is rendered too feeble to work the bells, the secondary couple is capable, by the electricity which it accumulates, of putting them in action. By a combination of the apparatus, not only may sound be produced, but light may be obtained at the same time.—*Comptes Rendus.*

Correspondence.

The Treatment of Cancer by Pressure and Iron.

To the Editor of the Scientific American:

Pressure is supposed to act beneficially in cases of cancer by diminishing the supply of blood, and consequently of nourishment to the tumor, by preventing the growth of the cells by depriving them of the necessary space, by injuring them from direct violence, and by promoting absorption. The credit of this discovery is due to the writer of this. Although there were many who doubtless had some vague glimmerings of the truth, yet none ever put their ideas into practice. The number of cases subjected to the pressure system alone was nineteen. Of these, seventeen were cancer of the breast, and two, ulcers of the cheek and upper lip. Twelve cases terminated by cure, and five were considerably benefited, the two cutaneous ulcers being somewhat improved. The majority of the tumors were hard, irregular, tuberculated, and the seat of great pain. Six of them were ulcerated and discharged ichorous pus. Even in the worst cases, the tumor diminished in size, but the patients fell victims to the constitutional disorder.

So favorable results attracted but little attention, and almost all my resources were exhausted, and I was afraid that I would have to give up any farther experiments, when I attracted the attention of M. Récamier, of the Hotel Dieu, Paris, who consented to go on with my experiments. One hundred cancerous patients were selected, on whom the pressure system was employed; sixteen appeared incurable and underwent a palliative treatment. Thirty were completely cured by compression alone, and twenty received considerable benefit from it; fifteen were radically cured by extirpation and pressure combined, and six by compression and cauterization. The compress used was made by using strips of soap plaster and adhesive plaster. Since then, I have used soft rubber balls, three quarters full of air or water, binding them on the ulcer with a common form of bandage. The artery feeding the cancer must be compressed by a spring truss, and great care must be taken that no ulceration of the artery ensues. A caustic plaster may be used to advantage under the ball, where the cancer is small.

Give the patient carbonate of iron, of which the dose is from 6 to 12 grains. Keep the bowels open; and if suffering great pain, use hydrate of chloral. The diet must be carefully attended to, and stimulants may be freely employed. In every place where this treatment has been pursued, every case has been cured with but one exception. Iron has been cried down, and been as little used as possible of late years; but it exerts great influence on cancer, and kills the cancer cells that may exist in the blood and allows no other cells to gather. I have just received a letter, from a gentleman of high standing in medical circles, in which he assures me that he has used iron in the form of the carbonate, and that in every case it has effected a cure. GEO. W. BAILEY, M. D.

Two Wrinkles.

To the Editor of the Scientific American:

Mechanics who want small gig saw blades will find that the steel springs of which hoop skirts are formed will make capital ones of any lengths; and they vary in width so as to be suitable for a variety of uses. They can be jointed straight by brazing, and then they make capital band saws.

I would suggest the investigation of the practicability of weaving covers for umbrellas, of a circular form, with a selvage around. The invention of a loom to produce such work would furnish ample study for an ingenious man, and would probably lead to fortune. WM. P. HOPKINS.

Lawrence, Mass.

The Interplanetary Telegraph.

To the Editor of the Scientific American:

Officers of the United States Coast Survey have long been accustomed to converse together at stations over 100 miles apart, by long and short flashes of sunlight reflected from the surface of a mirror. Similar signal lights are occasionally used at sea.

1. Any cryptogram, hieroglyphic, or signal flag alphabet is readily solved by modern ingenuity, often without a key. We may safely assume that any race of beings, who have developed a superior civilization to our own, would be able to interpret Morse signals, if their attention was once attracted thereto. That such beings exist, we infer from the fact that our sun is only a second rate yellow star, of comparative insignificance.

2. Light is the only means of communication available or possible for traversing space.

3. It is therefore probable that light messages are even now passing around us in every direction, between the inhabitants of different stellar systems.

Let us assume, for example, that the huge planets which travel around Sirius or Procyon are peopled by intelligences slightly more advanced in science than ourselves, and that they communicate with Uranus or Neptune in the manner supposed. It is evident that we need only a large telescope wherewith to verify the existence of such a conversation, in order to join in it with manifest profit to ourselves. In such a case we should select the simplest telluric language, perhaps the "modified English" of Minister Arimori Mori. Our stellar correspondents would perceive a flash of light from each metallic element in turn, followed by its English name in Morse signals. Wherever in the universe these light rays might impinge upon the object glass of a telespectroscope, there the observer would become aware of the existence of an inquisitive humanity.

One objection to my project of an interstellar telegraph is the insufficient swiftness of light, only 186,000 miles per second. Thus no less than four hours are required to send a message to Neptune, and three years are necessary to send a signal from our earth to the planets of a neighboring star. The same length of time must elapse before receipt of an immediate reply. SAMUEL H. MEAD, JR.

New York city.

Scientific Prophets.

Under this heading the New Orleans *Picayune* very tersely gives the results of the labor of the learned scientific Americans who lately met in Portland, from which it would appear that the prospect of the denizens of this sublunary world is not of the most cheering character.

"Professor Young tells us that the sun is nothing but a gigantic spherical mass of gaseous matter, which is constantly being contracted by the gradual cooling of its outside circumference. The central kernel of this huge star will always, according to the learned Professor, finally be crusted over with a thick, impervious coating, through which neither light nor heat can possibly reach us. The result, as far as we are concerned, will be total darkness, intense cold, the end of animal life, and a return to primeval chaos.

"General Barnard—another scientific seer—compares the earth to a hollow india rubber ball filled with molten lead. The spherical shape of our globe being the result of its rapid rotary motion, any accident such as the bursting up of some great volcano, the shock of a comet or of a meteoric body, would open a vent through the thin rind upon which we live whereupon the incandescent matter would at once project expiring humanity into vacant space.

"Professor Walling denounces the sun as a spendthrift who wastes with stupendous folly his inheritance of heat and light, and who, thanks to his prodigal habits, is fast progressing towards that bourne whence no traveller returns—the bankruptcy court.

"Professor Franklin Hough draws it more mildly, as he only threatens us with the total disappearance of water, owing to the wanton destruction of trees and forests.

"Professor Le Comte has paid special attention to insects, and warns us that their frightful increase will ultimately lead to the total destruction of the vegetable world, after which man himself will become their prey. The earth will then be a gigantic parish of Plaquemines, in which the mosquito tribe will rule supreme, until some other equally noxious vermin shall arise and devour them."

This cheerful *resumé* of the labors of our American *savans* indicates, adds the *American Builder*, that the human race is decidedly in a tight place. If the sun is to go out like a snuffed candle and the earth to explode like an old steam boiler, we may as well overlook the lesser contingencies of rainless years and the universal prevalence of vermin. *De minimis non curat scientia*

Impure Water.

Public attention cannot be too often called to the danger of using impure water in households. The origin of typhoid fever, which so frequently runs through families in city and country, is oftener in wells and springs than is supposed. In cities it is easy to understand, when aqueduct water is not supplied, how wells may become contaminated, but for many it is not so easy to see how wells in the country, among the hills or in the green valleys, can become so impure as to be sources of disease.

Since the general introduction of aqueduct water into large cities, typhoid fever has become more common in the country than in the city, and this disease is certainly zymotic, or one which results from a poison introduced into the blood. Wells in the country are very liable to become contaminated with house sewage, as they are generally placed, for convenience, very near the dwelling, and the waste liquids thrown out upon the ground find easy access by percolation through the soil to the water. The instances of such contamination which have come to our notice, and which gave rise to fevers, are numerous. The gelatinous matter, which is often found covering the stones in wells affected by sewage, is a true fungoid growth, and highly poisonous when introduced into the system. It is undoubtedly concerned in the production of typhoid fever. How it acts it is difficult to determine, but it is at least conceivable that the spores of the fungus may get into the blood and bring about changes after the manner of yeast in beer. These spores, as is well known, develope rapidly by a kind of budding process, and but a little time passes before the whole circulation becomes filled with them, giving rise to abnormal heat and general derangement, called fever. These fungoid or confervoid growths are always present in waters rendered impure by house drainage, and great caution should be used in maintaining well waters free from all sources of pollution.—*Boston Journal of Chemistry.*

MOTH PREVENTIVE.—The following recipe for keeping moths out of clothing is a favorite in some families: Mix half a pint of alcohol, the same quantity of spirits of turpentine, and two ounces of camphor. Keep in a stone bottle, and shake before using. The clothes or furs are to be wrapped in linen, and crumpled up pieces of blotting paper dipped in the liquid are to be placed in the box with them, so that it smells strong. This requires renewing about once a year.

Electrical Metallurgy.

Specifications of the English patents of R. Werderman, C. E., have lately been published, which are interesting as presenting a new application of electricity to the arts. This new purpose, to which electricity lends its aid, is to the reduction of metals from their ores, and the refining and purifying of the reduced metals, without the ordinary chemical action of carbonaceous matter, the purifying and refining taking place at the same time and by the same process, during the reduction from the ore. The ores, that is to say, oxides, sulphides, carbonates, or other combinations in which the metals exist in Nature, are first crushed, and then heated in a suitable furnace or retort. After the whole charge is raised to a red heat, two pieces of carbon or platinum, or some other suitable material which conducts electricity, are plunged in the crushed ore. These two pieces are connected by platinum or other suitable wires or ribbons with the two poles of a galvanic battery or magneto-electric machine. The electrical action and chemical decomposition which then take place may be seen from the following equations, which are given for the purpose of illustration, and are arranged in the order for their elimination:

	Negative pole.	Positive pole,
Oxide of zinc.....ZnO	Zn	O
Red oxide of copper.....Cu_2O	2Cu	O
Plumbic oxide.....PbO	Pb	O
Sesquioxide of manganese..Mn_2O_3	2Mn	O+O+O
Loadstone.....$FeOFe_2O_3$	5Fe	SO_3
Hematite.....Fe_2O_3	2Fe	As_2O_5 / Ph_2O_5
Brown hematite.....$2Fe_2O_33H_2O$	3Fe	SiO_2
Spathic iron.....$FeCO_3$	Fe	$Si\bullet_2$ / CO_2
Sulphide of zinc (blende)..ZnS	Zn	S
Subsulphide of copper....CuS	Cu Cu	CuS
Sulphide of nickel.....Ni2S	2Ni	SO_3
Bisulphide of iron (pyrites) FeS_2	Fe	SO_3 / $2SO_3$
Manganous carbonate.....$MnCO_3$	Mn	CO_2+O
Carbonate of zinc (calamine).$ZnCO_3$	Zn	CO_2+O

The reduction of iron ores may be effected either in the usual manner in the melting furnace with carbonaceous matter, or in a reverberatory furnace with some suitable flux only. The best ore for this purpose is the hematite, because it is a good conductor of electricity. As soon as the oxide begins to flow, the reduction takes place, and all noxious elements are eliminated in the following order, viz: sulphur, arsenicum, phosphorus, titanium, silicon, carbon.

By regulating in a suitable manner the electromotive force and the intensity of the electric current, and stopping it at the proper moment, cast iron, wrought iron, or steel can be produced directly from the furnace without any intermediate operations. This puddling by means of an electric current will occupy from 10 to 15 minutes only, instead of several hours as in the ordinary puddling by hand labor or machinery, and consequently a great saving of time will be effected.

The entire liberation of the electro-negative elements is in some cases not effected immediately, but an intermediate transformation of the ore takes place. For instance, in treating the subsulphide of copper, this ore does not conduct electricity at the ordinary temperature, but at 230° Fahrenheit it becomes a very good conductor; copper is then produced at the negative electrode or pole, and at the positive pole sulphide of copper is formed, which, being a good conductor at a lower temperature, is now entirely decomposed and converted into metallic copper. A great difficulty in the reduction of plumbic oxide in the usual process consists in the formation of silicate of lead, due to the presence of silicates mixed with the ore. This difficulty is entirely overcome by the application of the electrical current for the formation of the silicate of lead, which is readily fusible and is no obstacle; and all ores rich in silicates, which could not be treated till the present time, can now be employed for the extraction of lead.

Instead of treating the sulphides and carbonates and other more complicated combinations directly by the electrical current, such ores may first be converted into oxides by roasting them in the usual manner for some time in contact with atmospheric air or oxygen.

While the metal is being reduced, all impurities and noxious elements mixed or combined with it are eliminated, so that finally the metal is collected perfectly purified and refined.

In purifying metals, the removal of the metals or metalloids which are to be eliminated is effected either in a melting furnace or in a crucible or converter or puddling furnace. Two pipes of fire clay are dipped in the molten metal. Two hollow cylinders of carbon or platinum or other suitable matter are fixed inside the clay pipes at the end immersed in the molten mass. To the carbon or platinum cylinders are attached two platinum wires or ribbons, which run up inside the clay pipes and are connected directly or by means of copper wires to the two poles of a galvanic battery or magneto electric machine. To prevent the development of heat in the battery or magneto-electric machine, the connecting wires pass through a cooling apparatus. Instead of hollow cylinders of carbon or platinum, solid cylinders or sheets, or any other suitably shaped pieces, of carbon or platinum or other suitable matter can be used; in the latter cases, space must be left between the said pieces and the fire clay envelope, to permit the eliminated metals or metalloids to be volatilized and to escape through the clay pipes, and to be collected in a suitable vessel, in which they are converted either into the liquid or solid state or into salts, in bringing them in this *statu nascendi* in contact with any suitable matter to which they have great affinity.

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About Dyspepsia.

Sufferers from this horrible malady will find some of their own feelings described in the following article from the December number of the *Overland Monthly*:

Did you ever have the dyspepsia? Did you ever have—or ever imagine you had—a complication of all known, and several unknown diseases? If yes, then you have had the dyspepsia, or its full equivalent. Chronic dyspepsia may be defined as an epitome of every complaint wherewith transgressing mortality is scourged. It is as nice a thing to have about you as a trunkful of tarantulas, with the trunk lid always up An eminent English physician has said: "A man with a bad dyspepsia is a villain." He is, and worse. He is by turns a fiend, a moral monster, and a physical coward—and he cannot help it. He is his own bottomless pit, and his own demon at the bottom of it, which torments him continually with pangs indescribable.

When a worm of the business dust of this world has writhed with the dyspepsia until it has assumed a virulent chronic form, who shall find colors and abilities varied enough to paint his condition? His blood becomes first poverty-stricken, then impure, and, as "blood will tell," every part of his system is contaminated by the foul stream. The brain complains bitterly on its own account, and vehement complaints are being continually sent up to it from the famishing liver, bowels, spleen, heart, and lungs. Like "sweet bells jangled out of tune," the entire organization breathes discords. Even the remote toes telegraph up to the brain: "We are starving down here; send down some provender." The brain makes requisitions on the stomach, which are futile. The stomach is powerless to provide, and the brain cannot transmit. At times all the starving organs conspire together, suspend work and undertake to compass by riot what they fail to get by appeal. Then life trembles in the balance. Then the consolation—O, the consolation!—that is visited on the dyspeptic. Friends—when he is lifeless from lack of vitality—friends will exasperate him with taunts of being "lazy," "shiftless," "indolent," and "without ambition!" Nor can his friends be made to appreciate that it is as preposterous to expect one who is undergoing constant torture and consequent exhaustion to have "ambition" as it would be to expect a corpse to have an appetite, Remedy: everybody's advice—that is, ride everybody's hobby. Cure: death. Drugs are but aggravations, and "bitters" are bitter indeed we have heard of a chronic dyspeptic who took his cue from his chickens, and by swallowing daily a moderate handful of gravel stones of the size of a pea downward, finally succeeded in transforming "cue" into "cure." He claimed complete restoration. In the face of this evidence to the contrary, we re-assert that, for chronic dyspepsia in its worst form, there is but one certain cure—absolute rest. Preventive: take as good care of the coats of your stomachs as you do of the coats of your backs. Do you wish for faith in God, in human love, in earthly happiness, in the beneficence of Nature, and in immortality? Keep your digestion vigorous; on that hang all of these. Would you prefer an abiding faith in tortures unspeakable, in horrors inexpressible? Destroy your digestion. Would you live in the body for ever? Keep your digestion in full vigor; and although the end of the world may come, your end will not come—you will have to go after it. Old age is but the failure of nutrition. Nutrition is life; non-nutrition is death.

Spontaneous Combustion of Hydrocarbon Vapors.

During the years 1870, 1871 and a portion of 1872, at the Wood Preserving Works in San Francisco, Cal., several instances of spontaneous combustion occurred, accompanied by explosions of hydrocarbon vapors. Mr. I. C. Woods, manager of the works, at the last meeting of the California Academy of Sciences, gave the particulars of some of these accidents and a statement as to the remedy successfully applied. The hydrocarbon vapors used for the preservation of wood are obtained by the distillation of coal tar. A brick pit is attached to each two stills, to hold the hot pitch product as it runs from them. This pit has an opening in the side for access and a ventilating chimney through which the vapors from the pitch pass off into the atmosphere. The opening for access to the pit is closed by an iron door. The tar used is made at the gas works in that city. The stills used have a capacity of from 1,200 to 1,800 gallons.

In the progress of the work, the still containing the coal tar is run until the thermometer on the top, near the man hole, indicates a heat of 420° Fah., when they cease firing. The still and contents are then allowed to stand and cool until the thermometer indicates a heat of from 200° to 212° Fah. At this heat the liquid pitch is allowed to run from the still into the pitch pit; as it cools, it becomes solid. From the time the thermometer in the still indicates a heat of 420° Fah. until after the time of letting out the pitch, the corks remain open in the vapor pipe connecting the still with the wood-preserving tank.

Until April, 1872, this letting out of the hot pitch was attended with danger of fire, because of the tendency of its vapors to spontaneous combustion. If running the still daily, such accidents would occur three or four times a year. The vapors from the pitch in the pit, as they passed out of the ventilating chimney, were yellow, being the vapors of the naphthalin oils contained in the coal tar. The combustion would take place after the pitch had been running freely from the stills for some minutes. It was always accompanied by an explosion, loud enough to be heard across the street, and strong enough to force away the wooden braces placed against the iron door. Pieces of timbering in the pitch would take fire and burn until extinguished.

From the time the fire is extinguished under the stills to the time of letting out the pitch, there is always an interval of fourteen hours. The furnace of the still is always closed with an iron door and clayed up. There is a strong draft up the chimney of the still. The top of the ventilating chimney of the pitch pit is as high as that of the fire chimney of the still; and there is always a strong draft up this chimney through the crack between the iron door and the brick work of the pitch pit. A person standing at the iron door would not smell any of the vapor of the pitch. The distance from the outlet of the pitch pipe of the still to the furnace door of the still is not less than twenty-two feet. At the time of the last explosion, the furnace of the still had been carefully examined before the pitch was let out; no remains of fire were found there, nor was there any other fire in the building. The hour was 10 A. M., on Sunday, the works not being in operation.

This property of heated hydrocarbon vapors to spontaneously ignite after absorbing a certain quantity of atmospheric air is not generally known. The remedy devised by Mr. Woods is simple and complete. It consists in the introduction of a small quantity of water into the pitch pit while the pitch is running from the still. The hot pitch vaporizes the water, the yellow vapor from the chimney is changed to white vapor, and the desired safety is obtained. Too much water must not be put into the pit at one time, or the pitch will boil over: not a dangerous but a troublesome result.

Mr. Woods had noticed that the hydrocarbon vapors would eat away in holes the seat and valves of composition globe valves; and whenever this took place, steam was liable to leak into the wood-preserving tank during the process of vaporizing the wood. He noticed that, whenever the steam did so leak, the influence of the hydrocarbon on the wood was destroyed. This led him to try with success the experiment of the effect of steam on the vapors of the pitch. Since April 28, 1872, when the remedy described was first applied, not a single explosion has occurred at the works. The water is applied through a half inch iron pipe, connected with the city mains and regulated by a cock. Mr. Woods has reason to believe that the vapors from a combination of coal tar and petroleum are more liable to spontaneous combustion than the vapors from coal tar alone.—*Mining and Scientific Press.*

Magic Squares.

BY L. G. BARBOUR.

I will give three positions of a square of four figures to a side:

First position.				Second position.				Third position			
1	5	9	13	1	8	12	13	1	8	12	13
2	6	10	14	2	7	11	14	14	11	7	2
3	7	11	15	3	6	10	15	15	10	6	3
4	8	12	16	4	5	9	16	4	5	9	16

The second position is obtained from the first by inverting the two middle vertical columns, and the third from the second by inverting the two middle horizontal columns. It will be observed that, in the third position, each vertical column, each horizontal column, and each diagonal column sums up 34.

In a square of eight figures to a side, invert the four middle vertical columns, and then the four middle horizontal columns.

In general, invert the middle half of the vertical and horizontal columns.

After discovering this rule, I applied it to a square of twelve figures to a side, and so simple is the process that I wrote down not the first position or the second, but the third, at the very first dash, and without mistake. I subjoin one with eight figures to a side, so that the application of this principle may be seen:

Third position.

1	9	24	32	40	48	49	57
2	10	23	31	39	47	50	58
59	51	46	38	30	22	11	3
60	52	45	37	29	21	12	4
61	53	44	36	28	20	13	5
62	54	43	35	27	19	14	6
7	15	18	26	34	42	55	63
8	16	17	25	33	41	56	64

The sum of each row is 260.

The reader may try his ingenuity in constructing as many tables as he pleases. Ascertain beforehand what each column should sum up, by the usual method of arithmetical progression. Thus: the sum of the series 1, 2, 3, 4, 5, etc., to 64, is $\frac{65 \times 64}{2} = 2080$. Dividing by 8, the number of vertical or horizontal columns, we get 260 for the sum of each. For the series 1, 2, 3, on to 144, briefly, each vertical column $= \frac{145 \times 144}{2 \times 12} = 145 \times 6 = 870$.

I found a square of six numbers to a side rather harder, and one of five to a side quite troublesome. The reason was that the above method is not applicable. By approximating it, however, as nearly as practicable, and then using tentative means toward the close, I succeeded in both cases.

These tables are not useful in the ordinary sense of that term; they do not teach us how to measure corn cribs or survey farms; but they may interest pupils in arithmetic, and may cultivate the necessary but irksome art of adding up columns of figures. Let the teacher take an ordinary checker board some winter evening, cut out of card or leather sixty-four men, namely, round pieces of the size of a nickel; number them from 1 to 64, and set the boys and girls to work to construct a magic square. My word for it they will go at it with an interest such as the rule of three has failed to awaken.—*Home and School.*

Atmospheric Refraction.

At a recent meeting of the Manchester Literary and Philosophical Society, a paper on this subject was read by David Winstanley.

Mr. Baxendell has noticed the fact that at the moment of the departure of the sun below the horizon, the last glimpse is colored bluish green. Dr. Joule also observes that on two or three occasions he had himself noticed the phenomenon in question, and that, "just at the upper edge where bands of the sun's disk are separated one after the other by refraction, each band becomes colored blue just before it vanishes."

During the past eighteen months the writer, from his residence in Blackpool, has had frequent opportunities of observing the setting sun, and has noticed the phenomenon of the final colored ray certainly more than fifty times. To the naked eye its appearance has generally been that of a green spark of large size and great intensity, very similar to one of the effects seen when the sun shines upon a well cut diamond. The color, however, is by no means constant, being often, as in the case of Mr. Baxendell's observation, bluish green, and at times, as mentioned by Dr. Joule, quite blue. The period of its duration, too, is likewise variable. Sometimes it lasts but half a second, ordinarily perhaps a second and a quarter, and occasionally as much as two seconds and a half.

When examined with the assistance of a telescope, it becomes evident that the green ray results at a certain stage of the solar obscuration, for it begins at the points or cusps of the visible segment of the sun; and when the "setting" is nearly complete, extends from both cusps to the central space between, where it produces the momentary and intense spark of colored light visible to the unaided eye.

"Respecting the increased range of colors seen when the phenomenon is observed with telescopic aid, I may mention that, on the 28th of June, the sea was calm and the sky quite cloudless at the setting of the sun. Of the final colored rays, fifteen diameters showed the first to be a full and splendid yellow, which was speedily followed by the usual green, and then, for a second and a half, by a full and perfect blue. Respecting the increased duration of the color, I have found that, when the atmosphere is sufficiently favorable to allow a power of sixty diameters being employed, with a 3 inch object glass, the green effect is seen at that part of the sun's limb in contact with the horizon, even when one half the sun is still unset, and of course from then till final disappearance.

The different colors seen, together with the order of their appearance, are suggestive of the prismatic action of the atmosphere as the cause of their production, and the interception of the horizon or the cloud as the cause of their separation.

Assuming the correctness of this view, it becomes evident that an artificial horizon would prove equally efficacious in separating the colored bands, and also that, if employed during an inspection of the sun's lower limb, the least refrangible end of the spectrum would be disclosed. Accordingly, I introduced into an eyepiece of my telescope a blackened disk of metallic copper, having a slit cut in it of about the one hundred and fiftieth of an inch in width, and proceeded to make an observation, in July, when the sun was about one half of its meridian hight. The blinding glare, however, of that portion of the sun seen through the slit, rendered the observation futile. By projecting a large image of the sun into a darkened room, I was enabled to get the whole of the spectrum produced by the prismatic action of the atmosphere in a very satisfactory manner. In this case, a semicircular diaphragm was used, so placed that its straight edge divided the field of view into equal parts, from one of which it obscured the light. The diaphragm was placed as before in the focus of the eyepiece, and by rotating it every portion of the sun's limb could be in turn examined, and that too in the center of the field, so as to be equally subjected to the minimum of the peculiarities of the instrument. When the sun's lower limb was allowed to descend into the field of view, the first rays were intensely red. After a momentary duration, they gave place in succession to orange, yellow, and green, which were then lost in the ordinary refulgence of the sun. The upper limb gave green, blue, and finally purple, which latter color I have thus far never seen on the natural horizon. It should be remarked that the colors seen were vivid and unmistakable, and each one of them detained at will, or the whole phenomenon recalled, by the adjusting screws of the instrument. I apprehend that the results here given sufficiently prove that atmospheric refraction is the cause of the colored rays seen at the moment of the sun's departure below the horizon. I have, however, thought it worth while to examine the light proceeding from the moon's limb by the aid of the artificial horizon, and of course by direct observation. The results were decisive and satisfactory, the spectral colors being easily observed. The green effect I have also frequently seen on the departure of the moon beneath the edge of a dark and well defined bank of clouds. Telescopic aid has, however, in every instance been required.

The rapid changes in color observable in the case of almost any large fixed star at an elevation of twenty or thirty degrees above the horizon, and which changes vary between red, green, and blue, may I think be fairly attributed to the same cause as the color in the sun's final ray. Particles of dust floating in the air act, I apprehend, for the moment, in the capacity of diaphragm or horizon, and thus enable the eye to perceive, even in the light of the stars, the prismatic action of our atmosphere."

A TREE near a chimney will often cause a down draft of air.

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