# THE ARIZONA CITIZEN.

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THE ARIZONA CITIZEN

—IS—

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CORNER OF CHURCH AND CONVENT.

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Deputy Surveyor of Mineral Lands.
Tucson, Arizona. 30-tf

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ATTORNEY AT LAW,

TUCSON - - - - - - - - - ARIZONA.
Will practice in all the Courts of the Territory. 1tf

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TUCSON - - - - - - - ARIZONA.
Will resume the practice of his profession Thursday, July 1. Will give attention by preference to diseases of women and children.
Office hours from 9 a. m. to 3 p. m. and evening.

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ABOGADO Y CONSEJERO,

Se ocupa de todo lo que pertenece a su oficio; habla Español y da consultas GRATIS a los que necesitandolas no tienen con que pagarlas.
Los que viven lejos del Tucson pueden consultar, por escrito, tocante a las leyes del Territorio de Arizona.
Tucson Arizona, Julio 31, 1875. 49-tf

**Tucson Assay Office.**

I BEG LEAVE TO INFORM MY friends and the public in general that I have opened an

**Assay Office in Tucson,**

and am ready for work in any line of my business at following prices:

Single Assays for Gold and Silver.....$7 50.
Single Assays for Copper.....5.00.
Single Assays, Copper, Gold & Silver.. 8.00.

SAMUEL HUGHES, Assayer.
Tucson, Feb. 6, 1875. 18-tf

**Good and Cheapest Barber Shop.**

FRANCISCO BARRAZA HAS OPENed a new Barber Shop on Congress street, one door east of Custom-house.

Work satisfactorily done at these rates:

Shampooing, - - 50 cts.
Shaving, - - - 25 cts.
Hair Cutting, - - 50 cts.

Shaving and Hair Cutting per Month, $2.
Please call and try my work.
July 10, 1875. 40-tf

**Legal Papers Executed.**

—by—

**S. W. CARPENTER,**

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Office in the Court-house, Tucson.

DEEDS, MORTGAGES, BILLS OF Sale, Contracts, Dissolution and other legal documents executed neatly, promptly and correctly, and at moderate charges.

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JAMES E. McCAFFRY, Attorney,

Tucson, Arizona, our regular correspondent, to whom applications for information may be made. 51-tf

**For Sale Cheap.**

EIGHT SHARES IN THE MONTEZUma Ditch, in the Upper Gila Valley. Enquire at THE CITIZEN office. 24-tf


## "WHAT DO I KNOW."

So ran the motto on a seal;
His whose rare wit doth sprightlier dance
Than any other that hath been
The laughter-loving speech of France.

Upon this heaven kissing hill,
On this midsummer day of days,
That sad old question shoulders in
Among my thoughts of prayer and praise.

What do I know? Not much, alas!
Of all the breadth and depth and high:
That presses on my soul and sense
From day to day, from night to night.

And yet I know the light is sweet,
And pleasant 'tis to see the sun,
What time he climbs the eastern hills,
And when his course is nearly done.

I know the look of wild-blown grass,
The quiet rustle of the corn,
The lusty song the thresher sings
To usher in the glowing morn.

I know to what a merry tune
Yon river ripples on its way
And how, along its leafy brink,
The drooping branches softly sway.

I know the springs that trickle down
Through mossy bed of brush and fern,
Nectarly cool, nor Zeus himself
Drank better drink from Hebe's urn.

I know what fine enchantments lurk
In clouds that trail their shadows dim
O'er hill and vale, or lie at ease
Along the west at set of sun.

I know the night is calm and cool
And welcome when the day is spent;
And, when it fills the sky with stars,
Fills all my soul with sweet content.

But in the worlds of thought and love
Yet more and better things I know
Than this midsummer day of days,
Nor all its treasures, that I prize.

I know that many friends are kind,
That many hearts are fond and true;
Ah now—but hush! I may not tell
The half I know, Montaigne to you.

Wherefore, O skeptic, go and try
Your question in some other ear;
I know enough to keep my heart
Brim full of joy from year to year.

### New Mexico-Arizona Boundary.

The New Mexican of October 5, has the following items concerning progress of running the boundary line, (now in process,) between this Territory and New Mexico:

"Major Chandler Robbins, United States Commissioner to survey and mark the New Mexico-Arizona boundary, came into Silver City on the 23 instant, having left his party encamped upon the 274th mile on its southward course and about 116 miles north of its terminus upon the boundary of Mexico. The Major in a letter from that point to a friend in this city, says he had had an exceedingly rough time, having had rain almost daily and having had a great deal of the roughest country to survey over, that civilized man had ever traversed. In one place he was a week in making ten miles of line; and when he reached his present camp, his animals were all lame and his men had entirely worn out their shoes getting through the Mal Pais country. Plenty of game was found and taken, sometimes three or four deer being brought into camp during the day. It was thought the worst portion of the country had been passed, and the survey would be completed probably by the first of November. Between the south boundary of the Navajo Indian reserve at Fort Defiance and the Escudilla mountain, the party struck a long stretch of dry, sandy country, and though much rain fell, the men and especially the animals suffered considerably for want of water. The following localities are mentioned of the main points of interest passed on the line from its north terminus:

"At 86 miles 32 chains, a point 2 miles 1 chain east of Fort Defiance—at 92 miles 45 chains, Fort Wingate and Fort Defiance road—at 113 miles 77 chains, Puerco river, course southwest—at 114 miles, Fort Wingate and Prescott road—at 133 miles 32 chains, a point 11 miles 28 chains west of the Indian pueblo of Zuni—at 136 miles 63 chains, Zuni and Prescott road—at 145 miles 28 chains, Zuni and Camp Apache road—at 146 miles 38 chains, Zuni river, course southwest—at 149 miles, a point about 2 miles east of Deer Spring on west bank of Zuni river—at 177 miles 62 chains, a point 1 mile west of Soda Spring in canyon bearing north and south—at 203 miles 21 chains, Tularosa and Camp Apache road—at 206 miles 31 chains, foot of main range of the Sierra del Dátil—at 258 miles, San Francisco river, course west, in a box canyon about 2500 feet deep. This river flows nearly south in New Mexico a long distance about six miles from the line, till it makes nearly a right angle and crosses the boundary into Arizona."

IN a Pennsylvania town lately, a Mr. Sam Wache married a Miss Ophelia Ryan, and the German band of the village serenaded the couple on the wedding night, playing among other things, "The Watch on the Rhine." The young lady having grave suspicions that there was a personal allusion in the incident, became highly indignant. Her brother horsewhipped the leader of the band next day and the whole matter has got into the courts.

COMPACT EXPRESSION OF WISDOM from the Milwaukee News: "The biggest fool was a girl in New York who poisoned herself for a dry-goods clerk who parted his hair in the middle and wore an oroide watch and chain."

## PROCESS OF LIXIVIATION.

### Notes Upon the History of the Metallurgy in Sonora, Mexico.

PRESENTED TO THE MEXICAN MINING SOCIETY BY ENGINEER ANTONIO MORENO.

Translated for THE CITIZEN by J. Spring

Sonora is one of the States in whose bosom the largest quantity of silver ores are found; but amongst them there is little pure sulphuret of silver, seeing that the gray copper in its immense number of varieties, is the metal which, either pure—hecho)—as the practical miner says, or contained in the matrix in a state of more or less fine (menudo) grain, generally predominates: this gray copper may be divided in Sonora in two kinds, one of which is found in the veins of galena ores that contain few pyrites of copper, and in which, the galena being united with the pyrites, they form the kind of gray copper, in which the lead is predominant; the other which again might be divided in two classes, is that found in the veins whose predominating ore is the cuperous pyrite, in which also, instead of the copper and iron they contain, either lead or zinc being substituted, as well as arsenic and antimony, that exist in almost all the veins, the other two classes of gray copper are formed, which are those that contain copper, iron, silver and sulphur, small and variable quantities of lead, zinc, arsenic and antimony; and those in which arsenic and antimony come in as substitutes in considerable quantities for the sulphur. There is also found some hessite, (tellurid of silver;) but either because it is scarce or on account of the small influence it has in the process, I think there is no need of making any special mention of it, as is also the case with the chlorine, bromyrite and iodyrite, which forming chloride, bromide and iodide of silver, are found in some veins and especially in that of Ináhuac, twelve leagues to the southeast of Hermosillo; nor of the carbonate of lead, which I have seen in the mining district of San Javier, some thirty leagues to the southeast of said Hermosillo, it being the principal substance accompanying the silver bearing ore.

Now, as to the composition of the ores, called by practical miners rebellious ores, all those of high and low grades, that could be, although imperfectly concentrated, were worked by fire either by the process of kettles or in crucibles, and those that did not pay for concentration or consisted in copper pyrites, were thrown away, the result of which was that the patio process (heap amalgamation) which may be considered the only process in the mining districts in the other parts of the country, was used in Sonora only for very few classes of ores. Not till the year 1862, was erected the first establishment of importance for the purpose of working by the barrel process the ores of the mine called De Los Bronces, which name it received on account of the large quantito of copper pyrite its ore contained.

At the same time with the barrel process there was established at the village of San Marcial the process called the pan amalgamation, which some wanted to compare with that called "de cazo," but which is in reality far different from it, as I shall show in this treatise when touching upon this subject. Afterwards, that is to say, five or six years ago, one of the three methods of the lixiviation process was thought of, having adopted in the mining district "La Dura" that of Pattera, and using as dissolving agent for the chloride of silver, not the hyposulphite of soda, but that of lime, which is more easily obtained and cheaper, and as precipitating agent the polysulphite of calcium.

Intending to speak afterwards of each of the processes that have been practiced here, I commence in these notes with that of lixeiviation, as well as on account of its actual importance through the dearness of quicksilver, as also because, though the price of this article may be reduced, this process will be preferred on account of the cheapness of the extraction of each mark of silver and because all those who obtain bad results by other proceedings, will adopt it also when stimulated by the results that daily are obtained by it.

I.

The first operation which the ore has to undergo, is pulverization, which takes place in mortars, in the same manner as if the ores were to be worked in the patio—pan—or barrel process.

The machinery used for pulverizing purposes have been and are continually modified in an advantageous manner. When speaking of the establishments that I know, I shall then extend more in detail upon this matter, which cannot but be important. At present I shall pass to the second operation, which is that of roasting.

II.

This, which is unquestionably the most important, is performed in hearths of three compartments, of the following form and heated by one furnace: The bottom of each measures from the bridge, lengthwise, 3.10 metres, and the width from the mouth, measures 3.65 metres. The vault, which at the place where the fire enters, has a height above the floor of 0.58 metres and goes slanting downward towards the fire, where it has only a height of 0.30. The grate is from 2.20 to 2.50 metres long, and from 0.30 to 0.35 metres wide, the distance between the bars being 0.015, in order to admit the air; the thickness of the bars is little more than 0.015, so that the surface of the entering air would make a square, whose side would be about 0.60 metres; the bridge which separates the floor from the hearth, is only 0.28 metres wide, by 0.2 metres high, the section of the chimney should not surpass a square having for a side 0.45 to 0.50 metres: its height varies between four and six metres.

The floor of the second furnace or compartment, should be about 0.1 metre higher than that of the first, the same takes place with regard to the third, which communicates with the chimney.

The communication of one hearth with the other has nearly the same width as the fire-place; only the communication of the third with the chimney is reduced to the line of the chimney or is made to communicate with it by three different conducts; the communication of one hearth with the other as well as that of the last with the chimney, is arranged as indicated, in order that the flame may be be equally the first hearth, and the same happens with the air and the hot gases of the others. The greater height of the arch or vault near the fire-place and that adopted for the outlet cause the flame to extend itself over the whole hearth, passing four or five centimetres above the ore, making in this manner its action more oxidizing: for it is well known that when the combustion is not perfect, the gases forming the flame have a reducing action that injures the going on of the roasting, a thing which does not happen with the current of hot air that interposes itself between the flame and the ore and the action of which is always oxidizing.

These furnaces are charged with 368 kilograms (about 800 pounds) which charge it seems to me, should not exceed 300 kilograms, in order that the layer of ore might be less thick, for the easier the operator can stir it, the more complete would be the action of the hot air upon all the ore. I have charged furnaces of those dimensions with 230 kilograms (about 500 pounds) and have obtained sufficiently satisfactory results.

Of the manner of charging and discharging the furnaces, of the rakes, shovels, etc., which are used, I shall not speak, because between those operations and utensils and those described in the treatises about working of ores, there does not exist any essential difference; I shall, however, speak of the manner of conducting the roasting, which is not at all equal to that used in the working of ores by the barrel process.

In order to commence the operation, first the hearths are heated, for which purpose the damper (slide) is closed, which for that purpose is on the chimney, also the doors, and the furnace is charged and lighted, generally at the end of six hours the furnace is hot. The charge is placed in the third compartment, which as I said before, is that nearest the chimney; the operator extends it well over the whole floor, using either the shovel or the rake. Once extended he leaves it without stirring that it may become warm, and at the end of half an hour he begins to stir it with the rake (hoe) in order to facilitate the escaping of humidity and uniform heating of the ore; some sulphur commences to escape; two hours after the charge was made, it is moved to the following or second hearth, which the operator performs with the shovel; on this hearth the heat is greater, the exhalation of sulphur stronger and the oxidation of it which converts it in sulphuric acid, becomes another source of heat, which united with that from the hearth, elevates the temperature of the ore to a light red heat. The escaping of the volatile substances separates the particles of the ore from one another, giving to the charge such a mobility that in very sulphurous ores the operator in moving the rake has no other resistance to overcome than that of moving the raking over the bare surface, which is of great advantage, as it is necessary to stir the ore a great deal, in order to expose all the particles to the contact of hot air and to produce a very uniform oxidation.

One hour and a half after placing the charge on this hearth, the temperature commences to lower and the furnace darkens, then eight or twelve per cent. (of the weight of the charge) of ground salt is mixed in and stirred with it as well as possible; half an hour after or two hours after placing the ore on this hearth, it is passed to the first and the fire replenished, that the temperature may again rise.

At this period of the reverberation the copper and iron are to a great extent converted into sulphates; but the same does not occur with the silver, for testing a small quantity of ore with boiling water, filtering, concentrating and testing the liquid with a solution of chloride of sodium, it hardly gives traces of silver, only forming a very light cloud of chloride of silver; but if the residuum is tried with nitric acid, filtered, washed and tried with the said chloride of sodium, then a precipitate of chloride of silver is obtained, the more abundant, the larger the quantity contained in the ore.

From the foregoing it follows that it is during the last period of reverberation when the silver changes into sulphate and this into chloride. Indeed, at the temperature which the ore reaches, the sulphates of copper and iron become decomposed and convert themselves into oxydes; the sea salt at the same temperature, does not only melt, but suffers also a commencement of decomposition which is indicated by the odor of the chlorine that escapes; this commencement of decomposition and the affinity of the iron and copper with the chlorine make the decomposition of the sulphates and the conversion of the metallic oxydes into chlorides more complete, principally at the present temperature, and as the chlorine is just forming. The sodium of chloride is transformed into soda, which combines itself with a part of the sulphuric acid from the sulphates. Another portion of this acid, the sulphide of silver imperfectly reduced, being present, oxydizes the silver, partly decomposing itself and combining the not decomposed part with the oxyde of silver; but as these reactions must take place almost simultaneously with those that result from the decomposition of the salt, it results that the sulphide of silver in presence of the former and of the sulphates of copper and iron, passes to the state of chloride almost as fast as these sulphates are decomposed. In fact, through the reverberation the sulphides of iron, copper and silver are converted into chlorides, a part of the salt into sulphate and the rest remains in its natural state.

While these reactions take place, the ore puffs up, augments considerably in size, tends to agglomerate, and all that which is outside of the bridge, forms half melted clots; in order to avoid this, which causes loss, the operator has to move constantly the mass of ore, changing strongly with the shovel that from the bridge to the opposite side and vice versa. It is an operation which it is necessary to watch a great deal, because the agglomeration of the ore makes the work of the operator quite fatiguing, and there are few who do it with a good will. Shortly after the commencement of this last period the flame begins to take a green color, if the ore contains much copper and a penetrating odor is exhaled containing more or less sulpuric acid; at the close of it the flame is of a violet blue, and the odor of the acid is replaced by characteristics of chlorine and the color of the ore darkens, varying between tiger-gray and iron-black, according to the kind of metal, whose color, in every metal, forms the surest characteristic with practical men as to the end of the operation, which concludes two hours after placing the ore upon the first hearth.

The operation being over the hearth is discharged, the metal of the second passed to the first hearth, that of the second receives the metal of the third and this latter is fed anew.

So then, the reverberation lasts six hours, and ten operations may be made in twenty-four hours, supposing that the work is kept up.

Six men are employed, three during the day and three during the night, each are serving on each of the compartments of the hearth. On an average according to the condition of the wood, sixteen cargas (burro loads) of dry or twenty of green wood are used, the former weighing five arrobas (one arroba twenty-five pounds) and the latter from five and a half to five and four fifths arrobas. When the ores do not contain a sufficient quantity of sulphur, pyrites or sulphates of copper or iron are added.

After the ore is reverberated it passes into vats or boxes in order to undergo the other operations, but before I speak of them I shall make a few observations of several things that came under my notice.

I have said before that amongst the metals in Sonora, lead abounds, and arsenic, antimony and zinc are not scarce.

The sulphuret of lead which is equimorphous with that of silver, contains this compound in very variable quantities; when the galena or sulphuret of lead passes into the state of sulphate through reverberation, the silver it contains passes with it to the same state, and as the sulphate of lead is insoluble, the silver escapes during the subsequent reactions and is thus lost. The quantity which converts itself into chloride during the reverberation is small, as is easily shown by reverberating silver bearing galena with salt, testing the reverberated ore with hot water, filtering and testing the latter with iodide of potash, or another of the reactives which indicate its presence in the dissolutions.

The arsenic mechanically helps towards the loss of silver, for as the arsenic acid is tolerably volitile it carries away silver with it, which remains deposited in the chambers of condensation, it being known that more silver is left in these deposits made by arsenical ores. Some intelligent men maintain that the arsenic is pernicious in the process, because it forms with the silver insoluble arseniatum of silver; but perhaps they did not recollect that the arsenical acid decomposes itself with the dark red heat and converts itself into arsenical acid, and that therefore its formation during the reverberation is not probable. Antimony acts in a similar way to arsenic.

Great care must be taken to avoid the formation of clots, as the metal which remains in their inside escapes the reactions which is the object of reverberation and a loss of silver is thus caused. These clots must be separated, ground, mixed with two or three per cent. of salt and reverberated again with the ore placed on the first hearth.

III.

Preparation of the hyposulphite of lime and sulphide of calcium, used to dissolve the chloride of silver and then to precipitate the silver in the state of sulphide.

As I have before indicated in process used by Patera, it is advised to dissolve the chloride of silver with hyposulphite of soda; but as it is easier to procure hyposulphate of lime, and this is also cheaper, preference was given to the latter dissolvent which furthermore is as energetic as that of soda.

As is known, the preparation of hyposulphates is effected by converting first the metal that is to serve as base into sulphide and boiling then the sulphide with sulphur. The process used for the preparation of hyposulphite of lime is different. For a space of four hours boil one part of lime with one third its weight of powdered sulphur and four parts of clean water; the lime converts itself into hyposulphite of lime and into sulphide of calcium.

This mass is then treated with a solution of sulphate or chloride of copper; the copper is precipitated into the state of a sulphide and the lime remains dissolved in the state of hyposulphite. But it is necessary to take care not to put in an insufficient quantity of sulphate for the complete decomposition of the sulphide of calcium, for whatever quantity of this compound might remain in the dissolution of the hyposulphite would convert the chloride of silver into sulphide of silver and would naturally cause loss; the same would occur by using chloride of copper; but with the sulphate there is still another reason of loss which consists in the sulphate of lime being insoluble, while more sulphate of copper is used in a larger quantity of hyposulphate being decomposed, and although through the change of elements hyposulphite of copper would be formed, that would not have upon the chloride of silver the same dissolving power as that of the alcalinic or alcalic—terreous metals. The chloride of copper does not in this injure the operation in the least, but as it is of considerable value, it is better not to use it to excess.

IV.

LIXIVIATION. (LEACHING.)

The reverberated metal is placed into the leaching boxes, whose dimensions are according to the quantity of metal to be worked at a time. These tubs or boxes, which are generally made of pine wood, have a double bottom, and upon the upper bottom which is a wooden sieve, a coarse cloth of wool and cotton is placed which serves to retain the ore.

After the ore is placed in these boxes, it is washed with hot water, which dissolves the sulphate and chlorides of copper and iron as well as the other soluble substances that the ore may contain. The faucet, with which the lower bottom is provided, is then opened, and the water is allowed to run out into pans, where evaporating, the salts are chrystalized or thrown away. The operation of washing lasts from five to six hours. Then the ore is covered with the solution of hyposulphite of lime, which is generally kept in a depository placed higher than the box which contains the ore, it is left to digest for sometime; and then the faucet is opened, which conducts the liquid charged with chloride of silver, to the box or depository in which the precipitation of the silver is to take place. The filtration of the liquid lasts from one to two days, according to the kind of metal and also according to whether it is reduced to more or less fine powder. In some establishments they content themselves with this one washing; but the best is to place two or three leaching boxes, one above the other, and let the liquid of the first pass to the second, charged with ore like the other, and so on to the third; for in this manner and passing three new solutions of hyposulphite, one will be more sure that the last will have dissolved all the silver that the ore contained; which, by the way, may be ascertained by gathering in a glass a little of the liquid which comes through the faucet and testing it with sulphide of calcium; it will give a characteristic black precipitate if the dissolving liquid still contains silver. At the commencement of the operation the three boxes are charged and the ore of the uppermost, after three washings, is taken away and replaced by that of the second one, into which that of the first is placed and so on. Two advantages are thus obtained: The economy of the hyposulphite and the certainty of extracting all the silver contained in the ore.

From the last box the dissolving liquid is directed to the tubs, also of wood, in which the precipitation is made, for which purpose the apparatus is so disposed that, if one tub is full, the liquid of the last leaching box can be passed to the next tub. If the first tub is filled as much as desired, the same leaching is then gradually added that was used for the formation of the hyposulphate of lime before adding to it the sulphate of copper; the silver then precipitates itself into the state of sulphide in the same manner as the copper did.

In order not to guess and to make the operations with more certainty, measure in a vessel of known capacity a quantity of the liquid which contains the dissolved chloride, and measure also the quantity of solution of sulphur necessary to precipitate the silver which it contains, and as the capacity of the tub is known, it is easily calculated how much of the precipitating agent may be needed. As this operation is not performed with the same precision which is fixed by the alcalimatric analysis, take in a glass, after having placed all the precipitating matter, or when a little still remains to be added, some of the liquid which the tub contains, let it stand a moment, add a few drops of solution of sulphur, and if it gives a precipitation or turns black, it is because there is still some unprecipitating matter to be added, until after repeated tests no more precipitate is found nor any more darkening of the liquid occurs. When enough precipitating matter has been put in, which may be ascertained by adding solution of chloride of silver to the liquid taken from the tub, if no reaction is produced in the sulphur, which in case of containing an excess of sulphide of calcium, will also give the precipitate of sulphur or turn black; then add little by little solution of chloride of silver of that which comes from the boxes, until it no longer precipitates. That is done with the object of making again use of the original waters as dissolvers, having separated the sulphur from the silver, for if no hyposulphite of lime would remain in them and they should be used, the silver would be lost in the first box and become sulphide of silver.

In order to ascertain that no excess of precipitating matter has been used, the solution of another metal whose sulphur is black, may serve; for instance that of the copper which served for the preparation of hyposulphite, or that of acetate of lead, or another.

When the precipitation is finished the contents of the tub are allowed to stand that the sulphide of silver may settle, which will take place in a short time. Once settled, the liquid which covers the precipitated metal is taken out and carried to the depository, whence it is taken to the first box. The sulphur is separated, placed in a canvass bag that it may drain off, then it is pressed in a screw press made with two planks or in anyother best adapted manner; then it is placed in a small reverberating furnace, the reverberation is carried on with very moderate fire, that the sulphide of silver may not melt without being decomposed; two hours to two hours and a half are generally needed to reduce the sulphur and bring forth the silver in the metallic state.

Having taken the silver from the furnace, it is melted either in vases or reverberating furnaces or in crucibles; in either case it is well to stir it with an iron rake, which deprives it of the sulphur that may still remain, converting itself into sulphide of iron, forming a black crust; or else so as not to uncover the crucible, some pieces of metallic iron are put in together with the silver. What quantity to put in experience teaches. The silver is emptied into moulds.

THE Indians in Indian Territory this year have harvested six million bushels of wheat. Result of bad management.