A NEW CHROMATROPE.

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There are a number of phenomena, related more or less to that illustrated by the seven-colored rotating card known as Newton's disk (phenomena, in other words, involving the composition of colors and persistence of vision) which it would be desirable to illustrate by means of a transparent apparatus and a magic lantern, rather than by an opaque disk of large size viewed directly. In fact, for twenty years or more, Duboscq has been making several chromatropes of this character. One of these consisted of a Newton's disk made of sectors of colored gelatin, mounted between two thin disks of glass, which were rotated by a small central pulley, over which passed a barrel moved by a large driving wheel. Another consisted of two disks so painted as to produce by their opposite motion the appearance of undulatory movements in certain spots of light. These were driven by a cord carried continuously round the driving pulley and both the device disks. This chromatrope, when rapidly moved, developed by persistence of vision a figure of luminous chainwork, in a way which illustrated the phenomenon of persistence of vision very satisfactorily. Another of these chromatropes illustrated Faraday's observation of the toothed wheels rotating in opposite directions. While all of these were good of their kind, there yet remained something to be desired, as regards rapidity of rotation, solidity of machinery, and clearness of vision.

Wishing to employ many of these and other illustrations at a lecture on color which I delivered at the Academy of Music in Philadelphia, I applied to Mr. George Wale, of the firm of George Wale & Co., instrument makers to this institution, and he made for me the instrument which I have found very admirable in in its effectiveness and durability, and will now describe

Fig. 1.

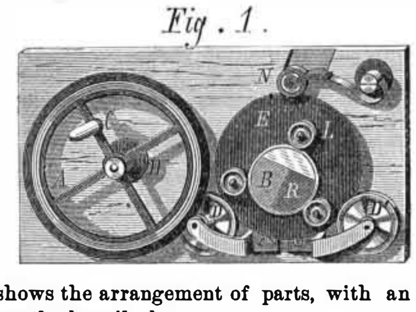


Fig. 1 shows the arrangement of parts, with an addition to be presently described.

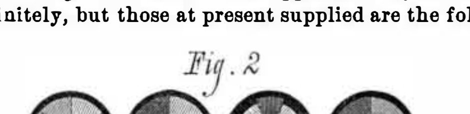
The large wheel, A, is made of brass, with a rectangular groove on its periphery, into which is sprung a flat ring of thick sheet rubber. This gears by friction into the smaller part of the pulley, D, and this gives to it a high velocity. C is a handle and H the axis, clamped in a slot in the frame so that it can be brought nearer to D to increase the driving friction.

The chromatrope disk rests on the larger part of this same pulley, and also on the other two pulleys, D and N. It is thus readily driven at a high speed by its edge, the grooves of the pulleys in which it rests being covered with thin sheet rubber.

The entire field of the chromatrope is thus clear and unobstructed by any belt, pulley, or the like. In order readily to change the design disk of the chromatrope, the pulley, N, is held by a spring and can thus be pushed back so as to release one disk and admit another.

The design disks used in this apparatus may be multiplied ndefinitely, but those at present supplied are the following:

Fig. 2



1. Newton's color disk. This consists of seven sectors, red, orange, yellow, green, blue, indigo, and violet respectively. This and the other color disks are made of pieces of stained glass, cemented with Canada balsam to a disk of plate glass, and so admirably fitted that the effect on the screen, even, is of the most perfect finish. Their richness, regularity, and accuracy of color surpass anything which has ever been produced by painting.

2. Disk illustrating Young's theory. Six sectors of red, green, and violet are here arranged, and when rotated they produce white.

3. Disk illustrating Young's theory, Professor Rood's design, showing that green and violet produce blue. This consists of various partial sectors, arranged as shown in the accompanying engraving, Fig, 2, third circle. Here we have a number of sectors, of which the large are colored green and the smaller violet. The shaded portions are black. When such a disk is rapidly rotated, we have on the outside a ring of green, so far as to the portion where the violet sectors begin; then we have a ring where both green and violet occupy the field in succession, and thus by persistence of vision blend and give their resultant impression; lastly, where the green sectors end, we have a circle of simple violet. In the case of this disk, the combined color obtained by the union of the green and violet is a light sky blue.

4. Disk illustrating Young's theory, Professor Wood's design, showing that red and green produce yellow. This is arranged on exactly the same principle as the previous one, except that the smaller partial sectors are made of red glass in place of violet.

5. Disk illustrating the fallacy of Brewster's theory, Professor Rood's design, showing that blue and yellow do not produce green. See Fig. 2, fourth circle.

This resembles the foregoing, except that the eight sectors are entire, and consist alternately of blue and yellow glass, and when rotated produce white light.

6. Disk illustrating persistence of vision, being the present writer's design of the chameleon top.

This is shown in position in Fig. 1. The disk, E, is of hard rubber, with an opening eccentrically placed, over which is supported, between three small pulleys, L, the glass device disk, B R.

If, while this disk is rapidly rotating, the finger is made to touch lightly the little wheels at a single point of their revolution, it will cause them to move slightly so as to rotate the device disk, R B W, very gradually. This is placed, as we have seen, eccentrically to the large disk; and having on it the irregular design shown in Fig. 3, in which R is red glass, B blue, and W white or transparent, it will, by the slow rotation described, have one color after another shifted into the center of rotation of the large disk, and also the combination of colors in circles outside of the center will be changed. Thus: Suppose, in the first case, that the position

Fig. 3.

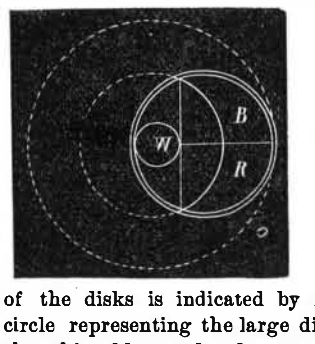
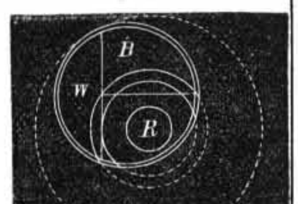


Fig. 4.



of the disks is indicated by Fig. 3, the largest dotted circle representing the large disk, and W, B, and R being the white, blue, and red parts of the device disk. In this case the white occupies the center of the large disk, and thus the rotation of this leaves the portion included in the small central circle always white. Outside of this, however, it is evident that, in the ring between this smallest circle and the next one, white, red, and blue will be carried in succession by the rotation of the large disk over the field, and thus, by persistence of vision, a blending of these three will occupy this ring-shaped space. Moreover, since the proportion of the colors will vary concentrically, this will not be a flat, but a shaded ring. Thus, just beyond the smallest circle white will predominate, while just inside the next circle there will hardly be any white.

Again, between this second circle and the outermost, there will be a similarly graduated ring, red and blue with no white.

Now suppose the small disk to rotate so as to shift the red portion into the center of the large disk, as shown in Fig. 4. Here evidently, when the large disk rotates rapidly, we shall have, by persistence of vision, a red center within the small circle; between this and the next circle a ring of combined red and blue; then a narrow ring of red, blue, and white; then a broad graduated ring of blue and white.

The shifting of the center is of course accomplished gradually, and thus the figure on the screen passes imperceptibly from change to change in countless variety, and with a beauty of effect that hardly admits of description. The prominent idea suggested to most is that of an ever-opening and changing morning glory, or of a fountain of light and color, from whose center wells out a succession of colored waves, chasing each other outwards until they are lost on the margin of the basin.

At the suggestion of Professor C. A. Young, of Dartmouth College, a further development was given to this chromatrope. The pulley wheel, D, in place of having one groove to drive the glass disk, was made a little broader and furnished with two grooves. The outer one was cut a little deeper than the other, so that it would act as a wheel of less radius aud communicate a slightly lower velocity to the glass disk it drove. The other pulleys, D' and H, were each made of two independent wheels.

Two disks, being placed in this arrangement, would therefore rotate in the same direction with high but slightly unequal velocities, so that one would, as it were, travel slowly over the other. The inner one of these disks was painted with a design, and the outer made part black and part white (that is, clear). The clear part, exposing in succession different parts of the design, produced corresponding changes in the persistence-of-vision figure developed. The simplicity of the means by which this result was obtained is a very admirable characteristic of the plan.

Other designs have been made by Professor MacCord, of the Stevens Institute, for driving disks in opposite directions, and indeed this fundamental idea of Mr. Wale, of driving the device disks directly by friction on their edges, seems to open the way for quite a number of developments of this piece of apparatus.

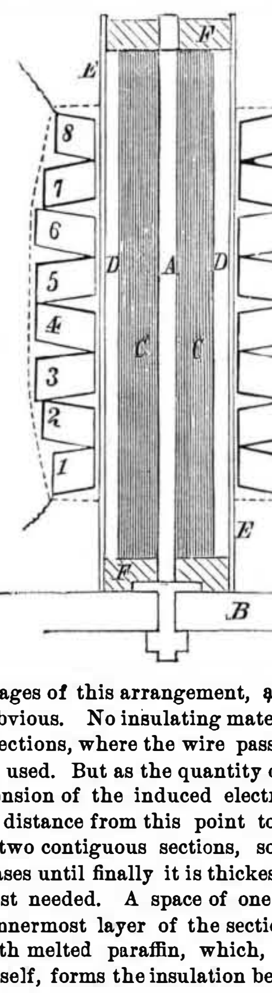
Cleansing Goods by Naphtha.

Naphtha is being used as a cleansing agent for furniture, carpets, clothing, etc., at an establishment recently opened in this city. The process consists simply in placing the article to be cleaned in a bath of the hydro-carbon and there leaving it for a couple of hours. Huge vats are used, capable of holding several barrels of naphtha at a time; and in these, sets of furniture or rolls of carpet are secured so as to be entirely submerged in the liquid. No preparation of the goods is necessary, and the naphtha seems to exercise no deleterious effect upon varnish or gilding, upon glued joints, or upon the finest silk or satin fabrics. Dirt and grease are entirely eradicated, the latter sinking to the bottom of the vats, from which it is from time to time removed in the shape of a thick yellowish mass. Moths are of course totally destroyed.

Several fine sets of furniture were shown us, which had been treated by the naphtha process. They appeared like new so far as the fabrics were concerned, and there was no discernible smell of the fluid. The process is patented. The principal item of expense is the evaporation of the naphtha; but this being allowed for, the cost of cleansing is somewhat less than that incurred in the ordinary method followed by the clothes-scouring establishments. It may be added that naphtha does not act upon linen or cotton, and is practically available only upon animal fibers.

A NEW INDUCTION COIL.

Mr. C. F. Brush, M. E., communicates to the *Engineerin and Mining Journal* a description of a novel induction coil designed by him, an engraving of which, in section, we give here with. The three eighths inch iron rod, A, is secured by a collar and nut in the base, B, and serves as a support for the core, C, which is composed of about 1,200 iron wires (No. 20 gage) made perfectly straight and carefully annealed. This core is covered by four layers of paper saturated with paraffin, then one layer of the primary wire, D, which is of copper one eleventh inch in diameter and 90 feet in length, then six layers of paper, and, finally, the second layer of wire. The latter is not covered but is wound with a narrow strip of paper between the consecutive turns, the object of this being to economize space. A hard rubber tube, E, incloses the primary wire, and is 12 inches long, 2½ inches in internal diameter, and ⅛ inch thick. It is held by the pieces of wood, F, which also support the core. The secondary wire is 30,000 feet in length, is wound in eight sections, 1, 2, 3, 4, etc , and covers 8 inches of the tube, as shown. Sections 1 and 8 contain 35 layers of wire each; sections 7 and 2, 55 layers each, and sections 3, 4, 5, and 6, 67 layers each. This arrangement places most wire around the middle portion of the core, where its inductive force is greatest. The consecutive layers of wire in each section are insulated from each other by ten thicknesses of unsized paper saturated with melted wax; and the consecutive turns of wire in each layer are insulated from each other by being wound with a space of one two-hundredths of an inch between them. The wedge-shaped space between the sections is filled with paraffin, which insulates them, and the exterior of the sections is also covered with the same material, until the shape of the apparatus becomes as shown. The secondary wire begins with section 1, and forms the outside layer first; thence it passes from layer to layer until the innermost one is reached, there it crosses over to section 2, where sections 1 and 2 touch each other, and forms the innermost layer of section 2, thence from layer to layer until the outside one is reached; thence it passes to section 3. forming the outside layer first, and thus it proceeds until it ends in the outside layer of section 8.



The advantages of this arrangement, as regards economy of space, is obvious. No insulating material being required between the sections, where the wire passes from one to the other, none is used. But as the quantity of wire, and consequently the tension of the induced electricity, increases directly as the distance from this point toward the opposite edges of any two contiguous sections, so the thickness of paraffin increases until finally it is thickest of all where insulation is most needed. A space of one eighth of an inch between the innermost layer of the sections and the tube, D, is filled with melted paraffin, which, together with the rubber tube itself, forms the insulation between the primary and secondary wires.

The object in using the secondary wire bare is economy of space. It is a matter of the greatest importance that the whole of the secondary wire be placed as near as possible to the magnetic core, E, as the inductive force of the latter varies inversely as the square of the distance from its axis. The same amount of silk covered wire would occupy at least double the space, and would, consequently, average a much greater distance from the core.

The condenser used with this coil consists of two hundred and forty sheets of tinfoil, five by ten inches, arranged in the