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(Illustrated articles are marked with an asterisk.)

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SCIENTIFIC AMERICAN SUPPLEMENT

No. 649.

For the Week Ending June 9, 1888.

Price 10 cents. For sale by all newsdealers.

THE COD HAVE "STRUCK IN."

A dispatch from Newfoundland says that the caplin have "struck in." This means that the cod, the most famous of all commercial fish, has arrived on the banks. From now until November the cod will "run," and the great fleet of fishermen, hailing from our own eastern coast and from New Brunswick, Nova Scotia, Prince Edward's Island, and Newfoundland, consisting of nearly 1,000 vessels, not including the French fleet, will be kept busy.

Those who have been on the Newfoundland coast when the caplin "strikes in" will not forget the excitement that ensued; the beautiful little fish, about seven inches long, filling all the bays and bights of the shore line, tumbling over each other, and darting up above the surface of the waters, their sides sparkling in the sunlight, in futile efforts to escape their worst enemy, the cod. They come down with the Arctic current, called the "Labrador current," off Newfoundland, and it is up in the Spitzbergen waters that their enemy, the cod, spawns. This Arctic current rounds the southern point of Greenland, and, joined by various similar currents coming through Davis Straits and Hudson Straits, makes the Labrador coast and then rushes across to Newfoundland. Off this coast it meets the warm waters of the Gulf Stream running eastward, and is split into two distinct parts, one portion crowding itself between the Gulf Stream and Newfoundland, and the other, not having sufficient power to combat this great force, is forced below, the warm waters of the Gulf Stream riding over it.

The caplin supply the cod with food until the last of July, when the squid or cuttlefish arrive and take their place; these giving place in turn to the herring, which "strike in" about the middle of September. As if they know all about the fisheries treaty, and were in favor of its continuance, these little fish almost always keep strictly within the "three mile limit" line, that is to say, within Canadian waters, where the Yankee fishermen may not go, though there is enough of this bait and enough of the fish it is used to catch to supply the demand many times told. Under the new regulations adopted by Canada, the Yankee fishermen are not permitted even to buy bait, and willing enough they are to do so, and gladly would the Canadian fishermen sell it to them if they were permitted, for there is a large shore population which for years has had no other income save that derived from selling bait, and now these poor people are in a very bad way, in reality being taxed to pay the Canadian cruisers for keeping their customers away; for the sole duty of these armed tugboats is to prevent the Yankees from buying bait or provisions or ice to keep their fish fresh. The Yankee fishermen, with characteristic ingenuity, have discovered a means of circumventing the Canadian "horse marines," as they are called, taking advantage of the opaque fog which seems ever to hang over the fishing banks and their vicinity to go in and take the bait that they are refused the permission to buy. When discovered at this work from the shore, a fight nearly always follows, the shore men coming off in their boats and trying to "trip" the seines and spill out the bait, for they believe, and with reason it would seem, that, should their neighbors be able to get what bait they want, there would not be any excuse for a fishing treaty with them at all, and hence no further market for the bait they are wont to catch.

Last week, a part of our fleet started for the Gut of Canso, between Nova Scotia proper and Cape Breton Island, a district of the same, to secure bait, and it is said that some of the Canadian fishermen are now making a business of supplying them at sea. The French fleet consists of about 400 sail; and though now the French possessions in North America are restricted to a small group of islands on the western coast of Newfoundland, these Frenchmen catch and cure a very large amount of fish, being expert and industrious and sending the catch across the ocean to their own country, where it easily competes with the catch taken in the North Sea. Miquelon, the principal of the French group, the others being St. Pierre and Isle Aux Chiens, though one of the most dangerous parts of the coast to approach in a southeaster or southwester, is the chief headquarters of the Gaul. The shores of this island are always strewn with wreckage, mostly of French craft too, but the Frenchman has great endurance, if not so much skill as his Anglo-Saxon brother fishers, and, having a ready market for hake and haddock and turbot and alewives, as well as for cod and halibut, there is great incentive to fish. The treaty made with the English, when they ceded these islands to the French, permits them to take bait and dry their fish and nets along the Newfoundland coast, but notwithstanding this there is continual dissension among the two peoples. The Grand Banks, the principal fishing grounds, are 600 miles long and about 200 wide, with a bottom of shifting sands, "no holding ground," as the sailors say; and while in ordinary weather the schooners—they are from 80 to 125 tons—ride to their anchors with a long cable out, as soon as it comes on to blow, and the sea rises—conditions existing five days out of seven—they get in their anchors and heave to under close-reefed foresails.

Don't Undervalue the Boy.

Too many men make their boys feel that they are of little or no account while they are boys. Lay a responsibility on a boy, and he will meet it in a manful spirit. On no account ignore their disposition to investigate. Help them to understand things. Encourage them to understand what they are about. We are too apt to treat a boy's seeking after knowledge as mere idle curiosity. "Don't ask questions" is poor advice to boys. If you do not explain puzzling things to them, you oblige them to make many experiments before they find out; and though experimental knowledge is best in one sense, in another it is not, for that which can be explained clearly does not need experimenting with. If the principle involved is understood, there is no further trouble, and the boy can go ahead intelligently.

Do not wait for the boy to grow up before you begin to treat him as an equal. A proper amount of confidence, and words of encouragement and advice, and give him to understand that you trust him in many ways, helps to make a man of him long before he is a man in either stature or years.

Give him tools, and let him find out for himself whether he has got any mechanical taste or not. Do not discourage him, as parents are apt to do, by saying, "Oh, it is no use for you to try to do anything with tools. I never have any taste that way, and of course you have not." If a boy finds he can make a few articles with his hand, it tends to make him rely on himself. And the planning that is necessary for the execution of the work is a discipline and an education of great value to him. The future welfare and happiness of the boy depends on the surroundings of his youth. When he arrives at that period in his life when he is obliged to choose what profession or what line of business to follow, it is highly important that he should take no false step. And if in his youth he has cultivated a taste for any particular branch, the choice of a profession or business will be made more easy.—*Architect and Building News.*

A Trick with Figures.

The following mathematical trick, from *La Nature*, although not new, may be revived for the benefit of those who are unacquainted with it. It never fails to mystify those who do not understand it.

Tell a person to select any even number of figures, and, without letting you see them, to write them down and then place under them the same figures in reverse order. Thus, for example:

943518
815349

This done, ask him to add the two numbers, and to give you the sum, less any figure which he may choose to reject, and the space occupied by which must be left blank or shown by a hyphen. For example, 17588-7.

Putting on an inspired air, you now assert that the figure omitted is 6. If you prefer, you can let the person subtract one number from the other, and then tell him the omitted figure with the same ease.

The trick is simple, and the explanation of it can be understood by any boy who has studied arithmetic. The sum of a number and the same number reversed is a multiple of 11, and their difference is a multiple of 9. Now, in multiples of 11, the sum of the even figures is equal to that of the odd ones. Applying this rule to our example, 17588-7, and representing the unknown figure by x, we have $x+8+7=1+7+5+8=21$. A simple mental calculation gives $x=6$. Where the number of figures in the product is an even one, the sum of the first two or first three will equal the sum of the last two or last three, and so on.

Proceeding with the difference, which is a multiple of 9, the sum of the figures must itself be a multiple of 9. Taking our example, 1-8169, and adding the figures, we obtain 25, but as this is not a multiple of 9, we have to add 2 to obtain the multiple, and this was the figure rejected.

The Oil Wells of Florence, Colorado.

This town, situated about 30 miles west of Pueblo, is the center of the oil region of Colorado. It was first discovered about twenty years ago, 12 miles west of the town, in the foot hills of the Rocky Mountains, and was pumped up by hand, refined in a rude refinery, and sold for $1.50 per gallon. When the Denver and Rio Grande Railway was built, the price tumbled to 50 cents per gallon, and the owners of the well supposed their business ruined.

There are now within the town limits about twenty paying wells, yielding about 1,000 barrels crude oil, or 450 barrels refined oil, daily; also two oil refineries, with a total daily capacity of 1,000 barrels. New wells are being bored, and the industry is said to be in its infancy. The town has doubled in size within a year.

The Denver and Rio Grande and the Atchison, Topeka and Santa Fe Railroad companies have extensive coal mines of excellent quality within three miles of the town, from which they draw their own supplies and furnish the towns throughout this part of the State.

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Wages Here and in Great Britain.

In the sixteenth annual report of labor, by Mr. Carroll D. Wright, of Boston, at page 107 he says: In the fall of 1883, we started upon an original investigation through personal agents of the bureau, in Massachusetts and Great Britain, and through these agents we have gathered from original sources (meaning by original sources the pay rolls of great manufacturing establishments, the official wage lists agreed upon in England, so far as England is concerned, between trade societies and employers, and from other reliable sources) the rate of wages paid in the following twenty-four industries, which are common to Massachusetts and Great Britain:

INDUSTRIES, 1884.	General Average Weekly Wages paid to All Employes.	
	Massachusetts.	Great Britain.
Agricultural implements	$10.25	$8.85
Artisans' tools	11.80	4.89
Boots and shoes	11.63	4.37
Brick	8.63	4.16
Building trades	14.99	7.21
Carpetings	6.08	4.11
Carriages and wagons	13.80	4.89
Clothing	10.01	6.71
Cotton goods	6.45	4.66
Flax and jute goods	6.46	2.84
Food preparations	9.81	2.72
Furniture	11.04	7.96
Glass	12.28	6.94
Hats—fur, wool, and silk	11.01	5.51
Hosiery	6.49	4.67
Liquors, malt and distilled	12.87	12.66
Machines and machinery	11.75	6.93
Metals and metallic goods	11.25	7.40
Printing and publishing	11.37	5.52
Printing, dyeing, bleaching, and finishing cotton textiles	8.67	4.94
Stone	14.39	8.58
Wooden goods	12.19	5.67
Woolen goods	6.90	4.86
Worsted goods	7.32	3.60
All industries	$10.81	$5.86

The Gamboa Dam on the Panama Canal.

Mr. Jacobson, an engineer from the Panama Canal, is staying at the New York Hotel. He arrived on the steamer Colon, from Aspinwall, and is on his way to France. Mr. Jacobson is a graduate of the Polytechnicon of Zurich, and has a fair knowledge of English. His position on the canal works was a very responsible one—that of chief executive officer for the Societe des Travaux Publics, contractor for that part of the line between Obispo and Emperador, including the celebrated Gamboa dam. Mr. Jacobson has been in the employ of the Societe for a year and a half, during which time he has resided on the canal line, giving the work his personal supervision. He returns to France at this time for needed rest and to arrange personal affairs.

In reply to inquiries about the condition and prospects of the Panama enterprise, Mr. Jacobson expressed his entire willingness to give any information in his power, and to pronounce an opinion upon any matter that fell within the range of his observation. He said work had commenced on the Gamboa dam, which, after long hesitation, was at last decided to be necessary for the control of the Chagres River.

Of the 3,000,000 cubic meters of material that the dam is to contain, about 30,000 have been deposited on the opposite ends of the works, at the bases and sides of the two large hills Obispo and Santa Cruz, between which the dam is to be situated. These deposits are far enough from the bed of the Chagres to be safe from the current, even during a freshet.

When, however, the work is further advanced, and the center of the dam is reached, which is to oppose the flow of the current, it is feared that the floods of the rainy season will carry away all the material within their reach. It is Mr. Jacobson's opinion that unless this central part of the dam can be completely finished in a single dry season, it will be found very difficult and perhaps impossible to construct it at all. Mr. Jacobson says, with reference to operations during the rainy season (which has now set in), that little more can be done while the rain lasts than to take care of the yards and material and preserve the work already accomplished.

Representatives of M. Eiffel, under the new contracts for locks, have begun work at several points, but the plans, Mr. Jacobson says, are still inchoate, and the number of locks and their final location not yet determined. In the excavation of the locks there will doubtless be obstacles to overcome. Already at points between the forty-fourth and forty-eighth kilometers the excavations made are actually too deep for the lock canal on the proposed level, which will necessitate the construction of dikes on one side to raise the water of the canal above that of the river. In this section the canal is in a plane with the Chagres and Obispo at their junction. That part of the Chagres will be suppressed by the Gamboa dam, and its flow diverted into an artificial channel on the south side of the canal, but a dike of about four kilometers in length and nine meters high must be raised between the canal and the Obispo.

M. Eiffel will have no part in any of the canal work, except the preparation for and construction of the locks. The other contractors continue the dredging and excavation as heretofore, except for such modifications as the new project necessitates. The completion of the canal does not, therefore, depend upon M. Eiffel any more than upon any other of the contractors. When asked whether he thought the canal could be completed and open for traffic in 1890, Mr. Jacobson smiled broadly, and said that if the work on the Isthmus could be completed in five years, it would be a great achievement.—*N. Y. Evening Post.*

Filtration of Water.

At a recent meeting of the Society of Engineers, London, a paper was read on "Filtration by Machinery," by Edward Perrett, A.M.Inst.C.E.

The paper first compared the processes of straining and filtering, and pointed out that in the latter process the mutual attraction of particles of matter, in addition to the straining action, causes the retention of the suspended material in a liquid passing through the filtering medium. After describing the early experiments made by the author in filtering Thames water through filter bags, such as are used for the filtration of sugar, the paper pointed out the danger of using animal charcoal for the filtration of drinking water. This material has the power of taking out matter in an infinitely fine state of division, and even in solution, the charcoal becoming so charged with such matter that nothing short of subjecting the charcoal to a red heat is sufficient to thoroughly clean it. An animal charcoal filter with any system of washing will gradually accumulate the very fine matter, which may germinate, and at length be carried through with the filtered water. A filter with a granular medium—such as crushed retort coke—designed by the author, is effectually cleaned by an upward stream of compressed air occasionally applied. This causes an agitation of the material, and the attrition loosens the dirt, which a small current of water washes away. At a waterworks in South America, where these filters are used, 20,000 gallons of river water are filtered per hour, the floor space covered being 37 feet by 7 feet 6 inches, or an average rate of nearly 100 gallons per square foot of filtering surface per hour.

The purification of water containing organic matter by contact with iron was mentioned. The original method of using Professor Bischoff's "spongy iron" on a large scale was to mix the spongy iron with gravel, and to use this mixture as a filter bed; but it was found that the top surface became hard and impervious after a short time, and Mr. Wm. Anderson introduced a machine to supersede these spongy iron filter beds. His "revolving purifier" causes ordinary iron borings to be mixed with the water as it passes through the machine. The water is afterward filtered through ordinary sand beds.

For the filtration of very muddy water for manufacturing purposes, sponge is used by the author. The machine consists of a cylindrical casing, in which sponge is compressed between two diaphragms; the lower diaphragm is movable and attached to a piston rod, which passes through the top cover. To clean the sponge, an up and down motion is given to the lower diaphragm or piston, thus alternately compressing and releasing the sponge. These filters will render Thames water at London clean enough for boiler,feeding or other manufacturing purposes at the rate of about 100 gallons per square foot of surface per hour. The precipitate resulting from the processes known as "softening" water is now generally extracted by filtration. The material used for this purpose is the filter cloth referred to at the commencement of the paper, as the chalk deposit may accumulate to a considerable thickness before it becomes impervious. In this case the deposit is easily removed. The author finds that simple external jets of water are sufficient for the purpose.

House Moths.

"Have you anything that is sure death to moths?" asked an anxious-looking housekeeper of a druggist the other day.

The druggist smiled, looked as though he would like to say "chestnuts," but answered: "So you belong to the moth-persecuted multitude of housekeepers? Well, for articles to be packed away in boxes or drawers, there are several things I can recommend. Some people prefer one remedy, some another. You will find some families putting their faith and their winter clothes in snuff or tobacco; others favor red pepper; but for many years I have used camphor, and consider that the best of anything. There is nothing disagreeable about it, and moths don't seek it as a regular diet; in fact, will never come where there is the camphor odor."

"Doesn't it evaporate too quickly?"

"No. Put in good sized pieces, and there is no danger from that source. A piece as large as your fist in six months or a year will be the size of a hickory nut, and the odor will penetrate every part of the box or drawer where the clothing is packed.

"Cedar chips are also a preventive," he continued. "Sprinkle them in among goods packed away, and you will have no moths. But they are not very easily obtained. Sometimes they can be found at a cigar box factory, but there are not enough to make their use very general.

"The best way of all," he added, "is to have a large cedar chest and pack everything in that. But such chests are expensive, and common mortals must content themselves with other methods."

"Can moths be kept out of things that are in every-day use, like carpets, furniture, curtains, etc.?"

"A good housekeeper should never be troubled with moths in a carpet, for if it is swept thoroughly, especially the edges and corners, moths will not make it their abiding place. Newspapers laid under a carpet are said to be an effective aid in driving away these troublesome pests, but hard sweepings are more reliable. If a room is to be shut up for any length of time, something should be sprinkled over the floor.

"Portieres and all curtains must have frequent shakings, or the moth millers will be sure to lodge in their folds. The great object is to keep them out of a house, for when they once locate and take up a claim they have the 'squatter's right,' and only force can drive them out."

"But how are the unfortunates who already have them in their houses to get rid of them?"

"For such cases I know of nothing better than some of the moth powders. The other things I have mentioned are preventives against moths, but these powders kill the moths themselves."

"Are they poisonous?"

"No. They are perfectly harmless. The moths don't eat the powder, but are suffocated by it. The powders are made from a tree that grows in Persia, and will kill anything that hasn't lungs. I sprinkle it plentifully around a room where there are moths, shut up the room for a while, and what moth-heaven gains we lose. The powders are good to put under carpets, and if a house is to be closed, should be liberally used in every room. A carbolic acid dilution is also very good for anything that can be dampened without injury."—*Chicago News.*

Pyrogravure.

At one of the recent sessions of the Societe d'Encouragement, Mr. Perier presented a communication upon the application of burning to the decoration of wood, leather, glass, etc.

This new process of engraving is not mechanical, and has nothing in common with branding boxes, corks, etc., with a hot iron.

Pyrogravure is a new method of engraving in black, reddish brown, bister, etc., by the use of a red hot metallic point. The engraving is done as easily as is drawing with a pen or pencil. A scraper and some gum serve to suppress or lighten the lines upon wood, just as upon paper.

Mr. Perier obtained his first pyro-engraved drawings with red hot pokers and the conical cauteries used in surgery. These burners, which it was necessary to keep continually heating, were replaced by platinum burners heated by an electric current, and then by instruments based upon the principle of gas soldering irons.

The invention of the Paquelin cautery has certainly given the best instrument of the kind to surgery and the best burner to pyrogravure. It is by the aid of one of these wonderful instruments that Mr. Perier produced the specimens that he exhibited at the above mentioned session. It is also with this instrument, the point of which is bent for its new application, that he demonstrated his new process, by making an engraving in the presence of the assembly.

The rubber bulb that serves to send carbureted air to the cautery has been replaced, for photogravure, by an organ bellows, an air bag, or a charged gasometer. The draughtsman, after regulating the pressure, has nothing to think of but his work, the burning tool remaining incandescent an hour or more if necessary.

Art decoration on a large scale, and industrial ornamentation, have in pyrogravure a new means of utilizing the talent of the artist and the skill of the workman. By means of it, we can just as well draw a portrait or a landscape as decorate a room, piece of furniture, or any other object, or mark the handle of a tool. The lines made by pyrogravure have not the sharpness of those given on wood by the graver or gouge. It increases the decorative effect of marqueterie and of objects of wood or leather inlaid with metals, ivory, mother of pearl, etc.

Binders, cabinet makers, toy manufacturers, etc., will be able to employ it with advantage for cheaply ornamenting their products. In a word, any object capable of being carbonized, or modified by the action of burning, can be ornamented or marked by this process. The process therefore interests the industries in general by its numerous applications.—*Annales Industrielles.*

Safety Envelopes.

Schlumberger's safety envelopes are tinted in such a manner as to turn black, blue, and red if an attempt is made to open them by wetting or by exposure to steam, while moist air or fog does not affect them.

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An Old Chinese Printing Establishment.

A correspondent of the North China *Daily News*, of Shanghai, describes a printing establishment which he found in a village in the interior, about 150 miles from Shanghai. The printing was being temporarily carried on in the village temple, and movable type only was used. In the large central hall of the temple were placed about 20 ordinary square tables, on which the cases of type were spread out, very much after the English method, only taking up much more room.

At the time of the visit one man was engaged in setting up type, another was printing. The former stood before a table, on which was what may be called the Chinese "case." It was a solid block of hard wood, about 22 inches long by 15 inches broad, and perhaps 3 inches deep. The inside was hollowed out to a depth of about ¼ inch, this depression being still further hollowed out into grooves about ¾ inch deep. The block had 29 of these grooves, each filled to the depth of ¼ inch with ordinary stiff clay. With his copy before him, armed with a small pair of iron pincers, the compositor began his work; character after character was transferred from the case and firmly pressed into the clay. When the "form" was complete, a flat board was placed on the top and the characters pressed perfectly even and level with the surface of the wooden block, the edge of which was cut to form the border generally found round every Chinese page.

The printer now received the form, and carefully brushed his ink over the type. Taking a sheet of paper, he pressed it down all over the form, so that it might be brought in contact with every character. He then removed the sheet and examined each character, carefully adjusting those which were not quite straight with the pincers, and apparently never touching the type with his fingers. After sufficient copies had been struck off, the type was distributed, each character being returned to its particular box. The type in the form was of three sizes, each character being kept in place entirely by the clay in which it stood. They were cut out of some hard wood, and were perfectly square. The writer was told that the art of printing in this way had been handed down in the same family since the Sung dynasty, more than 600 years ago.

No strangers were ever taught, apprentices being always taken from the same clan. They were open to take any work at the rate of about a shilling a day, which included the two men, type, and ink, but not paper. They were then printing family registers. The custom in that part of the country is to hire the printers, who bring their type and set up their printing establishment on the spot. In this way the same business has been carried on in one family for six centuries, and during all this time movable type only had been used in the manner here described.

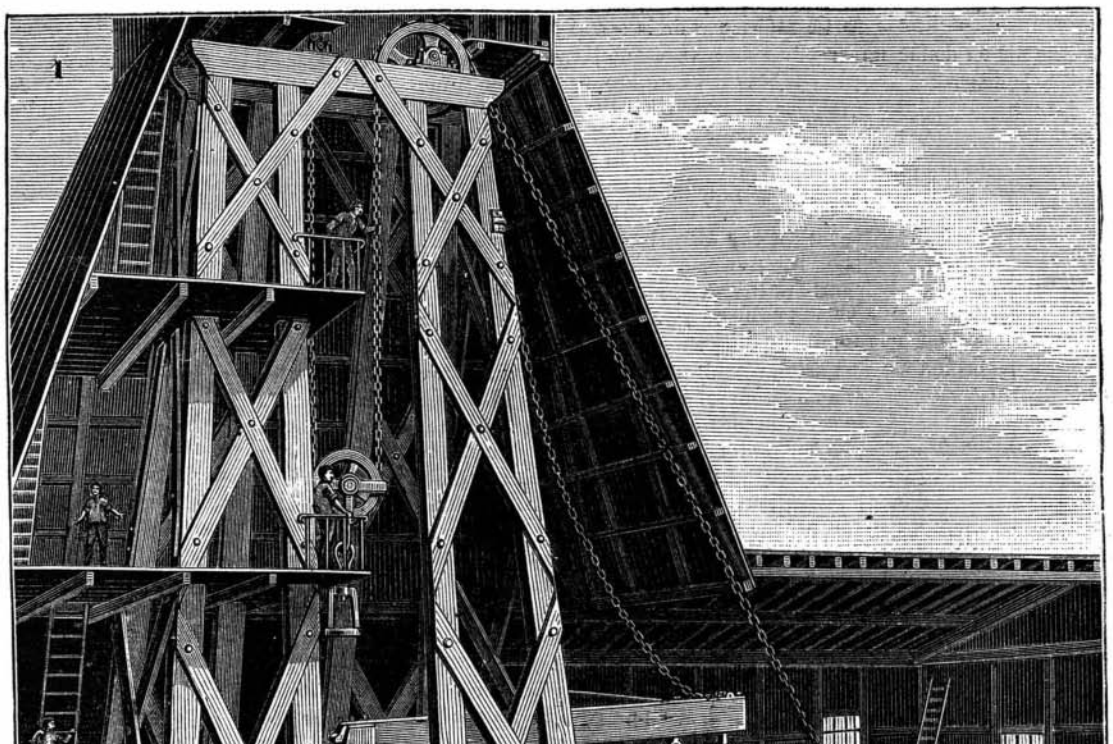
Whitening Linen with Potatoes.

According to *L'Industrie Parisienne*, a laundryman in the vicinity of Paris has discovered a very ingenious method of cleaning linen without soap. He uses no soap, nor lye, nor chlorine, but replaces these substances by boiled potatoes, with which he rubs the linen.

This curious process, it appears, is much superior to those hitherto employed, and the worst soiled cotton, linen, or silk, cleaned by this method, are made whiter than they could be by the use of an alkali. Besides, the method has the advantage that brushes can be dispensed with, and well water be used.

THE ARTESIAN WELL IN THE PLACE HEBERT, PARIS.

Well boring, in spite of the many applications which have been successfully carried out in many parts of the world, has recently attained a notable success in Paris. A new artesian well, the work on which has been in progress for a long time, has at last reached, at the depth of 2,359 feet, the water supply which it is designed to raise to the surface. The work has been watched with as much curiosity by the public as by scientists. The public sees in it the acquisition of a powerful supply of hot and pure water, which may be used for the various industrial and hygienic requirements of the city. The scientists, whether geologists or engineers, see in it a new investigation as to the constitution of terrestrial strata, the methods and systems to be employed, the composition of subterranean water, and finally the results of the various processes of boring, which specialists are constantly trying to improve.



1. General arrangement of the machinery for operating the drill. 2. General view of water flowing into subterranean conduits.

Fig. 1.—ARTESIAN WELL IN THE PLACE HEBERT, PARIS.

The work of sinking the artesian well in the Place Hebert at La Chapelle (Paris) was commenced, carried on, and successfully completed by the firm of Lippmann, of Paris. The greater part of the work is accomplished, and it simply remains to complete the final storage of the water. In the meantime the water is conducted through a subterranean gallery into the sewers of the city. After the work has been completed, Paris will possess an artesian well whose dimensions will place it in the first ranks of works of this kind, owing to its depth of 2,359 feet and its enormous diameter of 3½ feet. It may be remarked that similar wells in France and elsewhere are seldom more than from 4 to 8 inches. The enormous difference between these is noteworthy.

The soil of Paris, as in all cases where useful and interesting experiments in artesian wells have been made, contains various subterranean strata of water superposed one above the other between sedimentary formations which are alternately permeable and impermeable. The ascensional force of these different supplies depends upon the altitude of their original source.

The water supply which is reached by the boring in the Place Hebert is between 2,309 and 2,362 feet below the surface in water-bearing sand, and its origin is apparently in Champagne. It has great purity; it does not exceed 8 degrees hydrotimeter, which renders it suitable for industrial uses. It is well known that the legal requirements prescribe that it should not exceed 15 degrees hydrotimeter. Too great purity, much below 8 degrees, would be prohibitory, for water which is excessively pure, as for instance distilled water, attacks metals and corrodes them. The enormous natural filter of the strata of water-bearing sand at which the new artesian well terminates naturally determines its degree of purity.

The temperature of water at the surface is 12 degrees, that of the new artesian well is about 30 degrees, in compliance with the well known law which gives a sensible increase of temperature of one degree Centigrade for every 98 feet of increased depth. Therefore, when in an artesian well various superposed supplies are met with, the deepest is generally the most powerful, and it is best to use this, completely shutting off all the others. Experience shows, in a word, that the power of consumption of the supply is at least equal to its power of delivery. If the upper supplies remain in communication with the lowest one, the latter simply delivers what the others have left. It is better therefore to shut off all the other supplies which are traversed before the supply to be used has been reached. Remarkable work in artesian engineering executed by Mr. Lippmann at the general hospital at Tours has demonstrated this. This boring traversed three upper strata or supplies, which were completely shut off. The fourth, which was reached at a depth of 558 feet, gave a discharge at the surface of 1,056 gallons of water per minute, while another boring which had previously been made at the same establishment, having the same diameter, the same level, and the same depth, and having traversed the same strata, which, however, were left to communicate with one another, only gave a delivery of 264 gallons per minute. It is for this reason that attention is directed to the supply of a well having a depth of 2,359 feet; that is to say, that the best processes were studied to shut off the subterranean supplies met with in the tertiary formations and at the beginning of the cretaceous formations.

We will now briefly review the processes of boring which are actually used, a detailed description of which would be too extensive. These processes are known under the names of boring by the Chinese method, boring with a hollow instrument, and boring with a black diamond, which latter method was introduced by the engineer Leschot. These methods, however, were used only for making bores of small diameters; when large diameters of from one to two feet and more are required, which, according to the improved processes, are economical, the system of boring with a rigid instrument is employed, which instrument is very powerful, and the skillful use of which has given to our French scientists a well earned reputation.

The rigid shafts are made of wood or iron, and the perforation is made by means of an auger which crushes the rocks by concussion. The apparatus used by Mr. Lippmann are of this kind, but with a free fall. The shaft of the instrument is balanced, and the blow

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