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No. 272,
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THE ZODIACAL LIGHT.

On almost any clear moonless night now this phenomenon may be noticed in the western sky. In the early part of such an evening, after the twilight has disappeared, a triangle of faint light will be seen extending up into the sky. Its base will be found about the place on the horizon where the sun disappeared, and may be of considerable, though of varying and somewhat indefinite width. It will taper upward and gradually fade out about half way from the horizon to the zenith, although it has been observed extending through ninety degrees, and even entirely across the sky. Its edges are so indefinite that no two observers will agree as to just what its limits are. It is not generally noticed, because it looks so much like an extension of twilight that it is mistaken for that. But, as has been said, it is to be seen when the twilight has entirely disappeared, and its shape is so different that any one can distinguish it. It is found to lie along the ecliptic, that is, the sun's path in the heavens. The ecliptic is more nearly perpendicular to the horizon during the evening now than during the evenings of any other part of the year. A glance at any celestial globe, or at a terrestial globe having the ecliptic marked upon it, will make this perfectly clear.

If such a globe be set for the 1st of March and for a northern latitude, then turned over toward the west, it will be noticed at about eight o'clock that the ecliptic is nearly perpendicular to the horizon, and passes close by the zenith, the point in the sky directly overhead. As the zodiacal light always lies along the ecliptic, and is close to the sun, it is clear that about the 1st of March affords the most favorable evenings for its observation; it then extends farthest up into the sky. In the latitude of the north United States its path does not run directly toward the zenith, for the ecliptic never runs through our zenith, but to a point a little way south of that. In fact it extends up toward the noonday position of the sun in the longest summer days. The globe will also show that at an hour or more *before* sunrise the ecliptic is nearly perpendicular to the horizon, and hence rises highest in October. The zodiacal light is thus seen best in the early morning in October. Except at these seasons it stretches along the sky so near to the horizon that it is generally unnoticed. The present is, then, the most favorable time of year for evening observation of this curious phenomenon, and for several weeks any one may find it. It will not do to expect too close a resemblance to the cuts of the light usually given in our text books. They make it more distinct and with sharper outlines than it will be found to have in the sky, as well as too narrow for its ordinary shape. The cause of the zodiacal light is still uncertain. From its nearness to the sun, and its position along the ecliptic, its origin must be sought for about the sun. Kepler ascribed it to an atmosphere about the sun, and this view was generally held until Laplace showed that its observed limits were far beyond the point where centrifugal force would balance the force of the sun's gravity, and that it could not be an atmosphere belonging to and revolving with the sun in any such sense as our atmosphere belongs to the earth. Prof. Wright, of Yale College, has shown by means of the spectroscope that the zodiacal light is *reflected sunlight*. But this does not determine the nature of the reflecting substance. It may be a cloud of gaseous matter, or possibly of small particles of solid matter, surrounding the sun and extending out upon all sides toward the earth's orbit. More probably it is due to immense swarms of meteoroids surrounding the sun, and thus reflecting its light to the eye. G. M. P.

WHOSE BOILERS EXPLODE.

The records kept by the Hartford Steam Boiler Inspection and Insurance Company show that 170 steam boilers exploded in the United States last year, killing 259 persons and wounding 555. The greatest number of explosions in any month was 25, in December. The number for January is 19, September and November, 16 each; the other months ranged from 10 to 14, the lowest number being in June.

The classified list shows the largest number of explosions in any class to have been 47, in sawing, planing, and woodworking mills. The other principal classes were in order: Paper, flouring, pulp and grist mills, and elevators, 19; railroad locomotives and fire engines, 18; steamboats, tugboats, yachts, steam barges, dredges, and dry docks, 15; portable engines, hoisters, thrashers, pile-drivers, and cotton gins, 13; iron works, rolling mills, furnaces, foundries, machine and boiler shops, 13; distilleries, breweries, malt and sugar houses, soap, and chemical works, 10.

It would be an interesting thing to have a statement of relative frequency of explosion—the number, that is, to each thousand boilers in use in each given class of steam-using establishments.

STORM WARNINGS IN COURT.

On the night of March 24, 1877, the hull of the steamboat Rockaway, built at Norfolk, Va., was taken by the steamship Wyanoke, of the Old Dominion Line, to be towed to this city. As the vessels passed Fortress Monroe the attention of the captain of the Wyanoke was called to the Government Storm Signals, but they were disregarded by him. Subsequently the storm became violent, and the Rockaway was wrecked.

The owner of the Rockaway brought suit against the Old Dominion Steamship Company to recover damages to the amount of $40,000. The main plea of the plaintiff was that the captain of the Wyanoke, in disregarding the storm signals, failed to exercise due diligence and precaution for the protection of the property in his care. The case was recently decided, the jury returning a verdict for the plaintiff, giving him $35,018.37, with five per cent. allowance.

AIR AND WATER.

The two substances everywhere met with on the surface of this globe which receive the least popular attention are air and water. The latter especially is one of the most remarkable substances in nature, and exceeds in its pervasiveness even the air. Go where we will, on the most arid desert, the mountain top, the frozen pole, in the deepest cavern, we meet with water in some or all of its forms. The coldest, hottest, or driest air found in nature contains aqueous vapor. Water forms a large portion of many minerals, in which by the giant power of chemical affinity it is directly combined or is locked up as water of crystallization. To adequately discuss all the natural phenomena in which some form of water is a factor, would require a volume; to enumerate and describe all its industrial applications would require a number of volumes.

Both air and water are essential to the existence of all known life. Our bodily health can only be supported by our taking quantities of both at short intervals. Both may and often do become the vehicles of deadly poisons, which in densely populated countries and towns are liable to contaminate them. It is of essential importance that supplies of each needed for the support of animal life should be pure.

Air and water are the great natural distributers of heat and cold. The climates of different parts of the world are very materially affected by the hot or cold currents of air which flow over them, and by the analogous currents of water established by the action of heat in the great seas. Proximity to large bodies of water also has a very important effect upon climate. Water slowly absorbs the summer heat in very large quantity, and slowly gives it off again to the colder air of winter, thus tempering what would otherwise be cold and freezing winds, and retarding frost.

Air and water are the great natural distributers of mechanical energy. The currents of rivers represent a portion of the mechanical equivalent of solar heat expended in raising the masses of water that flow through their channels to the clouds. The winds that propel our ships and wind motors are the product of solar energy also. The chief and most economical means by which the heat generated in the combustion of fuel can be converted into mechanical energy for the propulsion of machinery is water, which this heat converts into steam.

The envelope of aqueous vapor which surrounds the globe, and forms a notable part of its atmosphere, is, as has been well shown by Tyndall, the great conservator of terrestrial heat. Should this aqueous envelope be removed by any cause the heat of the earth's surface would so rapidly radiate into space that every living thing would shortly perish.

The ice cover which forms upon the surfaces of lakes and rivers protects the life which exists in such waters. Were it not for this provision of nature these water deposits would become solid masses, in which all their teeming life would be immovably imprisoned.

The snow blankets which have spread this year over a large portion of our land perform a similar service for the vegetable life which lies dormant below. Without this protection the ground would be too deeply frozen, the frost would be too late in leaving the earth in the spring, the growing season would be shortened, and many of the plants that now thrive in the temperate zones would cease to exist in latitudes where they now abound.

Air and water vapor are the great diffusers of light. Were it not for our atmosphere no solar light could penetrate our houses where the sun's rays do not directly enter, except such as might be reflected from solid objects. Everything not directly illuminated by the sun would lie in deep shadow. In the mid-day many of our apartments would require artificial illumination. Out of the direct sunshine only the lowest forms of life could exist. But the enormous diffusing, transmitting, and reflecting power of our atmosphere compensates almost wholly for disadvantages of position, causing light to penetrate almost as universally as the air itself.

Thus is illustrated the wonderful character of these common substances—air and water—so important to all animated existence, yet so heedlessly regarded by the mass of mankind.

THE INDUSTRIAL CONDITION OF CANADA.

A couple of years ago our Canadian neighbors, tired of industrial stagnation, adopted a protective tariff in the hope of developing home industries. A return to a free trade policy is strenuously insisted upon by many Canadians, whose idea of national economy never rises above the sophistry of "buying in the cheapest market."

In an argument for the policy now under trial the *Industrial World* of Montreal describes a very hopeful state of things as its first fruits, and points out the obvious conditions of the new prosperity:

"Suppose, for instance, a factory is opened in Montreal, giving employment to 1,000 hands. what does this mean? One thousand factory employes will represent a population of at least 2,500. What would the closing of this factory and consequent expatriation of these craftsmen mean? A loss of 1,000 to 2,500? Much more. These artisans require boot, shoes, hats, caps, meat, bread, roots, vegetables, medi-