

PERUVIAN ANTIQUITIES.

The plateau of Ancon, in Peru, is an arid table land overlooking the sea coast and situated about 12 miles northwest of Lima. It is the location of a vast sepulchre, dating back to the earliest historical periods. Owing to the dryness of the air and the impregnation of the soil with salts, the contents of the tombs are finely preserved; and, as was apparent from the collection of mummies exhibited at the Centennial, even the lapse of ages has not determined the disappearance of either skin or hair. Fabrics, wooden vessels, and food have been found in the tombs in perfect condition: and as it was the custom of the ancient people to inter with their dead their choicest ornaments and objects of utility, a rich treasure is now open to antiquarians, from which it is possible to determine the habits and manner of life of the Peruvians during the period prior to the Spanish conquest.

A collection of these relics now exists in Paris, at the Musée de St. Germain, and is to form a portion of a still larger gathering relative to ancient life in America, which is to be exhibited at the French Exposition of 1878. Several of the more interesting objects are represented in the annexed engravings, for which we are indebted to *La Nature*.

There was recently exposed for sale in this city a collection of Peruvian remains, which were sold at ridiculously low prices. The condition of the objects was scarcely such as to tempt the collector of bric-a-brac, however interesting they might have been to the antiquarian; but despite the prevalent dilapidation, we noted, on examining the articles, the remarkable state of preservation of the woven fabrics—a circumstance which our contemporary also considers the most phenomenal feature in the fine French collection; not only is the tissue intact—as our engravings indicate—but the colors have kept their primitive brilliancy, and this although the fabrics seem but rough specimens of woolen weaving. The designs are always either fantastic or combinations of geometrical figures. Grotesque representations of animals are frequently introduced, as witness the remarkable cubical birds and the geometrical cats shown in Fig. 1. The man represented is an astonishing figure: and it will be noticed that he is provided with but four toes or fingers on the respective limbs. This is an invariable peculiarity in the pictures of the ancient artists of the country, which has not yet been accounted for. On the right of the engraving are two birds, which look like geese or swans, and which, strange to say, closely resemble the birds of like species represented on ancient Etruscan vases. We can commend these designs to those who are searching for new grotesqueries for Eastlake rugs. Mr. Eastlake suggests figures of animals not accurately drawn but possessing character, and these certainly answer the requirements.

Besides manufactured fabrics, distaffs and spindles, used for spinning the cotton or llama wool yarn, of which they are woven, have been found. The spindles, F, Fig. 2, are often ornamented with pearls and are gaily painted. Hanks of yarn and hand looms, the latter roughly made of sticks, have been exhumed, and even pins and needles. The pins are simply long thorns, the thick portion at the point of junction with the branch serving as the head. The needles are the same, having a hole for the thread.

In Fig. 2 are represented a number of other curious articles. D is a wooden spoon with carved handle; A is a llama in pottery; and B a terra cotta statuette of a woman; G and E are pendants in mother-of-pearl and ebony. H is an ivory ornament; and C is a red earthen vase representing a man seated.

Not only are objects of metal and wood found in the tombs, but some beautiful specimens of glassware have been obtained. The glass is perfectly clear; and as there is no evidence that the people possessed the material for making it, it would follow that it was imported; but whence, it is impossible to tell. The glass vase represented in Fig. 1 is of light blue color, ornamented with opaque white glass, which bears the traces of gilding. The ornamentation bears no resemblance to that commonly employed by the Peruvians, and thus another proof is added of its foreign origin. The handle and the neck were made separately, and fastened on afterwards in a manner which shows

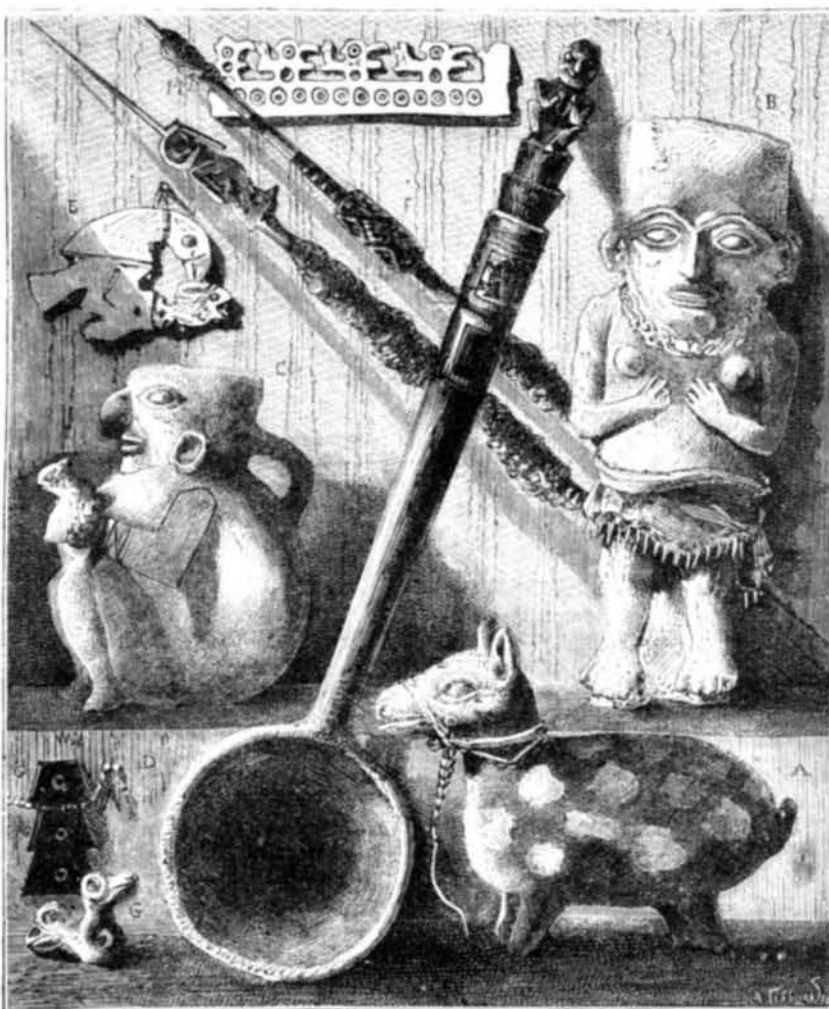
superior skill on the part of the workman. The neck is ornamented with a kind of griffin's head, which has no resemblance to any animal indigenous in Peru. It is supposed to have been brought from Asia, as it is believed that the Japanese and Chinese knew of the New World and maintained commerce with the inhabitant long before the discov-



PERUVIAN ANTIQUITIES, MUSEE DE ST. GERMAIN, PARIS.—Fig. 1.

ery by Europeans. But the decoration is not Oriental, but strictly Spanish; and hence the more probable assumption is that the object was brought into the country by the Spaniards in the 16th century, and hence that the Ancon sepulchres were in use at that period.

NEW GUANO DEPOSITS.—An English commission, sent to examine some recently discovered guano deposits to the south of Tarapaca, in Peru, has confirmed the reports of previous explorers as to the immense quantity of the deposit, amounting to at least 10,000,000 tons; and it is richer in ammonia and phosphates than that of the Chincha Islands.



PERUVIAN ANTIQUITIES, MUSEE DE ST. GERMAIN, PARIS.—Fig. 2.

Photographing Machinery.

It is a common practice with large manufacturers of machinery in this country and in England to have photographs taken of their products, especially of any new class of machine, to send to customers. For producing good photographs of this kind, the *British Journal of Photography* makes the following suggestions:

To execute this class of work successfully, every contingency must be provided against—not alone in the direction of chemicals, but in apparatus equally as well. A swing-back camera is indispensable. It frequently happens that the object to be photographed is in such close proximity to the camera itself—some portions of it lying in a plane oblique to that of the camera back—that accurate focusing can only be thus obtained, unless a stop of such diminished aperture be made use of that the exposure becomes so long as to introduce too many elements of non-success. Again: the usefulness of a swing-back will be seen when an object of regular form lies on the ground close to the camera, which latter has to be tilted to get the object in the field of view at all. Here a swing of the back—the top outwards—prevents all want of truth in the perpendiculars, and there will be no fear of the result representing a truly constructed machine with sloping sides and irregular contour.

For the successful prosecution of this class of work a good selection of lenses is necessary. The size of the picture required is generally fixed upon beforehand; and as the standpoint is often of limited area, if not absolutely fixed, there are not afforded the opportunities that landscapists enjoy in the selection of their point of view. The lenses, it must be remembered, should be chosen for their focus—not from their being wide or narrow-angled, quick, or slow. Let the latter qualities, of course, govern one in deciding; but the focus of the various lenses should so rise, step by step, that, wherever the point of view may be chosen or fixed upon, one lens may be found among the series which will take the picture the required size. The lens selected, the diaphragm used should be the largest it is possible to employ with the aid of a swing-back.

It will frequently happen that the object to be photographed lies at one end of a dark workshop. It would, then, be greatly conducive to rapidity and excellence of results if it could be brought forward, perhaps, into the open air; for it very commonly happens that the windows or skylights which illuminate such places are covered over with a fuliginous deposit, which seems to rob the light which passes through them of every particle of actinic power.

At this point it will be well to mention a very useful wrinkle. It will be impossible to get a very satisfactory picture of an iron casting, or, indeed, any metallic object which is not finely polished, unless it be purposely painted beforehand in a special manner—that is, with turpentine flattening—a light slate color being the tone most advisable, as its photographic value can be seen at a glance, without the chance of miscalculation which a green or a brown, for instance, might offer. This will be found to be a matter whose usefulness cannot be too highly valued. The contrast between a machine, no matter how excellently photographed, which has not been specially painted and the same subject with a coating of the flattening, will be so great that no one who has once seen the two would think of photographing an unpainted piece of ironwork if he could possibly avoid it. There is one precaution to be taken in laying the color on which, though it is more especially the painter's province to look after, may be pointed out here: it is that it should be made with so little oil or gold size that it will not dry patchy or cloudy—that is, with some parts dead and some bright. The effect then produced would be worse than if the machine had remained untouched.

During the exposure care must be taken that no workmen are allowed to lounge about and smoke; for it is remarkable what a small amount of smoke will suffice to fog a picture if it blow across the field of view, this being due, no doubt, to the highly actinic quality of the light reflected from the minute particles composing the smoke. We once had an otherwise excellent negative ruined through a similar cause, but from another source. The wind was strong, and carried a puff

of smoke from a neighboring office chimney right into the open doorway of the room in which we were photographing; it permeated the whole atmosphere of the place, and rendered it impossible to secure a clear negative, though at the moment the occurrence was not noticed.

When the negative is obtained, it will generally be found that the background will be required to be eliminated, plain white paper being generally preferred by manufacturers to show off the peculiarities and excellences of their machines, there being no chance of confusing their details with those of the surrounding machinery in the background. To stop out all these and leave a white background, we have tried a multitude of expedients, but find no plan better than to make an edging of about half an inch by means of Bates' black varnish, carefully following the outlines of the machine as accurately as possible, and then placing a paper mask to block out the whole of the ground left outside this edging. This plan reduces the risk of cracking from the black varnish, and is at the same time more expeditious. We have tried Indian ink, gamboge, and water colors *ad libitum*; but we find it most difficult to obtain the requisite body to stop out all the light, so as to avoid any stain or streak.

We trust that the few points that we have touched upon may tend to render this class of work easier to those intending to try it, and we advise all, from a pecuniary standpoint, to do so when the occasion offers; for it is certain that in time to come photography will be more and more in request for work of this description, and we are in a position to state that, even in small establishments, the annual expenditure for photographs of machinery forms a conspicuous item.

Dangerous Paper Hangings.

The sanitary chemist of Breslau, Dr. Franz Hulwa, reports that he has frequently found not inconsiderable quantities of arsenic in tapestries and hangings sent to him for examination. It was not alone in the well known bright green paper that arsenic was found, but also in bluish green, gray, brown, and red patterns, corresponding to similar results in other places.

In most cases it was not due to the direct use of arsenical pigments like Scheele's green, Paris green, Braunschweig or Brunswick greens, orpiment, royal yellow, etc., but the arsenical reaction was so strong that it ought not to be passed over in silence. The presence of arsenic was attributable in some cases to impurities or adulterations; sometimes it was referred to additions made to brighten the shades of color. Not infrequently suspiciously bright green paper was printed over with harmless dull green to make it more salable. Such hangings must be the more dangerous because people are deceived in regard to their poisonous characters. In one such case, a dull bluish green pattern was found to contain a surprisingly large amount of arsenic. In another beautiful green and very elegant velvet paper, the arsenic was evidently added to increase the brilliancy of the colors. The amount of arsenic on 1,000 square feet of surface of this paper, enough for a large room, was about 2 grammes, or 30 grains.

Lakes, which are precipitates from alkaline solutions of organic coloring matter by means of alum or chloride of tin, frequently have arsenic added to them to make them brighter and more pleasing. These lakes were made of madder, cochineal, and sandal wood; but the brightest and most beautiful are the lakes made with aniline colors with the addition of arsenic. In the lakes we meet with a series of dangerous colors previously but little noticed; these colors must now all be suspected of containing arsenic. Reichardt of Jena found from 1.96 to 3.49 per cent of arsenious acid in such lakes which were designated as free from arsenic. Hallwachs, of Darmstadt, found an enormous quantity of arsenic in a very popular Pompeian red paper hanging. In one French paper, printed with dark red velvet flowers on a gold ground, arsenic was distinctly proven by the Reinsch, Bettendorf, and Marsh tests, and with Fleck's silver solution.

Arsenic is least suspected in the dull gray or brown hangings. These indefinite mixed colors are frequently made from the residues of different dye pots and contain arsenic, partially for this reason, and partially because of the greater or less contamination of the raw materials used in dyeing with this poisonous substance. These phases of the case were observed both in a yellowish gray paper with gold figures, and one of light and dark pattern; the brown contained 2.1 grammes on a surface of 1,000 square feet. Although these figures are relatively small as compared with those of Sonnenschein, where green papers contained 1.8 to 4.4 grammes of arsenic in a square foot of surface, yet in general the injuriousness of arsenical hangings has been established. Gmelin first proved that living in rooms covered with arsenical paint or paper was very destructive to health; and these facts were substantiated by Oppenheim, Bunsen, Von Fabian, Kletzinski, Philips, and others. Beside the above-mentioned investigators, the following chemists have examined this subject, namely, Gintl, Wittstein, Halley, Williams, Basedow, Vohl, Kirchgäuser, Hager, Hamberg, and others. Recently Fleck has furnished the most striking proofs, by his very interesting and rationally conducted experiments, that not only does breathing the arsenical dust loosened from the walls and hangings injure the health, but that, by the action of moisture and adhesive organic substances, like glue, paste, and gum, the arsenical pigments evolve that terribly poisonous arseniuretted hydrogen gas, which is diffused through the room and may be the cause of dangerous illness. It is desirable, says Hulwa, to direct public attention to the use of arsenical colors in clothing,

artificial flowers, toys, window and lamp shades, wafers, and other articles. The public must be continually taught that arsenical colors have already done much harm and are capable of seriously injuring the health, and ought, as much as possible, to be excluded from common use. The sanitary police of Breslau, acting on Hulwa's suggestion, have passed an ordinance forbidding the sale of goods colored with arsenical dyes or pigments.

The New German Patent Law.

The new German Imperial Patent Law has just been passed by the Reichstag and will come into force on the 1st of July next. This new law puts an end to the disorder concerning patents in Germany that has existed until now, there being at the present time twenty-one different States granting patents of their own. These will be all embraced by one law after the 1st of July, and this a good and practical one, far better than many now in force in other countries. Pharmaceutical compounds, medicines, alimentary preparations, and chemical products cannot be patented under the new law; processes, however, by which these articles are obtained, can be patented. An invention must be novel, and not have been introduced to the public so that another person can imitate the same. Imported inventions are patentable only to the real inventor. Foreigners must be represented by a German citizen. It is unlawful to manufacture a patent article, to import the same from another country, or even to use without permission a patented machine, tool, apparatus, or process. Any one having an invention in use cannot be prevented from continuing to use the same. A patent remains good for fifteen years on payment of an annual tax. The duty may be paid three months after date. Patent rights may be withdrawn by the government after three years if the invention has not been carried into operation to a proper extent, or if the inventor has not taken the necessary steps to carry the patent into effect, if he refuses licenses to others who offer a fair royalty, or if it is advisable for the public good to grant such licenses. When the invention or improvement relates to purposes of war or marine, or affects the general welfare, a patent will not be granted, but the inventor will be recompensed by the State. The decision in this case will rest with the Imperial Chancellor. Any one having obtained a patent for improvements on a patented article, and wanting a license from the first inventor, is obliged to give the latter a license for his improvements. The applications will be examined by the Patent Commissioners and experts appointed for this purpose; an appeal can be made, in case of refusal, to a special commissioner, and from him to the Imperial Court at Leipzig. In the case of poor inventors, the payment of duty will be postponed for two years, or may be altogether remitted. Specifications and drawings can be inspected immediately after the application; on account of this, patents should be taken in other countries first. Patents being delivered, a short specification of the same will be published in the "Patent Journal." Infringements of patent rights are punished with a fine or imprisonment not exceeding one year. Marking articles as patented which are not so, is punished with a fine. At the publication of the invention, any one thinking he has a prior right, may enter an opposition, which is then examined in the presence of those concerned. Existing German patents may be transferred to the Empire, but cannot be prolonged.

Paris Cement White a Substitute for White Lead.

The best coating for painting has hitherto been white lead, the manufacture and use of which are so injurious to workmen that Mr. L. Henry, of Paris, has sought a product which, while rendering the same services as white lead, does not present the disadvantages mentioned, and he claims that he has not only attained that object but gone beyond it, as his product is superior to white lead, without taking into account that it is 50 per cent cheaper, and that with an equal weight he can cover one third more surface. All cements do not completely destroy humidity or damp, they only isolate it, and little by little the layer of paint is eaten away. The Paris cement white will be found of great service used as a cement, that is to say, applied upon the moist or damp parts as mastic, and the paint placed over it will always preserve its freshness, will not peel off, and there will be no blisters; this part will be as hard as stucco. When executing rich or costly works, it will only be necessary to use Mr. Henry's cement, as mastic to obtain panels of a brilliant whiteness or marbled, as may be desired, and with a perfect polish. In order that the resistance of the composition may be understood, he gives a comparison. It is well known that when it is desired to remove paint from a sign-board, for example, the painter is obliged by means of a small apparatus to apply flame to the part first coated in order to remove the white lead; now, his composition resists this firing, thus proving its hardness, and it also resists potassium. The Paris cement white is manufactured like white lead with kneading machines; it is, therefore, delivered in a paste, and when to be used for painting it is dissolved in linseed oil, as is done with white lead; it consists of whiting or Spanish white, baryta, oil, water, and zinc. He does not give the proportions of each product, as they vary with the quality of the said products and their destined use, whether at a mastic cement, for painting, for preserving railway sleepers, for making troughs or tanks watertight, and the innumerable other purposes to which his composition made of the above-mentioned matters in various proportions may be applied. The invention will be of considerable im-

portance to mines producing barytes, as it will extend the market, whilst it will be of equal interest to consumers, since they can use the Paris cement white at a low price, instead of paying the price of white lead for a material a large proportion of which consists of baryta.

Two Great Crops.

The United States produced last year a cotton crop worth about \$250,000,000, and a corn crop worth about \$583,000,000. Of a total agricultural product of \$4,000,000,000 the corn crop forms the largest item, being largely more than double the value of the crop which used to be called the King of American commerce. The King has now laid aside his purple robe and crown of jewels and become a highly respectable citizen, who is well received everywhere, but the whole of his estate is far less than that of his plebeian neighbor, Indian Corn, who enters into the business of society in a wonderful variety of forms. His guests sit down to a homely bill of fare, offering hominy, griddle cakes, egg bread, roasting ears, pudding, Johnny cake, popcorn. He shows with pride his well-filled stockyards of corn-fed beeves and porkers, which supply the home and foreign markets with the finest meat in the world, from the sweet beefsteak to the fragrant sugar-cured ham, fit for the table of a king. He has immense factories employed making starch and syrup, consuming millions of bushels. He runs great distilleries, which send out alcohol enough to float a fleet of war vessels, furnishing material to the arts, revenue to the government, rascality to the whiskey rings, and themes to the temperance lecturers.

The developments and applications of the great Western crop being so much greater than the Southern crop, it is not strange that the former is the stronger of the two. The principal use of cotton is for clothing; and while it has an excellence for that purpose, there are many substitutes for it, and its extinction would be a serious but not an irreparable loss to commerce.

The extinction of the corn crop would not only take from commerce a merchandise of more than twice the value of the other, but it would revolutionize many departments of trade.—*Louisville Commercial.*

A Possible Utilization for the Tramp.

Since writing our recent article on "Sewage Irrigation on a Small Scale," it has occurred to us that the chief item of expense in this most advantageous utilization of waste, namely, cost of labor of digging trenches, laying drain pipes, pumping, etc., might be materially compensated for by compelling tramps to do the work. It is a fact that the number of these vagrants is increasing, while society still stands puzzled before the problem of how to protect itself against them. Putting aside the actual depredations committed, their idleness alone renders them a dead weight upon the producing classes; and it therefore logically follows that no remedy which does not compel these vagrants to contribute their quota of useful effort toward the general welfare can ever reach the root of the evil. It is universally conceded that work is the punishment most dreaded by the tramp. Make it hard work, such as is involved in digging and pipe laying, and he will fear it the more. If, therefore, a village or town, desiring to test the profitableness of sewage irrigation, should, whenever a tramp comes within jurisdictional limits, arrest him under a vagrant act, and compel him to labor for so many days, it would probably be found that the necessary irrigation works could then be cheaply constructed, or the other much to be desired result, of suppressing the tramp nuisance in the vicinity, attained.

Zigzag Sparks.

With a view to finding the cause of the peculiar zigzag form taken commonly by electric sparks, especially those of the Holtz machine, in air, Professor Tait, of Edinburgh, has recently had a number of photographs of such sparks prepared. These sparks were produced partly in ordinary air, partly in the free air one or two feet above the flame of a strong Bunsen burner, partly in a wide glass tube, into which air was passed through a long iron tube, heated to a dark red glow. The general result of the examination is that the zigzag form depends on something which heat is capable of removing from the air. This is, therefore, not water vapor, nor is it very small drops of water, for even falling water drops were inactive, except that they produced simply an interruption in the photographed sparks. It is probably, the author thinks, organic substances which, as Schiller and Pasteur have shown, would be kept away from the apparatus by a cotton stopper as well as by direct combustion.

Fletcher Harper.

Mr. Fletcher Harper, the surviving member of the original firm of Harper & Brothers, one of the largest publishing houses in the country, recently died in this city at the age of 71 years. Mr. Harper began work as an apprentice to his elder brothers; and when 19 years old, having become proficient in his trade, he was admitted into partnership with them. It was through his enterprise that the several periodicals now published by the firm were started; and until his virtual retirement from active business, two years ago, they were the objects of his constant care. He was a man of great executive ability, and of superior business capacity; in brief, one of those upright, intelligent, industrious citizens, whom every one respected, whose death is a loss to the community, and whose life was an exemplification of the rewards which justly fall to honest labor and sterling worth.

The Value of Small Inventions.

An excellent exemplification of the large returns which a small invention may often bring to its fortunate originator is found in the experience of Mr. Charles W. Cahoon, who recently died at Portland, Me. Mr. Cahoon possessed much inventive ability, besides that quality of persistent determination to succeed which usually characterizes the successful inventor. It is said that he realized sixty thousand dollars out of a little lamp burner, which had an appliance for lighting the chimney so that the wick could be reached for lighting or the mouth of the lamp for filling. This saved the frequent removal of the chimney while hot, and so doubtless prevented many fingers from being burned and many chimneys from being broken. Simple as was this device, Mr. Cahoon studied hard over it, and nearly lost his eyesight by persistent watching of the lamp flame under different conditions. It was the first invention of the kind patented (February, 1861), and infringers were plenty, but Mr. Cahoon protected his rights manfully and triumphed in the end. It is to be regretted that he could not have lived longer to have enjoyed the fruits of his strivings.

NEW BOOKS AND PUBLICATIONS.

BLUE AND RED LIGHT. By S. Pancoast, M.D., Philadelphia, Pa.: T. M. Stoddart & Co., 723 Chestnut street.

This appears to be an attempt to galvanize new life into the moribund blue glass mania, through the production of some alleged benefits to invalids, supposed, this time, to be derived from red glass. A sense of duty to our readers has impelled us to devote some utterly wasted time to the examination of this work, which we now consign to the waste basket with the conviction that it contains more profound bosh than it has ever been our misfortune to find in so few pages—Pleasanton's book not excepted.

DIGEST OF COTTON BALE TIES. By Messrs. L. W. Jinsbaugh and T. C. Tipton. Price \$10. Published by the authors.

This is another one of those very valuable digests of special classes of inventions, several of which works have already been prepared by gentlemen connected, as are the present authors, with the United States Patent Office. We have no doubt but that this volume will prove exceedingly useful to inventors, manufacturers, and patent experts interested in its subject-matter. It is admirably compiled, and all the drawings are given complete, on a reduced scale. We should like to see more digests of this kind appear, one for instance on churns, another on cultivators, and another on beehives. The railroad people have been asking for just such a work on car couplers for a long time.

ANNUAL RECORD OF SCIENCE AND INDUSTRY FOR 1876. Edited by Spencer F. Baird. Price \$2. New York city: Harper & Bros., Franklin square.

This volume purports to be a complete history of the progress of science and industry for the past year. It consists, first, of a series of summarized reviews by Professor Barker, Dr. Dana, Professor Holden, and others, and second, of a compilation of receipts mostly from technical periodicals.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT FLOUR PROCESS.—WILLIAM F. COCHRANE, WILLIAM WARDER, RODNEY MASON, W. S. COX, *et al.*, APPELLANTS, vs. JOSIAH W. DENNER, GEORGE W. CISELL, JAMES H. WELCH, *et al.*
[Appeal from the Supreme Court of the District of Columbia.—Decided October term, 1876.]

The powers of the supreme court of the District of Columbia, in patent cases, are the same as those of the circuit courts of the United States. Upon a bill in equity for the infringement of a patent it is a matter of discretion, and not of jurisdiction, whether a case shall be first tried at law; and in this matter, the courts of the United States, sitting as courts of equity in patent cases, are much less disposed than the English courts are to send parties to a jury before assuming to decide upon the merits.

The jurisdiction of the circuit courts in cases arising under the patent and copyright laws is not changed by the Revised Statutes, and consequently the original cognizance of the circuit courts sitting as courts of equity in patent cases is retained.

Where it is discretionary with a court of equity whether it will first send a case to be tried at law, and it exercises its discretion to decide the case upon its merits without the aid of a jury of any sort, such action is not a ground of appeal.

But if the appellate court were convinced that the case was not properly decided, and could not be properly decided without such a reference, it might, in the exercise of its own discretion, remand it to the court below for that purpose.

It does not detract from the validity of a patent that the inventions of others are made use of in carrying out the patented invention. One invention may include within it many others, and patents for each and all be valid at the same time, but in such case each inventor would be precluded from using the inventions made and patented prior to his own, except by license from the owners thereof.

A process is a mode of treatment of certain materials to produce a given result, an act, or a series of acts, performed upon the subject-matter to be transformed or reduced to a different state or thing, and if new and useful it is patentable.

The patentability of a process is entirely independent of the instrumentalities employed, and it is immaterial whether or not the machinery pointed out as suitable to perform the process be either new or patentable.

The process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary consequence.

In the language of the patent law a process is an art. One device may be the equivalent of another in the general combination with other elements, and yet, when taken by themselves as separate pieces of machinery, they may not be the same, and the use of one not the infringement of a patent for the other.

While the parts of machinery which go to make up a combination could not when separately considered be regarded as identical or conflicting with those described in a patent, yet having the same purpose in the combination, and effecting that purpose in substantially the same manner, they are the equivalents of each other in that regard.

A foreign patent in order to invalidate an American patent must antedate the invention patented.

Mr. Justice Bradley delivered the opinion of the court: This is a suit in equity, instituted in the supreme court of the District of Columbia for injunction and relief against an alleged infringement of various patents belonging to the complainants. The bill was dismissed, and the complainants have appealed.

The patents sued on are six in number, originally five granted to the appellant Cochrane on the 13th of January, 1863, and numbered respectively 37,317, 37,318, 37,319, 37,320, and 37,321. They all related to an improved method of bolting flour, the first being for the general process, and the others for improvements in the different parts of the machinery rendered necessary in carrying on the process. Three of the original patents, Nos. 37,317, 37,318, and 37,321, were surrendered, and reissues taken in 1874, which reissues were numbered 5,841, 6,029, and 6,030, the first being for the process, and the other two for portions of the machinery. Reissue No. 6,029, being in place of the original patent numbered 37,321, was also subsequently surrendered, and two new reissued patents substituted therefor, numbered 6,594 and 6,595.

The case has been mainly argued on the question of infringement, the defendants using a bolting apparatus constructed according to letters patent issued to Edward P. Welch, in April, 1873, for improvements upon machines patented to Jesse B. Wheeler and Ransom S. Reynolds, which, as well as the process employed, they contend, are radically different from the apparatus and process of Cochrane.

A preliminary question is raised with regard to the jurisdiction of the court below to hear the case on a bill in equity, before a determination of the rights of the parties in an action at law.

The powers of the supreme court of the District of Columbia, in patent cases, are the same as those of the circuit courts of the United States. (See Revised Statutes relating to the District of Columbia, sections 760, 764.)

The principal patent sued on in this case was granted on the 21st of April,

1874, being a reissue of a patent granted to William F. Cochrane on the 6th of January, 1863. The original patent was numbered 37,317, and the reissue 5,841. The alleged invention is for a process in manufacturing flour. The patentee in his specification says:

"The object of my invention was to increase the production of the best quality of flour; and my improvement consisted in separating from the meal first the superfine flour, and then the pulverulent impurities mingled with the flour-producing portions of the middlings meal, so as to make 'white' or 'purified' middlings, which, when reground and rebolted, would yield pure white flour, which, when added to the superfine, would improve the quality of the flour resulting from their union, instead of deteriorating its quality, as had heretofore been the case when the middlings were mingled with the superfine."

The process employed for producing the result here indicated is then described. It consists in passing the ground meal through a series of bolting reels clothed with cloth of progressively finer meshes, which pass the superfine flour and retard the escape of the finer and lighter impurities; and, at the same time, subjecting the meal to blasts or currents of air introduced by hollow perforated shafts furnished with pipes so disposed that the force of the blast may act close to the surface of the bolting cloth; the bolting chest having an opening at the top for the escape of the air, and of the finer and lighter particles therewith, through a chamber where the particles are arrested, while the floor and sides of each compartment of the chest are made close so as to prevent the escape of the air in any other direction than through the said opening. By this means the superfine flour is separated, and the fine and light specks and impurities, which ordinarily adhere to the middlings and degrade the flour produced therefrom, are got rid of, and when the middlings are now separated from the other portions of the meal, they are white and clean, and capable of being reground and rebolted, so as to produce superfine flour equal in quality, and even superior to the first installment.

This is the process described; but the patentee claims that it is not limited to any special arrangement of machinery. He admits the prior use of currents of air in the interior of the reels, introduced by means of hollow perforated shafts, for the purpose of keeping back the speck and increasing the quantity of superfine flour; but not for purifying the middlings preparatory to regrinding. His improvement, therefore, does not consist in new drafts of currents of air, but in the process as a whole, comprising the application of the blast, and the carrying off of the fine impurities, whereby the middlings are purified preparatory to regrinding after being separated from the other parts.

The defendants deny that they use this process. They purify the middlings of the flour, as before stated, by means of machines constructed according to letters patent issued to Edward P. Welch, in April, 1873, for improvements upon machines patented to Jesse B. Wheeler and Ransom S. Reynolds.

In this process reels are not used for purifying the middlings, but a flat and slightly inclined vibrating screen or sieve is used for the purpose, over which the ground meal is passed, and while passing is subjected to currents of air blown through a series of pipes situated close underneath the screen, which currents pass through the screen and through an opening at the top of the chest into a chamber, carrying with them the finer and lighter impurities, whereby the middlings are rendered clean and white, and capable of being reground into superfine flour. The bolting chest is made tight and close on all sides except the opening at the top, so that the currents of air may be forced to escape by that exit.

Now, except in the use of a flat sieve or screen in place of reels, it is difficult to see any substantial difference between these two methods. The defendants use, in addition, brushes which revolve on the under side of the screen, so as to keep the meshes thereof constantly clean and free; but this is merely an addition, which does not affect the identity of the two processes in other particulars. We have substantially the same method of cleaning the middlings preparatory to regrinding by means of currents of air passed through them while being bolted, and while being confined in a close chest or chamber, said chamber having an opening above for the escape of said currents of air and the impurities with which they become loaded. The middlings being thus purified are reground and rebolted, producing a superfine flour of superior grade, a new, useful, and highly valuable result.

The use of a flat screen instead of a revolving reel for bolting and cleaning the middlings is a mere matter of form. It may be an improved form, and, perhaps, patentable as an improvement. But it is at most an improvement.

The forcing of the air currents upward through the screen and film of meal carried on it and against the downward fall of the meal, instead of forcing them through the bolting cloth in the same direction with the meal, is also a mere matter of form, and does not belong to the substance of the process. The substantial operation of the currents of air in both cases is to take up the light impurities and bear them away on the aggregate current through the open space and thus to separate them from the middlings. This, too, may be an improvement on Cochrane's method, but it is only an improvement.

The defendants admit that the process has produced a revolution in the manufacture of flour; but they attribute that revolution to their improvements. It may be, as they say, that it is greatly due to these. But it cannot be seriously denied that Cochrane's invention lies at the bottom of these improvements, is involved in them, and was itself capable of beneficial use, and was put to such use. It had all the elements and circumstances necessary for sustaining the patent, and cannot be appropriated by the defendants, even though supplemented by, and enveloped in, very important and material improvements of their own.

We do not perceive that the patent of Cogswell and McKiernan, if valid at all as against Cochrane (a point which will be more fully considered hereafter), affects the question in the least. That patent is not at all for the patent which Cochrane claims. If valid, and if, in using his process, Cochrane is obliged to use any device secured to Cogswell and McKiernan, it does not detract in the slightest degree from his own patent. One invention may include within it many others, and each and all may be valid at the same time. This only consequence follows, that each inventor is precluded from using inventions made and patented prior to his own except by license from the owners thereof. His invention and his patent are equally entitled to protection from infringement as if they were independent of any connection with them.

The process may be patentable irrespective of the particular form of the instrumentalities used, cannot be disputed. If one of the steps of a process be that a certain substance is to be reduced to a powder, it may not be at all material what instrument or machinery is used to effect that object, whether a hammer, a pestle and mortar, or a mill. Either may be pointed out, but if the patent is not confined to that particular tool or machine, the use of the others would be an infringement, the general process being the same. A process is a mode of treatment of certain materials to produce a given result. It is an act, or a series of acts, performed upon the subject matter to be transformed and reduced to a different state or thing. If new and useful it is just as patentable as a piece of machinery. In the language of the patent law, it is an art. The machinery pointed out as suitable to perform the process may or may not be new or patentable, while the process itself may be altogether new, and produce an entirely new result. The process requires that certain things should be done with certain substances and in a certain order; but the tools to be used in doing this may be of secondary consequence.

The machine patents come next to be considered. As to No. 6,030, which is a reissue of the original patent No. 37,318, the defendants clearly infringe, at least the last claim, which is in these words:

"In combination with the screen incased in a chest, the perforated blast pipe and the suction pipe, arranged to operate on opposite sides of the screen, substantially as set forth."

As to the patent next in order, namely, the original patent No. 37,319, which relates specially to the use of what the patentee calls the pump for introducing the meal into the chest and reels, while the valve arrangement used by the defendants may be an equivalent in the general combination with the said pump described by Cochrane, yet, taken by themselves, as separate pieces of machinery, they are not the same, and the use of the one is not an infringement of a patent for the other. (Curtis, sec. 332; Foster vs. Moore, 1 Curtis, C.C.R. 279.) Nor can we perceive that the defendants infringe the next patent, No. 37,320, which is for certain combinations of machinery, including the bolting reels, dead air chambers therein, slotted shaft, and reciprocating board for discharging the meal, etc., which it is unnecessary to describe more particularly.

The two remaining patents, No. 6,594 and 6,595, being reissues of original patent No. 37,321, are for combinations of essential parts of the machinery required for bolting flour and purifying the middlings according to the general process described in the first patent. The principal claim of the original patent was for the condensing or collecting chamber, through which the currents of air on leaving the bolting chest make their escape, and where they leave the fine particles with which they become loaded. This claim, it is said, was found to be too broad, inasmuch as a collecting chamber somewhat similar had been used in another connection, though not in the combinations presented in Cochrane's bolting process. The original patent, therefore, was surrendered, and the two patents now under consideration were issued in place thereof, claiming the use of the collecting chamber in combination with the various material parts of the bolting apparatus. The reissue, No. 6,594, contains three claims, and No. 6,595 one claim.

The first claim of reissue No. 6,594 is for the collecting chamber (used for the purpose aforesaid) in combination with the bolting air pipes, and valves for feeding and delive into the meal without allowing the air to pass therewith. Now, although the defendants use a flat boker instead of a reel, and use different kinds of valves for feeding and delivering the meal without allowing the air to pass, yet they employ the combination of devices described in this claim. They use the collecting chamber for the same purpose as that pointed out in the patent, and use it in connection with a bolting air pipes, and valves for feeding and delivering the meal without allowing the air to pass therewith, each effecting the same separate purpose, and all combined effecting the same general purpose, which the like parts are intended to accomplish in Cochrane's bolting apparatus. Though some of the corresponding parts of the machinery, designated in this combination, are not the same in point of form in the two bolting apparatuses, and, separately considered, could not be regarded as identical

or conflicting, yet having the same purpose in the combination, and effecting that purpose in substantially the same manner, they are the equivalents of each other in that regard. The claim of the patent is not confined to any particular form of apparatus, but, in regard to the valves for example, embraces generally any valves for feeding and delivering the meal without allowing the air to pass through. We are of opinion, therefore, that the combination here claimed is infringed by the apparatus used by the defendants.

It is unnecessary to make a separate examination of the other claims embraced in the two patents under consideration. They are all susceptible of the same observations which we have made with regard to the first claim. In our opinion the defendants do infringe them.

But a question is raised with regard to Cochrane's priority of invention. A patent was granted on the 12th of June, 1860, to Mortimer C. Cogswell and John McKiernan for improvements in ventilating bolting chests, which, it is contended, antedates and nullifies Cochrane's apparatus as patented to him in the original patent 37,321, and in the two reissues thereof before mentioned. This patent (of Cogswell and McKiernan) we have examined and find that it does contain five of the elements embraced in those reissues, namely (besides the bolting chest and bolter which are always used), it contains the perforated air pipe extending inside of the bolting reel, the fan for producing a blast of air therein, and a collecting chamber for arresting the flour carried off by the blast. The purpose was simply to cool the meal and keep the bolting cloths dry. The flour which collected in the chamber was returned to the chest. The parts contained in this apparatus are those which are patented in combination in Cochrane's reissue 6,595, which was separated, it is said, from reissue 6,594 on account of this patent of Cogswell and McKiernan. The combinations patented in reissue 6,594 embrace other parts not contained in Cogswell and McKiernan's patent, and the defendants contend that this reissue is void as not being sustained by the original patent 37,321.

The latter position we think is untenable. Cochrane's apparatus, as exhibited in his model, and described in his original patent, and in the series of patents taken out at the same time, all having relation to the same general process, and referred to in patent 37,321, contained all the parts which go to make the combination claimed in reissue No. 6,594. We see no reason, therefore, why such reissue was not properly granted to him by the Patent Office—the claim being, in fact, a much narrower one than that of the original patent.

The same observations apply to reissue No. 6,595. But, as to that, as before stated, the particular elements of the combination claimed in it are found in Cogswell and McKiernan's machine; and if this is entitled to the precedence over Cochrane's, reissue No. 6,595 is void. He contends that it is not entitled to such precedence; but that, in fact, Cogswell and McKiernan surreptitiously obtained a patent for his invention. We have examined the evidence relating to this matter and are satisfied that the improvement claimed by Cochrane was his invention; that Cogswell and McKiernan obtained their knowledge of it from him; and that there is nothing connected with their patent which ought to invalidate the reissued patent in question.

A French patent dated 27th of September, 1860, granted to one Perigault, is also referred to as anticipating the combinations in these patents. But it being shown that Cochrane's invention was actually made before that date, the point was not pressed in the argument. By the act of 1870 a foreign patent, in order to invalidate an American patent, must antedate the invention patented.

Our conclusion is that the patent for the process being reissue No. 5,841, and the several reissued patents for combinations of mechanical devices, numbered respectively 6,030, 6,594, and 6,595, are valid patents, and are infringed by the defendants; and that the other two patents named in the bill of complaint, numbered respectively 37,319 and 37,320, are not infringed by the defendants.

The decree of the court below is, therefore, reversed, and the cause is remanded with directions to enter a decree for the complainants and to proceed therein in conformity with this opinion.

Mr. Justice Clifford, dissenting.
I dissent from the opinion and judgment of the court in this case, for the following reasons:

1. Because the mechanical means employed by the respondents to effect the result are substantially different from those described in the complainant's patent.

2. Because the process employed by the respondents to manufacture the described product is materially and substantially different from the patented process employed by the complainants.

3. Because the respondents do not infringe the combination of mechanism patented and employed by the complainants. (Prouty vs. Ruggles, 13 Pet. 341; Vance vs. Campbell, 1 Black, 428; Gill vs. Wells, 22 Wall, 26.)

4. Because the respondents do not infringe the process patented by the complainants, the rule being that a process, like a combination, is an entirety, and that the charge of infringement in such a case is not made out unless it is alleged and proved that the entire process is employed by the respondents. (Howe vs. Abbott, 2 Story C. C., 194; Gould vs. Rees, 15 Wall, 193.)

I concur in this dissent.—Strong, J.
[R. Mason and Chas. F. Blake, for complainants.
A. L. Merriman and Howard C. Coody, for respondents.]

United States Circuit Court—District of Maryland.

INJUNCTION AGAINST THREATENING PATENTEES.—JOHN C. BIRDSELL vs. THE HAGERSTOWN AGRICULTURAL IMPLEMENT COMPANY.

[In equity.—Before Bond, C. J., and Giles, J.—Decided March, 1877.]
Motion to enjoin complainants from bringing suits against the defendants' vendees.

In this case, an injunction had been issued restraining defendants from infringing on the reissued patent granted complainant May 18, 1858; reissued April 8, 1862; for an improvement in machinery for hulling and thrashing clover. The defendants afterwards changed the construction of their machine and proceeded to sell clover hullers of the changed construction. On a motion made by complainant to commit them for contempt of court, for violating the injunction issued against them, by selling machines of this changed construction, the court held that, on the showing made, the machines were substantially different from Birdsell's patented machine; and, therefore, dismissed the motion. (See Official Gazette, March 13, 1877.) Thereafter complainant notified several of the vendees of defendants—some of whom were using the original machine that had been enjoined, and some of whom were using the machine as it had been changed—that, unless settlement were made with him forthwith, suit would be brought against them. Defendants, thereupon, moved upon a cross petition filed in the original case, for an injunction to issue against the complainant, restraining him, while the original suit was still pending against them, under which damages and profits could be collected for all the machines that they made and sold, from bringing any suit, or threatening to bring any suit against any vendees of theirs, based upon a user of a machine that might become subject of account in the original case.

Counsel for defendants, seeking the injunction against complainant, based their motion upon the general equity jurisdiction of the court; that, inasmuch as complainant had submitted himself to the jurisdiction of the court to obtain relief against the defendants, he was also subject to the order of the court in relation to any matter relating to the granting of that relief; that the defendants were thoroughly responsible; and that upon the original suit being carried on to completion, if recovery was made, the complainant would recover in that suit all the profits that defendants had obtained from the wrongful manufacture, and the damages that he had suffered by reason of the wrongful manufacture; and that complainant would, therefore, be put in the same position as if he had originally sold all the machines. That, this being the case, he ought not to be allowed to interfere with the vendees of defendants while the suit against them was pending. In support of their position they cited the decrees of Judge Drummond in the case of Isaac W. Barnum vs. Herman B. Goodrich, entered in United States Circuit Court for the northern district of Illinois, July 2, 1873, wherein the complainant having brought suit against the defendant and obtained an order for defendant to keep an account of the sale of the devices alleged to be an infringement, was enjoined from prosecuting suits, already begun by him in other circuits, against the defendants' vendees, and from bringing any further suits against defendants' vendees; also the decree entered by the Hon. H. H. Emmons, United States Circuit Judge, and Hon. P. B. Swing, United States District Judge, in the circuit court of the United States for the southern district of Ohio, in the case of Hezekiah B. Smith vs. J. A. Fay & Co., restraining the complainant from bringing suit against the defendants' vendees in other circuits, the complainant in this case having obtained an interlocutory decree and a reference to the master, and the suit being, at that time, pending before master on the question of the account.

The defendants relied upon the fact that the complainant was a resident of Indiana, and not before the court, and had sought the jurisdiction of the court for the purpose of bringing the suit, and for no other purpose. He was not, therefore, subject to any order upon him; and that the court could not enforce an order if it made one, and it would not do an idle thing.

The respondents asking the order were represented by Hatch & Parkin-son, of Cincinnati; the complainant by M. D. Leggett & Co., of Cleveland.

The court did not deliver a written opinion; but, having considered the matter, entered the following order:

DECREE.

Bond, J.: This cause coming on to be heard upon the petition of the defendant herein for an injunction to issue against the complainant to restrain him from commencing or prosecuting or threatening to prosecute, any suits against any of the vendees, or vendees of vendees of defendant, for the use or sale of clover hullers manufactured by the defendant at Hagerstown, and sold by them or their agents, and it appearing to the court that the complainant has been threatening to bring suits against said vendees while suit is still pending by him in this court against the defendant, the manufacturer, and the case having been fully argued by the counsel for the respective parties, the court doth order: That said John C. Birdsell, the complainant herein, be restrained and barred from commencing or prosecuting,