Timber Culture in Tennessee.

Tennessee is one of the few States that have not been stripped of their timber without concern for future needs and climatic conditions. About fifty per cent of the land in Tennessee is still wooded. There are 26,880,000 acres in the State altogether, of which nearly 13,000,000 are timbered. Only three States in the South have a greater timber acreage—North Carolina and South Carolina and Georgia. As the altitude of the forests of Tennessee varies from 200 to 6,000 feet above the sea's level, woods of every kind known to the United States are to be found there. In value, the oak has the first place, but the ash, of which there are two varieties, the white and the blue, is hardly less important. Even in Tennessee the forests of ash are now found only in districts remote from the railroads, but so rapid is the growth of this tree that it is being planted as an investment. A farmer who set out a grove of ash trees covering ten acres twelve years ago now has 12,000 trees 8 inches in diameter on an average and 35 feet high. There were no expenses of cultivating, and the ten acres of 12,000 trees are worth at the present time between $7,000 and $8,000. Besides oak and ash, Tennessee possesses three varieties of elm, two of gum, two of fir, three of hickory, two of locust, three of maple, two of pine, three of poplar, and two of walnut. Among other trees found in abundance are the beech, birch, buckeye, red cedar, wild cherry, cottonwood, cypress, dogwood, basswood, mulberry, tupelo, sycamore, and the sassafras. Of oaks, there are no less than twelve varieties. Cedar, unfortunately, is going very fast. Bucket factories in the State use 5,000,000 feet of this timber every year. Telegraph companies use it almost exclusively for poles. Nearly 1,000,000 feet goes each year to St. Louis, where it is made into fence rails. The rapidity with which the cedar is being consumed has opened the eyes of some of the friends of the forests in Tennessee, and a warning has been sounded.—*N. Y. Evening Post.*

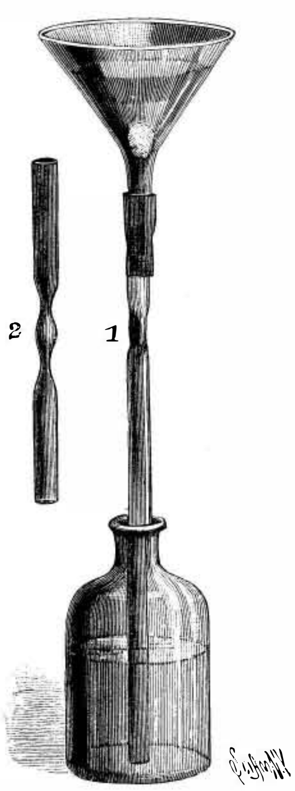
INCREASING USE OF TRACTION ENGINES.

The successful employment of the traction engine in heavy work is most effectively illustrated in the logging business of the Siskiyou Lumber Company, at Sisson, Cal., as shown in our engraving, made direct from a photograph. It is said the grades traveled over are also much steeper than it has been usual, heretofore, to attack with traction engines, but that the work is in every way successfully performed. The engine shown was made by the Best Manufacturing Company, of San Leandro, Cal., and many of these engines are now being used in California for agricultural purposes, freight hauling, etc. As the engine is three-wheeled, it can be turned in as short a space as a two-horse wagon. The starting, steering and reversing of engine, and pumping of water, are all done by one man without leaving his seat. The drive wheel tires are of steel, and the height of the wheels of the 50 horse power engine is 8 feet; the width of the tire, 26 inches. The engine is supplied with a windlass for hauling logs out of canons and other inaccessible places, this also being operated by the engineer from his place on the engine.

One of these engines is reported to be employed in hauling freight between Farmington and Stockton, Cal., on a road parallel with the railway and at the same rates, its owner thus doing a large and profitable business. The saving effected by their use in all kinds of agricultural work is something remarkable, the figures given for plowing, harrowing, and seeding, with the aid of these engines, being as low as 60 cents per acre, while, with the aid of a steam harvester, it is said that grain may be cut, thrashed, recleaned, and sacked ready for the mill at a cost of but 30 cents per acre.

RAPID FILTERING APPARATUS.

Mr. George A. James, chemist, of Selby, Cal., has sent us sketches of a very simple and effective filtering apparatus which we thought our readers would be interested in seeing. A glass tube of any convenient length, having a contraction near its upper end, is connected with the small end of the funnel by a short piece of rubber tube. The lower end of the glass tube is inserted in the bottle or other vessel which receives the filtered liquid, and the funnel is supported by a filter stand (not shown).



RAPID FILTERING APPARATUS.

The contraction in this case is made by flattening the tube so that its sides approach each other to within a very short distance, say $\frac{1}{100}$ of an inch. This contraction prevents air from entering the part of the tube below the contraction, and thus maintains a solid column of liquid below the contraction. The liquid by its weight produces a partial vacuum in the tube, and thus allows the air pressure on the liquid in the funnel to force the liquid through the filtering medium. The rapidity with which the filtering is accomplished depends upon the length of the tube, other things being equal.

In Fig. 2 is shown a modification of the apparatus, in which the tube is contracted evenly all around in two places, leaving a small circular opening instead of a flat one.

Experience shows the flattened tube to be preferable.

A Poser for Papa.

"Papa," said little Katie, "do you know how high those clouds are?"

"No, child," answered her father, with an indulgent smile.

"Well," said Katie, regarding them with critical eye, "I do. They're cirrus clouds, and they're about three miles and a half high. You didn't have very good schools when you was little, did you, papa?"—*Chicago Tribune.*

Remarkable Armor Plate Trial.

The St. Petersburg correspondent of the London *Times* says a remarkable trial of English armor plates took place on Thursday, June 28, in the artillery polygon at Okhta, near St. Petersburg, with results that were certainly startling. There were three plates —one from Messrs. Cammell, measuring 8 feet square and 6 inches in thickness, and two from Messrs. John Brown & Company, one being of the same dimensions as those of the Cammell plate, and the other 8 feet square, 10 inches thick, and bent. All three plates had been face-hardened by the Harvey process. The gun used throughout was a 6 inch Oboukhoff of 45 calibers. The projectiles were of two sorts—namely, the latest improved Holtzer shell, made at the Russian Putilof works, and a similar shell with a Russian improvement, the secret of which is jealously guarded. The velocity of six rounds fired at the 6 inch plates was about 1,850 foot seconds. At the 10 inch plates the velocity was nearly 2,400 foot seconds. One round was fired with each projectile, which, on account of the curvature of the plate, struck with an obliquity of from eight to ten degrees. All the shells treated by the secret Russian process penetrated the targets entirely, and sped some thousand yards to the rear, while the other shells under similar conditions, though obtaining greater penetration than has ever yet been reached by any projectiles known in England, were stopped and broken up. The secretly improved shells passed right through a wooden screen erected a short distance from the backing of the plates, so that there could be no doubt that they went through the plates undamaged, although no one was allowed to see them afterward.

It would seem that two lessons are to be learned from this important trial. In the first place the Holtzer shell made in Russia is better than any known in England; and secondly, the secret Russian improvement which it has always been expected would fail when tested by oblique firing has undoubtedly proved itself to be a remarkable success, and has placed in the hands of the Russian government a projectile superior to any hitherto invented. The oblique tests in themselves will be immensely useful, as I understand that very little experience has up to the present been gathered by oblique firing against armor. This in real warfare would naturally be the rule, and not the exception. Further trials at still greater angles of obliquity will take place.

Utilization of the Earth's Heat.

In his address to the *Chambre Syndicale des Produits Chimiques*, Mr. Berthelon, the illustrious chemist, suggested as a subject for the attention of the next generation of engineers the substitution of the heat of the sun, or the central heat, as a source of energy, for that derived from coal. The sinking of a shaft three or four kilometers deep is not beyond the power of modern and especially of future engineering. At such a depth, water would be found with a temperature of 160 degrees to 200 degrees Cen., which would develop enough power for any number of machines. This power would be available in any part of the globe, and many thousands of years would pass away before this store of energy would suffer an appreciable diminution.


TRACTION ENGINE USED FOR LOGGING PURPOSES IN CALIFORNIA.

The Storage Battery of the Air.

BY PROF. ALEXANDER M'ADIE IN "HARPER'S MAGAZINE."

The air will stand a strain of about 9,600 grains per square foot before breaking. That is, the flash will occur when the electrical pull amounts to this, 1·37 pounds per square foot. For the energy of a cubic mile of strained air just before the flash we have, then, about 70,000,000 foot tons. The average thunder head or cumulo-nimbus cloud is not a mile high, however. For a small cloud, one a hundred yards square, and distant only a quarter of a mile, we would get about 300 horse power. Now a flash even a quarter of a mile long means a potential of many million volts. We cannot at present measure this directly, but we can determine the potential of the air within certain limits on any day, thunderstorm or no thunderstorm. In 1885, at Blue Hill Observatory, and in subsequent years, we measured the potential of the air with insulated water-dropping collectors, after the methods of Thomson (now Kelvin) and Mascart. The top of the hill is 600 feet above the surrounding country; but with Franklin's idea of reaching out a little farther from the earth, I ventured to use at times a large kite, tin-foiled, and for kite string some 500 feet of hemp fish line wrapped about with fine uncovered copper wire. During thunderstorms the sparkling and sizzling at the electrometer end of the kite string were incessant and startling. And even on cloudless days I found it possible to draw sparks, reading at the same time on the electrometer from minute to minute the electrification of the air in volts. In 1886 and 1887, in some investigations carried on by the Chief Signal Officer, and more immediately under the supervision of Professor Mendenhall, I experimented at the top of the Washington Monument, at that time the highest edifice in the world. The investigation continued many months, but perhaps days on which severe thunderstorms occurred were most impressive.

It being beyond dispute, then, that high potentials can be obtained from the air, the question naturally ensuing is, Can we not use them? With three or four sparks as small as those mentioned above, a large fruit jar can be cleared of smoke with which it has previously been filled. Perhaps nature repeats this on a large scale with lightning and clarifies a foul dust-laden atmosphere with these great sparks. It may be, too, that these flashes are all needed, and to attempt to divert them would be unwise. Be that as it may, we are living in an age of "step-up" and "step-down" transformers; an age when, for the first time in centuries, we are perilously near duplicating lightning. Until recently we studied lightning only in miniature. Prof. Elihu Thomson was kind enough to show me in his Lynn laboratory, two summers ago, some of his larger home-made lightning. Indeed, potentials of 100,000 volts are less rare to-day than potentials of 5,000 volts were five years ago. All who saw the Thomson and Tesla exhibits at the Electrical building, Chicago, will easily believe that it is within our power to turn the fleeting high-potential lightning into a current of lower potential and use it.

Professor Trowbridge, of Harvard University, in a discussion of some photographic negatives, shows that "the discharge follows exactly the same path in air for three hundred thousandths of a second," and adds that "it is probable that an ordinary discharge of lightning of a few hundred feet in length could light for an instant many thousand incandescent lamps if it were properly transformed by means of a step-down transformer." The eye alone cannot give a complete history of the myriad minor flashes during a thunderstorm. The charred, though to us intensely brilliant, crack in the air which we call lightning is but a great splash in the ether ocean. The waves and ripples come tumbling along in all directions, spreading rapidly, aye, very rapidly, nearly 200,000 miles per second. Given a proper resonator, and the waves will do work. If my reader keep every sense on the alert, he may happen on some strange illustration of work done by lightning, now all unsuspected. In the tinkling of the telephone bell, the blinking of an incandescent lamp, the melting of a fuse, or the tiny spark from a gas pipe or loose wire, is the constant proof that there are more things going on between heaven and earth during a thunderstorm than most of us dream of in our philosophy.

Old Tin Cans.

Getting a "corner" on old tin cans and scrap iron will strike many as being an odd undertaking, yet this is what a Butte, Mont., alderman has done, says the *Inter-Mountain* of that city. Within the past six months business of saving the copper that flows in solution in the waste water from the mines has grown to be quite an industry, and Mr. Ledford, who has a lease on the Anaconda mine water, is carrying on the business on a large scale. He requires a large quantity of tin cans and old iron. Heretofore these could be had for the hauling away, but they have been so much in demand that the owners have set a price on them, and men are regularly engaged in their collection. The alderman alluded to is said to now control all the available old iron and tin cans in Silver Bow County, and has several car loads stored away which he will be willing to sell. It is understood he is desirous of getting into the copper business himself, and as he now thinks he holds the key to the situation it is likely that somebody will be forced to come to his terms or take him in as a partner.

The Spontaneous Ignition of Lamp Shades.

Dr. A. Dupre has described, in a letter to the *Times*, a remarkable instance of the spontaneous combustion of a paper lamp shade. It is stated that the shade in question was made about a year ago in the familiar style, of two sheets of crinkled tissue paper—one white and one yellow—gathered together at the top, and fixed to the wire frame, forming a considerable bunch of the material. For two days prior to the accident the lamp had not been lighted; and there had been no fire in the room. After the morning of the day of the fire, when the room was dusted and the shade seen to be apparently in its usual condition, the apartment had not been entered; and when the charred remains of the shade were at length found, the indications were such as to leave no doubt in Dr. Dupre's mind that the case was one of genuine spontaneous ignition. The cause is ascribed to the presence of chromate of lead in the yellow paper. The dangerous quality of such papers is readily detected by setting fire to it, and blowing out the flame. In the case of ordinary paper, it will be found that the glow along the burnt edge is very soon extinguished, while the presence of chromate of lead in paper causes it to act like touch paper. Besides the yellow paper, pale green tissue papers are also colored with the chromate, and would, doubtless, be equally dangerous; and there may be others in the same condition. The extensive use of the prettily colored crinkled papers for home-made lamp shades, etc., lends importance to Dr. Dupre's discovery. He admits that he has not yet been able to reproduce experimentally the necessary conditions leading to the spontaneous ignition described; but possibly the long drying that a year-old lamp shade receives had something to do with it.

Suspended Animation.

Ordinarily, if oxygen, water, nourishment, or heat be removed, death ensues. Experiments, however, have shown cases of suspended animation, in which the absence of one or more of these essentials to life has not produced death. Spallanzani experimented with a great many microscopic forms of life, and attained some interesting results. Some of them he dried eleven times, expecting to see them killed, but they revived every time. Doyere did the same, then heated them to 150 degrees Fah., and placed them in a vacuum for four weeks, but they revived when he poured water upon them. Baker kept them dry for four years, and then revived them by water. Lately, however, it has been proved that the forms which revive are not identical with those which were dried up. The animalcules themselves died, but their eggs withstood the severe heating of 150 degrees. In boiling water they would have perished.

Spallanzani has proved that the common snail may be deprived of any of the four conditions of life and yet survive. It simply retires within its shell and goes to sleep. Spallanzani cut small openings in the shells of the snails. Through these he could clearly see the functions of life in operation. As the temperature gradually diminished, these operations became weaker and weaker; at 0 degree all movements ceased, and the snail appeared to be dead. As soon as the temperature was raised, movements indicative of life began again; by raising the temperature to normal height, the snail regained its normal powers. Thus the experimenter quickened and reduced life at his pleasure. To prove that the absence of heat suspends the snail's animation through the winter season, Spallanzani made the following experiments: When the snail retired within its shell, it closed it hermetically, and both shell and operculum were impenetrable to air. The scientist bored a very small hole in the operculum and fastened a fine glass tube in it, excluding the possibility of air getting in. He then placed the snail under water and forced air into the shell through the tube. If there were any fine openings in the shell or the operculum, or if the snail before entering had filled the shell with air, the air forced into it by means of the tube would cause air bubbles to be visible through the shell; but Spallanzani could not detect any. He made another experiment to test this. He bored a hole in the operculum of another snail, and again fitted an air-tight glass tube into it and filled the tube with quicksilver. He then turned tube and snail upside down and dipped the end of the tube into a cup filled with quicksilver. If the snail's shell was absolutely without air the tube would show it, for it would act like a barometer.

Spallanzani found that there was no air inside of the shell. During the winter he placed several "snail-barometers" side by side with ordinary barometers for comparison. The "snail-barometers" acted exactly as the regular barometers. Spallanzani, however, went further. It was possible, he thought, that the snail, before shutting himself up, might have laid in a supply of air. He therefore extended his experiments to many specimens, making examinations just after the snail had retired, in the middle of winter, and in the spring, and proved to his satisfaction that the snail had not breathed during the winter. He also kept a number of snails during the winter on the bottom of glass jars filled with water, oil and quicksilver, proving conclusively that they had no air supply during that time. To prove that it is want of oxygen that puts the snails to sleep, he set them in a vessel filled with hydrogen. For about ten minutes the interior organs acted as usual, breathing the hydrogen; but suddenly they ceased, and the snail closed the shell by the operculum and lay still. At the end of five hours Spallanzani forced a little atmospheric air into the lungs of the snail, and almost immediately the heart began to act and the blood to circulat . When he stopped the supply of air, the operations of life also stopped. The snail remained immobile when carbonic acid gas or hydrogen was forced in. It is, consequently, the oxygen which sets the organism in motion.—*Naturen og Mennesket (Copenhagen).*

A Portrait of Napoleon.

Napoleon was at that time moderately stout. His stoutness was increased later on by the frequent use of baths, which he took to refresh himself after his fatigues. It may be mentioned that he had taken the habit of bathing himself every day at irregular hours, a practice which he considerably modified when it was pointed out by his doctor that the frequent use of hot baths, and the time he spent in them, were weakening, and would predispose to obesity. Napoleon was of mediocre stature (about 5 feet 2 inches), and well built, though the bust was rather long. His head was big and the skull largely developed. His neck was short and his shoulders broad. The size of his chest bespoke a robust constitution, less robust, however, than his mind. His legs were well shaped, his foot was small and well formed. His hand, and he was rather proud of it, was delicate and plump, with tapering fingers. His forehead was high and broad, his eyes gray, penetrating, and wonderfully mobile; his nose was straight and well shaped. His teeth were fairly good, the mouth perfectly modeled, the upper lip slightly drawn down toward the corner of the mouth, and the chin slightly prominent. His skin was smooth and his complexion pale, but of a pallor which denoted a good circulation of the blood. His very fine chestnut hair, which, until the time of the expedition to Egypt, he had worn long, cut square and covering his ears, was clipped short. The hair was thin on the upper part of the head, and left bare his forehead, the seat of such lofty thoughts. The shape of his face and the *ensemble* of his features were remarkably regular. In one word, his head and his bust were in no way inferior in nobility and dignity to the most beautiful bust which antiquity has bequeathed to us.

Of this portrait, which in its principal features underwent little alteration in the last years of his reign, I will add some particulars furnished by my long intimacy with him. When excited by any violent passion, his face assumed an even terrible expression. A sort of rotary movement very visibly produced itself on his forehead and between his eyebrows; his eyes flashed fire; his nostrils dilated, swollen with the inner storm. But these transient movements, whatever their cause may have been, in no way brought disorder to his mind. He seemed to be able to control at will these explosions, which, by the way, as time went on, became less and less frequent. His head remained cool. The blood never went to it, flowing back to the heart. In ordinary life his expression was calm, meditative, and gently grave. When in a good humor, or when anxious to please, his expression was sweet and caressing, and his face was lighted up by a most beautiful smile. Among familiars, his laugh was loud and mocking.—*Memoirs by Baron De Meneval.*

The Color of the Electric Arc Light.

Prof. J. A. Fleming has shown that the well known color of the light of the electric arc from carbon points is due to the incandescence of the carbon filling the space between the positive and the negative rods. The true arc is here, and exists in a space filled with the vapor of carbon, which has a brilliant violet color. Examined by the spectroscope, the central axis of the carbon arc gives a spectrum marked by two bright violet bands. Outside this is an aureole of carbon vapor of yellow or golden color. The electrical strain of the arc occurs chiefly at the surface of the crater which forms at the end of the positive rod, where, in fact, the principal work of generating light is done; for 80 per cent of the total light of the arc comes from the incandescent carbon at this place. Thus, in a sense, the arc light is mainly an incandescent light; the effect being produced by the layer of carbon which is being constantly evaporated at an extremely elevated temperature. Hence the light of the carbon arc is not, and can never be, white, as it is sometimes described as being, but must always be tinted violet by the carbon vapor normally present between the rods.