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Attention is called to the "Wants" column. All are invited to use it in soliciting information or seeking new positions. The name and address of applicants should be given in full, so that answers will go direct to them. The "Exchange" column is likewise open.

SORGHUM AND SUGAR BEETS IN KANSAS.

THE Agricultural Experiment Station at Manhattan, Kan., has been engaged for three years in a series of investigations upon sorghum, the principal aims being: (a) the attempt to find better varieties of sorghum for producing sugar; (b) to improve well-known and approved sorts; (c) to secure both early and late maturing kinds of good quality, especially the former, in order to lengthen the working season.

Bulletin 16 of this station, for December, 1890, gives the results of this work for 1890, including comparative tests of a large number of varieties, with analysis of their juice; attempts to improve seed by selection, trials of fertilizers, and a study of smut in sorghum. The same station has also established a series of experiments in the comparative culture of sugar beets, the results of 1890 being given in the bulletin referred to. The season was unfavorable to both sorghum and sugar beets, on account of both heat and drought.

Following is the station's summary of the results obtained as to sorghum.

1. The season of 1890 was very unfavorable to sorghum, owing to deficient rainfall and intense heat during the early summer, followed by cool, wet weather, culminating in an unprecedented killing frost Sept. 13. This frost was so exceptional as to date, and so erratic in distribution, its limit bearing no relation to isotherms or latitude, that it gives no ground for the conclusion that it was too far north for successful sugar manufacture from sorghum. Notwithstanding this, the tables show that the standard varieties maintained a good, though lower, standard of excellence.

2. The selection of seed with a view to improvement of varieties was almost wholly prevented by the early frost. A comparison of the results obtained for three years in selection of specially good canes lends encouragement to the hope that the standard of sugar-content may be permanently raised by this means.

3. A comprehensive experiment to test the effect of fertilizers on sorghum has shown no marked results this year, as was to be expected in view of the conditions of growth. The experiment will be continued from year to year, the same fertilizers being applied to the same plat throughout.

4. In view of the occurrence of two varieties of smut in the plats this year, caution in the introduction of new varieties is urged, lest destructive contagious diseases be brought in at the same time.

5. Crossing of varieties deteriorates the crop, so far as the experiments have gone.

The results of the experiments with sugar beets are as follows.

1. The sugar beets grown do not appear to be of as good quality as those reported to have been produced in other parts of Kansas and in Nebraska. This may have been due to the unusually unfavorable climatic conditions of last summer, or to unsuitability of soil.

2. Analysis of individual beets indicated that maturity, more than size, determined the sugar-content of the beet. A brown epidermis accompanied high per cent of sugar. As far as the observations went, a high weight of leaves, as compared with the roots, was no evidence of high sugar-content, but rather the reverse.

THE MERCURIAL PRESSURE-GAUGE ON THE EIFFEL TOWER.

THE new mercurial pressure-gauge devised by M. Cailletet and erected at the Eiffel Tower is an instrument of much scientific interest. The only instruments by which high pressures in gases or liquids can be registered with accuracy are very long vertical pressure-gauges. A gauge of this type, more than three hundred feet in height, was set up by M. Cailletet some years ago, first on the side of a hill, and afterwards in an artesian well. Several scientific men imitated this method of gauging high pressures, but the difficulty of handling and experimenting upon an instrument under conditions so unfavorable, threw considerable doubt upon the accuracy of the results obtained. The Eiffel Tower afforded a unique opportunity for setting up a pressure-gauge 984 feet high, every part of which should be accessible and open to observation. Thanks to the liberality of M. Eiffel, says *Engineering*, the task of constructing and fixing an instrument on so gigantic a scale has actually been now accomplished.

With a gauge of this height pressure up to four hundred atmospheres can be obtained, but it is manifestly impossible to use the customary glass tube. Recourse has, therefore, been had to a tube of soft steel of about one-sixth of an inch internal diameter, connected at the bottom of the tower with a reservoir containing mercury. By pumping water into the reservoir, the mercury in the tube can be gradually raised to the top of the tower.

A difficulty, however, arose from the slanting position of the columns supporting the tower, which prevented the tube being vertical. From the base of the tower to the first platform, a height of about 197 feet, the tube was therefore placed against the inclined plane of one of the rails of the lift, an iron staircase running beside it. Between the first and second platforms, which are separated by about the same interval, the apparatus was fixed to one of the helicoidal staircases. As this staircase is divided into several sections, not in the same vertical plane, on account of the obliquity of the column, the tube is similarly divided, and bends as it passes from one staircase to the other, sufficient slope being allowed for the descent of the mercury when the pressure is reduced. From the second platform to the top the tube is arranged in the same way, following the two vertical staircases, and is thus easily accessible from top to bottom.

The steel tube being opaque, the level of the mercury cannot be directly read off. Cocks with conical screws, each communicating with vertical glass tubes, are arranged at equal distances, about every ten feet, parallel with and alongside the tube. Each glass tube has a scale, carefully marked off on polished wood, which has been selected because it is very slightly affected by changes of temperature. It is adjusted by a rubber band to the metal framing, and leather rings compressed by a screw keep the cock tight. When one of the cocks is opened the interior of the steel tube is placed in communication with the corresponding glass tube. As the mercury rises in the steel tube, it penetrates into and acquires the same level in the glass tube alongside.

From the bottom of the tower to the first platform, the steel tube, as already mentioned, is in an inclined position, and the series of glass tubes placed vertically across it. These sections of glass tube are about ten feet long, each furnished with its scale and the cock communicating with the main steel tube; thus the pressure in any given glass tube is limited to its length of ten feet. The scales are marked in metres and centimetres, so that the head may be read with the utmost accuracy. The tubes and scales are protected from the weather by wooden hinged casings, which can be opened at will.

To obtain a given height or pressure at a given moment, the cock of the corresponding glass tube must be opened, and the hydraulic pump set to work. When the mercury reaches the cock, it rises at the same time in both the steel and the glass tube. By working the hydraulic pump slowly, it can be brought exactly up to the required level, but if the mark be overshot, a certain quantity of water under pressure is allowed to escape near the pump at the bottom. This arrangement is carried out in the laboratory at the foot of the tower. The necessary communication between the two operators, one at the bottom and the other at any required height, is effected by means of a telephone which the ascending or descending operator carries with him, and through which he can speak with those in the laboratory below. If the mercury rises by mistake above the top of any one of the glass tubes it returns to the foot of the tower through an overflow pipe.

As the graduated scales behind each glass tube are not always vertically superposed, their readings are harmonized by means of two connected reservoirs of water joined by an India-rubber tube. The horizontal plane for the base of each scale corresponding to the upper level of the preceding scale can be ascertained from this artificial level.

A laboratory has been erected in the west pillar of the tower, containing the hydraulic force pump, the mercury reservoir, the telephonic station, and other accessories. Among these is a metal gauge of large dimensions connected with the mercury under pressure. It is marked to scale to show first the pressure in atmospheres, and second the numbers corresponding to the different cocks up the tower. The operator is thus able to tell at once and beforehand into which glass tube the mercury ought to rise under a given pressure, and the right cock to get opened to show the level it has reached. To calculate the pressure according to the height to which the column of mercury is raised, the mean temperature of the column in each experiment must be found. This is done by measuring the variation in the electric resistance communicated by the column to the telephonic wire.

The apparatus here described will be found of the greatest use for making experiments on pressures hitherto impossible, and its value from a scientific point of view can scarcely be overrated. The thanks of all scientific men are due to M. Eiffel, who generously undertook the whole expense of constructing and setting up the pressure-gauge, and also to M. Cailletet, to whose skilful designs the success obtained is chiefly due.

PRECIOUS AND ORNAMENTAL STONES AND DIAMOND CUTTING.[1]

UP to the present time there has been very little mining for precious or semi-precious stones in the United States, and then only at irregular periods. It has been carried on during the past few years at Paris, Me.; near Los Cerrillos, N. Mex.; in Alexander County, N.C., from 1881 until 1888, and on the Missouri River near Helena, Mont., since the beginning of 1890. True beryls and garnets have been frequently found as a by-product in the mining of mica, especially in Virginia and North Carolina. Some gems, such as the chlorastrolite, thomsonite, and agates of Lake Superior, are gathered on beaches, where they have fallen from rock which has gradually distintegrated by weathering and wave action.

A very limited number of diamonds have been found in the United States. They are met with in well-defined districts of California, North Carolina, Georgia, and recently in Wisconsin, but up to the present time the discoveries have been rare and purely accidental.

Of the corundum gems (sapphire, ruby, and other colored varieties) no sapphires of fine blue color and no rubies of fine red color have been found. The only locality which has been at all prolific is the placer ground between Ruby and Eldorado bars, on the Missouri River, sixteen miles east of Helena, Mont. Here sapphires are found in glacial auriferous gravels while sluicing for gold, and until now have been considered only a by-product. Up to the present time they have never been systematically mined. In 1889 one company took the option on four thousand acres of the river banks, and several smaller companies have since been formed with a view of mining for these gems alone or in connection with gold. The colors of the gems obtained, although beautiful and interesting, are not the standard blue or red shades generally demanded by the public.

[1] From Census Bulletin No. 49, by George F. Kunz.

At Corundum hill, Macon County, N.C., about one hundred gems have been found during the last twenty years, some of good blue color and some of good red color, but none exceeding $100 in value, and none within the past ten years.

Of the beryl gems (emerald, aquamarine, and yellow beryl) the emerald has been mined to some extent at Stony Point, in Alexander County, N.C., and has also been obtained at two other places in the county. Nearly every thing found has come from the Emerald and Hiddenite mines, where during the past decade emeralds have been mined and cut into gems to the value of $1,000, and also sold as mineralogical specimens to the value of $3,000; lithia emerald, or hiddenite, to be cut into gems, $8,500, and for mineralogical specimens $1,500; rutile, cut and sold as gems, $150, and as specimens, $50; and beryl, cut and sold as gems, $50. At an altitute of 14,000 feet, on Mount Antero, Colorado, during the last three years, material has been found which has afforded $1,000 worth of cut beryls. At Stoneham, Me., about $1,500 worth of fine aquamarine has been found, which was cut into gems. At New Milford, Conn., a property was extensively worked from Oct., 1885, to May, 1886, for mica and beryl. The beryls were yellow, green, blue, and white in color, the former being sold under the name of "golden beryl." No work has been done at the mine since then. In 1886 and 1887 there were about four thousand stones cut and sold for some $15,000, the cutting of which cost about $3,000.

Turquoise, which was worked by the Aztecs before the advent of the Spaniards and since then by the Pueblo Indians, and largely used by them for ornament and as an article of exchange, is now systematically mined near Los Cerrillos, N. Mex. Its color is blue, and its hardness is fully equal to that of the Persian, or slightly greater, owing to impurities, but it lacks the softness of color belonging to the Persian turquoise. From time immemorial this material has been rudely mined by the Indians. Their method is to pour cold water on the rocks after previously heating them by fires built against them. This process generally deteriorates the color of the stone to some extent, tending to change it to a green. The Indians barter turquoise with the Navajo, Apache, Zuñi, San Felipe, and other New Mexican tribes for their baskets, blankets, silver ornaments, and ponies.

The finest garnets and nearly all the peridots found in the United States are obtained in the Navajo Nation, in the northwestern part of New Mexico and the north-eastern part of Arizona, where they are collected from ant-hills and scorpion nests by Indians and by the soldiers stationed at adjacent forts. Generally these gems are traded for stores to the Indians at Gallup, Fort Defiance, Fort Wingate, etc., who in turn send them to large cities in the east in parcels weighing from half an ounce to thirty or forty pounds each. These garnets, which are locally known as Arizona and New Mexico rubies, are the finest in the world, rivaling those from the Cape of Good Hope. Fine gems weighing from two to three carats each and upward when cut are not uncommon. The peridots found associated with garnets are generally four or five times as large, and from their pitted and irregular appearance have been called "Job's tears." They can be cut into gems weighing three or four carats each, but do not approach those from the Levant either in size or color.

Since the discovery of gold in California compact gold quartz has been extensively used in the manufacture of jewelry, at one time to the amount of $100,000 per annum. At present, however, the demand has so much decreased that only from five to ten thousand dollars' worth is annually used for this purpose. In addition to the minerals used for cabinet specimens, etc., there is a great demand for making clocks, inkstands, and other objects.

During the year 1887 about half a ton of rock crystal, in pieces