

that lately took place in that city from breakage of overhead wires during a storm. In one of these cases, the driver of a cab was caught by a sagging wire and fatally injured, his head being nearly severed.

In the Court of Common Pleas, Philadelphia, Judge Thayer presiding, application was recently made to restrain the Western Union Telegraph Company from erecting telegraph poles on 10th street, on the ground that by so doing the company were obstructing a public highway. It appeared in evidence that the company was authorized by charter to place its wires either above or under ground.

It was alleged against the company that the city would be greatly disfigured by the erection of these poles, and it was argued that, in view of the public injury and inconvenience arising from the great extension of the telegraphic system, the great increase in the number of lines, and the consequent increase in the size of the poles and number of wires, telegraph companies should be compelled to lay their wires under the streets instead of over them. Judge Thayer considered that it was impossible to doubt the practicability of successfully working lines laid down in that manner, in view of the fact, which was in evidence, that for the last twenty-five years important wires have been carried underground through the city of London. The extent of the underground wires in London, according to Mr. Fleetwood, is at the present time 3,500 miles. Underground wires are also extensively used in Paris, Berlin, Dresden, and other European cities. In view of such facts, all arguments against the practicability of this method founded upon mere theories and opinions amount to nothing.

Doubtless the time is not far distant when the necessities of public convenience and the great increase of telegraph systems in this country, will, through the instrumentality of legislative enactment, compel all companies to lay their wires underground in the large and populous cities of the country.

"Upon the whole case," said the court, "we are of opinion that the defendants, the Western Union Telegraph Company, have shown no sufficient title to warrant them in erecting their poles and wires on 10th street, between Market and Walnut, and the proposed erections are contrary to law, in violation of the city ordinance, and injurious to the public." The injunction was then continued until further notice.

So much for Philadelphia. We fear it will be some time before any such wholesome lesson is taught to the street-obstructing corporations of this city. Not only are telegraph poles everywhere allowed, but the builders of iron railway bridges are to be permitted to occupy and cover our principal streets. In the name of "Rapid Transit," no less than thirty-five miles of these structures, upon which locomotives are to rattle and roar, have been sanctioned by our local commissioners, and are now in process of erection along some of our finest and busiest streets.

It would seem to be in keeping with common sense that all structures like telegraph lines or steam railways, which can be effectually operated either underground or between the blocks, should be kept out of the public streets. But the citizens of New York, instead of following the enlightened progress of other cities in such matters, are at present actually moving backward.

FREE PASSES AT THE CENTENNIAL.

The Centennial Commission appears to be somewhat perplexed over the question of distributing free passes for the Exposition. Every politician in office, every newspaper man, in fact everybody who can conjure up even the shadow of a reason for the privilege, seems himself entitled to enter the Centennial grounds free, and the consequence is that the Commission is unable to fix any limit as to where this deadheading shall terminate. It seems to us that there is one, and but one solution, to the problem, and that is to issue no free passes at all. No respectable journal desires any such favor, and in fact the prevailing tone of all the press now-a-days is strongly averse to receiving any obligation of the kind on any account. The thousand and one reasons commonly urged for granting privileges to politicians and others should be scrupulously set aside, and in doing so the Commission will act not only for its own, but for the public's, best interests. It must be evident that, in order that the Exposition shall pay back the money invested in it, a very large daily attendance will be requisite, even at fifty cents per head admission. Every free pass given, therefore, is simply a diminution of receipts, and when the number of passes swells, as it easily may, into thousands, the loss will be one to make itself felt. This deficit will have to be made up, and there is only one source available, and that is the pockets of the general public; so that, reduced to its simplest terms, the pass system involves the payment by the people for the admission of a privileged class. Of this class the individuals are ten times better able to pay for themselves than half the masses who will flock to Philadelphia.

The only people who should have free entrance are the employees of the Commission, the exhibitors and their servants, and the judges. The only exception we would have made to the fixed tariff would be in favor of working men. When the latter come to Philadelphia, their means will be limited, and it would be a sensible act for the Commission (of course after proper proof that the applicants are bona fide working men) to sell them tickets at a reduced price, good for several admissions. These tickets might be made of conspicuous color and form, wholly different from any others; and each one should be distinctively numbered and provided with other checks to render it non-transferable. These might be forwarded to the principal industrial establishments in the country, to be disposed of by employers to

their men, and their possession might also entitle their holder to especial privileges in the reduction of railway fares. We believe that it is to the interest of the whole country to have the Exposition made as cheap to working men as it possibly can be; and if any deficit occurs on that account, let it be charged upon the public. The public can much better afford to bear it than to pay for official courtesies which confer no benefit except upon the immediate recipients.

THE PRACTICAL USES OF THE SPECTROSCOPE.

When light, in its way from a luminous body to one's eyes, passes through more or less transparent media, it is more or less absorbed; and the spectroscopy, which decomposes the light into the different kinds of colored and other rays of which it consists, is the apparatus which reveals what portion of the light is thus absorbed by the media through which it passes. This is the simple cause of the dark lines in the solar spectrum; they are generated by the atmosphere which surrounds the sun, which atmosphere absorbs certain kinds of rays and so forms the absorption bands, which we call the Fraunhofer lines, after the distinguished scientist who first observed them. Even our own atmosphere gives some such lines; they are situated between the solar absorption bands, and they have been closely investigated. They increase, both in intensity and number, as the sun approaches the horizon; while they decrease and finally almost vanish as we ascend with our spectroscopy to the summits of high mountains. The absorption bands (caused by transparent or translucent, colored or colorless, solid or liquid, substances) are of much practical importance, for every substance either absorbs different parts of the light or does it in a different manner; so that the absorption lines produced form characteristic properties of many bodies, by which they may always be recognized. To make these observations, it is best to use a white light giving a continuous spectrum, such as is produced by a gas flame, a petroleum lamp, a white hot platinum wire, a hydro-oxygen lime light, or an electric light passing between carbon points. As the solar spectrum has its own absorption bands, it is not to be preferred; however, it need not be totally rejected for this purpose, as the bands are very narrow and well defined, and their positions are well known, while the absorption bands of the solid and liquid transparent substances referred to are wide or broad, with somewhat undefined edges; and therefore they are generally easily distinguished from the solar absorption lines.

The substance to be examined is simply placed before the slit of the spectroscopy, and the light passed through it. If this substance is, for instance, smoked glass (that is, a piece of glass colored gray or black by exposition to a smoky flame), it will be seen that the light of the spectrum is dimmed over its whole extent, and this quite equally. The smoked glass, therefore, absorbs all kinds of rays, all colors, in the same way, and is an example of a continuous or general absorption. Quite different, however, is it when we use colored glass. A red glass, for instance, even when so intensely red as to appear almost as black as the smoked glass, will not absorb the red ray; but it will all the others. Cobalt blue glass admits the passage of the blue rays, and absorbs the green entirely, and the red only partially. Such kinds of glass, therefore, show an elective absorption, and this property of colored glass is made use of for signals on lighthouses, ships, steamers, railroads, etc., to give any desired color to a white light. If it were possible to make a colored glass which could transmit only the reddish or the bluish green rays contained in the solar protuberances, it would be possible to see, every time the sun shines, these protuberances directly, without the help of the spectroscopy.

Most of the colored pigments have already been investigated with the spectroscopy. It would occupy a very large space to recapitulate all the results obtained; and we will only give the general results in regard to the manner of observation and the definite laws which have been ascertained.

Melde has made experiments for determining these laws as far as possible; and he divides the variously colored substances into a number of groups, and gives a general account of the behavior of each class. To the first class belong such substances in solution, or such solid bodies, which, during a gradually increasing concentration, or a gradual increase of thickness of the transparent layers, continue the absorption from the red end of the spectrum toward the violet end; so that at last only a violet luminous band remains. This class does not contain many substances; but one of them is the ammonio-sulphate of copper.

The second class has the opposite property. The absorption progresses by increasing concentration from the violet end of the spectrum toward the red end, so that at last only a red band remains. This class contains a large number of bodies; and among them are many very intensely colored pigments, such as chromate of potassa, picric acid, iron chloride, saffron, etc. To this class belong also several translucent substances, which have in common the property that, when examined in thin layers, they admit the whole spectrum; but if increased in thickness, they absorb the light, first at the violet end of the spectrum, and continue to do so toward the red, until at last all is absorbed. One of the most common substances of this kind is water mixed with soap or with milk, so as to deprive it, more or less, of its transparency.

These two classes thus contain the substances which exhibit a one-sided absorption. A third class contains those

bodies in which the absorption commences in the middle of the spectrum and extends toward both ends, and which may therefore be called two-sided absorbents. There are not many substances of this class. One of them is Prussian blue dissolved in water with help of oxalic acid. In spectrum analysis, the bodies belonging to this class may be distinguished, one from the other, by the fact that the most intense portion of the middle band appears in different parts of the spectrum.

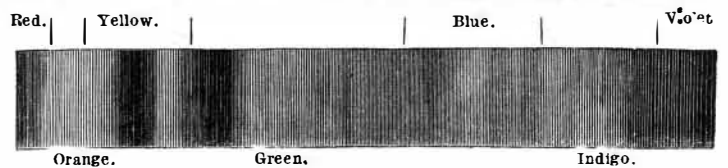
A fourth class contains substances which show luminous bands in two different places, separated by a middle dark band, with other dark bands at the extremities, which increase or diminish in width with the degree of concentration of the solution or thickness of the layer. A great many bodies belong to this class; among them are solutions of aniline blue, fuchsin, ammoniacal solutions of kino and Brazil wood, solution of salicylic acid colored with chloride of iron, etc.; and among solid bodies, cobalt blue glass. Each of these bodies is easily distinguished by the different character of the absorption, especially by the fact that the dark bands always occur at definite places in the spectrum, although the bands differ in position for each substance.

To the fifth class belong those bodies which, on increasing the dilution of the liquid, show three different luminous bands, and which, on further dilution, leave two dark absorption bands between them. This class is very numerous, and to it belong the solution of cesium in ammonia, watery dilution of blood, and the alcoholic tinctures of alkanet root and of sandal wood; but the various positions of the two dark bands peculiar to each make it easy to distinguish one from the other.

A sixth class contains substances producing three dark absorption bands. To this belong the ammoniacal solution of alkanet root and the alcoholic solution of chlorophyll, the green coloring matter of plant leaves. This classification may be continued for substances forming merely absorption bands.

In order to make practical and useful applications of the above, Melde made experiments to find out how far the various absorption bands pertaining to different substances were subject to fixed laws, which would explain their origin. He found that, in general, the absorption bands are not independent of each other, and that the absorption, exercised by a mixture, is not simply the sum of the absorptions of the simple substance, as is the case with the spectroscopic lines of the glowing gases. He found that, in colored mixtures, first, an absorption band is often observed between the two nearest bands of the simple fluids; a simple shifting of the bands, however, never takes place. He found, further, that the temperature of the substance had in most cases no influence on the position of the bands, even if the solution were heated nearly to its boiling point. In some cases, however, the absorption proceeded from the violet to the red end of the spectrum. Finally, he found that a greater concentration of the coloring material is perfectly equivalent to a greater thickness of the layers.

Armed with this preparatory knowledge, the determination of the nature of various colored solutions, such as ascertaining the presence of blood in a copious dilution with water, became an easy matter. Stokes, Hoppe, and Valentin made many observations, which led to infallible and therefore highly valuable results. Valentin found that the thicker layers of the light or dark red blood produce in the spectrum a light, luminous band, which reaches from



THE BLOOD LINES IN THE SPECTRUM.

the red to the dark line, D, in the yellow. Very thin layers of fresh blood, or thicker layers of blood diluted with water, give two characteristic bands in the green, both between the lines D and E, at a place where no other substance, as yet experimented upon, caused them to appear. These lines can be faintly seen, even when the blood has been diluted with 7,000 times its volume of water, when it is perfectly colorless to the naked eye by transmitted light, and by reflected light shows, at most, a faint yellowish tinge. The very same apparent color, given with a few drops of any yellow solution, such as saffron, gamboge, yellow wood, aniline, etc., does not produce these lines, which are characteristic of blood exclusively, and are, therefore, called the blood bands.

Valentin's skill in this respect was severely tried by giving him for investigation twenty numbered packages, containing small amounts of dirt of different origin. He emptied each separately in water, filtered the solutions, submitted them to spectroscopic analysis, and pointed out four packages containing blood. The first contained scrapings of a block which had served in the dissecting room of a medical college, but had lain for three years unused in a corner; the next contained scrapings from a block still in use for a similar purpose; the third contained rust from an old iron hook on which meat had been suspended in a butcher's shop; and the fourth contained a piece of cloth from a coat. In every case he could recognize the two absorption lines of the blood so clearly to leave no shadow of a doubt of its presence.

It is a curious fact that England, so interwoven with a network of railways, should supply an American exhibition with road locomotives and road rollers, the United States having at least 20 miles of road to one in England.

THE 51-ton Rodman gun has arrived at the Centennial