any desirable extent; and as regards silver sand of the best quality, there are only a few places in which it is to be found. It can, however, always be purchased, and is not expensive; while, for many purposes, sharp river sand, where it can be obtained, forms a good substitute. Leaf mold, or soil composed entirely of decayed tree leaves, is also an essential material in every garden establishment; and, generally speaking, there is little excuse for a gardener not having an abundant stock of this always on hand. It is seldom, however, in good condition for potting purposes until it is two or three years old; and, even then, it should seldom or never be used alone, but mixed with loam or other soils. The leaves of the oak and the elm are generally preferred to those of the ash, horse chestnut, walnut, and others, whose leaves are of a softer tissue. Every soil yard ought, also, to contain a portion of clay, or the runnings of a clay pit; this improves with keeping, and is exceedingly useful where the natural soil is inclined to be of a light or sandy character; the latter will be considerably improved by an admixture of clay, which will be found to render it more suited to the culture of fruit trees and strawberries in pots, melons, etc. Advantage should also be taken of any opportunity which may occur to secure a quantity of lime rubbish, from any old buildings which may be about being removed or under repair, as this material is of service to soils deficient in calcareous matter, and in the formation of vine borders. Of well rooted stable or hot bed manure, I need scarcely say a considerable portion should always be kept on hand; also a portion of dry cow, sheep, or deer dung; decayed mushroom beds, composed chiefly of horse manure; also a quantity of broken bones, charcoal, soot, etc., all of which should be kept separate, and in readiness in the soil yard.

RAILWAYS IN NEW YORK CITY.

"The statistics of the horse car companies now in operation in this city, when compared with the figures furnished by the London underground railroads, show that there will be immense profits from a properly managed steam road in New York. The total length of our horse car lines is seventy-six miles. They employ 11,086 horses, moving cars at the busiest hours at the rate of one every forty-five seconds. The speed per hour is five miles; the cost of construction, three eighths of a million dollars per mile. Last year, the passenger travel amounted to 192,000,000 persons, being two and a half millions per mile. One some roads the ratio was still larger. The Sixth Avenue road carried four millions per mile, and the Third Avenue line, below Central Park, carried five millions. The average fare on the different lines and their connections is $5\frac{1}{8}$ cents, while the total expense per passenger is 4 15-100, leaving a net profit of 98-100 cent. The business of the horse roads has increased 255 per cent in ten years.

In London, there are 19 3-10 miles of underground roads. The motive power employed is 70 engines. Trains run every four minutes, during the busiest hours of the day, at an average speed of fifteen miles. The cost of construction per mile, after deducting sales of surplus real estate, is three and a half million dollars. Sixty-five million passengers were carried last year, at the rate of three and a half millions per mile. The average fare is five cents, and the total expense per passenger 2 31-100 cents, leaving a net profit of 2 69-100 cents for each passenger carried. In the underground roads, the increase of business in ten years has been 360 per cent.

A comparison of these statistics gives a most favorable showing to the steam railway. While the expense of construction and equipment is larger in the case of the latter the operating expenses are very much less. The expense of transportation per passenger by the steam engine is about one half of that reported by the horse roads, while the net profit is nearly trebled without any advance in the fares. At the same time the speed is fairly trebled. The steam road is popular, too. Rapidly as travel has increased on the surface lines in New York, the increase on the London underground railway has been half as large again. The people have had practical proof of the speed and safety of the latter, and patronize it accordingly.

This comparison shows the large profits which lie within the reach of any corporation that shall be the first to go to work and give New York the benefit of rapid transit. There are no estimates in the figures just presented. They exhibit work that has been done and profits that have been pocketed. According to these statistics, steam roads might acquire a net profit of over five million dollars, annually, by carrying the same number of passengers that now yield the horse roads a profit of less than two millions. A competent engineer, who has carefully studied the subject of rapid transit, estimates the gross revenue of a road to Forty-sixth street at \$4,319,400 per annum, with \$1,916,000 as the annual cost of operating, leaving a net income of 23 78-100 per cent on the calculated cost. There would also be added to this the extra fare for carrying first class passengers, baggage, express parcels, or the mails.

This exhibit appears as reasonable as it is gratifying. If it be also taken into consideration that the population in the city limits will be largely increased as soon as rapid transit becomes a fixed fact, the probability of large returns on investments in this direction becomes a certainty.

A golden harvest awaits the corporation that shall enter upon the work. Labor is ripe for it, and capital will not hesitate to lend a helping hand in due time. There is no such opportunity for enterprize and profit elsewhere in the land. It were a waste of time to enlarge upon the benefit of underground rapid transit to the community. The profit it promises is the argument of the hour."

The above is from the *Daily Graphic* of this city. It is gratifying to be able to add that the Legislature, at its recent session, granted some additions to the charter of the Broadway Underground Railway Company, which it is expected will, before long, enable that corporation to begin the work in earnest. The authorized first section of the road is from the Battery, at the extreme southern end of the city, under Broadway to Central Park, with a side branch to the Grand Central Depot at 42d street. Considering that it now takes the passenger a dreary hour, by horse car, to traverse this distance, $4\frac{1}{2}$ miles, and considering that by the underground railway it may be done in ten minutes, it requires no great stretch of the fancy to predict that the new road will enjoy an enormous patronage.

Railway men, who have examined the matter, say that the Broadway Underground Railway route is the best railway line in the world. It passes through the heart of the city, in the center of all travel and traffic, the resident population along its line being greater than that of any corresponding distance in London, or any other city in the world.

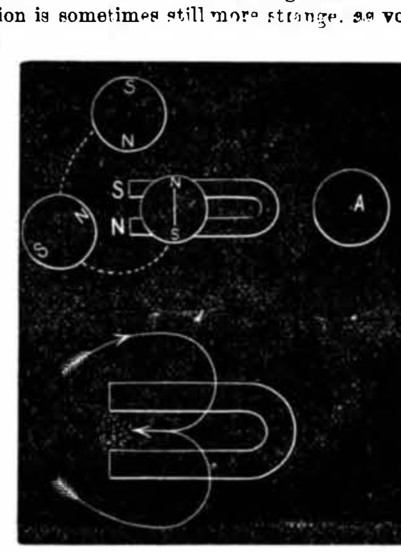
Surveys for the Broadway Underground Railway, made to accommodate the enlarged works authorized by the late Legislature, have lately been executed, and we hope before long to place before our readers some of the plans and estimates of the work.

Correspondence.

A Novel Experiment in Magnetism.

To the Editor of the Scientific American:

A good deal of amusement and some information can be obtained from a magnetic needle mounted in a disk of cork, of which I inclose you a specimen. If put in a basin of water, it is far more free to follow its own sweet will than when suspended by a thread; and as it is a new way of mounting a magnet, at least to me, I commend it to your attention. I would especially beg you to notice its queer movements when a small horseshoe magnet is laid in the bottom of the basin with from one to three inches of water over it, and to see how it will sail around the poles when placed as in the upper figure, finally assuming a position across the horseshoe at about one third of its length. When placed at A, its action is sometimes still more strange, as you will perhaps see.



With a bar magnet, its motions are different, but amusing and instructive; but in any mode of experimenting with it, its perfect freedom to assume its proper position serves to show the lines and centers of force with far more clearness than any form of magnetic toy I have ever seen.

Another very pretty experiment (see the lower figure) is to put one of the magnets in the basin with about one eighth of an inch of water over it; take a small file and a bit of iron, and let the filings drop on the water over the magnet. This is a much better way than to put the filings on paper and the magnet underneath. The way the filings sail into position is very interesting; they like to enter into position from the outside and near the center, and float down the middle, as in the direction of the arrows; and as they accumulate, the first ones are forced out beyond the poles, in the well known curves. Filing them is better than sprinkling filings over the water, as they fall each one separately. In sprinkling filings on the water, they fall in aggregations in which they are not as free as when each atom of iron is separate.

H. P. HENRY.

Pittsburgh, Pa.

REMARKS BY THE EDITOR: We have tried all these experiments, and, although the movements we observed are not precisely those described, they are still very amusing and interesting.

The Largest Locomotive in the World.

To the Editor of the Scientific American:

I see in a recent issue of your paper that a correspondent makes the statement that the largest locomotive is one on the Philadelphia and Reading railroad, which has two cylinders, 20 x 26, and twelve driving wheels; and that the whole weight is sixty tons. He probably has never heard of the "Janus," constructed by William Mason, of Taunton, Mass. It was built for the Union Pacific railroad, but could not be used there; and where it is now, I do not know.

Sandwich, Ill. GEO. H. FRIZZELL.

REMARKS BY THE EDITOR.—We are much obliged to our correspondent for reminding us of the Janus, which, as he states, was built at the celebrated Mason Machine Works, Taunton, Mass. Mr. Mason informs us that the Janus has four cylinders, 15 x 22, and twelve drivers $3\frac{1}{2}$ feet diameter, and no other wheels. Its weight, when the tanks and coal bunkers are full, is 84 tons. It is now working on a coal road in Pennsylvania. If anybody can produce a larger locomotive, we hope they will trot it out.

Hardening and Tempering Tools.

To the Editor of the Scientific American:

You have been talking to us in your "Practical Mechanism," by Joshua Rose, in a way that we can understand, and upon subjects in which we are directly interested, and, as I think, to our benefit. But please keep out the oxides. We do not want them in the shop; we know of straw and blue colors as different tempers because we always find them so in practice. If a straw may be a blue, and a blue a straw, temper, because of films of oxide and the time they were coming, our present system of tempering is gone, with no new one to take its place. I never yet found a blue as hard as a straw, nor a straw as soft as a blue, whatever time it took to draw them.

New York city. TOOLS.

Compound vs. Oscillating Engines.

At the Risdon Iron Works, San Francisco, Cal., under the direction of G. W. Dickie, M. E., the oscillating engines of the steamer Los Angeles have lately been removed, and a compound engine substituted, by which an important saving in fuel is gained. The engine, of 337 horse power, is known as an annular compound; the high pressure cylinder being $19\frac{3}{4}$ inches diameter by 28 inches stroke, and the low pressure cylinder $43\frac{3}{8}$ inches diameter by same stroke; expansion of steam, eight to one, the smaller cylinder being contained within the larger one, jacketed with high pressure steam, and both cylinders operated by one balanced slide valve, cutting off at three quarters of the stroke.

The consumption of fuel for the new machinery is claimed to be 1·6 lbs. of coal per hour per horse power. This, we think, must be a mistake, as it is considerably less than the average of the best compound engines. With the old oscillating engines, the steamer made nine knots an hour on a daily consumption of 22 tuns of Sydney coal. With the new engines, she makes the same speed on 5 tuns of coal.

Whitworth Steel.

Some idea of the solidity of compressed castings of Whitworth metal may be gleaned from the fact that, five minutes after the application of pressure,—about twenty tuns to the square inch,—a column of fluid steel becomes shorter by 12·5 per cent, or $1\frac{1}{2}$ inches to the foot. Sir Joseph Whitworth, as a writer in *Iron* states, holds the proportion that for certain purposes a metal must be used having a certain tensile strength and a certain percentage of ductility. Hence the metal cast at the Whitworth works is classified according to its possession of these qualities, and arranged for convenience in four groups, distinguished by colors, red, blue, brown, and yellow, and by numbers, No. 1 of each group representing the most ductile metal, and No. 3 the least so. Of Low Moor wrought iron, the tensile strength per square inch is 27 tuns, and ductility or percentage of elongation, 38. In good cast iron the same qualities are represented by 10 and 0·75. Various samples of Whitworth steel similarly tested gave from 36 to 72 tuns tensile strength, and from 33·3 to 14 per cent elongation. There is shown a singular relation between the tensile strength and ductility of the metal, the one generally increasing as the other decreases, a circumstance which, it is suggested, may possibly deserve investigation.

The Polyspheric Ship.

This is the name of a novel vessel, recently invented in England by Mr. Charles M. Barnes. The bottom is flat and fitted with three inclined planes with square ends, the effect being as though three teeth of a gigantic saw were moved through the water with the sloping portion of the teeth first.

The inventor has tested the device by means of small models impelled by rockets. A 7 pound model was driven, by a 3 pound 3 ounce rocket, a distance of 105 yards in 3 seconds, or at the rate of 63 knots per hour. The motion is said to resemble sliding over ice. There is scarcely any water disturbance, and the decks were apparently motionless. When drawn slowly over the water, the vessels offered more resistance than models of the ordinary shape; but when the equilibrium, between the horizontal pressure of the inclines forward and the pressure of the water in the contrary direction, is destroyed, the model at once rises in the water and passes over the mass of hitherto obstructing fluid.

Valve for Gases and Corrosive Liquids.

This valve is adapted to cases where liquids have to be forced into vessels under pressure. A piece of glass tube, about 3" long and $\frac{3}{16}$" internal diameter, has a bulb blown in the middle, and the ends are cut off square. A piece of india rubber tube 3" long, and of such a thickness that it will just pass into the bulb tube, has one end tied with string or platinum wire. Just below the ligature a transverse slit is made, so that the end is nearly cut off. The uncut part serves as a hinge. A small pellet of cork or india rubber is put into the end beyond the slit. The tube is then stretched on a piece of glass tube, and the whole forced into the bulb tube, till the valve occupies the interior of the bulb. Any pressure in the tube raises the valve on its hinge, while any back pressure closes it tightly. For pressures up to 30 lbs. on the square inch it is perfectly airtight. Beyond this the author has not tried it.—*Roland H. Ridout, in the Chemical News.*

A MOUTH without grinders is like a mill without a stone. A diamond is not so precious as a tooth.—*Don Quixote*