Test for the Presence of Gold in Solutions.

Protosulphate of iron gives a brown precipitate, which acquires a metallic luster when rubbed. Proto-chloride of tin gives a purple or blackish precipitate, insoluble in muriatic acid. Sulphuretted hydrogen and hydrosulphuret of ammonia give a black precipitate, insoluble in simple acids. Ammonia gives a reddish-yellow precipitate (fulminating gold) with tolerably concentrated solutions, either at once, or on boiling the liquid. Liquor of potassa gives, with neutral solutions of gold, a similar precipitate to that formed by ammonia, insoluble in excess.

AN ANCIENT HAND WARMER.

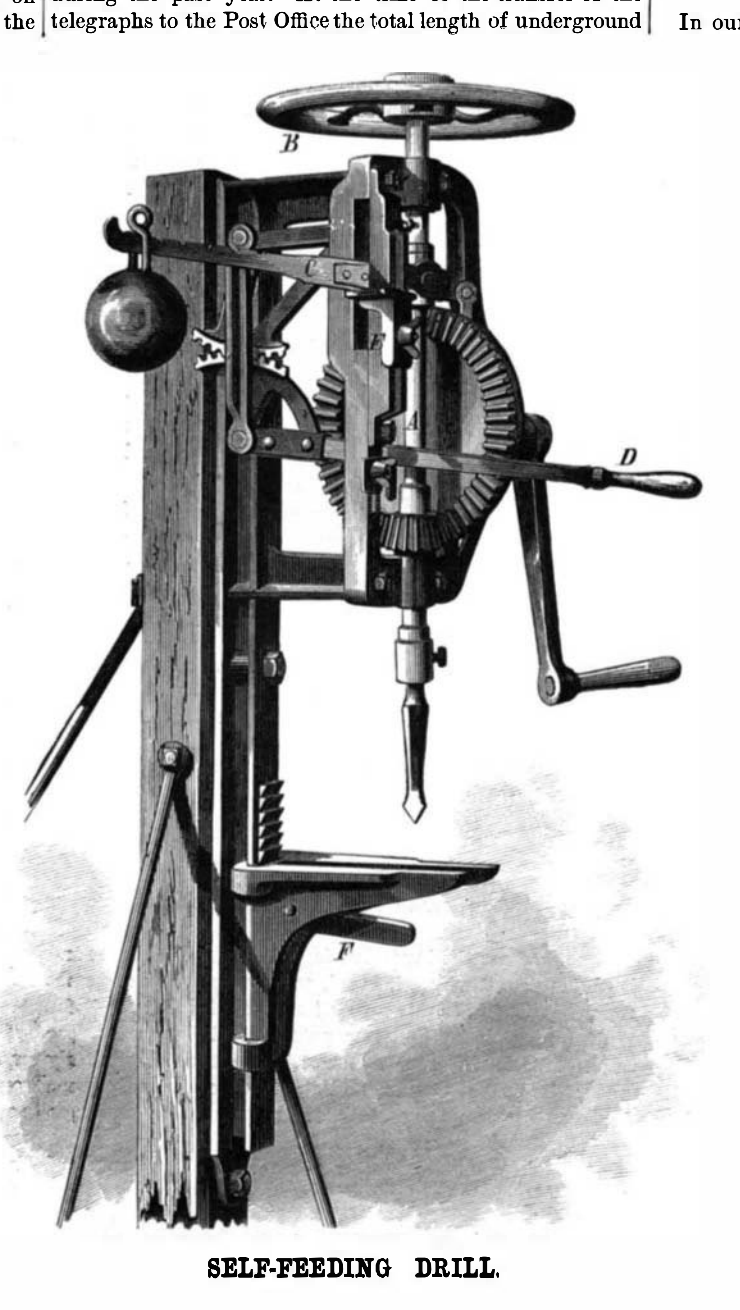
Our illustration represents a curious old article of comfort, which is almost forgotten now-a-days, but which once formed one of the many objects carried by ladies at their chatelaines. It is a hand-warmer, and consists of a small

spirit lamp hung in gimbals in several circles of metal, so that it stands always horizontal. It is enclosed in two hemispheres of copper, which are hinged together. The contrivance was clasped between the palms of the hands, and thus kept the latter warm.

IMPROVED SELF-FEEDING DRILL.

The annexed engraving represents a new self-feeding drill for boring iron, steel, etc. The feed is adapted for all classes of work and all sizes of drills, and therefore needs no adjustment. A is the drill shaft, having at its upper end the flywheel, B. This shaft is rotated by the bevel gearing shown, which is revolved by hand by means of the crank. On the bevel pinion is a feather which enters a keyway on the shaft, A, so that although said shaft is turned by the pinion it can be moved vertically within the latter. To the upper part of the shaft are attached collars, and between them is a sleeve which is secured for vertical movement upon the shaft by means of the collars, and prevented from revolving with it by the set screws which attach it to the beam, C. It will be observed that the shaft, A, is free to move vertically within certain limits, and that its vertical position is regulated by the beam, C, which is attached to the shaft by the sleeve above referred to. The short end of the beam is connected by a link to the frame. The long arm is notched so that the weight may be adjusted upon it to cause more or less downward pressure on the shaft. This beam is operated by means of a lever, D, the short arm of which is cogged and engages with the cogs of the bell crank shown, which latter is connected to the beam by means of clevises. By raising the lever, the long arm of the beam is depressed, and consequently also the drill shaft. In order to limit the motion of the beam and through it of the shaft, an adjustable stop, E, is provided which may be secured in any desired position. The table is likewise adjustable, and is placed as desired by means of the dog, F, which engages with a rack upon the standard.

The machine is strongly constructed and is in all particulars a very excellent and useful tool, especially adapted to the needs of the general machinist. For further particulars address the manufacturers, Messrs. Combs & Bawden, Freehold, N. J.



SELF-FEEDING DRILL.

The Atmosphere of Mars.

Mr. R. S. Newall, F.R.S., at the observatory, Gateshead, England, states that on August 23, during the total eclipse of the moon, he observed that Mars is surrounded by a whitish envelope, the diameter being about twenty times that of the planet. He saw it again on September 7 and 19 distinctly. It has a well-defined edge, and is densest nearest to Mars. Small stars were seen through it.

A New Dyestuff.

Not long since a new dyestuff made its appearance in the German market, which consisted of a slightly crystalline powder of a light red color, similar to mercuric iodide. According to Professor A. W. Hofmann's experiments it is the soda salt of an organic acid, mixed with a not inconsiderable quantity of alumina. It dissolves quite abundantly in hot water, less so in hot alcohol, with a deep brownish-red color; the solutions, which dye a beautiful orange inclined to red, crystallize on cooling. The salt is insoluble in ether. The salt will endure quite a high temperature without decomposition. At a high heat it swells up almost like Pharaoh's serpents, and leaves behind almost exclusively a mass of carbon, which burns only with very great difficulty.

In order to obtain the acid the commercial product was dissolved in boiling alcohol and the solution treated with concentrated hydrochloric acid. From the deep violet-colored liquid there separated on cooling fine hair-like red needles, to which some of the mineral substance adhered most tenaciously. By frequently repeated crystallization from alcohol and acid the last trace of incombustible matter was at length removed.

The pure dye consists of beautiful reddish-brown needles, which are quite soluble in water, still more so in alcohol, but insoluble in ether. Free alkalies as well as ammonia dissolve it with a brown color. From the last named solution the dye is precipitated in a crystalline form upon the addition of an acid. In this case the liquid acquires a deep violet color. The composition of the dyestuff dried at 100° C. corresponds to the formula $C_{16}H_{12}N_2SO_4$, and that of the silver salt to $C_{16}H_{11}AgN_2SO_4$.

Such a substance could be obtained by the union of 1 molecule of naphtolsulfo acid with 1 molecule of diazobenzol:

$$C_{10}H_8SO_4 + C_2H_4N_2 = C_{16}H_{12}N_2SO_4.$$

In fact the new orange was obtained by the action of diazobenzol upon alphanaphtolsulfo acid. The last named acid was prepared by digesting naphtol with sulphuric acid upon the water bath. The lead salt was first prepared and the lead then removed with sulphydric acid, and the solution of the free acid concentrated and saturated with sodic carbonate. When the solution of this salt was mixed with a solution of aniline nitrate and potassium nitrite, a deep red precipitate was at once formed, of remarkable coloring power, but still impure. It was dissolved in ammonia, when a resinous mass remained undissolved. A purer substance was precipitated by acids; and after re-crystallizing several times from a boiling mixture of hydrochloric acid and alcohol, it was obtained in the same fine hair-like needles which were obtained from the commercial product.

Underground Telegraph Wires in England.

A considerable mileage of overground telegraph in the United Kingdom has been replaced by underground wires during the past year. At the time of the transfer of the telegraphs to the Post Office the total length of underground wire in existence was a trifle under 2,000 miles. On the 31st of March last it had been increased to a trifle over 8,000 miles, being more than four times as much in 1877 as in 1870. A considerable proportion of the increase in the mileage of buried telegraphs during the year has been in London alone. The aerial system was fraught with danger to life and property in the neighborhood of the wires. Under the new arrangement the telegraphic system generally will be less liable to interruption when the frosts and snows of winter set in.

A NEW FLOATING OIL BURNER.

The annexed engraving represents a new floating oil burner for night or other lights in which a long wick may be used. It consists of a cup-shaped float, having a convex top. A tube passes through the float, extending both above and below it. The lower end of the said tube is loaded to

maintain it in a vertical position. A slot is cut in the side of the wick tube, near its upper end, to receive the edge of a serrated wheel, by which the wick is raised or lowered. A curved handle is attached to the top of the flat, for convenience in handling the burner. A ball is placed in the float which may be shifted so as to counterbalance the heavier side and cause the float to set evenly in the oil in which it is placed. The float is airtight and formed of thin sheet metal, and hence does not become oil-soaked.

This invention was patented through the Scientific American Patent Agency, September 18, 1877, by Mr. Oscar Tamagno, of New York city.

Mountain and Balloon Ascents.

In our number for August 9, we briefly noticed the ascent made by Mons. Wiener, of the mountain Illimani, one of the highest—if not the highest—of the Bolivian Andes, which forms a noble object from the city of La Paz, and was formerly reputed (by Mr. Pentland) to have an altitude of no less than 24,200 feet. Mr. Wiener, however, makes its height only 20,112 feet, while Mr. Minchin, as we have already observed, places its altitude at 21,224 feet. If the latter estimate be correct, Mons. Wiener has, we believe, not only made the highest ascent which has been made in the Andes, but has attained a greater altitude than has has been reached *on* the earth out of Asia, and in Asia has only been beaten by Mr. Johnson, who some years ago got to a height of 22,300 feet in Cashmere. As the recorded ascents to the height of 21,000 feet are extremely few, we shall be glad to hear further particulars respecting Mons. Wiener's exploit, and more especially whether he experienced much exhaustion through the rarefaction of the air. Practised mountaineers who have climbed to a height of 17,000 to 18,000 feet have been of opinion that even at such altitudes there is a very important and perceptible diminution of the bodily powers, and think it probable that the height of 25,000 or 26,000 feet will be found to be about the limit which will ever be reached on foot. As a set-off to this opinion we may mention the facts that hunters in the Himalayas frequently pursue their game at heights exceeding 20,000 feet without experiencing any notable inconvenience from the low barometric pressure; and that natives living on the base of Demavend, near Teheran, often ascend to its summit to gather sulphur from its crater without any great difficulty. The height of this mountain, there is reason to believe, also exceeds 20,000 feet, although it has never been accurately determined. If, therefore, severe work can be done with impunity at such elevations, it seems not unreasonable to suppose that much greater heights might be attained by men who had previously accustomed themselves to life at high altitudes. Aeronauts, anyhow, have proved that life can exist at 30,000 feet above the level of the sea, and that at 25,000 feet, and upwards, one may positively be comfortable if sufficiently warmly clad. That such is the case is sufficiently remarkable, for "travelers in the air" have to sustain incomparably more rapid variations of pressure and temperature than mountain climbers. Mr. Glaisher, on his memorable ascent on September 5, 1862, left the earth at 1 P.M., and in less than an hour shot up to a height of 30,000 feet. At starting the temperature of the air was 59°, and at its greatest altitude it was 61° lower! Mountaineers experience no such extreme variations as these. They rarely ascend more rapidly than 1,000 feet per hour, never so much as 15,000 feet in a day, and become to some extent acclimatized as they progress upwards. On the whole we are inclined to think that man will not rest until he has at least attempted to reach the loftiest summits on the earth, though we will venture to assert that it will be long before any one crushes down the snow on the summit of Mount Everest.—*Nature.*

Some Experiments with Diamonds.

It is not everyone who has an opportunity to conduct a series of experiments upon diamonds of various kinds, and we hope our readers will be interested in the results of Von Baumhauer.

Diamonds are not found exclusively in the form of more or less perfect, colorless or slightly colored, crystals. In washing diamondiferous sand there are frequently found rounded, and sometimes angular, masses, which are brilliant black on the surface, but when broken are dull and of a gray or violet color. These are known in the trade under the name of "carbonado," or "carbons."Under the magnifying glass they exhibit a great number of pores, and, if heated in water, give off a great many air bubbles. Although these carbons differ greatly from the real crystallized diamonds, yet E. H. Von Baumhauer found by examining a large number of carbons and diamonds, that there is an unbroken series of intermediate conditions between the carbon and diamond. It is remarkable that the carbon, which frequently accompanies the diamond in Brazil, has not been found in the diamond fields at the Cape.

Besides these two modifications of the diamond there is still a third, which is known to the dealers in stones as "bord." They consist of translucent, but not transparent, colorless or grayish spheroids, from which small octahedra can be split out, which are much harder than the well crystallized diamond, but are inferior to the "carbon" in this respect. Von Baumhauer determined the specific gravity of 17 different varieties, and his table of results shows that the highest specific gravity of 3·5225 to 3·5197 belongs to the purest diamond, that the "bord" comes next, being not much over 3·50, while the carbon has a considerably lower specific gravity, 3·3493 to 3·1552, probably because it is porous. The colorless diamond can be heated to a white heat in dry hydrogen gas, by excluding the air, without showing any change. Colored diamonds, on the contrary, change their color when ignited; a dirty green became pale yellow, a dark green turned to violet, the brown diamonds lost the greater part of their color, while the yellow remained unchanged. A colorless diamond acquired an intense rose color in consequence of being heated, and retained the color a long time in the dark, but soon lost it in the light.

If diamonds are heated by access of air, they become dull and opaque on the surface, they burn with loss of weight, but retain their transparency within. In oxygen the diamond comes to a lively glow, and burns with dazzling light long before the platinum crucible gets red hot. Small diamonds burn completely up after the lamp has been removed from under the crucible, while in larger ones the heat of combustion is not sufficient to support any farther combustion.

Although Von Baumhauer repeated these experiments several times, he never saw anything more than a quiet burning with dullness and cloudiness of the surface; a sight of blackening, conversion into coke, change of its state of aggregation, swelling up, fusion or softening, rounding of the corners or edges, was never vouchsafed to him.

By combustion of the diamond, it is perfectly established that the diamond is surrounded by a small flame whose exterior color is a bluish violet. When heated in superheated steam the diamond does not change at all, even for 10 minutes. The temperature employed was, however, only a moderate one. Heated to whiteness in an atmosphere of dry carbonic acid, the diamond became dull on the surface and lost in weight; hence it must have decomposed the carbonic acid and united with its oxygen.

[It is very rare that an element is able to drive out another atom of its own kind from a compound and take its place. The atomic condition of carbon in the diamond seems to differ from that in its compounds from its greater condensation, but it has not hitherto been considered to be in a very active state. Is the diamond perhaps when highly heated a kind of ozone carbon?—TRANSLATOR.]

Deep Mining.

Connection has been made between the Gould and Curry mine on the 1,900 level and the joint winze on the Savage line. This gives a fine circulation of air at that depth, the draft being southward through the Curry and up through the joint winze. It is a very important connection, as it opens up in the Curry mine for cross-cutting and prospecting 460 feet of new ground. Before this connection was made the drift was fearfully hot, the heat at the face being 126° Fah.

The benefit derived from such a connection is not instantaneous; on the contrary, when the opening is first made the miners get out of the place as soon as possible, as the heat and smell are such as to be unendurable, and frequently produce asphyxiation. It is the same air that the men breathe before an opening is made, but when it is set in rapid motion it appears to acquire some new and noxious quality. But for this the miners might drill ahead a great number of feet when drifts are being run to make such connections. A drill hole so run, however, would so sicken the men that they would be unable to work. When a connection is made it is desirable, therefore, to knock out as large a hole as possible with the last blast, then let the men employed retire for some hours until the foul air shall have passed out of the drift and level.—*Virginia City (Nev.) Enterprise, October 9.*

THE RAMIE PLANT AND ITS UTILIZATION.

In our editorial columns will be found the particulars of the recent offer by the British Government of large rewards to the successful inventors of a machine capable of preparing the fiber of the ramie plant for textile uses. In the following article we propose to explain what the plant is, and to summarize what has hitherto been done towards its utilization.

Ramie is the Indian name for the plant producing the fiber called China grass. It belongs to the *urticaceæ*, or nettle family, and is nearly related to the true nettles. It is found either in a wild or cultivated state throughout the greater part of tropical and eastern Asia. In 1867 it was introduced into this country from Mexico, and its cultivation has since been carried on chiefly in Louisiana, with but partial success. The plant itself is perennial and somewhat shrubby, growing to a height of about four feet. Its character is well shown in the annexed engraving, Fig. 1. Numerous stems, each about as thick as a man's little finger, bear opposite pointed serrate leaves, each 6 inches long by 4 inches broad, on long hairy petioles. There are two principal types of the plant bearing the specific names *nivea* and *tenacissima*; both are utilizable, but the latter is much the better for industrial purposes. The first has leaves green on one side and silvery on the other, and yields a fiber which is greenish, stiff, and brittle. The other is the true ramie, or East Indian rhea, and it is for the utilization of this variety that the reward is offered. The useful portion is the fiber of the inner bark, which must be bleached and picked apart into threads. The Chinese have for centuries accomplished this by hand, skinning the stalk and cleaning off the outer bark with a knife. This is exceedingly slow, as one man can produce but from one to two pounds per day of marketable raw product, which should be in the form of clear ribbons of a light yellow color. This is ungummed and bleached, dressed, and combed smoothly, and becomes a strong and brilliant staple now used for the manufacture of "Japan silk," "Canton goods," "grass cloth," "Nankin linen," and similar goods.

Fig. 1.—THE RAMIE PLANT.

The nature of this fiber has been microscopically and otherwise investigated by Dr. Ozanam with the following results. Under a magnifying power of 80 diameters he finds: (1.) The fiber of ramie is, so to speak, of any length, as it has been traced throughout a length of nearly 10 inches on the field of the microscope, without any break being found in it, whether it be constituted of a continuous cellula, or whether the different cellulas which succeed each other have lost their points of separation by reason of a more intimate fusion, one with the other. Hence the ramie fiber possesses great strength. (2.) Taking the ramie fiber as a unit in comparison with other fibers, the following relative results were obtained:

	Thickness.	Traction.	Elasticity.	Twist.
Ramie....	1	1	1	1
Flax......	$\frac{1}{2}$	$\frac{1}{4}$	$\frac{2}{3}$	$\frac{4}{5}$
Hemp....	$\frac{2}{3}$	$\frac{1}{3}$	$\frac{3}{4}$	$\frac{19}{20}$
Cotton....	$\frac{1}{3}$	$\frac{1}{3}$	1	1
Silk... ...	$\frac{1}{4}$	$\frac{1}{6}$	4	6

Thus the fiber of the ramie is longer and more uniform than all the others, except that of silk. It is stronger, offers greater resistance to traction and to torsion, and is more elastic than hemp or flax, and even than cotton, which is more flexible in twisting. Ramie in these respects only yields the palm to silk. To these advantages are to be added the sparkling whiteness and brilliant luster of the fiber, the easy cultivation of the plant, and its rapid reproduction and excessive multiplication. It yields three crops yearly and as many as 500 pounds of fiber to the acre. This last varies with the density of growth, a plantation with regular thick stands producing the above maximum. A mowing machine with thick short blades suffices to gather the plants, which are gathered in sheaves like wheat and are left in stacks. After a few days the leaves wither and fall under the handling and shaking they undergo while they are being carried to the machine. The plant should be cut from eight to fifteen days, according as the weather is dry or damp, before it is decorticated.

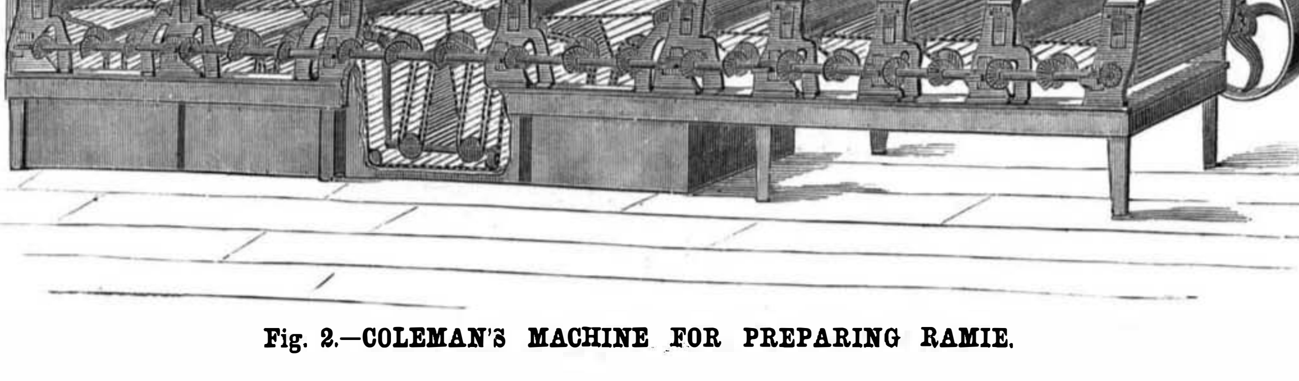


Fig. 2.—COLEMAN'S MACHINE FOR PREPARING RAMIE.

Persons familiar with the treatment of textiles know the impossibility of cleaning thoroughly any fiber, dried or green, by the continuous action of machinery. Either with drums or beaters the cleaning instruments cannot turn out the filaments without a certain amount of chaff and other refuse entangled in the fiber. All ex