this country. The inventor receives nothing from the law that he did not already possess. A patent operates merely to restrain others from making and using for a limited period what he has invented. If he so chooses, an inventor may keep his discovery to himself. He is given a monopoly by patent in order that he may be induced to disclose it. The franchise which a patent grants consists altogether in the right to exclude every one from making, using, or vending the thing patented without the permission of the patentee. If the patentee sees fit not to use his device, he has but suppressed his own. His title is exclusive. He is no more compelled to work his patent, than the owner of a piece of real estate is compelled to build a house upon it.

COLOR-BLINDNESS.

BY J. F. SPRINGER.

When you stand upon some mountain top gazing at the wonderful display of colors emblazoning the western horizon just after the fiery globe of the sun has sunk from sight, do you ever wonder whether the friend by your side sees precisely the same thing? When you see that stream of red in the sky, what does he see at the same place? Something beautiful, no doubt, and something he calls red as well as you. But is his red your red? When he points admiringly to another point of the sky, and you join in his wonder and enjoyment, is it just the same sensation that is produced in both minds? These are questions that can not be answered with certainty now, and perhaps science may never be able to do so. Still, we continually assume that what one person sees or hears or smells, another perceives—the one sensation being the duplicate of the other. And there is a very great probability that this assumption is correct or approximately so.

But John Dalton, the celebrated originator of the atomic theory, had a vivid awakening on this subject in his boyhood. While he was watching a British military display, he wondered at the comments made on the gorgeous red coats of the soldiers. When he asked wherein the color of the coats differed from that of the grass, he was answered with derision. Then he awoke to the fact that his vision was different from that of others. He was what we now term color-blind. This was a new thing then. In fact, it was the researches of this same distinguished man that attracted the attention of the scientific world to the subject. He described his own case with great minuteness and care, and compared it with other cases. Pink appeared to him by daylight nearly equivalent to sky-blue. Crimson was muddy blue.

The subject of color-blindness has attracted a great deal of attention from Dalton's time to the present. This has been due in part to the fact that colored signal lights are in common use on shipboard and in the railway service. Hence the subject has assumed a practical aspect.

It is interesting and rather curious to know that few women (less than one per cent) are color-blind. On the other hand, about three or four per cent of males have this defect of vision. Color-blind persons are not all affected in the same way. Thus Dalton was red-blind, while Prof. Nagel of Germany, one of the principal investigators of this subject at the present time, is green-blind. These are instances of the two great classes constituting well nigh the whole number of those affected. There are in addition a very few cases of violet blindness and total color-blindness. Persons blind to one fundamental color are technically called *dichromats*. Those who have no color sense, but perceive merely differences of shading, are called *monochromats*.

There are numerous methods of testing for color-blindness. One of the most popular is the Holmgren test. In accordance with this method, the subject has placed before him a large number of skeins of worsted colored a great variety of shades. The person being examined is requested to sort the shades, placing those belonging to a dominant color together. If he is a typical red-blind person, he will put the red shades with the grays, unless they contain more or less yellow. The greens he will put with the yellows, unless they contain blue. If he is green-blind, he may be expected to have a tendency to put the greens with the grays and the reds with the yellows.

Such persons are evidently unfit for an engineer's position in the railway service. The railways accordingly seek men without these defects.

The subject is of importance to the traveler because the night signal for danger is a red light, and that for caution is a green one. As an engineer has a number of duties to perform in addition to watching for signals, and as the signals, moreover, may appear under very unfavorable circumstances, it would seem to be the greatest of follies to put in charge of the engine a man who doesn't know red or doesn't know green when he sees it.

But is it enough merely to eliminate the man who is distinctly color-blind? Prof. Nagel has called attention in a very emphatic manner to the unsuitability of a class of persons intermediate between the normal and the color-blind. These would be able to pass the usual tests. At the same time, under unfavorable circumstances they are liable to make mistakes in distinguishing colors. Some of these unfavorable circumstances are precisely those which occur in practical railroading. Thus a very faint light or a number of differently colored lights shown simultaneously lead to errors. And even when the correct decision is ultimately reached, there is frequently so much vacillation and hesitation that the swift and unhesitant decision that may become necessary at any moment in the engineer's cab is something not to be depended upon. These abnormals (or color-weak persons) should not be employed in a position where lives may be lost through their inability to read the signals with quickness and certainty. In fact, when we consider that signals must often be read through smoke and rain, or hail, or snow, or mist, and that they are often obscured through discolored glasses and on account of dimly-burning flames, we feel that none but the very best of normal eyes should look through the windows of a cab.

However, Prof. Nagel has not left this matter of the unfitness of the abnormals to academic discussion. He has designed and carried out a number of experiments upon color-weak persons, and has reached pretty conclusive results. The experiments referred to were performed in the laboratory. The subjects were allowed all the time they wished, so that they may be regarded as having been favored by the fact that they were tested indoors. Their errors must be looked on as a minimum. That is to say, if they had been upon the road in actual service, the mistakes would probably have been more. The subjoined table represents

EXPERIMENTS UPON THREE ABNORMALS (COLOR-WEAK PERSONS).

Experiment 12, Subject: K. (Red-Abnormal.)		Experiment 15, Subject: S. (Red-Abnormal.)		Experiment 14, Subject: Dr. A. (Green-Abnormal.)	
Shown.	Named.	Shown.	Named.	Shown.	Named.
w 2	w	r3 r4 w3′	r? r? g	g3	w
r 2	r	w3 g4 g3	r w(g) w(g)	w5′	w
r 3	r	g6 w6′ r3	g w r	r3′	r
g 3	g	r6 r6 w3	r r g	g2	g
g 2	g	r5 r3″ r6	r g r	g4′	g
w 1	w	g6 g3″ g6	g g g	g6″	w
r 4″	r	w2 r3 w6	? r w	r6″	r
r 2″	(r?)g	w4 r6 w6″	g r g	w5″	r(w)
g 1	g	w2 w6 w6	? w w	g3	r
r 2	r	r4 r2′ r6	r g r	g3′	r
r3 w3 r3′	r w g	r6 r2′ r6	r g r	w3″	g
r2 w2 r2	r(g) w g(r)	r 2	r?	w3′ r4 r5	g w w
r2 w1 r2	r g r	g 6	g	w3 w5 w6′	g g w
g 1′	g	g 5′	g?	r3 r5′ r6′	r r r
w3″ r3 r3	g r g	r 2	r	r3 w5 r6	r g r
r3 w3″ r3	r g g	w 4′	(w, r?)	r6 w6″ r6	w g r
w3 w3″ w3	w r w	w 2′	(w, g?)	r6 r3″ r6	r g r
g3 r3″ g2	w r g	w 3	r	.....	. .
r6 w3″ r5	(w)r g r	....	....	.	.....
w3 r3 r5	r w r	....	....	.....	.....
w3″ r3 r5	g r (g)r	....	....	.....	.....
w3″ r3 r5	g r (g)r	....	....	.	.....
w6 r6 g6	g r g	....	....	.....	.....
w 6	w	....	....	.....	.....
w 6″	g	....	....	.....	.....

three different experiments. The letters *w*, *r*, *g* represent the three railway colors, white, red, and green. The figures placed after the letters represent openings of six different sizes through which the lights were shown. The sizes varied from 1 to 6 millimeters in diameter. The object of this was to imitate the conditions of lights placed at various distances. The marks ′ and ″ are to be taken as indicating the insertion of one and two ground glass screens for the purpose of dimming the lights.

It will be noticed in experiment No. 12 that the subject actually pronounced a red light (*r2″*) to be green, although a single light at a time was shown. Looking at the single exposures of experiment No. 15, it will be noticed that the subject seemed to waver a great deal, and even pronounced a white light (*w3*) to be red. In the single lights of experiment No. 14, there are a number of positive errors. Observe next the cases in all three experiments where three lights were shown simultaneously, and it will be seen that errors are quite numerous. It should be borne in mind that these persons were not color-blind, but merely color-weak.

Prof. Stratton of the Johns Hopkins University has been bringing a pretty strong indictment against the lights themselves, even in the case of the normal eye. Thus, the light of safety is the so-called white light; that is, the ordinary house light uncolored. When such lights are out at locations on the road where they should be burning, the engineer should suspect something wrong. As this light is precisely the same as that used for ordinary household purposes, there is always present the danger that the safety light may in reality be out, but the engineer may think it is burning and that consequently all is clear because he sees some other light which in reality has nothing to do with the railway service. This is not merely a theoretical objection. Several cases of wrecks are cited due to this cause.

The green light—warning to be cautious—is very susceptible to smoke. This constant incident of railroads has the effect of rendering green lights pale and sickly. They are then liable to be mistaken for white; that is, for a safety signal. The point is obvious.

The objections against the red light are peculiarly weighty. This is the danger signal. Accordingly, there should be nothing weak or uncertain about its note of warning. The color itself is good. When brilliant, it is very effective. But, in order to get a red light, a piece of red glass is placed in front of a colorless light. The red glass arrests all the rays from the colorless flame except the red ones. These it permits to pass through. And thus the light appears to shine with a red glow. But this effect has been secured at the expense of a great loss of intensity. The rays which have been stopped and not allowed to pass are of course ineffectual in acting upon the eye. Only a remnant (that is to say, the red rays) of the light proceeding from the flame actually reach the eye. It is calculated that the intensity should be about one-fifth. But actual tests show that the red was weaker than even this paltry amount. Apparently, the tests have been made with lights barely able to be discerned. Outside, where smoke favored the red, it was found necessary to increase the red to about fourteen times the intensity of the white light in order to render it visible, and in the laboratory, to about eighteen times. But these are best results. On the average, about thirty to one is the ratio.

Prof. Stratton advocates discarding the color system in favor of signaling by a *movement* of the light, or by showing signal lights which depend upon their form for their significance. The suggestion is made in connection with the latter to use the horizontal, the slant, and the vertical lines. With incandescent lines of considerable length and marked intensity. this would seem to yield a capital system.

MILITARY BALLOONING IN JAPAN.

It is well known that up to the time of the Russo-Japanese war, military ballooning was organized in a somewhat rudimentary fashion in the Japanese army. During the siege of Port Arthur the two adversaries made a frequent and successful use of strategic observations which were carried out in balloons. It appears that Japan is to take up the question of military ballooning from now on, recognizing the great services which this will render for the army, and the latter will no doubt be equipped with an aerostatic corps analogous to the ones which the other leading armies employ. A special commission was sent not long since from Japan to Europe in order to observe the organization and material of the different armies and to become familiar with the different features of ascensions and handling of balloons. At present this commission is in Germany, where it has been for some time past. It has already purchased two balloons in that country, and these will no doubt be employed for military use rather than for sporting purposes, although the latter may also find a development in Japan before long.

THE CURRENT SUPPLEMENT.

A graphic account of a trip in the Zeppelin airship opens the current SUPPLEMENT, No. 1702. A system of storing and distributing benzine and other inflammable liquids without danger of explosion is described. William O. Webber writes on the comparative costs of gasoline, gas, steam, and electricity for small powers. "New Forms of Steel for New Uses" is a review by R. B. Woodworth of the development of structural shapes rendered necessary by the increasing use of steel for building. In an article entitled "Weight of Marine Turbines" some new and valuable information is given. The fact that ozone is an efficient destroyer of odors of every kind is generally recognized. Ozone is employed extensively in Germany for purifying the air of rooms. Dr. G. Erlwein, to whom credit for the German system is largely due, contributes an article on the subject which will prove most interesting to American ventilating engineers. W. F. Stanley's excellent paper on Prehistoric Man is concluded. June 19, 1907, a new phenomenon disclosed itself in the Saturnian ring system. Prof. Percival Lowell describes the phenomenon under the title "The Tores of Saturn."

Attention is again called to the approaching meeting of the First International Congress for the Repression of Adulteration of Alimentary and Pharmaceutical Products to be held in Geneva on September 8, 1908. A large number of members from the United States have already joined, but it is desirable to have the largest representation possible from this country. The congress is held under the auspices of the White Cross Society and the Swiss government. The fee for membership is $4. Dr. H. W. Wiley, of Washington, D. C., chairman of the American committee, will undertake to forward names of members and their subscription. Reduced rates will be given on steamship lines and on European railroads. Information will be sent by Dr. Wiley to all persons who desire to be apprised regarding the details of the congress. Intending members are urged to send in their subscription at once.