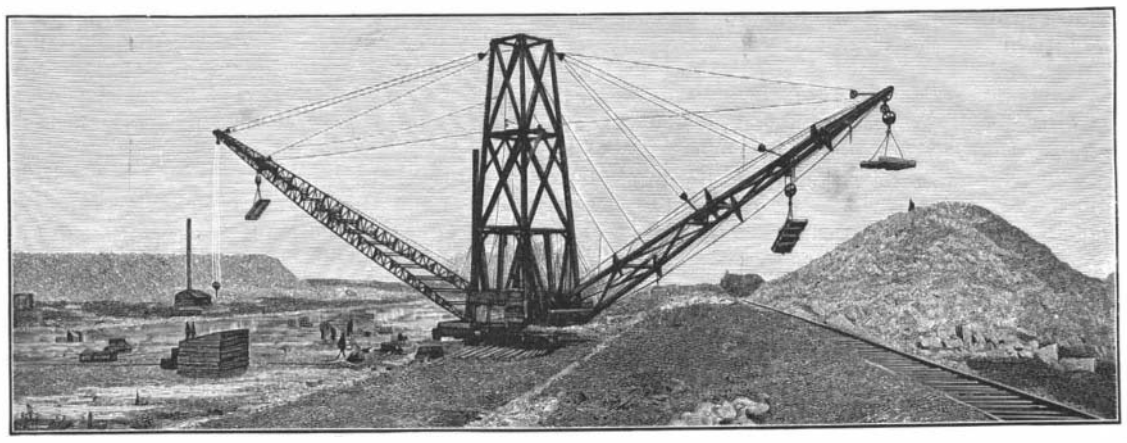
TWO ARM DERRICK—CHICAGO DRAINAGE CANAL.

Our engraving illustrates one of the high power two armed derricks now at work on section 14 of the great Drainage Canal of Chicago. The great radius of the arms facilitates the removal and deposit of the debris in a most economical manner.

The two arms of each derrick are of different lengths, one being long enough to handle skips clear across the channel and the other one shorter and equipped for handling them on the side nearest the point where the derrick stands. Each arm carries two skips, and while one is over the ditch picking up two skips the other is over the spoil bank dumping two.



TWO ARM DERRICK—CHICAGO DRAINAGE CANAL.

The Highest Bridge.

The highest bridge of any kind in the world is said to be the Loe River viaduct, on the Antofagasta Railway, in Bolivia, South America. The place where this highest railway structure has been erected is over the Melo rapids in the Upper Andes, and between the two sides of a canon, which is situated 10,000 ft. above the level of the Pacific. Counting from the surface of the stream to the level of the rails, this celebrated bridge is exactly 636½ ft. in height. The length of the principal span is 80 ft., and the distance between abutments (total length of bridge) is 802 ft. The largest column is 314 ft. 2 in. long, and the batter of the pier, what is known to bridge builders as "one in three." The gauge of the road is 2 ft. 6 in., and trains cross the bridge at a speed of 30 miles an hour.

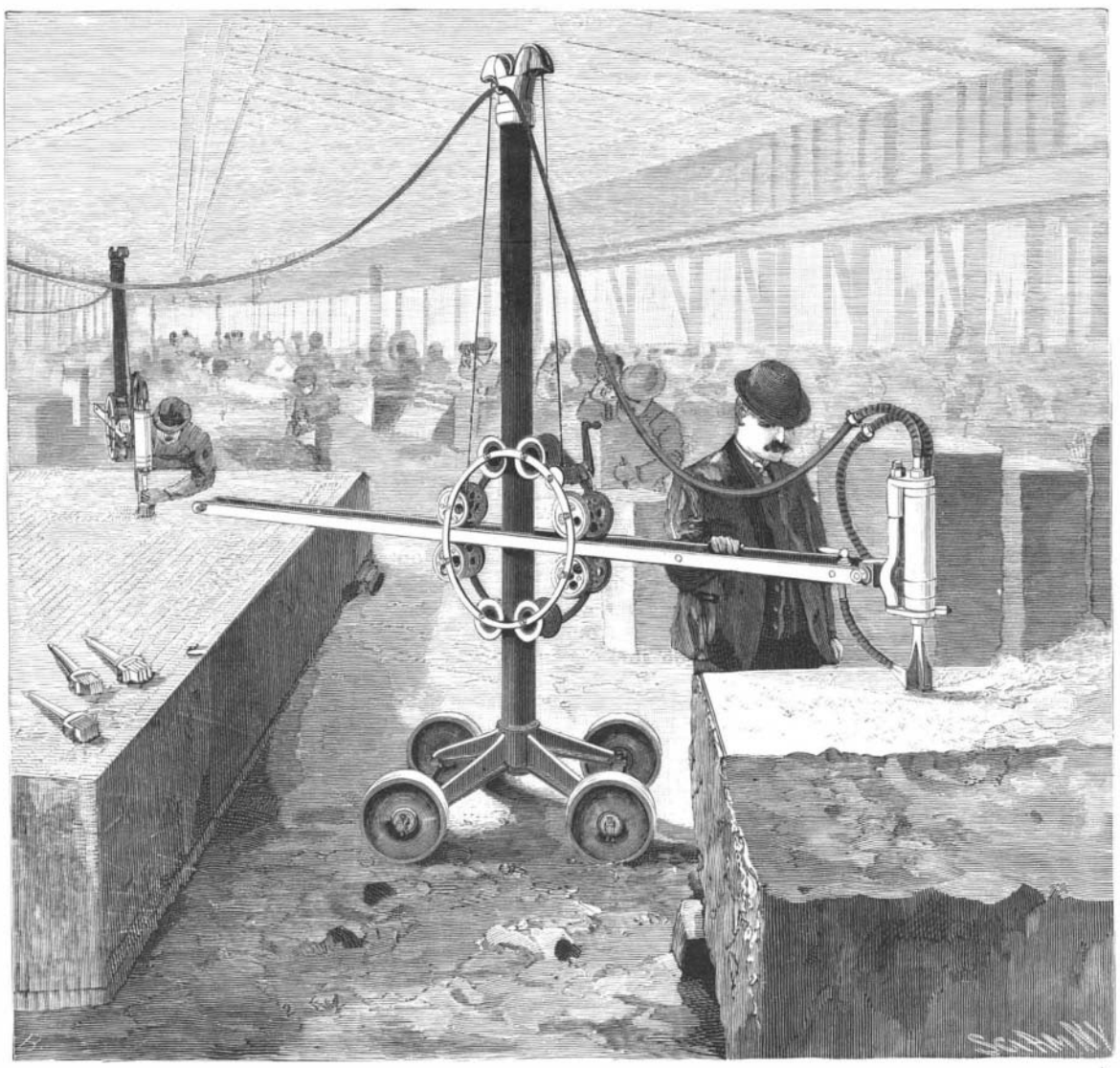
PORTABLE STONE DRESSING MACHINE OF THE AMERICAN PNEUMATIC TOOL COMPANY.

Some years ago we illustrated and described the MacCoy pneumatic tool, of the American Pneumatic Tool Company, of this city. At that time it was attracting much interest from a scientific standpoint, as well as from its extensive application in industrial work. Its uses have been varied and extended, and the stone worker and boiler maker both find it an indispensable adjunct in carrying out their work. The tool proper is virtually a little steam engine, which of course can be worked by compressed air. Within a cylinder is a piston which by the action of the steam or compressed air is made to reciprocate back and forth with very great rapidity. On the up stroke it cushions against steam or air, but on the down stroke it strikes against the head of a cutting bit, chisel or other appliance introduced into a socket in the lower end, and pressed upward by a spring. The chisel or other tool carried by it will receive several thousand blows in the course of a minute.

The distinctive peculiarity of the mechanism is that the cutting tool proper is not moved, but can be held constantly against the work while subject to the impacts of the reciprocating piston. On account of this distinctive action the pneumatic tool can be held in the hand against a surface and will operate thereon without any other abutment. It is startling to see great flakes of stone pared off by its action and stubborn material yielding to it as readily as wood to the action of a hatchet. A two inch chisel will cut flakes half as large as the hand in brown stone. For delicate work it is unexcelled; marble can be carved by it, the material shaping itself under the action of the tool, almost as if the design were being modeled from clay.

In our present issue we illustrate one of the last improvements introduced by the American Pneumatic Tool Company, of 844 Washington Street, New York City, the new portable stone dressing machine. This machine is designed for use on the hardest granite for working it to a surface. It takes the stone rough pointed, about an inch above the final surface level. It quickly brings the granite to a readiness for a polish by the use of a cross chisel, and for 4, 6, 8, 10 and 12 cut surface, bush hammers corresponding to hand hammers are used.

Upon a base carried on wheels, so as to be capable of movement when it is desired, is mounted a vertical hollow column. A carriage with guide rollers is arranged to move up and down this column, and this carriage sustains a horizontal carrier bar, which can slide freely back and forth, to one of whose ends the pneumatic tool is fastened. A partial counterpoise for the weight of the carriage, carrier bar and tool moves up and down within the column and is attached by wire ropes to the carriage, and for adjusting the play of the counterpoise to provide for different elevations of the carrier bar, there is a windlass on the carriage. The carrier bar is double and runs on four pairs of rollers, and by sliding it in and out and swinging its end laterally, the tool can be moved in any desired direction in a horizontal plane. The action of the mechanism is obvious. The stone to be operated on is placed in about the position required to work it by hand; the stone dressing machine is moved to any convenient place near the stone (or the stone to the machine), the play of the counterpoise is adjusted for the height of the surface to be operated on, and the tool started. The hard granite at once succumbs, and in a very short space of time the surface begins to take shape, and in a few minutes a superficial foot can be dressed. The exhaust of the tool is caused to maintain a blast against the point of the tool to blow away the chips and dust.



PORTABLE STONE DRESSING MACHINE OF THE AMERICAN PNEUMATIC TOOL COMPANY.

In the foreground of the picture the machine is shown operating a cross chisel, while fine bushing is shown in progress in the background, the operator holding the tool in his hands so as to regulate its work.

Allowing for wages, repairs, and fuel, it is estimated that the machine can be run for a cent a minute. From actual operation of the machine it is found that six to ten minutes is a fair average for work upon one superficial foot, and a saving of thirty cents per foot over hand labor on the basis of Quincy prices is found to be effected. On the work of a single machine this is a daily saving of $18, an annual saving of over $5,000. Owing to the more uniform cutting of the machine, from ten to twenty cents a foot additional is saved in the polishing, and the blacksmithing also costs less. As the machine produces no stuns, the quality of the cut work is very superior.

Another most important point is that it combines the skill of the workman with the efficiency of machinery. The stone need not be level, for by setting the tool properly and by ordinary attention on the part of the workman, it can be brought to a perfect surface.

A New Emerald Mine.

Mr. Geo. F. Kunz, writing to the American Journal of Science, says: In July, 1894, a new locality of true emeralds was discovered by Mr. J. L. Rorison, miner of mica, and Mr. D. A. Bowman, on the Rorison property, near Bakersville, Mitchell County, N. C. Here, at an elevation of five thousand feet a. t., on Big Crab Tree Mountain, occurs a vein of pegmatite some five feet wide, with well defined walls, in mica schist. This vein carries a variety of minerals besides its component quartz and feldspar, among these being garnets; translucent, reddish, and black tourmalines, the latter abundant in slender crystals; white, yellow, and pale green beryls; and the emeralds. These latter are chiefly small, 1 to 10 mm. wide by 5 to 25 mm. long, but some have been found two or three times larger than the larger size named. They are perfect hexagonal prisms, generally well terminated, and are clear and of good color, with some promise for gems. They very strikingly resemble the Norwegian emeralds from Arendal.

One vein outcrops for perhaps a hundred yards, with a north to south strike. The results thus far obtained are only from about five feet depth of working, so that much more may be looked for as the vein is developed.

The locality is fourteen miles south of Bakersville, and about the same distance from Mitchell's Peak, a little north of the crest of the Blue Ridge. It is some fifty miles west of the emerald locality at Stony Point, Alexander County, N. C., described by William Hidden, in 1881, in a pamphlet privately printed at New York, and in the Transactions of the New York Academy of Sciences, 1882, pp. 101-105, as also by the writer in "Gems and Precious Stones of North America," New York, 1888, p. 91.

I am indebted to Messrs. Rorison and Bowman for the information contained in this paper and for the privilege of examining the specimens found by them.

Lick Observatory.

In reply to a correspondent who asked, In a large observatory, such as the Lick, how are expenses met? Popular Astronomy replies as follows:

Of the $700,000 left by Mr. James Lick, for the erection of the Lick Observatory, more than $575,000 was used in preparing the site, erecting the buildings, and securing the astronomical instruments for the observatory. So that of the large gift bestowed, less than $125,000 remained for the support of the observatory after its completion. The observatory belongs to the University of the State of California, and we understand that the State pays all running expenses and has control of endowment funds through university officers. Professor Holden estimates the annual expenses of the observatory at $20,000.

The Atmosphere and Climate of Mars.

Dr W. H. Pickering has given in Astronomy and Astro-Physics a translation of Schiaparelli's latest views regarding Mars, as originally published in Natura ed Arte, from which we quote the following:

The polar snows of Mars prove in an incontrovertible manner that this planet, like the earth, is surrounded by an atmosphere capable of transporting vapor from one place to another. These snows are in fact precipitations of vapor, condensed by the cold, and carried with it successively. How carried with it, if not by atmospheric movement? The existence of an atmosphere charged with vapor has been confirmed also by spectroscopic observations, principally those of Vogel; according to which this atmosphere must be of a composition differing little from our own, and above all very rich in aqueous vapor. This is a fact of the highest importance, because from it we can rightly affirm with much probability that to water and to no other liquid is due the seas of Mars and its polar snows. When this conclusion is assured beyond all doubt, another one may be derived from it, of not less importance—that the temperature of the Arean climate, notwithstanding the greater distance of that planet from the sun, is of the same order as the temperature of the terrestrial one. Because, if it were true, as has been supposed by some investigators, that the temperature of Mars was on the average very low (from 50° to 60° below zero!) it would not be possible for water vapor to be an important element in the atmosphere of that planet, nor could water be an important factor in its physical changes; but would give place to carbonic acid, or to some other liquid whose freezing point was much lower.

The elements of the meteorology of Mars seem then to have a close analogy to those of the earth. But there are not lacking, as might be expected, causes of dissimilarity. From circumstances of the smallest moment, nature brings forth an infinite variety in its operations. Of the greatest influence must be the different arrangement of the seas and the continents upon Mars and upon the earth, regarding which, a glance at the map will say more than would be possible in many words. We have already emphasized the fact of the extraordinary periodical flood, which at every revolution of Mars inundates the northern polar region at the melting of the snow. Let us now add that this inundation is spread out to a great distance by means of a network of canals, perhaps constituting the principal mechanism (if not the only one) by which water (and with its organic life) may be diffused over the arid surface of the planet. Because on Mars it rains very rarely, or perhaps, even, it does not rain at all. And this is the proof.

Let us carry ourselves in imagination into celestial space, to a point so distant from the earth that we may embrace it all at a single glance. He would be greatly in error who had expected to see reproduced there, upon a great scale, the image of our continents with their gulfs and islands, and with the seas that surround them, which are seen upon our artificial globes. Then, without doubt, the known forms, or part of them, would be seen to appear under a vaporous veil, but a great part (perhaps one half) of the surface would be rendered invisible, by the immense fields of cloud, continually varying in density, in form and in extent. Such a hindrance, most frequent and continuous in the polar regions, would still impede nearly half the time the view of the temperate zones, distributing itself in capricious and ever-varying configurations. The seas of the torrid zone would be seen to be arranged in long parallel layers, corresponding to the zone of equatorial and tropical calms. For an observer placed upon the moon, the study of our geography would not be so simple an undertaking as one might at first imagine.

There is nothing of this sort in Mars. In every climate, and under every zone, its atmosphere is nearly perpetually clear, and sufficiently transparent to permit one to recognize at any moment whatever the contours of the seas and continents, and more than that, even the minor configurations. Not indeed that vapors of a certain degree of opacity are lacking, but they offer very little impediment to the study of the topography of the planet. Here and there we see appear from time to time a few whitish spots, changing their position and their form, rarely extending over a very wide area. They frequent by preference a few regions, such as the islands of the Mare Australe, and on the continents, the regions designated on the map with the names of Elysium and Tempe. Their brilliancy generally diminishes and disappears at the meridian hour of the place, and is re-enforced in the morning and evening, with very marked variations. It is possible that they may be layers of cloud, because the upper portions of terrestrial clouds, where they are illuminated by the sun, appear white. But various observations lead us to think that we are dealing rather with a thin veil of fog, instead of a true nimbus cloud, carrying storms and rain. Indeed it may be merely a temporary condensation of vapor, under the form of dew or hoar frost.

Accordingly, as far as we may be permitted to argue from the observed facts, the climate of Mars must resemble that of a clear day upon a high mountain. By day a very strong solar radiation, hardly mitigated at all by mist or vapor, by night a copious radiation from the soil toward celestial space, and because of that a very marked refrigeration. Hence a climate of extremes, and great changes of temperature from day to night, and from one season to another. And as on the earth, at altitudes of 5,000 and 6,000 meters (17,000 to 20,000 feet), the vapor of the atmosphere is condensed only into the solid form, producing those whitish masses of suspended crystals which we call cirrus clouds, so in the atmosphere of Mars it would be rarely possible (or would even be impossible) to find collections of cloud capable of producing rain of any consequence. The variation of the temperature from one season to another would be notably increased by their long duration, and thus we can understand the great freezing and melting of the snow, which is renewed in turn at the poles at each complete revolution of the planet around the sun.

As our chart demonstrates, in its general topography Mars does not present any analogy with the earth. A third of its surface is occupied by the great Mare Australe, which is strewn with many islands, and the continents are cut up by gulfs and ramifications of various forms. To the general water system belongs an entire series of small internal seas, of which the Hadriacum and the Tyrrhenum communicate with it by wide mouths, while the Cimmerium, the Sirenum and the Solis Lacus are connected with it only by means of narrow canals. We shall notice in the first four a parallel arrangement, which certainly is not accidental, as also not without reason is the corresponding position of the peninsulas of Ausonia, Hesperia and Atlantis. The color of the seas of Mars is generally brown, mixed with gray, but not always of equal intensity in all places, nor is it the same in the same place at all times. From an absolute black it may descend to a light gray or to an ash color. Such a diversity of colors may have its origin in various causes, and is not without analogy also upon the earth, where it is noted that the seas of the warm zone are usually much darker than those nearer the pole. The water of the Baltic, for example, has a light, muddy color that is not observed in the Mediterranean. And thus in the seas of Mars we see the color become darker when the sun approaches their zenith and summer begins to rule in that region.

All of the remainder of the planet, as far as the north pole, is occupied by the mass of the continents, in which, save in a few areas of relatively small extent, an orange color predominates, which sometimes reaches a dark red tint, and in others descends to yellow and white. The variety in this coloring is in part of meteorological origin, in part it may depend on the diverse nature of the soil, but upon its real cause it is not as yet possible to frame any very well grounded hypothesis.

Railroads in Africa.

Mr. H. M. Stanley, in an interview with a representative of the Exchange Telegraph Company, in regard to the situation in Uganda, said there was not room for two railways in the country, and, if the absolute need of a railway was felt by both England and Germany, it would be better for the two governments to combine in the enterprise than to construct two separate lines. The best thing would be for England to make the railway, and if the admirable "Lartigue" system were adopted instead of the old-fashioned earthwork and ballast railway adopted by the Germans in the 15 mile line they had already constructed, it would be possible, if the work were commenced three months from now, starting from Mombasa, to carry the line to Lake Victoria in about 18 months or two years at an expenditure of £1,000,000. The Lartigue system of railway was to be seen in operation on an experimental line eight miles in length between Listowel and Ballybunion in Ireland. The train runs upon three rails arranged triangularly, the top rail, which is the apex of the triangle, being several feet from the ground. With this system, if an accident happens to a train when at full speed, the train drops a few inches upon the ground, and very little damage is incurred, in addition to which the construction costs only about £1,500 a mile. This system was consequently far the best for pioneer railways such as that required in Uganda. All the plant would be manufactured in England, put up in sections and transported, which would greatly facilitate the speed of construction. In Africa, where labor cannot be got so easily as here, the expense of making earthworks is enormous.

The latest information he had received as to the progress of the Congo Railway was that it was being constructed at the rate of 200 meters a day, and this was due to the fact that for the Congo Railway the old style had been adopted, which was costing £8,000 a mile. Earthworks and ballast had been made for 40 miles, but of the actual Congo Railway only 32 miles had been constructed in four years. With the Lartigue system, from one to ten miles of line could be laid in a day. To-day the land through which the Uganda Railway would pass was valueless for all practical purposes, but the railway would open out 650 miles of new country to all kinds of enterprises, and at the end of the track there would be the shores of Lake Victoria, 12 miles in length, to feed the railway. The immediate customers of the line would, of course, be the British government in Uganda, the German authorities on Lake Victoria, the Congo state authorities to the west of Uganda, the Roman Catholic and Protestant missionaries of the lake regions, and the missionaries on Lake Tanganyika. To bring Lake Victoria and the surrounding country within five days', instead of three months', journey from the sea would give an enormous impetus to trading.

The Hungarian Flour Industry.

Consul Edward P. T. Hammond, Budapest, Austria-Hungary, writes as follows to the State Department: Hungary not only produces wheat enough to cover its own needs, but has a surplus production, enabling it to export wheat largely to neighboring Austria and to Germany and Switzerland, besides supplying its important milling industry, which exports large quantities of wheat flour to Austria, England, Germany and France. The Hugarian mills fully supply the home market and compete with American wheat flour in some of the foreign markets. The standard of living naturally differs with the different classes of the population, and as to these classes it again differs in wealthier or poorer districts. In the matter of eating and drinking there is hardly any difference between the mode of living of the wealthiest classes in this country and those of the Continental countries further west. It is only when we come to the vast host of less favored professional people, merchants, tradespeople, and employes of all kinds other than laborers inhabiting the cities and towns that we discover any substantial difference. These, comprising about one-tenth of the population, live chiefly on coffee and wheat rolls or bread for breakfast, and soup, boiled meats, vegetables and a dish of boiled dough, made of wheat flour of superior or inferior quality, according to the purse of the consumer, for dinner. Supper is a scantier meal, consisting of some meat or a flour dish. Wine, diluted with plain or mineral water, or beer is the common beverage.

The bread used by this class is rarely made of pure white flour; it is rather of a coarser quality. The bread most largely used is made of rye flour, occasionally mixed with barley flour. The rest of the population, engaged chiefly in agriculture, live mostly on milk, bread, cheese, bacon, vegetables, flour dishes, potatoes, corn porridges and, occasionally on Sundays and festival days, fresh meat. Of course, there is some, although not a very wide, difference between the food of the agricultural laborer and that of the peasant proprietor of small holdings. Along the larger rivers, where fish are abundant, the diet of the agricultural classes includes fish. Wine, in the wine-growing districts, and whisky, where no wine is made, are their chief beverages. The bread used is rarely made of wheat flour, except on festive occasions, when it is called in the vernacular "kalacs" (cake) to distinguish it from the rye bread generally used. The rye bread is coarse and dark, of better quality, occasionally mixed with wheat flour in lower and central Hungary and almost black in upper Hungary. Corn bread is largely used by the Roumanians in Transylvania.

The perfection of all the mechanical contrivances employed by the milling industry in Hungary and its extraordinary development are well known in the United States. But what may be less known is the extraordinary care with which the wheat growers, as well as the mills, co-operate to produce the finest quality of flour by assorting, classifying and thoroughly cleansing the different qualities of wheat grown. They used to produce as many as eighteen grades, but now these are reduced to about seven. The uniformity and reliability of these grades have contributed more than anything else to the success of Hungarian flour. It is claimed besides that the Hungarian flour is possessed of a peculiar buoyancy which makes it better adapted for bakers than any other flour, and this quality is attributed to a nice mixture of different brands of wheat, which is kept secret by the mills. While there are about fourteen large first-class flouring mills in Budapest, there are about 120 more scattered over the country, for the most part near the centers of wheat-growing districts. This proximity has the advantage of educating the farmer as to the needs of the miller, and at the same time it secures the grower a ready market and cash for his produce.

CRYOSTASE is the name conferred by a German chemist (Natur) upon a newly discovered body possessing the unusual property of being liquid at a temperature below the freezing point and solidifying under the influence of heat—in which respect it is absolutely unique. This body may be obtained by mixing together equal parts of phenol, camphor and saponin, to which is added a slightly smaller quantity of oil of turpentine.