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IMPROVED FILTERS.

In our issue of January 7, 1882, we gave an illustrated description of the "Multifold Filter," manufactured by the Newark Filtering Company. That filter was composed of several superposed compartments, the sand in which was washed by means of traveling jets of water.

The plan of washing is the invention of Mr. P. Clark, of Rahway, N. J., while the multifold construction of the filter was invented by Mr. J. W. Hyatt, of Newark. The multifold jet washer filter was a very excellent filtering device, and very likely no change in the system of filtering would have been adopted by this company had it not been for the inventive activity of Mr. J. W. Hyatt, the president of the company. The results of his invention in this direction are seen in three styles of filters here illustrated, and which are styled the Hyatt filters.

In these machines the movement of the water through the filter and the means of removing the impurities arrested by the filtering medium are striking and novel.

While these filters are adapted to the use of animal charcoal, wood charcoal, and various other filtering materials, there are very few cases where anything like the quantity and quality of water can be filtered by these substances so efficiently and economically as by the use of suitable sand. Where sand can always be kept clean and without waste, as can be done in the Hyatt filters, it is the most effective and at the same time least expensive of all filtering substances for purifying large quantities of water.

The economy of sand for filtering is shown, for instance, by the fact that the sand in a filter containing 50 bushels costs but a mere trifle, while 50 bushels of animal charcoal would cost about $150. The sand will last for many years without deterioration, while the charcoal, which while fresh, is excellent for decolorizing water, will become unfit for use in two or three months.

We shall therefore speak in this article of sand as the filtering agent employed.

The Hyatt filter No. 1 is especially adapted to houses, small steam boilers, laundries, etc., and wherever the quantity of water to be filtered is supplied through a ⅝ inch pipe under a pressure of five or six atmospheres, or less. Its operation is as follows: The water is admitted by the compound cock, A, and passes through the valve, B, into the sand. The course of the water, during the operation of filtering, is indicated by the arrows shown in the cut. A portion of the water passes upward from the valve, B, entirely through the sand by the side of the filter to the top, and then descends to the discharge pipes. Other portions traverse the sand from the side at various heights, between the top and bottom, and all escaping through the perforated discharge tubes, C, D. The upward current of water entering from the valve, B, loosens up the sand and keeps it in a state of mild ebullition for a distance laterally something less than one-fourth of the diameter of the filter. The sand is loosened the most and has the greatest motion next to the side of the filter, while further away it gradually moves slower, and becomes closer as the distance increases from the side, until motion ceases, and the sand compacts together more and more by the pressure of the water passing through. By this plan, in the first part of the filtering operation, the coarsest impurities in the water are retained in a distributed condition by the portion of sand which is in a loosely moving state; the next finer impurities are arrested a little further away, where, the current of water being slower, the sand is not so much disturbed; finer particles again are stopped further away by the still denser sand; and so the process goes on by gradations, till the water comes into sand which is motionless and compact. In this compact sand, adjacent to the outlet, the fine and last remaining impurities are obstructed, and pure water passes through the tubes, C, D, into the outlet pipe, E.

This description applies to each of the three varieties of Hyatt filters here shown. It permits a larger amount of water to be filtered by a given quantity of sand than is possible where the silt and impurities are permitted to accumulate in a dense stratum upon the motionless surface of a filter bed. At the same time the sand is in condition to be more easily cleansed, the impurities being loosely distributed among the particles of sand instead of adhering together in a more or less tenacious mass.

The filtering process having thus been explained, the method of cleansing the sand from the accumulated impurities will be described. As a rule the sand in a filter should be thoroughly washed at least once a day, although this depends upon the character and amount of impurities which the water contains. In warm weather, especially, cleansing should be done frequently to prevent decomposition of the organic matter remaining in the sand, which makes filters which are only cleansed at long intervals fountains of filth instead of purity.

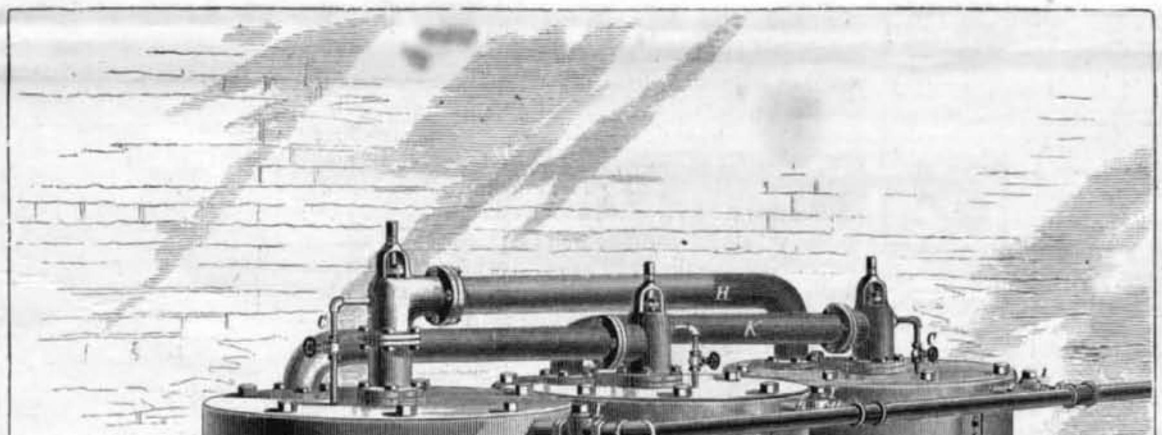
In washing Hyatt filter No. 1, the handle of the compound cock, A, is turned to the left as far as it will go. This shuts off the water from the valve, B, and permits it to enter through the small valves, F, which are distributed at regular intervals in the bottom of the filter bed. From these valves the water rushes upward through the sand, loosening and carrying with it all of the silt and impurities that have been retained in the sand while filtering, and discharging them through the central pipe, G, from which it issues by one of the openings in the compound cock, A, into the waste pipe, V. Five or ten minutes for washing is usually quite sufficient; and if this be done regularly each day, the filter will be kept in the most perfect order and will do its work for a practically indefinite period, as there is no waste of sand, and the filter is constructed of bituminized iron and has no working parts liable to get out of order. After washing, the handle is turned to the right until it stops, and filtering is at once resumed.

Some of these filters are arranged for the introduction of the unfiltered water over the sand instead of at the bottom. It is then filtered downward and discharged through perforated metal below. In a filter of the form and capacity of house filter No. 1, this arrangement will give finer filtration but a less quantity of water. The plan of washing the sand is, however, as above described.

Hyatt filter No. 2 is made in diameters of 40, 50, 96, and 120 inches respectively. They are worked in gangs or series of from two to ten in number, as may be desired. The method of filtering is the same as has been described in No. 1, the water passing up from the inlet valve, B, and passing across to the outlet screens. By reference to the arrows shown in the cuts and to the description of filter No. 1, this method of filtration will be

(Continued on page 195.)

THE HYATT FILTER NO. 1.



THE HYATT FILTER NO. 2.

IMPROVED FILTERS.

(*Continued from first page.*)

clearly understood. In filters of 40 and 50 inches diameter, the inlet is at one side of the bottom and the outlet on the opposite side, so that the water must be subjected to the filtering action of a sufficient quantity of sand. But in filters of larger diameter the water is admitted through the center, and passes upward and outward to the circumference, as will be explained in description of filter No. 3. The distinguishing feature of filter No. 2 is the process of washing the sand. They are set up in series of two or more, because one of them, in turn, contains no sand, but is idle while the others are filtering. For example, in a series of three filters, as shown in the cut, two of them are filled with sand and are used simultaneously while filtering, the third standing idle and containing only water.

In washing, suppose the last in the series of three to be the idle one. The outlet valve, D, in the first filter, is closed; the waste valve, I, and the valve at the top of the pipe, E, are opened. The water coming in through the valve, B, can then only escape through the pipe, E. This pipe in large filters is made tapering and terminating very near the bottom of the filter. Through this pipe the water rushes up into and through the horizontal pipe, H, and discharges into the top of the third filter. In doing so the water carries with it the sand from the first filter, conveying it all into the third filter in about ten minutes. This carrying process is facilitated by a current of water forced from the upper part of the filter through the small pipe, C, loosening up and helping to separate the impurities from the sand during its passage through the pipe, H. As the sand falls into the water in the third filter, the separated impurities flow out with the excess of water through the open valve, I, into the waste pipe; the sand, being thoroughly washed, settles and remains in the filter. Now, this washing of the sand from the first filter into the third, being accomplished, the valves, C and E, in the first filter, and waste valve, I, in the third, are closed; the inlet valve, A, in the third filter and its outlet valve on the opposite side are opened, and filtration is immediately commenced. Next the middle filter, or number two, may be washed, its contents being washed into the first filter precisely as had been done in the preceding case. Following in order, at the proper time, the sand in number three is discharged and washed into number two. And so, in regular order of succession, the filters are cleansed. About twenty minutes or half an hour each day is all the time required to keep a series of three in perfect order.

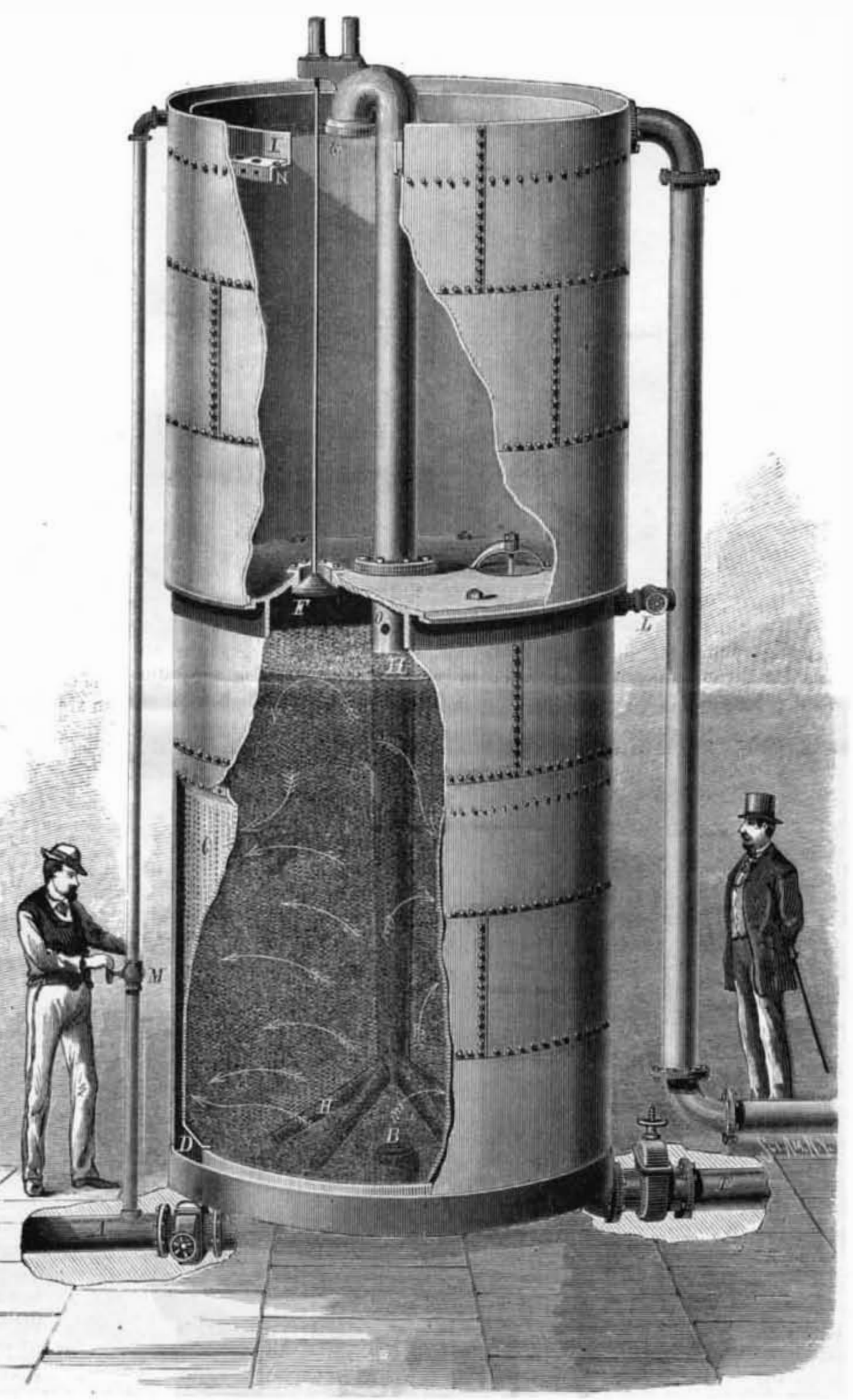
As before mentioned, this style of filter is made in gangs or series of any desired number, one of the series being always employed in rotation for washing the sand.

The Hyatt filter No. 3 differs from No. 2, not in principle, but only in construction; the object being to make a single filter complete in itself, both for filtering and washing purposes. In the great majority of cases, where more water is to be filtered than is used in an ordinary house or small steam boiler, the No. 3 filter will be recommended. But as it occupies more vertical space than No. 2, some industries having limited vertical space might find No. 2 better adapted to their conditions.

As will be seen in the illustration, filter No. 3 is constructed with two compartments, one above the other. The lower compartment is the filter proper, and the upper one is simply a tank used only during the operation of cleansing the sand. The cut shows a filter eight feet in diameter, and, including both compartments, twenty feet in height. In this size the water is admitted in the center, and passes upward and outward to the circumference of the filter, so that all the water is filtered through four feet of sand.

The operation in this filter is as follows: The water to be filtered is admitted through the valve, B, and, as it is filtered, passes through the perforated screen, C, which surrounds the sand and is supported by the outer shell. Ample room is provided between the screen and the shell for the passage of the filtered water down into the annular space, D, from which it issues through the outlet valve and pipe, E. This arrangement of large filters supplied with water in the center furnishes the greatest possible filtering capacity on a given ground space, and is especially adapted to large industries and to towns and cities.

When the sand in this filter is to be washed, the valve, F, in the head is opened and the outlet valve, E, closed. The water then rises till the upper compartment is filled. Then the valve, F, is closed, and valve, G, at the top of the pipe, H, is opened. The contents of the filter can then only escape by way of the pipe, H, through its branches, which reach nearly to the bottom of the filter. The pressure of water coming into the filter forces the water and sand in a steady stream up through the pipe, H, and discharges the whole into the upper compartment. Water also coming into the pipe, H, by the aperture, O, under the head, aids the flow of sand upward, and also assists in washing its particles free from the accumulated impurities. The water in the upper receptacle, as it receives the incoming flow, effects a complete separation of the impurities gathered in the sand, and they flow away with the excess of water into the overflow trough, I, and out through the waste pipe, K. In from ten to fifteen minutes, according to the supply of water, all of the sand in the filter (about 500 bushels in this size) is discharged and thoroughly cleansed into the upper tank. Now the filter below contains only water. To give it back its sand the supply pipe is closed, the valve, F, in the head, and valve, L, leading to the waste pipe are opened. Immediately the sand and water commence descending through the opening, F, the sand settling and filling the filter, while the excess of water escapes by the waste pipe.



THE HYATT FILTER NO. 3.

In this operation the sand is washed through the water a second time, and of course is left in a still finer condition for filtration. As the sand is descending, when two-thirds or three-fourths thereof have passed through the opening to the filter below, water is admitted into the trough, I, at the top, from which it falls in small streams through perforations in the bottom of the trough, washing the sand away from the sides of the tank and carrying it all through the opening into the filter underneath; then the valves, F, G, and L, are closed, and filtration resumed.

The largest size of filter (No. 3) is 10 feet in diameter and 20 feet high, having a capacity of 750 bushels of sand, and will filter from 500 to 750 gallons of water per minute. Twenty such filters will purify the water for a city requiring 10,000,000 gallons of water daily, and give a surplus; and the services of one man only would be required to thoroughly wash them once a day. The average waste of water in cleaning the sand in either style of these filters is about one per cent of the whole amount filtered. These remarks apply to the average water requiring filtration; but a larger percentage of water for washing, would be demanded to filter the water in some of the Western rivers, containing large quantities of clay.

In most cases filters above 40 inches in diameter are built entirely of boiler iron, and constructed for high or low pressure, as may be required. They are thoroughly bituminized interiorly to prevent rusting, and, it is believed, will last as long as the best constructed water mains; and as there is no waste of sand, there is nothing to repair, except the ordinary wear of water valves, thus confining the cost of maintenance to the expense of one man about fifteen minutes a day to do the washing of each filter.

It will be seen that, with these water purifiers, the Newark Filtering Company have the means of filtering river, pond, or lake water in any quantities, large or small, and in all situations and under any pressure required. Whether for house purposes, hotels, steam boilers, manufacturing industries, villages, or cities, they can meet any want, and claim the ability to filter a greater quantity of water, at less cost of installation and maintenance, than can be done by any other known means of mechanical filtration.

These filters are patented in the United States, Canada, and principal European countries.

God in Nature.

In a recent scientific lecture Professor C. A Young, the astronomer, of Princeton College, used the following language: "Do not understand me at all as saying that there is no mystery about the planets' motions. There is just the one single mystery—gravitation—and it is a very profound one. How it is that an atom of matter can attract another atom, no matter how great the disturbance, no matter what intervening substance there may be; how it will act upon it, or at least behave as if it acted upon it, I do not know, I cannot tell. Whether they are pushed together by means of an intervening ether, or what is the action, I cannot understand. It stands with me along with the fact that when I will that my arm shall rise, it rises. It is inscrutable. All the explanations that have been given of it seem to me merely to darken counsel with words and no understanding. They do not remove the difficulty at all. If I were to say what I really believe, it would be that the motions of the spheres of the material universe stand in some such relation to Him in whom all things exist, the ever-present and omnipotent God, as the motions of my body do to my will—I do not know how, and never expect to know."

Arizona's Mineral Wealth.

It is but a few years ago that Arizona was looked upon as simply a worthless desert waste, useless alike for farming and stock raising, while the owners of a few small mines which were known and worked labored under the great disadvantage of having to rely upon the slow ox and mule teams for the transportation of their supplies and products. Communication with the outside world was not only difficult, but the pioneer miners were in constant dread of Indian raids upon them that it was impossible to develop Arizona Territory with much success or profit. But a great change has taken place since the completion of the Southern Pacific Railroad across the Territory, and although the railroad does not extend directly to any of the mining camps, the increased facilities for transportation, and the opening up of the territory in consequence of it, have increased its population and developed its mining interests within the past two or three years wonderfully, and specially during the year 1882 the territory has made great advances in its resources.

From statistics recently published it appears that Arizona ranks third among the States and Territories in the production of gold, silver, copper, and lead, the total production of these metals aggregating in value for 1882—$11,702,293.

ONE ton of cotton seed yields thirty six gallons of crude oil, worth about $18. The hull from a ton of seed weighs about 900 pounds, and the meal before pressing weighs 1,100 pounds. The oil cake is worth $27 to $30 per ton. It is calculated that there is a net profit of about $9 in grinding the seed of a bale of cotton.

Safety Devices for Vessels.—Official Requirements.

At the annual meeting of the Board of Supervising Inspectors of Steam Vessels, held in Washington, January, February, 1883, in pursuance of Section 4,405, Revised Statutes of the United States, the following devices were approved by the board, and have also received the approval of the Secretary of the Treasury:

Holman's life-preserving bed (when constructed of at least fifteen pounds of solid cork and cork shavings, as a life-preserver or float for one person, on lake, bay, sound, and river).

Life-preserver, invented by Eliza P. Coggswell (when containing not less than six pounds of granulated cork, prepared in paraffine solution, and having a buoyancy of not less than twenty-four pounds, on lake, bay, sound, and river), with the further qualification that neither the board nor the Secretary of the Treasury "means to assert or admit, or in any way imply, that Mrs. Coggswell is the inventor, and legally entitled to a patent or other privilege."

Renton safety boat plug; James Snelgrove, automatic boat plug; Daniel B. Eddy, patent sea life-boat; Dean & Co., improved diagonal life-boat (for lakes, bays, and sounds); Herreshoff Manufacturing Company, pop safety valve; W. E. Pierson, pop safety valve; George E. Collyer, safety valve; Edwin A. Hayes, life-raft.

Some of the rules were amended as follows:

RULE 13.—Steamers navigating rivers only (except ferry-boats, freight boats, canal boats, and towing boats, of less than one hundred tons) must have one good, substantial boat.

Freight, ferry, canal, and towing steamers, of less than fifty tons, must be equipped with boats as, in the opinion of the inspectors, may be necessary, in case of disaster, to secure the safety of all persons on board.

Steam ferry-boats of fifty tons burden and over must be supplied with life-boats as, in the judgment of the inspectors, will best promote the security of life on board such vessels in case of disaster, according to the average number of passengers carried per trip.

Steamers making excursions under a permit must have at least one life-boat, and shall be equipped with other life-boats, or their equivalents, as, in the judgment of the inspectors, will best secure the safety of all persons on board in case of disaster.

Passenger steamers navigating the Red River of the North, and rivers whose waters flow into the Gulf of Mexico, must, in addition to the boat required in the first paragraph of this rule, be equipped with one life-boat of the buoyancy and capacity named in the *Example* in Rule 12, for every sixty passengers allowed, including the crew. One of the life-boats, unless exempted by the Supervising Inspector, must be made of metal.

All metallic life-boats hereafter built shall be furnished with a suitable automatic plug.

Passenger steamers navigating rivers other than the Red River of the North, and rivers whose waters flow into the Gulf of Mexico, must be supplied, in addition to the boat required by the first paragraph of this rule, with life-boats in proportion to their tonnage as follows:

Steamers between 100 and 300 tons, 1 boat; 300 and 600, 2; 600 and 900, 3; 900 and 1,200, 4; 1,200 tons and upward, 5.

Provided, however, that river steamers required to carry more than two boats may, where the owners prefer to do so, supply the boat capacity above that number with a good, substantial life-raft or rafts, such raft or rafts to be of equal aggregate carrying capacity of the boats so omitted.

These life-boats shall not be of less dimensions than those named in the example in Rule 12, unless, where smaller life-boats are employed, their aggregate capacity shall equal the aggregate capacity of the larger boats.

No steamer embraced in this paragraph shall be required to have more life-boats, or of a greater capacity, than sufficient to carry the passengers allowed by the certificate of inspection (including the crew). One of the life-boats, unless exempted by the Supervising Inspector, must be made of metal. The carrying capacity of the life-boats for steamers herein mentioned shall be determined by multiplying the length, breadth, and depth together, and dividing their product by five.

Passenger steamers navigating the ocean, Northwestern lakes, bays, and sounds of the United States, must be equipped with life-boats in proportion to their tonnage as follows:

Steamers under 100 tons, 1 boat; steamers between 100 and 200 tons, 2 boats; 200 and 300, 3; 300 and 400, 4; 400 and 500, 5; 500 and 1,000, 6; 1,000 and 1,500, 7; 1.500 and 2,000, 8; 2,000 and 2,500, 9; 2,500 and 3,000, 10; 3.000 and 3,500, 11; 3,500 and 4,000, 12; 4,000 and 5,000, 13; 5,000 and above, 14.

All these boats must be of proper size, and substantially built with reference to the trade in which the steamer is engaged: *Provided, however*, That no steamer shall be required to have more life-boats than sufficient to carry the passengers she is allowed by her certificate of inspection, together with her officers and crew.

A portion of the life-boats required on lake, bay, sound, and ocean steamers may be substituted by their equivalents in *approved* life-rafts when, in the judgment of the inspectors, it can be done with safety.

All steamers built for the navigation of oceans, Northwestern lakes, and sounds (meaning in waters sufficiently rough to swamp boats), shall be equipped with life-rafts in proportion of one at least to every two life-boats required.

RULE 14.—All life-rafts and floats composed of hollow cylinders must be rated in their carrying capacity according to the cubical dimensions of such cylinders, in the ratio of one person to every three cubic feet for ocean steamers, and two cubic feet for lake, bay, sound, and river steamers. Such life-rafts and floats must be suitably equipped with life-lines and oars.

All rubber or canvas life-rafts shall be kept inflated at all times.

RULE 23.—Steamers required to be provided with double-acting steam fire pumps, or other equivalent for throwing water, shall be equipped according to their tonnage as follows:

For a steamer of not more than two hundred tons burden, four inches stroke and two inches diameter of plunger, or its equivalent.

Of more than two hundred and not over five hundred tons burden, seven inches stroke and four inches diameter of plunger, or its equivalent.

Of more than five hundred and not over one thousand tons burden, seven inches stroke and six inches diameter of plunger, or its equivalent.

Of more than one thousand and not over fifteen hundred tons burden, ten inches stroke and six inches diameter of plunger, or its equivalent.

Of more than fifteen hundred and not over two thousand tons burden, ten inches stroke and eight inches diameter of plunger, or its equivalent.

Of more than two thousand and not over twenty-five hundred tons burden, twelve inches stroke and eight inches diameter of plunger, or its equivalent.

Of more than twenty-five hundred and not over three thousand tons burden, twelve inches stroke and ten inches diameter of plunger, or its equivalent.

Steamers are not restricted to the above particular proportions for fire pumps; any other dimensions equal to or greater in capacity may be allowed; and no fire pump thus provided for, excepting upon ferry-boats, shall be placed below the lower deck of the vessel.

The diameter of the pipes leading from the pumps must in no case be less than that of the discharge opening of the pumps.

A rotary pump, when driven by an engine independent of the main engine, or a steam siphon pump, may be considered as an equivalent for the double-acting fire pump, and used as such when equal to it in efficiency, and the degree of capacity required.

RULE 57.—It shall be the duty of the master of every inspected steamer carrying passengers on the ocean, lakes, gulf[s], or bays, when such steamer is under way, to cause to be prepared a station-bill for his own department, and one, also, for the engineer's department, in which shall be assigned a post or station of duty for every person employed on board such steamer in case of fire or other disaster; which station-bills shall be placed in the most conspicuous places on board for the observation of the crew. And it shall be the duty of such master, or of the mate or officer next in command, once at least in each week to call all hands to quarters, and exercise them in the discipline and use of the fire pumps, and all other apparatus for the safety of life on board of such vessel, and to see that all the equipments required by law are in complete working order for immediate use; and the fact of the exercise of the crew, as herein contemplated, shall be entered upon the steamer's log-book, stating the day of the month and hour when so exercised, and any neglect or omission on the part of the officer in command of such steamer to strictly enforce said rule shall be deemed cause for the revocation of the license of such officer. Upon navigable rivers, the captains of all passenger steamers shall be required to maintain a strict discipline and organize the officers and permanent crew so as to act with promptness in extinguishing fire; and the captain shall cause to be prepared at least two station-bills, assigning the officers and permanent crew to definite places; said station-bill shall be conspicuously placed, under glass, near the inspection certificate.

The Atlantic near the North American Coast.

At the recent annual meeting of the United States National Academy of Sciences, Professor Verrill, of Yale, gave the results of various observations made during eleven years off the coast between Chesapeake Bay and Labrador by the United States Fish Commission. One of these results is, that there is an error in maps and charts, in placing the warm belt, or Gulf Stream, too far from the shore by 30 or 40 miles. From the shore to about 60 miles out the fauna is Arctic; in the warm belt it is tropical or sub-tropical. The 100 fathom line has been taken to mark the border of the Gulf Stream; but it would be more correct to say the 65 or 70 fathom line.

Professor Verrill holds that there is no variation in the body of the stream (as has been supposed) in summer and in winter, though there is some variation in the surface water. The proof lies in the distinct line of separation of the two kinds of life on the bottom; if there were variation there, the sub-tropical life would be destroyed. The portion of the warm belt south of the New England coast, 70 to 120 miles from the coast, teems with life. In 1880 the dredges brought up 800 species of fauna, over one-third of which were wholly new, including 17 kinds of fishes, 270 of mollusks, and 90 of crustacea. To the 100 fathom point there is a gradual descent from the shore, then comes a precipitous descent to 1,000 fathoms or more. The warm belt seems to extend down this precipice only about 125 fathoms. Among other points noted in the animals found at great depths is their (generally) red or orange-yellow color; supposed to be a means of defense by rendering invisible. The bottom of the Arctic belt is a coarse gravel or sand; but that of the Gulf Stream is of sand so fine that the grains can only be distinguished with the microscope. Mixed with minute shells, this sand seems to form a bed as level and hard as any floor. Bowlders are sometimes found on this bottom among the dense animal and vegetable life with which it is carpeted; they have probably dropped from ice cakes. The dredges sometimes brought up a rock, possibly of Pliocene age, filled with fossil shells, like those now found on the bottom. The absence of all vertebrate fossils is remarked on. The dredges, also, never brought up any evidence of the existence of dead vertebrates, though the water swarmed with sharks, dolphins, etc., nor was any evidence of man's existence met with, except an India-rubber doll, dropped from some vessel. Yet the territory dredged was in the track of European vessels, many of which must have gone down there and lives been lost. Such facts led Professor Verrill to doubt the negative evidence in geology.

Coal Dust Explosions in Mines.

There can be no doubt that rich coal dust is inflammable and dangerous, especially in the presence of marsh or coal gas. The behavior of some dust shows that when thickly suspended in air and ignited, the flame runs along similarly to a train of gunpowder. In the presence of so small a quantity of gas that the Davy lamp is incapable of detecting, its violence is much more marked; and in this way it becomes a vehicle conveying flame from one part of the workings to another. The gas may not be in the necessary proportion to cause an explosion, but by the concussion of a powder shot dust is dislodged and may take fire. If this happens in the neighborhood of a local accumulation or "pocket" of explosive mixture, combination takes place, and the heat generated would be sufficient to subject the particles of dust to destructive distillation, and coal gas would be generated, which would ignite explosively and extend the work of destruction.

A charge of 1½ to 2 pounds of powder will carry flame in air about 20 feet; with coal dust in suspension it will carry flame double the distance; and with a small proportion of gas and dust it will go still farther, especially in the direction of the ventilating current of air. Firing shots and bringing down the coal will sometimes liberate pit gas, as will also falls of roof and changes in the barometric column; and although the firing of the gas thus liberated would not be in all cases at all a serious matter *per se*, yet when the same occurs in a dusty atmosphere the effects of the explosion are aggravated according to the quantity and character of the dust. My own opinion is that coal dust will not of itself explode except it be in a dense cloud, so dense that the particles, being very close together, are able to communicate ignition to each other, and the temperature, I think, must be higher than that experienced in the air of a mine.

But assuming the above conditions, and the ignition of the dust to have been effected, the production of coal gas by the decomposition of the coal dust would probably be so rapid that the oxygen of the air would soon be used up to form carbonic acid, water, and sulphurous acid. The dreaded after damp would permeate the entire workings, to the destruction of life. Flour, rice, and cotton dusts have caused explosions in mills both here and abroad; destroying life, and setting fire to the premises. Doutless coal dust is a source of great danger in mines, especially such dusts as those from superior gas producing coals. The dangers are increased by the presence of minute quantities of pit gases, and dusts which refuse to inflame in atmospheric air will do so if a small quantity of coal gas or pit gas be added thereto.—*C. E. Jones.*

American Pig Iron in 1882.

From reports received from all the makers of pig iron in the United States, the American Iron and Steel Association finds that the product of pig iron last year was 4,623,323 tons, or nearly half a million tons more than was made the year before. The yields of the different kinds of pig iron for the two years are shown in gross tons in the table below:

	1881.	1882.
Bituminous	2,025,236	2,176,855
Anthracite	1,548,627	1,823,338
Charcoal	570,391	623,130
Total	4,144,254	4,623,323

The stock of pig iron held unsold in the hands of makers at the close of 1882 was 383,655 tons. At the close of 1881 the stock on hand was 188,300 tons.

Mica Prisms.

At a recent meeting of the Physical Society, Mr. Lewis Wright read a paper on the "Optical Combinations of Crystalline Films," and illustrated it by experiments. He exhibited the beautiful effects of polarization of light, and the Newtonian retardation by means of plates built up of thin mica films and Canada balsam. The wedges thus formed gave effects superior to those of the more expensive selenite and calcite crystals. The original use of such plates is due to Mr. Fox, but Mr. Wright showed many interesting varieties of them, including what he termed his "optical chromotrope," formed by superposing a concave and one-fourth wave plate on each other. Norenberg's combined mica and selenite plates were also shown.