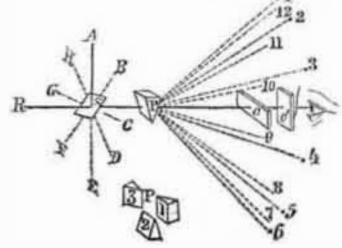
star wheel, S, in its proper position. The shuttle box—by this plan of operating it—can be made to revolve entirely, or make a semi or quarter revolution and rotate back again. Two such shuttle boxes can also be placed on one loom—one on each side.

There is neither spring, catch nor weight connected with the machinery, or operating the boxes. The links of the pattern chain can be painted and arranged together, just as the colors are wanted in the cloth, and these will be observable by the weaver at all times. Such a loom can be built in a very substantial manner, and from the ease of its motions, it is not liable to be broken in any of its parts. It can also be run at a high speed, because there must be less breakage of weft than on looms, which shift the boxes with a quick jerking motion.

More information may be obtained by letter (or otherwise) addressed to Mr. Ames, as above directed. This loom was awarded a silver medal by the Jury at the Crystal Palace.

Imponderable Agents.---No. 8.
[Second Series.]



Polarization of light.—This is one of the most extraordinary properties of light, and in the hands of opticians, it has recently become one of the most useful branches of optics, the phenomenon however, is not generally understood; it does not mean that a ray of light has two poles, like those of a magnet—a polarized ray of light, simply means, a *difference of sides*. The phenomenon of the polarization of light was discovered by M. Malus, a French officer of engineers in 1809. The double refracting property of Iceland spar, which had been so carefully examined by Huygens, drew also the attention of Newton, who concluded that the ray which suffers the unusual refraction must have its opposite sides affected by some virtue like magnetism, which gives them a tendency like magnetism. Malus in one of his frequent visits to the observatory during his residence in Paris in 1809, was struck with the brilliant reflection of the setting sun from one of the windows of the Luxembourg palace. On looking at the appearance through a prism of rock crystal, which he slowly turned round, he saw with surprise, that one of the images changed regularly from brightness to obscurity; next morning he repeated his experiment with the same results, and soon found that light reflected at a certain angle from the surface of the glass, acquires the same character as the extraordinary ray in the double refracting prison. This law was traced through various reflecting surfaces, but the career of Malus was cut short by a lingering disease in 1812.

That a ray of light should (in some cases) possess this property is not perhaps so wonderful or unexpected as that man should have been able to detect a fact so refined and remote from common observation, and even to distinguish different varieties of it, and investigate its laws. Indeed, these must be regarded as the very *penetralia* of physics, the very inmost secrets of nature that man has been enabled to wrest from her. If the *mensurable* spaces occupied by the *waves* of light be minute, how far less, in all probability, must be those *immeasurable* spaces to which its vibrations are confined (which even in sound are mostly inappreciable, though the waves occupy many feet); yet it is to the positions of these inconceivably minute vibrations that the differences of polarization are due.

Differences of *intensity* depend on their extent; differences of *color* on their frequency; differences of *polarization* on their form and direction.

These differences are not sensible to the eye, but are arrived at by inductive reasoning from facts like the following. Let R, fig. 1, represent a ray of light, which in its progress meets (obliquely) with the surface s; a portion of it will be transmitted, and the rest reflected in the directions S. A. Now, by making s revolve round an axis coincident with the ray, R S, we may obviously reflect it in various directions successively, as S B, S C, S D, S E, S F, S G, S H, all making equal angles with the original ray R S; and, if this be destitute of polarity, there is no reason why it should behave differently when reflected in these different directions, nor will a direct ray from any luminous source do so. The reflected light will bear the same proportion to the transmitted in each case; so that all the rays S, A, S B, &c. will be of equal intensity.—But if we find that they are *unequal*, the transmitted ray being *brighter*, and the reflected one *fainter*, when the latter is turned in the directions S B and S F (for instance), than in the directions S D or S H, we have distinct proof that this light has *sides*, or is *polarized*.

Or suppose we turn the ray aside by *refraction*, as by a prism P. By turning this prism round so as to take successively the positions shown in the lower part of the figure, at P. 1, 2, 3, we may plainly turn the ray upwards, downwards, or sideways, in any of the directions p 1, p 2, p 3, p 4, p 5, p 6, p 7, p 8, p 9, p 10, p 11, p 12, (the refraction in each case being equal). Now, if it behave differently in these cases; if, for instance, it be refracted doubly, or split into *two* rays of *equal* intensity when turned upwards or downwards, and into two of *unequal* intensity when turned to the right or left, its polarization is thus manifest.

Or again, if the eye receive this ray through a plate of some transparent substance *c*, and if more light penetrate this plate when it is held upright, as at *c*, than when held across as at *c* (though in both cases perpendicular to the ray,) we plainly learn from this not only the polarity of the *light*, but also that of the substance *c*, which must evidently possess a *grain* or polarity of texture, a difference of properties in different directions; and accordingly this action on light is perceived only in *crystallized* bodies, or those which, from the action of their molecular forces, assume certain definite geometrical forms, and whose *polarity* is also manifest in many other ways, as by their splitting in certain directions rather than others, their expanding by heat unequally in different directions, &c. &c.

General Scientific Memoranda.

Bohemian Crystal Knives.—Among the various novelties prepared for the new year, and in which the shops of Paris abounded were fruit knives of Bohemian crystal; the blade of white crystal, and the handle a happy mixture of white and blue, or white and claret colors.—Hitherto silver knives have been thought indespensable for fruit; but this crystal novelty is likely to supersede them; they are not only an ornament for a dinner table, but are more easily kept clean and bright than silver.

Fall of a Suspension Bridge.—The Suspension Bridge, uniting the cities of Covington and Newport, Ky, just erected at a cost of $80-000, and whose entire destruction by falling into the river in consequence of the breaking of the keys, had, as is stated by the Cincinnatti "Commercial," just been taken off the hands of the contractors by the towns, and a toll gate established. Its capacity of resistance was never tested before the job was taken from the contractors, a neglect quite unpardonable.—When the bridge fell, a drove of cattle were upon it near the centre, while the driver doubting the security of the bridge, stood at a little distance, on the Newport side, and watching his cattle, saw them take the dizzy plunge, amid crashing timber and iron, into the icy river.

Manure Irrigation in Agriculture.—Mr. Mechi, of Tiptreehall farm, Essex, England, has this year read at the Society of Arts his annual statement of experiments on the poor land he has been farming at Tiptree. This land, when he took it, was of the most meagre kind, and nothing like repaid the expense of cultivation. Mr. Mechi has drained it, irrigated it, manured it, employed all the improved machines, erected buildings for the cattle, has been at great expense, and has adopted all the newest improvements, even to the American threshing machine. The result has been that last year—a bad year for weather—after paying all expenses, he is the gainer of $3,000 in hard cash, and his estate is worth ten times what it was when he took it. He enlarged much upon the immense improvement in grasses obtained by liquid manure, and expressed his wonder that ships should be sent to a distant land, and $50 a ton paid for guano, when a far better fertilizer was to be had at home. He instanced a piece of pasture land, of his own, which eighteen months since was a wretched piece of plastic clay, producing meagre drab colored grasses. It was like bird lime in the winter, and iron in the summer, and really not, and never had been, good for any thing. Irrigation with liquid manure has changed all this, and now it produces the very finest and most fattening grasses, the importance of which may be understood when Professor Way, in his valuable analysis, stated that irrigated grasses contained 25 per cent more meat making matter than those which are not irrigated.

The difference between the present and former Balance Sheets, lies in the live stock accounts. By irrigation he is enabled to double, if not triple, his green and root crops, and thus renders them highly profitable instead of being unprofitable. By doubling his stock he doubles the quantity of manure. And by doubling his green and root crop he diminishes their cost by one-half. Irrigation permits each crop to be responsible for its animal charge, thus rendering them all remunerative.

Breech-Loading Cannons.—A final trial of Dr. Church's breech-loading cannons has been made at Woolwich, England. They were fired fifty times with heavy charges of powder and ball with perfect success. No defect could be pointed out by the best judges. According to this plan, heavy guns can be loaded and fired and brought into position by two men five times in a minute, and field pieces eight times in a minute. The gun heats but very little.

Glass Columns.—The Prussians have put glass to a novel use. A column, consisting entirely of glass, placed on a predestal of Carrara marble, and surmounted by a statue of Peace six feet high, by the celebrated sculptor Rauch, has been erected in the garden of the palace at Potsdam. The shaft is ornamented with spiral lines of blue and white.

Marine Telegraph Cable Across the Hudson.—A new cable of telegraphic wire made by Messrs. Newell & Co., at Gateshead-upon-Tyne, England, has been laid across the Hudson River from Fort Washington to Fort Lee, by order of Mr. Rogers, Superintendent of House's New York and Washington telegraph line. The cable contained a single conductor of No. 16 copper wire, covered with two coats of gutta percha, and wrapped with rope yarn, forming a core, over which are spirally laid eight No. 10 galvanized iron wires, as a metallic covering, to protect the enclosed copper conductor. It weighs 3,525 pounds, is three fourths of an inch thick, and one mile in length. It was unrolled from a capstan on board the steamboat Delaware.

There are about one hundred steamers lying side by side at the Cincinnati levees, some frozen in by the ice and others aground. Cargoes are taken on board, so that the shipper may get a bale of lading and the advances upon it. The cargoes are insured when put on board.—Two things endanger these vessels and their freight. Fire breaking out in one would be likely to sweep the whole, and on the breaking up of the ice by high water, they are in danger of being sunk, as numbers were two years ago.

Two mammoth steamers are building in Buffalo, to run in connection with the Michigan Central Railroad route on the opening of navigation. They are estimated to cost $500,000 each, and are to be named the "Plymouth" and "Western World."

Vastness of the Universe.

Professor Hitchcock, in one of his popular scientific works has aptly illustrated the vastness of the Universe. Light, although apparently visible instantaneously, really requires an appreciable time to travel. A flash of lightning, occurring on earth would not be visible on the moon till a second and a quarter afterwards; on the sun till eight minutes; at the planet Jupiter, when at its greatest distance from us, till fifty-two minutes; on Uranus till two hours; on Neptune till four hours and a quarter; on the Star Vega, of the first magnitude, till forty-five years; on a star of the twelfth magnitude till four thousand years.

Extraordinary Invention.

Messrs. Editors—While we are every day hearing of new inventions and the progress of reform, I take the liberty to state to the readers of your valuable journal what I have invented and am about to bring before the world at the earliest possible period. For the last four years I have had my mind engaged upon a marine locomotive, and I have succeeded in bringing it to nearly a perfect plan, it is unlike anything now used in navigating the ocean: one of its most important features is the remarkable fact that it has no head-water resistance—thus the speed can be increased in the same ratio as we increase the number of revolutions. I make these statements candidly, and my object is to open the way to give my invention a public demonstration, and if any one has any invention of the same kind, embracing the same principle, let him make it known now, and not wait until the thing is before the public, and then come forward and claim it as his own. If any one has invented a locomotive that will cross the Atlantic in four days without any head-water resistance—let him speak now; if not, let him forever hold his peace, for I have such an invention, and am ready to prove my statement to any one who will address me post-paid. Henry A. Frost.

Worcester, Mass., Jan. 18, 1854.

[Since the above letter was in type, Mr. Frost has furnished us with diagrams of his astonishing invention, from which we shall execute engravings to present to our readers in a few weeks.

To Detect Cotton in Linen.

Elsner has published a critical review of the various methods proposed to distinguish cotton and flaxen fibres (Berlin. Industrie u. Handelsbl. xxiv.), the best of which we extract from his report. Stockhardt observed that a flaxen fibre, inflamed in a vertical position, and then extinguished, appeared to be carbonized at that end in a smooth, coherent shape, while cotton, similarly treated, appeared to be spread out like a brush or tuft. Elsner observes that it especially occurs when the flame is violently blown out, and that it succeeds with dyed goods, unless dyed by chrome yellow.

The potash test consists in putting the fibre into boiling caustic potassa-lye for a couple of minutes, when the flax turns deep-yellow and the cotton is scarcely changed. The test is not reliable.

One of the best is the microscopic examination, for when flax is magnified 300 times, it appears like long, compact tubes, with a narrow channel in the centre, while cotton appears to be flattened, ribbon-like cylinders, with a wide channel, and mostly in spiral windings.

The test with oil of vitriol is reliable in an experienced hand, but every trace of weaver's gum must have been previously removed by boiling with water. The fibre are laid on a plate of glass, and oil of vitriol dropped on it.—A single lens is sufficient to observe the effect. In a short time the cotton fibre is dissolved, the flax unaltered, or only the finest fibres attacked.

The oil test is also a good one, and convenient in execution. When flaxen fibres are rubbed up with olive-oil, they appear transparent, like oiled paper, while cotton, under similar circumstances, remain white and opake.—Dyed goods exhibit the same, if previously bleached by chloride of lime.

Elsner's method consists in putting the fibres for a few minutes into a tincture of various red dyes, of which cochineal and madder give the most striking results. The tincture is made by putting 1 pt. madder, &c, into 20 pts. common alcohol for 24 hours. In the cochineal tincture, cotton is colored bright-red; flax, violet;—in madder, cotton becomes light-yellow; pure flax, yellowish-red.

It is better to employ several of these tests, the microscopic, oil, sulphuric acid, and combustion, rather than to rely upon a single test.