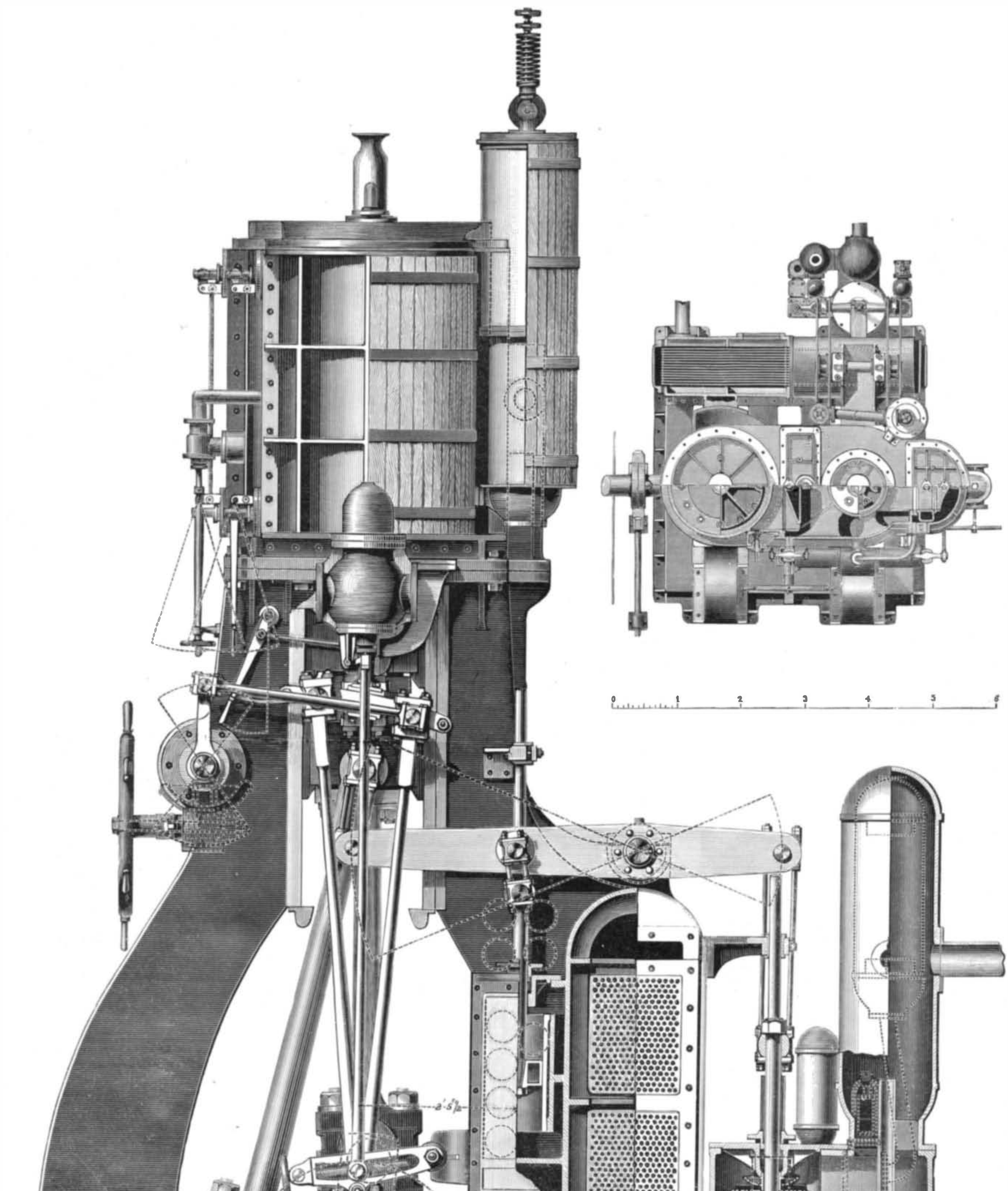
### COMPOUND MARINE ENGINES.

The accompanying engravings illustrate the compound engines of the English steamship Grangemouth, plying between the port of the same name, Leith, Rotterdam, and Amsterdam. The vessel is 190 feet long, keel measurement, 27 feet beam, and 14 feet 2 inches depth, moulded; and her displacement is 1,124 tons. The dimensions of the engines are as follows: Diameter of cylinders, 24 inches and 43 inches; length of stroke, 42 inches; nominal horse power, 125; condensing surface, 1,000 square feet; load on safety valves, 80 pounds per square inch. On trial the following results were obtained: Steam pressure, 79½ pounds per square inch; revolutions per minute, 85; speed of piston, 595 feet per minute; vacuum, 24·5 inches; indicated horse power, 766·3; speed in knots, against tide, 10·5. There are two tubu-



COMPOUND ENGINES OF THE STEAMSHIP GRANGEMOUTH.

lar boilers, having a total heating surface of 1,882 square feet, with a total furnace grate area of 64·4 square feet. The engines are provided with a Weir's patent feed heater, shown fixed to the side of the high pressure cylinder. The feed water from the hot well is pumped into the top of this vessel, and descends in the form of spray over a series of trays in the interior, mingling at the same time with a jet of steam taken from the receiver. This raises the temperature to upwards of 250°. It is then continuously drawn off at about that temperature, and forced into the boilers. The boilers are fitted with Cockburn's patent safety valves, loaded with direct springs. The *Engineer*, from which we obtain these particulars, states that the Grangemouth's engines have more power than is needed for the requirements of the trade in which she is engaged, and that her performance during the time she has been on her station has been highly satisfactory. On several voyages her engines have maintained an average speed of 79·5 revolutions per minute from port to port, with a very small consumption of coals.

## Communications.

### Treatment of Ores.

*To the Editor of the Scientific American:*

Being a practical quartz mill man, my attention was attracted by the leading editorial in your issue of March 23. Your opinion that a process for a finer comminution of ores is desirable would lack universal concurrence for two reasons: First, after passing through a 50 or 60 mesh screen, the ore particles, as a rule, conceal but little metal. A reason for this is that quartz is more tenacious than the mineral it contains, and in breaking or crushing ore the fracture is naturally through the richest portions. In support of this is a fact well known to many, that almost always the coarsest sand in the tailings (when cleaned as well as possible from particles of quicksilver and finer portions of tailings) will assay far less than the average tailings. If tailings from the Consolidated Virginia or California ores (they are all crushed coarse and ground), after running over the blankets, are discharged into a V box, which allows the escape of one half through the bottom and the other half over the top, the latter will assay about 50 per cent higher than the coarser half.

Secondly, ore can be made extremely fine in good pans in proper shape, time only being required; or by raising the muller just enough not to grind, we have the condition you suggest, *i. e.*, forcing the pulp through the quicksilver. A large percentage of the pans of to-day, however, do not fill these conditions, because of improper currents. A pan should generate a spirally annular current, passing under the muller with proper force and volume.

The principle that employs the stamp and pan for amalgamation purposes may be radically wrong, but he who thinks to supplant them by a better will find it a great undertaking; yet the reward would not be wanting, for there is no class of people who desire more to have the very best, or who take better to genuine improvements, than the mining men of the Pacific coast. M. P. B.

Oakland, Cal.

### The Polariscope as a Photometer.

*To the Editor of the Scientific American:*

In my communication published in the SCIENTIFIC AMERICAN of March 23, page 186, I forgot to mention an important advantage possessed by my arrangement, and which is not shared by that of Herr Merz, described in the issue of March 16, page 163, in which the reflectors are all placed in a fixed position. The advantage referred to is that my apparatus can be used as a photometer, by attaching a graduated scale so as to measure the angle under which the analyzer is turned round. All who are familiar with polarized light know that when the planes of polarization of polarizer and analyzer coincide, there is no loss of light except that due to the absorption by ordinary reflection or refraction; further, that when either polarizer or analyzer is turned round, the light is gradually obliterated until the planes of polarization make an angle of 90°, when the minimum amount of light is reached. It is therefore evident that the number of degrees required to make two sources of light equal gives a comparative measurement of their relative intensities. Theory teaches, however, that this angle itself gives only an approximate estimate, and that the correct measure is the square of the sine of the angle. This has been confirmed by experiment, which is easily done when such a polariscope is used in conjunction with the ordinary means of photometry. I will illustrate this with an example: Suppose we have as two lights the flames of a kerosene lamp and of a standard wax candle, and that we have to turn the analyzer 30° in order to reduce the kerosene flame to the intensity of the wax candle. As the sine of 30° = ½, and its square ¼, it would prove that the kerosene flame is four times brighter, and therefore equal to four standard wax candles.

Another item has to be added, namely, that Zöllner of Berlin has applied this very same method to the classification of the stars, substituting, for the rough estimate thus far followed in dividing them into stars of the first, second, and third magnitudes, etc., a regular astro-photometric process. He uses for a standard a lamp the light of which shines through a small hole, throws its light by reflection into the tube of the telescope, and its image in the focus of the eye-piece, employing for this purpose a similar arrangement to that used to illuminate the fine cross threads serving for measurement by night observations. Suppose him now to compare two stars, say Sirius and Capella, and that he has to turn the analyzer through 23° to reduce the light of Sirius, and 10° to reduce that of Capella to the same intensity as that of the lamp, a rough estimate would give the relative intensity of these stars as 23 : 10 or, nearly, 7 : 3, showing that Sirius gives about 2⅓ times more light than Capella. The more correct estimate gives for the sines of 23° and 10° respectively 0·0389 and 0·0174, of which the squares are 0·15138 and 0·03027; of these numbers the first is nearly five times greater than the last, proving that if correctly calculated the light of Sirius is equal to five times that of Capella. This agrees better with estimates made before, though with less perfect means. Some of the results obtained by Zöllner by the use of this polariscope-photometer, are as follows:

COMPARATIVE LUMINOSITY OF THE MEMBERS OF OUR PLANETARY SYSTEM.

| | |
|---|---|
| Sun is to full moon as | 613,000 : 1 |
| " " Mars as | 7,000,000,000 : 1 |
| " " Jupiter as | 5,500,000,000 : 1 |
| " " Saturn as | 131,000,000,000 : 1 |
| " " Uranus as | 8,000,000,000,000 : 1 |
| " " Neptune as | 80,000,000,000,000 : 1 |

COMPARATIVE LUMINOSITY OF SOME STARS.

| | |
|---|---|
| Capella and Sirius are as | 1 : 5·0 |
| " " Vega " | 1 : 1·2 |
| " " Betelgeuse | 1 : 0·5 |
| " " Regulus | 1 : 0·4 |
| " " Pollux | 1 : 0·3 |

COMPARATIVE LUMINOSITY OF STARS AND PLANETS.

| | |
|---|---|
| Capella and Venus are as | 1 : 48·0 |
| " Mars " | 1 : 7 |
| " Jupiter " | 1 : 10 |
| " Saturn " | 1 : 0·4 |
| " Uranus " | 1 : 0·0066 |
| " Neptune " | 1 : 0·0007 |

These data will form important records for the future, as it is well known that continual and sometimes very great changes take place in the amount of light developed or reflected by the heavenly bodies.

P. H. VANDER WEYDE.

### PLANT MIND.

IV.

IMMOBILITY VERSUS ACTIVITY.

Careless observers accept without question the idea of immobility, in connection with the life and being of plants, considering them as only intended to adorn the surface of the earth, and please the eye with their beauty, or as good for food and medicine; yet due consideration of the organization and phenomena of plant life goes far to contradict this general impression. Attentive observers and profound thinkers have drawn different conclusions. We quote, to begin with, from the "Cosmos" of the illustrious Alex. von Humboldt: "If nature had endowed us with microscopic powers of vision, and the integuments of plants had been rendered perfectly transparent to our eyes, the vegetable world would present a very different aspect from the apparent immobility and repose in which it is now manifested to our senses." Charles Darwin also, in his "Structure and Distribution of Coral Reefs," remarks that our forests do not conceal so many animals as the low weedy regions of the ocean, where the sea weed rooted to the bottom of the shoals, and the severed branches of the fuci (sea wrack), loosened by the force of the waves and currents, and swimming free, unfold their delicate foliage, upborne by air-cells.

Baron Charles von Reichenbach, in his valuable work on the "Dynamics of Magnetism," relates some interesting experiments on living organic structures, demonstrating that special manifestations of intense vital activity occur in plants. For instance, coils of stout wire were laid over a *Calla Æthiopica*, a *Pelargonium moschatum*, and an *Aloë depressa*. The wire became immediately hot in the hand of the holder, and at the same time the point of the wire diffused cold wind. The *Calla* manifested the greatest strength, the *Aloë* the least, while the *Pelargonium moschatum* always kept the medium, and so it seemed likely that the measure of the strength increases in equal degrees with the rapidity of the growth. The *Calla* is quick growing, while the *Aloë* is slow. M. Reichenbach also discovered that entire trees produced a total impression of coolness; and plants in pots were mostly warm on the stem, cool in the flowers. Trees were cold near the upper end, but warm near the ground.

The vital activity of plants consists chiefly of processes which are not visible to the unassisted eye, such as growth and assimilation, or vegetable glandulation, by which are separated from the sap or vegetable blood, mucilage, starch, and sugar, for the sustenance of bulbs and buds. An exception, however, may be found in their secretion of honey, in the *nectarium* or honey gland, which is of great importance in the vegetable economy. In 1694, Tournefort recognized its existence in the passion flower and some other plants; and Vaillant, in 1718, regarded it as a part depending on the petals. Its name is due to Linnæus, derived from *nectar*, the fabled drink of the gods. In many flowers the *nectarium* is shaped like a spur or horn; in others, forms a part of the corolla, lying within the substance of the petals (lily); again, in a series or row within the petals, yet unconnected with their substance, often resembling a cup, as in *narcissus;* situated upon, or making a part of the calyx; seated upon the anthers, or tops of the stamina; placed upon the filaments; upon the seed bud, attached to the common receptacle; with others of so singular a construction, they do not properly fall under any of the above descriptions. In the *Pelargonium*, or African geranium, the nectary is a tube running down one side of the flower stalk. In this honey cup the secretion is exposed to the open air previously to its absorption into the vegetable vessels. A French philosopher has endeavored to show that the oxygen, or base of vital air, is the constituent principle of our power of sensibility. The sugar-making process carried on in vegetable vessels is a great source of life to all organized beings, and cannot be made from aërial matter without the assistance of vegetation

To return, this process of honey making results in an accumulation of carbon or sugar in the nutritive organs of the plant, which is consumed by its reproductive ones. The *Cacalia suaveolens* produces honey in such abundance that it may sometimes be smelled at a great distance from the plant. Dr. Darwin remarked that he had at one time counted on one of these plants, "not only bees of various kinds without number, but above two hundred painted butterflies, which gave it the appearance of having so many additional flowers." This honey forms the food of the male and female parts of plants, and the nectary begins and ceases its production with the birth and death of those *animated beings*, the *stamens* and *pistils*, or the parts of the plants in which seems to be concentrated what may be termed the *individuality* of plant life.

The similitudes of vegetable and animal anatomy will occupy our attention from this point. R. C. K.

### Thomas C. Connally.

In the notice of deaths in the Patent Office at Washington, omission was made of one which creates a profound impression among a large circle of acquaintances. Thomas C. Connally was long connected with the Patent Office as Assistant Examiner, and filled the position with credit to himself and satisfaction to the government. He was a man of great purity of character, much personal worth, kind, generous, sympathetic. An acquaintance of many years enables me to bear this slight tribute to his memory.

Mr. Connally was formerly a journalist, and the writer first became acquainted with him as editor of the *Evening Telegraph*, published in Washington 1852–3. He was highly esteemed by his cotemporaries, Messrs. Gales and Seaton of the old *National Intelligencer*, Blair and Rives of the *Globe*, and Gideon of the *Republic*. He was an honorable laborer in the field of Washington journalism, and contributed not a little to the enviable position of metropolitan political papers of that day.

Mr. Connally never wholly relinquished his interest in the press, and during the last Presidential campaign contributed the power of his pen toward the success of his party. He was fond of literary and scientific work, devoting much of his leisure to the advancement of their claims. Several gentleman residing at the Capitol organized, a few years since, a scientific association, holding bi-monthly meetings, to discuss matters of general scientific interest. Mr. Connally was an active member.

It is always painful to record the departure of friends, but when men of so much usefulness and great personal excellence die, we feel that no common loss has befallen the community Peace to his memory. D.

### Accidental Fish Propagation.

About two years ago the Missouri and upper Mississippi rivers were stocked with salmon. During the last season salmon in various stages of development up to full size were caught in these rivers; and the frequent finding of large fish has caused no little astonishment to those who regard the stocking of two years ago as the original beginning of the species in the locality, the matter becoming a topic of newspaper comment. A correspondent, residing at Oregon, Mo., recalls to our recollection the fact that, some eight or nine years ago, a fish train, bound for California, under the auspices of the Fish Commission, was wrecked on the Elkhorn, near the confluence of that river with the Platte, in Nebraska. Our correspondent happened to be a witness of this accident, and confirms the statement published at the time, that millions of small fish and fertilized eggs were in this way lost (as it was thought) in the Elkhorn. This appears to be a sufficient explanation of the frequent appearance of full-grown fish at the present time.

### Scientific Novelties.

Following in the wake of the scientific novelties that have been for some time exhibited in our shop windows under the form of hygrometric or barometric flowers, which change color according to the varying conditions of the air, we note the appearance of "luminous flowers." These flowers are prepared with sulphurets of strontium, calcium, etc., and it is only necessary to expose them for a short time to sunlight to observe them become afterwards phosphorescent in the darkness.

Recently Messrs. Dagron & Gisclon have put forth a novelty in the shape of "sympathetic pipes." The bowl of a meerschaum may be colored a most beautiful chocolate in five minutes, by first tinting it with a solution of nitrate of silver in ether and alcohol, to which essence of roses and camphor are added. By these means any image or superscription painted on the pipe will gradually appear, like a photographic impression, under the influence of the light or heat of the burning tobacco. The images once made are permanent.