Correspondence.

Transplanting Trees.

To the Editor of the Scientific American:

In the article on transplanting trees published in the SCIENTIFIC AMERICAN, November 26, from *Garden* (London), one of the most important precautions is entirely overlooked; that is, to have the tree, when transplanted, in the same position as to the points of the compass as before removal.

The south side of a tree is exposed to the direct rays of the sun, while the north side is more or less protected from them. Nature accommodates itself to this changed condition, and the difference in development in many trees on the south and north sides is obvious to ordinary observation.

When the south side of a tree is turned to the north, each side finds itself in a position for which nature has made no preparation, and death follows almost as certainly as if the top were put in the ground and the roots turned up to the sky.

The willow and some other trees will grow if planted upside down, and many trees will grow with the south side turned to the north; but with trees difficult to transplant at best, it is a mistake very apt to be fatal to turn the south side to the north, and the older the tree, the greater the danger from changing sides in transplanting. D. S. TROY.

Montgomery, Ala., November 28, 1887.

A Singular Railway Accident.

To the Editor of the Scientific American:

An unusual accident occurred on the railway at Parkersburg, W. Va., a few days ago in which a locomotive was badly used up and several persons somewhat injured. The locomotive attached to a freight train was pulling out of the station up grade, and was working a full head of steam at full stroke, the fireman was shoveling fine or slack coal into the furnace, when suddenly the netting in the diamond stack became entirely stopped up, which forced all the blaze, gas, smoke, and steam from the exhaust out of the furnace door into the cab, severely burning the engineer and fireman and brakeman. The engineer jumped out through the front window of the cab, leaving the throttle wide open. The engine commenced slipping with fearful velocity, and when stopped it was found that both parallel rods were bent down about four inches out of a straight line, and all the wrist pins badly sprung. The engine was hauled to the shop and repaired, started out with a train, but broke down again. This time one of the piston heads broke off from the piston inside the cylinder, knocking out the head and otherwise injuring the cylinder. The peculiarity of the accident has caused considerable comment among railroad men as to the cause and some of the effects of the accident. My opinion is that the exhaust caught up some of the fine coal that the fireman was using, and carried it up against the netting, and the pressure in the stack, immediately following, holding it there as securely as though it had been cemented. This caused the fire, etc., to come out of the furnace door, with the result above stated. As to the rods becoming bent, the great velocity of the revolutions of the wheels, the rods not being strong enough to resist the strain caused in changing the motion from down to up, is what caused them to be bent; and the piston must have become fractured when the engine was shut off, as it would not be apt to occur while working steam with the engine slipping, as the steam would act as a cushion to receive the blow of the piston at the end of each stroke; but when shut off, this cushion, as it were, was removed, and the piston became fractured, so that when steam was applied after the engine was repaired, the head broke off entirely. I believe that the axles of locomotives are frequently sprung while slipping, by the engineer giving the engine sand, especially if the sand is fed by one pipe. In this case the sand would act as a powerful brake on one driver, while the others would with their momentum tend to force ahead, with the result of springing the axles or pins. I was much pleased in reading Prof. Sloane's account of his experiment on the injector in a late number of the SCIENTIFIC AMERICAN, as some months ago I wrote to the *Locomotive Engineer's Journal*, giving my views as to "why the injector worked." I compared it to a shot gun in which the steam was the powder and the water was the shot. The powder, or steam, was harmless without the water or shot. The steam having no weight could not penetrate the check; but give it the shot, or water, and it would go through the check instantly. Prof. Sloane proves this clearly in his experiment. He could blow through the tube all day with no effect, but when the shot are put in, they strike with such force as to open the little check valve easily. Some of our great wise men laughed at my explanation, and it is a great satisfaction to see it so clearly explained by Prof. Sloane.

Marietta, O., November 26, 1887. "W. M."

THE curvature of the earth is such that a straight line a mile long would be 2·04 inches from the surface at either end.

Work Begun on the Ship Canal between Liverpool and Manchester.

The actual work of constructing the Manchester Ship Canal was commenced, November 11, in a strangely modest and unassuming manner, says the *Engineer*, considering the magnitude and importance of the undertaking. Instead of having an elaborate ceremony, with a public personage as the leading figure, as is customary in such cases, the directors went quietly up the Mersey to Eastham, on the Cheshire shore, and each cut a sod. Nothing could be more unpretentious than that method of inaugurating what is likely to prove a revolutionary enterprise, commercially speaking; but it must be observed that Eastham is not the most convenient or most accessible spot for an elaborate public ceremony, and this may have influenced the directors in dispensing with formalities. An ordinary navvy's spade being handed to Lord Egerton, the chairman of the company, his lordship cut the first sod, amid ringing cheers from the assembled spectators. Following him, Sir J. C. Lee, deputy chairman, Mr. Alderman Bailey, Mr. Henry Boddington, Mr. J. K. Bythell, Mr. W. J. Crossley, Mr. C. J. Galloway, the Mayor of Stockport (Mr. J. Leigh), and the Mayor of Oldham (Mr. S. R. Platt), each cut a sod, they being directors. Mr. Leader Williams, C.E., chief engineer to the company, next filled a wheelbarrow with earth and tipped it near by, thus really beginning the work of excavation, and subsequently Mr. Boulton, of Ashton-under-Lyne, cut a sod on behalf of himself and other shareholders.

Later on the directors examined the plant which the contractor, Mr. Walker, has collected, which, at Eastham and Ellesmere Port, embraces fifteen locomotives, numerous steam navvies, or excavators, of the latest and most improved type, massive cranes, and a vast quantity of timber and steel rails. It is expected that rapid progress will be made with this, the lower part of the canal, notwithstanding the advent of wintry weather, and the upper part will be proceeded with. A sufficient number of trucks have been provided by the Ashbury Railway Carriage Company, which has contracted to supply 100 wagons each week up to next May. Already within a week a good deal has been done. The steam excavators have been put in position, railways are being laid down for carrying away the excavated matter, and smiths' and joiners' workshops and store sheds have been erected. Naturally, the prospect of work has drawn many hundreds of unemployed men to the scene of operations; but as only one section of the canal is at present being proceeded with, only a small number of men has been taken on yet. Only some three or four hundred are so far employed, but there is a good prospect for genuine and capable workmen, for this section alone will probably require at least two thousand men, and when the whole work is in progress the number of men employed will be between twenty and thirty thousand.

Gerson's System of Filtration.

The system of filtration invented by Dr. Gerson, of Hamburg, depends chiefly for its action upon the presence of iron in the filtering material, and is carried out in two stages. The fatal influence of iron on the class of organisms found in water is well known, although only imperfectly understood. It is taken advantage of in the well known Bischof spongy iron filter and in the process of water purification pursued at the Antwerp Water Works under the superintendence of Mr. William Anderson. In the former case, contact with metallic iron seems to be the means by which bacteria and the like are destroyed, while in the latter the impurities in the water are attacked by a solution of iron, and are afterward removed by a sand filter. In Dr. Gerson's apparatus the germicidal material is insoluble tannate of iron, which is presented to the water by being distributed thoughout the entire mass of the filtering medium. Two substances are used to carry the iron. The first is sponge, and the second pumice stone. It is well known that sponge makes a capital filtering material, taking solid matters out of water most efficiently. But as ordinarily used it is subject to decay, and consequently it not only requires renewal, but may also introduce contamination into the water which it is supposed to purify. But if all its fibers be filled with insoluble tannate of iron, the vegetable material is preserved, and may be regarded almost as a mineral. In passing through the sponge the greater part of the insoluble matter in the water is removed, while there is a prolonged contact with the iron, which cannot fail to affect the organisms. It is, however, the second filtering material which is supposed to have the greater effect on these creatures. In this the tannate of iron is held in the cells of pumice stone, which is used in layers of different size, varying from gravel to fine sand. Here we have the separating power of a sand filter added to the action of the iron, the result being that the water emerges with a very high degree of purity.

This system may be carried out by aid of various apparatus. A usual method is to employ a pair of vertical iron cylinders for the preliminary filtration and a second pair for the final filtration. The water is admitted simultaneously to the lower parts of the first two filters, and flows upward under a head of about 15 feet. The greater part of the sand and mud is extracted by the first few inches of sponge, the office of the remainder being to catch the finer floating particles. After emerging at the top of the cylinders, the water passes to the bases of the cylinders forming the secondary filters. These are filled with layers of pumice of various degrees of fineness, also impregnated with tannate of iron. In passing through this material every drop of the water has to come in contact time after time with the iron, and not a single organism can escape the prejudicial effect of the iron. The secondary filters can, according to local circumstances, be worked either under high pressure or low pressure. In the first case their capacity is about half the capacity of the preliminary filters, and the total pressure for both filters, 26 feet to 28 feet; while in the second case, under low pressure—namely, about 32 inches—they require ten times the surface of the preliminary filters, but still exceed the capacity of sand filters twenty-five times.

The filters are cleaned by reversing the current, valves being provided by which this result can be immediately attained. By this device the greater part of the dirt, which lies at the bottom, can be washed out, although it is, of course, impossible to thoroughly cleanse the filtering material in this way. It is not, however, a very serious affair to take out the whole of the sponge and the pumice and to purify them thoroughly. As far as the sponge is concerned, the method adopted by the Pulsometer Engineering Company, of Nine Elms, London, of alternately compressing and relaxing the sponge in the cylinder, while at the same time water is flowing through it in the reverse direction, would probably add greatly to the efficiency of this filter, as it would enable one-half of it to be made thoroughly pure every day, or several times a day if required.

Dr. Gerson's filters are designed for bleach works, paper works, breweries, boiler feeding, and other industrial purposes, as well as for towns' water works. For the latter purpose they only require about one-ninth the floor space occupied by sand filters. For many industrial purposes the first filtration is quite sufficient without the second. Already there are two installations at work in this country, one at the Alexandra Dock, Newport, Mon., and another at the paper mills of Messrs. Fletcher & Son, Stoneclough, Lancashire. On the Continent these filters are used in many large breweries, paper works, and the like. The following are some analyses made of water from sand filters in comparison with Dr. Gerson's filters. The quantity of organic matter has been determined by the consumption of oxygen for their oxidation:

	Oxygen.
Analysis by the German Imperial Sanitary Board:	
Water from the Elbe, unfiltered	0·365
" " " filtered through sand	0·316
Analysis by the German Hygienic Institute in Munich:	
Water from the Elbe, unfiltered	0·420
" " " filtered through sand	0·400
Analysis by Dr. Niederstadt, in Hamburg:	
Water from the Elbe, unfiltered	0·373
" " " filtered through Dr. Gerson's filter	0·11
Analyses by Messrs. Senurier and Lubeen, in Amsterdam:	
Water from the downs at Amsterdam, unfiltered	0·23
Ditto, filtered through sand	0·22
Water of the Schie, near Rotterdam, unfiltered	0·29
Ditto, filtered through Dr. Gerson's filter	0·17

Analysis by Mr. Stein, town chemist at Copenhagen:

Water from the canal of the water supply, cleared through standing.

	Un-filtered.	Filtered through Dr. Gerson's system.
Residue after evaporation (130° Cent.)	4·800	3·540
Ammonia	—	—
Nitric acid	traces	traces
Hydrochloric acid (HCl)	0·592	0·374
Sulphuric acid (H_2SO_4)	1·144	0·563
Lime (CaO)	1·100	1·100
Magnesia (MgO)	0·382	0·216
Oxygen required for the oxidation of organic matter	0·097	0·076

Microscopical Examination.

Unfiltered water:

Tails of algæ, vortochaceæ, infusoriæ, wire bacteria, dust bacteria, oscillariscæ, palmellaceæ, pediostocæ, desmediacæ, diatomeæ, green wire algæ, living crabs, and some urchins.

Water from Dr. Gerson's filters:

No organisms found.

—*Engineering.*

Rise and Progress of Steam Navigation.

In fifty years steamships have increased in tonnage from 67,969 tons to 4,318,153 tons, while their proportion to the total registered tonnage of British ships has increased from 1 to 41 to 1 to 2·14. The first Cunarders were only 207 feet long and 34 feet 4 inches beam, while the first steamer which plied regularly between Liverpool and New York, the Royal William, measured only 175 feet in length. The steps by which the marine engine has developed have been, first, the screw propeller, then the introduction of iron and steel in the building of ships, then the increase of steam pressure in the boiler, then the adoption of surface condensation, followed by the use of compound and duplicate expansion cylinders, and a much larger increase in boiler pressure, rendered possible by the use of mild steel in the construction of boilers, have effected in all a reduction of 70 per cent in the consumption of coal and an increase of 110 per cent in speed.