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## THE IMPROVEMENT OF NEW YORK HARBOR.

One of the most important operations ever conducted by the United States government, from a commercial point of view, is now in process of execution. We allude to the improvement of the channels leading up to New York City from the ocean. In his recent message to the Board of Aldermen, Mayor Hewitt alludes to this work briefly, emphasizing its great importance to the residents of this city. With the increased length and depth of ocean steamers, it has become very evident during the last few years that something must be done, unless commerce is to be diverted from New York, or, at least, its expansion modified by the restricted depths and widths of the channels. While the question of depth affects the construction of the vessels directly, the narrowness of the channels has rendered necessary quick turning, so that the long type of vessels now in greatest favor for ocean navigation have found great difficulty in getting in and out of the harbor. They have been obliged to arrange their periods of starting by the tide, and very frequently are forced to wait outside of the bar until high water, if they reach it at any other than that period. It has been obvious for many years that some improvement was required, and little prescience was required to see that the necessity for such improvement was increasing in importance.

In 1884, an appropriation of $200,000 was made by Congress under the River and Harbor bill, to be devoted to "the improvement of Gedney's channel, New York harbor." In order to work intelligently

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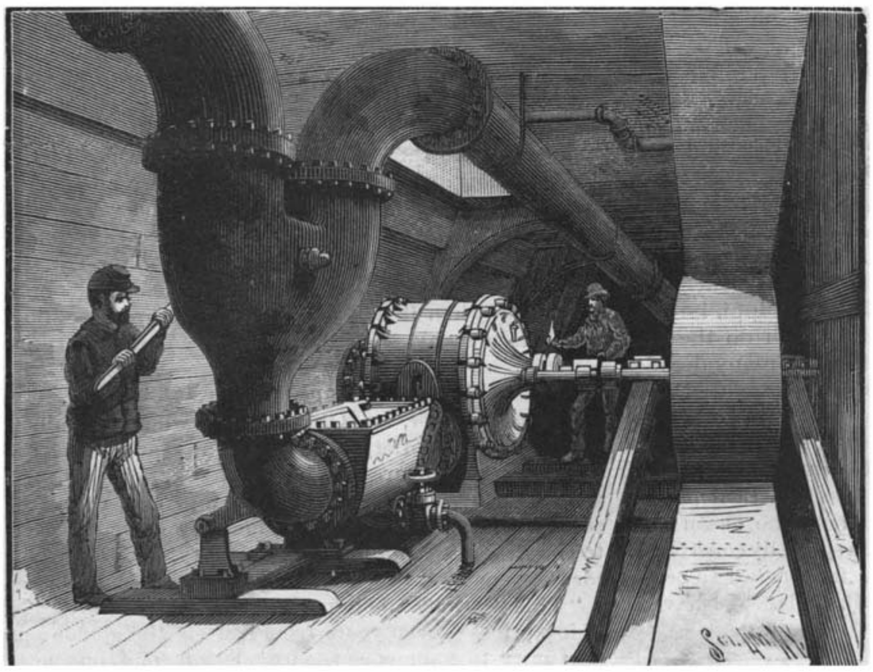
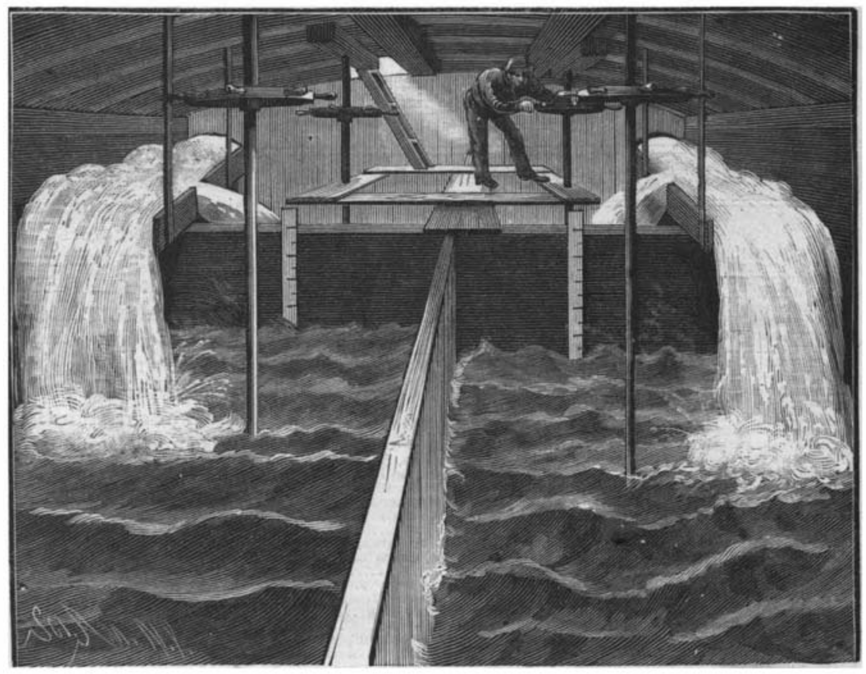
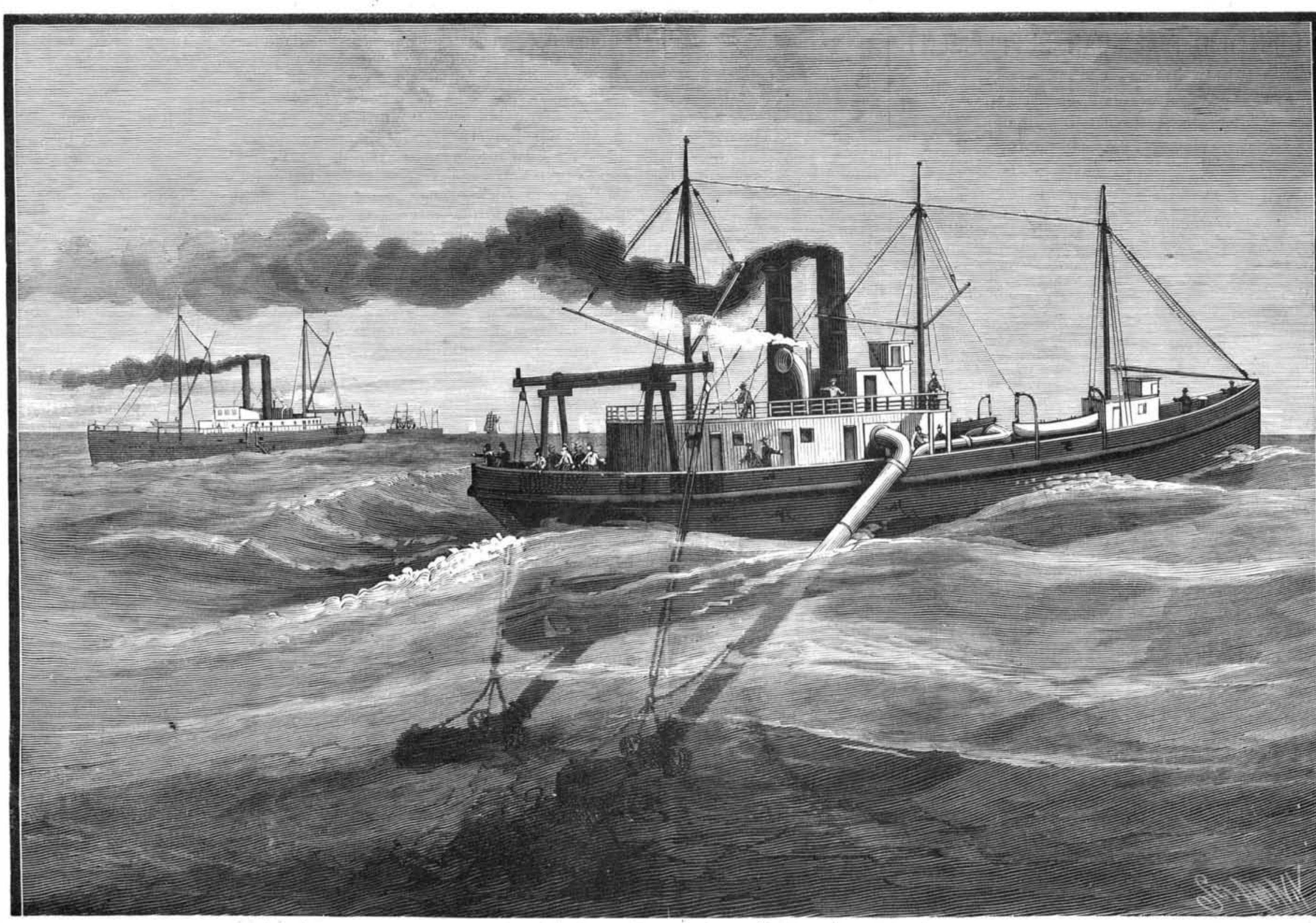


CENTRIFUGAL PUMPS AND CONNECTIONS.



THE TANKS AND DISTRIBUTING SYSTEM IN THE HOLD OF THE DREDGING VESSEL.



DREDGING VESSEL AT WORK DEEPENING THE CHANNEL IN NEW YORK HARBOR.

**THE IMPROVEMENT OF NEW YORK HARBOR.**

(*Continued from first page.*)

on so complicated a problem, Col. G. L. Gillespie, of the United States corps of engineers, then in charge of the New York district, was directed to make a survey of the whole harbor of New York. This was done by order of the Secretary of War through the chief of engineers.

The survey was commenced in August and completed in December, 1884, and reflects great credit on Colonel Gillespie, as well from its thoroughness as from the short space of time in which it was done. Soundings were taken by lead line from a tug boat which was kept in constant motion over the ground. Every half minute a sounding was taken and recorded, and every second sounding was located by sextant observations referred to fixed points on shore, whose geographical positions had been determined with great accuracy. With regard to the exactness of this method as compared with rod soundings, comparative tests have been made where part of the ground has been gone over by both, and it has been found that the rod soundings show a less depth than the line soundings by an average of six inches. A fourteen pound lead was used, and the line was compared at frequent intervals with a steel tape in order to verify its accuracy, and when not in use was kept lying in fresh sea water. The object of the survey was not only to determine just what was to be done to improve the harbor to the greatest advantage, but it was also designed to ascertain whether any shoaling of the channels had taken place.

The results obtained in this 1884 survey were compared with the first accurate coast survey made in 1835, nearly fifty years before, and no shoaling whatever during this period of years was shown, and it was proved that a 23 foot channel had been maintained by the natural scour of the ebb tide.

It was not certain, however, that a greater depth could be maintained, and therefore Colonel Gillespie, while advocating dredging the channels to a depth of 30 feet at mean low water, with a width of 1,000 feet, stated that in all probability the only way to maintain a 30 foot depth would be to contract the tidal prism by means of a dike starting from Coney Island and running toward Sandy Hook in a general southwesterly direction, on the ground that the contraction of the tidal prism would increase the ebb scour.

Colonel Gillespie's report was referred to the board of engineers for fortifications and rivers and harbors, who generally concurred in Colonel Gillespie's plan. It was proposed to leave an opening in the dike for the Coney Island channel, which is, to a large extent, used by the Coney Island and Rockaway steamboats and by oyster smacks and other small vessels from the Great South Bay and other points on the shore of Long Island. Such a dike would close the 14 foot and East channels. But these two are avenues of comparatively little importance, and their closing would be fully justified were the Main channel and Swash channel thereby benefited.

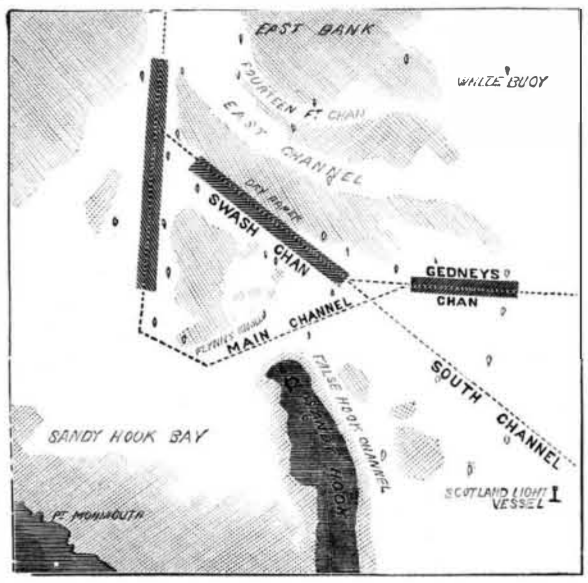
Estimates were made of the expense of improving Gedney's and the Main Ship channel, placing it at about $1,000,000; but as this did not allow for the increase of 30 per cent due to scow measurement of dredgings, because it referred to material in place, the total cost of this estimate rises to $1,370,000.

As the act appropriating the $200,000 specifically stated that it should be applied to Gedney's channel, bids were asked for to do the work there, and it was commenced by hydraulic excavators, with large centrifugal pumps, which raised the material from the bottom. These excavators were not self-propelling. A tug boat was used to tow them up and down the channel. By their use a general increase of two feet in depth over a width of 1,000 feet was obtained. Before this first appropriation was exhausted, a new appropriation of $750,000 for general improvement of New York harbor was voted, August 6, 1886. The matter of the expenditure was referred to the board of engineers, who decided to apply the appropriation to dredging only, as it was not thought that the dike was needed, for the present at least, as in any event the channels would have to be deepened.

We illustrate the apparatus now in use by the Joseph Edwards Dredging Company, who are the sole contractors under this appropriation. Their fleet of vessels comprises three propellers, each fitted with two Edwards centrifugal pumps and two dredging scoops connected by pipes with the pumps. Each vessel is divided by bulkheads into tanks for the reception of the dredged material. In the bottom of each of the tanks are valves, worked by horizontal valve wheels. By proper conduits the dredged material can be delivered to any one of the tanks, according to the way in which the chutes are set.

The estimated capacity of the plants per working day are: No. 1, 2,000 cubic yards; No. 2, 1,500 ditto; No. 3, 3,000 ditto; giving a total capacity of 6,500 cubic yards. All the material is taken outside of Scotland Lightship and dumped at a distance of about 8 miles from the Main Ship channel and 5 miles from Gedney's channel, in not less than 14 fathoms of water.

The general operation is as follows: The scoop is dropped down to the bottom, on which it runs upon wheels. The pipe which connects it to its pump is of steel, containing a ball and socket joint and including also a short length of heavy India rubber pipe re-enforced with steel bands, in order to prevent breakage when the vessel is rolling or pitching in a seaway. By means of a steam jet connected with the top of the centrifugal pump, a vacuum is produced within the pump and pipe, under the effects of which vacuum water rises through the pipes until the pump chamber is completely filled. Then, on starting the pump and opening the outlet valve hitherto closed, it at once

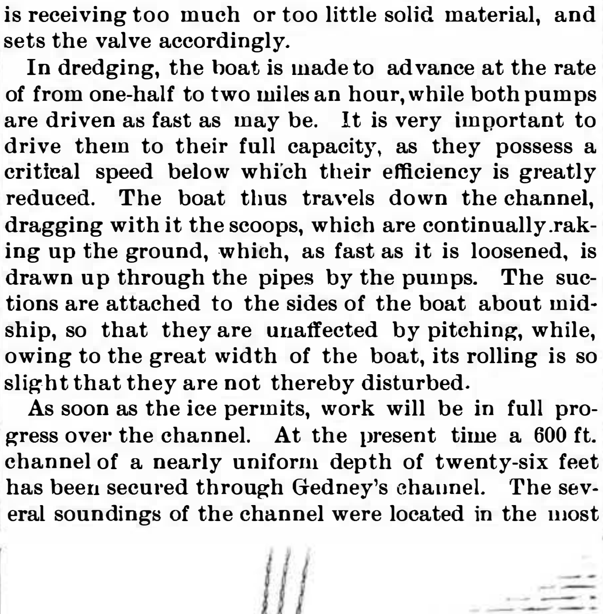



**CHANNELS OF NEW YORK BAY.**

begins to draw up material. At the upper surface of the scoop, a foot or so above the bottom of the water, a water valve is arranged which may be opened or closed by means of a small rope or lanyard. This is done from the deck of the propeller, and regulates the proportions of water and solid material. The operative can tell by the sound of the pump whether it is receiving too much or too little solid material, and sets the valve accordingly.

In dredging, the boat is made to advance at the rate of from one-half to two miles an hour, while both pumps are driven as fast as may be. It is very important to drive them to their full capacity, as they possess a critical speed below which their efficiency is greatly reduced. The boat thus travels down the channel, dragging with it the scoops, which are continually raking up the ground, which, as fast as it is loosened, is drawn up through the pipes by the pumps. The suctions are attached to the sides of the boat about midship, so that they are unaffected by pitching, while, owing to the great width of the boat, its rolling is so slight that they are not thereby disturbed.

As soon as the ice permits, work will be in full progress over the channel. At the present time a 600 ft. channel of a nearly uniform depth of twenty-six feet has been secured through Gedney's channel. The several soundings of the channel were located in the most



**DREDGING SCOOP AND SUCTION PIPE.**

accurate possible manner. Tripods, or other fixed stands, were erected in the water on one side of the survey, on which platforms were mounted. Upon these transits were placed, with attendant engineers. A boat was then allowed to drift down the channel within a given range, with the tide, and soundings were taken from her stern with a pole terminating in a flat plate of iron, to prevent penetration of the bottom.

As each sounding was taken the signal was given and the spot was located by transit observations. The geographical position of each of the tripods (or transit stations) had been accurately located beforehand, which eliminated any possibility of error.

This survey was executed during the past fall, and is a monument of hydrography. It is proposed, in spring, to execute a second survey of similar character, in order to ascertain whether any change has occurred during the winter storms. A survey made at the close of the work, in December, 1886, and another made before work commenced, in the summer of 1887, showed that, instead of shoaling, Gedney's channel had slightly deepened during the winter.

As the work is now being executed, there is every promise that in a short time the harbor of New York, as regards approaches, will be excelled by no harbor on the Atlantic coast, as it is excelled by none in the world in the anchorage and shelter it affords vessels when they have once entered it.

Up to the end of 1885 this work was in charge of Colonel Gillespie, corps of engineers, who is now stationed in Boston, and who was succeeded by Colonel Walter McFarland, corps of engineers, who is at present in charge.

**Steel Pipes.**

According to the Chicago *Tribune*, the piping for natural gas to that city will be made as follows:

A mild steel disk of the required size is folded under heat by several applications of specially designed machinery into the structure of the steel, and made proof againt rust, even muriatic acid producing no effect upon the metal. It is then drawn cold over mandrels, which has the effect of producing the form of a tube. It is then put upon a mandrel and rolled to any desired length. It is next cleaned with acids and treated to a preparation of tin, inside and out, which permeates its thickness and increases its tensile strength 25 per cent. The result is very similar to that reached in steel wire.

An idea of the strength and temper of the metal so treated may be gained from the fact that receivers have been produced under this process whose thickness is 41-1000 of an inch and whose bursting pressure is 600 pounds to the square inch. The comparative cheapness of the process is shown by the following figures:

A twelve inch steel piping, whose bursting pressure is one thousand and one hundred pounds, can be sold at a handsome profit for $74.67 per hundred feet, while the cost of wrought iron and cast iron piping of much less bursting pressure is $211.25 and $150 respectively. Another interesting comparison is as follows: Twenty miles of twenty-four inch seamless steel piping one-eighth of an inch thick will weigh three million pounds. The same piping, if it could be made of welded iron—as a matter of fact it cannot—would weigh 12,600,000 pounds. The same piping made of cast iron will weigh 26,755,000 pounds. In each case the bursting pressure of the steel is nearly twice that of the iron, and in addition a glass surface and a "positive" (non-leaking) piping is warranted. The piping will be made in all sizes, from thirty-six inches in diameter, and even larger if required, to the smallest used, and will probably be in lengths of twenty feet.

**Little Things that Kill.**

At various times the newspapers have warned the public against swallowing the seeds of grapes, oranges, etc., because of the danger of such substances getting into a small intestinal bag, or cul-de-sac, called by doctors the *appendix vermiformis*. This is a receptacle formed at the junction of the large and small intestines, but its use or object no physician knows. It has been thought to be a rudimentary or incomplete formation—or possibly some meaningless survival of a lost anterior type. At any rate, its existence, while presenting no apparent "reason for being," as the French say, is, on the other hand, a positive and constant source of danger, because of the liability of its becoming the receptacle of some undigested seed or other indigestible substance. In that case it produces a state of inflammation, which, in nearly all cases, proves fatal. Fortunately, but few seeds among the great number so heedlessly swallowed seem to get into this little death trap—although any one seems likely to lodge there. Perhaps more cases of inflammation of the bowels than the doctors suspect may be, in reality, due to this obscure and disregarded cause. One sad case which to-day produces a feeling of deep regret among thousands, and which plunges a family into overwhelming grief, occurred in this city recently, in the lamented death of J. Robert Dwyer, the much esteemed adjutant of the governor's foot guard—a man whose place that corps cannot make good. His case so baffled the physicians that an autopsy was had, and that revealed a piece of peanut shell in the *appendix vermiformis.—Hartford Times.*

THE annual statement of the Ætna Life Insurance Company, which appears in another column, is a strong financial exhibit. In every department of its business the Ætna makes a gain. In surplus, $77,753.04; in assets, $1,074,746.99; in new business, $1,352,456; and in insurance in force, $5,109,365. The Ætna's new business annually exceeds that of any other life insurance company located in the New England States.

### The Electrical Sewage Process.

Much attention is being drawn to a process devised by Mr. Webster for purifying sewage by means of electric action. This scheme is not, as we have heard it asserted, of "an entirely novel character." As far back as 1858 Mr. J. Chisholm obtained a patent for treating sewage by means of electricity, and described eight methods for effecting his object. Mr. C. F. Kirkman, in 1870 (No. 2,653), claimed an arrangement by which a continuous current of electricity is made to pass through the sewage. In 1873 Mr. F. H. Atkins (No. 556) applies "galvanic, magnetic, or electric action to . . . tanks, for the purpose of precipitating organic or inorganic matters in suspension or solution." Mr. E. H. C. Monckton, in 1874 (No. 265), passes sewage through electrified channels, and uses windmills as a power to generate electricity for purifying sewage. Finally, Mr. F. Herbert, in 1883 (No. 5,850), proposes an electrolytic process for the treatment of sewage, dispensing with chemicals and filter beds; and M. Hermite, the inventor of the electric bleaching process, has also quite recently proposed a method of treating sewage electrolytically. But though the general idea of the process is thus by no means novel, it is perfectly possible that Mr. Webster may have introduced some improvement which renders his process both legally valid and practically useful. On these points it is our duty to suspend judgment until fuller and more precise information is laid before the public. The inventor uses no chemicals save such as are created in the water by the action of the current upon the electrodes and upon the sewage itself. The quantity of precipitating matter thus created will not, it is said, exceed 1 grain per gallon. This is a very small amount, since, according to the scheme which the Metropolitan Board of Works propose to apply, 3½ grains of lime and 1 grain of copperas are to be used per gallon, and this is considered by practical men a very small dose. One great point in Mr. Webster's favor is that he does not introduce lime, and that his effluent water will probably therefore be free from the dangerous quality of alkalinity. The nature of the precipitants generated will of course depend on the metals of which the electrodes are composed. If these consist, as is probable, either of zinc, tin, lead, iron, copper, or aluminum (?), the precipitant must be a salt of one or other of these metals. Salts of tin and zinc are, of course, inadmissible in sewage treatment on account of their highly poisonous nature. Metallic aluminum is, we fear, as yet too costly. The choice then seems to lie between iron and copper. Now, it seems to us that a pound of iron in the shape of copperas can be bought more cheaply than a pound of iron first brought into the metallic state and then redissolved by the action of the electric current. That in Mr. Webster's process the precipitate will be buoyed to the top by the hydrogen gas resulting from the decomposition of the water is a matter of course.

We are by no means surprised that the suspended matters are said to be precipitated by the electric current just as are carbonaceous and metallic particles in air.

As regards the working cost, experiments made on the small scale seldom furnish a correct basis for calculating the cost when it comes to actual practice. Mr. Webster will have the advantage of competing with one of the most anti-economical schemes ever projected. If his deposit is useful as manure, London may at least be saved the crowning extravagance and waste of conveying manurial matters away and casting them, not upon the land, but into the sea to poison the fishes.—*Electrical Review.*

### Light from Incandescent Bodies.

Referring to the above subject in a recent number, the *Revue Scientifique* pointed out that although it is generally admitted that when a solid body is heated it begins, at about 525° C., to emit red rays, to which are successively added radiations more and more refrangible as the temperature increases, the investigations of M. Weber have led to different results. By observing, in an absolutely dark room, either an incandescent lamp, excited by a current of gradually increasing intensity, or plates of different metals heated by a properly adjusted Bunsen burner, he found that the emission of light begins at a temperature much below that above mentioned, with the production of very pale gray rays, the refrangibility of which is equal to that of the yellow and greenish-yellow rays of the central spectrum. As the temperature rises, the light emitted grows yellow, and gives in the spectroscope a wide gray band, whose center is tinged with grayish yellow. At low red, a narrow red line appears at one side of this band; and almost at the same time a green band, large and of slight intensity, appears at the other side. The temperature still rising, the spectrum spreads both toward the red and green ends; and M. Weber further ascertained, by means of a thermometric element soldered to the plates, that the first traces of gray light are emitted at a temperature varying with the nature of the plate—about 396° C. for platinum and about 377° C. for iron.

### A Two Foot Gauge Railroad.

An interesting account of the Bridgton & Saco Railway, one of Maine's two foot gauge roads, is given in the Boston *Transcript* by Chas. O. Stickney. He says that South American railway projectors have lately been examining the road with a view to using the idea in their work. From this account we take the following: The origin of the two foot road is of recent date. Its inventor, Mr. George E. Mansfield, of Boston, only a few years ago first demonstrated its feasibility by a ten inch gauge road, a little over one-eighth of a mile long, in Hyde Park, Mass., adown whose straight sections and sharp curves, on a little open car, run simply by gravitation, which "that crank Mansfield," as he was then termed, safely carried members of the legislature, of the press, and other representative men. Next, the Bedford & Billerica two foot road, eighteen miles long, the charter for which was obtained after a protracted struggle, which proved the entire practicability of the theory. For business reasons purely, in a year or two, the rails and rolling stock were sold to the Sandy River Railroad Company, in Maine, where they are successfully used to-day.

As our narrow gauge road, the Bridgton & Saco River, which taps the Portland & Ogdensburg (standard gauge) at Hiram, sixteen miles west of Bridgton and forty miles west of Portland, is a representative, and one of the best representatives, of its kind, I will take it for illustration. The general reader, as well as railroad men, will readily note its unique, curious, and interesting features.

The road was built in the summer of 1882 and the winter of 1882-83. That winter was notable as one of the most severe on record, the mercury for weeks at a time registering from 5 deg. to 25 deg. below zero, and the snow being deep; which, with the then high price of materials, made the expense much more than it would cost to build the same road at the present time. The exact length of the road is 15·9 miles, independent of sidings. The cost of construction was $169,395; of equipment, $26,473; total cost, $195,868. The same kind of steel rails can now be bought from 30 to 35 per cent less, and other materials are cheaper; so that what then cost about $1,000 per mile to construct could now be done for $700. The rails are of steel, Cawbridge pattern, are 30 feet long, and weigh 30 pounds to the yard. Number of ties used per mile, 2,640. There are two engines—built at the Hinkley Locomotive Works, Boston—each weighing 26,000 pounds, with driving wheels 30 inches in diameter; and their power, considering their small size and weight, is simply surprising, as is shown by the way they conquer steep grades with heavy loads, and force their way with plows through deep snows and huge drifts, by which they are seldom long detained. The two passenger cars (built at the Laconia Car Works, New Hampshire) are each 45 by 6½ feet. Each seats thirty passengers—one person to a seat, there being two rows of seats—is finished in solid mahogany, and nicely upholstered. Between the floorings of each car mineral wool three inches deep renders them fire proof, prevents any cold air from passing, and deadens the noise. These cars are run with little jar or noise on 18 inch wheels, are equipped with the Miller platform and vacuum brakes, are elegant, cozy, pleasant, comfortable, in short, are every way satisfactory, and compare favorably with their more pretentious brethren. The freight cars, some twenty in number, are 26 by 6½ feet, and carry ordinarily a burden of eight tons, although having a capacity of twelve tons. There are also a baggage-mail-express car, a combination car, three hand and three push cars, and a snow plow. Adopting the truism that the best is the cheapest, the company, while avoiding any hint of extravagance, made comfort, utility, durability, and safety a *sine qua non.* All the trains are mixed. They ordinarily take one hour to accomplish the sixteen miles of road, but have been run that distance in thirty-six minutes. The amount of coal required for the round trip—thirty-two miles—is 500 pounds. The heaviest grade (200 feet to the mile) is near the Hiram terminus, and is on a half mile 20 degree curve. There is another curve of 18 degrees, one of 16, one of 12, one of 11, four of 10 each, and a considerable number of less degree.

The aforesaid Central and South American inspection parties learned some, to them, surprising facts in their 40 minutes' ride from Hiram to Bridgton. They learned that the little 26,000 lb. locomotive could draw a well loaded train up a grade 200 ft. to the mile; that it could easily round a 20 deg. curve; that the seeming recklessness of attempting to run a train on rails only two feet apart proved a thoroughly safe performance, so far as any danger of a tip over was concerned, on account of the nearness of the cars to the ground and consequent lowering of the center of gravity; and that the three essentials of safety, speed, and comfort were abundantly secured. A striking test of the capability of the system was made. The visitors were disembarked at the beginning of the 16 deg. curve, and, despite their fears and misgiving when Mansfield, who chaperoned the party, told them the train should round that sharp arc at a speed of 25 miles an hour, the thing was done before their very eyes. No wonder that the optics of Senor Ruiz (Ecuadorian consul at New York and son-in-law of the president of the republic of Ecuador) and those of his fellow travelers dilated with astonishment.

From the report of Treasurer Burnham, of the Bridgton & Saco Railroad, we learn that the total cost of running and maintaining the road for the first year, including taxes, repairs, insurance, salaries, damage and waste, office expenses and all the incidentals, was only $15,248.31. Passengers carried, 12,355; passenger mileage, 173,835. Freight carried, tons, 6,962; freight mileage, 92,926. And the road could easily do double this amount of business at hardly any increase of expense. For further information, letters addressed to J. A. Bennett, superintendent Bridgton & Saco Railroad, Bridgton, Me., will be cheerfully answered.

Our road was built five years ago, and in all this time not a passenger has been injured, not an engine nor car overturned or derailed, not a smash-up of any kind. What better record could be had?

There are four other 2 ft. gauge roads in Maine, the Sandy River, the Monson, the Franklin & Megantic, and another whose name I cannot now recall, varying from 15 to 18 miles in length.

A few words, in conclusion, in regard to the two roads to be built in the southern part of this continent, the possible adoption by which of the plan of the little 2 ft. road away down East drew these emissaries from the South hither. The Central American road is to be built by the Honduras North Coast Railway and Improvement Company, whose president, S. B. McCarnico, lately inspected our road, and will connect the port of Truxillo with Puerto Cortez, in the republic of Honduras, 115 miles long, for the development of the trade in tropical fruits and vegetables, native woods, medicinal plants, minerals, etc., in which that region abounds. The route of the South American road is 110 miles long, and extends from San Lorenzo Bay to Isbarra, about 40 miles from the city of Quito, in Ecuador, the city being the capital of the republic, with a population of 90,000, and located at an elevation of nearly 8,000 ft. above sea level among the Andes mountains. It is the intention to complete the road to Quito, in time, the name of the road being the Pacific & Quito Railway. There is not a railway in the country, most of the traffic being done on the backs of mules, and it is proposed to build this line to help the trade of that country with America.

### Waste.

The complete erasure of the word "waste" from the dictionaries, at all events in so far as it has any relation to industrial products, is, if not quite an accomplished fact, undoubtedly becoming more and more imminent; and we may thank the chemists of this generation for teaching us how to recover and utilize innumerable substances which, in their ignorance, our grandfathers threw away. Thirty years ago the manufacturers of iron, gas, and chemicals everywhere neglected all but the prime objects of their industries, whereas to-day, on the system of taking care of the pennies and allowing the pounds to take care of themselves, competition has induced us to regard our legionary by-products as so many integral parts or branches of each enterprise. If the intelligent men who have "gone before," and who were looked upon by their contemporaries as wise in their generation, could by any chance reappear among us, we might conduct them to our gas works, and with a certain pride explain the origin of our sulphate of ammonia, our aniline dyes, and our hundred other extracts from coal tar. From the contemplation of gas we would turn with them to some of our smelters and furnaces, and point to the mineral wool, the cement, the glassware, the pottery, the fire bricks, and the fertilizer, all derived from our furnace slag; and finally, entering a great chemical works, we should show them how the once devastating gases, so fatal to life and vegetation, are no longer sent free into the air, but are condensed and transformed into staple articles of trade, and how by an ingenious and, to them, undreamed of process we extract the precious metals from our exhausted sulphur ores. To their wondering question, "How can these things be?" we might reply that all these marvels result from a modern and enlightened policy, which, in many countries, has fostered every species of research in every branch of science, encouraged great minds to ponder over and gradually unravel the mysteries of nature, and stimulated a general thirsting for that knowledge which, properly applied, must ever ameliorate our condition in this "vale of tears."—*The Age of Steel.*

### House Poison.

If the condensed breath collected on the cool window panes of a room where a number of persons have been assembled be burned, a smell as of singed hair will show the presence of organic matter; and if the condensed breath be allowed to remain on the windows for a few days, it will be found, on examination by a microscope, that it is alive with animalcules. The inhalation of air containing such putrescent matter causes untold complaints which might be avoided by circulation of fresh air.—*Philadelphia Bulletin.*