The Big Bend Tunnel Completed.

For five years past a company of New York capitalists have been engaged in the stupendous undertaking of turning Feather River from its bed at the Big Bend, 16 miles above Oroville, in Butte County. [Illustrations of this remarkable work were given in the SCIENTIFIC AMERICAN of February 6, 1886.] Here a mountain spur has caused the river to make a detour, which, following the trend of the mountain for 14 miles, returns to a spot not more than two and one-third miles from the point on the opposite side. For years the Yuba and Feather Rivers have been noted for their richness in the early days of the State, and untold millions had been taken from their beds, but at this point the depth of the canon through which the river flowed, coupled with the large volume of water, made it impossible for the pioneer miners to extract the great stores of wealth. It is this which attracted the attention of Dr. R. V. Pierce, of Buffalo, New York, and he determined to associate a number of capitalists with himself, and by tunneling the mountain spur at the Big Bend obtain the gold which had defied all other efforts to get it.

The work of tunneling the mountain was begun five years ago and has just been completed. The tunnel is 12,000 feet, or nearly two and one-third miles, in length. One hundred men have been engaged on it night and day, using the largest sized Burleigh drills, driven by compressed air. The tunnel, as completed a year ago, was nine by sixteen feet, but this was found too small for the volume of water, and the aperture has been increased to twelve by sixteen feet in size. On October 16 the river was turned through the tunnel, which was found of sufficient capacity, and the bed of the river was laid bare. Numerous prospect holes were sunk at various spots, and gold was found in paying quantities, some of the places paying as high as fifty cents to the pan of dirt. Owing to the quantity of water coming through the gravel and the want of pumping machinery, but little can be done this season, but enough has been discovered to show the richness of the claim, which will be thoroughly equipped with all the necessary pumps for next season's work. The water of the river, as it comes from the tunnel, is at a height of 300 feet above the river below, and this tremendous fall will be utilized to generate electricity, which will be conveyed to the various pumps by copper wires, and again developed into force by the dynamos there. Dr. Pierce has brought a number of samples of gold nuggets and dust from the claim as an earnest of what is promised in the future. He is now stopping at the Palace Hotel, and is engaged in making contracts for his pumping machinery. This will be erected during the winter under the supervision of the superintendent, M. A. Harris, and all will be in readiness for next season's work. The cost of the tunnel has been nearly one million dollars. This expense has been borne by the Big Bend Tunnel Company, whose capital stock is $20,000,000.—*S. F. Alta.*

The Heating of Points by the Electrostatic Discharge.

In a recent note on the heating of points by the electric discharge, M. Semmola thus describes some experiments he has made:

A point is used made half of antimony and half of bismuth soldered at the extremity, so as to constitute a thermo-electric couple. Having connected the point with the prime conductor of an electric machine, the poles of the thermo-electric couple are connected by wires with an insulated galvanometer of low resistance. When the plate of the machine is rotated, the needle of the galvanometer deviates because of the thermo-electric current produced by the heating of the point as it discharges the electricity of the conductor to which it is attached. (It is scarcely necessary to remark that with a mono-metallic point no current is produced.) A current may even be obtained by attaching the point, not to the conductor, but to a large metallic bar in communication with the ground and at a short distance from the machine.

On performing these experiments in the dark it is observed that when a small star appears on the point, the deviation of the needle is much greater than when the "plume of light" appears there. This proves that the discharge of negative produces more heat than does the discharge of positive electricity. By bringing the point near the conductor, so as to have a constant spark, thin, hissing, and visible in day light, the deviation of the needle decreases.

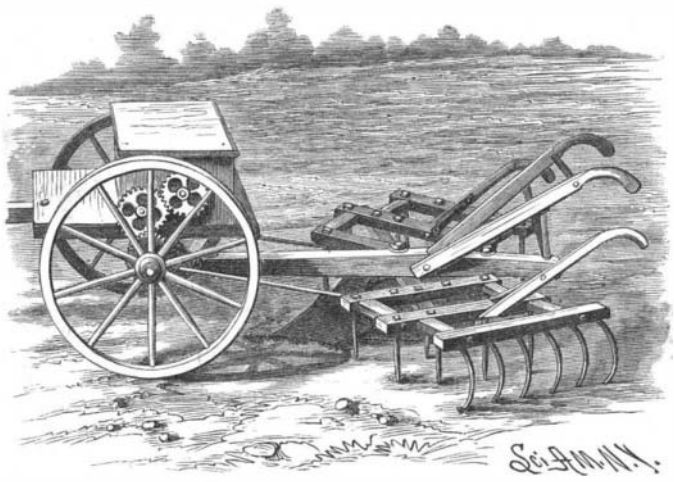
The electric blast of air that blows from the point is also hot, as can be easily proved by placing upon the conductor of the machine a curved mono-metallic point, a few centimeters distant from one of the faces of a Nobili's thermo-electric battery. On turning the plate of the machine, the electric blast blows against the battery and the galvanometer needle at once deviates.

A point of bismuth and antimony or one of iron and platinum placed on a metallic bar in communication with the earth, and exposed upon the summit of an edifice, like a lightning rod, might in certain cases be of use in examining the atmospheric electricity, and in detecting by the production of a current of feeble intensity the electricity of storms or of the *aurora borealis.—Revue Scientifique.*

A CULTIVATOR, DUSTER, AND DIGGER.

A machine intended to prepare ground to receive crops, to dust poison as required, and to dig or harvest potatoes or other crops, is illustrated herewith, and has been patented by Mr. William C. Davidson, of Grandville, Mich. The beam of the plow, having reversely set or double mouldboards, is connected at its forward end to the sulky axle, preferably by links engaging a clevis of the plow beam, the plow having the usual handles. In a couple of eye bolts in the sulky axle are hooked two draught bars, to each of which a cultivator harrow is held, each of which has a handle, allowing the operator to guide the harrows sidewise, or to lift them bodily to clear their teeth of trash or for passing over obstructions. The opposite harrows are so connected that they may be set nearer to or farther from each other, according to the work to be done, and are so constructed as to allow of the attachment of interchangeable forks or mouldboards at the backs of the harrows, and disposed at like angle with the harrow-frame bars, to facilitate potato gathering.

On the sulky frame is fitted a box in which is journaled a cylinder or drum, its periphery being made of sheet metal and provided with a series of perforations, for scattering or dusting poison upon plants, there being any preferred arrangement for closing a portion of the holes in the drum, according as the poison is to be dusted upon plants set in drills or in a continuous line, in hills, etc. The drum is rotated by the advance of the machine, from a gear wheel fixed to the sulky axle, through a belt and pulley.



DAVIDSON'S CULTIVATOR, DUSTER, AND DIGGER.

For simply dusting poison on growing plants, the plow and harrows are removed; and for gathering crops, the belt is unslipped from the drum-driving pulley.

The Tin Mines of California.

Within three or four miles of the railroad leading from Riverside to Santa Ana, is a deposit of tin ore, consisting of over 200 ledges carrying tin, or rather that number of mining locations, and more, were made some twenty years or more ago, upon what is now known as the Rancho Sobrante San Jacinto. This ranch, consisting of eleven square leagues of land, patented by the United States government in 1868, after a large amount of litigation, was purchased afterward by a corporation organized under the laws of our State, called the San Jacinto Tin Company, which at once took steps to ascertain whether or not there were tin lodes upon it. A thorough examination developed the fact that an area of about ten square miles was permeated with tin veins of various thickness to such an extent as to establish the fact that there was tin enough there to supply the United States with that metal. The company selected one location as easiest of access, called the Jahalco, and upon this vein sunk a shaft to a considerable depth, and ran drifts each way, developing one of the richest deposits of tin ore ever known.

Some one or two tons of tin was smelted from the ore in this city, in a crude way, from ores sent up from the mine. Quite an amount of tin sheets and tinware, as well as many bars of tin, were also made and exhibited at the Mechanics' Fair in this city in 1869, for which a gold medal was awarded. Some of the tin, both in bars and in the ore, was sent to England, and tested thoroughly, with the result of being found almost perfectly pure, carrying no wolfram, arsenic, or tungsten, as is usual with tin ores. At the time this company, which still owns the property, carried on this work, it was very expensive to get supplies and labor there. Los Angeles, fifty-five miles away, was the nearest place for supplies, which had to be hauled by wagon. Tin ores have to be treated in a peculiar way, requiring power to crush and concentrate, and fuel for this purpose, as well as to smelt the concentrations, was not to be had then, in that section, unless at too great an expense.

When the company ceased work, not because the ore had given out, but because it would not then pay to work, the vein was over 8 feet in width of solid ore, carrying in tin from 5 to 50 per cent. The want of water, and the cost of transporting the ores to a point where water and fuel was to be had, was too great, and the company closed the mine. But enough had been done to justify the statement that within what is known as the tin district, of about 10 square miles, there are mines enough and tin enough to furnish all the tin required west of the Rocky Mountains, if not for all the United States.

Shortly after closing the mine, the company disposed of some 3,500 acres of its *mesa* land to the Riverside Company, which land now comprises a portion of that thriving place, and of Arlington. Afterward the government of the United States allowed its name to be used in a suit brought by a person named Baker, of Los Angeles, who owns, or claims to own, a large number of tin locations made in early times. This suit was decided in the United States Circuit Court here in 1885 by Judges Sawyer and Hoffman, after a long and expensive litigation, in favor of the company, in an exhaustive opinion. As the plaintiffs had two years within which to make an appeal to the Supreme Court of the United States, an appeal was taken within but just previous to the expiration of the time allowed by law, and the case is now before the Supreme Court, or rather will be before it in this term. As it has been advanced on the calendar to be heard on January 7, 1888, we may hope to get a final opinion upon it early in the new year of 1888.

If decided in favor of the company, we hope to see this industry of tin mining carried on with vigor, as it will add another to the many mining industries of our State. It is believed now that the railroad is so close to the mines that the ores can be transported to water and fuel so cheaply that the mines can be worked very profitably. Coal has been discovered within a few miles of the mines, and the Santa Ana River is but a few miles away. —*Min. and Indus. Advocate.*

The Alteration of Iron by Moderate Heat.

An important question to engineers and contractors having to do with iron and steel exposed to variations of temperature of more than a natural range—such as, for example, in connection with gas retort house work—was recently put in *Engineering* by Mr. A. Elink Sherk, the engineer of the Lake Haarlemmer drainage works. It appears that a chain hanging in the chimney of a pumping engine broke with the weight of a man in a gantry seat, although the material was the best that money could buy, and the links 5-16 inch in diameter. The chain was two years old when it broke. When new, the chain had been tested to 1,353 kilos (nearly 3,000 lb.). The manufacturer, on being appealed to, ascribed the breakage to the metal having been continually heated and cooled in the chimney, which made it hard, loose in grain, and brittle. As a matter of fact, the chain had been subjected 35 times *in situ* to the heat of melting lead and cooled again to atmospheric temperature. The curious point is that similar chains hanging in other chimneys for four or five years have apparently remained perfectly sound under exactly similar conditions, although these were not so good to begin with. In reply to Mr. Sherk, Mr. C. E. Stromeyer has written to state that in his experience steel and iron exposed to the heat of melting lead in the fumes of a sulphurous coal will lose nearly all their strength.

Mr. B. H. Thwaite also suggests that the contact of the heated chain with soot might recarbonize the metal and turn it practically into cast iron. Mr. Thwaite remarks, however, that mere heating and cooling, not in a chemically active atmosphere, will not alter the molecular structure of metals, and states that wrought iron tie bars of high temperature furnaces do not become altered chemically or physically. Any gas manager who has ever pulled down an old retort stack, in which tie bars may frequently be found turned to lumps of carbon rather than iron, will be able to testify that there are conditions in which iron alters its constitution and appearance, though buried in brickwork, and not subjected at any time to a red heat.—*Jour. Gas Lighting.*

American Dentistry Abroad.

Among the new companies lately formed in London is one entitled the American Dental Institute. Capital 1,000*l.*, in shares of 1*l.* each. Object, to promote the adoption of advanced American and other scientific methods of dental surgery; to protect the interests of dentists and the profession of dentistry; to consider all questions connected therewith; to promote or oppose legislative and other measures affecting the profession; to collect and circulate statistics and information in regard thereto; to act as and to appoint arbitrators for the settlement of any disputes in connection with dentistry.