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THE CENTENNIAL INTERNATIONAL EXHIBITION.

The progress of this country during the first century of its national life has been fully and elaborately described in our leading editorial of this week's issue; and it seems thoroughly in accordance with the spirit of our laws and institutions that we celebrate this anniversary by inviting all the world to come and see us, and to bring with them the best that they can produce, that we may compare results in friendly rivalry which may promote international commerce, and stimulate our exertions on the onward march of civilization. The first proposition of such a celebration emanated from the Franklin Institute of Philadelphia in August, 1869; but the idea was too large, and the object too national, for that excellent society to carry out. But Philadelphia, the birthplace of the nation, and the first metropolis of the country, was selected as the *locus in quo*; and the subject was at once brought before the councils of the city and before the Pennsylvania legislature at Harrisburg: and a committee of each house of the last-named body was appointed to bring the undertaking before the notice of Congress.

It is not necessary that we should in this place rehearse the history of the movement, all the events of which have been chronicled from time to time in our pages. We have now to congratulate the managers on the magnificent results of their zeal and energy, which, in times of great commercial depression, raised the large sum of $8,500,000 for the purposes of the enterprise, conducted the vast work of organizing the exhibition, and prepared and arranged the series of buildings, unprecedented in their extent and convenience. It is especially to give the reading public a correct idea of the magnitude of this undertaking that we illustrate herewith the Centennial buildings, and also some of the more important structures erected by the different States of the Union, and several of those devoted to the use of distinct trades and manufactures.

Our first engraving gives a birdseye view of the grounds in Fairmount Park, looking in an easterly direction; and it shows in the foreground the five large structures and the United States Government Building

BIRDSEYE VIEW OF THE CENTENNIAL GROUNDS AND BUILDINGS.

On the extreme left of the picture is the Agricultural Hall, 820 x 125 feet; near it is the Horticultural Hall, 383 x 193 feet; to the southeast of this is Memorial Hall, a permanent structure, to be used for exhibiting the art collections, 365 x 210 feet; the Main Building, 1876 x 464 feet; and the Machinery Building, 1402 x 360 feet, with an annexe 208 feet x 210 feet. These buildings form almost a semicircle, the center of which is occupied by the Government Building, covering 2 acres. The five principal structures afford 50 acres of space; but some large additions are already needed to accommodate the exhibits tendered to the managers from all parts of the world.

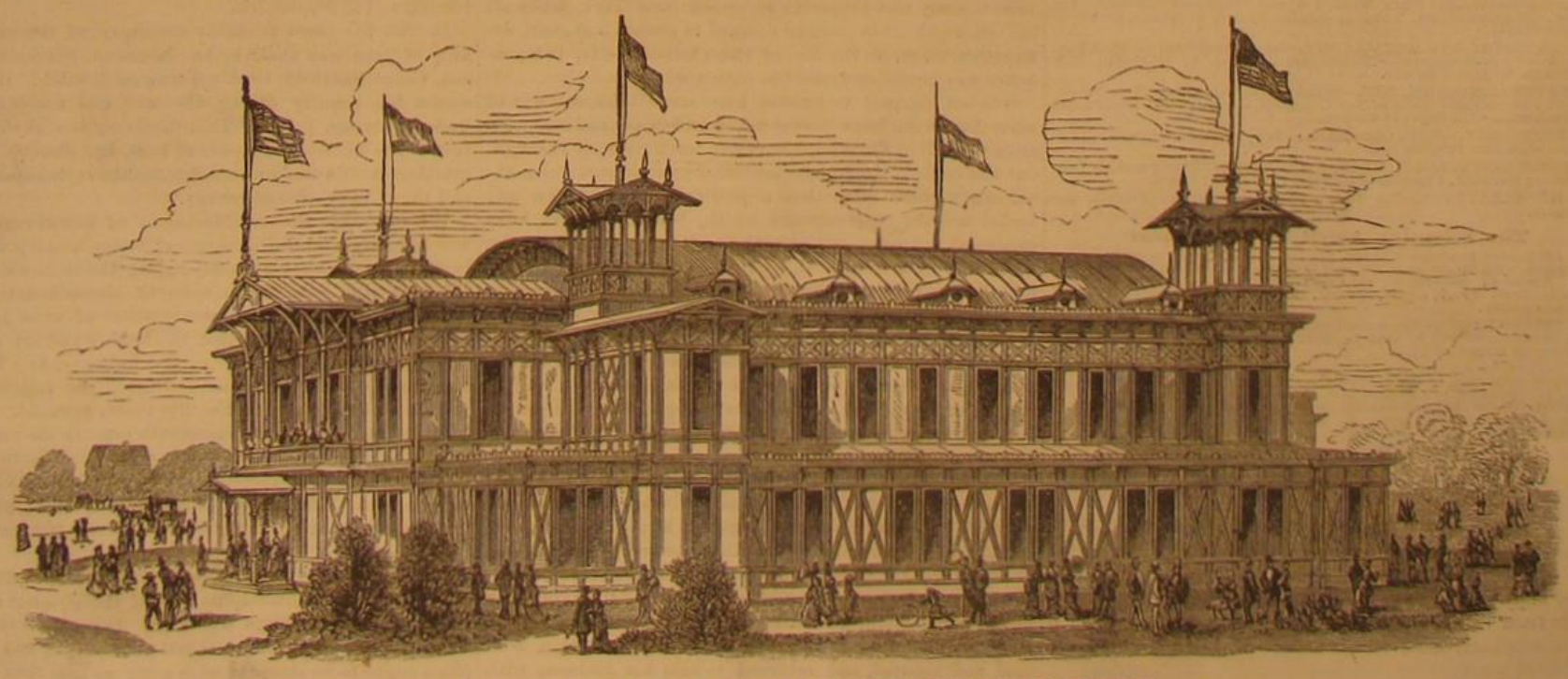
Our second engraving represents the pavilion erected for the use of the judges and committees who are to award the prizes. It is, of course, a temporary building, and is constructed of wood filled in with plaster, a method which has, in skillful hands, produced some of the best and most durable edifices in Europe, which are, moreover, nearly fireproof It is 152 feet long and 113 feet broad; and in the center is a large hall, 59 x 78 feet, containing a platform and a speaker's desk A corridor ten feet wide runs around this hall, and divides it from another large apartment, 28 x 59 feet, all the partitions being movable. Ten smaller rooms, for the use of committees, etc,, are provided. The building is a very ornamental one, and will be much admired by our European visitors.

We resume our descriptions and illustrations on page 323 of this issue.

English vs. American Plows.

The London *Agricultural Gazette* says that the following remarks on the working of English and American plows in India were embodied in a letter recently communicated to the Agri-Horticultural Society at Calcutta: "I am very glad to reply to your inquiry," says the writer, "as to our experience of the two plows which have been on trial. Both of them, the English and the American, were easily worked by a pair of ordinary bullocks; each turned up the soil to a depth of 6 inches, and there was no perceptible difference in the quality of the work turned out. But I imagine that no native farmer would care to own the English (iron) plow, when he could do the same work with the wooden American plow of simpler construction, and with a renewable point to the share. The points rapidly wear down in India; and the plowshare being made in one large piece, the alteration required is expensive. In the American self-sharpener, the movable top not only lasts longer but costs little to replace."

A FINE bell metal consists of 71 parts copper, 2 zinc, and 1 iron.



THE CENTENNIAL EXHIBITION—THE JUDGES' PAVILION.

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(Illustrated articles are marked with an asterisk.)

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For the Week ending May 20, 1876.

With 65 Illustrations.

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The Scientific American Supplement

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AMERICAN PROGRESS—I.—FROM 1776 TO 1820.

There are few darker pages in history than those which recount the condition of the thirteen colonies of North America during the months just previous to the adoption of the Declaration of Independence. A year had elapsed since arms had been taken up against the mother country; and although the colonists had resisted successfully, the very fact carried fresh terror to the doubting, for it augured invasion, not by a few battalions sent to quell a rebellious mob, but by the grand armies of England, victors in a century of wars. If not extirpation, then reduction beneath a tyranny, more grinding than that against which they had revolted, now menaced the rebels. Congress sat doubting, distrustful, divided in thought, seeing no glimmer of light in the prevailing darkness, thinking, as John Adams moved on the 10th of May, 1776, that the colonies should themselves establish separate governments, "adequate to the exigencies." But the stirring eloquence of Thomas Paine was ringing through the land, replete with the suggestion of a hope which none had dared to cherish. The war against England's blind and headlong oppression was fast becoming, through popular sentiment alone, a war against England herself; and it needed but the formal declaration of Congress to elevate the conflict from a mere rebellion to that grandest of wars, which finds its parallel in all animate nature, the struggle for national existence.

To turn from the political to the industrial condition of the colonies is but to bring to view fresh evidences to show the fragility of the foundation on which the fabric of our country was reared. Iron and steel works there were none, nor woolen nor flax manufactories: all were suppressed by England. Iron founderies had been started, and in New England hats had been made; but Parliament declared America factories "a nuisance," and crushed them ruthlessly. It allowed the production of pig iron; but the colonist was forced to have the material manufactured in England, and pay an enormous profit to the English founder. Agriculture, hunting, fishing, and cutting lumber, England could not check; hence these furnished occupations to those who were not engaged in such few trades as were carried on. Probably the most extensive factory in the country was Baron Stiegel's glass house, in Mannheim, near Lancaster, Pa. Operations were conducted in a curious manner, for the owner's ideas were of the feudal ages. He built castles and mounted cannon wherewith to salute himself on arriving and departing; and when a guest was received, the workmen were summoned from furnace and foundery to attend the new comer with music and rejoicing. The war cut off the Baron's funds from Europe, and the works were soon after discontinued.

Shipbuilding existed in New England, and brick-making in nearly all the colonies. There were but two steam engines in the territory; one built in 1772, for use in a distillery in Philadelphia; the other had been imported in 1736, for the Schuyler copper mines, at Passaic, N. J. Both were of the Newcomen type. No agricultural machines were known, except, perhaps, the grain drill, no cotton mills existed, and the green seed or staple cotton alone was cultivated. Not a printing press existed west of the Alleghanies; and there were only forty, all hand machines of the crudest type, in the colonies. Thirty-seven newspapers sufficed to spread intelligence. From Boston to New York was a week's journey by coach, sloops plied between New York and Albany; and in winter, colonists in Virginia were practically isolated from those in Massachusetts. Certainly no nation ever embarked in so gigantic a struggle worse prepared; for of the material prosperity whence the sinews of war are drawn, the colonies were destitute. Canada, refusing to join them, furnished vantage ground for the invader.

The Spaniards along the Mississippi looked with no favor on the rebellion, and the English in Florida were actively hostile. Thus on the 10th day of May, 1776, just one hundred years before the opening day of the Centennial, the few but resolute inhabitants of the thirteen colonies found themselves hemmed around with foes, bankrupt in money and in industries wherewith to gain it, menaced by an uprising among the Indians on the border wildernesses, disunited in thought and feeling among themselves; and to crown all, a British army was preparing to attack New York, while all the seaboard cities seemed doomed to certain and swift destruction. Yet, in the face of these terrible odds, Independence was proclaimed, and the nation was born.

It is our purpose to present here some brief account of what Americans have accomplished in Science and invention since the bell in Philadelphia pealed forth "liberty throughout the land." Much must necessarily be omitted; of nothing can we take more than a passing glance, so vast and varied are the achievements which, beyond all else, have combined to create a great and powerful nation in the shortest period known to history. To the same ancestry that asserted their rights as freeborn men, an ancestry gathered from the skillful workers of all countries, are due the frugal and industrious habits, the facility of adopting means to ends, and the indomitable perseverance and energy which characterize the American people; and it is well to remember that in the very restrictions placed upon their efforts toward progress were found the impelling causes of the war of independence.

The industries of the country being practically ruined when the war began, the record of invention and scientific progress up to the close of the conflict is meager in the extreme. The discoveries of Franklin, the first great contributions of the New World to Science, had all been made; it was in 1752 that he demonstrated the identity of lightning with the electric spark, and drew electricity from the clouds. Early in 1775 he left England, where he had been honored and courted, and returned to bide his fortunes with his native country; but even the engrossing labors imposed upon him as a member of the Continental Congress and a framer of the Declaration were not sufficient to distract his attention from Science; and when sent as Commissioner to Paris, he took advantage of the voyage to make observations of the Gulf Stream and to plot a chart of that great current, which still forms the basis of our maps.

One other name, that of David Rittenhouse, of Philadelphia, may be noted beside that of Franklin, whom he succeeded as President of the American Philosophical Society. Rittenhouse was a clockmaker, and carried the perfection of his art into the manufacture of orreries, which still exist, and which show the movements of the heavenly bodies for a period of 5,000 years, and their positions for each year, month, day, and hour, with marvelous accuracy. He made a successful observation of the transit of Venus in 1769, and on account of his great mathematical attainments was elected a Fellow of the British Royal Society.

After peace had been declared, the country found itself exhausted in resources and in men as well, and saddled with a debt of forty million dollars, with no system of public revenue wherewith to provide for it. Financial disaster followed, and private confidence fell in the wreck of public faith. It was no time to await the slow development of events, and the people recognized the fact. It seemed as if every one worked with a will. The whir of the spinning wheel and creak of the loom were heard all over the land. Every family became a manufacturing society. In 1784 New Jersey alone had forty-one fulling mills for woolen fabrics and not a woolen factory in the State. In two counties in Virginia, 315,000 yards of flaxen cloth, 45,000 yards of woolen, 30,000 yards of cotton, and 45,000 of linsey woolsey were made in one year by household labor. One family completed 1,355 pair of shoes in a year. The inventor's skill was quickly called into action.

In 1785 Oliver Evans, of Philadelphia, first applied steam machinery to the grinding of plaster and sawing of stone, and to flour mills. Then he invented the elevator or bucket chain to raise grain, the conveyer to take it from place to place, the hopper boy to spread it, the drill to carry it by rakes instead of buckets, and the kiln dryer. In 1799 he attempted to build a steam carriage, and in so doing invented and constructed the first high pressure steam engine. In 1785 John Fitch built the first steamboat, and ran it on the Delaware river. It had reciprocating paddles, and steamed at the rate of eighty miles per day. During the succeeding year James Rumsey propelled a boat on the Potomac by a stream of water driven out through the stern by a steam engine. In 1790 Jacob Perkins, of Massachusetts, invented a machine for cutting and heading nails, which produced those useful articles at the unprecedented rate of 200,000 a day. On the 31st of July, 1790, the first United States patent was issued, the patent and copyright laws being both first enacted in that year; and thereafter a marked increase in the number of inventions becomes visible.

At this period, the growing cotton industry of the country seemed to have encountered an obstacle, which bid fair to be a serious one. Hand-cleaning of cotton was slow and costly; and unless mechanical means could be devised, the new staple could never become a source of wealth. It so happened that there then came to the house of Mrs. General Greene a poor student, from Yale College, named Eli Whitney, who, in various ways, showed himself possessed of considerable mechanical skill. While some officers, her guests, where one day regretting the absence of the machine above noted, Mrs. Green laughingly suggested that Whitney should invent one. The young man overheard the words and remembered them. He had never seen cotton in his life; but making his way to Savannah, he obtained a small quantity and, shutting himself up in a room, went to work. It is said that the saw gin was suggested to him by the accidental use of a toothpick to try the tenacity of the seed. Within ten days after he began experimenting, he made a model which was capable of cleaning 50 lbs. of green seed cotton daily. Thus was completed one of the greatest inventions of modern times, and one which the inventor lived to see result in increasing the cotton production from 5,000,000 to 215,000,000 lbs.

In 1796 the great scientific discovery of the non-materiality of heat was made by an American, Benjamin Thompson, Count Rumford, then residing in Munich. He had deserted his country during the war, and accepted service under a foreign prince. This discovery lies at the foundation of the mechanical theory of heat, and directly led to the grandest doctrines of modern Science, the correlation of forces and the conservation of energy.

We may note the establishment of broom-making as a new industry, and the invention of broom-making machinery in 1797, by the Shakers located along the Mohawk river. In the same year Amos Whittemore, of Massachusetts, devised the first machine for the manufacture of wool and cotton cards; this device punctured the leather and set the wires. This proved of great value to the industry, and highly remunerative to the inventor. During the following year Robert McKean patented the first steam sawmill.

At the opening of the nineteenth century the signs of remarkable progress were everywhere discernible. In ten years the population had increased by nearly two millions. The exports for 1799 were $78,665,522 against $79,069,148 imports, and during the previous decade 306 patents had been granted.

In 1801, the oxyhydrogen blowpipe was invented by Dr. Robert Hare, of Philadelphia, one of the greatest as well as the earliest of American scientists. It occurred to him that a flame produced by the combustion of oxygen and hydrogen gases ought to be attended with a higher heat than that gen

erated by burning charcoal. But the two gases mingled in certain proportion produced a dangerous explosive mixture, and Dr. Hare was thus led to adopting the expedient of storing the gases in separate vessels, and bringing them together by tubes which met at the point of ignition.

Now followed one of the most important advances in steam navigation, although the fact was not recognized for years after. It was the practical demonstration of the efficacy of the screw propeller, by Colonel John Stevens of Hoboken, who in 1804 built a boat containing a Watt engine, a tubular boiler of his own invention, and the bladed screw. It was a pirogue some fifty feet long. The machine itself is still in existence, and was illustrated in these columns some time ago. During the same year, Oliver Evans ran an amphibious, stern paddlewheel boat on the Delaware and Schuylkill rivers. This was driven by a double action high pressure engine—the first of its kind—which rotated wheels when the craft was ashore, and operated the stern paddle when afloat. In 1806, Thomas Blanchard, of Massachusetts, invented a machine which made 500 tacks per minute, with perfectly finished heads and points. Soon after, he devised an apparatus for turning gun barrels throughout their entire length by one self-directing operation. This was the initial work which culminated, twenty two years later, in the magnificent invention of the lathe for turning irregular forms. Blanchard's inventions are now applied to many operations in making musket stocks, and comprise no less than thirteen different machines for making different portions of the weapon

The following year, 1807, witnessed the triumphal voyage of Robert Fulton's steamer, the Clermont, from New York to Albany. Fulton at that time was already an inventor of repute, both in England and in the United States. He had devised a mill for sawing marble, machines for spinning flax and making ropes, an excavator for canals, and he had successfully tried, probably, the first submarine torpedo boat. It was in relation to the latter that he returned to this country from England. Here he received a congressional appropriation, and made some successful experiments in blowing up vessels ; but ultimately Commodore Rodgers reported the system impracticable. Later, he obtained the exclusive right to navigate the Hudson river in his steam vessels. In 1814, Fulton built for the United States government the first steam war vessel, a heavy and unwieldy mass, capable of making about 2½ miles per hour. The war of 1812, in which she was designed to be used, terminated before her completion. Fulton died during the construction of the vessel.

During the year 1807, oil cloth for floors was invented and manufactured in Philadelphia, and John Bedford of the same city devised the first metal-bound boots and shoes. The first breech-loading military arms ever offered to troops, and likewise the first fire arm made on the interchangeable system, were invented by John H. Hall, of Massachusetts, in 1811. Some of these old weapons were captured at Fort Donelson in 1862.

In 1812, anthracite coal was for the first time successfully utilized. It appears that Colonel George Shoemaker, of Pottsville, took nine wagon loads of the "black stones" to Philadelphia, and there sold two wagon loads to Messrs. White & Hazard, wire manufacturers. White and his firemen worked faithfully for half a day, but the stones refused to burn ; whereupon at noon they slammed the furnace doors shut in disgust, and went to dinner. On their return the doors were red hot and the furnace in danger of melting. Meanwhile the Colonel had sold his other seven loads to less successful experimenters, and was by them arrested as a swindler for selling them rocks for fuel.

During the war of 1812 but very few military inventions appear. Probably the most important was the columbiad, a long-chambered cannon capable of projecting shot and shell at high angles and with heavy charges. It was devised by Colonel Bomford. In 1813, Francis C. Lowell invented numerous important improvements in the power loom, notably the stop motion for winding on the beams for dressing, and the double speeder to regulate the movements of the fly frame in filling the spools. The first important American improvement in printing presses appeared in 1817, and was the Columbian press, invented by George Clymer of Philadelphia. The power was applied to the platform by a compound lever consisting of three simple levers of the second order. The first transatlantic voyage made by a steam vessel was accomplished by the Savannah in 1819. The vessel was of 380 tuns burden, and was driven by paddles. In the year last mentioned, Jacob Perkins invented engraving on steel as a substitute for copper.

During the period from 1800 to 1820, just reviewed, the commerce of the country passed through a season of terrible stagnation, owing to the orders in council of England and Napoleon's Berlin and Milan decrees. In 1808, imports fell off to $56,990,000 and exports to $22,430,590. This decline continued to 1814, when an extraordinary impulse was given to trade, and imports went up to amounts excessive of the wants of the country. Subsequently, the average of imports and exports remained uniform at about $78,000,000. From 1800 to 1810, only 1,086 patents were allowed ; and from 1800 to 1,820, 1,748. The population of the country had, however, increased to 9,638,131, and with it the number and extent of manufacturing industries augmented, thus providing for the season of renewed prosperity which followed.

The rapid growth of this country in population, wealth, and culture since the year 1820 is now a just cause for pride and congratulation ; and in our next two issues, we shall note the prominent incidents in this interesting and important era

THE GRASSHOPPER SCOURGE OF 1876.

There is cheering news for Western farmers, conveyed in Professor C. V. Riley's recent statements, in the *Colorado Farmer*, relative to the probable numbers of the grasshoppers during the coming summer. Some one, it appears, has asserted that the soil of the region in the northwest portion of the country lying east of the Rocky Mountains is covered with prodigious numbers of grasshopper eggs; and this disagreeable announcement has gone the rounds of the press, through the length and breadth of the land. Professor Riley gives it its *quietus* in so characteristically effective a manner that we are half inclined to be grateful to the mendacious individual who set the story afloat, since it has been the means of obtaining such welcome intelligence from probably the best entomological authority in the country.

From personal observation, Professor Riley states, so far as Missouri and Kansas are concerned, the report is wholly groundless. In Minnesota, a State commission has determined that the eggs have mostly perished from excess of moisture, which dissolves the glutinous substance which normally protects and hold them together. In some parts of the high country lying east of the mountains, especially toward the north, eggs have been deposited in numbers by the swarms which left the lower and more fertile country devastated last spring ; but in that region, such is the case every year, for it is the native home of the swarms which occasionally extend to the upper Mississippi valley. In Missouri, Kansas, and Nebraska, however, the number of eggs, laid by the few straggling insects that passed over those States last fall, will not equal that laid in ordinary seasons by indigenous species. In Colorado there is every hope that the protracted rains have destroyed the eggs.

Professor Riley gives it as his conclusion, in addition to the above, that, compared with other parts of the country, those States ravaged by locusts in last spring and early summer will enjoy the greater immunity during the same season of 1876, not only from locust injuries, but from the injuries of obnoxious insects, except the wood borers. In short, the people of the ravaged section have every reason to be hopeful rather than gloomy.

FIRE INSURANCE.

The address of Mr. H. A. Oakley, President of the National Board of Fire Underwriters, delivered before that body at its recent session in this city, contains many useful suggestions relative to fireproof building, which, however, here at least, appear to be "more honored in the breach than in the observance;" and the speaker's impressions of European fireproof construction may well be contrasted with the way in which late edifices are built in this city. He remarked, he says, the universal use of concrete floors, of oak, and other hard woods instead of pine as finish, the entire separation of stories from each other, the absence of wooden or lath and plastered partitions, the solid backing given to the exterior of fronts, the thickness of division walls, the absence of wooden staircases, the isolation of flues from beams or woodwork, the hight of the buildings (not exceeding sixty-five feet), and the covering of the roofs with iron and slate laid on beds of plaster. To compare this excellent *resumé* of what fireproof building ought to be with the flimsy affairs built in this country is to adduce at once the reason of the gigantic conflagrations with which even the best organized of fire departments are unable to cope. A building even now in process of erection on Broadway is exteriorly a mere shell of thin iron which towers above the adjacent structures, while within it is a network of wooden beams and partitions, its present exposed skeleton showing no trace of fireproof fittings. There are many other structures of the same description in New York city.

Mr. Oakley tells us that the solid character of its buildings alone saved Paris from destruction at the hands of the the communists; and he states that he witnessed the burning of entire floors in houses, involving the destruction of everything in them, without perceptible damage to the stories of the same building either above or below those burned.

The percentages of losses paid to premiums received aggregates 47·16 per cent for 1875 against 42·50 per cent for 1874. The loss rate for the first three months of the present year is largely in excess of the like period in 1875; and generally speaking, Mr. Oakley considers that the outlook for the insurance business is not good. He further says that, despite all the modern appliances for the prevention of fires, the fact still remains that there is a steady increase in their number, and from causes too often within the control of the owners or occupants of the property. We pointed out this state of affairs some time since as one of the disadvantages of the insurance system, disadvantages sufficiently great to excite the question as to whether, after all, insurance is not more injurious than beneficial to the community. The carelessness on the part of owners, of which Mr. Oakley complains, seems to us the legitimate consequence of the risk of loss being taken off their shoulders; and for the same reason, they have little interest in availing themselves of the many new and useful inventions to protect their property.

Moreover, buildings have very often been burned, and life and adjacent property been imperiled, merely to obtain insurance money; and certainly few edifices are better adapted to the practice of this crime than those of the type which we have above referred to, the almost certain destruction of which effaces all evidence of the deed. It may be added that at the present time, when real estate has greatly depreciated in value, such incendiarism might well be most prevalent; and this is in significant accordance with Mr. Oakley's further statement as to the recent steady increase in numbers of fires.

PROGRESS AT THE CENTENNIAL.

Contrary to the general expectation, the Exposition will be nearly complete on the opening day. Nine tenths of all the exhibits are in place, and there is every indication that every department will be further advanced than has been the case on the first day of any previous World's Fair. Machinery, Agricultural, and Horticultural Halls will be filled; and from the rapid manner in which the work is now progressing, it appears that the Art Department will likewise be in readiness. The condition of affairs at the present time is in marked contrast with the disorder prevalent two weeks ago; and the wonderful celerity with which the thousands of contributions have been arranged is another instance of that peculiar American characteristic which delays matters to the last moment, and then accomplishes herculean tasks in incredibly short periods of time.

The Centennial Commission has likewise indulged in tardiness in disposing of some of the more important questions before it, and in making many material alterations in existing regulations. We allude elsewhere to its action in closing the Exposition and grounds on Sunday. The temperance question has recently been discussed, the point being whether to approve of the contracts, made by the Board of Finance, licensing the sale of intoxicating liquors in the grounds. The Commission arrived at no conclusion, and indefinitely postponed the whole subject, leaving the liquor men to sell their beverages under the concessions, and the temperance advocates to carry the matter, if they so elect, to the decision of another tribunal. Some important changes in the jury arrangements, we notice, have already been made. Owing to the immense number of applications for positions on the American Committee, some 4,000 in all, the names of appointees have been kept secret, and it is only lately that any of those who, it is desired, shall serve have been notified of the fact. The total number of jurors has been increased from 200 to 250 ; one half of the members are foreigners, to be chosen by the foreign commissioners, and the other half Americans. Ninety-six of the latter, we learn, have been selected, fifteen of whom are from New York, and fourteen from Pennsylvania, other States having a smaller representation. The pay of the American jurors has been reduced from $1,000 to $500, a proceeding of questionable wisdom, in view of the fact that elaborate professional reports are to be required, in lieu of medals or other more easily settled awards. There are not many experts who can afford the time and labor, which are involved in the careful examination and criticism of entries frequently during the coming six months, in return for a sum of money hardly sufficient to meet their necessary expenses. It would have been better to have abolished free passes, and increased the revenue in that way, than to have reduced the jurors' pay to such a small amount.

The Centennial Bank has been opened, and doubtless will prove a great convenience to exhibitors and visitors. Krupp's 1,600 pounder cannon has been removed from the steamer and set up in the grounds, A magnificent series of industrial art productions has recently arrived from Italy; and a boat load of young alligators, from Florida, are disporting themselves in one of the ponds.

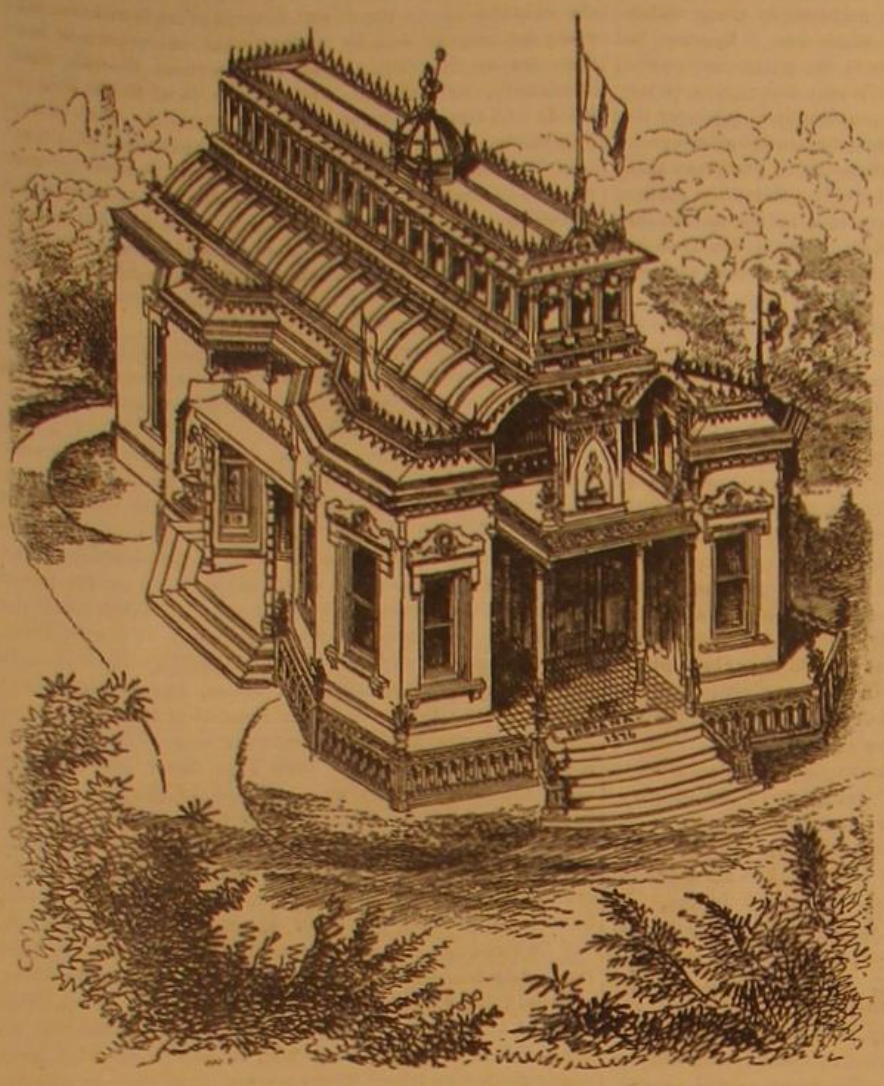
The President of the Commission has issued the final address, or rather invitation, to the public. He says :

"The sanitary condition of Philadelphia is good; rational amusements have been provided ; arrangements for protection from fire, thieves, etc., are as nearly perfect as it is possible in a great city. Within the Exhibition every precaution has been taken for the safety, comfort, happiness, and pleasure of the public. The buildings of the Exhibition are in order. The Exhibition will promptly open on May 10, and is an assured fact. All preparations have been made on a gigantic scale. Philadelphia and her citizens have spent millions in preparation for the reception and care of guests. There is no disposition to nor evidence of extortion. Increased business at usual rates is considered sufficient compensation for the vast amount of capital and labor expended. Living is as cheap as, if not cheaper than, in any large city in America. The accommodations are unsurpassed. All grades of society can be accommodated. Railroad and transportation facilities are unequaled."

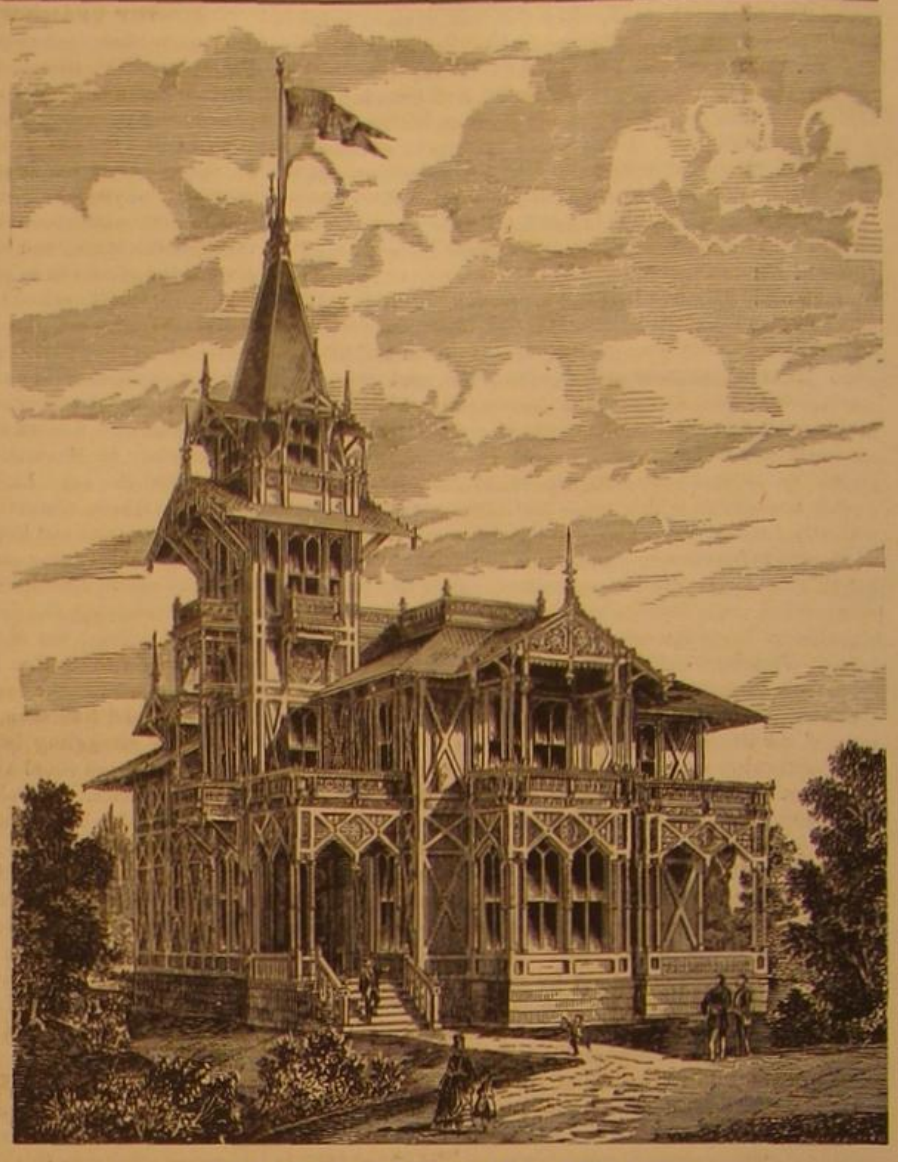
There is no doubt, it now appears, of Philadelphia being able to entertain, at reasonable prices, 150,000 and possibly 200,000 persons. The hotels will charge from $5 to $1.50 per day, boarding houses $1 to $2.50, and the Centennial Agency will provide breakfast, lodging, and supper for $2.50. By steam and horse cars, 20,000 persons per hour can reach the Exposition from any part of Philadelphia. One minute after the arrival of trains on all main lines, passengers can be within the Centennial Buildings. There is a good prospect of still further reductions to railway fares being made, in order that every one may visit the Exposition at a comparatively small expenditure.

By the time our next number is issued, the opening ceremonies will have taken place, and the long-looked-for Centennial will be fairly under way. We shall give full descriptions of the proceedings; and when the various departments are in a condition to admit of proper examination of their contents, we shall make our readers acquainted with whatever seems to us novel and interesting.

A SOLUTION of iodide of potassium is slowly decomposed by the action of light; but when some cane sugar is added, it turns yellow, owing to the liberation of iodine. If starch is present, a blue color is produced. If a sheet of starched paper is soaked in a solution of iodide of potassium and sugar in the dark, and then exposed under a photographic negative to light, a blue positive print is obtained, which is fixed by washing in water.



THE INDIANA STATE BUILDING.



THE MICHIGAN STATE BUILDING.

THE CENTENNIAL EXHIBITION.—THE STATE BUILDINGS.

As mentioned in the general description of the buildings, on the first page of this issue, many of the States have erected separate buildings for the convenience of their delegates and exhibitors. Some of these structures are highly ornamental, and they differ so widely in general design that altogether they contribute largely to the picturesque appearance of the grounds. The Indiana Building is intended by its architect to represent the characteristics of Indiana homes and productions. It is constructed of a combination of wood and other building materials, a frame of wood being the support of the building and roof, to which an outer wall of brick, stone, terra cotta, iron, and coal can be attached. There are three entrances by four broad steps to the front and side porches, and an open-roofed balcony extends from each side entrance to the front entrance. The assembly hall is designed to be a grand auditorium for miscellaneous gatherings. It is in the form of an irregular cross, 55 feet at its longest angle, and has about 1,400 feet of floor. From the level of the ceilings of the side rooms, it is spanned by a truss-arched roof at a hight of 24 feet above the center of the hall. It is lighted by the rotunda above, and an ornamental fountain plays in the center below. On the walls are 200 tablets, of which number 92 will be used by the counties of the State for the general statistics of each county, and the remainder will be given to individuals or firms. There will also be committee rooms, a ladies' parlor, invalids' room, post office, telegraph office, baggage room, and gentlemen's parlor; and the building will be a place where any citizen of the State can be at home, to entertain friends and

THE OHIO STATE BUILDING.

dispatch business. The whole will be surmounted by a handsome truss roof, from the top of whose arches a lighted open rotunda of glass and wood rises, crested with metallic ornaments and statues. The entire cost of the building will not exceed $10,000.

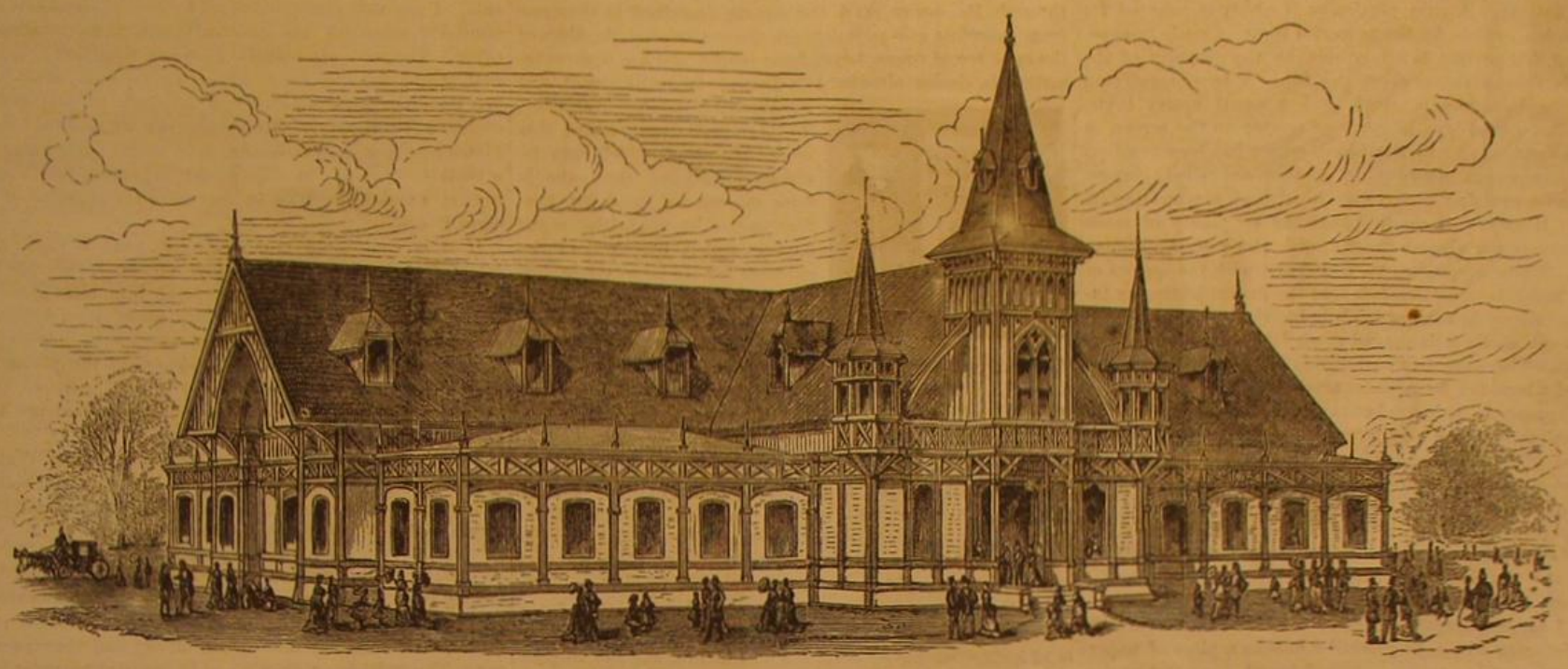
Our next engraving shows the Michigan Building, which stands about 1,000 feet north of and facing the Main Building. The narrow gage passenger railway which runs around the entire Centennial grounds passes in front of the Michigan building. The site is elevated, and commands a fine view of the surrounding grounds. The building is of the Swiss style of architecture. Its outline is very graceful, and the exterior is elaborate and ornamental. The ground plan shows an area of about 50 x 65 feet in size. The foundation is of stone, with exterior facing above ground of Lake Superior sandstone. This building is constructed entirely from Michigan material and of Michigan workmanship. It is designed to show the resources of the State in respect to building material. The brown stone foundation is from Marquette; the slate of the roof is from Huron Bay. The entire interior finish is of native woods, marble, and alabaster, and is highly polished. The floors are laid with hard wood of various kinds and colors, and in fancy patterns. The doors are of solid walnut, elaborately carved; the main staircase is a marvel of beauty and skill. The wainscoting n all the rooms is paneled in beautiful designs of various woods or other material. That in the reception room is of highly polished alabaster from the quarries at Grand Rapids; that in the Governor's office, as well as the mantel in the same room, is of marble. The furniture is of the very finest character, made of Michigan material and of Michigan workmanship, and contributed by manufacturers in different parts of the State. The walls will be ornamented with pictures by Michigan artists The large painting by Robert Hopkin, entitled "Off Sleeping Bear Point, Lake Michigan," will occupy a prominent position in one of the rooms.

Our next illustration shows the Ohio State Building, which is an admirable specimen of villa architecture. In addition to the usual purposes for which these buildings have been erected, the Ohio Building is to contain a very interesting archæological display. No State in the Union is more fertile of relics of bygone ages and races; and the Archæological Association of the State has done much to preserve these evidences and to foster a taste for this interesting study. The exhibits will comprise all articles fabricated by the Mound Builders or Indians, whether in stone, flint, bone, shell, or copper, such as hammers, mauls, axes, wedges, tubes, perforated balls, rollers, beads, ornaments, arrow points, spear heads, pestles, and every ancient thing that is clearly artificial. The proper arrangement and care of this Department has been entrusted to Professor M. C. Read, of Hudson, Ohio.

Our next subject is the building erected by the wealthy State of Pennsylvania. It is located on Belmont Avenue, near the United States Government Building. The State appropriated $15,000 for its erection, and it is to be the headquarters of the Pennsylvania State Commission. It is a Gothic building, built of wood, and is 98 x 55 feet. It is surrounded by a tasteful piazza, six feet wide, and is ornamented with a central tower, flanked on each side by two smaller octagonal towers. The hight to the eaves is 22 feet, to the peak of the roof 39 feet, and to the top of the central tower 65 feet. The main hall is 30 x 50 feet, on the right of which are two rooms 20 x 20 feet each, intended for ladies' and gentlemen's parlors, beautifully fitted up, and having dressing rooms and other conveniences attached. On the left are two committee rooms, 20 x 27 feet.

Our last illustration in this series shows the Women's Pavilion, erected by the exertions and under the supervision of the Women's Centennial Committee; and it is intended to be a place for the exhibition of all articles made or invented by women, and is expected to be, in fact, an epitome of the whole Exposition. It is located on Belmont Avenue, near the horticultural grounds; it covers an area of 30,000 square feet, and is formed by two naves intersecting each other, each 64 feet wide by 192 feet long. At the end of these there is a porch, 8 x 32 feet. The corners, formed by the two naves, are filled out by four pavilions, each 48 feet square. The whole structure is in modern wood architecture, roofed over by segmental trusses. The centre of the edifice is raised 25 feet higher than the rest of the building, and is surmounted by an observatory, with a cupola on the top of the same, making the entire hight of the building 90 feet. The interior of the building presents a very attractive appearance, but four columns obstructing the view, the main support of the roof being furnished by trusses resting on the outside walls. The panels are beautifully decorated with allegorical groups representing Faith, Hope, Charity, Art, Labor, Instruction, Religion, and the Family, from designs by Camille Pitou, an artist who has done much towards the embellishment of the buildings on the Centennial grounds.

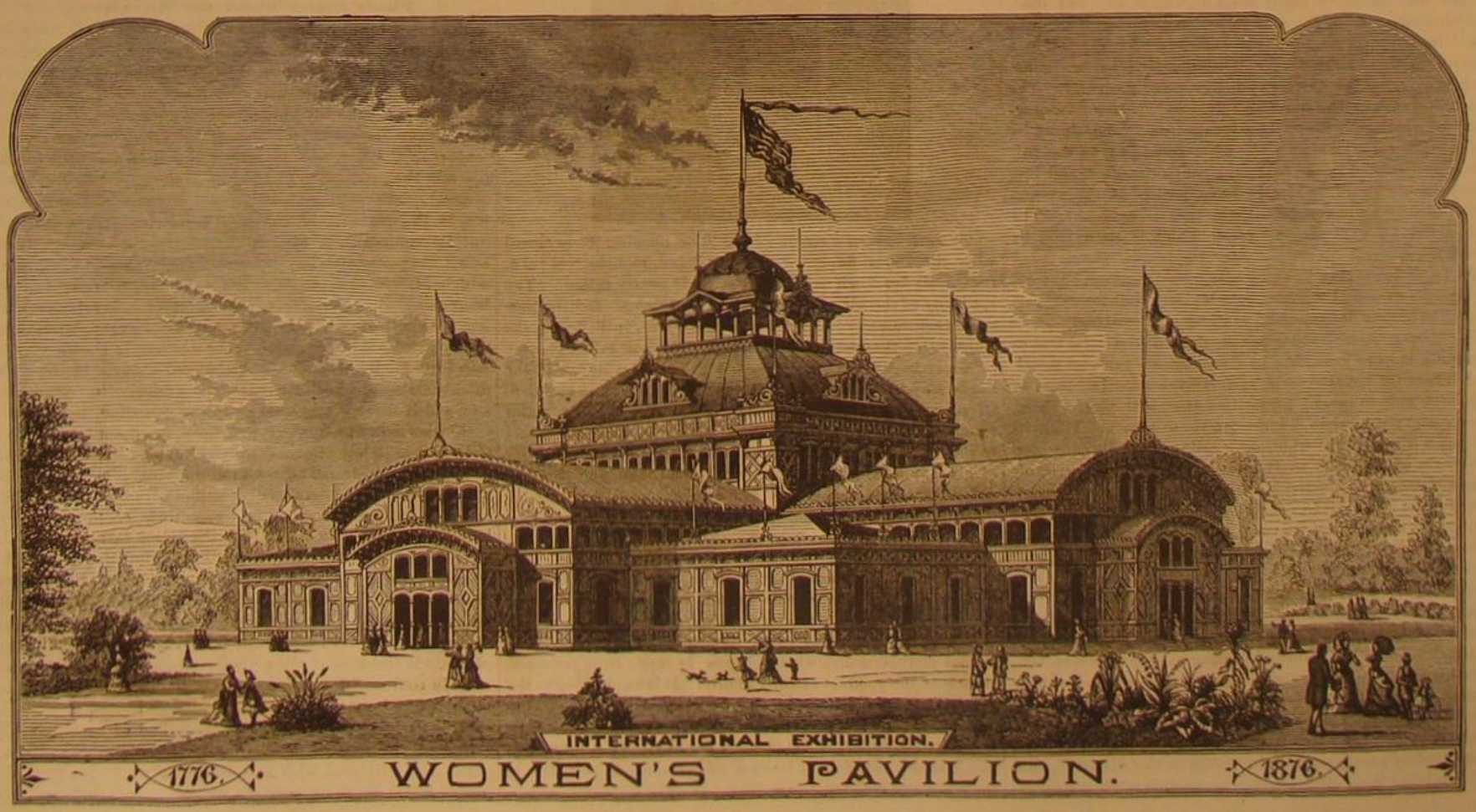
For illustrations and descriptions of some of the buildings erected for the separate industries, see pages 326 and 327 of this issue.



THE PENNSYLVANIA STATE BUILDING.

The Solvay Soda Process.

The ammonia-soda process of Solvay has been so greatly improved that the German soda ash manufacturers fear they will no longer be able to compete with him. Solvay is now on the point of erecting a factory, says a German contemporary, large enough to supply the demand of all the consumers on the Rhine



A Microscopical Exhibition.

Mr. D. S. Holman, the Actuary of the Franklin Institute, recently gave a very interesting microscopical exhibition in Philadelphia. The method he adopted of giving ever person in the audience a good view of the image was a novel one. An assistant carried a white screen some 18 inches square to different parts of the room, and all in its immediate vicinity had thus an opportunity to examine the details of the object. Mr. Holman has invented a number of very ingenious appliances for exhibitions of this kind. Perhaps the most noteworthy is a slide by which a small animal, like a salamander, may be kept alive in water, and quiet enough to show the circulation of its blood. The fish is laid in the groove of the glass slide, through which a current of water is kept flowing. A thin portion of the body is selected for examination, which, by the powerful light, is made transparent, and this portion is firmly held by the pressure of the very thin sheet of glass above the fish. A lens magnifying about 800 diameters is used, and a small artery invisible to the naked eye is made to appear on the screen as large as the finger; and the blood, which has been resolved into its component globules, or, as they are called, corpuscles, is seen coursing along, each heart beat accelerating its motion. It may be remarked that the frequency of these beats corresponds almost exactly with those of the human subject. These corpuscles vary in shape with the species of animal, and it is upon this fact that the expert testimony introduced latterly in murder trials is based.

In the salamader it is shaped much like a boy's torpedo or a pegtop. There are two varieties in all blood, the red and white, of which the former are much the more numerous; the red appears to be inert, but the white has apparently an individual motion, and may be said to be endowed with a certain kind of intelligence. These corpuscles are suspended in a transparent fluid which, of course, the microscope does not analyze.

At a private exhibition at the Institute, Mr. Holman, by a lens of his table microscope magnifying 1,200 diameters, showed the circulation of the sap in the leaves of plants. What does 1,200 diameters mean? Simply that the surface appears 1,440,000 times as large as it really is. To furnish a basis for comparison, he pricked a hole in a piece of paper with a fine cambric needle point, and found, when put in the field of the microscope, that the hole was nearly four times as large as the field. A small portion of a leaf of the *anarcharsis alsinastrum*, a water plant, was then shown under the lens, and the cellular structure of the leaf was seen. The cells appear like bricks laid in a wall, about forty appearing in the field, each overlapping its neighbor, and of about the same proportions as a brick.

Within each cell were little globules, which kept up a ceaseless movement round about the edges of their prison, like little mice chasing each other around a room. In all the cells the movement was in the same direction and at the same speed. That infinitesimal point could be studied with interest and profit for hours.

That motion is an attribute of all matter is very nicely shown by Mr. Holman in a slide which illustrates what microscopists term the dance of the atoms. Gamboge is pulverized and thrown into water, which is slightly colored by it. With a lens magnifying 2,000 diameters, the particles are seen in a rapid, cycloidic motion, which never ceases and is perfectly uniform, resembling very much a swarm of midges in the warm days of October.

Progress of Torpedo Improvements.

An experimental trial of a new torpedo boat, embodying the most recent improvements of the Lay system, was recently tried near the Navy Yard, Washington, D. C. The boat, of cigar shape, 16 feet long, 19 inches in diameter, is made of iron. It is propelled by liquid carbonic acid, carried in a reservoir within the shell, the liquid being allowed to expand into gas, which operates an engine and propeller. The boat is steered and the speed and direction of the engine governed by electricity, the circuit being opened and closed by means of a cable, which is wound or unwound, as desired, from a reel carried in the boat: the boat's direction and motions being governed by electric keys, located at the station or on the vessel whence the torpedo boat is sent out. The boat carries an explosive magazine which is discharged by electricity.

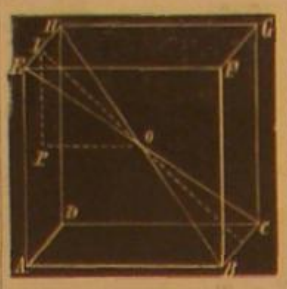
Mr. Lay's invention is calculated to revolutionize the entire system of naval warfare, particularly that branch pertaining to harbor defences and protection of fortifications, as well as open combat between floating navies. So fast as shipbuilders have been able to construct the thickest metallic defences for naval vessels, so fast have manufacturers of guns been able to invent projectiles that will pierce them. The submerged torpedo is impregnable to attack. With its explosion it carries far wider destruction than the most terrific storm of shot and shell, and the loss of life inevitable upon a close naval conflict is entirely avoided. The advantages of the movable torpedo over fixed mines and the spar torpedo are so apparent that it is not necessary to enumerate them. The torpedo boat is calculated to be used in a most efficient manner for offensive warfare. It can be used as a towing boat to effect an entrance to the harbor of an enemy or approach his fortifications, even if they are protected with fixed mines or torpedoes in the channel. To the Lay torpedo boat may be attached a line of floating explosive mines, connected with the operator's station, as is the torpedo itself, by electric cable. The torpedo boat may be despatched with these floating mines in tow to open the channel. The mines can be detached from the boat at any given point and sunk in position by an arrangement peculiar to their construction, still retaining their electric cable connection with the operator's station. They may be fixed at will. Mr. Lay has invented a submarine torpedo battery for harbor and coast defence. It is similar to the ship floating torpedo.

Correspondence.

The Largest Cube in a Ball.

To the Editor of the Scientific American:

There is an error in the reply of L. S. W. to J. C. W., No. 58, page 267, in regard to the largest cube which can be cut out from a ball; this error has been pointed out by others of your correspondents. L. S. W.'s assertion is strangely wide of the mark, as the great circle of a sphere passes always through its center, and the square inscribed in the same must therefore also pass through the center; but the sides of the cube are of course beyond the center, and are squares inscribed in circles situated at a distance from the center, and consequently much smaller. The annexed figure makes this clear: the globe which may be circumscribed on the cube is here represented, and its surface passes through the eight angles; and it has none of the surfaces for its large circle, but the larger circle will have for its diameter the diagonal, E C, passing from one angle to the diagonally opposite one, through the center, O, of the sphere and cube. This diagonal is considerably longer than the diagonal of one of the sides of the cube.



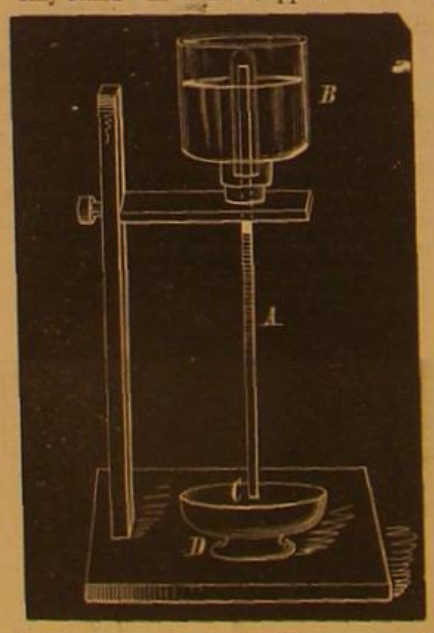
To find the relation between the globe and inscribed cube, we draw the perpendiculars, P O and I P, and the line, O T. Then we have P O = P I, and E I = ½ E H = half the side of the cube, which we will call s. Further: $I O^2 = O P^2 + P I^2 = s^2 + s^2 = 2s^2$. Further: $H O^2 = I O^2 + s H^2 = 2s^2 + s^2 = 3s^2$; but H O is the radius of the ball, and so, if we call this r, we have $r^2 = 3 s^2$, and $s^2 = \frac{1}{3} r^2$, or $s = r\sqrt{\frac{1}{3}}$. If we call the whole side of the square x, and the diameter d, we have, for the same reason, $x = d\sqrt{\frac{1}{3}}$; so that, if the diameter is 12 inches, we have $x = 12\sqrt{\frac{1}{3}} = 6{\cdot}94$ inches, and the volume of the cube $576\sqrt{\frac{1}{3}} = 332{\cdot}95$, considerably less than that found by L. S. W. in applying his erroneous proposition.

New York city. P. H. VANDER WEYDE.

Liquids under Atmospheric Pressure.

To the Editor of the Scientific American:

The accompanying engraving shows a very simple and cheaply constructed apparatus for illustrating the flow of liquids under atmospheric pressure, which might be called an interrupted siphon. It consists of a long glass tube, A, passing through a cork fitted in the neck of an open-mouthed bell glass, or a bottle with the bottom cut off, B, and a large test tube. Any stand will do as a support. B is filled with



water to the upper opening of A. The opening, C, is closed with the index finger of the left hand, and the test tube, previously let down over the tube, A, is gently raised. The elasticity of the air confined in A is diminished, and the normal pressure upon the surface of the water, in B, forces the water up in the test tube and into A. So soon as the column of water in A is greater than the depth of water in B, the finger may be removed from C, and the vessel, B, is emptied. Of course, if C is already under the surface of the water previously placed in D, it is not necessary to apply the finger to C. By holding the test tube quite high, a small quantity of air may be kept in the top of the test tube, and thus the difference of atmospheric pressure is very prettily shown.

Baltimore City College, Md. C.

Corn Sugar.

The Davenport (Iowa) *Gazette* claims for that city the first manufactory of pure glucose in this country. The demand for the article by confectioners alone, in the United States, is immense. The sources of supply heretofore have been France and Germany, where glucose is made from potatoes. Here it is the product of corn wholly. It is as pleasing to the taste as honey. The production of grape sugar and glucose opens a new department for Iowa corn. The capacity of the works at Davenport is 500 bushels per day. This branch of manufacture bids fair to become of immense importance to the State and country

Preserving Wet Plates.

At a recent meeting of the Belgian Photographic Society, a paper was read by M. Watrigant, who was of opinion that none of the dry plate processes in vogue at the present day were capable of giving pictures equal to those from wet plates. M. Watrigant proposed a method for maintaining the moist film in a wet condition for many hours, so that it would be possible, for tourists and others occupied in photography, to employ wet plates without having the trouble of carrying about with them a lot of solutions necessary under ordinary circumstances.

M. Watrigant's plan is to take the plate as it comes from the dipping bath, and to put round its margin an india rubber ring, in such a way that the rubber laps over on each side. Upon this sensitized plate he now places a second one, similarly prepared, the two collodion films towards each other. The two are tightly fastened together in any way that might suggest itself, by string or some other means, and then one is in possession of a couple of prepared films sealed hermetically. No injury can arise from the two plates pressing against one another, as the rubber ring forms a suitable buffer. M. Watrigant says that plates may be kept in a moist condition in this state for a period of forty-eight hours.

If it is considered undesirable to have a dark tent in which to separate the films before exposure, then M. Watrigant suggests that only the sensitive film should be sealed in like manner against an ordinary glass plate, and then an exposure may be made in the camera without inconvenience, due regard being paid to the thickness of the plates in the dark slide. The result in this case is not, however, so good as that secured when two prepared films are fastened together.

The landscape photographer, by adopting the Watrigant method, may spare himself the trouble of carrying collodion, silver bath, developer, and other solutions, and this is the object which the author desired to obtain.

Zuccato's Papyrograph.

This is a useful invention for the speedy reproduction of circulars, price lists, diagrams, maps, examination papers, music, etc., upon any description of dry and unprepared paper. The writing or drawing to be multiplied must be executed with a steel pen, by means of special ink, upon a sheet of prepared waterproof paper. The ink passes through the fibers of the paper without injuring them, and attacks or corrodes the waterproofing beneath. The corroded parts are then removed by placing the waterproof paper upon a piece of thoroughly wet calico. The moisture from this dissolves the corroded lines, ascends through them to the surface of the paper, and, loosening the ink, enables it to be entirely removed by blotting paper. The result is a porous paper stencil, held together by its fibers, which presents in facsimile the delineations that have been made upon it with the ink. The stencil is then lightly painted upon the written side with papyrographic color. It is next placed upon a pad of velvet, painted side downwards, and, upon being pressed, color is forced through the lines of the matrix and brought in contact with the paper employed for printing, upon which is formed a perfect facsimile of the writing. A like result is attained, without repeating any of the before-mentioned operations, as often as a new sheet of paper is laid upon the stencil and submitted to light pressure by means of a copying press. A proof impression can be taken in a few minutes, and afterwards quickly multiplied. It is said that 500 copies can be produced from one sheet of the specially prepared paper at an infinitesimal cost.

Photo Plates under the Microscope.

M. Jules Girard, who has published several valuable works upon the application of photography to the microscope, has just communicated to the Academy of Sciences the results of his interesting researches upon the transformation of collodion in photographic operations. A microscopic examination of collodion permits one to discover the texture of the film, and to follow the reactions which take place in the production of the luminous impression. When of good quality, the collodion plate is translucid and colorless in the event in the collodion being perfectly dissolved; but its composition, age, and the actions which constitute sensitizing change its texture. The photo-micrographs which M. Girard presents to the Academy, representing enlargements to 50 diameters, demonstrated several phenomena. Old collodion which gives very fine images, but the rapidity of which leaves much to be desired, is shown to contain liquid bubbles holding unchanged ether. If the collodion contains alcohol, it has the appearance of a cellular tissue; and if there is much water in the collodion, the fibers of cotton become apparent in the form of flocculent matter Collodion which is too thick gives intensity, but is not rapid it has the appearance of an undulated cellulo-vascular tissue. The irregularity of the film militates against the clearness of the image. Two indications or proofs are at hand of the time during which the action of sensitizing in the nitrate of silver bath is still incomplete, and of the moment when the operation has terminated. In the first case, the greasy marks, which are an indication of the sensitizing being still incomplete, are full of streaks and groups of crystals, some in the form of needles and some amorphous. It seems as if the crystals of iodide of silver, which were in course of formation, have been arrested in the midst of their development.

In the second case, when the operation of sensitizing is complete, the texture of the film is homogeneous and compact. It is covered with a uniform network, rendered the more evident by those portions which are free from crystals

The greater part of the photographic action necessary to obtain an image is due to the successive transformation of the crystallographic system, the reaction of the iodide of silver being the most perceptible of all. The result is that an examination of the plate at different stages of the operation under a microscope of moderate power permits the operator to judge of the success or otherwise of the process he is employing.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number III.

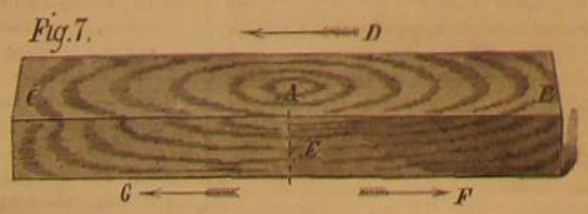
PATTERN MAKING

In using a jack plane, we commence each stroke by exerting a pressure mostly on the fore part of the plane, commencing at the end and towards the edge of the board, and taking off a shaving as long as the arms can conveniently reach. If the board is longer than can be reached without moving, we pass across the board, planing it all across at one standing; then we step sufficiently forward, and carry the planing forward, repeating this until the jack planing is completed. To try the level of the board, the edge or corner of the plane may be employed; and if the plane is moved back and forth on the corner or edge, it will indent and so point out the high places.

The fore plane (or truing plane, as it is sometimes called) is made large, so as to cover more surface, and therefore to cut more truly. It is ground and set in the same manner as the jack plane, with the exception that the corners of the iron or blade, for about one eighth inch only, should be ground to a very little below the level of the rest of the cutting edge, the latter being made perfectly straight (or as near so as practically attainable) and square with the edge of the iron. If the end edge of the cover is made square with the side edge, and the iron is ground with the cover on, the latter will form a guide whereby to grind the iron edge true and square; but in such case the cover should be set back so that there will be no danger of the grindstone touching it. The oilstoning should be performed in the manner described for the jack plane, bearing in mind that the object to be aimed at is to be able to take as broad and fine a shaving as possible without the corners of the plane iron digging into the work. The plane iron should be so set that its cutting edge can only just be seen projecting evenly through the stock. In using the fore or truing plane, it is usual, on the back stroke, to twist the body of the plane so that it will slide along the board on its edge, there being no contact between the cutting edge of the plane iron and the face of the board, which is done to preserve the cutting edge of the plane iron from abrasion by the wood: as it is obvious that such abrasion would be much more destructive to the edge than the cutting duty performed during the front stroke would be, because the strain during the latter tends mainly to compress the metal, but, during the former, the whole action tends to abrade the cutting edge. The face of the fore plane must be kept perfectly flat on the underside, which should be square with the sides of the plane. If the under side be hollow, the plane iron edge will have to protrude further through the plane face to compensate for the hollowness of the latter; and in that case it will be impossible to take fine shavings off thin stuff, because the blade or iron will protrude too much, and as a consequence there will be an unnecessary amount of labor incurred in setting and resetting the plane iron. The reason that the under surface should be square, that is to say, at a right angle to the sides of the body of the plane, is because the plane is sometimes used on its side on a shooting board.

When the under surface of the plane is worn out of true, let the iron be wedged in the plane mouth, but let the cutting edge of the iron be well below the surface of the plane stock. Then, with another fore plane, freshly sharpened and set very fine, true up the surface, and be sure the surface does not wind, which may be ascertained by the application of a pair of winding strips, the manner of applying which will be explained hereafter. If the mouth of a fore plane wears too wide, as it is apt in time to do, short little shavings, tightly curled up, will fall half in and half out of the mouth, and prevent the iron from cutting, and will cause it to leave scores in the work, entailing a great loss of time, in removing them at every few strokes. The smoothing plane is used for smoothing rather than truing work, and is made shorter than the truing plane so as to be handier in using. It is sometimes impracticable to make a surface as smooth as desirable with a truing plane, because of the direction of the grain of the wood. Thus, in Fig. 7, let E represent a piece of stuff requiring to be planed on the upper sur-

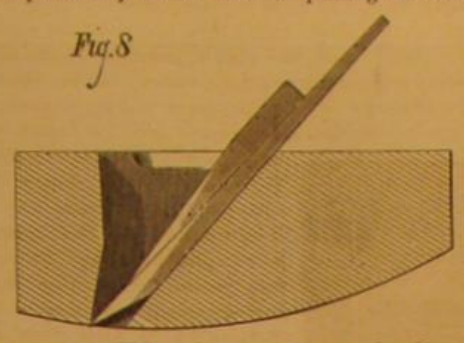
Fig. 7.



face, and let us plane it, cutting in the direction of the arrow, D; it is evident that the edge of the plane iron, when cutting the surface from B to A, will strike against the edge or end of the grain of the wood, tending to rough it up: whereas, while passing from A to C, the tendency of the pressure of the iron edge would be to smooth the grain of the wood downwards, the difference between the two tendencies being sufficient to make it necessary in many cases to use a smoothing plane cutting in both directions, as shown in Fig. 7, first from A to B, cutting in the direction of the arrow, F, and then from A to C, cutting in the direction of the arrow, G. Thus the cutting will be at all times performed in the direction tending to smooth down and not rough up the grain of the wood. That this method of planing is necessary is demonstrated in planing across the end grain of wood, for which purpose the smoothing plane is almost indispensable, and in which operation it is necessary to use it, on small surfaces, with a side as well as with a forward sweep, thus producing a curved motion, the most desirable direction of which is determined by the direction of the grain of the wood

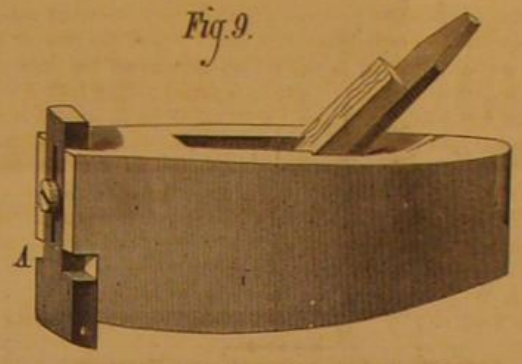
Fig. 8 represents an ordinary compass plane, which is a necessary and very useful tool for planing the surfaces of

Fig. 8



hollow sweeps. This tool is sometimes made adjustable by means of a piece dovetailed in the front end of the plane, as shown in Fig. 9, at A; which, by being lowered, alters the sweep and finally converts it from a convex to a concave. There is now, however, in the market a compass plane, the body of which is made of malleable iron with a sole made of

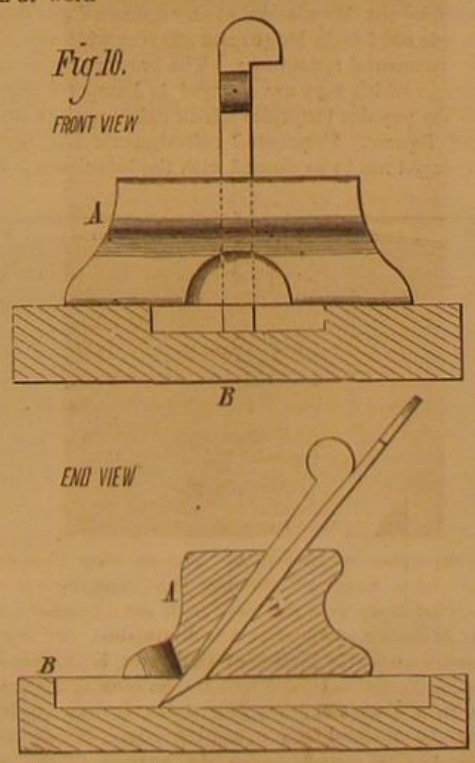
Fig. 9.



a blade of spring steel, which, by the operation of two screws, can be set to any curvature, either concave or convex, within the capacity of the instrument.

Another very useful species of plane is the router, shown in Fig. 10, which represents one of these planes in operation, A being the router, and B the work. The use of this tool is to plane out recesses (exactly to any given depth) such as are required to receive rapping plates. The wood in the plane stock is cut away just over the edge of the iron, to give clearance for the shavings, and so that the cutter may be seen at work

Fig. 10.



Rabbet planes are narrow planes having the sole or side of a conformation to suit the work. Fig. 11 represents a rab-

Fig. 11.

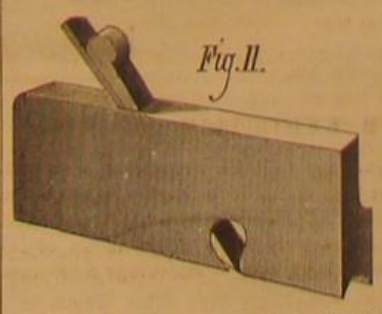
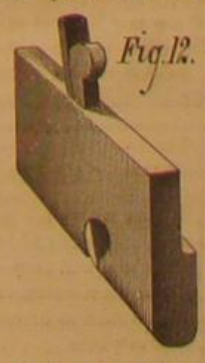


Fig. 12.



bet plane to suit a round edge, Fig. 12 a similar plane for a groove, and Fig. 13 a side rabbet plane The latter is, however, very seldom used, but is especially useful in planing hard wood cogs fitted to iron wheels, or the teeth of wheel patterns or other similar work. For ordinary use, it is sufficient to have two, a ¾ and a 1¼ inch, as represented in Figs. 11 and 12, and two or three having a flat sole for flat bottom grooves. Small thumb rabbet planes, having an iron stock, with the blade near the front end, are now supplied, and are very useful for cutting out half checks that are not cut right across the stuff.

Fig. 13.

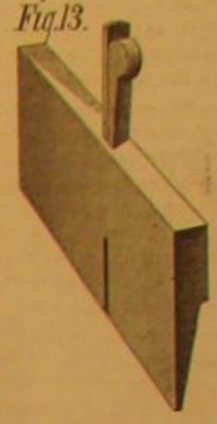


Fig. 14 is an end, and Fig. 15 a side, view of a core box plane, suitable for planing semicircular grooves out of the solid. The principle of its construction and use is that the angle in a semicircle is a right angle. Suppose, for example, that Fig. 16 represents a piece of wood having a semicircular groove in it, and we mark off on the groove the points, *a*, *b*, *c*, *d*, *e*, and strike from each of these a line directt o each corner

Fig. 14.

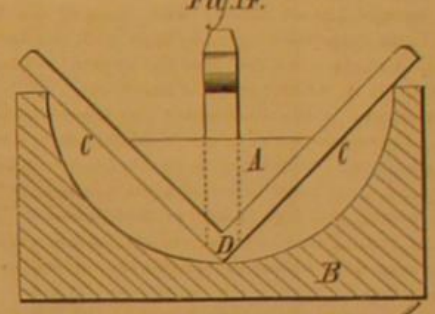
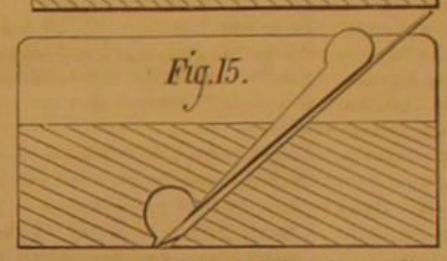
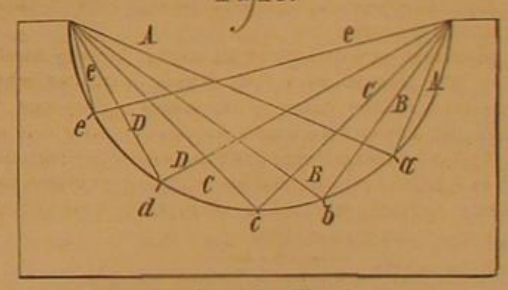


Fig. 15.



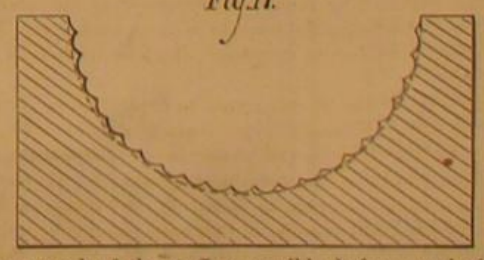
of the groove. We shall thus find that the two lines struck will be at a right angle to each other, the two lines, A A, meeting at the point, *a*, being at a right angle. The two side faces, C C, of the plane in Fig. 14 are made to stand at a right angle to each other; and while the plane is in position (as shown in Fig. 14) to bear against the corners of the core box, a semicircle (the apex of the plane, D, in Fig. 14)

Fig. 16.



must be in the semicircle, and will only cut away the wood in the form of the circle, no matter in what position the plane stands, so long as its sides touch the corners of the semicircle. This being the case, the first operation in using this plane is to cut out the required semicircle to the necessary width, which may be done with a rabbet plane. The core box plane may thus be employed to cut out the semicircle, commencing at each of the corners and planing on each side down to the center of the depth of the semicircle. As this plane is intended to finish the work, it is desirable to cut

Fig. 17.



away as much of the stuff as possible before employing it, the work appearing as shown in Fig. 17. These planes have one disadvantage. They are apt to abrade the corners of the work; hence great care should be exercised in their use, and care must also be taken that the extreme point of the plane iron stands just at the apex of the angle of the body of the plane; for if it be in advance or not up to it, the work will not be semicircular.

Trademark Decision.

In a recent application for trademark registration for the use of the words "Star Oil," the Commissioner of Patents refused registration, because a prior registration had been obtained, by other parties, for the use of the figure of a star in connection with the word oil, thus: "* Oil." The Commissioner held that, in cases where parties used a brand containing the figure of an object, the mere substitution, by a new applicant, of the name word of that figure, would no entitle such applicant to registration.

THE CENTENNIAL BUILDINGS--THE INDUSTRIAL PAVILIONS.

In this division of the numerous structures (some 150 feet in all), the Photographic Hall claims our first attention. It covers a space of 258 feet long x 107 wide, its length laying east to west. The interior is fitted up with screens for the exhibition of photographs; these are 28 in number, and 4 of them are 19 feet long, and 24 are 24 feet long each. Both sides of the screens are valuable as exhibiting space; and allowing 10 feet square to each exhibitor, 1513 exhibitors can be accommodated on the screens alone. The halls of the building will accommodate 532 exhibitors, giving them also 10 feet square each, with some T-shaped screens in addition, giving 720 square feet, a total of 19,080 square feet being thus appropriated.

THE PHOTOGRAPHIC HALL.

The screens stand 16 feet apart, and in some cases floor space can be gained for exhibits between them; and floor space will be had for the same use all along the middle avenue between the ends of the screens. The T-shaped termination of the screens towards the middle avenue is available for pictures, and will be about 2½ feet wide. These ends of the screens, being covered with pictures, will greatly improve the effect in viewing the middle avenue along its entire length, as in sharp perspective it has the appearance nearly of a continuous wall of pictures. The main purpose of it, however, is to stiffen and strengthen the screens.

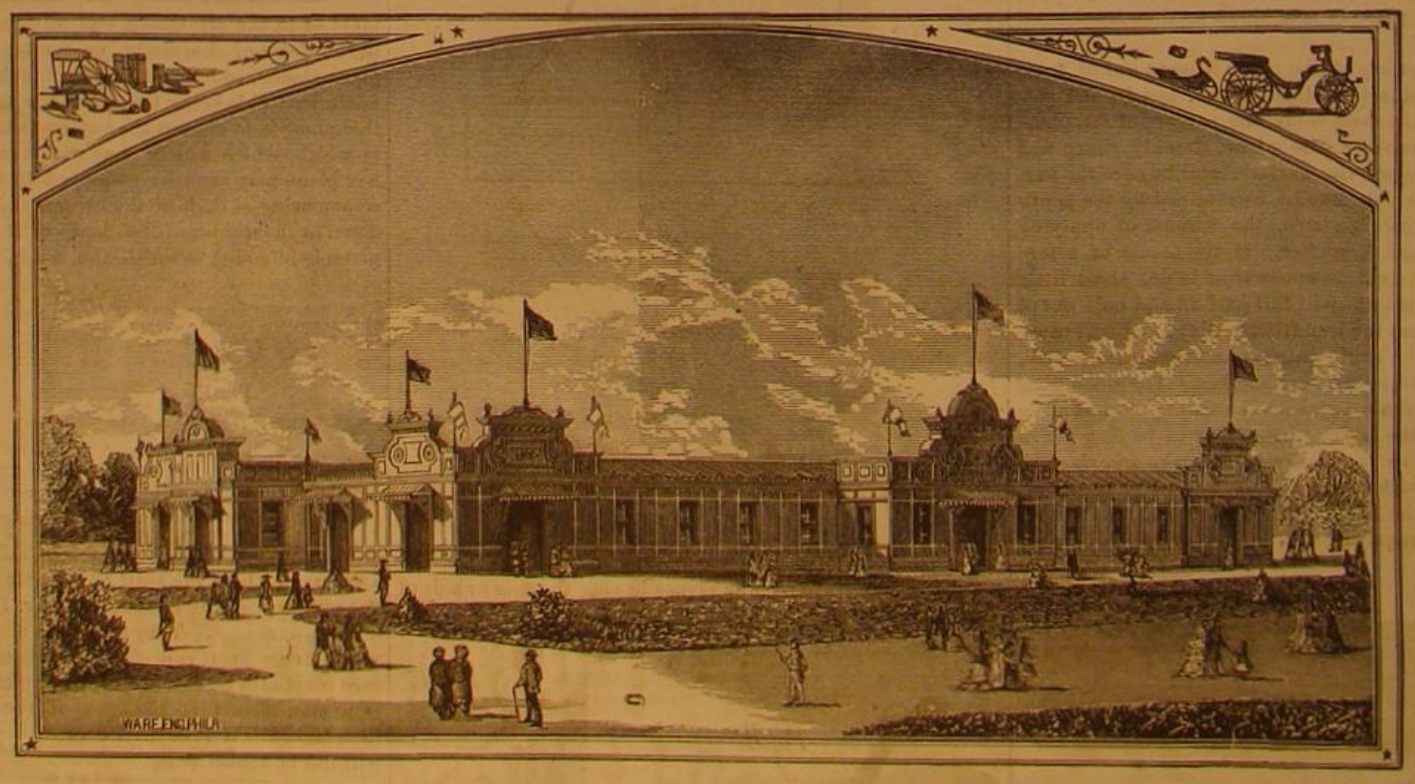
It will be seen from this that there will be an exhibition of photography here such as the world never saw, if there is more enterprise shown in filling the space allotted than there is in subscribing for the stock to build it. In this matter we must do our best, or our friends will beat us. Dr. Vogel says that there will be a very elegant and interesting collection sent from Germany. It left Berlin in February last, we believe. Dr. Horning, editor of the *Photo. Archiv.*, in Vienna, writes that a fine collection is coming from his city. He says: "I hope to be able, according to the invitation of our American co-workers, to excite an animated participation of our photographers, and I shall be glad if I can succeed, to enable me to show you my esteem for the extraordinary exertions you have made in the interest of our art."

M. Adolph Braun, the renowned carbon art printer and publisher, has applied for 265 square feet of space, and promises to make a famous exhibit. Many French, English, and other foreign exhibitors will join in the display.

The Carriage Builders' Pavilion, next illustrated, will afford a most interesting show. The exhibits will consist entirely of pleasure carriages; and the light-running vehicles for which this country is famous will sustain our reputation in this branch of industry. The position of the building is north of the Main Building and west of the Art Gallery, on the main avenue leading from the Art Gallery to Machinery Hall, Government and other buildings. It is also near Belmont Avenue, the principal drive through the grounds.

The building is 346 feet long, 231 feet wide, in shape a parallelogram. The material used in its construction is wood, sheathed with corrugated iron. The building is one story high, with hipped roof, having five skylights running the full length of the building. From the floor to the top of roof is 36 feet; to main plate, 24 feet. Four principal entrances allow of the easy ingress or egress to and from the building. Besides the skylight, the building has large windows, 14 feet in hight on the side. Offices are placed at each entrance of the building, affording accommodation to the many visitors. The south half of the building is allotted for the carriage trade; the other half to palace cars and stoves.

The amount of square feet allotted to foreign countries is as follows: Great Britain, 4,500; Germany, 210; Italy, 224; Canada, 2,700. There will be about 75 exhibitors of carriages from France who will probably exhibit in the United States.



THE CARRIAGE EXHIBITION BUILDING.

Our next engraving shows the building erected by the United States Brewers' Association, in which is made a grand display of all the materials and processes employed in the brewing of beer, which will be exhibited in full operation. For this purpose the large and elegant building represented is erected by the Association, at an expense of $70,000. The building is 300 feet in length and 100 feet wide, and presents a very ornamental appearance. The brewers claim that the industry in which they are engaged is hampered and imperiled by the popular prejudice which exists against the use of distilled liquors. Fermented refreshments like beer, they allege, ought not to be classed with the intoxicating distilled liquors which are productive of such widespread wretchedness. The use of beer they claim to be highly beneficial to mankind, and they intend to prove this by a national exhibit of the most extensive character. Their object is not to induce a man to drink more beer, but to encourage more men to drink beer

Next on our list of illustrations is the newspaper building, which will contain nothing but an exhibition of newspapers. The structure occupies a conspicuous position near the miniature lake, on a line between the United States Government Building and Machinery Hall.

The plan of exhibition is an alphabetical arrangement of the partial files of each newspaper or periodical in such a manner as will make them instantly accessible: the space devoted to each bearing a label with the name of the publication printed thereon, and further designated by a number, by means of which a stranger, upon reference to his catalogue, will be able at once to approach the section of the building where the particular journal which he desires to examine or refer to may be found. The cases containing these files will form alcoves similar to those in public libraries for the arrangement of books; and these alcoves form long tiers, one on each side of the building throughout its entire length, a portion of the space between being reserved for the accommodation of attendants, leaving a passage way for the public 18 feet in width, extending from one end of the structure to the other. The second story, approached by four flights of stairs, is devoted to reading rooms for the accommodation more especially of newspaper men, and will be supplied with conveniences for correspondents. Mr. George P. Rowell, of New York, has assumed the management of the enterprise, and with him will rest the responsibility of making it what it should be.

Our last engraving represents the building erected by subscriptions from members of the shoe and leather trades, for the accommodation of the industries in which they are especially interested. There is probably no branch of industry in which labor-saving machinery has been carried to greater perfection than in the boot and shoe trade, and this part alone will constitute one of the principal features of the exhibition. Here will be seen machinery for the performance of almost every conceivable operation in the trade, from mills for grinding the bark with which the skins are tanned, with currying, hairing, graining, splitting, pebbling, polishing, buffing, and coloring leather, up to the intricate and ingenious machines employed in the cutting, sewing, pegging, forming, and finishing all varieties of boots and shoes; and their name is legion. There will be machines which make pegs, and secure the soles upon the boots and shoes, by means of them, in one operation; and others which make kinds of screws of brass wire, and insert them in the shoe or boot for the same purpose. This building is 256 feet long by 160 feet wide; the roof is supported by columns 16 feet apart, the central section being a curve 80 feet wide, of the Howe truss pattern, over which is a louvre ventilator 26 feet wide, running the length of the building, 60 feet above the ground. The pavilions are 20 and 30 feet high The ground floor of the building is divided as follows: An aisle 15 feet wide and 300 feet long runs through the center, and on either side is one 10 feet wide, parallel with the center aisles. Across the center of the building is a passage way 10 feet wide, at one end of which is a doorway leading to Machinery Hall on the north. The east and west sections of the ground floor have aisles 14 feet wide. There are eight main exhi

bition spaces for exhibits (bounded by the aisles) 20 feet in width and 117 feet in length, and four exhibition spaces of 20 feet in width by 114 in length.

These illustrations and descriptions show clearly the various styles which have been chosen for the buildings, the selection being governed by circumstances. Altogether, a lavish provision of space has been made, and there will be no just reason for complaint of want of room. We are glad to know that the exhibits which have arrived and are arriving from all parts of the world will justify the managers in providing such extensive and costly accommodation; and we anticipate an exposition which shall redound to the credit of the United States.

THE BREWERS' BUILDING.

Sunday at the Centennial.

It has at last, after much discussion, been decided that the Exposition shall remain closed on Sundays, the Centennial commission voting in the ratio of three to one against adopting the minority report to the contrary.. All the buildings and grounds will be closed to the public on the Sabbath.

We think the decision of the commission is the one which will please the majority of our people best. The strong argument against closing lay, first, in the fact that Sunday is the only opportunity afforded to working men to visit the Exposition by daylight; and second, that many citizens and foreign visitors do not observe the Christian sabbath, and hence should not be debarred entrance on a day which, to them, is no different from any other in the week. While there is considerable reason in these views, they manifestly should not prevail when the Exposition is regarded in the light of a national undertaking. The workmen who would be benefited are only those who reside within short distances of the Centennial, a very small majority compared with the entire working class. In this country, moreover, we live under the rule of the majority, and the sabbath of that majority is the Christian sabbath, a day which our ancestors of one hundred years ago venerated and reverently observed.

THE NEWSPAPER BUILDING.

Moreover, foreigners will come here to study us and our institutions as they are, and one of those institutions is certainly the sabbath as a day devoted to rest and religious duties. Hence, the question after all reduces itself to whether a small minority of one class of the population, *plus* a still smaller proportionate minority of the entire religious community, are to be accommodated in opposition to a public sentiment which overwhelmingly prevails.

There are various other considerations, notably the enforcement of extra work among the employees on the grounds, and the interference with the quiet enjoyment of the day of rest by those residing in Philadelphia and its suburbs, which need not here be reviewed. As we said in the beginning, the decision will be acceptable to the greatest number of our people.

Centennial Relics.

Every year, it is said, the battlefield of Waterloo is carefully planted with battered bullets, odds and ends of accoutrements, and other rubbish, which in the following year are dug up and sold to credulous tourists, as relics of the conflict, by the enterprising natives. Not long ago the German government was ruthlessly victimized by some ingenious Arabs who manufactured and sold as real some spurious specimens of rare and ancient pottery. Almost any one, indeed, who has traveled through Europe can add scores of instances of like deceptions being practised which probably have come under his notice; so that at the present time, antiques in Naples, coins in Rome, pipes and pottery in the East, and the thousand bits of *bric-a-brac* that travelers delight in gathering are either the handiwork of the present inhabitants of the historic localities, or, far more likely, have their origin in Birmingham, England, that world's supply shop for all heterogeneous articles, from big Japanese idols down to pins.

We did cherish the idea that the relic-manufacturing industry had not traversed the Atlantic; and although we might secretly laugh at the friend who proudly exhibits Waterloo bullets and Roman *oboli*, we were fain to accept as genuine flint lock muskets which have been through the Revolution, or the moth-eaten old uniform kept in the garret since the days of 1812, and now brought out for exhibition in this Centennial season. But this era of confidence has passed. We now point the finger of scorn at the musket, and express doubts as to whether the uniform is not one on which army officials have been testing the much-vexed moth patent. We might have continued in our innocence, despite the fact that General Washington's headquarters have sprung up over the land like mushrooms, necessitating the supposition that the hero must have been endowed with ubiquity, or else have spent his existence in traveling from one to the other; but when we regard the number of his favorite and

THE SHOE AND LEATHER BUILDING.

only chairs, at least one of which is now deemed indispensable to every well regulated furniture store, and the quantities of abnormally written documents attributed to the Father of his Country which photography reproduces in uncounted and genuine originals, our credulity gives way, and we warn our readers against Centennial relics. During the past winter, we have seen certainly thirty quilted petticoats which fair wearers assured us belonged to Martha Washington, and this is in only one city. How many such garments Philadelphia possesses, we cannot divine. All along Broadway, conscienceless small boys are vending musty, yellow, and ragged newspapers; and not a single anniversary of any revolutionary battle can occur but that copies of the particular ancient paper containing the account of the conflict are sold in New York, in editions so large that the long since dead publishers would have deemed their fortunes secure had their original publications achieved one half the circulation. Lafayette buttons are appearing by the gross; and as for Franklin's canes, their name is legion. There is a strong and growing desire for these things, which bids fair to establish a new and patriotic industry devoted to their manufacture

THE DI CESNOLA COLLECTION.

LECTURE DELIVERED AT THE STEVENS INSTITUTE OF TECHNOLOGY, BY WM. HENRY GOODYEAR, ESQ., OF NEW YORK.

"Westward the star of empire takes its course" has always been a fundamental truth with regard to the progress of civilization; and although at the present day the troops of the Czar steadily pursue their march eastward, all our modern nations owe their being and development to a steady movement in the opposite direction. Our ancestors lived in the mountains of Hindostan and called themselves the Aryans; and when they started out upon their migrations westward and settled in Europe, they became in time Greeks, Romans, Germans, Celts, Slavonians: all of whom belong to the same great family, to which the name of Indo-European or Indo-Germanic has been given. We know the fact of their kinship by the similarity of their languages as revealed by comparative philology. Take a single example: Mother in Sanscrit is *mâtâr*, in Persian *mâder*, in Greek *μητηρ* in Latin *mater*, in Celtic *mathair*, in Slavic *matka*, in Swedish and Danish *moder*, in German *mütter*, in Dutch *möder*, in Anglo-Saxon *moder*. If such then are the ties which connect us with the ancient world, the study of its civilization proceeds from higher motives than mere curiosity; it is the study of our own first beginnings.

The subject of the present lecture is the development of art, as illustrated by the Di Cesnola (pronounced *Chessnola*) collection in the Metropolitan Museum of Art at No. 128 West 14th street, New York.

General Louis Palma di Cesnola, an Italian by birth, but an American citizen, who fought in our civil war, was appointed Consul to Cyprus in 1865 by the American government. Cyprus is one of the largest islands of the Mediterranean Sea; it is situated near the Syrian coast and belongs to Turkey. Owing to its position, it is a convenient point for the representatives of the European powers to keep watch on each other's movements with regard to the Eastern question. Although the whole island contains less than one hundred and fifty thousand inhabitants, there were then as many as seventeen consuls on it, whose whole business was to bully each other and act as spies for their governments. Di Cesnola, whose government was not involved in the Eastern question, perceived the importance by reason of its lying directly in the route of ancient civilizations, and proved himself the only sensible consul on the island; for he commenced to dig.

The importance of the objects he exhumed soon attracted the attention of archæologists; and in 1869, when the lecturer was on the island, with an agent of the Berlin museum, he witnessed the sale of everything that had been brought to light up to that time. But Di Cesnola continued his excavations after that; and in the winter of 1869 to 1870, he began work on the site of the ancient city of Golgos, discovered the Temple of Venus, and brought to light the most important collection of statuary yet found.

The way in which the city of New York came to secure so great a prize was as follows. It was first offered to Boston, and then transferred to London with a view to its acquisition by the British Museum. But Mr. Newton, the head of that institution, was unwilling to accept it under the conditions of the sale: namely, that it should retain the name of Di Cesnola, and that it should be kept intact. As there was a mortgage on the collection, Mr. Newton expected to obtain it on his own terms by delaying his decision until the day of the sale; but he was baffled in this by Di Cesnola, who grew tired of the whole business, and sold the collection to Mr. John Taylor Johnson, of New York, for $40,000.

The two principal features of the collection are its ugliness and the confusion it is likely to leave in the mind of the spectator. This confusion will disappear when we study the position and history of Cyprus with a view to what we may expect to find there.

The island of Cyprus is only 150 miles distant from the Euphrates, that is to say, from the great Assyrian empire of Babylon and Nineveh. The nearest neighbors were the Phœnicians of Tyre, a great commercial nation, who had sailed as far as Britain, B.C. 1300. They first colonized Cyprus as far back as B. C. 1800 or 2000. Then the island passed successively under the dominion of the Egyptians, the Assyrians, the Persians, the Greeks and the Romans. As we do not know of any Phœnician art, the first to occupy our attention is the Egyptian. The characteristics of Egyptian art are evident in the temple of Ipsamboul. There we see the sculpture as an auxiliary of architecture. The statues are not free, but attached to the walls. The artists seem also controlled by the principle that their work should adapt itself to the material of which it is made, in other words, that a stone statue should be stony. Lastly, their sculpture, like all art, reflects the spirit of the people. The great characteristic of the Egyptian people was their sentiment of eternity. All their works show its imprint, either by their colossal nature or by other attempts at conferring durability. We notice it in the pyramids, the tombs of their kings, in the embalming of mummies, and in their statuary. Here everything is of a fixed type, from which the individual artist may not vary. Hence we find, in all Egyptian statues, the same monotonous expression, the same conventional breadth of shoulder, the same head dress. A statue from Cyprus, which exhibits the above characteristics, is consequently pronounced Egyptian. Its date would therefore be between B. C. 1440 and the end of the twelfth century B. C., the period of Egyptian ascendency in Cyprus.

We next find Cyprus as a part of the great Assyrian empire, and the sculpture of that period may be expected to exhibit Assyrian peculiarities. What these are appears in a representation of the winged bulls of Nineveh, taken from the Assyrian Court in the Crystal Palace, London. In the Assyrian empire, where mind was held in as much esteem as force, we find curious combinations of human and animal figures, male still more subservient to architecture than the Egyptian; for they are all in relief. There are no free figures. The Assyrian statues found at Cyprus are all distinguished by their helmets, their beards, and the peculiar simple drapery.

When Nebuchadnezzar destroyed Tyre, in 571 B. C., he crippled the power of the Phœnicians in Cyprus as elsewhere, and gave the Greeks a chance to gain a firm foothold on the island. With their increasing influence, the art of the Greeks began to flourish. There is a fine specimen of it which is easily recognized to be a statue of Hercules by the knotted club and the lion's skin. The head of the lion forms the head dress of the statue. The teeth and upper jaw form a kind of crown on its forehead, and the lower jaw is divided into two parts, one over each cheek. The face resembles that of the native Cypriote type of the present day, and leads us to conclude that its sculptor was a Cypriote. This statue is one of the most valuable of the collection, and would bring about ten thousand dollars.

The next period in the history of Cyprus is again one of Egyptian ascendency; and the statues of this time, although still Assyrian, show the influence of Egyptian art. One specimen exhibits the Assyrian helmet, beard, and drapery, but also the conventional breadth of shoulder peculiar to the Egyptian statues.

After this the faces and drapery of the statues become more and more Grecian. In one figure the high priest of Venus, holding in his hand the dove sacred to the goddess and a patera or cup for libations, exhibits the peculiar zigzag character of Greek drapery. Originally they first carved their statues in wood, and then dressed them up. The angular nature which their first crude attempts had was afterwards copied in stone and became consecrated by usage. Observe the Assyrian helmet and beard and the Cypriote type of face. It is a curious and instructive fact that all these varieties of statues were found together in the same temple; for it shows us the gradual development of Greek art from Eastern art. One specimen is the most perfect example of Greek art in the collection; and it is not forty years removed from the date of the finest specimens of sculpture Greece has ever produced. The statue of the Discus Thrower shows indeed a giant step in advance; but it was very long before the development was reached. For five hundred years the Greeks were, like ourselves, too busy making money to have any art of their own. When we, in our brown stone fronts, etc., imitate some of the least desirable features of ancient art, and thus expose ourselves to criticism, we may point to the Greeks as imitators before us. The discus thrower just referred to dates not 150 years after the statue of Hercules.

After the Persian wars, when Cyrus had taken Babylon, and Cambyses conquered Egypt, the Phœnicians, who were the allies of the Persians, again flourished in Cyprus. Then the faces of the statues assume the semitic type, but otherwise preserve Greek characteristics. A figure in which the drapery is very carefully executed shows the peculiar ribbed woolen undergarment, peculiar to later Greek statues.

To prove that the statues shown were not the representatives of merely provincial but of true Greek art at different periods, the lecturer threw upon the screen a picture of statues from the Acropolis at Athens, and pointed out the same characteristics in them.

After the conquests of Alexander, Greek art rapidly declined, and we find portraits instead of ideal faces and figures. The Greeks were spread over too large a territory and formed too small a fraction of its inhabitants to maintain the ascendency of their taste. They were diluted too much by the barbarians. The same cause operated unfavorably to the development of Roman art. There was not enough Roman blood in their vast empire to produce anything truly national.

The temple in which so many valuable objects were found was 60 feet long and 30 feet wide. It was built of mud bricks, 5 feet high and 2 feet thick, dried in the sun, and had a wooden roof. In the course of time the bricks crumbled, the roof rotted away, the space between the statues was filled up, and other *débris* accumulated above it.

C. F. K.

LINING metal for axle boxes: Tin 24 parts, copper 4, antimony 8. Melt together, and add 24 parts more tin.

Trombes.

A good deal of attention has of late been given by meteorologists to the whirling atmospheric movements denominated *trombes*. That these *trombes* are of electrical origin has been suspected from the very beginning of electrical science, and in last century experiments were made by way of imitating them on a small scale. Between two metallic plates, the upper of which was electrified, while the lower was connected to earth, various easily movable substances were brought. Water was raised in form of a cone; bran was lifted so as to form a pillar, than scattered in a whirl. In such experiments, however, the phenomenon can only be observed momentarily; the cone or column, if indeed produced, immediately disappears through the scattering of its component particles.

In a recent communication to the Berlin Academy, M. Holtz has described an apparatus by which this interesting phenomenon can be produced with greater certainty, and observed for any length of time. The arrangement consists of a cylindrical glass vessel about 8 inches high, 6 inches wide, and $\frac{1}{12}$ or $\frac{1}{8}$ inch thickness of side. It has a perforation in the middle of the bottom; this is filled with tinfoil, and closed on both sides (above and below) with two large plates of tinfoil. In the middle of the glass vessel hangs a hollow, flat-pressed, metallic ball, $\frac{1}{4}$ inch in thickness, and 4 inches in diameter. The suspending piece consists of two metallic tubes, one movable in the other; the upper one is connected with the conductor of an electric machine.

If now various easily movable substances, pulvervulent, and not very good conductors, be introduced into the vessel—so much of them as will be sufficient to cover the inner plate of tinfoil $\frac{1}{6}$ to $\frac{1}{8}$ inch—then, as soon as the machine is put into action, and the second conductor connected to earth, the substances are thrown into violent motion between the two opposite electric surfaces. With sand, however, or similar materials, no determinate cone or column formation is distinguishable. But with substances of better conduction and coarser structure, such as bran or sawdust, there are constantly formed, through the deposition of new portions, large cones and perfect columns, from which, however, the stormy, whirling, and progressive motion is absent.

M. Holz obtained a phenomenon much more similar to the natural *trombes* when he used a liquid instead of powder—especially turpentine or olive oil—and gave the lower electrode a pointed form by adding a column of wood, this substance being taken to avoid the passing of sparks. The vessel was filled with liquid up to $\frac{1}{4}$ inch above the point, and the interval between the metallic disk and the liquid was regulated according to the tension of the electricity.

"If we now bring the machine into action," says M. Holtz, "we observe, first, at the surface of the liquid a slight curling, and presently it tends to rise up the sides of the vessel in a peculiar vibratory motion. Very soon there is a stronger undulation, and a middle cone is formed, which gradually increases; and so long as it does not reach the metallic body, it flies off in minute dancing droplets. If, on the other hand, the cone has become a column, the liquid moves from the middle of the metallic surface to the border, and there falls down at several parts in the form of thinner columns, which, differently from the middle one, have their large bases above. Often, too, the rising stream parts into several of similar form, each of which follows its own path towards the middle part of the disk, and thence toward the edge, where, again, it branches into several descending streams. The liquid also frequently arises simultaneously at various parts, so that, sometimes, reckoning the downward streams, one may count more than twenty distinct columns; and all these columns are in constantly progressive and whirling motion."

M. Holtz calls attention to the circumstance that, in the formation in question, no difference was observable between negative and positive electricity; only the motion was more violent when the metallic disk was negatively electrified.

That the agreement between the artificial and the natural *trombe* is not absolute is, of course, evident from the circumstance that in the one case we have a closed space, with walls probably not without electric tension, as against unbounded space in Nature; and the formation occurs in Nature between movable surfaces, whereas in the experiment it is between fixed surfaces.

New York Academy of Sciences.

At a meeting of the New York Academy of Sciences, recently held at 64 Madison avenue, a section of biology was organized. This section will meet on the first Monday evening of each month, and to it will be referred all papers on zoölogy, botany, entomology, ethnology, anthropology, and kindred subjects. Professor E. H. Day, of the New York Normal College, was elected chairman of this section, and Dr. Heinzmann secretary. It is proposed to form field parties and make frequent excursions to the suburbs, as soon as the season permits of botanizing and fly catching. As the meetings of the Academy are public, those of our readers who are interested in plants and insects will do well to attend, bringing with them any curiosities they may chance to find.

Improved Zinc White.

According to a recent report of the Austrian Chemical Society, M. Orr produces a very beautiful zinc white by the following process: Sulphuret of raw barium is washed, and the liquid obtained is mixed with equal quantities of chloride and sulphate of zinc. The precipitate is collected, pressed, and dried. It is then heated on a hearth, and, while hot, is thrown in cold water. This last treatment produces a mass of great density, and the material, after washing and grinding, is of great purity and whiteness.

A Locomotive for Working Steep Gradients.

An English engineer, Mr. Andrew Handyside, has recently patented in England and this and several other countries a locomotive engine for drawing trains up inclines. A trial was recently made with one of these engines at Bristol, England, and the result was such as to show that the invention is one of some merit.

The engine weighed 13 tuns, and to it were attached two trucks weighing together 25 tuns 14 cwt.; and one portion of the line on which the trial was made was on an incline of 1 in 12. The peculiarity of the system is that the engine is coupled to the train by a steel chain or wire rope, wound round a drum mounted in the framing of the engine. The axis of this drum works horizontally in bearings fixed in the main framing of the engine, and it is rotated by gearing from a separate pair of cylinders, distinct from the usual cylinders which drive the locomotive. A drum, 2 feet in width and 1 foot in diameter, will accommodate chain enough to fulfil all the requirements of the system. On each side of the engine framing, and on each side of one or more carriages or wagons of the trains, there are suspended one or more self-acting gripping struts, which, when let down on the rails by the driver or other person in charge of the train, will firmly grip the sides of the rails, and hold the engine or train stationary. On arriving at the foot of the incline, the engineer releases the hauling drum, and, without stopping the engine, runs up the gradient to the required distance. The struts are then let down on the rails; and by grasping the rails, they render the engine stationary, and the load is drawn up to the engine much after the fashion that loads are drawn up inclines at collieries. The last truck of the trial train was furnished with an automatic gripping strut, which, when the trucks commenced a retrograde movement, at once grasped the rails on each side, and held the train in its place beyond the possibility of its being moved, our informant states, even when the engine with full steam on was backed against it.

The experiments were of the most thorough description, and the invention was tested in every way. In the first place, the value of the gripping strut was shown. The powerful little engine mounted the gradient without its load, and, full steam on, ran the whole length of the siding. At a signal from Mr. Handyside, the brakes were applied, and the engine was brought to a standstill in the length of a rail and a half. The contrast between the power of this brake and the ordinary hand brake, with which the engine was also supplied, was fully shown. The wagons were then attached, and the brakes on the engine and on the brake van were applied simultaneously with equally satisfactory results. This experiment was witnessed with very considerable interest, as the brake question is just now occupying very much of the attention of railway men. With the continuous brake, it was pointed out that, 90 per cent of the wheels being braked, a train is pulled up in about 900 feet with the train going at a speed of fifty miles per hour. In this case, the train pulled up in 600 feet, and only 75 per cent of the carriages were braked. After duly testing the brake, the method of mounting steep gradients was shown. The engine put full steam on, ran to the foot of the incline, and then, letting out the steel wire rope which coupled it to the trucks, mounted the steep alone. The gripping struts were then let down; and the engine having thus been made stationary, the trucks were hauled up to it, the automatic gripping strut coming into action, and the whole train remaining stationary. The accomplishment of this test occupied a surprisingly short time. The trucks were then lowered to show the control which the driver was able to exercise over a train for lowering purposes. The company claim that, by this invention, smaller and less powerful engines may be used on heavy gradients, and that it will allow of less cost in constructing lines, inasmuch as less cutting will be required.

Detection of Adulteration in Wine by Means of Absorption Spectra.

Professor H. Vogel states that the simplest method of detecting adulteration in wine, especially in regard to the coloring matter, is by means of the spectroscope. The apparatus required is as inexpensive as the operations are simple. Professor Vogel employed for the purpose a pocket spectroscope which cost in Berlin 36 mark (about $9.00). The instrument is first directed towards the blue sky, or to its reflection in a mirror, clamped in a horizontal position in a retort holder, and the slit closed until the principal Fraunhofer lines, C, D, E, F, G, and a few intermediate lines are distinct. The liquids to be studied are put into square white bottles about 0·30 inch thick, and placed before the slit.

It is well known that many substances of similar color have produced very unlike absorption spectra, while others, which are very different chemically, have very similar absorption spectra, like chloride of iron and tincture of iodine. These facts are no objection to spectral analysis by absorption. It resembles analysis by polarization, which cannot be employed for all substances; but where it can be used, it is invaluable.

Analysis by the absorption spectra, of course, assumes various spectra to be known, and here stands a serious barrier in the way of its present extensive introduction, namely, the maps of absorption spectra, which are insufficient and incomplete. Drawings made in the ordinary manner are incorrectly reproduced by the lithographer or engraver, and rendered still more imperfect by the coloring applied. For this reason Dr. Vogel employs the graphic method as follows: Upon a horizontal line or abscissa he erects perpendiculars to represent the chief Fraunhofer lines, and represents the absorption of a given substance by a curve, the hight of which increases with the intensity of the absorption.

The absorption bands of the most important coloring substances lie between C and F; those which lie beyond C require sunlight for their study, which is not always to be had, and hence they are useless. At the request of certain wine dealers Professor Vogel has investigated and published the absorption spectra of pure and colored wines. Perfectly pure specimens of the following sorts of red wine were obtained from reliable sources, namely: Assmannhauser, Burgundy, Nuits, Cote d'Or, and Bordeaux. Although they differed in age and intensity of color, they give the same spectra.

Pure concentrated wine absorbs the whole spectrum to the orange. Dilute wine destroys the dark blue almost entirely, allows the light blue to pass, but absorbs the green and yellow green, and stops at D, while red goes through unchanged. Tartaric or acetic acid darkens pure wine inconsiderably. Ammonia changes the color of wine to a dark gray green, and makes it much more opaque, so that it must be strongly diluted in order to obtain the spectrum, which is totally different. Indigo and blue are strongly absorbed; the absorption sinks towards the green and is least in the yellow and orange, but exhibits a faint band in the orange. By lamp light, the absorption of alkaline wine is scarcely perceptible.

The spectral reactions of the substances employed to color wines are quite different. Those coloring substances which are objectionable to the taste, but not injurious to health, give reactions very similar to those of red wine. The juice of bilberry, sour cherry, and elderberry, and extract of mallow blossoms absorb nearly the whole spectrum. For this reason it is preferable to add one part of tartaric acid or of ammonia to 10 parts of the juice.

Opening to Navigation of the Vicksburg Cut-off.

The city of Vicksburg, Miss., is located on high bluffs, under which the Mississippi makes its way by sharp deflections, east and west, of nearly fifty miles from its direct course. During the late war the Union commanders sought to avoid the heavy batteries of the Confederates at Vicksburg, which commanded the river, by opening a cut-off or canal across the country, back of De Soto Peninsula, opposite Vicksburg. The river at the upper or northerly end of the canal was accordingly shut off by a dam; and the work of digging the channel was then carried on extensively, with every promise of success, until, by a sudden rise of the river, the water broke through the dam and put a stop to the work.

General Grant, finding that too much time would be consumed in the endeavor to repair and finish the channel, adopted other expedients for passing the batteries, and the canal was left unfinished. It has now, however, been completed by the silent mining operations of the river itself; and the boats pass up and down through it, avoiding the *détour* to Vicksburg, and thus saving about thirty miles of navigation. Our engraving shows the general position of the new canal cut-off.

A Canal from the Hudson to the Mississippi.

Mr. W. J. Abernethy, editor of the Minneapolis *Farmers' Union*, writes to point out that the two principal rivers—the Fox and Wisconsin—together form an almost unbroken water channel from the Father of Waters to the great lakes. Rising, the one in the southern and the other in the northern part of the State, they flow towards each other until their waters almost touch, when they suddenly sweep away at right angles, and empty, one into Lake Michigan at Green Bay, and the other into the Mississippi at Prairie du Chien.

In a few weeks, the canal which is to join the two will be completed, and Wisconsin will honor the event with appropriate ceremonies.

On the Fox River a system of slack water navigation has been adopted, which is proving entirely successful. There are numerous falls on what is known as the Lower Fox, and these are overcome by dams with locks, to pass boats around them. The work is so far advanced that, if no unforeseen obstacles occur, vessels can run up its entire distance to Portage (160 miles west of Lake Michigan) this fall, and pass over into the Wisconsin. Considerable dredging, however, remains to be done on this river.

The Wisconsin river is, at the portage, three fifths the size of the Mississippi at St. Paul. It is a rapid stream, full of floating sand, which in low water seriously obstructs navigation. Sections of the river have been improved by wing dams; but in order to permanently secure a navigable channel, it will be necessary, in some sections of it, to make a canal on the bank. According to surveys made for a canal by General Warren, of the United States Engineer Corps, it can be built, says our correspondent, the entire distance from Portage to the Mississippi, 118 miles, for $4,164,270.

SCIENTIFIC AND PRACTICAL INFORMATION.

DYNAMITE.

Sobrero, the inventor of dynamite, in a recent communication to the Academy of Turin, designated two of the operations in the manufacture of dynamite as especially dangerous: first, the mixing of the nitroglycerin with the infusorial silica (*kieselguhr*), and second, pressing the mass into molds for cartridges. In both cases an explosion may easily be caused by friction and pressure. Nobel recommends the following process as far safer, namely, to mix the silica with water to a dough, then press it into cartridge molds and dry perfectly. These cartridges are then put into nitroglycerin, which they absorb into their pores, the absorption being aided by exhausting the air. Sobrero made his experiments with infusoria of Italian origin which can be easily made into cartridges that will absorb as much as 75 per cent of their weight of nitroglycerin.

A FALLACIOUS TEST FOR LEAD IN TIN.

An item has been widely circulated, both here and abroad, in which it was stated that the presence of lead in tin could easily be detected by putting a drop of nitric acid on the clean surface of tin plate, heating gently to cause it to attack the metal and evaporate the excess of acid, and moistening the white spot with a five per cent solution of iodide of potassium; if lead were present, the spot would become more or less yellow from the formation of iodide of lead. Dr. A Puerkhauer calls attention to the fact that tin, free from lead, will also yield a yellow spot when thus treated, evidently due to the liberation of iodine by the presence of free acid; for nitric acid cannot be completely expelled from tin, even when the tin is heated to its melting point. It may be easily proved that the yellow spot, formed on tin which is free from lead, is due to the liberation of iodine, by touching the spot with starch paste. The above mentioned reaction can be made reliable by touching the white spot made by nitric acid with very dilute caustic potash before applying the iodide of potassium, when a yellow coloration will not fail to indicate lead.

SUBCHLORIDE OF COPPER IN VERDIGRIS.

Wittstein has found in some samples of acetate of copper a white precipitate, insoluble both in water and acetic acid, but soluble in dilute mineral acids. Investigation showed that this peculiar body consisted chiefly of subchloride of copper formed by the chlorhydric acid, which is always present in acetic acid made by decomposing crude acetate of lime with chlorhydric acid. For this reason manufacturers of verdigris would do well to use only such acetic acid as has been made by the use of phosphoric or sulphuric acid, as these acids are not sufficiently volatile to distil over with the acetic acid.

A GREEN VARNISH FOR METALS.

A varnish for small or large metallic articles can be prepared, says the *Industrie Blätter*, in the following manner Finely pulverized gum sandarac or mastic (the latter, however, is too expensive for some uses) is dissolved in strong potash lye until it will dissolve no more. The solution is diluted with water and precipitated with a solution of a copper salt, either sulphate or acetate. This green precipitate is washed, dried, and dissolved in oil of turpentine. This produces a fine green varnish which does not change under the effect of light, and will be especially useful for ornamental iron work.

HERACLINE.

This is the name given to a new blasting powder, invented by Dickerhoff, and which has been tried with success in the coal mines of France and Austria. It is composed of picric acid, saltpeter, nitrate of soda, sulphur, and sawdust. The gases produced by its combustion are not injurious, it is claimed, and it burns comparatively slowly, so that it only tears apart the masses blasted, but does not hurl them violently about.

DECISIONS OF THE COURTS.

United States Circuit Court—District of New Jersey.

BOTTLE STOPPER FASTENING.—HENRY W. PUTNAM *vs.* HENRY W. TERRINGTON.

[In equity.—Before NIXON, J.—Decided March 28, 1876.]

Mere change of material used in the construction of devices is not invention; it is only the exercise of mechanical judgment, and hardly adds enough to the domain of knowledge to raise the person to the dignity of an inventor who first thought of making such a change.

The mere carrying forward of an original conception patented—a new and more extended application of it—involving change only of form, proportions, or degree, the substitution of equivalents doing the same thing as did the original invention, by substantially the same means, with better effects, is not such invention as will sustain a patent.

It is the invention of what is new, and not the arrival at comparative superiority, or greater excellence in that which was already known, which the law protects as exclusive property, and which it secures by patent.

A reissued patent must be for the same invention as the original, containing no new matter.

It is not meant by this that no new or different language should be employed.

New matter is such an enlargement of the original specification or claims as to include combinations or results which did not necessarily flow from the invention, as originally stated and described.

An inventor is entitled to all the uses to which his patent may be applied, and to all the beneficial results which legitimately follow the use of his instrumentalities, as shown by the statement of his invention, and the figures used to illustrate it; and such uses and results may be stated and described in an application for reissue by the inventor, without subjecting himself to the imputation of incorporating new matter.

NIXON, J.:

The bill is filed in this case for the alleged infringement of reissued letters patent No. 1,606, for a new and useful improvement in bottle-stopper fastenings.

The original patent was issued to the complainant March 15, 1859, for the term of fourteen years. This being duly surrendered, he obtained the reissue on the 19th of January, 1864, for the residue of the term, which was further extended by the Commissioner of Patents for seven years, from March 15, 1873.

The defendant, in his answer, and afterward by stipulation, admits the infringement of the four claims of the said reissue, but insists that the said patent is invalid for two reasons: first, because the complainant was not the original and first inventor; and second, because the reissue is not for the same invention as that shown and described in the original patent.

I have carefully compared the complainant's patent at first obtained with his reissue. The statement of his invention and the figures used to illustrate it are the same in both cases. Not a device or instrumentality appears in the second that was not exhibited in the first. He states results in the reissue which were not stated in the original patent, and which were omitted, I presume, because he did not know until he was taught by experiment that such results would follow. But an inventor is allowed to do this in a reissue without subjecting himself to the imputation of incorporating new matter. He is entitled to all the uses to which his patent may be applied, and to all the beneficial results which legitimately follow the use of his instrumentalities.

The principal new effect which he sets forth in the reissue, and which he failed to note in his former specifications and claims, is the substance of the first claim—to wit: Such a formation of the new fastener over the cork that the pressure thereon may cause the fastener to hold more securely, as specified. No new device was needed to accomplish this result, and hence the claim falls within the objects and purposes of a reissue.

[*Thomas H. Dodge* and *Palmer S. Barnes* for complainant.
F. C. Nye and *L. C. Ashley* for defendant.]

United States Circuit Court—Southern District of Ohio

THE UNION PAPER-BAG MACHINE COMPANY *et al.*, *vs.* NIXON & CO.

[Before Emmons & Swing, JJ.—Filed March 30, 1876.]

It is not a fair construction of the assignment of a patent that the assignee shall first assign the entire right for a particular territory, and get its whole value from his vendee, and, after having thus received all the benefit he was entitled to under the transfer, sell single machines to be used in the same territory during the extended term.

An assignee of a patent, by granting and transferring the exclusive right to manufacture or use an invention within such state, exhausts his whole power of disposition under and by virtue of the assignment to him; and such assignee has no right to flood the country with machines to be used after the expiration of the term of the original patent, thus defeating the interest of the patentee in the extension.

The rise to use a machine after the expiration of the term of the patent is an incident to the primal right to use it during the original term; if that fails on account of fraud, the incident falls with it.

Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GANG PLOW

Edward S. Beckelhymer and Hugh H. Canaday, Fairfield, Iowa.—This gang plow is so constructed that the draft may be applied directly to the forward ends of the plow beams, bringing the point of the draft attachment close to the points of resistance, enabling the plow to be easily raised from the ground.

IMPROVED CURD DRAINER.

Jonas Wilder, West Rupert, Vt.—This invention consists in a cheese-curd drainer, in which the sheet metal lining passes through the discharge slot in its bottom, and is secured to or formed solid with the discharge spout, and in a detachable screen, made in sections, in combination with the drainer and the discharge spout.

IMPROVED SEEDER AND CULTIVATOR TOOTH.

Rufus F. Billings, Kingston, Wis.—This tooth is so constructed that it will swing back should it strike an obstruction, will return to its place as soon as the obstruction has been passed, and will allow the seeder or cultivator to be backed without raising the teeth from the ground.

IMPROVED CALF WEANER.

Alvord M. McLeran, Onawa City, Iowa.—This is a combination of a folded plate, on bent and knobbed wire, and spikes with each other. The plate prevents the animal from getting hold of the teats with its mouth; and should it attempt to suck, the spikes will be thrust into the cow and prevent her from standing still. At the same time the device does not prevent the animal from putting its mouth to the ground and eating freely.

IMPROVED MILK-STRAINING CAN.

Albert P. Knapp, Randolph, N. Y.—The usual flat side of the strainer is made round, so that the appliance is more easily kept clean. A hoop is applied to the lower end which may be applied to pans, and which has eyes to catch on hooks on top of the pail. A breast prevents the milk from slopping over, and is contrived so as to serve as a handle to the strainer. The bottom is struck down in concave form, and the strainer is fitted in the middle portion considerably smaller than the top of the can, so that plenty of space may be had, around the stream of milk flowing into the can from the strainer, for the escape of the animal heat.

IMPROVED STALK PULLER.

George W. Butler and Timothy P. O'Connell, St. Antonio, Tex.—This is a machine designed especially for pulling cotton stalks. There is a cylinder provided with the curved and bearded V teeth, which take hold of the stalks, pull them, and carry them over. Another cylinder has rows of curved teeth, in such positions as to pass up between the teeth of the first cylinder to detach the stalks from said teeth. A slotted plate removes from the teeth any stalks that may adhere to them, to keep the said teeth always clear.

NEW CHEMICAL AND MISCELLANEOUS INVENTIONS.

IMPROVED PAVEMENT.

Joseph R. Abrams, Greenville, Ala.—This invention consists in a series of receptacles, in dimensions of about 10 inches depth, 8 inches diameter, and 1½ inches thick, made of artificial stone, terra cotta, or other analagous earthenware, capable of disintegration and wear, which said receptacles are filled with tightly rammed macadamized material, or broken stone, with a top dressing of sand and gravel. The said receptacles are placed upon a smooth road bed, and the interstices between the same are also packed with the the same material and in the same way, so as to present a perfectly smooth upper surface, the receptacles operating as binders to prevent loosening of the materials.

IMPROVED HAND SUPPORT

George R. Knapp, Vinton, Iowa.—This is a book rest, having shoulders of different sizes at both ends of the hand rest and a sliding extension rest for the arm. It furnishes thus a better support for the hand and arm, and admits of the neater and easier keeping up of account books, etc.

IMPROVED FRUIT DRYER

William Aram, San Jose, Cal.—This invention pertains particularly to the combination and arrangement of vertical sliding partitions and registers in a case or oven, provided with suitably located openings for passage of hot and cold air, whereby the application and degree of heat are controlled at will in the several compartments of the case or oven, through which the fruit is conveyed on wheeled frames.

MACHINE FOR PACKING FRUIT AND OTHER ARTICLES.

George W. Deitzler, San Francisco, Cal.—This consists of one or more vertically reciprocating pistons, that press the articles by means of guide boxes into suitable packages, which are supported on movable and spring-acted bottoms, that are intermittently locked by sliding latch pieces actuated by lever connection with the driving shaft.

IMPROVED BUCKLE.

Warren T. Reaser, Centralia, Wis.—This buckle has its central cross bar provided with a stud, which constitutes the means for securing one end of the strap to which the buckle is applied, and also supports the free end of the tongue, which passes through the end of the strap.

IMPROVED BREASTPIN FASTENING.

Charles O. Hood, Pawtucket, R. I.—This is an improved breastpin fastening for the cheaper kinds of jewelry; and consists of a pin bent at a right angle at the end, and set into the longer end of a socket hinge, formed by bending a perforated plate around the end of the pin, the shorter socket section serving to retain the same. The elasticity of the pin is obtained by the contact with a shoulder formed between the socket sections.

IMPROVED NECKTIE FASTENER.

Michael D. Levy, New York city.—This consists of a metal hook, adapted to hook to the neck of the collar stud from above, and so arranged, relatively to the top of the bow, that it is prevented from rising by the collar turned over the bow, so that the hook cannot work off from the stud.

IMPROVED BOTTLE STOPPER.

Augustus E. Rich and Charles S. Sawyer, Fall River, Mass., assignors to themselves and James H. Crittenden, of same place.—This consists of a yoke hinged to a ring of wire fixed around the neck of the bottle, in which yoke a nut is pivoted, which has a thumb screw for screwing down on the rubber stopper after it has been pressed in.

IMPROVED PAINT.

John Fetzer, Rolla, Mo.—This is a paint consisting of fireproof clay, sulphate of lime, sulphate of barium, calcined magnesia, bleached glue, tragacanth gum, alum, linseed oil, shellac, and water. The paint thus prepared mixes well, and adheres as well as any oil paint, gives a fine polish, and admits of being marbled. It congeals at 60° Fah., and should be put in a warm water bath to be applied.

IMPROVED GLASS-LINED REFRIGERATOR.

James H. Collingwood, Poughkeepsie, N. Y.—This consists in a refrigerator lining formed of glass plates jointed and cemented together at their edges, and secured to the bottom, sides, top, and doors of the box.

IMPROVED BARBED WIRE FENCE.

Myron W. Colwell, Dunlap, Iowa.—This is a combination, with a fence wire, of four pointed barbs, formed of two short pieces of wire twisted together between their ends, and secured to the fence wire by turning the prongs around the shoulders formed by offsets in the fence wire.

IMPROVED GAGE ATTACHMENT FOR SQUARES.

Edward Kuhns, St. Clair, Pa.—This invention consists in a device made in U form to fit upon the edge of a square, and overlap its sides, and provided with pointers and set screw to adapt it for use. The device is very useful in laying out stairs.

IMPROVED GRAND PIANOFORTE FRAME.

Charles F. Chickering, New York city.—In order to strengthen the pin block and prevent it from being drawn upward by the tension of the strings, the webs and plate are formed in one solid piece, with the longitudinal bars and the plate attached to the pin block, in combination with the belly rail and pin block.

IMPROVED MACHINE FOR CANCELLING STAMPS.

William H. Bowyer, Philadelphia, Pa., assignor to John J. Ridgway, Jr., of same place.—This is a revolving grinding roller, to which the stamps are exposed for cancellation on a spring-acted board with a rubber feed roller, corresponding in length to the grinding roller.

IMPROVED ADDING PENCIL.

Marshall M. Smith and Fletcher W. Potts, Verdi, Nev.—This invention consists of a spirally-grooved revolving cylinder in a slotted case, numbered consecutively in the coil up from the lower end, ten numbers to each coil. It carries an index by the groove, with contrivances in the lower part of the case to revolve the cylinder, by pressing a pointer into the case against a spring, as many numbers as a pointer in the pencil case is pushed back along a scale at the lower end, and carrying the index along the spiral column a corresponding number of figures. The pencil is then relieved of the pressure and the spring forces it out again, when it is ready to repeat the operation. This invention was illustrated and fully described on page 214, volume XXXIII.

IMPROVED HAT VENTILATOR

Francis P. Flanagan, Springfield, Mass.—This inventor proposes a gauze cover for the ventilating hole, applied so as to cover and hide the eyelet used to bind the hold and keep the gauze in shape, thus making a neater construction.

NEW HOUSEHOLD ARTICLES.

IMPROVED COOKING VESSEL.

John B. Jones, Brooklyn, E. D., N. Y.—This is simply a second or false bottom for cooking vessels, secured in place by a beaded flange, which fits the sides of the main vessel. This forms an air chamber, and protects the contents of the vessels from being burned.

IMPROVED VEGETABLE CUTTER.

Martin Gillespie, East Palestine, Ohio.—The novel feature in this is the hopper, which being pivoted at its lower end in front of an opening in the case, may be used either as a horizontal or as an oblique self-feeding hopper.

IMPROVED SLOP BUCKET.

Benjamin P. Walker, Macon, Ga.—This invention relates to slop jars, which are provided with flaring top rims, to prevent the liquid poured thereinto from slopping out, and consists particularly in making on the flaring rim an upward extension that rests against the wall, and thereby prevents the latter from being spattered.

IMPROVED LAMP STOVE.

John Ward Cole, Brampton, Canada.—This consists mainly of water compartments for cooling the wick tubes arranged above the oil receptacle, and provided with air chambers between and at each side of the wick tubes, for the increased supply of air to the flames. A self-feeding water reservoir keeps up the supply of water around the wick tubes.

IMPROVED VEGETABLE CUTTER.

Friedrich Rentschler and John Keck, Ann Arbor, Mich.—This is formed of a plate having inclined transverse slots formed in it, bent in opposite directions at the opposite sides of said slots, and also of wires having loops formed in them at the ends of the plate. In using the device, it is laid upon a table, the loops supporting it in a slightly inclined position. The vegetables to be cut are then placed in the box, and the said box is pushed back and forth upon the plate, slicing the vessels quickly and evenly.

IMPROVED LAMP STOVE.

Joseph Irving, Chicago, Ill.—This consists of a removable non-conducting disk, provided with a metallic sleeve extending up around the burner, between which and the sleeve a portion of the draft passes; also on its lower surface, with a shallow cup of foraminous metal to protect the flame from sudden blasts. The disk rests on the non-conducting top of the oil chamber, to which a drum containing a hot air chamber and metallic chimney is hinged.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED DRAFT EQUALIZER.

Amos O. Rowley, Bassett, Iowa.—This is a three-horse evener, contrived so that the single horse may work on the short arms, and the two horses on the long arms, as is required for plowing and working reapers and mowers and the like.

IMPROVED CAR VENTILATION.

Charles G. Lea, Alton, Ill.—This is a monkshood blower, with a pipe extending into a water tank, and another pipe for conducting the air from the tank into the car, together with similar blowers for effecting exhaust to aid in inducing an active current of fresh air into the car.

IMPROVED DOME SUPPORT FOR CISTERNS.

Adam Snider, Pierceton, Ind.—This is a cone-arch skeleton on which to build cement or other arched covers for cisterns and the like. The said frame is constructed with a base ring and arch in sections, contrived for putting them up and taking them down conveniently, to allow of removal through the manhole of the arch after the latter is completed.

NEW TEXTILE MACHINERY.

IMPROVED WARP TENSION REGULATOR.

John F. Morley, Waterloo, Canada.—This is a contrivance of compound levers and an adjustable fulcrum, for adjusting the tension to warp of different sizes and strengths, and a novel contrivance for shifting the weights of the friction strap levers as the size of the warp roll diminishes.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BOILER CLEANER.

John L. Lloyd, Williamston, Mich., assignor to himself and Oscar McCausey, *same* place.—This is a strong broom for cleaning the dirt and sediment from the bottom of steam boilers, and consists of wood bristles clamped between arc-shaped and screw-connecting pieces that are screwed to a handle.

IMPROVED SANDING MACHINE.

Jehiel Baker, Westport Point, Mass., executor of John H. Baker, deceased.—This is an apparatus for spreading sand over cranberry bogs. In using the machine, the lower edges of the hinged sides of the box are swung together and fastened, to prevent the sand from falling through while being shoveled into said box. When the box has received the desired amount of sand, a latch lever is unfastened, which allows the hinged sides of the said box to swing apart, and the sand to fall in a body upon the wire bottom, whence it is fed out, as the machine is drawn over the box, by oscillating a frame and its toothed bars.

IMPROVED BRICK YARD PLANT.

Joseph L. Irby, Grenada, Miss., assignor to himself and J. H Campbell, same place.—This consists of a system of rails and cars for conveying the molded bricks from the mill to the drying ground, and from the latter to the kiln, more economically than it is done by the common method, and also of a simple contrivance for covering the drying ground with movable sheds, when necessary, to protect the drying bricks in wet weather.

IMPROVED SWITCH SIGNAL.

Thomas W. Peeples, Elizabethport, N. J.—The invention consists in fitting the switch lever on a shaft in the opening of the lamp case, so that the lamp will be turned only a quarter while the shaft makes a half revolution.

IMPROVED ADJUSTABLE STAND FOR DANDY ROLLS.

Archibald McDermid, West Fitchburg, Mass.—This is an improved stand for the dandy rolls used in paper machines for making the impression or water mark on letter and bank note paper. It has an adjustable lower arm and journal bearing for carrying any size of dandy roll, and an adjustable top arm and screw clamps for supporting the cloth-holding stick or flag in the proper position to the roll.

IMPROVED SPINDLE STEP LUBRICATOR.

Henry Whorwell, Paterson, N. J.—This invention consists of a collar on the spindle in the oil cup, with projecting arms and flanges on the wall of the cup, to prevent the collar from turning with the spindle. The object of the collar is to prevent the oil from being forced around rapidly by the spindle, which causes it to overflow and waste.

IMPROVED TIRE-HEATING FURNACE.

Nathaniel Crank, Winslow, Mo.—In using this device, the fuel and tires are placed in a sectional ring box, the fuel is set on fire, and the covers of the box are closed. The box is then rotated by means of a crank and rod, which, through openings in the box, causes the fire to burn furiously, heating the tire very quickly and with a comparatively small amount of fuel. The covers are then turned back, and the tires are taken out and set.

IMPROVED SHAFT COUPLING.

Samuel Moses Guss, Reading, Pa.—This improved coupling comprises a solid hub, with a central hole for the shaft, which is enlarged for part of the circumference at each end. In this enlargement is fitted a bush, which is keyed firmly against the shaft, so as to press it very firmly against the part of the hole in which it is keyed, thus making a firm coupling. The parts of the solid hub are cast together with the key ways.

IMPROVED ELEVATOR HOISTING MACHINE.

Volney W. Mason, Providence, R. I.—The novel features in this device are a shipper bar, by which either pulley may be made to drive the machinery, or both may be allowed to run loose, a new means of enabling the brake to be automatically applied whenever the clutches are unshipped, and the arrangement of friction clutches and loose pulleys, so that the belt strain is equalized.

IMPROVED RAILROAD SIGNAL.

John W. Hawley, Warsaw, N. Y.—This invention consists of a wire connection extending from the signal box at the crossing to some distance from the same, to be operated by the locomotive depressing a spring-acted crank rod and releasing the signal.

IMPROVED POST HOLE AND WELL DIGGER.

Isaac M. Perry, Slate Cut, Ind.—This is an arrangement of two semi-oval blades, bolted to opposite sides of the head. The handle is formed in sections. In using the device, it is thrust into the ground and then raised, bringing its contents with it, which are jarred or shaken out, and the tool is again thrust into the soil.

IMPROVED BRICK MACHINE.

Newton J. Wolfe, Canal Winchester, Ohio.—This is a contrivance by which the mud is pressed into shaping dies, which move forward into the brick molds when the presser goes back for another batch of mud; and when the dies go back to receive the next batch from the presser, the shapes made by the dies are left projecting into the mold, and are cut off at the surface of the molds, forming bricks. The filled molds are then removed, and empty ones put in to be filled as before, and so on. An essential advantage of the projecting of the dies into the molds consists in the delivering of the brick in the molds without disturbing the sand with which the sides are sanded.

IMPROVED MILL-FEEDING APPARATUS.

Robert B. Van Onner, Mifflintown, Pa., assignor to himself and James M. Van Onner.—This consists of a stationary tube, extending down from the hopper a suitable distance. A revolving disk in the bottom is turned by a damsel, which works up and down through it freely as the stone is raised or lowered, so as not to alter the feed. The said tube has openings through the lower part, out of which the feed is thrown by the disk, and has an outside tube on it, which is raised and lowered by a shaft to regulate the feed.

IMPROVED DEVICE FOR CONVERTING MOTION.

Charles E. Willis, New York city.—This invention relates to means for producing motion in any direction at the will of the operator. It consists of a cam in a support capable of turning on its axis, and surrounded by a reciprocating ring, to any part of which the cam is presented by the turning of the tube, so as to be worked in any direction. The motion is transmitted in some cases from the cam by an arm to which one end of a bar is attached, which is mounted so as to both vibrate and reciprocate, and which works the feed or other device by its other ends; but as this contrivance does not in all cases give the motion in straight lines, a combination of compound parallel bar mechanism is used with the sam, by which the device operated is moved in straight lines in all cases.

IMPROVED THROTTLE VALVE LEVER.

Charles W. Garland and George W. Garland, Lancaster, N. H.—This invention consists of a swinging throttle valve lever, with supplementary fulcrumed handles, that release spring dogs from double arc-shaped ratchet bars, but lock the lever securely when not taken hold of.

Business and Personal,

The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.

Notes & Queries

S. W. M. will find a description of the water-freezing machine on p. 82, vol. 33. For a battery for plating, see p. 26, vol. 32.—W. H. B. C. will find directions for bending timber on p. 43, vol. 30.—S. B. is informed that we have published very many descriptions of ice machines, and in every case we have given the inventor's name.—E. T. I. will find full directions for soldering of all kinds on p. 251, vol. 28.—M. C. H. will find directions for making adhesive fly paper on p. 75, vol. 31.—T. J. W. (who does not send his name) will find an explanation of his wheel difficulty on p. 298, vol. 31.—C. S. R. will find directions for molding in paper pulp on p. 170, vol. 30.—B. B. B. will have difficulty in sizing his Indian ink drawing, unless he mixed acetic acid with the ink with which it is made.—T. D. H. will find directions for making rice glue, suitable for mounting photographs, on p. 155, vol. 32.—A. G. W. will find a recipe for a cement for hard rubber on p. 203, vol. 30. For Babbitt metal, see p. 122, vol. 28.—C. H. J.'s case was one of spontaneous combustion. See p. 26, vol. 33.—T. J. will find directions for etching on steel on p. 250, vol. 27.—H. H. should fill the crack in his marble slab with the cement described on p. 344, vol. 32. For a description of lithographic stone, see p. 298, vol. 31.—L. C. will find a description of Portland cement on p. 199, vol. 31.—T. W. will find directions for brazing band saws on p. 194, vol. 31.—W. S. will find directions for painting brickwork on p. 277, vol. 26.—J. J. R. will find directions for finishing malleable iron castings on p. 138, vol. 29.—G. W. G. will find directions for tinning iron and steel on p. 362, vol. 31.—E. B.'s difficulty with the scaling off of copper from iron arises from the iron not being properly cleaned. See p. 139, vol. 31.—C. E. N. is one of some scores of correspondents who write to us to report the invention of perpetual motion machines. It is strange that people will waste their time on such nonsense.—C. G. will find that marine glue will do to fasten rubber to cloth. See p. 43, vol. 32.—G. S. W. will find a recipe for composition for picture frames on p. 223, vol. 31.—J. M. C. can exterminate ants in sugar by the directions given on p. 234, vol. 27.—P. P. W. will find a recipe for indelible ink on p. 129, vol. 28; for writing ink, see p. 92, vol. 33.—A. A. B. will probably find that celluloid will answer his purpose. See p. 23, vol. 33.—G. F., of Toulouse, France, will find directions for bluing iron and steel on p. 123, vol. 31.—W. B. should consult a physician.—H. T. P. will find directions for cementing leather to iron on p. 42, vol. 26.—H. T. P. will find a recipe for paint for iron chimneys on p. 34, vol. 33.—B. W. G. will find directions for preserving butter on p. 74, vol. 31.—R. D. B. will find a recipe for whitewash for outdoor use on p. 138, vol. 34.—A. M. L. will find measurements of coal per tun on p. 11, vol. 33.—M. J. G. will find a recipe for pure black ink on p. 92, vol. 33.—G. A. S. will find directions for cleaning coins, etc., on p. 217, vol. 26.—W. G. McC. will find directions for molding in plaster on p. 58, vol. 24.—F. J. B. will find a recipe for liquid shoe polish on p. 73, vol. 26.—B. M. W.'s so-called isinglass is mica, described on p. 241, vol. 34.—C. G. B. is informed that the words perpetual motion signify a self-moving machine, and no other.—R. C. J. will find that a method of molding paper, applicable to the manufacture of masks, is described on p. 170, vol. 30.—J. A. A. should address the Agricultural Department, Washington, D. C., for seeds.—W. P. C. will find a description of a silver-plating fluid on p. 299, vol. 31. For gold plating without a battery, see p. 116, vol. 32. For nickel plating, see p. 235, vol. 33.—D. A. S. will find directions for preparing peat on p. 1, vol. 29.—A. B. will find directions for making an aquarium on p. 80, vol. 31.—E. W. M. will find directions for making indelible ink on p. 129, vol. 28.—C. C. R. can clean mildew from carpets by the method described on p. 69, vol. 25. For removing stains from marble, see p. 330, vol. 32.—O. D. will find a description of a simple calculating machine on p. 214, vol. 33.—J. A. is right as to the Atlantic cable being coiled in the hold of the Great Eastern.—D. S. will find directions for making fulminating powder for percussion caps on p. 234, vol. 30.—S. P. will find a good recipe for a verde bronze on p. 283, vol. 31.—W. T. will find directions for transferring pictures to wood on p. 138, vol. 30.—G. A. K. will find that the long screwdriver mystery is explained on p. 21, vol. 19.—A. E. B. will find directions for preserving eggs on p. 219, vol. 31.—H. H. B. will find directions for browning gun barrels on p. 11, vol. 32.—C. A. C. will find instructions for distinguishing real from false diamonds on p. 251, vol. 34.—B. J. H. will find a recipe for a depilatory on p. 186, vol. 34.—C. H. M. will find directions for making rubber hand stamps on p. 156, vol. 31.—G. C. A. will find directions for constructing an anemometer on p. 249, vol. 33.—F. N. will find directions for getting tin off tin plate scrap on p. 319, vol. 31.—W. M. will find a formula for the proportions of cone pulleys on p. 180, vol. 26.—A. H. M. can silver his plate glass by the process given on p. 267, vol. 31.—W. H. A. will find a recipe for liquid blacking on p. 73, vol. 26. For bronze liquid, see p. 185, vol. 33. For marking ink, see p. 273, vol. 28.—J. W. S. will find directions for making a tar concrete sidewalk on p. 185, vol. 33.—A. J. H. will find directions for producing a black finish on brass on p. 362, vol. 25. For a black finish on German silver, p. 288, vol. 31.—A. L., S. P., H., G. W. C., H. L. M., G. C. A., J. G. B., H. D. E., E. C. L., A. W. R., J. C. M., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of of whom are trustworthy firms, for catalogues.

(1) W. J. C. asks: Is there any rule for finding the size of the steam ports of a land engine, in proportion to the horse power? A. Multiply the area of the cylinder by the speed of the piston in feet per minute, and divide the product by 4,000. The quotient is the area of each cylinder port in square inches.

(2) W. W. S. asks: 1. Is a rod of all galvanized iron wire cable a safe conductor of electricity? A. The house would be safer with such a rod than without it, provided the earth connections are good. 2. Are not glass insulators, which surround the rod completely, very liable to break by electricity expanding the rod? A. Insulators for lightning rods are worse than useless. Fasten the rod directly to the house by means of metal strips.

(3) F. E. A. says: In electrotyping I have made my impressions in wax, and brushed them with carburet of iron until well polished. I put the wires on the edges of the molds and placed them in a bath of sulphate of copper, attaching the mold to the zinc element of a zinc and carbon battery. There is a copper anode facing the mold, which is connected with the carbon of the battery. The deposit begins immediately and runs over all the high parts of the mold, but will not go down in the letters. I have five cells of battery. What is the matter? A. Five carbon cells give too high an electromotive force, except, perhaps, for starting. Try two cells. You will find it advantageous, also, to have a number of small wires attached to different parts of the mold, and all connected to the zinc.

(4) G. A. H. asks: Which is the best way to tell good steel? A. By trial of the best known brands.

(5) B. M. says: 1. I have 2 one inch electro-magnets. Can I make an electro-motor by cutting off the current just before the vibrator reaches one magnet, and putting it on the other magnet to draw it back? A. Yes. 2. How long a stroke could I have? A. Probably not much over ⅛ inch. 3. How large and heavy a balance wheel should I have? A. The wheel might be about 3 inches in diameter. 4. How many cells of Callaud's battery would it take to run such a motor? A. Three cells, if the resistance of the coils is about equal to that of the battery.

(6) P. F. asks: Which is the best lightning rod, one that is hollow or one that is solid metal, having the same circumference? A. The solid one is to be preferred.

(7) C. C. W. says: 1. I have constructed an electrical machine. It consists of a glass cylinder about 1 foot long x 5½ inches in diameter. The crank, handle, and standards are of wood. For insulating the conductors, I have long-necked bottles. The rubber is of two thicknesses of very thick flannel. I get ne electricity. Can you inform me what the matter is? A. Make the cushion of leather and stuff it with horse hair. Do not insulate it at all, unless you desire to accumulate a negative charge. The prime conductor, however, should be very carefully insulated. It is probable that the bottle is not good enough for the purpose. 2. How can I make an amalgam of zinc, tin, and mercury? A. Amalgam is prepared as follows: One part of zinc and one part of tin are melted together and removed from the fire, and two parts of mercury stirred in. The mass is then transferred to a wooden box containing chalk, and well shaken. Before quite cold, the amalgam is powdered in an iron mortar. Use with a little lard.

(8) D. McS. asks: Who was the first to apply steam to machinery? Was the power of steam discovered before Watt's time? A. We believe the mention of it by Hero of Alexandria, 250 B. C., is the oldest reference to it extant. This answers both questions.

(9) S. R. S. says: I have some dentist's pellet gold alloyed with about ¼ copper. I want to work it into a ring, but it is so very brittle that it will not work at all. I have tried melting it again and again, but it does no good. How can I make it malleable? A. If in small particles, digest for several days in pure, hot nitric acid. This will extract part of the copper and render the alloy softer. You will find a recipe on p. 139, vol. 33, by means of which the gold may readily be obtained in the pure state, after which it will not be difficult to obtain alloys of any desired fineness.

(10) A. B. T. asks: Is the 120 foot rail, recently made in Pennsylvania, the longest ever rolled? A. No. Rails of 130 feet and upwards were recently made in England.

1. A friend says that there were held in London three grand universal expositions. Is this so? A. There were two principal ones, those of 1851 and 1862; and afterwards a series of ten annual ones, open to all nations, was commenced, but it was discontinued. 2. Was there ever a world's fair held in Russia? A. Not that we know of.

(11) B. J. E. M. asks: How can I make honey mead? A. Boil some honeycombs in water till the residual honey is dissolved, and ferment the liquor. Some persons add a little brandy.

(12) R. C. says: It is claimed by lightning rod dealers that a strip of zinc folded within a sheet of copper will establish a current of electricity, and that the two metals thus combined in the rod will greatly increase its conducting power. As public safety is involved in this, will you please give your views on the combination? A. All bosh. The rod will conduct better if a second copper strip replaces the one of zinc.

(13) J. H. F. asks: India rubber bags used for hydrogen and oxygen gases for the oxyhydrogen light deteriorate in course of time, so that, although there may be no perceptible leak, there nevertheless occurs leakage. Is there any way of preventing this? A. The Goodyear bag, made on the principle of the Macintosh cloth (stout canvas and rubber) will last, with ordinary care, a very long time without appreciable leakage. It is better, when not in use, to keep the bags constantly filled with air, in order to avoid creasing. 2. Would an interior coating be beneficial? How would paraffin answer? A. This suggestion is not practicable.

(14) J. F. asks: Can you tell me a simple method of ascertaining whether well water is pure or not? A. If by purity you mean suitable for drinking and culinary purposes, place a quantity of it in a clean bottle and add a few drops of an aqueous solution of the permanganate of potassa, just sufficient to impart a slight tinge. Allow to to stand for several days. If at the end of this time there is no perceptible diminution of the color, the water may be considered safe. If, however, the color has disappeared, the contrary is the case.

(15) E. T. B. says: I have a black walnut stand that has been varnished. What preparation can I use to take the varnish off without injuring the walnut? A. Rub the surface quickly over with a strong solution of potassa in hot alcohol, and immediately afterward with dry sawdust. Finish with pumicestone.

(16) M. P. B. asks: How can I easily give copper cooking vessels the tin lining necessary to keep them fit for their purposes? A. The vessels intended to be tinned must be well scoured and present a perfectly clean surface. They are then heated to nearly the melting point of tin; and when ready, some molten tin is poured into them and brushed about with a piece of hemp over which some sal ammoniac in powder has been strewn.

(17) L. C. C. asks: 1. How may grease stains be removed from marble? A. Have you tried benzole? 2. How may iron rust stains be removed from marble? A. They cannot be removed without injury to the marble.

(18) H. T. P. asks: In a good article of wheat, what is the proportion of 1st and 2nd class of flour, and what of bran and middlings? A. This depends much upon the method of grinding and preparation. We believe the average to be about as follows: Fine 60, second 13, bran and loss, 27 parts in 100.

(19) W. L. D. asks: Please give me a recipe for iron tonic or wine of iron. A. The so-called wine of iron consists of a solution of the citrate of iron and quinine in a mixture of spirit of wine and water.

How can I make paste blacking? A. Blacking consists of a black coloring matter, generally bone or ivory black, and substances which acquire a gloss by friction, such as sugar and oil. The usual method is to mix the bone black with sperm oil, sugar, and molasses; a little vinegar is then well stirred in, and strong sulphuric acid gradually added. The acid, acting upon the salts of lime in the bone black, produces sulphate of lime and a soluble acid phosphate; the sulphate forms a tenacious paste with the other ingredients, which can be spread very smoothly. The oil serves to render the leather pliable. This makes a liquid blacking; paste blacking contains less vinegar. The proportions should be about as follows: Bone black 8 parts, oil 1 part, molasses 4 parts, sulphuric acid 2 parts, vinegar 2 parts.

(20) C. S. M. asks: Can I advantageously use the refuse lime from gas works for a manure to enrich a sandy soil? I was informed by a gardener that, if I put it on my grounds, it will certainly ruin my land. A. The gardener's statement is correct.

(21) J. S. T. asks: I wish to melt cast steel scraps with cast iron, copper, and brass. I can melt it, but cannot get it hot enough, when melted together, to run a piece of casting. Can I melt it in an ordinary foundery furnace? A. Melt the steel first, then the iron (cast, not wrought) and copper, and finally the zinc. We do not think that you will succeed in obtaining good castings from such an alloy, and, moreover, such a compound metal certainly have little to recommend it.

(22) W. C. R. asks: Where are the chief centers of the carbonate of soda manufacture in America? A. American manufacturers cannot compete with the English in the production of this salt, and consequently there are no manufactories of any account in this country. We cannot find any statistics of this trade.

(23) A. L. E. asks: Please give me a good recipe for removing stains from the fingers after smoking a cigarette? A. Use a little piece of pumicestone with soap and water. This is the least objectionable method.

(24) C. P. H. asks: 1. What will clean white spots and stains from zinc? A. Try a little fine emery cloth, and finish with powdered pumicestone. 2. What will clean frosted silver? A. Use a rag buff and putty powder.

(25) S. C. asks: Can you let me know an easy way to find the chord of an arc when the radius and degrees are given? A. Chord=$[2\times(\text{radius})^2-2\times(\text{radius})^2\times\text{cosine angle}]^{0.5}$.

(26) R. & H. say: 1. We have a double oscillating engine cylinder, 3x6 inches, which we desire to put in a steam launch. What dimensions of boiler would be suitable? A. Use a boiler 3 feet in diameter and 4 feet high. 2. Would steel be preferable to iron? A. Either will do. 3. What size of boat would she drive successfully at 6 or 8 miles per hour? A. Use a boat 25 or 30 feet long. 4. What size and number of blades of propeller would you advise? A. Use a propeller 28 or 30 inches in diameter, and of 3½ feet pitch, with 3 blades.

(27) W. S. P. says: 1. I am building an engine of 2 inches bore by 3¼ inches stroke, with a fly wheel 12 inches diameter weighing 16 lbs., running at 300 revolutions per minute with 50 lbs. steam. What power would it develope? A. From ½ to ¾ of a horse power. 2. What would be the proper size for a boiler with single flue? A. Make one 18 to 20 inches in diameter, and 3 feet high. 3. How large a boat would the above engine propel at a speed of 3 or 4 miles per hour? A. One 10 or 12 feet long. 4. Which would answer best, a screw or paddle wheels? If a screw, of what diameter and pitch should it be? A. Use a screw, 16 or 18 inches in diameter, and of 2½ feet pitch.

(28) T. H. W. asks: Can a velocipede be constructed to run with one or more coil springs? The springs are to be wound up with a crank. A. It seems possible.

(29) C. W. says: I say that, by taking an ordinary rubber cane, with a loaded head, by the ferrule end, one can strike a heavier blow than if one grasped the cane in the center. My friends say that more power can be applied by grasping in the center. What is your judgment? A. You have the right idea.

(30) C. L. asks: Gas leaking through pipes has vitiated the air till our nostrils are assailed violently. Is this gas slightly or very injurious to health? A. Very.

Is Bright's disease a disease of the urinary organs? A. Bright's disease is a fatty degeneration of the kidneys; and it is so called because Dr Bright, in 1827, first pointed out the frequent connection of anasarca and other dropsical affections with a degeneration of the structure of the kid-

neys, the prominent character of which is the deposition of a peculiar granular matter in the substance of the renal gland, together with the gradual atrophy of its cortical and tubular structure.

I have broken the translucent glass of my kaleidoscope. How shall I replace it? A. Obtain a piece of finely ground glass, cut to the exact size of the tube, and fit it as before.

(31) I. H. R. says: 1. Some time since, you published a plan of making the baroscope of Babinet. After the baroscope is constructed, and the red fluid made to rise in the glass tube by blowing into it, must the top be sealed? A. No. It may be drawn out to a point, but the tip of this must be broken off in order that the air may press upon the surface of the liquid in the tube. A very minute hole will answer the purpose. 2. Is it necessary that the baroscope should be placed in the open air for the effect of the atmosphere? A. No.

(32) L. C. E. says: I make black ink, but it corrodes the pen. The ingredients are blue galls, sulphate of iron, acetate of copper, gum arabic, and sugar. How can I remedy this corrosion? A. It is probable that the sulphate of copper is not neutral. Try the addition, with constant agitation, of a solution of carbonate of ammonia until a precipitate just begins to form.

(33) F. R. W. asks: Can the American black walnut be stained or changed to a light color? A. Strong nitric acid changes the appearance of good black walnut to that of light mahogany. Chlorine and chlorinated lime bleach it.

(34) H. R. says: I am driving a circular saw by hand power with a 2 inch belt from a 5 feet driving wheel to a 3 inch pulley on the saw shaft. The objection to this plan is that the large wheel occupies so much room. Please give me some idea of the loss of power I shall sustain by using a countershaft and a smaller driving wheel. A. If the shafting is accurately fitted, the loss will probably not exceed 10 or 12 per cent.

(35) C. J. asks: Is there any chemical that will bleach rosin as it runs out with spirits of turpentine? A. No. It is impracticable.

(36) C. R. asks: What relative efficiency have petroleum and coal as fuel? If you have to generate steam in a boiler, and you use 1 tun good steam coal, how many lbs. crude petroleum would you require, with perfect combustion, to do the same work? A. About 1,366 lbs.

(37) C. P. S. asks: How can light colored tobacco leaf be made dark without injury to the leaf and its burning qualities? A. We know of nothing that we can recommend for this purpose.

(38) A. A. M. asks: Is there anything that can be put into preserves to keep them from candying? A. We do not know of any way of avoiding it with concentrated sirups.

(39) S. O. asks: Would two extra keels, one on each side, just below the water line, a little shorter than the main keel, make a canoe sail closer to the wind, and let it carry more sail? Canoe is 20 feet long by 4 feet wide, and has a keel about 7 inches deep. A. There is some difference of opinion on this subject. If any of our readers have made experiments, we would be glad to hear from them.

(40) G. E. S. says. I wish to put an upright boiler in a steam launch 35 feet long, 6 feet wide, and about 3 feet deep. It is desirable to get the weight of the boiler as low as possible, and to have it as large in diameter as would be safe. What diameter and length of tube would you recommend, to drive two 6x6 inches vertical engines? A. About 4 feet in diameter and 6 feet high.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the results stated:

B. F. W.—It is galena or sulphuret of lead.—W. P. D.—It is sulphuret of lead, or galena.—G. W. P.—It contains lead and antimony.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On a Window Stick. By H. T. G.
On the Glacial Period. By F. B.
On a Thread Telegraph. By G. Q. T.
On the Phylloxera. By A. S.
On Alexander Selkirk. By W. R.

Also inquiries and answers from the following:

F. C. R., Jr.—O. K.—G. A.—M. N.—A. B.—B. B.—G. M. R.—J. C. W.—C. E. S.—E. F. T.—W. L.—H. N.—W. C. R.—A. F. P.—H. C. N.—T. S.—R. R.—E. L. E.—J. S.—C. G. W.—G. M.—E. S.—E. T. B.—J. P. O.—W. M. R.—C. W. L.

HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells red cedar? Who sells lead pencils? Who sells German silver penholders? Who sells imitation gold pens? Who sells brad-cutting machines? Who makes a machine for ironing collars? Whose is the best furnace for burning wet tan? Who sells the best steam trap? Who makes the best fire engine lanterns?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL]

INDEX OF INVENTIONS

FOR WHICH

Letters Patent of the United States were Granted in the Week Ending,

April 18, 1876,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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9,235.—CANISTERS.—J. B. Rohrman, Philadelphia, Pa.

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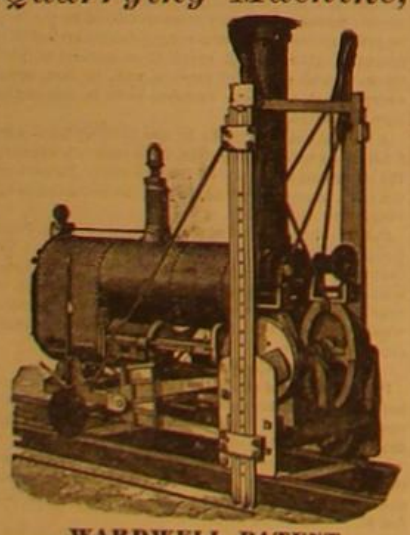

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