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THE reader's attention is called to the advertisement of Mr. Fredolin Smith's patent bent wagon hound, on the back page of this paper. This is claimed to be a useful and excellent invention, calculated to be of much economical value to carriage and wagon builders. It relates to a construction of hounds whereby they may be better and stronger when bent than before, and whereby they may be formed without spoiling so many in bending as is unavoidable when they are bent in the ordinary manner. J. H. Cole, of Tiffin, Ohio, is the sole agent of this patent.

A WOMAN'S WORK FOR SCIENCE.

"Great men and great causes have always some helper of whom the outside world knows but little. Sometimes these helpers have been men, sometimes they have been women, who have given themselves to help and to strengthen those called upon to be leaders and workers, inspiring them with courage, keeping faith in their own idea alive, in days of darkness 'when all the world seems adverse to desert.' Of this noble company," says her biographer, in a volume of recently published memoirs, "Caroline Lucretia Herschel was one:" and the record of a life which lacked but two years of a century in length offers a bright example of what a woman's work may be, when an intense personal sympathy and affection enlists her powers. It was to the advantage of Science that those powers were directed to its furtherance: for had Sir William Herschel, unstrengthened in his purpose by her, remained the humble music teacher, he would have passed to posterity as the composer of a few mediocre symphonies, and not as the discoverer of Uranus; she herself, at the close of a vocalist's career, would have sunk into oblivion, and Sir John Herschel, the son of the one and nephew of the other, doubtless would have followed his father's lowly path. It is only necessary to remember the inestimable value of the labors of these three persons in the cause of the grandest of the natural sciences, to realize how great would have been the loss to mankind had the three lives passed away unmarked and unknown.

The life of Miss Herschel was for nearly half a century so closely linked with that of her brother that, in reading her own story of her discoveries, it is difficult to believe that she speaks of her own original labor, so modestly and withal so persistently does she hold herself forward as "merely the tool" which Sir William shaped to his own use "for minding the heavens." It was in 1772, at the age of 22 years, that she left Hanover, her native country, and joined her brother in England, where she found him a hardworking teacher of music, with but a few hours at his disposal to devote to the study of astronomy, a work in which his whole soul was fast becoming absorbed. Insufficient mechanical means aroused his inventive genius, and he had begun to contrive a telescope of eighteen or twenty feet in length. "I was much hindered in my musical practice," says Miss Herschel, "by my help being continually wanted, and I had to amuse myself with making the pasteboard for the glasses which were to arrive." This "pasteboard" was the first crude model of the great instruments subsequently made by her brother, whose then early attempts soon led him to seek larger mirrors, though none were to be had. By good fortune, he obtained the tools of a Quaker resident at Bath, who had made efforts in a similar direction, and forthwith, "to my sorrow," says the sister, dropping the astronomer for the housekeeper, "I saw almost every room turned into a workshop."

In those days the grinding of specula was done by hand, there being no accurate machinery for the purpose. The tool on which they were shaped having been turned to the required form and covered with emery and water, they were ground on it to the necessary figure and afterwards polished with putty or oxide of tin. To grind even a six inch speculum was no small labor; and some idea of the work that William Herschel undertook may be gleaned from the fact that once, in order to finish a seven foot mirror, he would not remove his hand from it for sixteen hours together, while Caroline says, "by way of keeping him alive, I was constantly obliged to feed him by putting the victuals in bits in his mouth."

At this time the name of William Herschel was fast becoming famous, mainly through his repute as the inventor of instruments of unheard-of power. Now (1781) came the discovery of Uranus, and a few months later the election of the discoverer into the Royal Society. King George III, whose army in America just then was meeting reverses, commanded the presence of the astronomer at court, and solaced his royal disappointment over the probable loss of his colonies by frequently gazing at the new planet, which had been christened Georgium Sidus, after him. Herschel, however, did not fancy following the king about with telescopes; "company is not always pleasing," he naively writes, "and I would much rather be polishing a speculum": but despite this distaste, he chose to be Astronomer Royal at $1,000 a year, rather than go back to music teaching for a livelihood. "Never bought monarch honor so cheap," caustically said Sir William Watson, when the meager stipend was granted.

"I found," says Miss Herschel, "that I was to be trained for an assistant astronomer, and by way of encouragement a telescope adapted for sweeping was given me. I was to sweep for comets, and to write down and describe all remarkable appearances I saw." Her brother, near her, meanwhile devoted himself to his magnificent observations on the new planet, the nebulæ, and the double stars; and to Caroline's labors with her instrument, which consisted mainly in searching for nebulæ to be marked in her catalogue, were added the duties of assisting him "either to run to the clocks, to write down a memorandum, to fetch and carry instruments, or measure the ground with poles, etc.": certainly enough tasks without the further implication of the *et cetera*. Often she remained patiently beside Sir William, jotting down his rough notes, when the weather was so cold that the ink froze in the bottle; and then before dawn she would take the manuscript to her cottage, and by morning have ready a fair copy of the night's work. Occasionally her brother did not need her services; and at such times she prosecuted the observations that resulted in the discovery of the comets of 1786, of 1788, of 1791, of 1793, and of 1795 (the last now known as Encke's) and rediscovered three previously found comets. In 1783-4-5, she produced a new catalogue of a thousand stars; in the five years following she added a thousand more stars to the list; and she discovered the places of five hundred others between 1788 and 1802. Meanwhile she studied mathematics, her brother aiding her only by asking difficult questions at the breakfast table, the answers to which she carefully preserved. She was thus enabled to help him in his numerical calculations, while she unceasingly ministered to his wants during the construction of the famous 40 foot telescope. She tells us in her letters some pleasant anecdotes of that great instrument: how when it was completed a large company, headed by Sir William, entered its huge tube and sang "God save the King." Later King George himself walked through it, followed by the Archbishop of Canterbury. The prelate was portly, and the road was not an easy one for him, so the king graciously extended his hand to assist him, saying "Come, my lord bishop, I will show you the way to heaven."

In 1822, Sir William Herschel died, and the faithful sister returned to Hanover, almost brokenhearted with grief. She did not, however, relinquish her beloved labors, but at the age of over seventy years began the laborious reduction of the places of 2,500 nebulæ, presenting in one view the results of all Sir William's observations of those bodies up to the year 1800. It was an instance of touching fidelity, this labor in her old age, for the dead brother for whom she had so earnestly worked during his life. The task was completed in 1828, and won for her wide renown. The twenty years yet remaining to her were passed in Hanover, where from her quiet seclusion she watched the growing fame of her illustrious nephew, aiding him by her mature advice, and welcoming, with an enthusiasm equal to his own, the results of his great efforts. In January, 1848, that long and useful life peacefully and tranquilly closed.

THE PATENT OFFICE APPROPRIATION.

No better evidence of the progress of invention is needed than the fact that the receipts of the Patent Office for the month of March were the largest ever known. They exceeded eighty thousand dollars, which is in excess of the same month of last year by ten thousand dollars; and Congress will act very unwisely if it reduces the appropriation for this department. Such a step would necessarily decrease its working force, which is now hardly sufficient to permit prompt action and careful research on the part of the examining officers. The salaries of the examiners are at present so small that it is impossible to retain for a great length of time those best qualified for the work; and the prosperity of the Patent Office department and the interests of inventors depend largely upon the efficiency of the Commissioner and the examiners, the latter of whom decide upon the patentability of all inventions submitted to the Office.

Commissioner Duell has proved himself one of the best executive officers that has presided over the Patent Office since Judge Mason was Commissioner; and the liberal construction of the laws, inaugurated by the last named gentleman, allowing inventors to receive patents for improvements without regard to the degree of invention, is the wise policy of the present Commissioner. This liberal interpretation meets the approbation of inventors, and at the same time largely increases the revenue of the department.

Since the above was in type a correspondent of one of our daily papers—the *Graphic*—writes from Washington that, "since it has become generally known that our reform House of Representatives has proposed cutting down the appropriation for the support of the Patent Office, every mail has brought to Commissioner Duell letters, from inventors, manufacturers, and business men in all parts of the country, protesting against such retrenchment. It should be constantly remembered that the overburdened taxpayer, about whose sad condition such jeremiads have been chanted in Congress and on the stump, does not pay anything to support the Patent Office. That institution is self-supporting, and, as I showed in a former letter, has over $750,000 to its credit in the Treasury. It is carrying retrenchment a little too far to deny the inventors of the country speedy and intelligent action at the hands of the government while taking their money for it. In some of the communications sent to the Patent Office, the writers say that, if Congress cuts down the salaries in the way proposed by Randall's committee they will favor the starting of a subscription to pay the examiners proper salaries, so that the Office may not lose their services."

The latter named proposition is, of course, not feasible, and those who have written letters offering to subscribe for such an object cannot but know that no employee of the Patent Office would be allowed to receive any contributions from inventors or others doing business with the department; but that such a thought has entered the heads of a considerable number of persons indicates the objection, felt by persons interested in the prosperity of the Patent Office, against Congress reducing its appropriation. We are not among those, however, who think that there is no room for further economy or improvement at the Patent Office. We hope that Congress will carefully look into the institution, and faithfully do whatever may be necessary to increase its usefulness and efficiency.

STREET TELEGRAPH LINES.

In this misgoverned city of New York, the constant extension of the telegraph has resulted in the lining of all our principal streets with unsightly wooden poles, and the cry is "still they come." The sidewalks are obstructed by them, while the lives and limbs of citizens are more or less endangered by the poles and wires. In winter, especially, the ice-covered wires frequently break, animals are maimed, drivers of vehicles sometimes thrown, pedestrians tripped, etc. In London the wires are, to a large extent, carried underground The portions above ground occasion more or less trouble We have before us the details of three serious accidents

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 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, deems 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 spectroscope, 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 Frauenhofer 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 spectroscope 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 spectroscope, 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 spectroscope.

Most of the colored pigments have already been investigated with the spectroscope. 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.

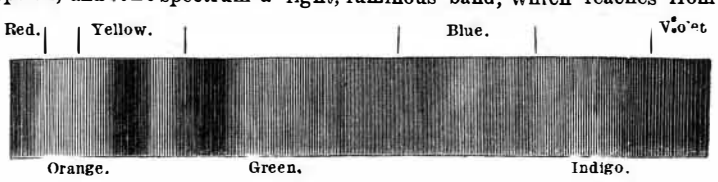
A fourth class contains substances which show luminous bands in two different places, separated by a middle dark band, with other dark bands at the extremities, which increase or diminish in width with the degree of concentration of the solution or thickness of the layer. A great many bodies belong to 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 cæsium 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 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.



THE BLOOD LINES IN THE SPECTRUM.

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