and Silver.

Mr. G. W. Griffin, U. S. Consul, Sydney, N. S.W., says: This process was discovered in 1868 by Mr. F. Boyer Miller, then one of the assayers to the Sydney mint and now superintendent of the bullion office in the Melbourne branch. It was introduced on a practical scale in 1869, when over 200,000 ounces were treated; since then it has been applied to the whole of the gold brought to the Sydney mint for coinage, with the exception of such small quantities as had been previously refined. The total weight operated on at the Sydney mint has amounted to more than 6,600,000 ounces (or 20 tons), and the value of the silver extracted and sold to $875,000, of which $200,000 have been paid over as revenue, and the remainder to the owners of the gold. The average assay of the refined gold, which in 1869 was 0·9931, is now 0·9965. These results have been obtained with comparatively little expense, while the introduction of the process has been in many ways of the greatest advantage to the successful working of the mint.

The chlorine process has also been in use at the Melbourne branch since its opening in 1872 and over 7,000,000 ounces of gold have been refined with the same satisfactory results.

Mr. Miller stated in his application for a patent that his invention has for its object the toughening of brittle gold bullion and the refining of alloyed gold, whether naturally or artificially alloyed, together with the separation of any silver it may contain. The operations requisite may be performed on the sole of a reverberatory or other furnace or in retorts made of some refractory material, or, as the inventor prefers, in good clay crucibles.

The crucibles are prepared by dipping them in a strong solution of borax in hot water, and subsequently drying them. In these the gold to be operated on is melted in the ordinary manner, with the addition of one-half of 1 per cent of fused borax, a well fitting cover having first been luted over the mouth of each crucible employed. In this cover are one or more holes to allow of the introduction of a tube or tubes constructed of some suitable refractory material, such as fire-clay, descending to the bottom of the crucible, and through which chlorine gas or hydrochloric acid gas is forced while the gold is still in a melted state. After the chlorine gas or hydrochloric acid gas has been thus passed through the melted gold for a sufficient time, which necessarily varies according to the quantity and quality of the gold operated on, the silver and baser metals are converted into chlorides, and rise to the surface of the refined gold. The more volatile chlorides partially escape, and the remainder is easily removed by pouring the entire contents of the crucible into the moulds and taking out the cake of chloride as soon as cold, or by allowing the gold to cool sufficiently to set or become solid, but not to become so cold as to prevent the more fusible chlorides from being poured off, to be subsequently reduced to the metallic state by any of the well known methods.

A BOILER has been constructed in France in which the metallic surface exposed to fire does not touch the water.