THE OCCURRENCE AND FABRICATION OF ROCK CRYSTAL.

In a paper read before the New York Academy of Sciences, on May 31, Mr. George F. Kunz presented a number of very interesting facts concerning the occurrence of rock crystal in nature, and the industries based upon it, in Japan and elsewhere.

Many ancient writers, and even such acute philosophers as Pliny, Seneca, and some of the more illustrious among the early fathers of the Church, were firm in their belief that rock crystal was nothing but water which had been congealed by a cold so intense that the ordinary methods at our command failed to melt it. Pieces of quartz were not infrequently employed as burning glasses, and were particularly recommended by Orpheus for kindling the sacrificial fires. Pliny similarly favored their use for cauterizing parts of the human body. In olden sepulchers it is not unusual to find carefully polished balls of rock crystal, amulets and other gems, which were apparently held to possess the power of exorcising evil spirits. Their use as talismans is indeed mentioned by a number of authors. They have also been found associated with the ashes of cremation. The old error of supposing rock crystal to be solidified moisture was held even as late as the 17th century, when popular treatises declared it to be nothing else than snow or ice congealed by time beyond the power of liquefaction. In the East, the superstition took a more grotesque form. The smaller crystals of pure quartz were believed by the Japanese to be the congealed breath of the White Dragon, and in its larger and more brilliant form to be the saliva of the Violet Dragon. Rock crystal was formerly known as *clear ice*, the one expression serving for both substances. The Chinese and Japanese word *suisho* reflects the same idea, as it means "substance of water."

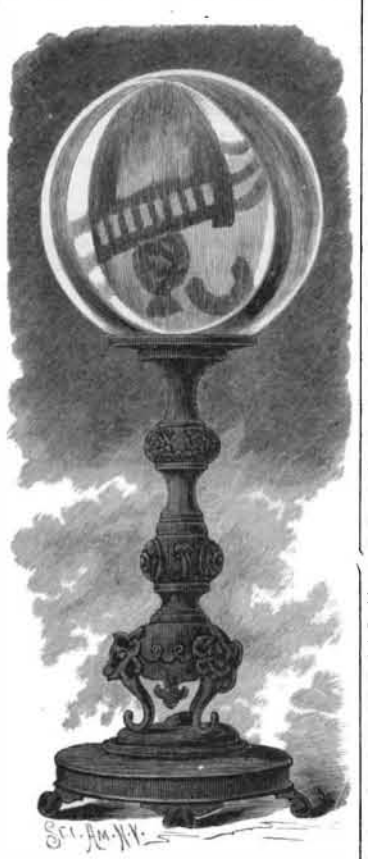
JAPANESE METHOD OF GRINDING CRYSTAL BALLS.

The occurrence of rock crystal in nature is almost unlimited, but the more beautiful crystals, so highly prized in the fine arts, are sufficiently rare to be ranked among the precious stones. There are a number of famous localities scattered throughout Europe, particularly in the Tyrol and in Germany. Fine, clear crystals are found by the inhabitants of Chamouny, in the neighborhood of Mount Blanc. A remarkable cave in the granite at Galenstock yielded over 1,000 crystals, weighing from 50 to 300 pounds each, and of a rich smoky color. The finest of this group is in the Bement collection, at Philadelphia. It is known as the *President*, and weighs 125 pounds. Another notable quartz crystal, found in a drusy cavity at Zirkenstock, weighed 800 pounds. These, however, were remarkable finds, and will probably never be duplicated.

GRINDING CRYSTAL BALLS IN THE OBERSTEIN DISTRICT, GERMANY.

The material for the crystal-cutting industry in Japan is found in large, clear masses in the mountains on the islands of Niphon and Fusiayma and in the granitic rocks of Central Japan. In the entire empire, nineteen mines are worked for this mineral. Transparent masses that would furnish perfect spheres six inches in diameter have also been found among the gravel beds. It is supposed however that much of the Japanese material really comes from China, and possibly from Corea. The Corean embassy that recently visited America stated to Mr. Kunz that there were twelve crystal workers in that country.

The Japanese methods of working rock crystal are extremely simple, and depend more upon the skill and patience of the workers than upon the tools at their command. Our illustration shows the process of manufacturing crystal balls. It is taken from a sketch recently made by an Oriental traveler. The rough mass of crystal is gradually rounded by careful chipping with a small steel hammer. With this tool alone a perfect sphere is formed. The Japanese workmen thoroughly understand the fracture of the mineral, and know just when to apply chipping and when hammering. The crystal, having been reduced to a spherical form, is handed to a grinder, whose tools consist of cylindrical pieces of cast iron, about a foot in length, and full of perforations. These cylinders are of different curvatures, according to the size of the crystal to be ground. Powdered emery and garnet are used for this first polishing. Plenty of water is supplied during the process, and the balls are kept constantly turning, in order to secure a true spherical surface. Sometimes they are fixed in the end of bamboo tubes, and kept dexterously whirling in the hand until smooth. The final polishing is effected with crocus or rouge (finely divided hematite), giving a splendid lustrous surface. As hand labor is exclusively used, the manufacture of crystal objects, according to the Japanese methods, is extremely laborious and slow. Were it not for the cheapness of labor in the Mikado's country, the method would be commercially impracticable.



LARGE JAPANESE CRYSTAL BALL BELONGING TO MR. R. E. MOORE.

In Germany, France, and the United States, where labor is so much better paid, the fabrication of rock crystal is accomplished almost entirely by machinery. The crystal to be shaped into a ball is placed against a semicircular groove worn in huge grindstones. Our illustration shows the method practiced at Oberstein. The workman has his feet firmly braced against a support, and, resting upon his chest, presses the crystal against the revolving grindstone. It is unnecessary to add that the position is extremely unwholesome, and develops early consumption. A constant stream of water is kept flowing over the stone, so that the crystal shall always be moist, as the friction would otherwise heat it, and the subsequent addition of water would be liable to cause a fracture.

The final polishing is done on a wooden wheel with tripoli or a leather buffer with tripoli or rouge.

Of the many forms of manufactured rock crystal, the sphere has always been a favorite. One of the largest and most perfect ones known is in the Dresden Green Vaults. It weighs 15 German pounds, and is 6·69 inches in diameter. It was undoubtedly used for purposes of augury. The finest ball in this country is that in the possession of Mr. R. E. Moore. It is 6·625 inches in diameter, and is valued at $5,000. It was made in Japan, and is a *tama*, or jewel ball, absolutely pure. The stand is of Indian workmanship. Another ball in the possession of the same collector, though much smaller, is of interest as an excellent example of the Japanese fondness for representing crystal balls borne aloft by the waves. The stand is of bronze, and an admirable imitation of a succession of waves. The largest ball, 2·5 inches in diameter, rests on the crest, while three smaller balls, all under an inch in diameter, are distributed about the base. A 4·5 inch ball, of exceeding purity, was sold in the Morgan collection last winter for $1,750. It was mounted on a silver stand, ornamented with a golden dragon and other figures, and containing the private or palace seal of the Mikado. The stand alone was estimated to be worth $800. There are a number of other crystal balls in this country which are worthy of mention. Mr. Samuel Nickerson, of Chicago, has one measuring 5·625 inches in diameter, which was brought from Japan by Commodore Perry. It is valued at $2,500. Mr. Brayton Ives has one of the same size valued at $3,000. A ball in the possession of Mr. Heber Bishop has a diameter of 5·875 inches, and Mr. Walters, of Baltimore, owns another 5·75 in. in diameter.

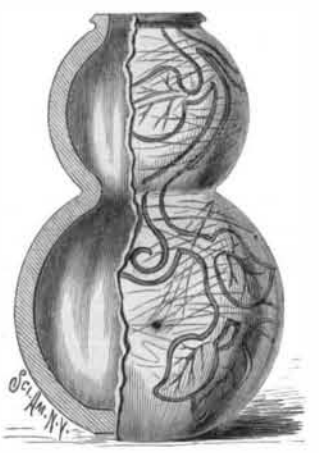
JAPANESE CRYSTAL BALLS ON BRONZE STAND REPRESENTING WAVES.

The high prices of crystal balls are not due to the cost of fabrication, as is commonly supposed, but simply to the extreme rarity of masses of rock crystal which will afford absolutely pure spheres from 3·5 inches in diameter upward. The constant demand for these beautiful objects, which has at all times been greater than the supply, warrants the belief that their value is increasing, and that in years to come they will be even more difficult to obtain than at present. The numerous valuable cabinets in this country cannot boast the possession of half a dozen perfect crystal balls over five inches in diameter. It is undoubtedly the material, and not the skill, that is lacking. Thus, for instance, the facilities for working hard minerals in the Oberstein district in Germany are so excellent that a dish of agate, 13 inches long, 8 wide, and over 3 deep, which had been reduced to one-eighth of an inch in thickness, sold in New York for $200, in spite of duty and the profits of three dealers. In the United States the facilities for crystal cutting are also excellent, but large masses of the material are rare. There are now three parties who have machinery such as is used in the Oberstein district, and who are prepared to manufacture perfect crystal balls at the following prices: 1 inch, $1; 2 inches, $5 to $8; 3 inches, $15 to $25; 4 inches, $40 to $75; 5 inches, $125 to $150; 6 inches, $200 to $300; 7 inches, $300 to $400; and intermediate sizes in proportion.

RUSSIAN CRYSTAL VASE.

Even dealers themselves are frequently ignorant of what constitutes the expense of crystal balls, and state that it is the labor and skill required in their cutting, instead of the rarity of the material employed. Mr. Kunz has had occasion to visit almost all the public and private collections in this country, and to write hundreds of letters of inquiry on the subject of American gems and gem minerals, yet he failed to learn of any masses of rock crystal in the United States that would produce a perfect three inch ball.

There were several pieces that would have afforded balls from three to four inches in diameter, but they were so filled with veinings that the material was used for other purposes. The rarity of large masses of pure crystal is such that a well-known dealer has a standing offer open of $1,000 for a five inch crystal ball, $1,500 for one of five and a half inches, and $4,000 for a seven inch ball.



CRYSTAL VIAL, SHOWING ACICULAR CRYSTALS OF HORNBLENDE. (FULL SIZE.)

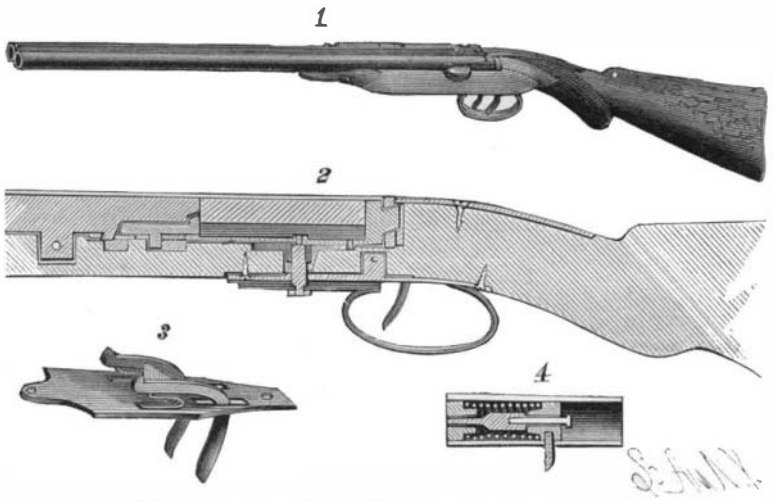
Messrs. Tiffany & Co. have very recently come into possession of a magnificent mass of rock crystal which will probably afford the material for a five inch ball. It comes from a new American locality, and is apparently without blemish.

Among the imperfections which unfit so much of the rock crystal for the purpose of manufacture are seams, inclusions of other minerals, and cavities filled with liquid. In addition to these there is the bulb of concussion, as it is termed, produced when a mass of crys-

© 1886 SCIENTIFIC AMERICAN, INC

tal receives a sharp blow. These may be seen in any agate mortar which has been extensively used in the laboratory. A perfect funnel-shaped flaw is produced, and is apt to become further developed if an attempt is made to work the crystal.

Viewed as works of art, however, the cups, vases, and pitchers of crystal made during the 16th and 17th centuries at the Louvre, Dresden Green Vaults, and Shatz Kammer at Vienna, are immensely superior to the simple crystal balls. Two pieces of this class, recent Viennese reproductions, were formerly in the Morgan collection. They are in the shape of dishes, and measure from 4 to 6 inches across. They are beautifully engraved in intaglio, and mounted in silver and gems. One of the most notable of these objects in the United States is now in possession of Messrs. Tiffany & Co. It is a circular disk of 9⅞ inches in diameter, on which the Finding of Moses has been beautifully cut in intaglio. Shortly after its completion, this remarkable piece of crystal was unfortunately dropped by the engraver, and is now in two pieces, but even in its mutilated condition it is an admirable work of art. Another piece of good carving and beautifully clear crystal, in the possession of the same firm, is a solid crystal vase of Russian workmanship, 5 inches high and about 3·25 inches broad. The small crystal vial, shown full size in our illustration, is an ingenious piece of work, both balls having been hollowed out from the one opening in the end. The rock crystal itself is full of delicate acicular crystals of hornblende. One of the finest pieces of work in European cabinets is an urn 9·5 inches in diameter and 9 inches high. The entire object, including the pedestal, is made of one piece of rock crystal, the upper part being handsomely engraved. Its cost was about $20,000.



JANSEN'S BREECH-LOADING GUN.

The Japanese have a favorite proverb, "Until polished, the precious gem has no splendor," which will be appreciated when a rough fragment of rock crystal is compared with a finely polished ball; but the fact remains that its real value lies beneath the labor and beneath the polish, in the crystal itself.

A WRENCH WITH LIFT CAMS.

The opposite sides of the socket of the wrench herewith illustrated are formed with cams to act against a nut to lift the wrench between successive turns, thus making a tool which can be used conveniently in place of a ratchet wrench. The square corners or faces which abut against the nut to turn it in one direction are adapted for making a right hand turn on one side of the tool, while the other side has these square corners adapted for making a left hand turn, the withdrawing or backward movement of the wrench being in each case aided by the cams at the corners of the socket adjacent to each angular face that bites on the nut. With this wrench it is only required to move the hand back and forth, as the cams lift the wrench to the top of the nut upon the back stroke, and gravity causes it to drop again over the nut. This invention has been patented by Mr. Alfred Wood, of Trenton, N. J.

WOOD'S RIGHT AND LEFT WRENCH.

ONE pound nitrate of ammonia to two or three pounds water is the best of the simple mixtures for producing cold.

A HAMMERLESS BREECH-LOADING GUN.

In the illustration herewith are shown a perspective view (Fig. 1) and details of an improved construction of breech-loading gun in which the hammers are concealed, Fig. 2 giving the longitudinal vertical section, Fig. 3 the trigger plate and triggers, and Fig. 4 a section of one of the lock chambers. The barrels are connected in the usual manner, and have near their breech ends a downwardly projecting tongue, which is secured in a recess in the stock by a pin, the breech ends of the barrels thus resting upon the forward end of the lock and barrel seat. The side of one of the barrels has a long cylindrical eye, through which passes a long pintle, a tube secured to the side of one of the lock casings turning upon the pintle, and there being a twisted slot in the tube in which works a pin, by which, when the lock casings rest in their seat, the lip of the extractor will rest in notches in the breech ends of the barrels, but when the lock casings are swung out to the side, the pin will be forced rearward, drawing the arm and extractor rearward with it, throwing out the empty shells from the breech ends of the barrel. The lock casings are tubular, and have longitudinal slots in their under sides, pins or sears projecting from the sliding hammer blocks through the slots in the lock casing, and sliding therein. The forward ends of the triggers have beveled upwardly projecting lips, so that the lower beveled ends of the sears may be drawn over the lips and engaged by the same, the forward ends of the triggers having springs forward of their fulcra which force the lips of the triggers upward.

Our illustrations show the invention as applied to a double-barreled gun, but the mechanism may as well be employed in a single-barreled fire arm, the principle remaining the same, or portions of the mechanism may be used with portions of other similar mechanism.

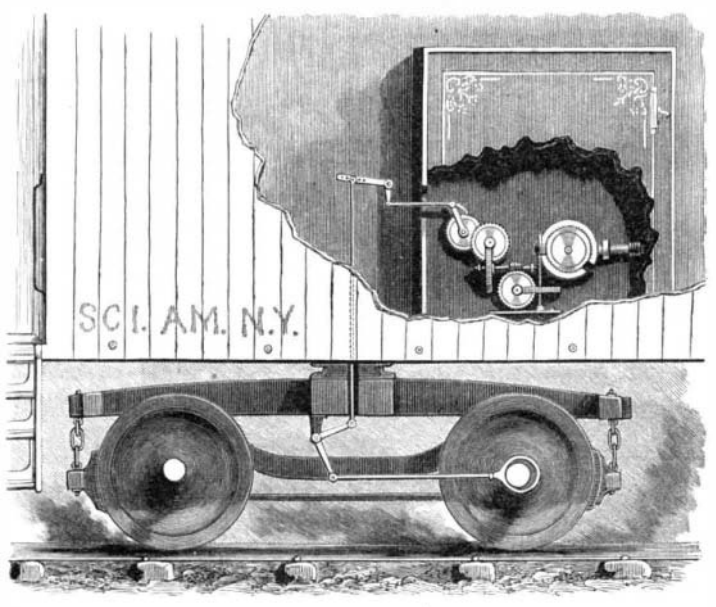
This invention has been patented by Mr. Diederich W. Jansen, of Joplin, Mo.

A Scientific Woman.

A regulation as old as the French Academy of Sciences has just been broken through in Paris. Women have hitherto been excluded from the sittings of the Academy, but at the meeting of June 28 the interdiction was raised in favor of Mlle. Sophie Kowlewska, professor of mathematics at the University of Stockholm, and daughter of the eminent paleontologist. Admiral Jurien de la Graviere, who presided, welcomed her in graceful terms, and said that her presence should be a cause of pride and pleasure, not only to the mathematicians present, but to the whole Academy. As she entered, the whole of the members rose to salute her. She took her place between Gen. Fave and M. Chevreul.

DEVICE FOR CONTROLLING LOCKS ON RAILWAY CARS.

The invention herewith illustrated exhibits a construction by which a railroad express or freight car, or any part thereof, or a safe in the car, may be locked so as to prevent admission thereto while the car is in transit, or only at certain places on the journey, the locking and unlocking mechanism being such as can be set for the distance to be traveled, and not affected by the time taken for the journey. Upon one of the axles is an eccentric, which operates a bell crank connected with a lever in the interior of the car, from which motion is taken to actuate a train of gears forming the running or bolt-controlling mechanism of the lock. A means of regulating the motion of the bolt-controlling mechanism is afforded by making the lever connected with the bell crank with a series of holes at different distances from its fulcrum, with any one of which the rod may be engaged to make the motion faster or slower. The bolt-controlling tumbler, too, may be adjustable, or be provided with a number of slots to provide for the drawing back of the bolt at fixed distances apart on the route. This invention has been patented by Messrs. Roman L. Baca and John L. Leavitt, of Grant, New Mexico.



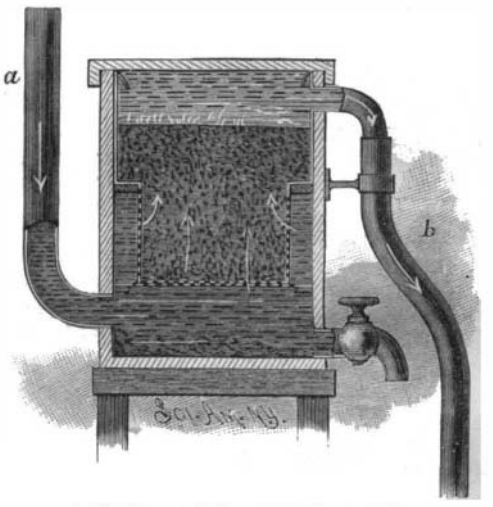
BACA & LEAVITT'S RAILWAY CAR LOCK.

How to Separate the Layers of Insect Wings.

A wing that has never been dried is placed in 70 per cent alcohol, then into absolute alcohol, and after a few days' immersion then placed into turpentine. After remaining a day or two in the turpentine, the specimen is plunged suddenly in hot water, when the conversion of the turpentine into vapor between the two layers of the wing so far separates these layers that they can be easily parted and mounted in the usual way, as microscopical preparations on a slide.—*Royal Microscopical Journal.*

RAIN WATER FILTER.

The simple and inexpensive filter herewith illustrated is designed to purify the rain water flowing from the roof, and conduct it to a cistern. The water from the roof flows through the pipe, *a*, from the leader into a compartment in the lower part of the tank. The first water, which has washed the roof, is allowed to flow through the faucet and go to waste. When the water is comparatively clear, the faucet is closed, when the water flows upward through a false bottom supporting the filter proper, which is made smaller at its lower portion than at its top, and which snugly fits the tank, a packing making it watertight against the sides, to compel the water to pass through the perforated sides and bottom into the interior, which is filled with sand, charcoal, or some other suitable material. The water then flows through the pipe, *b*, to a cistern or reservoir. It is evident that by admitting water at the bottom, and causing it to be purified as it rises through the filter, all leaves or dirt of any kind will be held back by the perforated false bottom, and, after the rain has ceased, may be discharged through the faucet. It is thus impossible for any decomposable matter to find its way into the cistern.



LIGGET'S RAIN WATER FILTER.

This invention has been patented by Mr. Benjamin Ligget, of Tucson, Arizona.

New Source for Verbena Oil.

The *Eucalyptus staigeriana* tree, known as the lemon-scented iron bark, is a native of Queensland, where it was first discovered by Mr. P. F. Sellheim. Its leaves possess an odor exactly like that of the lemon-scented verbena, and the oil they yield is equal in fragrance to that of the so-called oil of verbena of commerce, which is not obtained from the verbena, but from the grass *Andropogon citratus*, D. C. The dried leaves, according to Staiger, yield 2¾ per cent of volatile oil of sp. gr. 0·901. The demand for the lemon grass oil is considerable, as much as 13,515 oz. having been exported from Ceylon in 1875; it is also largely manufactured at Singapore. Hence this tree, the *Eucalyptus s.*, appears worthy the attention of planters on account of its volatile oil. The odor of the oil is quite different from that of *Eucalyptus citriodora*, which resembles and might be substituted for citronelle oil, so extensively used for scenting soap.—*New Commercial Plants and Drugs, Thos. Christy.*

© 1886 SCIENTIFIC AMERICAN, INC