was flooded abaft the engine room, the two after holes being opened to the sea. This was a case such as they have no merchant steamers afloat capable of surviving. During this time the whole of the losses from the Admiralty list—eleven in number—have been from drifting on rocks, or otherwise drifting on shore, with the solitary exception above quoted. In the same period seventy-six ships have been lost which had been offered for admission to the Admiralty list, but had not been found qualified; of these, seventeen, or 22½ per cent, were lost by collision, and ten, or 13¼ per cent, were lost by foundering; most of the rest stranded or broke up on rocks. That the general superior character of the ships on the list is of no value in reducing the risk of collision is shown by the following comparison.

It can be proved that of the entire British mercantile fleet of steamers about 1 per cent, without distinction, receive damage of a fatal character by collision during the year. Of the number thus damaged, those on the list remain afloat, while those not on the list are lost. This is deduced from the following figures: Referring to the table given above, he would take only those cases of collision to ships on the list which would have proved fatal but for their compliance with Admiralty requirements. These are 9, or an average of 1½ per year, giving 1½ in 157, or 1 per cent of prevented fatal cases. Again, the average number of ships sunk by collision per year from the unqualified part of the fleet is 35, and the average annual record of the fleet for the six years is about 3,500, also giving 1 per cent of—in this case—fatal cases. Thus the risk of fatal collision is about 1 to 100, irrespective of the class of ship, and thus ships on the Admiralty list enjoy almost absolute immunity from loss by this cause. It is therefore proper to consider that the vessels on the list have no natural advantages with regard to their safety beyond that due to their bulkheads.

Two New Gelatine Emulsions.

F. Knebel offers the following formula: 20 parts of hard gelatine (Winterthur) are soaked in 200 parts of distilled water (1 in 10 by weight) and afterward dissolved by heating. He then adds 24 parts of potassium bromide and ¼ part of potassium iodide in solution, and 3 or 4 drops of acetic acid or 0·1 part of citric acid. Secondly, he dissolves 30 parts of crystallized silver nitrate in 100 of water. Thirdly, a gelatine solution for subsequent use is made of 14 parts of hard gelatine and 6 parts of soft gelatine, for summer use; but if it is to be used in winter, 10 parts of each are taken. They are softened first, and then dissolved in 250 parts of water. The silver nitrate solution is *gradually* poured into the first gelatine solution and the vessel rinsed with half as much water (50 parts), which is also added. The emulsion is now digested for two hours on a water bath at 65° or 70° C. (150° or 160° Fahr.). It is quickly cooled to 30° C. (86° Fahr.) by placing it in cold water. Next, 6 or 7 parts of ammonia (specific gravity, 0·920) are added to No. 3, which must be nearly cold and not very fluid. It is well stirred and then poured into the emulsion, which is at 30° C., shaken thoroughly, and filtered through flannel and afterward in Braun's apparatus, after having first been pressed through canvas and well washed. It is now ready to be poured upon the plates to dry. Another method, by Pizzighelli and Hubl, is called the cold method.

No. 1. One part of gelatine, 50 parts of water, 2 parts of ammonium carbonate, 15 parts of ammonium bromide, 2 parts of potassium iodide solution (1 to 10), 140 parts (by volume) of 92 per cent alcohol, from 1 to 5 of ammonia water.

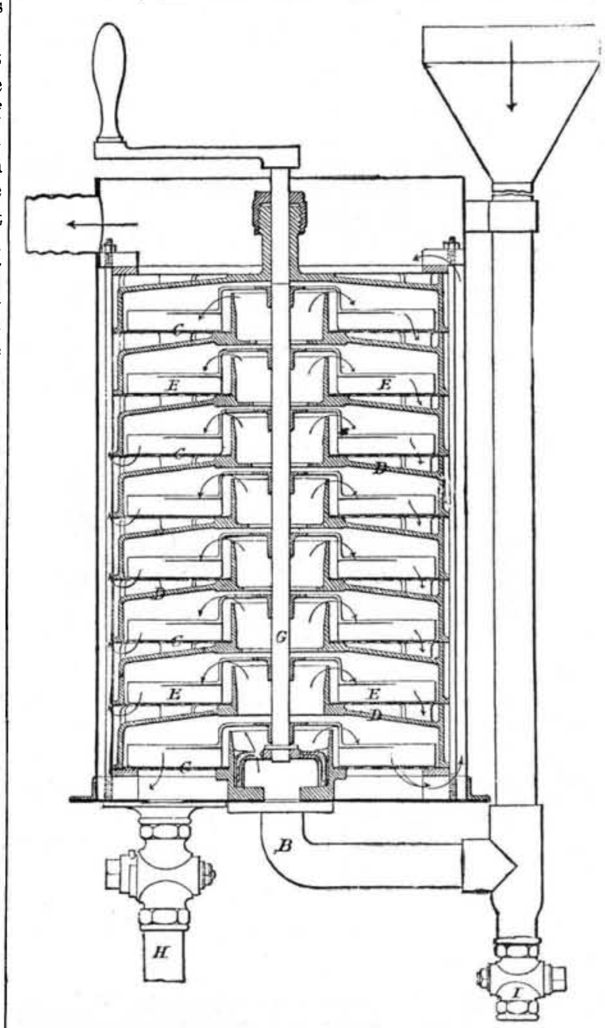
No. 2. Silver nitrate, 20 parts in 100 parts of water.

No. 3. Hard gelatine, 24 to 30.

The constituents of No. 1 are mixed in the order there given, except the gelatine, which is softened and dissolved, then added. The more ammonia the softer and more sensitive the photographic film. The emulsion is formed as usual by adding No. 2 to No. 1, under the well known precautions. They are digested as usual about five hours, then the emulsion is poured into a beaker glass and No. 3 stirred in, allowed half an hour to soften, and completely dissolved on a water bath. It is now rapidly stirred and 500 parts (by volume) of strong alcohol added, which precipitates the emulsion. The lumps that form are melted in small portions and poured into cold alcohol, where it is stirred with a glass tube, two inches in diameter, closed at the lower end. The emulsion attaches itself to the tube, and is then washed half an hour in flowing water.

PIEFKE'S FILTER.

The filtration of water is, from both a sanitary and manufacturing point of view, one of daily increasing importance; our rivers are becoming more and more polluted, and the value of space is increasing too rapidly to admit of large sand filtering beds and settling tanks being adopted for the purification of water for domestic and manufacturing purposes. The filter which we illustrate from *Engineering* is designed to combine in the smallest possible space the largest and most effective filtering surface, and differs not only in construction but also in the material used from any previously employed. It is the invention of Mr. Carl Piefke,



PIEFKE'S IMPROVED RAPID FILTER.

chief engineer of the Berlin Water Works, and is manufactured by Messrs. G. Arnold & Schirmer, engineers in Berlin; it has been adopted in several large industrial establishments on the Continent on an extensive scale.

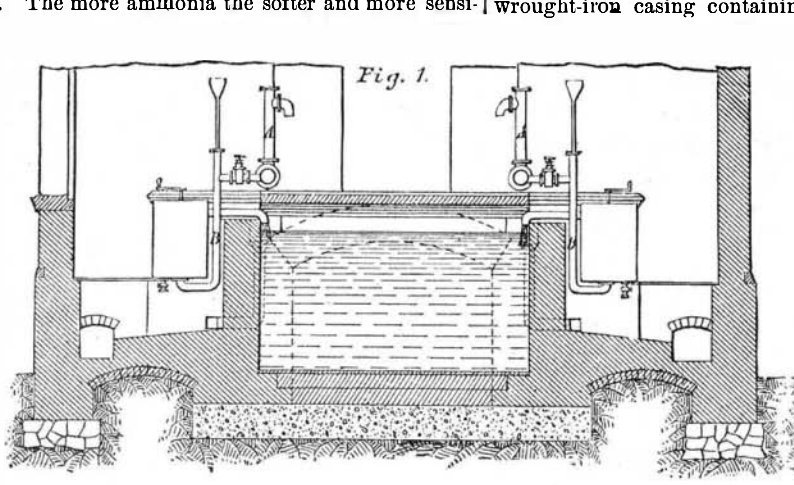
Our illustrations, Figs. 1 and 2, show a general arrangement of a filtering plant, consisting of twelve of these filters, each capable of purifying 1,100 gallons per hour. A large reservoir in the center of the building collects the clean water; the filters are grouped two and two, in two rows of six each side, and are supplied with water through the mains, A, A, while the funnels serve to charge the filters with the filtering material. Three tanks, together with thirty-six filters, have been recently fitted up by Messrs. Arnold & Schirmer at a large bleaching establishment near Warsaw, where about 800,000 gallons of filtered water are used daily.

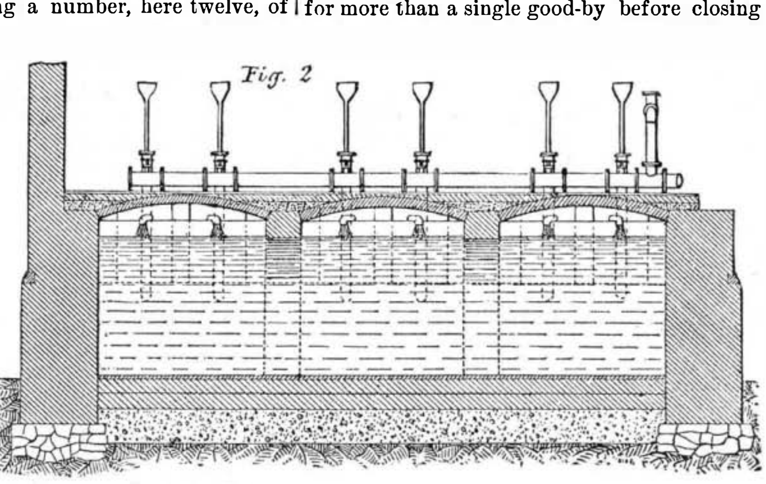
The filter itself, shown in section in Fig. 3, consists of a wrought-iron casing containing a number, here twelve, of perforated brags, C, which form the bottom of flat bell-shaped cast-iron vessels, D, the whole grouped one above the other inside the casing. The water to be filtered enters by the funnel, A, and through pipe, B, runs into the vessel, overflowing in the direction of the arrows, and after passing through the filtering material spread upon the perforated brags, C, rises till it overflows at the outlet. The filtering medium is chemically prepared cellulose or vegetable fiber, and is variously treated according to the purpose for which the filtered water is to be used, or, in other words, according to the degree of purity required in the filtered water. Its price varies accordingly; the best quality is charged at 75s. per cwt., and a filter capable of purifying 1,000 gallons of water per hour requires, for its first charge, about 3 lb. of filtering material. To charge the apparatus, the fiber is mixed with water to a thin paste and admitted through the funnel, when it deposits in an even layer over the perforated surfaces, C, and the filter is then quite ready for action. After about 1,200 gallons of water have been purified per square foot of filtering area, the latter requires cleaning or washing out; this is performed in a very simple manner by charging the filter with water in the usual manner, and at the same time slowly rotating the vertical spindle, A, which carries the scrapers, E, and by means of which the filtering material is suspended in the water, the latter washing out the impurities. As soon as the water runs clear again the rotary action is stopped, and the tap, H, on the bottom of the casing opened to allow the water to run off, and the filtering material to settle, when the filter is again ready for use. The quantity of water which may be filtered before it becomes necessary to clean the fiber depends, of course, largely on its state of impurity, and it is advisable to use as a guide the pressure required to force the water through the filter. This should not exceed from 3 ft. to 4 ft. of water pressure, and it is therefore best to place the funnel about that height above the overflow. At each cleaning a small quantity of filtering material is naturally washed away with the impurities; this amounts to about 10 per cent, which quantity should be replaced by admitting it with the water. For the purpose of washing out the filter it is not necessary to use filtered water, nor is water of any particular pressure required; it may be simply charged through the delivery pipe. If at any time it becomes desirable to entirely empty the filter of the filtering material, water is charged through the delivery pipe or into the open vessel, and the tap, I, at the bottom of the supply pipe, A, is opened, when the fiber will run out with the water. The apparatus can be recharged as described above, and for the complete operation of cleaning one filter, one man only is required for about ten minutes. This filter is recommended by the manufacturers for purifying water for all purposes, a small size measuring only 9 in. in diameter and 15 in. high inside, and carrying only about 1 oz. of filtering material, is specially manufactured as a portable filter for military purposes, capable of filtering over 80 gallons of water per hour; this is apparently a very handy form, and certainly a very valuable addition to the field equipment of an army. We understand that Messrs. Arnold & Schirmer are about to make arrangements for the manufacture of these filters in this country.

The Diamond Rattlesnake.

Of all the snake varieties of which we have yet any knowledge, the diamond rattlesnake, as it is called, seems to be the most deadly. It grows to a length of six feet or seven feet, and is somewhat thicker than a man's wrist. It is armed with the whitest and sharpest of fangs, nearly an inch in length, with cisterns of liquid poison at their base. A terror to man and beast, he turns aside from no one, although he will not go out of his way to attack any unless pressed by hunger. A description of his movements by a traveler who has encountered him states that he moves quietly along, his gleaming eyes seeming to emit a greenish light, and to shine with as much brilliancy as the jewels of a finished coquette. Nothing seems to escape his observation, and on the slightest movement near him he swings into his fighting attitude, raising his upper jaw and erecting his fangs, which in a state of repose lie closely packed in the soft muscles of his mouth. This snake is not so active as the famous copperhead of North America, nor so quick to strike, but one blow is almost always fatal. His fangs are so long that they penetrate deep into the muscles and veins of his victim, who has little time for more than a single good-by before closing his eyes forever. In one instance the fangs were found to be seven-eighths of an inch in length, and though not thicker than a common sewing needle, they were perforated with a hole through which the greenish-yellow liquid could be forced in considerable quantities, and each of the sacs contained about half a teaspoonful of the most terrible and deadly poison.

THE official returns give the value of the tobacco consumed in France in 1882 at 363,500,000 francs. Cigars show a total of 60,500,000 francs; cigarettes, 16,000,000; and chewing tobacco, 9,000,000. The heaviest amount, 278,000,000 francs, was for ordinary smoking tobacco.





PIEFKE'S IMPROVED RAPID FILTER.

Magnetization of Iron and Steel by Breaking.

At a recent meeting of the Society of Physical and Natural Sciences of Karlsruhe, says the *Karlsruher Zeitung*, Herr Bissinger offered a communication on the magnetization of steel and iron bars when broken in a testing machine. The phenomenon is not brought about by the elongation that accompanies the breakage, but is produced at the very moment of breaking, the two halves being converted into magnets of equal strength. The breaking occurs with a loud noise and strong shock, and the resulting concussion might possibly be considered as the cause of the magnetization. It should be remarked just here that in the testing machine the bars are placed vertically, and that the south pole forms at their upper extremity.

It would be interesting to ascertain whether magnetization would occur equally and with the same intensity if the bars were horizontal or inclined. The maximum of magnetization should occur in cases in which the bar was parallel with the axis of the earth; but the machine owned by Herr Bissinger allows only of a vertical position.

The different tools and objects of steel that happen to be in the vicinity of the bar at the moment it breaks also become magnetized, but to a much less degree.

Sense Culture.

The special culture of the senses is too much neglected by us in this modern busy life. Probably at no previous period of human history has the nervous system generally, and, more particularly, the sense organs, been so severely taxed as they now are, but never have they been less carefully cultivated. This is in part, if not wholly, the cause of the progressive degeneracy of the faculties of special sense, which is evidenced by the increasing frequency of the recourse to spectacles, ear trumpets, and the like apparatus, designed to aid the sense organs. The mere use of faculties will not develop strength—it is more likely to exhaust energy.

Special training is required, and this essential element of education is wholly neglected in our schools, with the result we daily witness—namely, early weakness or defect in the organs by which the consciousness is brought into relation with the outer world. It is not necessary to adduce proofs of the position we take up, or to argue it at length or in detail. The truth of the proposition laid down is self-evident. On the one hand we see the neglect of training, and on the other the increasing defect of sense power. The matter is well worthy of the attention of the professional educators of youth.

Muscular exercise wisely regulated and apportioned to the bodily strength is felt to be a part of education. Sense culture, by appropriate exercises in seeing, hearing, touching, smelling, would, if commenced sufficiently early in life, not merely prevent weakness of sight, deafness, loss of the sense of feeling, and impairment of the sense of smell long before old age, but by its reflected influence on the nutrition of the brain and upper portion of the spinal cord would do much to reduce the growing tendency to paralytic diseases, which are very decidedly on the increase.—*Lancet.*

Sinking of a Large Building.

A curious instance of the difficulties which the peculiarities of tropical soils give rise to when dealing with the foundations of heavy buildings has recently occurred in Georgetown, the capital city of British Guiana. Designed by the government engineer until lately in charge of the Public Works Department of that colony, some erections intended for use as law courts had proceeded to a certain point, when the successor to the office above named discovered that the buildings were bodily sinking, and this—as far as we have been able to learn—was taking place without any settlements or cracks being visible in the walls of the building, and without any disturbance of the surface soil close to them. In fact, it was not easy to detect the immediate cause of the subsidence, but it was ultimately found that at a few yards distance the ground was bulging upward. The present head of the Public Works Department in his report in no way reflects upon the character of the design given by his predecessor to the footings, or on the dimensions of the foundations.

There is nothing, indeed, in these to find fault with, and the difficulty has arisen apparently from the twofold character of the soil in the immediate vicinity of the buildings; that on which the work is erected being of good, solid, unyielding sand, but being surrounded to all appearance by a bed of earth less capable of withstanding either vertical or lateral pressure. The consequence has been that this surrounding belt of earth has yielded upward to the force exerted upon it by the lateral thrust of the squeezed material immediately below the buildings.

Iridium Plating.

Mr. W. L. Dudley has announced before the Ohio Mechanics' Institute that the problem of electroplating with iridium has been solved by employing a suitable solution of the metal and properly regulating the electric current. The solution is kept at uniform strength by using a plate of iridium as the anode. The metal is deposited in the reguline state, and takes a good polish. A buffing wheel that will grind off nickel plating in a few moments only serves to polish the iridium. Thin platinum foil, coated with iridium, retains its flexibility; and if the coating is not too thick, it will not readily scale off.

THE HUDSON RIVER TUNNEL.

After a cessation of about five months, work has been resumed at the New York end of the tunnel. It will be remembered that upon the New Jersey side nothing had been encountered in driving the tunnel but silt, which presented a shell or coating sufficient to hold the air when the pressure was kept near the hydrostatic head; but on this side nothing has been found except sand, and the difficulties presented have been serious and hard to overcome.

Last November, when it was decided to stop work, the tunnel had been completed through this sand to a distance of about seventy feet from the shaft, and a bulkhead of flanged iron plates had been built across the heading just in front of the masonry, as shown by the dotted line in Fig. 2.

To support this bulkhead, heavy timbers were placed vertically across its face, and others at right angles to these, while against the latter beams rested whose rear ends were embedded in the masonry. When the engines were stopped and the air pressure lowered, the incoming sand and water quickly pushed out the calking in the seams and flooded the chamber. In this condition the tunnel was left.

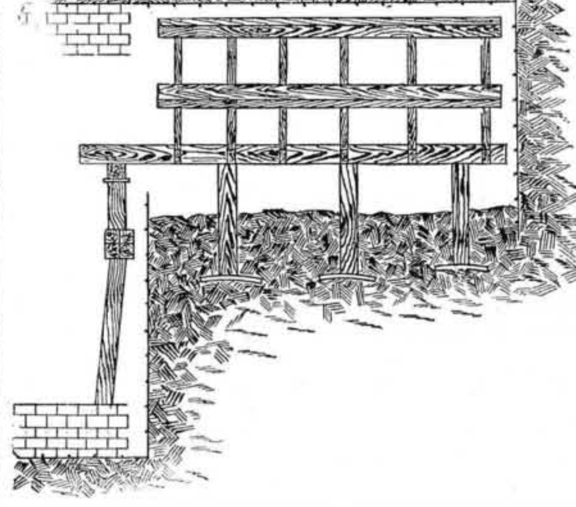


Fig. 1.—HUDSON RIVER TUNNEL.

On the 22d ult., when the engines were started again, the work was found unchanged, and no time was lost in beginning the building of another section. The method now pursued is very simple in appearance, yet requires great care and experience to insure success.

The upper plate of the bulkhead is removed and another inserted horizontally and bolted to the one already in position over the masonry, so that the crown line is continuous. One by one plates are put in ahead of and to the side of the first one, until the end of the section it has been decided to build has been reached, when the bulkhead is commenced and carried down with the sides. A regular system of bracing prevents settlement. The engravings are longitudinal sections, Fig. 1 showing the section when about one-half excavated, and Fig. 2 when all the material has been removed.

As the work is carried down, the upper part of the section forms a segment of a cylinder having a vertical end of iron plates, sides of plates, and the other end open to the working chamber, or finished tunnel. This acts as an inverted basin, beyond the edges of which the water cannot rise.

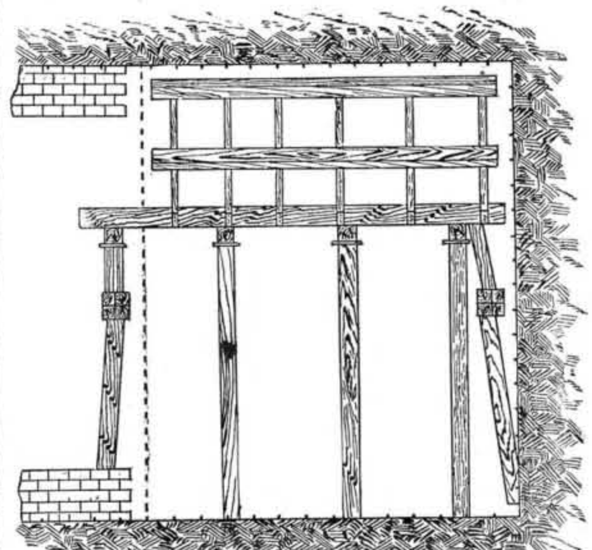


Fig. 2.—HUDSON RIVER TUNNEL.

To support the roof, beams are placed beneath the framing, and rest on plates embedded in the sand, as shown in Fig. 1. When the section has received its coating of iron the masonry of the tunnel is begun, and gradually carried up and around until completed. To prevent the escape of air, every seam is thoroughly calked, either with silt brought from the other side of the river, or with a mixture of Portland cement and sand.

Air is furnished by two compressors built by the Ingersoll Rock Drill Company, and one duplex compressor, built by the Clayton Steam Pump Works.

The north and south tunnels upon the other side of the river have been finished to a distance of 1,550 and 560 feet respectively from the shaft. Work on the tunnel has been resumed and is progressing favorably.

We are indebted to the courtesy of Mr. S. H. Finch, Chief Engineer, for explanations of his methods.

Bleaching of Paraffine.

M. De Molon's patent process of bleaching of paraffine (as described in the *Corps Gras Industriels*) is said to be more rapid and less expensive than the older methods, while presenting the additional advantage of incurring none of the waste which has been alluded to. It consists, in the first place, in the filtration of the rough paraffine, which is subjected in a boiler to the action of lime, there being added about five per cent of its own weight of sulphide of sodium and water. The mixture is let cool in order to allow of the solidification of the layer of paraffine; it is then washed with boiling water and then pressed. The sulphide of sodium may be replaced by ten per cent of lime in powder. After boiling for an hour, the mixture is filtered, and is treated, as above, with amylic alcohol. The residues from these operations are preserved in order to be treated subsequently by an acid—for instance, hydrochloric acid or sulphuric acid. The action of these acids is to form with the base a salt, and consequently to liberate the carbureted oily substances. The paraffine and the amylic alcohol are then set free by the process of distillation.

The inventor of this system remarks that in place of sulphide of sodium and lime other sulphurous combinations could be used. It is further stated that, after the performance of the operations which have been described, the action in a suitable apparatus of sulphuret of carbon, of amylic alcohol, or other dissolvents can be substituted for the filtration by means of animal charcoal, which has hitherto been customary. Care should be taken that the liquid intended to be used in the filtering process should be made as cool as possible. After this treatment has been carried out, the paraffine has only to be filtered and pressed before being delivered to the trade.

Book Cleaning.

Some of the books in the last installment of the Sunderland sale, London, have been ruined by clumsy attempts to clean them. A Terence, with the date 1469, would be the earliest known printed copy, if the date were genuine. But the paper was so grievously rotted by chemicals that the volume was sold for twenty-five shillings. In another copy, so extremely rare that Dibdin only knew it in an imperfect state, and Brunet did not know it at all, the paper had also been rotted in the cleaning, and the book sold for four pounds. It seems a pity that a beginner in the fine art of washing books chose such valuable specimens for his first experiments. In the "Annuaire du Bibliophile" for 1862, M Meray teaches the poor collector how to make a clean and valuable book out of a dirty and ignoble specimen. If a book be greasy, you separate the sheets and dip them in a solution of *potasse caustique*, following up this by a bath of eau de javel, with a fourth part of clear water. A bath of sulphite of soda follows, and it only remains to hang the sheets up to dry on strings stretched across the room. When paper is "cottony" and rotten, a bath in water in which gelatine has been dissolved with a little alum may be recommended. The *Graphic* facetiously adds, however, that it would be extremely interesting to make these experiments on the books of our friends.

Don't be Afraid of Work.

Don't be afraid of killing yourself with overwork, son, is the facetious way the Burlington *Hawkeye* has of counseling young men to thrift. Men seldom work so hard as that on the sunny side of thirty. They die sometimes; but it is because they quit work at 6 P.M. and don't get home until 2 A.M. It's the intervals that kill, my son. The work gives you an appetite for your meals; it lends solidity to your slumber; it gives you a perfect and grateful appreciation of a holiday. There are young men who do not work, my son—young men who make a living by sucking the end of a cane, and who can tie a necktie in eleven different knots, and never lay a wrinkle in it; who can spend more money in a day than you can earn in a month, son; and who will go to the sheriff's to buy a postal card, and apply at the office of the street commissioners for a marriage license. So find out what you want to be and to do, son, and take off your coat and make success in the world. The busier you are, the less evil you will be apt to get into, the sweeter will be your sleep, the brighter and happier your holiday, and the better satisfied will the world be with you.

IT is not uncommon to meet in our streets peddlers of kerosene going from house to house vending their illuminating fluid from a can. In Paris the electric stored light is carried about the streets like kerosene here, and it is said to have become a favorite way of illuminating houses on social and official occasions. The accumulators are carried in a vehicle, which is stationed in front of the house, and electric wires are conducted into the building through the windows. Incandescent lamps are placed in the ordinary candelabras, and the fitting of the most complex lighting is an affair of but a very short time.