level of the liquid outside. This difference of level has practically the same effect that a plug in the bottom of the stem would have; the head of the funnel being nearly full of air, it floats just as any hollow glass vessel would. In a beaker filled with sulphuric acid alone the funnel would sink, the glass being heavier than the acid.

The experiment is a very pretty one for the lecture table, and the exact cause of the phenomenon will prove rather a severe test for an elementary class.

A tubulated champagne glass, with the bottom cut off, may be used instead of the funnel, and I think likely that a saturated solution of hyposulphite of sodium could be used instead of the acid. It certainly would be safer.

If, while the funnel be floating, one pours sulphuric acid into it slowly, it does not sink, but *rises higher out of the water*, for the acid expels the water that entered during immersion, from the stem, and consequently decreases the length of the column necessary to support the funnel. If, on the other hand, water be poured into the funnel, it will sink at once, for the water cannot get down past the heavy acid in the bottom of the stem, and consequently fills up the head.

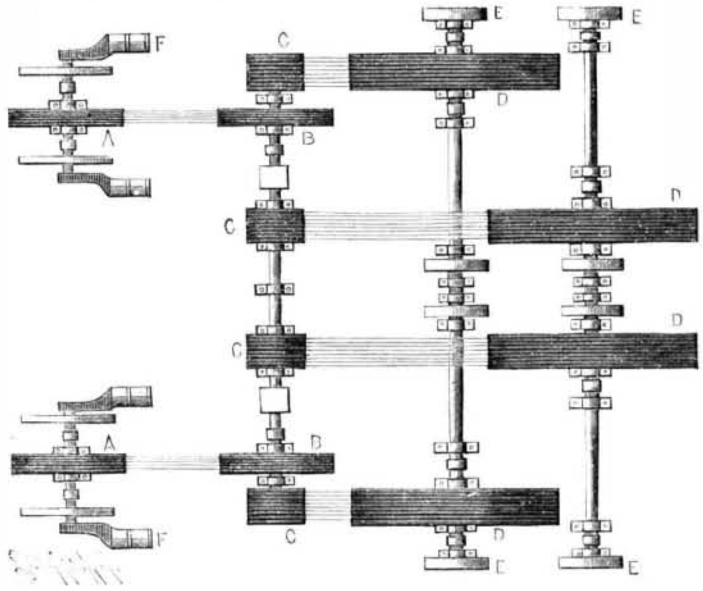
Baltimore, Md., March 14, 1892.

ROPE TRACTION FOR CABLE RAILROAD PLANTS.

The great rope drive wheel shown in the accompanying illustration is one of four of the same size made by the Walker Manufacturing Co., of Cleveland, Ohio, for the Third Avenue Cable Railroad. These wheels are each 32 feet in diameter, 6 feet 1 inch wide on the face, and provided with 22 grooves each suitable for a 2¼ inch cotton or hemp rope. The finished weight of each wheel is 75 tons.

The connecting flanges of the segments of the rim are placed in line with the arms, and turned bolts fitted into reamed holes serve to secure these segments together. The arm ends are secured to the flanges on the segmental rim by through bolts, a portion of which are turned, fitted into reamed holes.

The centers, which present a very massive appearance, are accurately faced to receive the flanges of the arms, the connection being made by through bolts, half of which are turned bolts fitted into reamed holes. The wheel is shown in the lathe in which it was held for the making of the grooves in its face, the wheel being turned by a supplemental wheel clamped to its hub, while the supplemental wheel was turned by bevel gear connections. Other wheels of various sizes, ranging in diameter from 9 feet up to 22 feet, are being made by the company for the same work. The down town power house of the Third Avenue Cable road will be at the corner of the Bowery and Bayard Street, and at each of the power stations the entire plant will be duplicated to prevent any possible delay from breakdowns.



A, B, C, D, Rope Pulleys from Engine, F, to Cable Drum, E.

POWER TRANSMISSION BY ROPE PULLEYS TO CABLE DRUMS.

The Walker Manufacturing Company are also now making some similar rope wheels for the Broadway Railway Company, but these wheels will be still larger, being 32 feet in diamater and 8 feet 4 inches wide over the face, weighing over 100 tons each. The accompanying diagram of the Houston Street power station of the Broadway road, work on the foundations for which is now progressing, shows how these rope traction wheels are employed. The power plant is to be on one floor, all beneath the street level, and it has been necessary to excavate to a depth of 40 feet to obtain the room which will be required for the machinery. There are to be four engines of 1,000 horse power each, arranged in pairs. Each pair of engines, F, operates a shaft on which is a rope traction wheel, A, but a clutch mechanism allows either of the engines to be disconnected. A series of ropes transmits the power from A to the similar wheel, B, on a transverse shaft, this shaft also being similarly connected with the other pair of engines, and the arrangement being such that either one of the four engines may be employed to operate the shaft.

The smaller rope traction wheels, C, on the transverse shaft, are connected by a similar series of ropes with the large wheels, D, on shafts carrying the cable drums, E, on their outer ends. This means of conveying power from the engines to the cable drum shafts is not as rigid as would be a system of gears, and runs with far less friction, while some decided advantages are claimed for it over belt traction. The portion of the cable coming in is always under a higher tension than the portion of the cable which is going out, and this arrangement of rope-driving wheels is designed to give a certain elasticity to the system which will better accommodate the differences of tension than would be accomplished with either leather belt or cog wheel power transmission. There will be two entirely separate cables laid, the cars being provided with duplex grips, by means of which a change can be quickly made from one cable to another, should any accident occur by which the running cable is disabled.

A GREAT ROPE TRACTION WHEEL FOR THE THIRD AVENUE CABLE RAILROAD.

The Artificial Coloration of Flowers.*

The excitement about blue carnations led my neighbor, Mr. W. Dorrington, and myself to endeavor to solve the mystery by imitating it, and we soon discovered that, although flowers could not be tinted by immersing them in dye solutions, they could readily be colored by placing their stalks in aniline solutions.

Aniline scarlet dissolved in water to about the transparency of claret has a very rapid action on flowers, coloring them pink and scarlet. Indigo carmine produces beautiful blue tints. The two combined dye various shades of purple, with curious mottled effects, some parts of the flowers becoming pink and other parts blue and purple. Greens are produced by using the blue dye with yellow. We also tried indigo and cochineal, with partial success. Lily of the valley flowers became beautifully tinged with pink or blue in six hours; narcissi are changed from pure white to deep scarlet in twelve hours, and delicate shades of pink are imparted to them in a very short time. Yellow daffodils are beautifully striped with dark scarlet in twelve hours; the edges of the corona also become deeply tinged, and the veining of the perianth becomes very strongly marked. Cœlogyne cristata, lapageria alba, calla æthiopica, cyclamens, snowdrops, leucojums, hyacinths, Christmas roses, Solomon's seal, tulips, and many other flowers were successfully treated, and many leaves were found to become colored very quickly by the process. I send you herewith a number of examples.

The more interesting question of how this rapid change is brought about soon attracted my attention, and proved extremely interesting. The coloration is mainly confined to the vessels.

There is a system of veins in plants, the vein tubes being clearly seen under the microscope passing through the leaves, petals, and other parts of the flower. In these tubes the motion of the colored water can be seen, and it became evident that it was by these that the color is conveyed and left in every portion of the plants. In the case of cut flowers, the action is very rapid, the water tubes beginning at once to absorb the fluid, which was passed along by either capillary attraction, contraction, or possibly by some more active life-force acting within the veins. My experiments in proof of this were made at first entirely with cut flowers. I afterward tried the experiment by taking a Roman hyacinth very carefully out of the soil, and placing the roots in aniline water. In twelve hours the petals began to color, and the flowers gradually became pink tinted throughout. This experiment was repeated on many narcissi and other bulbs. It cannot, however, be said that the root fibers were unbroken; probably they were so, as I have failed to color any flower by merely watering the soil with colored water. The filtering appendages to the roots evidently prevent the absorption of much of the color, as the petals of the flowers do not become either so quickly or so deeply tinted when the plant has its root as with cut flowers. It was, however, clearly seen that the vein tubes proceeded from the roots, thus completing the water system of tubes from root to flower.

The veins when colored are beautifully seen under the microscope as clear tubes running in parallel lines, the interspaces filled by cellular matter. The tubes gradually branch out as they proceed, and as they approach the margins they are often finely branched. When the colored water reaches the margins of the petals they thus become deeply tinctured, especially in the narcissi, illustrating the cause whereby the daffodil so frequently obtains the deeper color at the edge of the corona. It is the same with the leucojum and the snowdrop.

Very singular results were obtained in the variegated leaves of the aucuba and ivy—plants which, at this winter season, one would suppose, had the leaves quite dormant. Single leaves, with their stalks placed in aniline dye water, began to color in about three hours, and in twelve hours had their margins deeply colored. They were thus shown to have the absorptive power, quite apart from the stem.

Another remarkable instance was seen in lapageria alba, which has a very thin wiry stalk and a large waxy flower. With the stalk placed in dye water, the whole flower became beautifully veined with pink in three or four hours—a singular fact, when one considers the minuteness of the tubes through which the liquid has to be drawn. It is difficult to believe that this can be accomplished by capillary attraction only. In eucharis amazonica, which has thick stalks, the flower does not become tinted at all, but the style is dyed a deep red. The pistils of flowers always become deeply colored, which is an important fact, showing that the solid matter of the coloring solution is thus secreted [deposited in] by the fruiting vessels of the flower.

White tulips furnish excellent illustrations of artificial coloring, as they can be readily tinted either pink, blue, green, or purple in a few hours. The vein tubes which are thus displayed in the petals agree with the strongly marked features, known as the "flamed" or "feathered" varieties of the florist. It is generally known that all tulips raised from seed are self-colored when they first bloom; they are then called "breeder tulips," and the enthusiastic amateur florist grows on his "breeders" for six or seven years until they "break," when they become either "flamed" or "feathered" varieties. Now a florist may ascertain in six hours whether his breeder tulip will become a feathered or a flamed sort, and whether it will be worth growing on for the breaking time, because the veining of the petal is shown by the color, and it is that which makes the feature when the tulip is fully matured. Blue tulips have always been desired, and they can thus be artificially produced for florist purposes.

Daffodils and narcissi generally can be greatly varied in color, and especially by showing their exquisite veining when thus treated. The tube and corona take a darker and richer tone of color than the perianth, thus agreeing with the fact that all daffodils are more or less bicolor. The Christmas rose is also an interesting flower when artificially colored. Straight tubes cross the petals from base to point, with numerous cross tubes, and the main ones branch out angularly, thus dividing the snow-white petals into a network of red lines. The interspaces are filled with oval cellules, and as the tubes are permeable, the cellular spaces become suffused with a delicate shade of pink. Snowdrops and leucojums are also very interesting when thus treated. Their petals are veined with about eight tubes at the base, which pass across the petal to its point in nearly parallel lines, strongly and clearly marked. These are branched near the tip of the petal in fan-like form, producing rich pink margins to the flower. The double white camellia is another very pretty illustration, as it easily assumes a pink shade throughout. It is difficult to imagine how this is done, as the camellia has a small woody stalk; and in the case of a double flower, with forty or fifty petals, the attachment of each of them to the tubes in the stalk must be very slight, and yet every petal becomes tinted in a few hours.

White lilac takes the color perfectly, becoming either pink or blue at pleasure. The abutilon has the calyx colored, but not the petals. These are already strongly vein marked, and they seem to refuse the new comer. Primulas take the color readily, but the common wild primrose will not be changed. Forced leaves of the Swede turnip, grown in the dark for culinary purposes, are extremely susceptible to coloration. They begin to color in about three hours, and in twelve hours are beautifully fringed with red, and suffused with rich orange. Thus tinted, they are beautiful objects for table decoration.

* Wm. Brockbank in the *Gardeners' Chronicle* of March 12. The editor adds: "Botanists have long since availed themselves of colored liquids to ascertain the course of the juices of plants, and the particular tissues through which the current passes, but our correspondent gives some details of much interest at the present time, and the specimens he sends exceed in interest any that we have before seen. To the botanist they are of special value, as showing so clearly the course of the vessels. The value to the florist is also curiously illustrated in the case of the tulip."

How Paper Barrels are Made.

This interesting process, which is the invention of Mr. J. R. Thame, is being carried out by the Universal Barrel Company, London, at their works at Boxmoor, Herts. These premises, which are known as Two Waters Mill, possess a special interest, inasmuch as they constituted one of the first paper mills in England, having been built during the reign of Queen Elizabeth. The process, which we were recently afforded the opportunity of inspecting, says *Iron*, forms another example of the utilization of waste, for the materials used are waste paper, cotton waste, leather waste, and, in fact, any waste substances of a fibrous nature. These materials are first sorted and are then slowly fed into a pulping machine, which consists of a beater running in a circulating tank of water, the waste being by degrees reduced to a fine pulp. When the pulp has attained a sufficient consistency it is run out into an accumulating tank on the floor below, in which is placed the apparatus for forming the bodies of the barrels.

In this machine the pulp flows into a tank and impinges against an endless traveling blanket, which picks up the pulp, the water draining off through the blanket. On the upper side of the blanket, and in contact with it, are placed, at intervals, the cylinders upon which the barrel bodies are formed. On these cylinders are placed sheet metal cores, which can be expanded and contracted, and it is upon the surface of these cores that the pulp is deposited from the blanket. Under the blanket, and in a line with each of these cylinders, is a pressure roller, which consolidates the pulp as it is deposited on the upper cylinder. When a sufficient thickness of pulp has accumulated on the cylinder, which occupies an average of four minutes, the metal core with the barrel body on it is taken off and the barrel body removed from it and placed in the drying room. And here it should be mentioned that this method of forming barrel bodies has been previously attempted in America. But we believe it failed on account of the difficulty experienced in removing the newly formed body from the core. This difficulty is overcome by Mr. Thame's ingenious contracting core. The drying room is heated by hot air circulated by a blower, and here the barrel bodies remain for a day, at the end of which time they are perfectly dry, and are taken to the trimming department, where the ends are trued up by saws, and afterward finished by hand, with sand paper. The bodies are then waterproofed by dipping them in a heated mixture of resin and resin oil. When dry the bodies are hooped up with a couple of American elm slips, and are ready for having the bottoms and heads fitted in and finishing.

The heads are made in two different ways. In one case they are formed from sheets of cardboard produced on a wood roller in the same way as the bodies, the paper cylinder being cut longitudinally and spread out into a sheet, which is dried, and out of which the heads and bottoms are subsequently stamped and finished off in the same way as the bodies. In the other case the heads and bottoms are formed from the pulp in a hydraulic press under a pressure of 750 lb. per square inch, and are finished in the same way as the others. In heading the casks a wood lining hoop is first fixed inside the body near the end, and the bottom is inserted and held in place by a second hoop on the top, the head being fixed up in the same way. The barrels are then painted ready for use. So far, the barrels we have been describing are plain cylinders, but bulged barrels of a superior class are also made, and for these the pressed heads are used. The bulged barrels are produced by placing the cylindrical body in an open-topped moulding press, the interior of which is of the necessary contour. Inside the body is placed an India rubber bag, connected up with the hydraulic main, and to which the water is admitted under the pressure before named. The pressure is kept on until the body has set to the desired form, when it is removed to the drying room to be dried and finished. All kinds of barrels are turned out, round as well as square, the latter being used for packing matches, but the barrels which were being made upon the occasion of our visit were plain cylindrical cement barrels, measuring 28 inches long by 16 inches diameter, and holding 3 cwt. of cement. The machinery is driven by an interesting example of steam engineering, namely, a compound beam engine of 30 horse power, bearing the date 1856. Steam is supplied by two Lancashire boilers, one of which is kept in reserve.

The works were started experimentally some four years since, and have been gradually developed into the practical working factory which to-day finds them. The present plant is comparatively small, there being only one body-forming machine. It is, however, equal to an output of 300 barrels per day of twenty-four hours. Besides the manufacture of barrels, that of cardboard is also carried on, boards of excellent quality being produced. An important feature of the manufacture is its economy, there being absolutely no waste. The cuttings and trimmings, and in fact all surplus material at every stage, is returned to the pulping machines. In one department we found an interesting application of the paper barrel to driving machinery. This was a 16 inch driving pulley, the rim of which was formed of a portion of a barrel body, while the arms and boss were made out of a pressed barrel head, the pulley working very well. For the paper barrels thus manufactured many advantages are reasonably claimed, among which are that they are strong, durable, and economical, that the parts are interchangeable, and that they can be made of any required tare, and to suit almost every purpose for which barrels are used. From all that we have stated it will be seen that in paper barrels we have not only an interesting process, but a practical manufacture which promises to prove a commercial success.

Ancient Cave Dwellers in Asia.

The Russians have made a singular discovery in Central Asia. In Turkestan, on the right bank of the Amou Daira, in a chain of rocky hills near the Bokharan town of Karki, are a number of large caves, which, upon examination, were found to lead to an underground city, built, apparently, long before the Christian era. According to the effigies, inscriptions, and designs upon the gold and silver money unearthed from among the ruins, the existence of the town dates back to some two centuries before the birth of Christ. The edifices contain all kinds of domestic utensils, pots, urns, vases, and so forth. The high degree of civilization attained by the inhabitants of the city is shown by the fact that they built in several stories, by the symmetry of the streets and squares, and by the beauty of the baked clay and metal utensils, and of the ornaments and coins which have been found. It is supposed that long centuries ago this city, so carefully concealed in the bowels of the earth, provided an entire population with a refuge from the incursions of nomadic savages and robbers.

To Clean Corundum Wheels.

Take one-third chloroform and two-thirds alcohol. The chloroform dissolves the wax and oil that accidentally gets on the stone; the alcohol removes the shellac and leaves the corundum free to cut as when the stone was new.—*Dr. Beacock, Dom. Dent. Jour.*