Correspondence.

Fall of the Sheepshead Bay Water Tower.

To the Editor of the Scientific American:

As I see in your paper several theories advanced in regard to the fall of the stand pipe at Sheepshead Bay, I will advance my theory, and if you think it worthy of publication, you may publish the same, and I will need but few words to express it. The actual cause of the bursting of said pipe I believe to be the vibrations of the water inside of tube or pipe, caused by and from the motion of the pumps, by which motion, on the stroke or discharge of the pumps, the water in the tube would have to rise, and on the receding motion would drop back, which rising and falling motion would cause a greater strain on pipe than if it had been full of water, said vibrations being kept up until there was gained a regular rising and falling motion of water in pipe. Hence the rumbling noise and the irresistible force. WESBY KORMS.

Salina, Kan., January 28, 1887.

Chances for Trade with Madagascar.

To the Editor of the Scientific American:

Much has been written in reference to possible markets for manufactures, and it would seem that Madagascar, now that the war is over, offers something of a field. Recent investigation shows that there is a pressing demand for various manufactured goods, and extravagant prices are demanded and obtained for articles of every day use in countries more favored with the one great necessity for commerce, *i. e.*, transportation. A personal inquiry and research on the west coast of the island of Madagascar has convinced me that the trade of that section, at least, is capable of great expansion. The resources have never been touched, and an immense area of country still remains that neither the trade from the east nor west coast stations at present reaches at all. The goods exhibited on the west coast are of the cheapest and most flimsy description, with the exception of the American brown sheetings, and there are more imitations of that article than there is of the real. Also, the prices range from 66 to 100 per cent profit on the most common articles, while for anything outside of the usual trade it is by no means an uncommon thing to hear of 600 to 700 per cent profit.

Except to the people actually in the trade, the commerce of Madagascar is very little known, and the west coast is almost a *terra incognita*, even merchants long established in Mozambique—only two to three days' sail from one busy port (Maintyrano)—knowing nothing at all of it; and those who are in the trade will only forward letters, etc., when they are obliged to, and then grudgingly and with a great deal of grumbling, ometimes even passing the bounds of decency in their efforts to keep the trade hidden.

If the interest of American manufacturers in the export trade is a real one, why do they not place their productions before the people of Madagascar? Here are 225,000 square miles of tropical country, peopled by races that have the means of payment ready to hand, in the shape of natural products to be had for the gathering. A long list of valuable articles are indigenous, foremost of which at present are rubber, orchilla, hemp, etc., with immense possibilities in the future. B. E. M.

Moroundara, Madagascar, October, 1886.

An Indo-European Canal.

In a recent communication to the French Academy of Sciences, M. Emile Eude proposes a canal between India and Europe by way of the Euphrates Valley, the Persian Gulf, and Syria. This was in ancient times the great route of commerce, before the founding and and development of Alexandria diverted it on Suez and led to the Suez Canal. The new route is put forward as a parallel way to that of Suez. His project is a canal with a double aim—a canal of irrigation and of navigation. In thi way he proposes to restore fertility to these wastes.

The plan is to create a river from Soueidieh to the Persian Gulf, by making the Euphrates flow to the Mediterranean by Aleppo and Antioch; from Beles, in deepening the river from Beles to Felondjah (near ancient Babylon); in passing from the Euphrates to the Tigris by the canal of Saklavijah; and lastly, in descending the Tigris from Bagdad to Kornab, Bassora, and Fao on the Gulf. The new canal would shorten the going and coming voyage to Bombay by six days. M. Eude does not consider the engineering difficulties of a serious kind, except the stony banks of Abou-Said and Kerbeleh, which, however, would not resist modern appliances. He estimates the total cost of the works at more than a milliard of francs, and the maximum capital required would be fifteen hundred million francs.

Recent Progress in the Manufacture of Explosives.

Several new processes have recently been patented in France and Germany for the manufacture of explosives. The improvements consist chiefly in the substitution of other detonating substances for nitro-glycerine, as most of the accidental explosions in mining operations in late years have been caused by explosives in which nitro-glycerine forms the chief ingredient.

The use of nitro-glycerine and explosives derived from it are now under the discussion of the legislature of this and several of the European countries, and it is hoped that the laws relating to the use and sale of explosives may be modified in a way which will exclude the storage and transportation of large quantities of materials which are now known to be spontaneously explosive.

Nitro-glycerine was discovered in the year 1847 by the Italian chemist Sobrero, who was a pupil of the celebrated French savant Pelouze, who had previously described in 1838 the preparation and principal properties of gun cotton. It is, however, chiefly due to the investigations of the Swedish engineer Nobel, whose death was recorded only a short time ago, that we are indebted for an exhaustive examination of the properties of nitro-glycerine, and for the present methods which are in use for rendering it a suitable explosive agent. The various explosives now manufactured and known under the names of dynamite, sebactine, extra dynamite, petrolite, nitrolite, and possibly many others, consist of nitro-glycerine mixed with different proportions of solid materials, such as charcoal, gun cotton, nitrate of potash, and different kinds of porous earth and clay. All these compounds have given rise to numerous accidents, by reason of their spontaneously explosive nature. Many other nitro compounds besides nitro-glycerine have been suggested as explosive agents. Among these may be mentioned nitro-benzol, nitro-toluol, nitro-naphthaline, nitro-phenol, nitro-mannite, and the compounds obtained from starch, cellulose, and sugar by the action of concentrated nitric acid.

A German patent (No. 36,872) of Alfred Nobel, in Paris, covers the use of a mixture of metallic salts of acids rich in oxygen, *e. g.*, nitrate, chlorate, or perchlorate, with one or other of the nitro compounds of glycerine, sugar, or cellulose. The barium, potassium, and sodium salts are mentioned in the patent, and for blasting operations a mixture of from 75 to 80 per cent of one of these salts with 20 to 25 per cent of nitro-glycerine is recommended. For fire arms, 5 to 15 per cent of nitro-glycerine is added, or 10 to 30 per cent of either nitro-glycerine thickened with nitro-cellulose, or nitro-sugar, or nitro-cellulose alone, is substituted. These mixtures are said to be safe, and not liable to spontaneous combustion or explosion. A somewhat similar mixture has been patented by Jacob Engels, of Kalk, near Deutz (Nos. 36,705 and 10,232), in which the nitrate, sulphate, or chloride of ammonium is the salt added to the nitro compounds. The composition of these explosives is somewhat complicated; they contain 5 to 10 per cent pyroxyline, 70 to 60 nitro-glycerine, 15·5 to 18 pyro-papier, 0·5 nitro-starch, 5 to 1 nitro-mannite, 0·5 nitro-benzole, 10 to 30 ammonium salts, 0·5 waterglass, and 8 to 10 of saltpeter. An explosive based on the same principle, and recommended for shells, is made from gun cotton saturated with a solution of potassium chlorate (100 parts gun cotton to 12 parts potassium chlorate), and then slowly dried at a temperature of from 62° C. to 75° C.

The shells are filled with thi compound by first making it into a paste with collodion (12 to 14 per cent) and then allowing the mass to harden within the shell. This mixture is also said to be capable of withstanding a sudden percussion without explosion. The double picrate of sodium and lead or barium obtained by mixing three equivalents of sodium picrate with one of lead or barium picrate is also the subject of another patent. The explosives in which these picrates are used have the composition: 15 to 30 per cent barium sodium picrate, 8 to 30 lead sodium picrate, 2 to 10 potassium picrate, 20 to 5 nitro-naphthaline, 40 to 20 potassium nitrate, 3 to 1½ sugar, 3 to 2 gum, and 4 to ½ of lamp black (English patent 14,140).

BELLITE, A NEW EXPLOSIVE.

M. Carl Lamm, the director of the manufactory of explosives at Stockholm, has come to the conclusion that one of the safest explosives consists of a mixture of nitrate of ammonium with a di- or tri-nitrobenzine. The dinitrobenzines are easily obtained from benzine by direct nitration with a mixture of nitric and sulphuric acids. All three compounds are thus formed, the meta compound being in the largest quantity. They are all soluble in alcohol, from which solution, on cooling, the meta compound crystallizes out first, while the ortho and para dinitrobenzoles remain in the solution. The meta compound melts at 90°, and, when free from nitric acid, can be kept unchanged for any length of time. The tri-nitro compound is easily obtained from the meta compound by heating it with more nitric acid and fuming sulphuric acid to 140° C. Numerous experiments have been conducted by M. Lamm, with a view of ascertaining the best proportions of these two substances to yield the maximum explosive effect. He has named this mixture "bellite," and recommends its use as a substitute for the coarser kinds of gunpowder used in the larger fire arms.

Bellite has the important quality of not being spontaneously explosive; it can, therefore, be manipulated and transported without any risk. To cause it to explode, it is necessary to bring it into contact with a light or with some substance which is strongly heated. Numerous experiments have been tried, in order to determine whether it is possible to explode it by a violent shock; but, in the two years during which these experiments have been carried on, it has never been made to explode by a shock alone, or by friction. Both dinitrobenzine and ammonium nitrate are stable compounds, if in their preparation care be taken that there remains no excess of free nitric acid. P. J. Cleve, the well-known professor of chemistry in the Swedish University at Upsala, has confirmed these statements of the discoverer, and has certified that bellite may be stored or transported by railway without any danger of spontaneous explosion.

Bellite appears to have a power which is greater than any of the explosives at present employed. In one experiment 15 grammes, exploded by means of an ordinary fulminating cap, projected a shell weighing 42·5 kilo. to a distance of 120 meters; and in experiments on blasting, bellite has been found to remove a greater quantity of rock than that obtained by employing the same weight of explosives derived from nitro-glycerine. The mean force of bellite is equal to thirty-five times that of ordinary cannon gunpowder.

The Swedish artillery have made a series of experiments with this new explosive, which go to prove that when it is used for grenades, the e grenades are not liable to spontaneous explosion by any sudden shock, and that, when thrown and caused to explode by a convenient percussion fuse, the results are superior to those obtained from grenades charged in the ordinary way with powder. Mines constructed with bellite are not set on fire or exploded even when struck by a bullet.

The explosive force of bellite, compared with that of fulminating cotton, is as 115 is to 100. From these results, it would appear that bellite marks a new departure in the history of the manufacture of explosive materials; and it would appear that, from its valuable property of being incapable of explosion by shock or friction, we may not fear its application to the destruction of property in the same way as dynamite has unfortunately been used for. M. Henry M. D'Estrey has lately brought this compound under the notice of the scientific public of France, so that we may hope that, before long, it may come into general use as a substitute for dynamite and the allied nitro-glycerine compounds.

Recent experiments by the Minister of War at Berlin on new explosive materials have just been conducted at the island of Eiswerder, near Spandau, and if this compound has been included in their investigations, we may hope for further particulars of its properties in the report on the results.—*Industries.*

Dams in California.

Among the most important dams built in California are: The Bowman dam, height 100 feet, length 425 feet; three dams owned by the Milton Mining and Water Company, forming the English reservoir, the largest of these having a height of 131 feet; the Fordyce, of the South Yuba Canal Company, 567 feet long and 75 feet high; catchment basin, 40 square miles; the Eureka Lake dam of the Eureka Lake and Yuba Canal Company, length 250 feet and height 68 feet. All these dams are built of dry rubble stone and faced with a water-tight lining of planks. An engraving of this kind of dam we take from Mr. Bowie's work on hydraulic mining in California, together with these facts:

The Tuolumne County Water Company built several timber crib dams, the largest across the south fork of the Stanislaus River. This dam, which is 300 feet long and 60 feet high, rests for its entire base on solid granite bedrock. The cribs constructed of round tamarack logs, from two to three feet in diameter, and about eight feet square from log to log (10 feet center to center), and the timbers are pinned together with wooden treenails. The cribs have no rock filling.

The face is formed of flattened three inch timber pinned with wooden treenails to the crib and calked with cedar bark. The flood water passes over the crest of the dam for the entire length. The water is drawn off by several gates, one above the other, placed on the inclined water face. The dam was built in 1856. Its total cost did not exceed $40,000. Pine dams owned by this company, constructed on the same plan, have decayed, while cedar cribs are still in perfect order. The Spring Valley and Cherokee Company's Concow reservoir, in Butte County, is formed by two earthen dams, each about 55 feet in height. One of these, which is used as a waste, has its lower side built of heavy brush embedded in the earth. —*Min. and Sci. Press.*

The American Watch Industry.

John Fernie, M.I.C.E., writes from Philadelphia, in *Engineering*, December 3, as follows, on the American watch manufacture:

"I always read with great pleasure the words which fall from Mr. Head, the able president of the Institution of Mechanical Engineers, and I am sure he will pardon me when I call his attention to a great omission he made in his remarks about the American Watch Co. Mr. Head, like a good many more Englishmen who speak about American machinery, gets the facts all right, but does not get down to the philosophy of the facts; and this, I observe, has been the case in like discussions in England about American bridges. Now, in 1876 I visited the watch works at Waltham, and a long account from my pen was published in the *Times* of what I had seen there. This paragraph I copy from the letter:

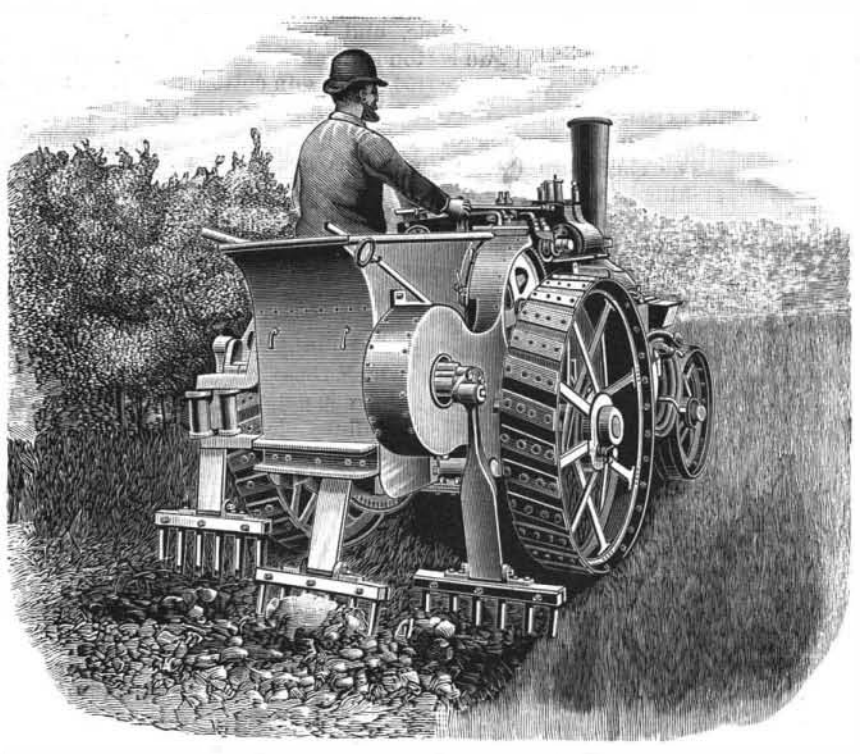
"'I was desirous of seeing how they obtained their scale, and Mr. Webster, the able engineer of the company, informed me he found the thousandth part of an inch too coarse a dimension and the ten-thousandth too fine, and he was led to divide the millimeter into a hundred parts, and found it a proper proportion for his work; and it is from a series of gauges founded on this system that the whole of the watches are built up and the constant accuracy of all their dimensions maintained.'

"Now in this scale, this series of gauges, lies the philosophy of the success of the American watch, because it is the foundation on which stands the accuracy, the repetition, the almost perfect duplication, of a perfect machine, which no one can make any finer. The ordinary fineness of work for the principal part of the watches is 1-2540 part of an inch, but for the very finest work they can subdivide this into 1-5080, or even 1-10160 part of an inch, and in the manufacture of standard gauges they can work to the 1-25400 part of an inch. Now what has grown out of this system since 1876? The old factory torn down and doubled; hand machinery replaced by automatic machinery; watches made for half the cost; quantity increased three or four times; quality immensely improved; in 1876 they were turning out 366 watches a day, in 1886 they were turning out 1,200 watches a day; and now I come to my moral, and apply the wise warning words of Mr. Head about watches to the manufacture of locomotives in England:

"'They began by studying the watch as a piece of mechanism. They selected the best points of any current type. They abandoned the pin (*sic*) and chain. They introduced improvements of their own. They settled on a standard type, determined to adhere to it; made certain sizes and no others. Result: Killed the watch trade in England, and would have killed it in Switzerland had the Swiss not adopted the American system and machinery.'"

IMPROVED STEAM DIGGER.

Our engraving shows an improved form of steam digger, recently made at Thetford, Eng., by Burrell & Sons, from the plans of F. Proctor. The machine is said to work well, and, according to the *Engineer*, is likely to prove valuable. The machine is provided at its rear end with a series of three digging forks, which alternately enter and break up the ground, and the vehicle advances as fast as the diggers perform their work. This device appears to be capable of operating on uneven ground. When not employed in breaking the soil, the machine may be used for various other agricultural purposes.



IMPROVED STEAM DIGGER.

To Re-ink a Type Writer Ribbon.

J. S. D. writes about type writer ribbons:

"Some time ago I tried the experiment of re-inking a ribbon, with such success that I never expect to buy one again. In two ounces or more of any ordinary writing fluid put a spoonful of thick gum arabic mucilage and a teaspoonful of brown sugar, warm the mixture, and immerse the ribbon long enough to become well saturated. When dry, spread the ribbon on a board and brush it well with glycerine. Should there be too much "color" in the ribbon, press it out, between papers, with a warm flatiron; or, if too dry, brush it again with glycerine. The secret of the ribbon giving out its color is in the glycerine, and if you have body enough in the color, there is no danger that it cannot be made to work well. Such a ribbon is not affected by the dryness or humidity of the atmosphere, and I esteem mine as much better than any obtained from the trade.

"It may be that I was fortunate in hitting upon just the right proportion of the different constituents, and possibly a second trial might not be so successful; but I think with a little care any one could do as well with the same or similar means. My object was to get body to the color, hence the mucilage and sugar. Then it was necessary that the ribbon should retain a certain degree of moisture, for the gum and sugar make it dry and harsh, so the glycerine coat was put on; but there was danger of smearing the paper with too much moisture, or a wrinkled surface, and the ironing obviated this."

HOW LARGE DOES IT APPEAR?

T. BERRY SMITH.

I give a method which I have found useful in giving to students of the microscope some adequate idea of the dimensions of animalcules found in stagnant water.

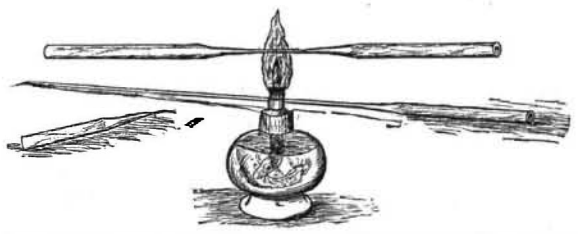


Fig. 1.—DRAWING THE GLASS TUBING IN ALCOHOL FLAME.

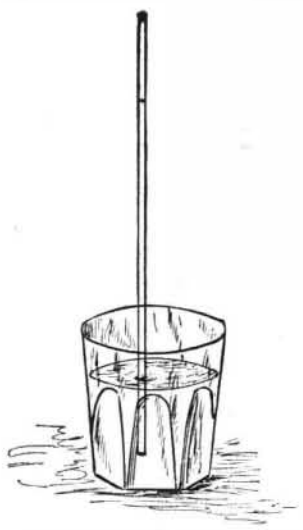


Fig. 2.—FILLING THE TUBE BY CAPILLARY ACTION.

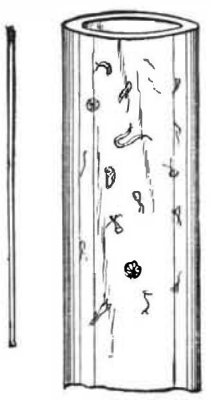


Fig. 3.—THE TUBE, AND THE TUBE ENLARGED SHOWING ANIMALCULES WITHIN.

A drop of apparently clear water may be placed on a glass slide, put under the objective, and cause wonder and astonishment when the multitudes of animalcular life are brought to view. There they are, swimming, twisting, standing, but how large are they? Don't know, because there is nothing to compare them with. Take a piece of soft glass tubing and soften it in the flame of a gas or alcohol lamp, and then draw it out into a very fine thread, which will be a capillary tube (see Fig. 1). That it is a tube may be proved by inserting one end in water, and blowing into the other end, when minute bubbles will rise. Now, insert this tube in a cup of stagnant water, and the water will readily enter it, rising perhaps several inches above the surface of the water in the cup (Fig. 2). Hold the tube before you. No larger than a hair of your head, and the bore much smaller. Is it possible there are living creatures in that small space?

Place the tube under the microscope, and lo! many a curious creature disporting itself in as much space as a man would have in a wide street of a city (Fig. 3). I have seen them where it would take at least a score of them placed end to end to make a chain long enough to reach across the space in the tube.

How large are they? Hold up the glass thread before your eyes and consider. It is small, the bore is smaller, and they are twenty, perhaps fifty, times smaller still. Yet each is a perfect creature, with organized structure, and organs adapted for various functions. How large is one's mouth, foot, heel? Where is the limit?

"'Tis said that all the larger fleas have lesser fleas to bite 'em,
And these in turn have smaller fleas, and so *ad infinitum*?"

Interchangeability of Machinery.

Mr. David Beddie, writing from Blayney, New South Wales, to the *Ironmonger*, raises certain questions which merit the attention of implement and machinery manufacturers. He complains of the multiplicity of patterns of various parts of harvesting and other machines, and instances fingers, intersections, braces, and connecting rods as parts which he thinks might with advantage be reduced to about half a dozen standard forms. In knife sections he complains that the rivet holes vary, while in the fingers the bolt holes are not alike. In consequence of these variations it is often difficult, and even impossible, to get extra parts; and, as these are not made in the colony, much trouble and loss are caused. As examples Mr. Beddie furnishes the following particulars:

"Last year I altered some old fashioned wrought iron fingers to the steel plated fingers of a popular American maker. This year I got some more to alter. I set to and drilled the bar, etc., for the alteration, and sent for the fingers, and was informed they were not to be had in Australia. I sent to the agent for some Hornsby fittings four months ago, and have not got them yet. I ordered some shares for Ransomes, Sims & Jefferies' Scotch grubber, and am informed they are not to be had. I ordered a Pulsometer No. 1 pump from the agents, and was informed they had none. I asked them to get one from their branches in the other colonies, or say how long until they would have one. To the first part I got the answer 'none,' and to the second 'that they could get it in, 'say, four months.' I have written six letters over it, and have not had one yet. In some of the replies I was informed that a Mr. Clarke could make one in Melbourne in two weeks from receipt of order. The address was not given. I was advised to address him, 'Maker Pulsometer Pumps, Melbourne,' which I did, and have not received a reply. Perhaps I will have it through the Dead Letter Office. Did all manufacturers catalogue and code their wares, as all number them, in cases such as I have mentioned, they could be telegraphed for and landed here in six weeks, independent of agents, who will not trouble to do so."

These complaints, it will be seen, appear to hint that there is something wanting on the part of the Australasian agents for the British firms named.

What is really worthy of being discussed is the question of the interchangeability of machine and implement parts, although we do not anticipate that that system is likely to be carried so far as to cover all the makers of any given article. Take mowers and reapers, for instance. There are numerous patterns of these machines, each having its peculiarity, and each being claimed to possess merits not owned by any of its rivals. It is not easy, consequently, to understand why or how A will derange or alter his machine in its vital points simply in order that the parts of B's machine may interchange with it. Nor, supposing the principle to be admitted, is it easy to settle who shall give way, and who be regarded as having the standard to which all the other makers are to work. At the same time, we are quite of opinion that there are several minor—and some leading—parts of the different kinds of machines and implements which might with advantage be made to standard sizes or dimensions.

Wanted—An Inventor.

The pita plant of Honduras invites the enterprise of American capital and Yankee invention. Only one thing is needed and the lucky man's fortune is made. Mr. Burchard, our consul, reports that this pita plant, which has never been cultivated, grows spontaneously and in apparently inexhaustible quantities by the margin of every river and lagoon, and, indeed, anywhere below the altitude of two thousand feet. It can be had for the cost of cutting. The fiber is susceptible of a thousand uses. The people of Honduras convert it into thread for sewing boots and shoes, and into nets, fish lines, and cordage. The finest hammocks and most costly are also made of it. The small quantities which have been sent to this market have been manufactured into handkerchiefs, laces, ribbons, false hair, and wigs. The difficulty is to decorticate the plant without rotting or otherwise injuring the fiber. The man who can do that will be able to take fortune at the flood.—*N. Y. Herald.*