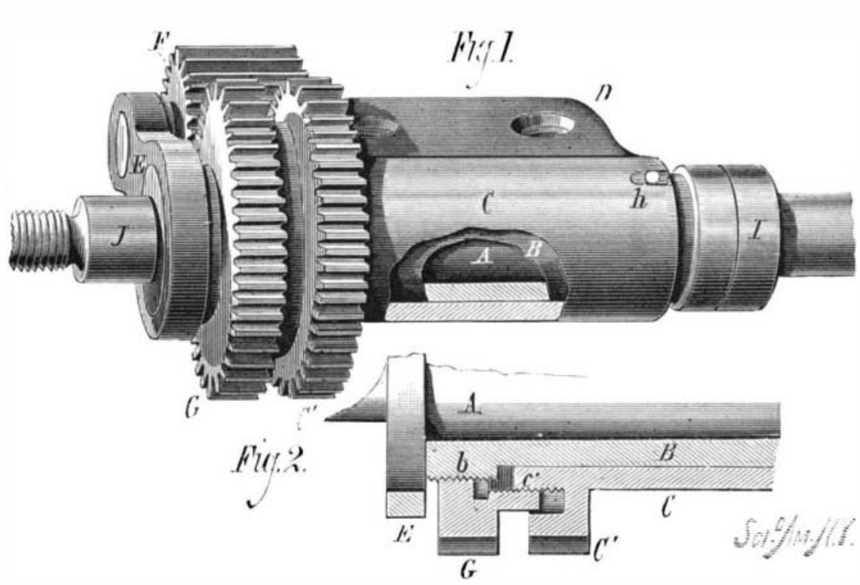
METHOD OF CORRECTING A LEADING SCREW.

BY JOSHUA ROSE, M.E.

It was recently required, when cutting a new screw at the Pratt & Whitney Company's works, to correct the error in the lead screw of the lathe in which the new one was to be cut. This was accomplished by employing the device shown in our engravings, and which was designed by Mr. A. Swasey. It was first ascertained by testing the lathe that its lead screw was too short by $\frac{7}{100}$ of a revolution in a length of 2 feet, the pitch of its thread being 6 to an inch. Now in 2 feet of the screw there would be 144 threads, and since $\frac{7}{100}$ (the part of a revolution the thread was too short) $\times \frac{1}{6}$ (the pitch of the thread) $= \frac{7}{600}$ (which was called $\frac{1}{85}$), the error amounted to $\frac{1}{85}$ inch in 144 turns of the screw. The construction of the device employed to correct this error is as follows: In Figs. 1 and 2, A represents the bearing of the feed screw of the lathe, and B *b* a sleeve, a sliding fit upon A, prevented from revolving by the pin, *h*, while still having liberty to move endways. C represents a casing affording journal bearing to B *b*, having a fixed gear wheel at its end, *c'*, and an external thread upon a hub at that end. D is the flange of C to fasten the device to the shears of the latter, being held by screws. E represents an arm fast upon the collar of the feed screw, and carrying the pinion, F, the latter being in gear with the pinion, C', and also with G, which is a pinion containing two internal threads, one fitting to B at *b*, Fig. 2, and the other fitting to C at *c'*, Fig. 2, the former having a pitch of 27 threads to an inch, the latter a pitch of 25 to an inch.

The operation is as follows: The ordinary change wheels are connected to the feed screw, or lead screw, as it is sometimes termed, at J in the usual manner. The arm, E, being fast to the feed screw will revolve with it, and cause the pinion, F, to revolve around the stationary gear wheel, C'. F also gears with G. Now F is of 12 diametrical pitch and contains 26 teeth, C' is of 12 diametrical pitch and contains 37 teeth, and G is of 12 diametrical pitch and contains 36 teeth. It follows that the pinion, F, while moving around the fixed gear, C', will revolve the pinion, G (which acts as a nut), to an amount depending upon the difference in the number of its teeth and those of fixed gear, C' (in this case as 36 is to 37), and upon the difference in the pitches of the two threads, so that at each revolution G will move the feed screw ahead of the speed imparted by the change gears, the end of the sleeve, B, abutting against the collar, I, of the feed screw to move it forward.

In this case there are 36 turns of the feed screw, A, for one turn of the nut pinion, G, the thread on sleeve, B, being 27, and that on the hub of C being 25 to the inch; hence, 36 turns of the feed screw gives an end motion to the sleeve, B, of $\frac{1}{25}$ minus $\frac{1}{27} = \frac{2}{675}$, and $\frac{1}{36}$ of that $= \frac{1}{12150}$ of an inch = the amount of sliding motion of the sleeve, *b*, for each revolution of the lathe feed screw. By varying the proportions between the number of teeth in C' and G and the pitches of the two threads in a proper and suitable ratio, the device enables the cutting of a true thread from any untrue one in which the variation is regular.



DEVICE FOR CORRECTING A LEADING SCREW.

About Sugar.

Strawberries contain 5·86 per cent of their weight of glucose, cherries 10, white currants 6·40, and hothouse grapes 18·37; pineapples, on the other hand, contain 11·33 per cent of cane sugar, apricots 6, and oranges 4. The sugar cane, when perfectly ripe, contains 18 per cent of sugar. The juice of the sugar beet contains about 14 per cent of sugar. In Havana we learn that there is one cane factory capable of producing 125 tons of sugar per diem. In many factories the use of blood is now entirely dispensed with, though great care is required in the management of the filtration.

FIREWORK MAKING.

This art is, if not really a secret one, very little known to the general public, owing to the danger attending the manufacture, which prevents casual visitors inquiring, and to the nature of the product, which offers no inducements to the analyst.

In calling special attention to pyrotechny as an art well worth cultivating, even although apparently an expensive luxury, we desire to laud the wondrous æsthetic effects of light and color, rather than the mere detonations calculated to impress the savage or the uncultured.

It is a matter of great regret that the results of the pyrotechnist's art are so evanescent, not even ephemeral, but almost instantly vanishing. The stately rocket and its comet-like tail of soft fire, the fiercely hissing gerb, the detonating bomb, and the fountains and myriad devices delighting with swift surprises in coruscation, steady glow, flashing, gleaming, and waning—all minister to our sense of the beautiful, and are well calculated to arouse and to maintain enthusiasm in the cause in which they are offered in honor.

It is our purpose to approach within the precincts, and analyze the modes by which all these effects are produced. It must be premised that the manufacture is dangerous to all concerned in it, principally from the liability to accidents caused by careless strangers. Hence it is secluded and shrouded in mystery. The operatives should be well separated by open space to prevent a petty accident causing a general disaster. There are few, if any, complicated or costly machines. Tables and vises, pans and sieves, pastepots and twine, and a stove, compose the principal "plant."

Nearly all fireworks require paper cases—made of pasted strips rolled around a wooden mandrel. These cases are filled with "compositions" made of "meal powder" (that is, ungrained gunpowder) mixed with various ingredients.

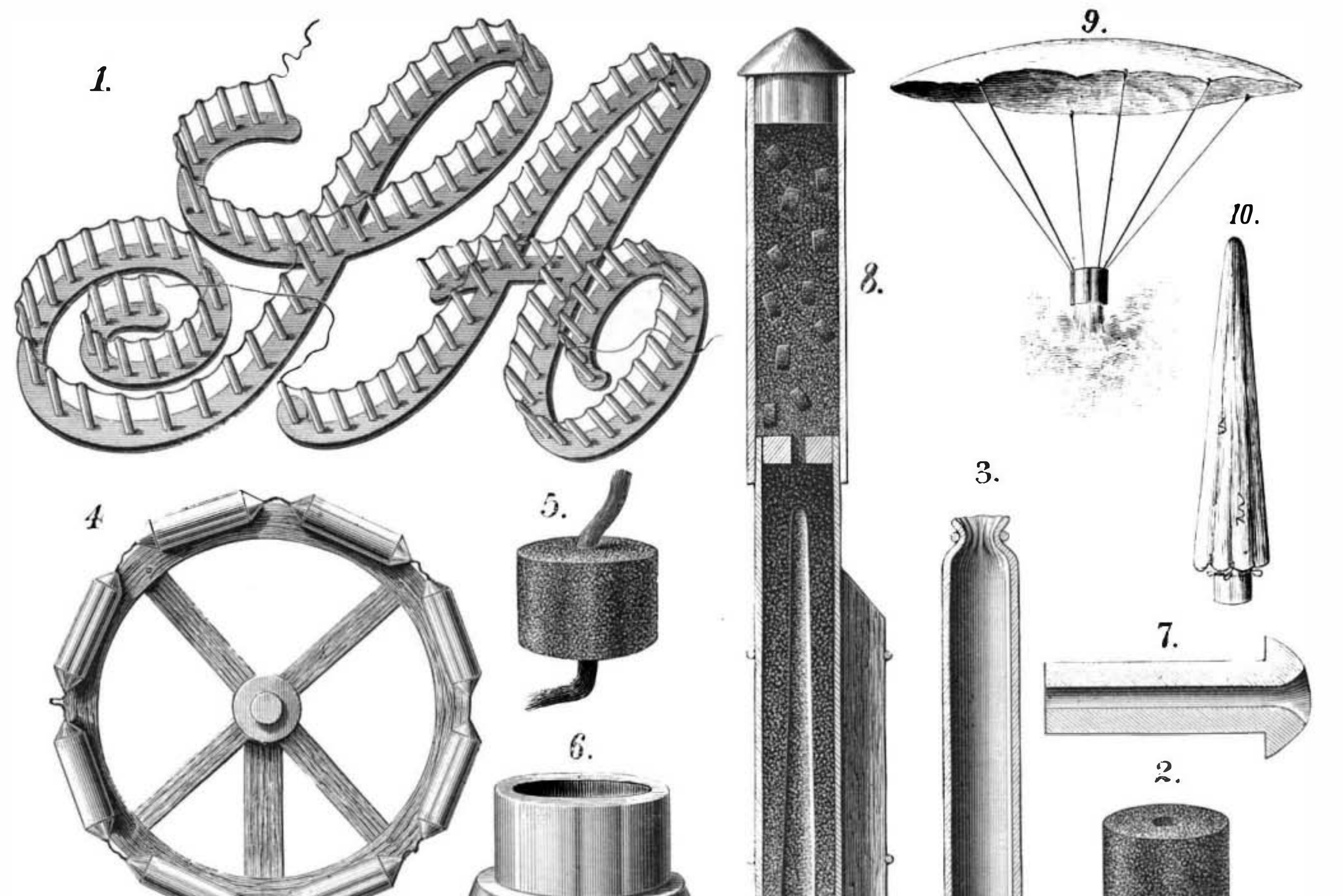
In some "pieces" there is required "force;" in others, color. In the rocket force is most needed; in the Bengal light, color. Roman candles need force and color alternately. For all, the cases need to be light and strong, and it is desirable to have the powder burn as long as possible.

The meal powder is made of sulphur, niter, and charcoal. With this are mixed, according to the result desired, filings of cast and wrought iron, steel, copper, and zinc; dust of camphor, rosin, or lycopodium. To get the brightest red and white sparks, long iron filings free from rust are needed; for brilliant fire with radiations or coruscations, steel filings and cast iron borings. Green flames are given by copper; pale green, by verdigris; palm green, by blue vitriol (sulphate of copper) and by sal ammoniac. Blue is given by zinc; better blue, but with more smoke, by sulphuret of antimony. Yellow comes from amber or rosin, or dry salt. Lampblack makes gunpowder flame red, which an excess of niter tones down to pink. Camphor is used to give an intense white flame; also to give aromatic odors, as do benzoin and storax. Lycopodium gives magnificent rose-colored flames. Hundreds of formulas are given in Spon's "Workshop Recipes" and other works.

The simplest element in pyrotechny is the small paper case called a "lance," used by hundreds in "set pieces." Lance are quills or thin tubes (say 5 inches long) of about ¼ inch bore, and tightly rammed with a color composition. These are closely fixed perpendicularly to frames of desired outline, and their outer ends connected by a quick match so that all burn at once. They should burn about two minutes. The sketch, Fig. 1, shows how a "set piece" would be made.

The large Bengal light case should not burn; and is rammed with color composition. The Roman candle case is thicker and still stronger. It is packed with alternate layers of color, "stars," and projecting compound; the design being to burn with color, and then to shoot out a star which shall burn in the air while more color is burning at the case. The American star, Fig. 2, is a hard dry wad of coloring composition about half an inch each way, and pierced so as to burn inside and out. The English makers make their stars of short thin paper cases, open at each end; or if desired to be changeable, open at one end only, and rammed with two layers of color composition. The star rests on a layer of projecting powder, which sends it out and lights it at the same time.

The gerb, Fig. 3, is a thick strong case, packed with projecting composition. It is "choked" at one end, so as to give a smooth small outlet for the gases, and thus give them more force. Gerbs are fixed tangentially on a free wheel, Fig. 4, which their combustion causes to rotate. The "choke" is effected when the case is wet, by making one turn of a strong cord near the mouth, and pulling strongly.



DETAILS OF FIREWORKS.

The "bomb," which is a magnificent and effective sound and color piece, very expensive, is a hollow sphere of zinc or paper (made in halves and pasted together with muslin), filled with stars just like those for Roman candles and rockets, save that each has a fuse extending through it, Fig. 5. A small quantity of gunpowder among the stars causes the shell to burst and lights the scattering stars. The bomb is fired either from an iron mortar or off a "block," Fig. 6, which is a wooden breech on which a temporary paper barrel is put. There is a "dish" in the top, a little powder is laid in this, the bomb on this, the paper barrel slid over the bomb, and the charge fired. A

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time fuse, Fig. 7, page 373, in the shell, explodes it at the proper point in its flight. A 3 inch shell contains 48 stars; 6 inch, 432; 8 inch, 1,674; 10 inch, 3,150; 12 inch, about 5,000!

A rocket, Fig. 8, is at once a highly scientific device and a work of art. It must be light, strong, steady, and high soaring; and it is sometimes demanded that it explode and liberate stars, or a parachute with a pot of colored fire. The conical cap is of no use, being merely a commercial "finish." There is a hard, thick, well choked paper case, rammed tight with projectile composition, but having a central conical bore left, so that the composition burns along the whole length of this bore, and most freely toward the end of its flight. If it be intended to explode at the end, there is a compartment filled with explosive powder, and with stars if desired, a pierced clay wad separating this from the regular filling.

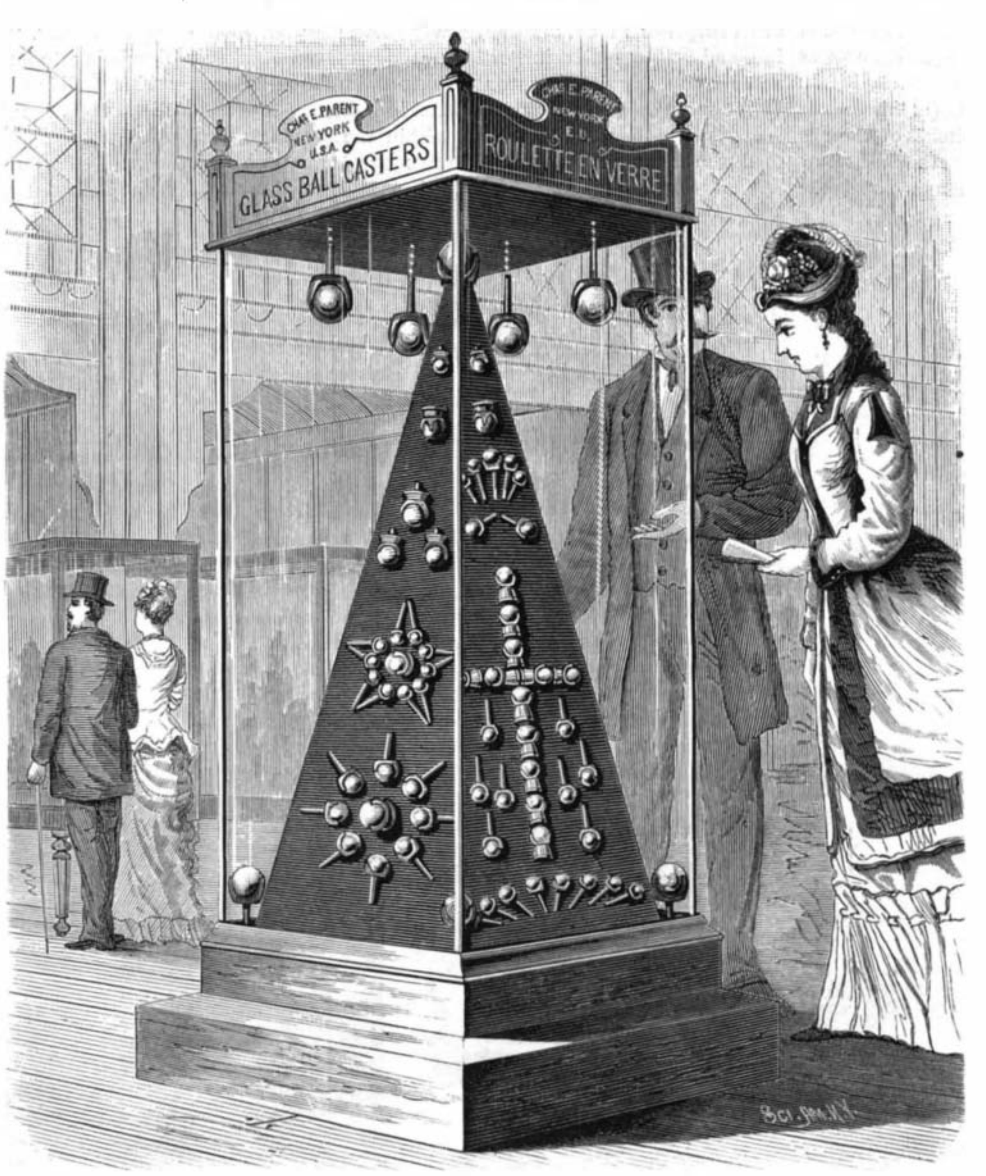
The "parachute," Figs. 9 and 10, is a muslin circle, having suspended from it a "fire-pot," which is lighted when the rocket explodes and the parachute is set free. The rocket stick is merely to balance and guide it. Rockets are used for throwing life lines to wrecks, and recently for carrying charges of gun cotton up into the air so as to explode over any locality where it is intended to give a warning. Some strong rockets can soar nearly a mile in height.

A tourbillion is a case filled with projectile compound, and having its lower and lighted end pierced with spirally inclined vent holes, which cause it to ascend and revolve.

While at first thought a pyrotechnic display appears to be a very expensive luxury, it must be remembered that by no other means can an immense concourse be pleased, and that a display costing even $10,000, if witnessed by say 250,000 people, figures up to but four cents a head for two hours' varied and unceasing enjoyment.

THE GLASS BALL CASTER.

The illustration herewith presented represents the tasteful exhibit at the Paris Exposition of the Adgate Glass Ball Caster, an exceedingly ingenious contrivance which offers many advantages over the roller caster in common use. The construction of the device embodies little that is not seen at a glance. A glass ball, of size varied according to the weight of the article of furniture to be supported, is held in claws which are cast upon a shank, which last either slips into the leg of the piano or other object, or is attached to it by screws. The mode of attachment, in fact, is the same as with the ordinary caster. As of course the ball touches the inner sides of the claws only at points, at these places metal projections are provided, and directly under the shank is inserted a piece of bone, as shown in the small engraving. This reduces the friction between the ball and its holder.



THE ADGATE GLASS BALL CASTER.

The chief points of merit of this caster are its strength and remarkable ease of motion. When supported on roller casters a heavy piece of furniture when pushed usually moves in any direction but the one desired. With this caster the object is at once caused to travel as desired. The weight being placed directly above the ball, no leverage is exerted as in the case of the roller caster to twist off arms or break the shank. The ball being perfectly smooth leaves no mark on the softest carpet, nor can it become jammed so as not to roll. The friction between ball and carpet is thus very small and the wear of the latter reduced to almost nothing. For pianos, we are informed, this caster has proved especially suitable not merely in rendering them more easily handled, but, according to the testimony of Mr. S. B. Mills and other well known performers, it very greatly improves the tone of the instrument. Patented April 2, 1878.

For further particulars address the manufacturer, Mr. Charles E. Parent, 96 John street, New York city.

Firing Guns under Water.

Dr. H. A. Mott, of this city, has recently conducted a series of interesting experiments on the range of small arms when fired under water, his object being to determine whether this mode of testing could be used instead of the usual practice of firing the weapon in the air. He finds that the United States Army rifle is capable of projecting a bullet through water for a distance of 4 feet $1\frac{1}{16}$ inch, which corresponds to an air range of 3182·54 feet. The travel of a bullet one quarter inch under water is equivalent to a flight of 16 feet in the air.

Dr. Mott concludes that by this mode of investigation range and penetration can be arrived at with the greatest precision, and by the same means can be determined the value of the numerous gunpowders in the market in point of maximum and minimum effect, the best weight of bullet for a given weight of powder, and the best length of barrel and size of bore for a given weight of powder and bullet. All these observations can be carried on in a room less than 10 feet square. Dr. Mott's report of his investigation, with tables, etc., will be found in full in SCIENTIFIC AMERICAN SUPPLEMENT, No. 127.

Oleomargarine Under the Microscope.

Mr. Thomas Taylor, the microscopist of the Department of Agriculture, at Washington, has been examining under the microscope and comparing different specimens of butter obtained in the markets of that city, with the view of determining the difference between pure butter and that made from oleomargarine, or butter made by churning fat with cream. He finds that, when viewed under the microscope, pure dairy butter presents a uniform appearance as far as color is concerned. The forms seen consist of oil globules and the crystals of common salt. When viewed by polarized light very little change of color is observed; but when a specimen of oleomargarine is examined in the same manner, the field is speckled all over with shining particles which change color with every quarter turn of the analyzer, and Mr. Taylor has demonstrated that these glistening points consist of crystallized fat. In using a power of about 250 diameters, animal tissue is also seen more or less over the whole field, and a thin sheet of the fat placed under a power of about 75 diameters exhibits the polarized light beautifully, each solid fat cell showing all the colors of the rainbow; and on turning the analyzer or polarizer the changing complementary colors are exhibited. The process of grinding the fat by means of rollers destroys the solid crystalline cell contents; but the glistening appearance remains the same under polarized light, only subdivided, as a natural consequence.

THE GLASS BALL CASTER.

One specimen of the oleomargarine butter examined by Mr. Taylor was highly charged with animal tissue and the urate of magnesia, the crystals of which were well defined, showing that the fat used in this case was impure and probably that of a diseased animal, which would seem to prove that the assertions made by the oleomargarine manufacturers as to the perfect purity of the fats used by them are not altogether correct.

From this it would appear that oleomargarine may be easily known from butter by the aid of the microscope, and that any impurities in the fats of which it is composed may be readily detected; and that it would pay large consumers of butter to microscopically examine their purchases so as to be certain of the quality or purity of the article they buy for butter.

THE INDUSTRIAL WEST.

With the oversupply of labor and capital in the East it is natural to look to the great teeming West for an outlet for the surplus labor and for the employment of capital in great enterprises and achievements. The "West," that is, the great basin east of the Rocky Mountains and west of the Alleghanies, holds a variety of resource and offers an opportunity for industrial employment not elsewhere found in the world.

Bound by ties of blood in a common brotherhood, connected by the iron pathways, and associated in trade and commerce, and political and social emulation, the East looks westward for her provisions and raw material, and for a market for her surplus and the employment of her overflow. How far is the world justified in its expectations of the West, and how much of hope is there of its industrial future?

The West has just felt the full force of the wave of disruption and disaster which followed the period of inflation succeeding the war. Not until within the past six months has the foreclosing of inevitable results fallen in its full effects upon the industries of the central western country. Some premonitions the West had from time to time in the disasters east of the Alleghanies, and the long shadows those troubles cast westward; but the disruption and disturbance of all fixed foundations and prospects have but come while the East is settling up old scores and reawakening to industrial prosperity. In the past six months the great iron works of the West have felt the force of the slackened demand for their products, and the heavy decline of the price of goods consequent upon the lower scale of manufacture and the almost bankrupt disposal of material. The great shops which are not idle are too nearly so to allow of profit, and to keep the plant in operation so as to avoid the loss of rust and waste in idleness is about the only effort. This is not the condition in a few instances, but in all the West beyond Pittsburg. The large shops at Chicago and vicinity, at Indianapolis, Cincinnati, and Cleveland, and especially at St. Louis, are idle or but partially in operation. In Chicago and St. Louis the suspension or winding up of more than half the banking institutions shows the pressure the country has had to meet.

Nor are the iron works the only ones. Every industry in the Mississippi basin has had its share of the disaster. That the wave of difficulty is over is more than probable, for there is no fuel upon which the element can feed; it has spent itself, and the tide of recuperation is slowly at work. The foundation upon which the future prosperity of the West is to be built is about all there is existing; but the foundation is firm, and the dear school of experience has been passed through, and the people have the knowledge and hold it worth all it so painfully cost.

What is to be the future of the West, and upon what basis of enterprise and achievement their prosperity is to be builded, can be only partially intimated. The first principle is the value to be derived from and the dependence to be placed upon her broad, unobstructed agricultural advantages. No other nation or locality has such resources and advantageous opportunities to begin with, and we are satisfied that the leaven of scientific cultivation now slowly working is soon to produce astonishing results in the great West. Not one half the fertile land of Ohio, Indiana, and Illinois is yet under cultivation, while but half the returns from the soil are received of which the land is capable. More labor will soon be given to ten acres than one hundred now receive, and the profits will be proportionately high.

Next after the agriculture the mineral resources of the West will yet be scientifically developed, and that to a proportionate profit. All other things upon the earth and in and under it are for the service of the farmer's pursuit, and in no part of the world is it so apparent as in the central Western States. No people can have more than they produce, and we are satisfied that no part of the world will take more interest or more pride in the development of their home resources to their utmost than the West. We are satisfied, too, that the central West is to be the great inland industrial empire of the world.

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