Quick Method for Chilling Test Pieces.

Writing on the use of liquid carbon dioxide for chilling test pieces, especially stone, iron, and steel, at low temperatures, M. Haller says that a cheap and simple form of apparatus in which the test specimens could be cooled would consist of a wooden box with double walls, top and bottom, the spaces between being filled with some non-conducting substance. The liquid gas could be led into such a box from the iron or steel flasks in which it is furnished, and would be deposited in great part in the form of frost at a temperature of about —78 degrees Centigrade. The test specimens could be readily put into and taken from such a box, and would quickly get to a low temperature. One of the Russian railroad companies is on the point of having such an apparatus constructed for testing rails and wheel tires at low temperatures. The possibility of accomplishing the desired object with such an outfit, viz., the rapid freezing of specimens, was demonstrated by putting a number of iron test pieces into a bag of several thicknesses of coarse cloth and then introducing the liquid gas. This at once became solid, and filled all the spaces between the specimens, which thus lay packed in snow. Each specimen was provided with a depression into which mercury could be poured, and on doing this, after a short exposure in the freezing bag, it was found that the mercury immediately soldified, showing, in the absence of a suitable thermometer, that the temperature of the specimens was certainly below —39 degrees Centigrade, if not lower. At the St. Petersburg Laboratory of Experimental Medicine a cold room of quite large proportions has been fitted up in which also liquid carbonic acid is the cooling agent.—Industrie Zeitung.

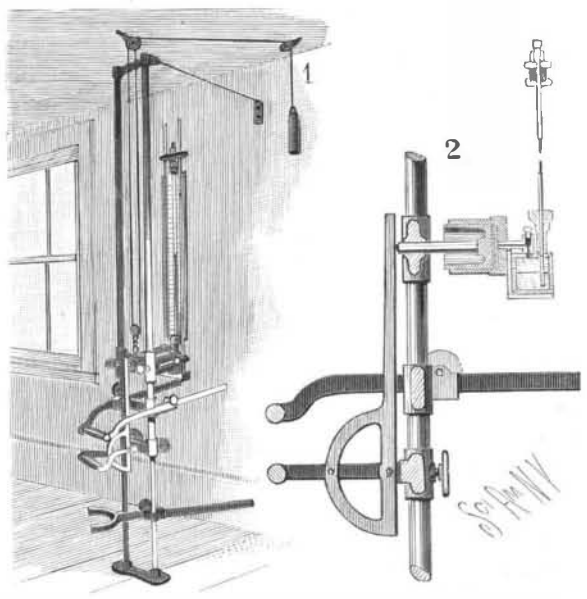
Alumina from Clay.

Suppose a clay of a known strength in alumina. For each mol. of alumina we incorporate with the clay 3 mols. ammonium sulphate and an almost equal weight of neutral potassium sulphate; 1 mol. of potassium sulphate is theoretically sufficient. The whole is well worked up and made into hollow bricks. These bricks are baked at 270°—280°. The ammonium sulphate is then decomposed into acid ammonium sulphate and ammoniacal gas, which may be collected in a condenser. The acid of the acid ammonium sulphate is first thrown upon the neutral potassium sulphate, which becomes acid sulphate. The latter at this temperature, in presence of alumina and clay, is neutralized by the alumina, forming double aluminum and potassium sulphate, i. e., alum. The bricks are then extracted by methodic lixiviation. The silica may be used for cement. The alum is freed from iron by recrystallization, and the solution may be treated for the precipitation of the alumina by means of the ammonia which has been distilled off. To obtain the alumina in a granulated state it is spread out upon stages in a tower traversed from bottom to top by the hot moist ammonia obtained on baking the bricks. The alum is thus transformed into a mixture of ammonium and potassium sulphates and of granular alumina.—Joseph Heibling.

NEW DYNAMOMETER FOR USE IN ANTHROPOMETRY.

The modern method of making progress in any branch of science or mechanics consists in governing future practice by what has been learned by past experience, making every step looking toward advancement only after analysis of what has already been accomplished.

Dr. J. H. Kellogg, of Battle Creek, Mich., has applied this principle to the human body by means of



KELLOGG'S ANTHROPOMETRICAL DYNAMOMETER.

a very simple yet thoroughly practical machine, which he calls the universal dynamometer.

What the indicator and brake are to the steam engine, what the electrical dynamometer and other meters are to the dynamo, Dr. Kellogg's device is to the human body.

It is used for testing the strength of individual groups of muscles; in fact, it can be applied to every important group of muscles in the body, these groups numbering twenty-five for each side. It not only furnishes a basis for the scientific study of muscular dynamics, but it also furnishes a means of testing to secure accurate data on which to base prescriptions for exercise, so as to insure the scientific application of gymnastics to the correction of deviations from the normal standard of symmetry.

This apparatus, as will be seen by reference to the engraving, is simple. It does not show the amount of labor involved in bringing it to perfection. The frame consists of parallel standards secured to base and top pieces and braced. On these standards is placed a rest for the foot or leg, and above this a lever having an arm extending upwardly and bearing on a piston rod projecting from a piston, which acts through the medium of a body of oil and a layer of water on a column of mercury, serving the double purpose of an indicator and a resistance. The mercury column is inclosed by a glass tube and moves in front of a scale. The hydraulic cylinder is adjustable on the parallel rods and is counterbalanced by a weight attached to a cord running over pulleys. An adjustable rest is supported by the rods between the cylinder and the lever.

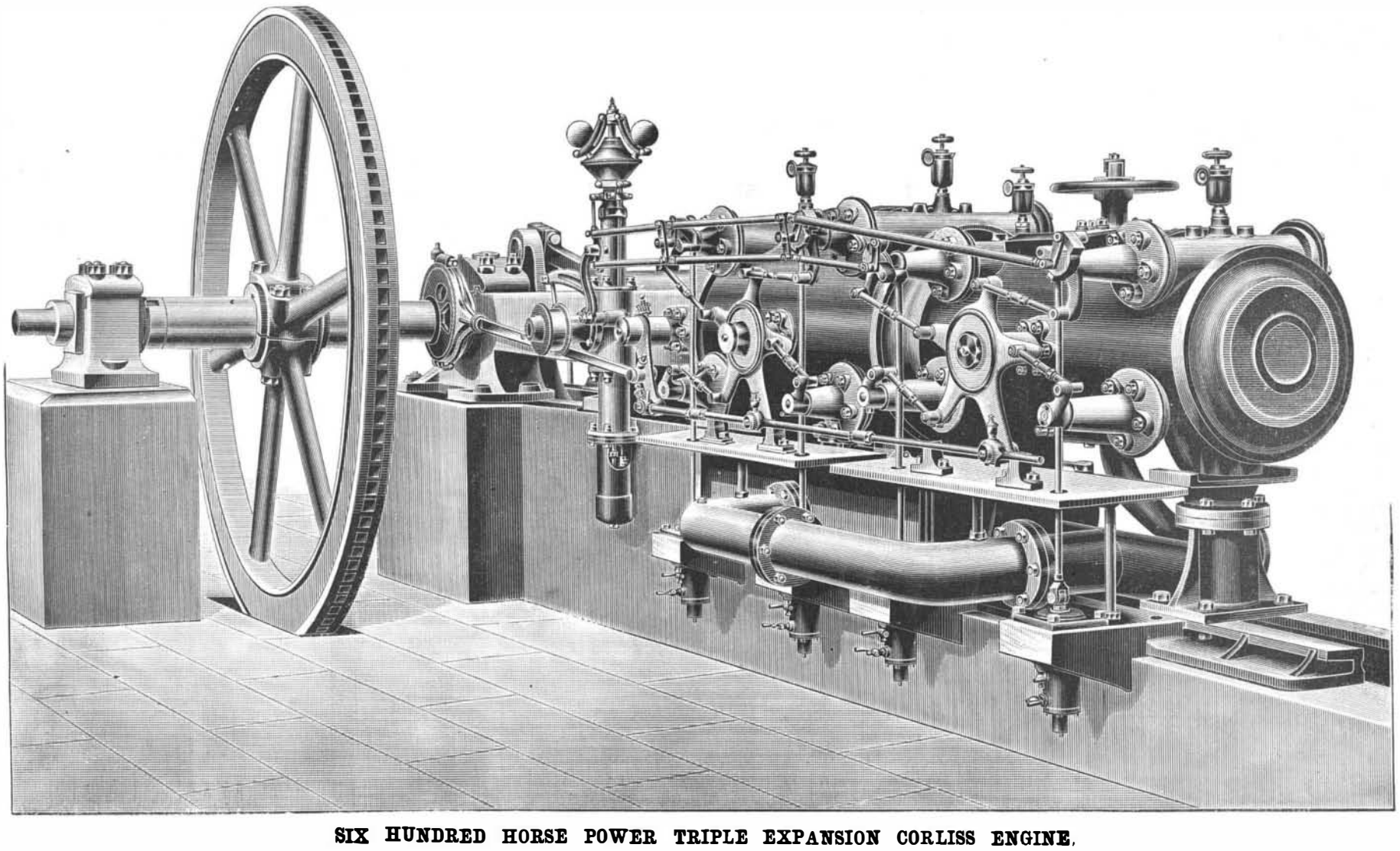
In connection with the dynamometer, Dr. Kellogg's "Percental Charts" are used for making a record of a given case. These charts are based upon the examination of hundreds of healthy men and women of different ages.

This dynamometer has been adopted by the government for testing cadets at West Point, and is in use at Yale University, Wisconsin State University, and in other places where special attention is given to physical culture.

TRIPLE EXPANSION ENGINE—FRIKART'S SYSTEM.

We illustrate herewith, from the Engineer, a triple expansion engine, which has lately been exhibited by Messrs. John Cockerill & Company, at the Antwerp Exhibition. In no country has the rotary valve, which is the main feature of the Corliss system, found more favor than in Belgium. All the large horizontal engines exhibited at Antwerp have valves of the Corliss type, though each manufacturer has a different method for regulating the admision and cut-off, which he considers superior to that adopted by rival makers. In Messrs. Cockerill's engines the system used is called the Frikart. They have for some time made single cylinder engines on this principle, and exhibit one of 100 indicated horse power, with cylinder 1 foot 7¾ inches diameter and 3 feet 5¼ inches stroke. This machine is used to drive a dynamo, and works very steadily under a varying load. The application of the Frikart valve to triple expansion engines is quite new, and the one exhibited at Antwerp is the first that has been made. It works at a pressure of 150 pounds, and its principal dimensions are: Diameter of high pressure cylinder, 1 foot 3¾ inches; intermediate, 1 foot 11⅝ inches; and low pressure, 3 feet 1⅜ inches. The length of stroke is 3 feet 11¼ inches, and the number of revolutions is 80.

The chief characteristic of the Frikart valve is that by it any degree of cut-off from 0 to 75 per cent, or even more if necessary, can be obtained with a single eccentric, as the governor completely controls the admission. It is of the highest importance to be able to prolong the admission, as by this means the power of the machine to deal with extreme cases is greatly augmented. For instance, it may be required to exert increased power; or the pressure in the boiler may fall, either accidentally or because the fires are allowed to burn down before stopping the works. If, as in many machines when the admission of steam extends over more than four-tenths of the stroke, the cut-off only takes place toward the end, this sudden increase



SIX HUNDRED HORSE POWER TRIPLE EXPANSION CORLISS ENGINE.

in the admission will necessarily make a considerable, and possibly prejudicial, change in the speed. An arrangement by which the admission can be regulated so as to take place through any proportion of the entire length of the stroke is especially advantageous for compound and triple expansion engines, where there may be a large amount of steam admitted into each cylinder.

Our illustration is from a photograph showing the high pressure and intermediate cylinders, which are arranged as in a tandem engine. The low pressure cylinder drives a crank on the opposite side of the fly-wheel from the other two. The condenser and air pump are behind the low pressure cylinder, and in line with it. All three cylinders are steam jacketed; the steam for the jacket of the high pressure cylinder is direct from the boiler, that for the intermediate from the reservoir or steam chest between it and the high pressure, and that for the low pressure cylinder from the other reservoir between the intermediate and low pressure cylinders. These two steam reservoirs are under the floor, and the water which condenses in the jackets is drawn off by three separate pumps, and returned to the boiler. The engine has been designed for an effective horse power of 600.

Ancient City in Guatemala.

Besides the interesting archæological collection of the first capital of Guatemala, Santiago de los Cubeleros, now known as "Ciudad Vieja" (old city), a buried city has recently been discovered on the slopes of the Volcan de Agun, about a league east of the former, says the San Francisco Chronicle. It lies on the land of Manuel J. Alvarado, called the Pompeii plantation. Not the slightest tradition remains to connect it with the present age.

Two years ago the owner of the lands, finding a few ancient Indian relics, resolved to make excavations at different points. In one place, at a depth of twelve feet, he has taken out a great many rare and interesting objects, such as flower pots, earthen vessels for domestic use, ancient glazed ware, large vases of exceedingly fine manufacture, covered with engravings and with pictures in brilliant colors painted upon them, domestic utensils for the kitchen such as the Indians use to this day; axes, hammers, tomahawks and war clubs of stone; knives and daggers of obsidian, with sharp points and edges; lances and lancets of the same material, idols of stone and clay, well wrought jewelry of turquois and other precious stones, of all ordinary sizes and figures. Among the jewels was found a rare kind of precious stone of deep green color, known among the aborigines as the chal-chivilli stone, capable of the highest polish. This stone Indian royalty of long ago wore as the waist and breast ornaments on state occasions.

On some of the finest vases were artistically traced symbols and characters, the colors as fresh and brilliant as though they had just left the artist's hands.

Most of the clay idols are well formed. Some of the carved faces wear the tragic mask, but in one particular, evidently of a later day, is a fat, pot-bellied, round-faced, plump-cheeked little chap, the incarnation of good living. The people of that remote time must have had a certain sense of humor, and did reverence to this idol as the god of fun.*

Among the stone idols are two worthy of special note, chiseled from a hard brownstone and representing a person in a reclining, flat, front position, with the head erect and the chin on a line with the body. The head, face and neck are sculptured to a perfect finish, but the rest of the body is in an unfinished state. The contour and the expression of the well-cut features of the larger one is a most striking likeness to the features of the Roman race, while the smaller one represents the highest type of our Indian race. On the head of each is a remarkably well executed warrior's helmet, mounted with a clear cut tuft or crest of feathers hanging over a rimless front. Encircling it is a wide band, well upon the forehead, ornamented with quadrant figures in bass relief set closely one within another from the outer lines to the center, all arranged with perfect mathematical precision. In its makeup the helmet closely resembles that worn by the Praetorian guards of Rome. Another idol of natural size wrought from the same material attracts attention as being a perfect resemblance of the Mongolian race, with slanting moon eyes, flat nose and high cheek bones.

At the foundation level of the houses were found many human skeletons scattered about on the floors, as though they had fallen there by some sudden casualty, some in a sitting posture and others lying prone. Some of the skeletons measured from six to seven feet in length. Also within these buried dwellings were found many human skulls placed in a glazed clay vase ornamented with crude figures in gaudy colors. In some of these vases the heads were placed in an erect position, the chin on a level with the rim of the vase, and some were face upward, each one holding in his mouth a chal-chivilli stone wrought in the shape of the human tongue, and also another class of well wrought precious stone with a hole through it placed immediately under the nose. Evidently the latter had served as nose jewels. The foreheads of most of the skulls are broad and high, the cheek bones prominent and the chin projecting. It seems probable that this extinct race esteemed the head as the noblest part of the body, and at death had it severed from the trunk and kept as a sacred relic of the dead.

* Similar figures are common in Japan.

Increase of Wild Animals in Vermont.

From the Boston Journal we derive the following: A farmer living five miles from Rutland entered complaint last week that a herd of deer had destroyed an acre and a half of buckwheat and devoured his vegetables. George H. Woodward, of the mountainous community of Cuttingsville, reports that the deer come into his fields seven or eight strong every afternoon at sundown and stay until he drives them away in the morning. They are so tame they do not leave their feeding grounds or the yards where cows are kept at night until some person approaches within three or four rods. Even then they sometimes refuse to move off, and actually have to be driven away. They have great fondness for herding with domestic animals, especially cows. Occasionally a bull shows fight, but they seem not to care for his angry, threatening movements. What the result would be in a fair field and fair fight none can predict.

Within two miles of Rutland the other day, two deer were met trotting along the traveled road as docile as a house dog. Reports came of them in all sections of the mountainous regions, and the feeding with cows in the pasture is of frequent occurrence. One day two weeks ago a man crossing the mountain to Woodstock saw fifteen of the fleet-footed animals at close range. A fox hunter a fortnight ago ran into seven in the vicinity of Plymouth.

A reliable gentleman reports that a strange dog was running a deer last week over the mountains, near Rutland, but was lucky enough to keep out of range of a posse of enraged residents. Later in the day the deer, followed by the dog, came down into the highway, and, after traveling it for a full mile, started off over the hills toward the Bethel country. Those who saw it say that it was a fine, large buck, with big antlers. Many other incidents of recent date are talked about in that section.

Another animal that has increased rapidly in Vermont is what is commonly known as the hedgehog, or porcupine. A party of people of Rutland one night recently occupied a deserted house in a lumberman's camp in Mount Tabor. A pack of porcupines, attracted by the light or the smell of the food, or possibly the beer, attacked the shanty, and crawling up the sides to the roof, kept up a continual scratching and howling during the night. Several of them fell off the building, setting up fearful cries, greatly to the annoyance of the sleepers within, but all disappeared with break of day.

Farmers in the mountains also complain of the abundance of partridges, which overrun their gardens, making havoc with fruit and berries, flowers and growing vegetables.

Bears also are very numerous, and often, with their young, take a hand in destroying fruit and vegetables, and are almost as tame as the wild deer unless their cubs are molested. Their young are of varied size and weight, and are equally as destructive as their parents. These Vermont bears are not only getting plentiful in the woods, but they are learning how to avoid some of the annoyances that come with advanced civilization. Mr. Silas N. Wheeler has a hilly farm in Stamford. Mr. Wheeler recently went into a pasture and saw a good sized cub eating sweet apples. The animal was in a corner made by two barbed wire fences. He thought if he could entangle the young bear in the barbed wire fence he would have a good opportunity of killing him. He therefore drove him on the run for the fence, but the bear jumped over the top of the wire as nimbly as an athlete could do it and escaped in the woods.

Bears have often been seen roaming about the open country. One was seen the other day on what is known as Campbell Hill, on the quarter line road; in the vicinity of several residences another was roaming about with her cubs on an opening in the woods in a small mountain called Bald Mountain, both in plain sight of the city of Rutland and not far distant. On the eastern and southern outskirts of the city gardens have been invaded at night both by deer and bears. A deer was seen running along Allen Street, within the city limits, a few weeks ago, but soon taking fright at a locomotive whistle, leaped the fence and made haste for the nearby wood.

The protection the wild animals of Vermont have received from the State laws in the effort to allow animals to breed unhindered by the sportsman is likely to be somewhat modified in the near future. The law affecting deer is, and has been for years, prohibitive, and has been rigidly observed. It was first extended to ten years, and then to fifteen years, and now is operative until 1900, unless repealed or modified by the next Legislature, which meets in October. By this law the killing or capturing of deer, or the mere possession of its meat, is punishable by a fine of fifty dollars, and the informant of such deer-killing gets half the fine. A dog found pursuing a deer is liable to be shot.

The statutes affecting fur-bearing animals—mink, lynx, otter, and beaver—or those affecting wild birds are equally strict and rigidly enforced, except in the open season.

The increase in the number of noxious animals in Vermont is one of the unlooked-for results of the restrictive laws, for the forests are little hunted nowadays, and the bay of the deerhounds has not been heard for years. There is thus a vast and beautiful country up there among the mountains where the animals of the chase have increased and multiplied until the hard-working Vermont farmers have found in them a constant menace to their crops, and are crying aloud for protection.

Important Patent Case Before the Supreme Court.

The argument in the case involving the life of the Bate refrigerating patent, a process for freezing meats, was begun in the Supreme Court of the United States on November 15, by C. E. Mitchell, of Connecticut, ex-Commissioner of Patents, for the company. The case is probably the most important in the history of the Supreme Court, in view of the vast extent and value of the interests that will be affected by the decision.

The matter at issue is the construction of Section 4887, Revised Statutes, relating to the life of a patent granted by the United States upon an invention for which a foreign government has also granted a patent, and the particular question to be decided is: Does the date of application for the patent or the date of issue of the patent in the United States determine whether or not the term of the patent is to be limited by the term of the foreign patent?

The Bate Company brought suit for infringement of its patent against Schwarzschild & Sulzberger in the Southern District of New York, and the bill was there dismissed upon the defendants' plea that a patent had been issued in England upon the same invention between the dates of the application for and the issue of the patent in the United States, and that therefore the latter patent had expired with the English patent prior to the bringing of the suit.

The case went to the Court of Appeals, and that court has asked the Supreme Court of the United States to instruct it upon the question, in effect, "When did or when does the patent granted Bate in the United States expire?"

The decision of the court will affect the life of many important and valuable patents, notably in connection with the telephone and electric light, and the case is being closely watched by the attorneys of companies interested.

African Potassium Nitrate Fields.

The nitrate beds at Prieska, Cape Colony, present the most valuable and richest deposit of nitrate of potash ever found. It is a most valuable substance, not to be confounded with sodium nitrate or Chilean saltpeter, so largely exported from South America and sold on the London market at £10 per ton, whereas the average price of unrefined potassium nitrate is £16 10s. per ton. The yield of the farms prospected is virtually unlimited, and, while in many of the large kloofs enormous masses of practically pure salt are found, the average in the soil for the whole area may be calculated at 25 per cent. Attention need only be drawn to the working of nitrates in other countries to prove the richness of the most recent South African discovery. Soils containing nitrate of potash are worked in India and Ceylon when containing only 2½ to 5 per cent, and the richest deposits in those countries rarely contain more than 8 per cent, while in Hungary nitriferous soils containing ½ to 2½ per cent are worked at a profit. The Cape deposit is most easily extracted, merely by lixiviation, by hot or cold water, decantation of the clear liquor from the soil into shallow tanks, and evaporation by the rays of the sun, when practically pure nitrate crystallizes out. By this process nitrates on a large scale could be produced at less than £2 per ton, and the cost of transport over 140 miles of country to De Aar, and thence by rail and sea to Europe, is £5 per ton.—Engineering and Mining Journal.

A FRENCH process of casting hard glass consists in first melting the material in a peculiar tank furnace, tapped into moulds, a special substance being used in place of sand, the mould and the glass inside of it being also heated and cooled together. The mixture to be used in the place of sand is selected so as to have as nearly as possible the same conductivity and capacity for heat as glass, in such a case the glass and mould forming, as it were, one homogeneous body. The glass thus treated cools, it is said, without cracking, even if the cooling process be comparatively quick, which is necessary when hard glass is produced.