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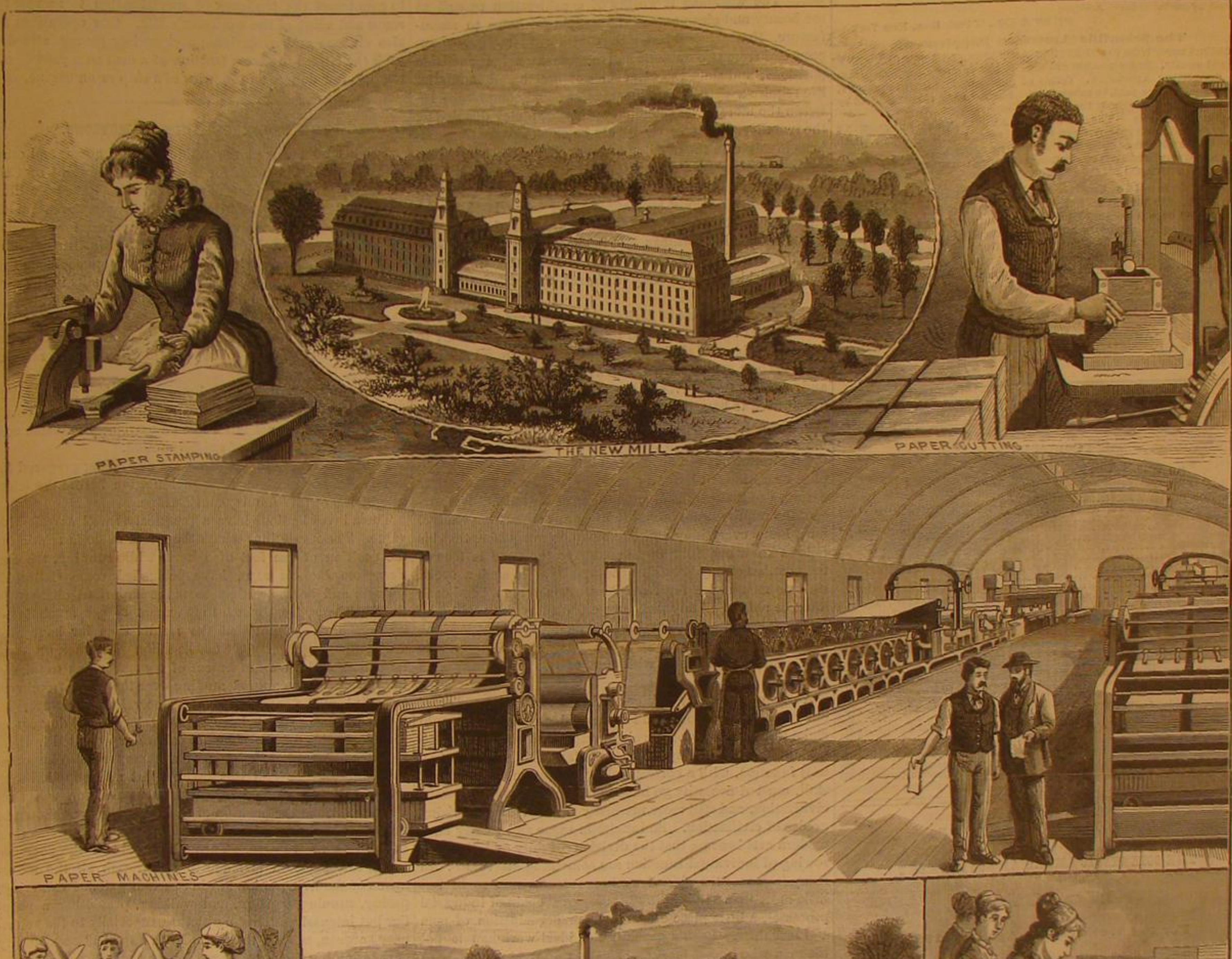

THE MANUFACTURE OF WRITING PAPERS.—OWEN PAPER COMPANY HOUSATONIC MASS.—[See page 275.]

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NEW YORK, SATURDAY, APRIL 30, 1881.

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(Illustrated articles are marked with an asterisk.)

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THE SCIENTIFIC AMERICAN SUPPLEMENT

No. 278.

For the Week ending April 30, 1881.

Price 10 cents. For sale by all newsdealers.

THE DIVISION OF LABOR.

Since Professor Babbage wrote for the "Encyclopædia Metropolitana," a generation ago, his celebrated chapter on the economic advantages of the division of labor, the principles he laid down and illustrated have been discussed with endless iteration in every sort of industrial publication, and demonstrated over and over in every department of the mechanic arts.

They are fundamental truths, which each generation of artisans and manufacturers must learn, and learn to apply to the ever-changing needs of new trades, new processes, and new social and industrial conditions.

But when we have proved that division of labor is an essential condition of successful and economical production on a large scale, we have not by any means exhausted the subject. The workman is worthy of consideration as well as the beauty and cheapness of the article he helps to manufacture. Hence the subject of the division of labor may be approached from two opposite and to some extent irreconcilable positions; and since the exigencies of social and industrial life require a perpetual adjustment of and compromise between the more or less conflicting lines of policy dictated by the two divergent interests, it is to be expected that the problems involved in the division of labor will never be shelved as thoroughly settled and done with.

If regard is had only for rapid, perfect, and economical production, the utmost specialization of labor is to be desired, if need be with the extremest limitation of the operative scope of the workman. If the well-being of the artisan, and through him that of the society he helps to form, are the main consideration, a very different aspect of the case appears.

It is for the interest of society that every man shall be of the manliest sort; to this end there is no theoretical limit to the knowledge and skill desirable in the artisan, who would be at his best only when he knew everything worth knowing, and was able to do everything worth doing, or that society might need to have done. The natural limitations of human capacity and the brevity of the time at command for acquiring knowledge and skill compel a material scaling down of the theoretical standard. Except under the lowest and simplest conditions of living no man, however well endowed by nature, can make himself an epitome of his tribe. The savage, the requirements of whose life are few but imperative, must know everything and be able to do everything that his fellows know and do. To a less degree the same is true of the member of any primitive community. In such a social state no man varies far from the "average man," and each must be able to fill any place or perform any duty that may arise. There are but few things to be done; the scope of the life is narrow, and every man's knowledge and skill must be substantially coextensive with that of the community as a whole.

A corresponding capability on the part of any member of our more complex social and industrial communities would make him a prodigy of learning and trained ability as admirable to think of as impossible to realize. Division of industrial function, with a corresponding limitation of individual skill, must of necessity go hand in hand with progress toward civilization, and still more markedly through all the rising grades of civilization. So infinite in scope and variety have modern arts become that the division of duty and the narrowing of individual function are something marvelous. In many instances the skilled workman seems now to be but little more than a living link in some great chain of industrial processes, a little piece of some huge organization of men and machines. In this capacity the ideal workman is not the man who knows most and can do the greatest variety of work, but he who can perform his own allotted task quicker, surer, and altogether better than any one else. And to do the required duty with the speed and skill demanded may be possible only by such close and protracted application of the man to that one monotonous operation as to measurably spoil him for any other industrial duty.

Here the tendency of the division of labor would be fatal to humanity within the range of its influence were it not constantly being restrained and corrected by inventions which substitute machines of wood and metal for human machines.

In the classic illustration of Professor Babbage—the manufacture of pins—the division of labor had become so minute that each pin required the work of four men, four women, one boy, and one girl, or ten different operatives, each performing some one specific and sharply limited task. At this stage the American pin-making machine came in to do the work of all except the wire-drawers, setting the rest free for more comprehensive and, it is to be hoped, less monotonous labor. The same process of increasing specialization of labor, ultimately mitigated by inventions which take the place of special skill and make the specialist a machine tender instead of part of a machine, is going on in every branch of the industrial arts. The invention of automatic machines thus becomes the salvation of the laborer, relieving him of the narrower and more brutalizing forms of toil, and at the same time, by cheapening products, putting within the workman's reach and enjoyment such food and clothing, conveniences and luxuries as would otherwise be beyond the reach of the richest.

The division of labor is thus a necessary evil and the means of much good; and it rests largely with the artisan himself to determine whether the minute specializing of labor, which the perfection and highest economy of manufacturing necessitate in so many departments, shall dwarf him or help him to higher manliness. If the daily pressure which the factory brings to bear upon the workman, tending to reduce him to the industrial condition of a cog in a great wheel or a wheel in a great machine, is not resolutely offset by an effort on his part to broaden his mental life and increase his knowledge and skill in other divisions of industry than the one he is specially engaged in, the chances are that his manhood is doomed. If his ambition is satisfied by the ability to perform one operation, or one limited round of operations fairly well, and he is willing to spend his life in that way, he must not expect to enjoy much of the life of a free man.

One of the great industrial problems to be solved by the American people is how to adjust the relations of machinery and minutely divided labor, so as to secure on the one hand the best and cheapest productions, and on the other hand to counteract the tendency of specialization to narrow the scope and value of the workman's life. Our operatives are also citizens and sovereigns; and society cannot afford to spoil the citizen to save a fraction of a cent on a yard of cotton or a few dollars on the price of a ship or an engine.

THE STUDY OF ANIMAL MOTIONS.

The instantaneous photographic views of horses and other animals in motion taken for ex-Governor Stanford of California, by Mr. Muybridge, of San Francisco, have been illustrated and repeatedly referred to in this paper. Mention has also been made of the zoogyroscope, devised for studying the pictures taken. Improvements in this instrument have brought out several curious features in the phenomena produced. For instance, a larger number of slits in the zinc disk than there are figures on the glass one will increase the rapidity of the motion of the figures. Owing to this peculiarity, two figures may be placed on the same glass disk and will appear to be traveling at different rates of speed.

It is announced that the photographs taken at Palo Alta are being prepared for publication in a large and costly volume, which cannot fail to be an extremely valuable contribution to the science of animal motion.

Facsimiles of the photographs are also being prepared for use in the zoogyroscope, for presentation before the scientific bodies of this country and Europe.

These investigations have a practical as well as scientific value. The revelations which they have made in relation to the position of the feet of a horse while running, the San Francisco *Bulletin* says, have persuaded some California trainers and horse breeders to make important changes in their methods, from which they expect to get much faster time. They represent that the results thus far have been very satisfactory. By the construction of a track around a large tent, and the arrangement of cameras so as to take an impression of the animal moving over the track from various points at the same moment, some valuable pictures for the guidance of artists have been obtained. All degrees of fore-shortening of the same animal are represented in these pictures. A perfect skeleton of a horse was also imported from the East, which was taken apart and supplied with artificial ligaments to its joints. This skeleton was then made to assume the position of the living horse, as shown in the various photographs of the latter taken, and it was then exposed to the camera. Through the aid of the zoogyroscope, this skeleton is made to go through all the movements of the living animal in his various gaits of cantering, pacing, running, trotting, and walking, presenting a peculiar but intensely interesting picture, especially to the veterinary surgeon, who is thus afforded a practical opportunity of determining the effect of motion on the various joints.

THE ELECTRIC LIGHT IN AKRON, OHIO.

A novel, and thus far successful, experiment in electric lighting, was inaugurated in Akron, Ohio, April 9.

The town is lighted by two groups of lamps, one supported by an iron tower rising 208 feet above the street, the other by a wooden mast on the observatory of Buchtel College, about 40 feet higher than the tower lamps. Each group consists of four lamps of 4,000 candle power each, or an aggregate light of 32,000 candle power.

The chief novelty of the system is the tall tower, made of boiler plate in 55 sections, each 50 inches in length. At the bottom the diameter of the tower is 3 feet; at the top, 8 inches. The tower is steadied by six wrought iron guys reaching to the top. Over the lamps is a five-foot copper reflector, which serves also as a hood. Thirty feet from the street is a wrought iron balcony, to which the lamps are lowered for trimming.

The entire electric circuit is 9,110 feet, the conducting wire being of copper. The total cost of setting up the system, including boilers, engines, etc., was $11,317, and the cost of running the lights a year is estimated at $1,580. The cost of the iron tower was $1,609.

The light promised from these two centers is to be equivalent to bright moonlight, over a circuit of half a mile radius from each group of lights, or two circular areas each one mile in diameter. It is thought that four more centers of illumination would supply the entire city. From 300 to 400 or more street gas lamps will be displaced by the electric lamps now in operation.

THE *American Architect* refers to a surveyor's blunder, by which a substantial brick hotel has been built in the suburbs of Philadelphia on a lot distant forty feet from the one bought for the purpose.

MORE ABOUT PICKETT'S CAVE.

BY H. C. HOVEY.

In reply to inquiries concerning the new cave found in Williams' Cañon, Colorado, the following particulars are given:

"The Boys' Exploring Association," to whose diligence this discovery is due, is an organization of young mountaineers living in the vicinity of Pike's Peak, whose laudable purpose it is to combine the enjoyment of camping out with the study of botany, geology, and mineralogy, amid the hills and valleys of that remarkable region. In this they have been encouraged by Rev. R. T. Cross and President Tenney, of Colorado College, who have accompanied them on some of their excursions.

One of their earliest fields of exploration was Williams' Cañon, into whose crannies and crevices the boys penetrated under the direction of their leader; and two brothers, John and George Pickett, climbing up a path no one had ever tried before, crept into an opening only four feet high and ten feet long, which proved to be the antechamber of a cavern of huge dimensions.

Fortunately the boys had candles and matches along, and proceeded at once to explore room after room, each decorated by beautiful stalactitic folds and pendants. The largest then entered was about 60 feet high, irregular in shape, and described as resembling the bed of some river that had suddenly frozen while leaping down successive cascades. In a room to the right of this the boys were dismayed to find themselves on the brink of a pit, 50 feet deep, into which they were not prepared to descend.

Retracing their steps, they found a narrow passage leading up to the chimney-like opening described in my last; and here ended their first underground tour, whence, with great difficulty, they made their way back to the bottom of the cañon.

The report they gave of course stimulated further exploration, with results already described, most of which are similar to those with which visitors to other caverns are familiar.

The presence of extensive beds of ocher indicates that the subterranean stream flowed from the granite mountains above, bringing the decomposed materials of the feldspathic rocks in the form of these ferruginous clays, which are so hard and compact as to take a fine polish.

Other evidences of former streams are furnished in the beds of rounded pebbles, often coated by stalagmitic deposits. It is an interesting fact that similar smooth pebbles are found in the *open* gorges or "caves," as they are incorrectly called, cutting through the walls at a height sometimes of 200 feet from the bottom.

The opinion is advanced that these caves and cañons were made when the ocean washed the foot of Pike's Peak; but that is hardly probable, in view of the fact that the geological formation is Silurian limestone, through which, as in the case of Mammoth and other caverns, the acidulated rain water could have eaten its way *since* the elevation of the region above the sea level. The swirling of a subterranean stream could round the fragments of granite into pebbles as readily as the wash of the waves.

In some instances we know that what now are open cañons were once caves; a striking example of which is furnished by the famous natural bridge of Virginia, the arch being merely the remnant of an ancient cave roof; and the combination of a cave, chasm, and natural bridge, on Hudson's Brook, Mass., as pictured in "Hitchcock's Report," vol. i., page 288, is even a better example of the same thing.

We cannot draw the conclusion that *all* cañons were once caves; but the subject is worthy of more careful investigation, and we commend the problem to the consideration of the "Boys' Exploring Association."

Among mineralogical peculiarities noted in Pickett's cave is the occurrence of oulophyolites, or curled crystals of gypsum, often mimicking floral forms: likewise acicular crystals, probably of Epsom salts; both of which abound in Wyandot and Mammoth caves.

No inhabitants have yet been observed except bats and rats. And it is the opinion of the discoverers that no human beings ever penetrated to these subterranean rooms before. But it is so uniformly true, in respect to other caves, that careful examination has brought to light vestiges of aboriginal occupancy, that I am inclined to think it may prove so here.

Experiments should also be instituted forthwith to determine the rate of stalactitic growth, which is apparently very rapid in Pickett's cave. And the subject of stalactitic distortion by currents of air, fungoidal growths, and other causes, demands some attention for the sake of comparison with similar inquiries made in other localities.

Rock-boring Ephemera.

At the meeting of the New York Academy of Sciences, April 11, Dr. Trimble, of New Jersey, exhibited specimens of marine shells and marble which were deeply perforated by larva of certain ephemera. The marble had been bored in every direction to the depth of from two to three inches, and thus honey-combed with slender passages plugged at the entrance with a closely cemented deposit. In their flying state the ephemera (commonly called May flies or day flies) live but a few hours. The larvæ live in water for a year or more, and, according to Dr. Trimble, secrete an acid which enables them to bore into limstone, passing through their first transformation in the closed burrows.

STANDARD TIME IN THE UNITED STATES.

The American Metrological Society have issued a circular in relation to the introduction of uniform standard time into daily use for both popular and scientific matters; a question which, through the extension of rapid electric and railway communication, has become of considerable practical importance.

The society find at least a hundred local times or meridians in ordinary use, many of them differing but a few minutes from each other. More than seventy such standards are used by railway and other companies in the United States and Canada, making no little unnecessary confusion and complexity in their time tables. It is, accordingly, proposed that the community unite upon a division of the continent into a few (time) sections, throughout each of which the time by the clock shall be kept in agreement with the standard meridian.

In anticipation of the ultimate adoption of a system of standard times throughout the world, the society recommends for the United States the adoption of a central meridian in the Mississippi valley exactly 90° or six hours west of Greenwich, and proceed to east and west by steps of exactly one hour each. On this plan the sectional times would be about as in the following:

PROPOSED SCHEDULE OF STANDARD TIMES.

Geographical Section.	Standard Meridian west of Greenwich	Standard Times slower than Greenwich.	Standard time slower or faster than true "local times."	Designation of proposed Standard Time.
		H. M. S.	Min.	
Newfoundland, New Brunswick, Nova Scotia	60°	4 0 0	29 slower than St. John's, N. F.	Eastern Time.
			24 faster than St. John, N. B.	
			14 faster than Halifax, N. S.	
Canada, Maine to Florida, Ohio to Alabama, Lower Lakes	75°	5 0 0	15 slower than Quebec	Atlantic Time.
			18 faster than Toronto	
			16 slower than Boston	
			3 slower than New York	
			8 faster than Washington	
			19 faster than Charleston	
			45 faster than Montgomery	
			14 faster than Buffalo	
			30 faster than Detroit	
			38 faster than Cincinnati	
Mississippi Valley, Missouri Valley, Upper Lakes, Texas	90°	6 0 0	0 faster than New Orleans	Valley Time.
			1 faster than St. Louis	
			12 faster than St. Paul	
			18 faster than Kansas City	
			19 faster than Galveston	
			10 slower than Chicago	
Rocky Mountain Region	105°	7 0 0	0 faster than Denver	Mountain Time.
			28 faster than Salt Lake City	
Pacific States, British Columbia	120°	8 0 0	12 slower than San Diego	Pacific Time.
			10 faster than San Francisco	
			11 faster than Olympia	
			12 faster than Victoria	

What the Gulnare Expedition Failed to Do.

It will be remembered that the expedition in the Gulnare to plant the first Howgate Arctic colony came to naught through the unfitness of the vessel for any sort of sea-going service. The disappointed commander was naturally in no amiable frame of mind during his brief Arctic experience, and traces of his displeasure appear in the irony of his official report, a summary of which has got into unofficial print. Probably no one will enjoy his little scold any more than those explorers who did not fail so conspicuously.

"The cruise of the Gulnare," says Lieutenant Doane, "is the first acknowledged failure in Arctic annals. We did but little, but left a great many things undone requiring some moral courage to refrain from doing. We did not change the names of all the localities visited, as is customary, nor give them new latitudes, to the bewilderment of the general reader. We do not dispute any one's attained distance, nor declare it impossible that he should have been where he was. We did not hunt up nameless islands and promontories to tag them with the surnames of plethoric merchants and wildly enthusiastic females who had given us plug tobacco and button-hole bouquets. We did not even erect cenotaphs. A cenotaph is a monument erected to one who is buried elsewhere or not buried at all. The artistic style for such a structure is a pile of rocks, on the flattest of which is daubed in letters of tar the following stereotyped inscription: 'Sacred to the memory of the heroic ——.' Why a cenotaph should be erected where no one will see it, and what use there is in erecting one at all, are questions. We received no flags, converted no natives, killed no one. We discovered no new evidences regarding the Mosaic account of the Creation, nor the Deluge, nor the unity of races, nor the location of ancient Troy, nor the Garden of Eden. We found nothing in Greenland to put our naturalists to the blush by comparison, nothing superior to railroads and modern civilization. We did not see anything half so grand, half so sublime, nor half so beautiful there as can be seen in the Yellowstone National Park and a dozen other localities at home. We did not even see what others have seen in the same regions.

"The primary geographical iceberg, which in perspective towers above first-class ships in the foreground, and has a contemplative bear gazing seaward from the loftiest pinnacle, oblivious of the herd of fat seals on its beach, is not produced any more. Neither is the iceberg of shop windows. The present ones are not so high by several hundred feet, and instead of being in a freezing condition were rapidly thawing whenever afloat. Polar bears do not put their paws on men's shoulders and smilingly offer their stomachs to be ripped open in the Norwegian regions, as formerly. The rocks and bluffs of the Arctic are not at all clouded with water fowl, as pictured, nor is it dangerous to run a whaleboat lest it should ground on a sleeping whale, be pierced through by the horn of a narwahl, or captured by an angry herd of walrus. Arctic scenery is grand, but with little variety. The glacial phenomena alone in summer-time are magnificent; in winter the auroras are added. At the pole during the summer there is, of course, constant daylight, yet nobody seems to have thought it worth while to call attention to the fact that solar observations could be taken astronomically during that season. No one has proposed wintering at the pole. The proposition would probably not be carried into effect if outlined. The object of this report is to expose a few of the specious pleas, fallacious reasonings, and ill-grounded conjectures which are called scientific, and to place the subject of circumpolar exploration on a basis of facts and reasonable probabilities. One cannot explore the earth's surface from an observatory, nor by mathematics, nor by the power of logic. It must be done physically."

Another Florida Project.

Mention was made not long since of a plan to drain Lake Okeechobee and the adjoining Everglades of Florida, the aim being to reclaim some 12,000,000 acres of land suitable for the cultivation of sugar, cotton, and tropical fruits.

A charter has been granted by the State of Florida to another company—composed, however, of the same Philadelphia capitalists—having for its purpose the construction of a ship canal across the State by way of the Caloosahatchie River (the outlet of Lake Okeechobee), the lake, and eastward across the low country to the Atlantic, ending at or near the mouth of the St. Lucie River. The capital stock of the ship canal company is $30,000,000. It is said that operations will begin at once, surveyors having already been sent into the field.

A proper ship canal across the Florida peninsula is something to be desired; and, if the canal required for the Everglades drainage scheme can be utilized for commerce, its double usefulness might atone in part for its otherwise unfavorable position.

The Great Corliss Engine.

The great Corliss engine of the Centennial Exhibition seems to have the power of multiplying itself as remarkably as the bones of mediæval saints, or the furniture of the Mayflower. A little while ago, according to local reports, it was doing duty in San Francisco, and also in several other places this side the Rocky Mountains. Its latest appearance is in the new town of Pullman, near Chicago, where it gave impressiveness to the ceremony of inaugurating the Pullman Palace Car Works, just started there.

A Valuable Patent Right.

It is announced that the right to use in this country the basic process for dephosphorizing iron has been purchased by the Bessemer Steel Association. The Philadelphia *Bulletin* says that the figures involved in this important transaction (by which all of the patents covering the basic process, comprising those issued in the names of Messrs. Thomas, Riley and Snelus, become the property of the Bessemer Association) are placed all the way from $275,000 to $400,000, but parties who have facilities for knowing something of the matter say that the lesser figure is the correct one.

Instantaneous Silvering Mixture.

To coat copper or brass objects with silver, without difficulty or loss of time, the following process is given in the *Gewerb.-Bl. f. Ost- u. Westpreussen*: Mix 3 parts of chloride of silver with 20 parts of powdered cream of tartar and 15 parts of powdered common salt. Moisten a suitable quantity of the mixture with water, and rub it with a piece of blotting paper upon the metallic object, which must be thoroughly clean. The latter is afterward rubbed with a piece of cotton upon which precipitated chalk is dusted, then washed with water, and polished with a dry cloth.

Nitrate of Silver for Worms.

Dr. M. P. Greensword (*Medical Summary*) was accidentally led to regard nitrate of silver as a remedy for worms. Further use of this drug has convinced him that it is one of the most potent agents we have for the destruction and expulsion of worms. He gives a teaspoonful three times a day, of a solution of five grains of nitrate silver in six ounces of rain water.

Ladies, Beware!

A singular case is reported from the University of Michigan, service of Dr. A. B. Palmer. A young married woman of twenty-one years was brought to the hospital, suffering much pain, partly paralyzed, subject to convulsions, helpless. Various forms of treatment were used, particularly for uterine difficulties, which was the supposed trouble, but without improvement. Finally it was diagnosed that it was a case of lead poisoning, and under proper treatment for that disorder she soon improved and recovered. But how the lead ever found its way into her system could not at first be ascertained, though the most careful inquiry was made. It came out at last, however, that she had for several years been in the habit of beautifying her complexion by the use of a white powder sold as "flake white," which she applied to her cheeks after first wetting them with water. This "flake white" proved on analysis to be nothing more nor less than carbonate of lead, a deadly poison to the human system.

IMPROVED WATER METER.

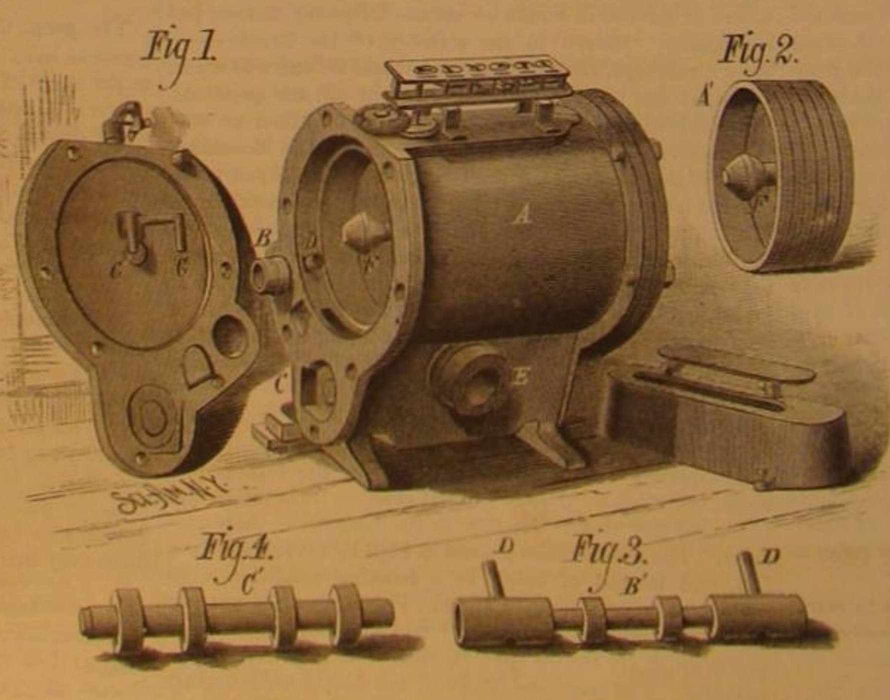
There is no question of more vital importance to a city than that of its water supply. What at first seemed like a plentiful supply in many of our large cities has proved inadequate when the increasing waste has remained unchecked, but when this waste is checked by registering the amount of water used by means of efficient meters, the original estimates were found ample. This proved to be the case in this city, for according to the report of the Commissioner of Public Works in 1880, the supply which ten years ago was required for a population of 842,000, by the introduction of water meters is made to suffice for a population of 1,280,000.

The city of Brooklyn, which, during the last season, almost suffered a water panic, would have been enabled to distribute a plentiful supply of water and to arrest waste if a good water meter had been adopted. In fact, the universal adoption of an efficient meter, to be used as a part of the water supply system, is the only means of insuring economy in the use of water.

We give herewith an engraving of a meter, which, according to the reports of the New York and Chicago Water Commissioners, has proved very satisfactory. The following tabulated statement of the test at Chicago indicates very accurate registration:

Duration in Minutes.	No. of C. feet by Meter Register.	Actual quantity delivered.	Pressure upon Main.	Remarks.
2[illegible]	10	10·3	29·5	Discharging through 1 inch nozzle.
2[illegible]	10	10·4	30·5	" " [illegible] " "
2[illegible]	10	10·5	29·5	" " [illegible] " "
3[illegible]	10	10·3	30·5	" " [illegible] " "
9[illegible]	10	10·3	29·5	" " [illegible] " "

The meter is shown in Fig. 1 with one of its heads and the cover of the recording mechanism removed, showing the inside of the cylinder and valve chamber with the piston and valves in position. Fig. 2 is a detail view of the piston, and Figs. 3 and 4 are, respectively, auxiliary and main valves.



SEQUEIRA'S WATER METER.

Water is admitted to the meter through the inlet, E, to the main valve chamber, C, passing between the two middle heads of the main valve, C', through ports into the cylinder, A, forcing the piston to one end of the cylinder. When near the end of its stroke it strikes one of the pins, D, projecting from the valve, B, and moves the valve in the same direction, thereby directing the flow of water into the valve chamber, C, between one of the outside heads of the main valve, C', and the head of the meter. The main valve is then forced to the opposite end of the valve chamber, when the flow of water into the cylinder, A, is reversed, and the piston is moved back into its original position, forcing the water on the eduction side of the piston, downward and out through the exit opening, which is exactly opposite the inlet opening.

The recording mechanism is operated by a double cam, F, projecting from the center of the piston, A', as seen in Fig. 2. This cam engages a forked lever having two projecting lugs, G G, projecting into the cylinder. This forked lever is attached to the lower end of a vertical shaft which extends upward through a stuffing box, and carries a double lever at the top, having two pawls which engage a ratchet wheel actuating the recording mechanism on the top of the meter, the wheel being moved forward one tooth for each stroke of the piston.

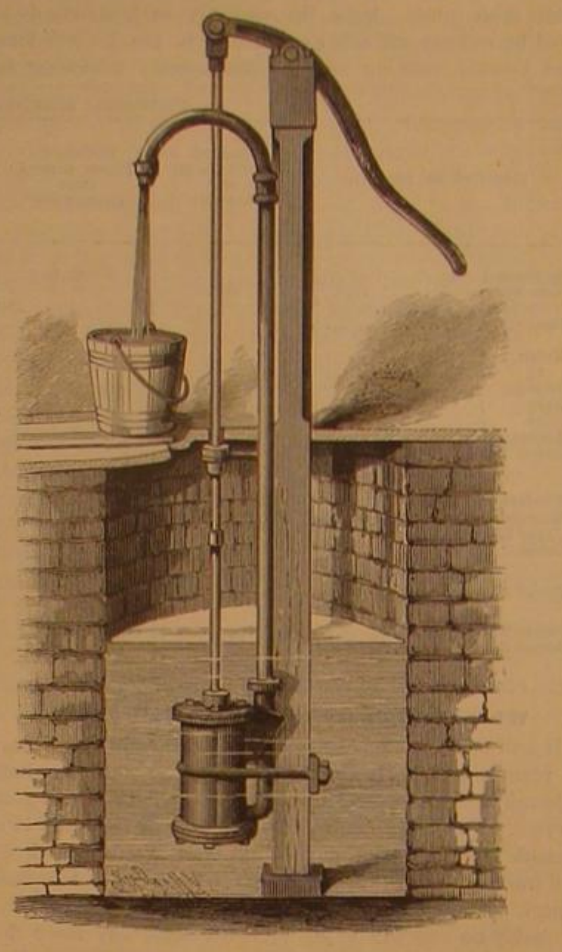
This meter is inexpensive in its construction and registers accurately.

Further information may be obtained by addressing Mr. Augustus Sequeira, 1447 Broad street, Hartford, Conn.

Daniel F. Beatty, the celebrated organ manufacturer, of Washington, New Jersey, was re-elected Mayor of that city this week. This is the third successive term of Mayor Beatty.

IMPROVED FORCE PUMP

The annexed engraving represents an improved force pump recently patented by Mr. A. J. Hopkins, of Hamilton, Ontario, Canada. The cylinder of the pump is mounted on a standard which rests on the bottom of the well, and reaches above the well covering a sufficient distance to receive the handle and support the upper end of the discharge pipe.


IMPROVED FORCE PUMP.

The pump is double-acting and works very freely, taking the water from the bottom of the well where it is coolest and purest. It can never freeze, for as soon as the movement of the piston is stopped the water retreats from the discharge pipe into the well. The pump is well made and calculated to remain in order in all seasons and under all conditions.

A New Photographic Process.

The phosphorescent properties of sulphide of calcium have been applied to many purposes more or less useful both in and outside the bounds of photography; but so far as the latter is concerned the applications have been hitherto of little real practical utility.

At a meeting of the London Photographic Club, however, Mr. A. L. Henderson announced an entirely new and, if it should prove to be practically workable, a most valuable application of the sulphide of calcium. This is, as yet, only in the experimental stage, and is given to the public that others may join in working it out to a practical issue. It consists in a method of producing instantaneous pictures by any light, however feeble—as Mr. Henderson himself described it, even by gaslight—with a pinhole stop. This result is attained by incorporating finely divided sulphide of calcium with the emulsion itself. With such an emulsion Mr. Henderson has himself obtained startling results, though as yet not perhaps photographically perfect. The luminosity set up by the momentary exposure of the phosphorescent film to light, feeble though it may be to the eye, is sufficiently powerful to gradually impress the particles of silver bromide, which, after a short time, become amenable to alkaline or other development in the same manner as if impressed in the ordinary way, the length of time between exposure and development ruling the degree of impression effect; in other words, the longer the plate is kept the better or more fully "exposed" it will be. We have not yet had the opportunity of trying this novel application of phosphorescent light to photographic purposes, as while we write but a few hours have elapsed since it was made public; nor is it possible yet to prognosticate what degree of success will attend its practice; but we give it at once to our readers on Mr. Henderson's behalf, feeling certain that many will be ready to enter the field of research in this direction.—*British Journal of Photography.*

Alcoholism a Predisposing Cause of Crime and Epilepsy.

In a recent number of the journal with the awkward title *Brain*, Dr. Clarke has published some tables of statistics, which lead him to the conclusion that "alcoholism of parents is a predisposing cause of crime and epilepsy in their children." Forty-four per cent of the epileptic criminals were the children of drunken parents. The proportion of epileptic and insane relatives is found to be very much greater with criminals than with ordinary epileptics. The convictions for bastardy are three times as numerous among epileptics as among non-epileptics. The statistics show that the amount of crime, as indicated by the number of convictions, is greater among epileptics than among ordinary criminals.

MECHANICAL INVENTIONS.

A safe and simple stationary fire escape, suitable for buildings of all kinds, has been patented by Mr. Charles Barlow, of Cookshire, Quebec, Canada. The invention consists of two cylinders fixed on different radii, each cylinder being filled with liquid, air, or gas, and containing two pistons provided with orifices that may be opened or closed by the relative adjustment of the pistons, to prevent or permit the passage of the liquid or air from one end to the other of the said cylinders, and thereby retard or hasten the operation of the lowering mechanism.

Mr. William H. Grubb, of Hannibal, Mo., has patented an improved device for bending metal tubes, consisting of a steel plate having several holes of different sizes which are perpendicular to the faces of the plate, and the holes are of the exact size required for standard sizes of pipe. The device is first firmly secured in vertical position in a vise clamp, the portion in which the hole is formed being uppermost. One end of the pipe is then inserted in the hole and the pipe drawn gently toward or pushed from the workman at right angles to the axis of the hole. The pipe is then pushed through the hole half an inch, or thereabout, and the operation of drawing and bending repeated, thus producing the curve.

Messrs. George M. Fay and Nahum Fay, of Eureka, Cal., has patented a combined sawing, grooving, and planing machine, more particularly intended for the sawing, planing, and grooving of boards to be used for roofing.

A mandrel that may readily be inserted in and withdrawn from the hole in the piece of work to be turned, that furnishes a parallel bearing the full length of the hole or any part thereof, has been patented by Mr. John A. Wilde, of Hudson, N. Y.. The invention consists of a mandrel having an enlargement or boss in the middle of its length, or at either end, that is cut away so as to form two raised parallel longitudinal bearings and a corresponding groove, which are at equal distances apart, the groove being deeper at one end than at the other, and being designed to receive the third bearing, which consists of a corresponding key that is to be forced into the groove to secure the mandrel in place in any piece of work.

A simple saw-filing machine that is readily adjustable for any desired rake, bevel, and depth of tooth, and for any length of file, has been patented by Mr. Eugene P. Ellis, of Emporia, Kan.

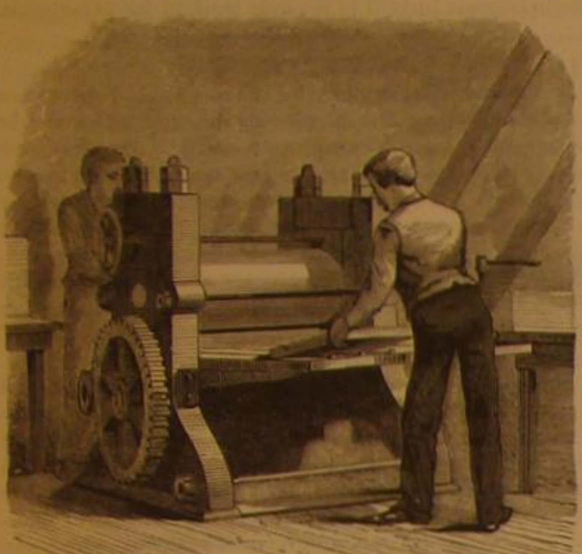
A magnetic support for scale beams has been patented by Mr. Solomon H. Brackett, of St. Johnsbury, Vt. This invention relates to beam or even balance scales, or other scales depending on pivoted levers. The main feature of this invention consists in the combination, with the pivotal beam or lever, of a magnet arranged to attract the central or pivotal part of the beam, and suspend or partly suspend the same against the action of gravity.

An improved tiling for roofs, etc., has been patented by Mr. John J. Williams, of Fair Haven, Vt. The object of this invention is to apply tiling to roofs, floors, and other places in such a manner that water cannot pass in through the joints between the tiles, and that the expansion, contraction, springing, and sagging of the tiling or its support will not open the joints and cause leakage.

AMERICAN INDUSTRIES.—No. 72.

THE MANUFACTURE OF WRITING PAPERS.

While it is pretty generally known that the American people use more paper in proportion to their number than any other people in the world, there are few who realize how large is the amount of capital or the number of hands employed in the manufacture of paper, to say nothing of the more extended industries involved in book and newspaper making and general printing. It is acknowledged that more than one-third of the paper now made in the world is manufactured in the United States, and it is estimated that over $100,000,000 of capital and 40,000 persons are engaged in its manufacture. The business has shown a wonderful growth in the past ten years, and American skill, inventive genius, and business capacity have each found admirable illustration in the prosperity of this trade. In 1869 we had no export business in paper worth mentioning, while our imports amounted to more than half a million dollars, and in 1873 the imports had increased to $1,326,460. For the last fiscal year, however, our exports amounted to $1,183,140, while our imports had fallen to $235,051, the most of this being in fancy wall papers, writing paper representing only $28,167 of the total. In the finer kinds of paper the progress made by our manufacturers has been particularly marked, and the productions of American mills now find a steadily growing demand in nearly every foreign market.


PLATING PAPER

In the first page illustrations of this number we represent the manufacture of fine and staple writing papers of all kinds, as conducted by a firm the commencement of whose business dates back more than half a century—the Owen Paper Company, of Housatonic, Mass. When their business was established, in 1822, paper making in this country was in its infancy, and very little paper was made anywhere except by hand, the Fourdrinier machine, which was destined to work a revolution in the business, having then been but little used in England and France. The first employment of one in this country was in 1833, but the machine has been greatly improved since its first introduction, and is now used in making the finest papers, the improvements made in it having been quite as much in the direction of perfecting the goods as in lessening labor and cheapening the product. There is little or no paper now made by hand in this country, the Fourdrinier machine having been so adapted to the necessities of the business that it works with a nicety of adjustment and an exactness of detail which gives a more uniform and perfect quality than can be found in handmade-papers, while another invention, known as the cylinder-machine, has been carried to great perfection in this country in the manufacture of book, news and cheap papers for various uses.

The first detail in paper making is the sorting of the rags, or the stock from which the paper is made. These are classified by the dealers, according to color and fiber, so that the manufacturer is able to select and purchase his raw material with close regard to the exact kind of goods he proposes to make. In this establishment nothing but the best linen and cotton fiber is used. If the rags are dirty when they come to the mill they are first passed through a duster, where they are thoroughly thrashed and beaten by a machine, of which there are several varieties, but in all provision is made for the dust dropping out or being blown out through a wire screen. The rags then go to the sorters and cutters, who stand at a table covered with wire cloth, and provided with knives inclined a little from the perpendicular, as seen at the left in one of the small views, entitled "Cutting Rags." Against these knives the rags are drawn and torn, to open seams and dislodge dirt, remove buttons, buckles, etc., and, while a close assortment is being made, the rags are cut to a suitable size for the engines and the dirt falls through the wire cloth to a receptacle below. Only the rags for the finer grades of paper are cut by hand, those of the coarser kind, for lower qualities of manufacture, being cut by machines.

The next process is boiling with alkalies to loosen dirt, remove grease, coloring and glutinous matters, etc., before washing. For this purpose lime, soda ash, or caustic soda is used, in water. Sometimes the lime solution only is used, while in other cases lime and soda ash are used. The boiling is effected now generally in rotary boilers, of a capacity to hold 3,000 to 6,000 pounds of rags, the solution being poured in upon the rags, and the heat supplied by steam at a pressure of 30 to 50 pounds, which is admitted at a point below the top of the liquid.

The rags, after being boiled a longer or shorter time, according to their condition, are then ready for treatment in the washing engine, shown at the bottom of the page. This machine is an oblong kind of vat, with rounded ends, divided lengthwise in its center by a midfeather. There is a constant flow of fresh water, only the purest water that can be obtained being used in this, as in all other processes of paper making. On one side of the midfeather is an inclined plane on the bottom of the vat, leading up to the bottom of the dip of a revolving roll, whose circumference carries steel faced blades; the bottom of the vat then so conforms to the space in which the roll revolves that the rags, passing in with the water, are carried partly around the roll against other knives in the bottom, and dropped on the other side of the roll, to be then carried around the end and through the other side of the vat until they come again to the roll, the action of which washes, rubs, and disintegrates the fiber. In the other side of the vat, is an eight-sided cylindrical frame, covered with fine wire cloth, through which the wash water strains to the interior, where it is gathered by buckets and discharged over the side of the vat. After the rags have been submitted to the process for a time, the roll is so lowered that its blades reduce the stock to finer fibers than would be effected in its first position, different kinds of stock requiring different treatment, but it being indispensable, in all first-class papers, that the pulp should be fine and even. The bleaching agent, usually a solution of the ordinary bleaching powder of commerce, is applied when the stock is in the condition of half stuff in the washing engine, and, after the pulp has again been thoroughly drained in the drainers below, it is subjected to the action of the beating engine which operates on the same principle as the washer, but runs faster and has knives which are not so blunt. There is great difference in the treatment of the pulp in the engine, according to the quality of the stock and the paper that is to be made, coarse paper requiring but 4 or 5 hours, while fine writing paper takes 15 to 24 hours, strong bond and bank note papers, where the fibers must be long, requiring sometimes as much as three days and nights.

The sizing and the coloring are the last operations in the preparation of the pulp, except in the case of super-sizing, which consists in putting on a coat of size after the paper has been made. A certain amount of size in the body of the paper is necessary, however, to increase its strength, to prevent ink spreading on its surface, and to give it a body which will admit of a high finish. Quite a number of different substances enter into the manufacture of size for various qualities of paper, a vegetable size being made of resin dissolved in a solution of water in soda ash or soda crystals. Alum is also used to some extent, and has the effect of brightening many colors. In the preparation of the size in this establishment where the best animal sizing is used, a large stock must always be kept on hand and forms an important department of the business, the general features of which will be readily understood from the view given in one of the illustrations.

The Fourdrinier machine, which forms the central view on the first page, is a most elaborate piece of mechanism, in which the paper is made in a continuous web, but with devices by which it may be slit and cut into sheets as desired. The pulp is fed into a regulating box, where any excess of what is required is taken by an overflow; the pulp is kept constantly agitated, and flows upon an endless wire cloth, upon which the paper is formed, the water straining through and leaving the pulp as a thin sheet upon its surface. Guide bands at the side, called deckles, determine the width, and, after traveling about forty feet, what are called couch rolls, remove the paper from the wire cloth, the pulp being previously subjected to a shaking motion laterally to interweave or felt the fibers, the motion being greatest where the pulp is most fluid, and diminishing as the web becomes free from water. Letters, figures, etc., are impressed upon the paper in the soft web by a wire cylinder, called a dandy roll. When the dandy roll is covered with plain woven wire cloth, what is called "wove" paper is made. When the roll is covered or laid over with wires running parallel and at some little distance apart, it impresses lines in the soft web, producing what is known as "laid" paper. All the water draining off, with its coloring matter, sizing, particles of fiber, etc., is taken back to the mixing box to be again incorporated with the pulp, so that absolutely nothing is wasted. The web, after leaving the couch rolls, is delivered to an endless felt apron, and passes between rolls to press out the water, and, when its moisture is largely diminished, it passes between and around a number of steam-heated drying cylinders. The paper may now be passed through calendering cylinders, if desired; these are accurately ground, and have polished surfaces, the paper in passing through them being subjected to great pressure, which compacts the fiber and gives a hard, smooth surface. This operation also charges the paper with electricity, which is drawn off by a simple device; in case this is not done the sheets are very likely to stick together.


HANGING PAPER TO DRY

In cutting the paper for the many different sizes of fancy goods in which the finer qualities are sought, the operation is conducted as shown in one of the views, the paper having first been cut from the web in sizes approximating those to which it is finally to be trimmed, or so that it will divide with but a minimum of remnants to be reworked. This, and also the ruling, folding, and stamping, shown in separate views, are very particular details in the making of the finer grades of paper, an important specialty with the Owen Paper Company. On many of their styles and machines they have patents, the goods having attracted wide attention and having commanded a large sale.

For bank-note, bond, and other fine writing papers, the drying is not completed on the Fourdrinier machine, but in steam drying lofts, as shown in one of the views. After drying, the sheets are subjected to a powerful pressure, which gives them a dead finish, without disturbing the grain of the surface. Subsequently the finishing is continued by different methods and different machines, according to the use for which the paper is designed, or the caprices of the users, who demand sometimes an excessively smooth surface (which is obtained by rolling between polished metal plates, as shown in one of the views); sometimes a surface of medium smoothness, and sometimes a rough "antique" finish—the finishing process being necessarily different for each.

In all the papers of the Owen Paper Company, the stock consists of the most carefully selected white linen and cotton rags, and especial care is taken that nothing shall be used in the washing or bleaching to impair the strength of the fiber.

The Owen Paper Company was incorporated in 1862. The business was commenced at Lee, Mass., in 1822, by a firm of which Charles M. Owen was the senior partner. In 1849, Edward H. Owen, a son, became a partner, and soon succeeded to the practical management of the business. The firm built, in 1857–8, the mill at Housatonic, shown in our sketch as the "Old Mill," which, with various enlargements, is now 320 feet in length, its internal arrangements being admirably adapted for saving labor, the bales of rags being taken from the cars at one end of the mill, and reloaded as finished stock ready for transportation from the other end. The company formed in 1862 included Edward H. Owen, Henry D. Cone, and Charles M. Owen, the former of whom died in 1864, and the latter in 1873, leaving Mr. Cone treasurer and manager of the business, of which he is now, also, the sole proprietor. He has continuously made it a specialty to manufacture only first class paper, made from the best linen and cotton fiber, without any of the adulterations and make-weights in the shape of clay, china clay, kaolin, and other substances used in cheap papers. As a result, the business has developed with great rapidity, the foreign demand for the goods of the company being felt in most if not all the civilized countries of the globe, large orders being received from abroad, frequently without solicitation. The new mill just erected, about half a mile lower down the river, will be, when fully equipped, one of the largest and most complete paper manufacturing establishments in the world. Mr. Cone owns all the houses, with two exceptions, with the land both sides of the river, for a mile and a half; and the two main buildings of his factory, connected by a central building, have a frontage of 500 feet. In the rear, and adjoining them, is an auxiliary building 400x30 feet, and an ell 200x40 feet; also boiler and engine house, store houses for stock, and the like. A good idea of the plan and elevation may be obtained from our illustration. A considerable village has arisen in the neighborhood, the result of this industry, in which most of the workmen live in houses occupied by only one family each, and educational and social advantages have been generously supplied by the liberality of Mr. Cone. There is an admirable library of several thousand volumes, free to all, with salary of librarian and all expenses of library and a well furnished reading room paid by Mr. Cone. The place is, of itself, one of great natural attractions, and to see it so occupied by a flourishing industry, making happy homes and intelligent, well-to-do workmen, is no less a matter of personal pride to Mr. Cone than is the business success he has achieved in a department of manufacture where we formerly depended so much upon foreign labor and capital.

The Cattle Car Prize.

During a recent visit to Chicago we saw the collection of models of cars and plans of cars which have been sent to Mr. Brown as chairman of the judges. There are 480 of the former and 243 of the latter.

A careful description of each is being prepared for the use of the judges. It will be apparent, at a glance, that this must be done in justice to each competitor, and also that careful work and much time are required for it. This explains the delay; a delay which must be protracted for some time longer.

Then in several manuscript volumes are copies of every patent issued so far by our Patent Office for an improved cattle car, numbering now 116; the first, in time, bearing date in West Virginia, May 29, 1860. It will require much careful consideration to determine how many of the new plans were already protected by one or other of these numerous patents.

We were curious to know whence the competitors came. Nearly every State is represented, and also England, Switzerland, and, of course, Canada.

Illinois has 51 models and 18 plans, being the highest numbers from any one State; Pennsylvania is second, with 47 models and 27 plans; New York is third, with 43 models and 15 plans; Ohio is fourth, with 37 models and 18 plans; Indiana is fifth, with 21 models and 13 plans; Massachusetts is sixth, with 19 models and 26 plans; Michigan is seventh, Iowa eighth, Missouri is ninth, and Minnesota is tenth. Among the competitors are eight women, from the same number of States.

Some competitors have more than one model, and others more than one plan.

The collection represents a great amount of thought and labor and ingenuity, as well as skilled workmanship. That a better car will be the result no one doubts who has full information on the subject. There are cars which came into existence in consequence of the offer of the prize, which are not there, because their inventors think them too valuable to part with for the prize; but their points will be known to the judges, and they are, of course, a part of the valuable results already secured by the offer.

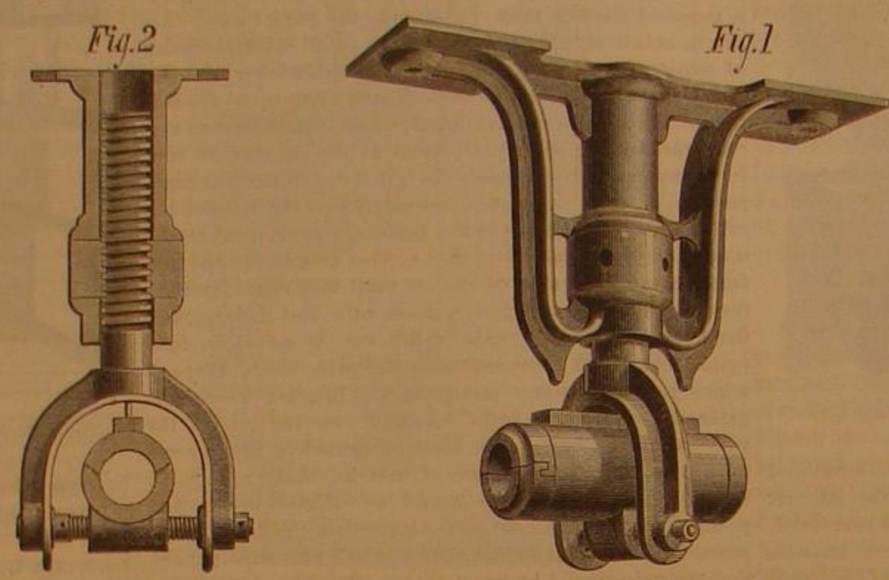
It is, also, beyond question that the judges will have before them a more complete exhibition of all that ingenuity has done so far in this direction, than has ever before met the eyes of any man or any body of men.—*Our Dumb Animals.*

HANGER FOR SHAFTING.

Next in importance to the shaft itself are the supports which sustain it, and in putting up a shaft of any length the duration of its usefulness depends on the manner in which it is supported, and on the truthfulness of its alignment. It is useless to provide large and perfect journal bearings for a shaft without providing means that will permit of its automatic adaptation to any flexure of the shaft without binding or heating, and it is also essential that the bearing be capable of adjustment in all directions in the plane of the shaft's rotation.

The hanger shown in the annexed engraving meets these various requirements, and presents a shaft support as nearly perfect as human ingenuity can make it.

Fig. 1 shows the hanger complete, and Fig. 2 is a perspective view showing the various adjustments.



IMPROVED HANGER.

The journal box proper is made in two parts, held together by means of rings or nuts screwed on at the ends, and forming a chamber to receive hempen or other packing, and when properly screwed up effectually prevents all dripping of oil or other lubricants from the ends of the journal box. These rings or nuts may, if desired, be divided and interlocked so that they can be readily taken off the shaft after they are unscrewed from the box.

The box is provided with an automatic oiler at the top, and is supported by a steel pin or pivot passing through the two arms of a fork formed on the lower end of a screw extending upward through a sleeve forming the central portion of the fixed part of the hanger, and a threaded sleeve (of proper length to work between the two arms of holding fork) which is screwed through the lower section of the box; and the proper alignment of shaft is made by turning the threaded sleeve on the pivot and thereby driving the box to one side or the other of the holding fork of hanger, as may be required. A cylindrical nut fitted to the bisected portion of the sleeve receives the screw of the forked support. This invention will be understood without further description. It was lately patented in the United States, Canada, and Great Britain, by Mr. Henry D. Cone, of Housatonic, Mass., to whom inquiry in relation to the same may be addressed.

The Telephone in China.

The Chinese language is so peculiar that there is great difficulty in devising any practicable system for conveying telegraphic messages. The telephone, therefore, is received with peculiar favor by the Chinese Government, which has at length decided to establish a complete system of telephones throughout the country, commencing north of the Yang Tse Kiang. The work will be conducted under the charge of J. A. Betts, the American telegraphist, under whose superintendence the telegraphic line was built from Tientsin to Taku.—*L'Ingén. Universal.*

Mechanics to the Front.

There has been no time since the exactions of the war from 1861 to 1865, says the Boston *Journal of Commerce*, when good workmen were in such demand as the present. It would be well for interested readers to notice the adjective "good," the writer adds, for pretenders and half-learned apprentices will get the cold shoulder at every shop where good workmen are obtainable. One of the great hindrances to the pushing forward of mechanical enterprise just now is the need of competent workmen. Only a short time ago the country was swarming with good workmen, excellent mechanics, some of whom were strongly tempted to take to the road as tramps because of their trouble of procuring employment. All this is changed, and if there is any mechanic who believes himself to be a workman and can prove his faith by his works, now is his opportunity.

It is a matter of frequent, almost daily, surprise to hear the inquiry from manufacturers: "Do you know of any good workmen?" But now as always, it is of little use for a fly-away apprentice or a slouchy workman to apply for work; the demand is for first-class *workmen*, not for shop hands or pretenders. In machine shops the requirement is for good tool makers, good planer men, lathe men, filers and fitters, floor men; and there is less room for fill-gaps, and mere operatives and would-be-apprentices have a poor show. But if one of this latter class can get a position, he has now a much more encouraging show for advancement than for many years past.

Our tool manufacturers and machine builders are at their wits' ends to meet their orders in time; not so much for lack of material and need of room as for want of good, sensible, steady, competent workmen. This is one of the periods when the earnest and honest mechanic can go a peg higher, and the industrious apprentice can have unusual opportunities to improve himself in the finer work of his department.

RECENT INVENTIONS

In canning fruit, etc., much difficulty and inconvenience are often experienced in introducing the cans or jars into the vessel of water and withdrawing them, and great care must be exercised to prevent the contact of the jars, if they be of glass, with the bottom of the vessel or boiler, lest the jar be broken. A simple, inexpensive, and convenient device for overcoming these difficulties has been patented by Sarah W. Brown, of Hudson, N. Y.

An improved adjustable spring bed bottom has been patented by Mr. Henry A. Scott, of Athol, Mass. The object of this invention is to furnish invalid bed bottoms having head and foot sections capable of easy adjustment in horizontal or inclined positions, which may be used with and easily removed from ordinary bedsteads.

An improved fountain for soda and mineral waters has been patented by Mr. Charles Jackson, of New Bedford, Mass. The objects of this invention are to permit connection of the two parts of the fountain by a brazed joint, whereby strength and security against leakage are obtained; to permit inspection of the interior of the fountain; to permit of their being readily washed out and retinned without separating the joints.

First Gold in California.

General Sherman has given this account of the first discovery of gold in California: "I remember one day that two men, Americans, came into the office and inquired for the Governor. I asked their business, and one answered that they had just come down from Captain Sutter on special business, and they wanted to see Governor Mason in person. I took them into the Colonel and left them together. After some time the Colonel came to his door and called me. I went in, and my attention was directed to a series of papers unfolded on the table, in which lay about half an ounce of placer gold. Mason said to me, 'What is that?' I touched it, and examined one or two of the larger pieces, and asked, 'Is it gold?' Mason asked me if I had ever seen native gold. I answered that in 1844 I was in Upper Georgia, and there saw some native gold, but it was much finer than this, and that it was in phials or in transparent quills; but I said that if this were gold it could easily be tested—first, by its malleability and next by acids. I took a piece in my teeth and the metallic luster was perfect. I then called to the clerk (Baden) to bring an ax and hatchet from the backyard. When they were brought I took the largest piece and beat it out flat, and beyond doubt it was metal, and a pure metal. Still, we attached little importance to the fact, for gold was known to exist at San Fernando, at the south, and yet was not considered of much value."

Tea Two Hundred Years Ago.

While investigating the history of tea an English writer came across a rare manuscript in the British Museum, giving as below a quaint summary of the virtues of "the herb called tea or chee." It bore the date of October 26, 1686, and purported to be a translation from the Chinese.

1. It purifies the Bloud that which is grosse and heavy.
2. It vanquiseth heavy Dreames.
3. It easeth the brain of heavy Damps.
4. Easeth and cureth giddiness and Paines in the Heade.
5. Prevents the Dropsie.
6. Drieth moist humors in the Heade.
7. Consumes Rawnesse.
8. Opens Obstructions.
9. Clears the Sight.
10. Cleanseth and Purifieth Adust (*sic*) humous and hot liver.
11. Purifieth defects of the bladder and kidneys.
12. Vanquisheth superfluous sleep.
13. Drives away dissines, makes one nimble and valient.
14. Encourages the heart and drives away feare.
15. Drives away all paines of the Collick which proceed from wind.
16. Strengthens the inward parts and prevents consumptions.
17. Strengthens the memory.
18. Sharpens the will and quickens the Understanding.
19. Purgeth safely the gaul.
20. Strengthens the use of due benevolence.

RECENT DECISIONS RELATING TO PATENTS.

Supreme Court of the United States.

TILGHMAN *vs.* PROCTOR *et al.*—SEPARATING FATS, OILS, GLYCERINE, ETC.

Mr. Justice Bradley delivered the opinion of the Court.

This case involves a consideration of the same patent which was the subject of litigation in the case of *Mitchell vs. Tilghman*, reported in 19 Wallace, 287. The evidence in the present case, which is quite an unwieldly mass, is much the same as in that, being supplemented, however, by the testimony of the patentee respecting the nature of his original experiments and the practicability of using profitably the coil apparatus described in the patent, together with certain exhibits relating to the novelty of the alleged invention. Upon the renewed consideration which has been given to the subject the court is unanimously of opinion, contrary to the decision in the Mitchell case, that the patent of Tilghman must be sustained as a patent for a process, and not merely for the particular mode of applying and using the process pointed out in the specification, and that the defendants have infringed it by the processes used by them.

The patent in question relates to the treatment of fats and oils, and is for a process of separating their component parts so as to render them better adapted to the uses of the arts. It was discovered by Chevreul, an eminent French chemist, as early as 1813, that ordinary fat, tallow, and oil are regular chemical compounds, consisting of a base which has been termed "glycerine," and of different acids, termed generally "fat acids," but specifically "stearic," "margaric," and "oleic" acids. These acids, in combination severally with glycerine, form stearine, margarine, and oleine. They are found in different proportions in the various neutral fats and oils, stearine predominating in some, margarine in others, and oleine in others. When separated from their base (glycerine) they take up an equivalent of water and are called "free fat acids." In this state they are in a condition for being utilized in the arts. The stearic and margaric acids form a whitish semi-transparent hard substance, resembling spermaceti, which is manufactured into candles. They are separated from the oleic acid, which is a thin oily fluid, by hydrostatic or other powerful pressure, the oleine being used for manufacturing soap and other purposes. The base (glycerine) when purified has come to be quite a desirable article for many uses.

The complainant's patent is dated the 3d day of October, 1854, and relates back to the 9th day of January of that year, being the date of an English patent granted to the patentee for the same invention. It has but a single claim, the words of which are as follows:

"Having now described the nature of my said invention and the manner of performing the same, I hereby declare that I claim as of my invention:

"The manufacturing of fat acids and glycerine from fatty bodies by the action of water at a high temperature and pressure."

In the case of Mitchell the majority of the Court was of opinion that in the application of the process thus claimed the patentee was confined to the method of using the process particularly pointed out in the specification, and as by that it was proposed to produce a very rapid separation of the fatty elements by the use of a high degree of heat—the operation being effected in the space of ten minutes by forcing the fat mixed with water through a long coil of strong iron tube passing through an oven or furnace, where it was subjected to a temperature equal to that of melting lead, or 612° Fah.—it was concluded by the Court that the producing of the same result in a boiler subjected to only 400° Fah., and requiring a period of several hours to effect the desired separation, was not an infringement of the patent, although the process by which the effect was produced—namely, the action of water in intimate mixture with the fat at a high temperature and under a sufficient pressure to prevent the formation of steam—was undoubtedly the same. On further reflection we are of opinion that in the case referred to sufficient consideration was not given to the fact that the patent is for a process, and not for any specific mechanism for carrying such process into effect.

Decree of the Circuit Court reversed and the patent sustained.

Our space only permits the presentation of a small portion of the decision, which is very interesting. The report *in extenso* will be found in SCIENTIFIC AMERICAN SUPPLEMENT, No. 278.

The Manufacture of Artificial Hydraulic Lime.

A few years ago an English writer on limes and cements suggested in our columns the advisability of preparing an artificial mixture of chalk and clay, rather than continue to employ the fat chalk limes which at one time were so much in favor with London builders. It was at once urged that, possessing, as we do, such vast deposits of gray chalk lime, or lime rich in silica and aluminum, and with a broad belt of liassic limestone running across England from Somersetshire to Yorkshire, it was quite unnecessary to think of preparing an artificial hydraulic lime, or to go to the expense of improving the limes made from pure chalk. It is impossible to deny that we have in this country many very excellent building limes; still, such limes do not exist in all parts of the country, and in the North of England the limes chiefly burnt from the carboniferous and mountain limestones are notoriously bad for structural purposes. Such being the case, a description of the great manufactories of artificial lime near Paris, which for some reason or other are rarely visited by English travelers, may not be without interest.

The rocky escarpment crowned by the fortress of Issy, which overlooks the plain of Meudon, is a chalk ridge, and the hill of Issy is an outcrop of the upper or flint bearing chalk, which here is from 1,200 to 1,500 feet in thickness. The belts of flint run through it in perfectly horizontal lines or strata, showing its undisturbed geological position. The quarries of Issy are extremely interesting, as the workings are all in parallel galleries or tunnels having arched roofs, each gallery being three meters wide and seven meters high. These galleries are very numerous and intricate, and extend for great distances under the hill, as the quarrying has been practiced since 1829. The French Government engineers have the entire control of the quarrying operations, and decide upon the positions of the galleries and tunnels. The chalk is got by piecework; the men being paid 1·20 franc per cubic meter loaded on to the carts; this is about equivalent to 9*d.* per cubic yard. Considering that the men have to keep the galleries neatly trimmed, and the roofs a true arch, the price seems small, though we were given to understand that a good workman easily earns 5*s.* per diem at this work. The chalk, when brought to the works, is mixed with 20 per cent, by measure, of clay brought from Argenteuil. This is a gray plastic clay with veins of yellow and red, indicating the presence of iron. It is an excellent brick earth, and is largely employed at the potteries in the neighborhood for the manufacture of tiles, pans, drain pipes, etc.

The mixture of the chalk and clay is effected in two different ways: the one the summer plan, the other chiefly practiced in winter. As the drying of the compound is accomplished without artificial heat, it is necessary during the winter to effect the mixture of the chalk and clay with the least possible quantity of water; and to do this it is usual to employ during the cold months an ordinary vertical pug mill similar to that in use in brickworks. The chalk and clay are thrown in by shovelfuls at a time, five of chalk to one of clay (the chalk naturally contains about 4 per cent of clay). This compound is pugged twice, and then spread in small lumps on the floor of large sheds to dry. It becomes dry enough to put in the kilns in about twenty-four hours, or that spread one day can be burned the next. The calcination is effected in small running or continuous kilns with interstratified fuel; the fuel consists of small coal and gas coke. The burnt lime is drawn out twice a day, and placed in sheds, where it is slaked with a minimum of water. The slaked lime remains for five or six days in layers of considerable depth, after which it is ground and sifted. The grinding appears to be necessary, chiefly owing to a considerable proportion of "core" or underburnt material. From the sieves the lime passes into small sacks, in which it is sent out for use. Nearly all the hydraulic lime used in Paris is thus sent out by the burner as *slaked* lime. The sacks are supplied gratis to the customer—that is, no charge is made for them if they are returned in fair condition when the next load is delivered.

This hydraulic lime, which makes excellent mortar, is usually mixed with three parts, by measure, of sand, though it is a common practice to specify two measures of sand to one of lime. Comparatively very little lime, however, is used in Paris, owing to the practice of employing plaster of Paris, which still prevails almost universally. The plaster seems to stand fairly well even in exposed situations, in consequence of a considerable admixture of lime, which protects it, to a great extent, from the action of the weather. The mixture of lime and clay obtained from the pug mill is very imperfect, and on crushing up the lumps from the kiln they are found to be full of particles of quicklime, many of them as large as peas. The manufacturers admit the incompleteness of the compound made in the pug mill, but content their customers with the assurance that they must have this or nothing, as they cannot prepare a slip in the winter time.

The summer mode of manufacture is precisely similar to that practiced by some of our English Portland cement makers: the chalk and clay are washed together in a mill, which consists of a large wheel rotating in a circular trench. The tire of this wheel is armed with iron spikes, and a considerable quantity of water is used. The chalk and clay are ground under this wheel for from one and a half to two hours; at the end of which time the contents of the mill are reduced to a creamy slip, which is run off into settling ponds or becks to dry. The water gradually evaporates or soaks into the ground, and the creamy mixture when sufficiently consolidated to be dug out, which may take several months, is removed in small cakes to the drying floor, whence in twenty-four hours it is ready to be burnt.

The hydraulic lime thus prepared is far more perfectly mixed than it could be by simple dry-pugging, and the quality is much superior to that prepared in the manner we first described. During the winter-time a large quantity of clay is carted into caverns or excavations in the galleries of the quarries, and is there mixed by washing with chalk, in order to dry and become ready for summer use. The advantage of making this mixture in the quarry is that the chalk is so absorbent that the water is very freely sucked away from the slip, and the compound becomes sufficiently dry for use with little or no trouble.

The works at Meudon are those originally founded by M. St. Leger, who was the first maker of hydraulic lime in France under the process described by Vicat. M. St. Leger seems to have patented his process in England, but it does not appear that he ever put his plan in operation here.

Near Paris there are now three manufactories of artificial hydraulic lime on this plan. That of M. Deschamps-Hévin, of the Route des Moulineaux, at Issy, is the most important. The price of the ground hydraulic lime is about 24 francs per cubic meter—say, roughly, 15*s.* per cubic yard.—*Building News.*

Engineers' Club, Philadelphia.

At a recent meeting, Dr. H. M. Chance described an attempt to extinguish the Kehley Run Colliery fire at Shenandoah City, by carbonic acid gas and nitrogen. The gas was generated in an open brick furnace with reversed draught, and forced into the mine through four 3-inch pipes by injectors supplied with steam at 60 lb. pressure. Each pipe was supposed to supply 1,500 cubic feet per minute, or a total of 6,000 cubic feet per minute. The attempt was entirely unsuccessful, and Dr. Chance attributes its failure principally to *the impossibility of making the mine airtight*, but also considers that the gas was delivered at too high a temperature, and that it was possibly mixed with carbonic oxide. The method seems to be worthy of further trial at mines that can be made thoroughly airtight.

Mr. P. H. Baermann described briefly the construction of the Cooperstown, N. Y., waterworks, and particularly the method of laying the supply pipe extending from the pumphouse up the Susquehanna River into Otsego Lake, a distance of 4,500 feet. The pipe was laid from a staging carried on 120 barrels, and lowered in 108 foot sections. Up to 9 feet in depth the joints were made with dry pine wedges, and above this with lead. The end of the pipe is provided with a copper strainer, which is in 38 feet of water and 10 feet above the bottom.

A paper was also read by Dr. Chance on "Wear in Wire Ropes," showing that the cause of rapid wear is often due to the use of drums, sheaves, and pulleys of insufficient size, and that a great saving might be effected by increasing their diameters; especially that of the small deflection and knuckle pulleys and sheaves. The actual wear averages 0·138 cent in slopes, and 0·053 cent in shafts, per ton, for each hundred feet of lift.

A Barber on Baldness.

Speaking of the credulity of many people touching the efficacy of hair tonics, an intelligent French hairdresser says:

Very often the hair falls out after sickness. In such cases it generally grows again without the aid of any hair tonic whatever; but when it falls out from natural causes it never grows again. The celebrated Dr. Bazin, who was formerly physician in chief of the St. Louis Hospital at Paris, and who is known throughout the world as the most learned specialist for affections of the skin, told me one day that there was nothing that could make the hair grow after the baldness had come on gradually. This I believe firmly, for, if there was anything of the kind, we would not see so many New York doctors with heads as completely destitute of hair as the backs of turtles. I am even persuaded that these gentlemen would follow the example of those Greek heroes who, under the leadership of Jason, made a voyage to Colchis to bring back the Golden Fleece. Modern Argonauts, the doctors, would consider themselves happy if they could bring back from such a voyage the secret of restoring the human fleece.

I don't think I am far from the truth when I say that during the past twenty-five years that I have practiced the profession of hairdresser, I have made the trial upon different bald heads of more than five hundred different hair tonics, and I am bound to admit that I never saw a single head the hair of which was restored after baldness. At the end of so many failures, I am completely undeceived as to the value of all the preparations, and I would not now recommend any one of them, because I would be afraid to commit the crime that is designated by the words, "obtaining money under false pretenses." In my pathological studies upon the hair, I have found that people who perspire a great deal from the head are apt to get bald. The bad habit of wearing hats indoors is also very hurtful to the hair. In 1806, after the famous battle of Jena, in which the Prussians were completely defeated by Napoleon I., Baron Larrey, the celebrated military surgeon, perceived that many of the German prisoners were completely bald. Surprised, he made inquiries as to the cause of this, and he found that they owed their baldness to the shape—as homely as unhealthy—of their caps. The foul air of their head gear, having no issue, destroyed the vitality of the hair.

Disinfectants.

Professor Beilstein, who has recently studied the various substances used for disinfection, arrives, in a communication made to the St. Petersburg Technical Society, at the following conclusions: Sulphuric acid would be the best disinfectant if it did not destroy the sides of the tanks; the use of lime and of salts of lime ought to be completely renounced, as they but temporarily destroy bacteria, and under some circumstances may contribute to their development; nor does sulphate of iron, even in a solution of 15 per cent, ultimately destroy bacteria, as they revive when put into a convenient medium. Therefore, Professor Beilstein recommends sulphate of aluminum, which is used in paper and printed cotton manufactures. The best means for providing it is to make a mixture of red clay with 4 per cent of sulphuric acid, and to add to this mixture some carbolic acid for destroying the smell of the matter which is to be disinfected.

HULLING COTTON SEED.

Cotton seeds contain elements which are invaluable to the farmer as food for animals and as a fertilizer. The following table shows the relative value of different kinds of food, and, as will be seen, cotton seed stands highest on the list:

Kinds of Food.	Flesh Producing.	Fat Producing.
Turnips	1	5
Straw	3	16
Potatoes	3	17
Hay	8	50
Rye	11	72
Oats	12	63
Corn	12	68
Beans	22	60
Linseed cake	28	56
Bran and coarse mill stuff	31	51
Decorticated cotton seed meal	41	77

The importance of cotton seed as a food for animals is thoroughly recognized by Southern farmers, and its value as a fertilizer is unquestioned; but to utilize this article to the fullest extent it requires hulling, as the hulls are injurious to animals, and retard the decomposition of the seeds when used as a fertilizer. In view of these facts the importance of an efficient cotton-seed hulling machine will be at once recognized.

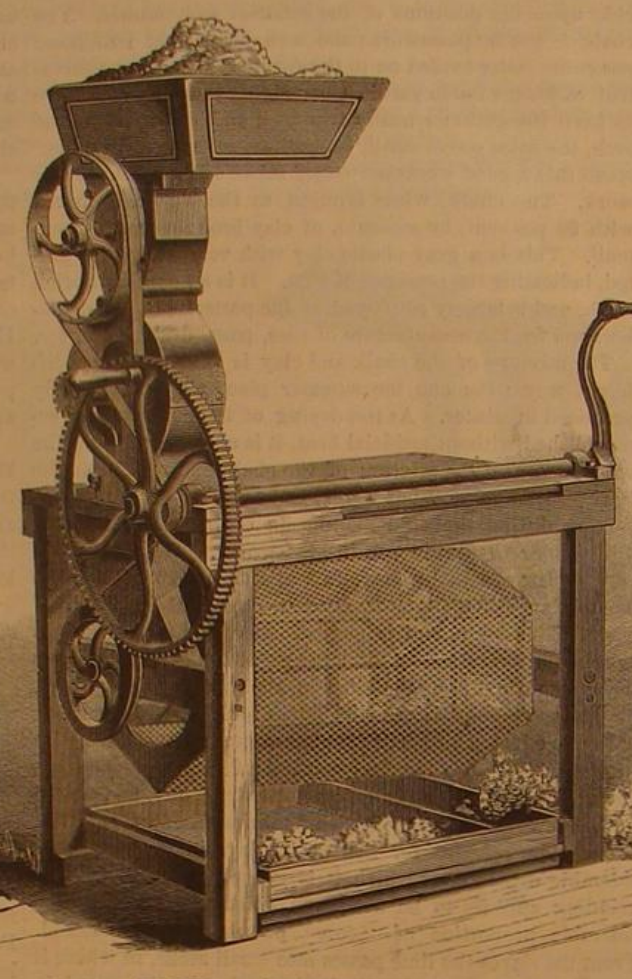
We give engravings of two forms of huller—a hand machine and a power machine—manufactured by Mr. David Kahnweiler, of 120 Center street, New York city. These machines have been largely introduced, and are favorably known all over the South. In addition to the sizes represented. Mr. Kahnweiler makes larger machines, having a capacity of 20 to 25 tons and upward per day. These machines are extensively used in oil mills. The smaller machines are used on plantations, the smallest ones being operated by hand, the larger by steam or horse power.

The judges at the Centennial Exhibition, in their report recommending the machine to the Commission for Awards, gave a very concise statement of the advantages of this huller, which we copy. It was recommended "for being well made and thoroughly efficient, supplying an increasing want on cotton plantations, namely, a means of preparing the cotton seed, by the removal of the shell and the cotton left by the gin, to be made into a highly valuable food. The mechanism is simple and the result satisfactory. The feed roller insures regular supply and prevents passage of nails, sticks, and other foreign matter which would injure the mill. The under roller or cutter head has a smooth surface, carrying eight knife sections; they are easily regulated to compensate for wear. The concave has three or four knives." The shell and kernel fall into a hexagonal revolving screen which permits the seeds to fall through, while the hulls are carried through the revolving screen and are delivered at the end. The hand machine has a capacity of 3 to 4 bushels per hour, and the power hullers for plantations will hull from 10 to 25 bushels per hour, according to the size. The steel knives on the cutter cylinder are made adjustable. The machine may be used to advantage in grinding and cracking corn, peas, etc.

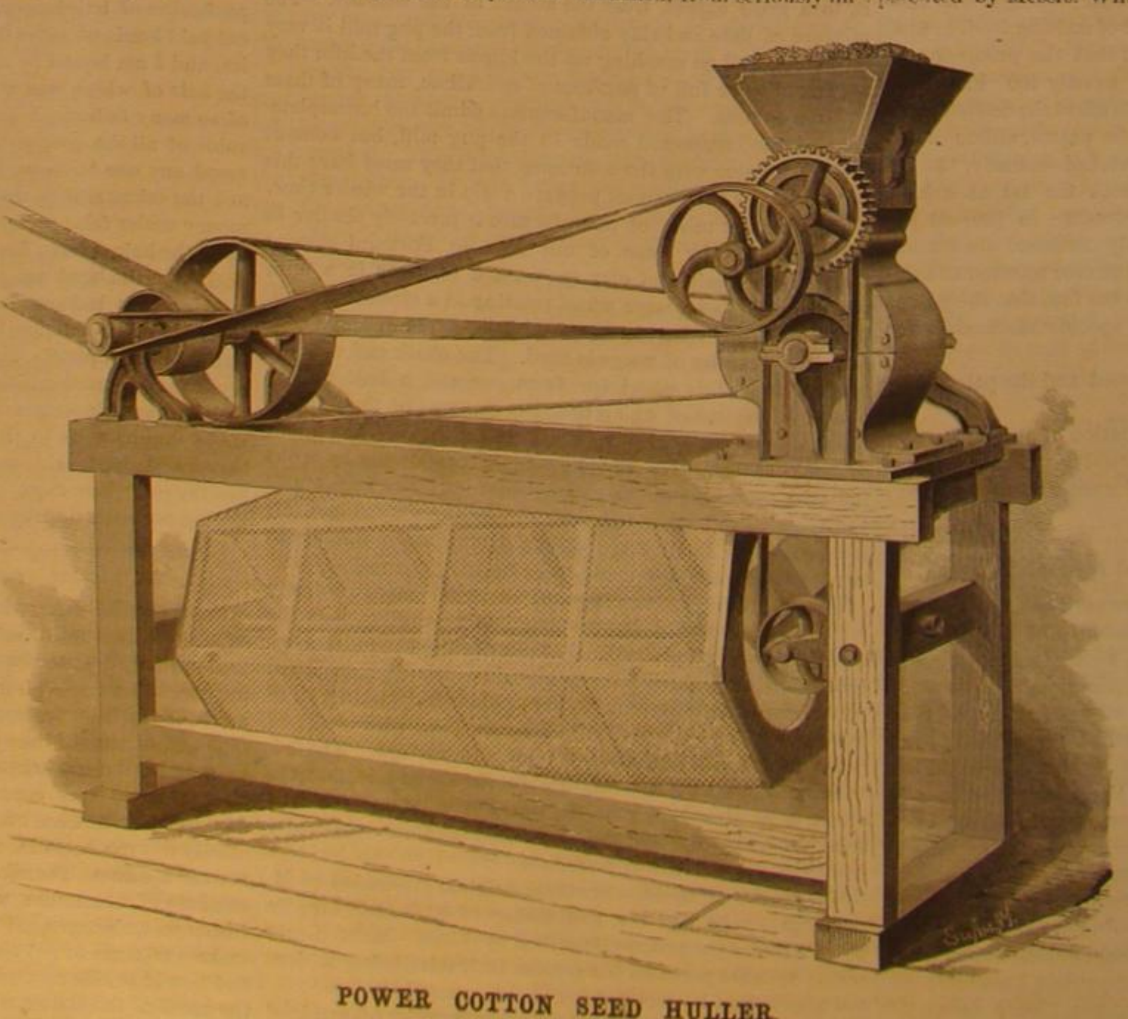
It is believed that these machines will save the planter hundreds of dollars every year, enabling him to prepare his own feed and fertilizer. The old process of preparing cotton seeds as a fertilizer by exposing them in heaps to the action of the elements for months is wasteful of the most important fertilizing elements, and besides this many of the seeds are not killed, and will sprout. By employing a cotton-seed huller the seeds are at once deprived of power to germinate and are ready for immediate use as a fertilizer, and all of their nutritious elements are retained.

If desired, the meal and hulls may be permitted to mix as they are discharged from the machine by simply removing the hexagonal screen.

One of the recent improvements made in this machine is the adding of a countershaft, rendering the entire apparatus self-contained.



HAND COTTON-SEED HULLER.



POWER COTTON SEED HULLER.

Progress in Japan.

Reviewing the industrial operations of the Japanese during the year 1880, the *Japan Mail* mentions the building of the Sapporo Railway; the two smelting furnaces at Kamaisi, delivering an output of some 700 or 800 tons of iron per mensem; the works of the harbor of Nobiru, almost completed; the weary tunnel at Kariyasu in Uzen, at last carried through; the great aqueduct from the Inawashiro Lake achieved, and an immense area of country irrigated; the building of ships on western lines at the two dockyards of Kawasaki and Tokiyo carried on with increased industry; silk-reeling establishments erected in the three prefectures of Hiroshima, Aichi, and Shidzoka; the port of Mikuni opened to shipping; the works on the Tsuruga Railway progressing vigorously; the outcome of the coal mines in Kiushiu augmented; the docks of Nagasaki unceasingly occupied; and mining industries exceptionally active.

An Old Battlefield Uncovered.

During the spring rains in Georgia the Coosa River overflowed its banks, and in one place washed the soil from a considerable area. After the water subsided the washed land was found to be an ancient battlefield and burying ground. Part of the territory consisted of mounds, evidently fortifications. These were strewn with implements of aboriginal warfare, beads, and earthen vessels.

The remainder of the ground was covered thickly with skeletons, all perfectly exposed, and all in good preservation.

A press dispatch from Rome, Ga., dated April 2, says: "The place is attracting crowds from all directions, and it is almost impossible to prevent vandalism from seriously impairing what will undoubtedly prove to science one of the richest 'finds' ever made on the American continent. Among the countless number of Indian pipes found is one of great size and exceedingly fine workmanship, the bowl of which is carved with great skill into the form of a human head."

MISCELLANEOUS INVENTIONS.

Dr. Christian Heinzerling, of Biedenkopf, Germany, has patented an improved method of converting hides into leather, consisting in subjecting them to the action of a compound containing chromic acid and then treating the hides by a solution of stearine or similar fats.

Mr. Joseph H. Clyde, of Atlantic, Iowa, has patented an improvement in pantaloons, the object being to prevent the protrusion in front and wrinkling in rear in the knee portions of the legs of pantaloons, and also the uneven wearing of the seat portion.

In the manufacture of scrap-books and other books of a similar character it is necessary to provide guards or spacings between the sections of the book, and this is usually done by inserting the sections between folded strips of paper, and the sections and strips being afterward secured together, the strips form the guard between the sections. Mr. Frank Bowman, of Brooklyn, N. Y., has patented a device which obviates these difficulties of manufacture, and reduces the expense, and produces a stronger and better appearing scrap-book.

A cheap, simple, and effective trap, to be placed over mole or gopher "runs," for the purpose of destroying the animals, has been patented by Henry W. Hales, of Ridgewood, N. J.

An improved chalk holder for billiard tables has been patented by Mr. John Jefferson, of Columbus, O. The invention consists of cords, weights, and pulleys attached to and moving in suitable casing and tubes attached to the gas fixture, chandelier, or other object over the billiard table, the chalk being suspended above the table by the cord. It may be drawn down to a convenient position for use, and when released will be automatically returned to place.

An improvement in cryptography has been patented by Mr. Charles G. Burke, of New York city. The invention consists in the use of four characters, differing in form or color, which, when used in combination with a scale consisting of three horizontal parallel equidistant lines and spaces, represent intelligible sounds, which are convertible into words and sentences, and may be substituted for and made the equivalent of the English language.

Messrs. Green E. Hood and Charles W. Tift, of Albany, Ga., have patented a cotton-seed planter and guano distributer so constructed that it can be readily adjusted to plant more or less seed, or distribute more or less guano, and to cover the seed to a greater or less depth, as may be required.

An improvement in wool carding machines has been patented by Messrs. William E. Bosworth and H. Wallace Bosworth, of Lexington, Ky. The object of this invention is to obviate the trouble experienced in carding machines from the wool getting under the creel spools and thereby becoming tangled, stretched, and broken; also, to prevent accumulation of wool on the guides of the carding machine where the rolls enter, so that free passage of the rolls shall not be hindered.

An improved watch case spring has been patented by Mr. Joseph Canne, of Newport, Ky. The object of this invention is to provide a more durable watch-case spring, the spring part of which can be replaced, when broken, without renewing the body. This invention consists in forming the spring of sheet steel, having the thinner part toward the head instead of toward or near the body, as in other watch-case springs, so as to have the head on the most elastic part of the spring, and in lapping over the head instead of forging it, and in cutting away the lower edge of the spring portion for the purpose of increasing the elasticity of the spring and diminishing its stiffness. By using sheet steel for the spring no forging is required, and the strength of the spring is not impaired, and by having the thinnest or most elastic part near the head the spring is not so liable to "stay back" after usage, as is commonly the case with springs of even thickness and with those that are thickest near the head.

THE STAG BEETLE AND CHAMPION BEETLE.

The common stag beetle (*Lucanus servus*) must have been known to the ancients, for Pliny says in one of his books on natural history: "Beetles (he calls them scarabei) have a hard covering over their feeble wings, but none of them have a sting. There is, however, a large family, which have horns, on whose points are two-pronged forks, which can be closed at will and are capable of pinching. They are hung on the necks of children as a charm." Rigidius calls them Lucanus. Moufet, who, in his "Insectorum sive Minimorum Animalium Theatrum," has collected with great industry all that was known about insects up to his time, describes the stag beetle, but believes that the same description will apply to the female; while Aristotle asserts that in insects the males are always smaller than the females. Now every boy who is acquainted with beetles and lives in a region abounding in oaks, where the stag beetles make their appearance, knows that those having horns are males, while the females have simply short curved mandibles in no way conspicuous. The most recent observations on other kinds of stag beetles have taught us that according to the scanty or abundant nourishment of the larvæ, the beetles turn out small or large, and this is especially true of the males. The horn-like mandibles of the smaller beetles through small development confers upon the whole beetle a changed appearance, in comparison with a fully developed one. We may, therefore, see in a single family medium and smaller forms, without bestowing on them special names, as in earlier times.

The stag beetle is the largest of the European beetles. The male has enormous horn-like jaws or mandibles, the tips being armed with antler-like projections, slender antennæ, the upper lip is bent downward, and the tongue is deeply slit. The color is a dull black, the wing covers and horns are a glistening chestnut brown.

In June these beetles are found in the oak forests, where on beautiful evenings the males fly with a loud humming noise about the tops of the trees, while the females keep themselves concealed. In the daytime they run among the dry leaves on the ground and betray their presence by their rustling, or they sit on the bleeding trunks of the oaks and lap up the sap. Chop gives an interesting account in his "Garten-laube" of their behavior at these feasts.

In June, 1863, while lying under the cooling shade of an old oak tree on a very warm afternoon, a peculiar rustling sound attracted his attention. A soft snapping or grating was heard at short intervals, as if small dry twigs were being broken. Shortly a blackish object fell from the tree to the ground; it proved to be a stag beetle, which he found after a long search in the act of creeping up the rough bark again. The rustling did not cease, and when the observer looked upward he saw, seven or eight feet up the trunk, a peculiar brown mass. In the course of half an hour eleven stag beetles, of both sexes, had fallen down one after another, and because the crackling sound was still heard Chop procured a ladder in order to examine this remarkable appearance. A curious sight met his view. Upon a small surface the sap was flowing down from the old bark. To this dainty meal a very mixed company of insects had invited themselves as guests.

Large ants climbed busily up and down, dainty flies of all kinds sat together in crowded heaps, and hornets swarmed fiercely humming around the trunk. But the most conspicuous guests were undoubtedly the stag beetles. There were twenty-four individuals of them counted, those already captured not being reckoned. They played apparently the most important character at this banquet, and in spite of the sweet food did not seem to be in very good humor. Even the bold hornets avoided coming too near the powerful nippers of their clumsy companions, and held themselves at a respectful distance. The beetles fought a furious battle with one another, and certainly two-thirds of them contended together. The females, with their short, strong teeth, angrily bit each other in their struggle for the food. The contest between the males was especially interesting. Their horns were interlocked and projected over the neck shields of their antagonists, and they fought furiously together until one of the combatants dropped to the ground from sheer exhaustion. Sometimes a skillful fighter would succeed in seizing his opponent about the body, and with his head erected let him struggle in the air for a little while, and finally drop him. The observer, although near, was unnoticed, the fighters struggling and the victors licking the sap greedily. They seemed disturbed when the breath touched them, and the slightest noise, as the breaking of a twig, immediately affected the whole company. They would all raise themselves quickly and appear to listen. A similar thing would happen if one of the beetles that had fallen to the ground ascended the tree again and approached the others. In this case the males would move toward them with wide open mandibles eager to engage in a combat with them. Toward evening the greater part of the beetles buzzed away, and the crackling sound was much diminished when the observer left the garden at eight o'clock. The struggles of a male over a female are of a more serious and determined nature, as the deep impressions and perforations in the wing covers show.

THE STAG BEETLE AND CHAMPION BEETLE.

At the end of June or the first days of July the short swarming time is past. The pairing takes place in the night, the females lay their eggs in the decayed wood of an old oak tree, and the hard remains of the dead bodies of the males lie strewed around. It may even occur, and has frequently been observed, that after the pairing the feeble males, while still alive, are eaten by the rapacious ants, the hard front of the body being robbed of the soft back part, and they drag themselves painfully along on their long legs, a singular habitation for solitary ants. The bodies of the females are seldom found, because few of them come forth from their brooding places, and because the females are much more seldom met with than the males, who are about six times as numerous.

The larvæ grow very slowly, and are nourished by the decayed wood of the oak tree. It requires four or five years for them to attain their growth of about four and one quarter inches and the thickness of a finger.

Their appearance is similar to that of others of their family. They have four-jointed antennæ on the horn-like head; the last joint is very short. The anterior of the three rings around the body is imperfectly defined on account of the cross folds, and has six strong legs which are yellow like the body; the horny parts about the mouth are black.

These larvæ were without doubt known to the ancients, for Pliny says: "The large wood worms which are found in hollow oaks and called 'cossis' are regarded as a choice morsel, and are even fattened with meal." They must have long been in use as a means of nourishment, for Hieronymus says: "In Pontus and Phrygia large, fat, white worms with black heads, which are generated in decayed wood, afford a considerable source of revenue and are valued as very dainty food." The full grown larva prepares a firm case, as large as the fist, from the decayed splinters of wood, and smooths it out well inside. Three months sometimes pass before the larva assumes a chrysalis state and afterward becomes a beetle. From the hatching of the egg to the development of the perfect beetle requires about five years, some say six, and they enjoy for scarcely four weeks their winged existence. They may be kept in confinement by nourishing them with sweetened water or sweet beer.

Bültner mentions a swarm of stag beetles which were drowned in the Baltic and washed ashore. Cornelius gives an account of the great number of beetles which appeared in a limited locality at Elberfeld, in 1867, and thinks that every five years they will return again, and that the supposed developing time must be five instead of six years. Haaber mentions this and thinks this supposition is confirmed, as he observed a large number of beetles in 1862 and again in 1867 in the region of Prague.

Here, as at Elberfeld, they flourished in old oak stumps, which appear especially favorable to their propagation. It would be of interest for other regions to note the flying year of the stag beetles. These beetles extend over the whole of middle and northern Europe, and are only wanting in regions where there are no oaks.

The champion beetle (*Cerambyx heros*) may be seen on an oak stem with the stag beetle in our engraving. It is a magnificent insect, of a glittering black. The head is long, the eleven-jointed antennæ swell out in the third to fifth joint into a club shape, and end in a long slender joint, which appears to be separated, and in the male is considerably longer than the body. The neck shield is grooved or wrinkled, and has in the middle a thorny point at the broadest place. The wing covers have a blunt three-cornered shield in front. The under part of the body is covered with silky hairs, and is silvery white.

The larva has a granulated horny shield on the back of most of the joints, and lives three or four years in the inside of decayed oak trees. The broad flat passageways in the decayed wood which they bore out wind in various directions next to the bark. A trunk which is already perforated seems to possess a particular attraction for the female, and the work accomplished by these colossal larva is enormous. The beetle emerges from the chrysalis in July, and is not seen by day; it only projects the points of its antennæ out of its retreat and speedily draws them back again if it is not approached very cautiously. The antennæ must project a long distance to enable one to bring the sly fellows to light. In most cases they will allow the points to be torn off before they can be drawn out of their retreat. After the sun has set they come out voluntarily and fly swiftly around, but not very high, in search of others of their family. The pairing ensues during the night, and the swarming time is, as with the stag beetle, a limited one.—*Brehm's Animal Life.*

Eighty-three thousand buffalo hides were sold at Miles City, Montana, alone, during the past fall and winter. At this rate the buffaloes will become extinct before long.

Wasting Color.

In looking over the imports of aniline dyes, and comparing them with the amount of goods dyed in this country, we are astonished to see how much more color we require to produce a certain shade than in the old countries. Does our cotton and wool require more coloring than foreign goods? There is no reason why it should, but where is the cause of this large consumption? We have principally to attribute it to the indifference of our dyers. If we look in our dyehouses, especially those which are connected with large establishments, we notice an almost constant stream of colored water of all shades running into our rivers, thus actually throwing away large amounts of money, which might be saved by very little care and attention. It might be the easiest way for the dyers in large dyeworks, after they have acquired the desired strength of their color, to let the liquor which remains in the dyebath simply run away, especially if a color of the same shade should not be immediately wanted again. But could not this color be saved and worked over again and be used afterwards? We have noticed in large dyeworks a constant stream of blue water running into the river, which would surely carry with it at least one pound of dry blue every hour. This is worth saving, even if some care and trouble is needed. If these dyeworks would arrange cisterns large enough to hold the remainder of one certain color, and give it time to settle or precipitate the coloring matter with some chemical agent, a large amount of money could be saved. It might look at the first glance on this matter that this idea might not be very well carried out in large dyeworks, where so many shades are produced every day. It might need too many cisterns and too much extra work to make it pay; but *a trial* would not cost too much, and practical experience would bring the matter into a very easy state of working.

This might be a practical idea: After every dyeing process, when the liquor of a certain color is no more needed, collect it in a barrel, and add to it the same color every time during that day. Let stand for at least two or three days or longer, if the capacity of the establishment allow of it. Then draw off the liquor through holes in the barrel into a second one, and a large amount of color, in paste form, will be found at the sides and on the bottom of the barrel. This collect carefully, and dry. The barrel is, without washing out again, used for the same color and the whole commenced in the same manner again. The dry color, although sometimes not as good and bright as in its original state, will do very well for dark shades. Many dyeworks will be able to save in this manner up to one third of the color, which is certainly inducement enough to give the matter a thorough trial.—*Textile Colorist.*

A New Thermograph.

Dr. A. Wellington Adams, of Colorado Springs, has invented a new form of thermograph, which is designed for measuring and recording automatically the heat of the human body for a given or indefinite length of time. It is said to be a very ingenious contrivance, and is based upon the principles advocated by Breschet. There has long been need of an apparatus which would register accurately the rise and fall of temperature during sickness, the system in use being sadly limited by many imperfections and the very narrow range of its applications.

The thermometer proper in Dr. Adams' instrument consists of a spiral spring made of two lamellæ of brass and steel respectively, soldered together, the brass occupying the outer side. As this spring expands uniformly with equal increments of heat, the brass, the more expansible of the two metals, will, upon a rise of temperature, give a platinum knob attached to the free end of the spring a concentric twist. In this way there is produced a varying pressure upon the contents of a vulcanite tube against which the knob impinges. The vulcanite tube is filled with a powder made of finely divided plumbago, gas carbon, and silver, and these contents, at the other extremity of the tube, abut against a platinum knob attached to a hard rubber bracket. The whole is inclosed in a circular, perforated German silver case, with rounded edges. The two platinum knobs are placed in electrical communication by means of binding posts. When the apparatus is introduced into an electrical current the latter enters through one of the binding posts and emerges at the other, passing in its course through the substance in the vulcanite tube. Two handles are provided at the sides of the thermometer for securing it in proper position in the axilla. The salient feature of the apparatus is the changing of its electrical resistance with pressure, and the ratio of these changes, moreover, corresponding exactly with the pressure, the latter, in turn, being dependent upon and in unison with the rise and fall of temperature.

By subjecting this instrument to varying degrees of temperature the resistance of the powder varies in precise accordance with the pressure exerted by the uniform expansion of the spiral spring under equal increments of heat, and consequently a proportionate variation will be produced in the strength of the current. The latter possesses, therefore, all the character of heat waves, and, by its reaction through the medium of an ingenious electro-magnetic piece of mechanism devised by Dr. Adams, these are transferred to a movable surface, in the form of a sinuous line whose rising and falling inflections give a graphic representation of them. Not only is it possible with this instrument to procure a continuous curve denoting the constant febrile condition of a subject, but, with the addition of certain accessories, now in process of construction, there may be procured on the same strip of paper, at the same time and under similar conditions, a sphygmographic and a respiratory curve, thus enabling pathologists, therapeutists, physiologists, and, in fact, general practitioners to study the inter-relationship of these three cardinal symptoms under various modifying circumstances. The inventor feels confident that he shall be able to make additions that may also furnish a moisture curve.

Correspondence.

History of the New Mineral "Hiddenite" So-called.

To the Editor of the Scientific American:

I have seen the various articles in your paper touching the discovery of the new mineral as above. I discovered this mineral at White Plains, Alexander County, N. C., in 1876, and collected it as a beautiful variety of diopside, associated with beryl and other minerals. Shortly after its discovery I sent a number of specimens to different mineralogists, among these Prof. N. Spang, of Etna; and some time after that, or in 1879, Prof. W. E. Hidden came to Statesville with a letter of introduction and recommendation to me. I showed him my collection, and showed him some of this mineral, *which was the first he had ever seen.* I then took him to White Plains, and showed him the locality where I had been collecting this green mineral. Prof. Hidden went away, and some time after that returned with another gentleman. They called to see me, and Mr. H. remarked that they were going to take a ride. He, accompanied by his companion, then went, without my knowledge or consent, to the locality which I had shown him, and leased the land.

Up to this time the mineral had been pronounced diopside, but when Prof. Hidden commenced work upon the lease he sent some specimens to Prof. J. Lawrence Smith, who examined it and found it to be a new mineral, and wrote to Prof. Hidden, proposing to call it "Hiddenite." I at once, upon learning of this letter, wrote to Prof. Smith, informing him that I had discovered the mineral about three years before Prof. Hidden came to North Carolina, and asked if I, as the discoverer, did not have the right to say what it should be named (intending to call it "Mitchellite," in honor of the late Rev. Prof. Elisha Mitchell, D.D., of this State, an able and devoted scientist). Prof. Smith's reply of November, 1880, led me to believe that the mineral would have no distinctive name, but would only be called spodumene, so I let the matter rest until I saw his article in the *American Journal of Science* for February, describing the mineral and conferring the honor of the name upon Prof. Hidden, and so wording the article as to deprive me of the credit of the discovery. I. A. D. Stephenson.

Statesville, N. C., April 2, 1881.

The Fusing Disk.

To the Editor of the Scientific American:

In your paper of the 16th inst. I find a reprint (with cuts) of an article from *Engineering* (London), relating to the fusing disk. I have written *Engineering* that the statements made in the article are so astonishing, and the work exhibited is so radically different from any that I have ever seen produced by the fusing disk, that I think the gentlemen who furnished the article and cuts and made the statements contained in the article have made a mistake, and I asked for their address that I might give them attention first.

In answer to Mr. Emerson, permit me to say that I do not feel called upon to specifically answer in detail every article published relating to the fusing disk, or the theory which I, at the urgent request of many eminent scientists, have advanced, explaining the phenomena exhibited in its operation, as the machine and theory are now being considered in all civilized countries, as my receipts of letters and scientific journals show. But I will from time to time explain my theory, and will cheerfully accept the result of its discussion, whatever that may be.

I call the machine a fusing disk because I conceive that the material operated on is changed instantly from the solid state to the fluid state. I conceive that the change of state occurs because the material disengaged from the solid bar operated on flows downward and welds into a solid mass (nine inches below the point of fusion). I consider fusion simply as a phenomenal indication of the degree of intermolecular velocity, as temperature, luminosity, and incandescence are phenomenal measures of molecular velocity; therefore, whatever increases molecular velocity tends to bring the metal nearer to the *velocity of fusion.*

Not a single atom composing a molecule, nor a molecule composing a physical structure in the universe, is at any time in an absolute state of rest.

Matter *per se* is inert; its energy is derived from the physical forces. The force of attraction is inherent in the atoms, *and can neither be increased nor diminished.* It tends to draw the atoms together and hold them in a state of rest. The force of caloric accompanies the atoms. *It may be increased or diminished;* and tends to push the atoms apart into a state of activity. By virtue of the resultant force so exerted, the atoms composing a molecule, and the molecules composing a physical structure, are held at a certain distance from each other and kept in a continuous state of activity.

The force of attraction being inherent, its energy is exerted in an inverse ratio with the distance of its object, hence its greatest power is exerted when the atoms and the molecules are nearest to each other, and least when they are furthest apart. The change of distance is the result of the activity of the atoms and the molecules. An increased motion separates them, and a decreased motion brings them nearer together.

When the molecular velocity of a body is of that low degree that the *molecular resultant force exceeds the force of gravity,* the molecules remain in a relative local position to each other, and are said to be in the solid state. Now, when the molecular velocity is increased to that degree so as to separate the molecules to such a distance from each other that the molecular resultant force which holds them together is reduced to a less measure than the force of gravity, the molecules are no longer held in a correlative position; they become mobile, and gravitate into the fluid state. And this is what I call fusion.

The essential requisite of fusion, therefore, is *the molecular velocity of fusion,* and I conceive that this is attained in the fusing disk as follows: A *round bar* of steel is placed in front of the disk and caused to revolve at the rate of 200 revolutions per minute. The disk is revolved at a rate equal to a peripheral velocity of 25,000 feet per minute. The atmosphere, pressing against the sides of the disk at nearly 15 pounds to the square inch, is thrown outward. The increased velocity of the air separates its molecules to a greater distance, and they abstract additional caloric from the surrounding atmosphere. This column of air, surcharged with caloric in proportion to its velocity, is carried around the periphery of the disk at the rate of five miles per minute. Now, when the revolving bar is brought into close proximity to the disk, the passage of the air is retarded, its velocity reduced, and the molecules approach nearer to each other. This unlocks the surcharged caloric, and it becomes sensible heat, which enters the bar and increases its intermolecular activity to the velocity of fusion. The fused metal flows away and a fresh point of the bar is continually presented to the disk. In addition to the caloric unlocked from the air, a portion of the metal oxidizes, which furnishes additional caloric, which, with the impact of the air traveling at a velocity of five miles per minute, keeps up the velocity of fusion in front of the disk until the bar is severed in two.

Now, gentlemen, please remember this is only a theory based on my limited knowledge of molecular physics, and in your criticisms don't be personal, but let us endeavor to increase our knowledge of the physical forces which energize the universe. Jacob Reese.

Pittsburg, Pa., April, 1881.

Medical Properties of Sulphocyanide of Mercury.

To the Editor of the Scientific American:

Inasmuch as many inquiries have been elicited by your publication of item regarding the medical properties of sulphocyanide of mercury in certain affections of air passages of the human body, as more fully specified in your issue of April 9, 1881, and inasmuch as your generous impulse led to a more pretentious heading to the article in question than was intended by the insertion of the word "catarrh," it is hoped you may not be indisposed to add these few lines in explanation.

The prevalent idea attached to the term "catarrh" lies in an entirely different direction from the line and scope of experience indicated in the article in question. It is doubtless safe to say that nothing whatever is known as to the action of the compound under consideration in connection with "catarrh" in the popular sense of that term.

Judging from letters of inquiry from different parts of this country, it seems probable that some may endeavor to make the substance in their own way. Let not any unskilled manipulator undertake the production and preparation of this compound for his own use or that of his friends; the chances are altogether in favor of his finding something decidedly more "snaky" and poisonous than the veritable "eggs of Pharaoh's serpents." The substance for use, as suggested by experience, must be pure sulphocyanide of mercury; from the *per*-nitrate, not *proto*-nitrate, and washed until there be no acid reaction. The use of this in the manner and quantity and for the purpose indicated in your issue of April 9, 1881, will be attended with prompt and effectual relief, and without the slightest injurious results.

J. De Walden Churchill.

Richmond, Va., April 10, 1881.

Ammonia for Preventing Petroleum Fires.

M. Schlumberger has communicated a note to the Société Française d' Hygiène on the "Automatic Extinction of Petroleum Fires." Many accidents are caused, he says, chiefly by the igniting of this substance through imprudence. The druggist, for instance, in going into the cellar where the oil is kept does not always take proper precaution, and the result is that a disastrous explosion often takes place. He proposes a method of extinction in this and similar cases which he recommends shall be made compulsory under police regulations. His plan is to place on each barrel of petroleum a large bottle of liquid ammonia, so that, at the least explosion or on contact with the flames, the glass will be broken and the vapor of the liberated ammonia will form an automatic mode of extinction. The author states that he speaks from practical experience, and that he has frequently been indebted to ammonia for safety while conducting distillations of a dangerous character. He suggests that the plan should be extended to mining operations, and that easily broken vessels filled with ammonia should be stored wherever there may be a risk of accident from fire-damp explosions. Carbonic oxide cannot burn in an ammoniacal atmosphere.

THE COLORS OF THE STARS.

The constellated regions of the heavens, says the astronomer Niesten, in *Ciel et Terre*, offer an exceedingly vast field for the investigation of all those who desire to see progress made in astronomical science; and the most varied and interesting questions crowd themselves upon observers for examination. Among these the study of the coloration of the stars holds one of the most important places, not only for the attraction that it offers because of its novelty, but for the facility with which it may by pursued, and for the importance, especially, of the scientific questions connected with it.

If, on a fine evening, we raise our eyes toward the starry vault, we are immediately struck with the diversity of size, or rather with the brilliancy, which the stars exhibit. If we bestow a little attention on the subject we shall be readily convinced that these worlds or unknown suns, which are commonly said to shine with a whitish light, emit rays of the most varied colors. If the observer compares with each other the most brilliant stars—those of the first magnitude—*Procyon* and *Altair* will appear to him of a dazzling white; *Sirius*, *Vega*, *Castor*, and *Regulus*, of a white slightly tinged with blue; *Aldebaran*, *Betelgeuse*, and *Arcturus* will be orange; *Pollux* and *Alpha* of Cetus will appear yellow; and *Antares* and *Alpha* of Hercules will be orange red. Among the stars of the second magnitude *Epsilon*, *Zeta*, and *Eta* of Ursa Major will appear white, while *Alpha* will be distinguished by its yellowish color. In Ursa Minor, *Alpha* or the Polar Star will be seen to be yellow, and *Beta* yet more so. Castor will be found to emit greenish-white rays, while those of *Eta* are of a pronounced blue. Finally, if the observer makes use of a telescope, there will be seen thousands of stars exhibiting to him the same diversity of color.

According to Sir John Herschel, there is, near *Kappa* of the Southern Cross, a remarkable group formed of one hundred and ten stars, the principal ones of which, scarcely of the eighth magnitude, exhibit the greatest diversity of colors: one is of a bluish-white, two are red, two are green, and the three others are of a pale blue. It is an extremely brilliant and beautiful object, says Sir John, and the stars which compose it, when viewed through a telescope of sufficient power to distinguish their colors, have the aspect of most exquisite jewels.

These different colorings are not limited to certain particular stars, but we may observe in certain constellations nearly all the stars having the same tint. Libra and Eriadnus contain a large number of stars which are yellow. The principal stars of the beautiful constellation of Orion exhibit a color of a decided green, while the majority of the smaller ones are of a blood-red. Dunlop, in his catalogue of southern stars, refers to an extensive group, all of whose stars are blue.

By using a sufficiently powerful telescope, the observer will be enabled to separate certain stars which to the naked eye appear single, and he will then be struck with the richness of the coloring, and especially with the notable difference of color which in most cases exists between them. Some, and indeed the majority of them, will show him the principal star colored either yellow or white, while its companion is one of the shades of white, yellow, or red, or else is tinged with purple, as in *Eta* of Cassiope, or with sapphire-blue, as in *Beta* of Cygnus. In others the two components are orange, or else one is orange and the other blue, as in *Theta* of Centaurus, or green, as in *Epsilon* of Bootes and *Gamma* of Andromeda.

In some stellar systems we find white contrasted either with purple, as in *Delta* of Orion; or with green, as in *Zeta* of Corona Borealis; or with blue, as in *Pi* of Andromeda, *Lambda* of Ophiucus, *Psi* of Cygnus, and *Delta* of Bootes; or with yellow, as in *Gamma* of Delphinus; or with red, as in Twelve of Coma Berenices. In other systems of double stars a white color is met with in both components, as in *Alpha* of Gemini and *Gamma* of Virgo. Red is associated with blue in *Antares*, *Eta* of Perseus, *Omikron* of Draco, etc., and garnet with blue in *Omega* of Auriga, and with green in *Alpha* of Hercules. Finally, Fifty-three of Ophiucus, *Mu* of Draco, *Delta* of Ophiucus, and Fifty-five of Coma Berenices, are formed of two bluish stars, while *Alpha* of Pisces and *Sigma* of Cassiope each consists of one blue and one green star.

Upon the whole, in the light of the stars—those distant suns which probably illumine other worlds that are as yet unknown to us—the observer will possibly meet with all possible combinations of the principal colors along with their extended scale of tints. He will then ask himself whether these colorings are indeed real; whether all these tints, so harmonious in juxtaposition, are not the effect of contrast; and whether all these sparkling fires of ruby, topaz, and sapphire are not perhaps optical illusions merely. Having assured himself on this point, he will endeavor to learn whether these stars do not exhibit in their coloration a short period of variation or a secular one, as has been ascertained already with regard to the intensity of their light. The effect being known, he will strive to learn the cause, and perhaps will succeed in finding, in these differences in the intensity of luster and coloring, some indices that shall aid him in extending the knowledge which we possess in regard to the stellar world.

Remarkable Nugget of Platinum.

Mr. P. Collier states, in the *American Journal of Science and Arts*, that he has in his possession a nugget of platinum said to have been found near the village of Plattsburg, N. Y., and the weight of which is 104·4 grammes (about 3½ ounces). Its composition by weight is 46 per cent native platinum and 54 per cent chromite. The occurrence of the platinum metals in the St. Lawrence valley has long been known, and the presence of extensive deposits of chromite and its mineral associate, serpentine, in the same general locality is well established; but so far as known the nugget under consideration appears to be remarkable not only for its size, but also as an indication of the probable presence of this metal in a locality hitherto unsuspected. On visiting the locality where this and several other specimens were found, Mr. Collier found it to be a drift deposit of considerable extent.

RICHLY DECORATED VASE.

The accompanying engraving represents a porcelain vase of French manufacture highly ornamented. The central object is composed of game and a huntsman's paraphernalia in high relief.

FRENCH PORCELAIN VASE IN ALTO-RILIEVO.

The vase, in addition to the richness of its decoration, which unfortunately cannot be shown here in its many colors, is, as the reader will observe, symmetrical in form and artistic in design.

Constipation.

Dr. S. H. Price (*Medical Brief*, March, 1881) says the following combination has never failed to relieve constipation, in his experience, when the person is otherwise healthy: ℞. Ext. cascara sagrada, fl., f. ℥ j.; tr. nuc. vom., f. ʒ ij.; ext. belladon., fl., f. ʒ ss.; glycerine, f. ℥ j. M. Sig.—Teaspoonful night and morning, as necessary. He has used this in all ages, from the three weeks' infant to the octogenarian, changing dose to suit age.

A New Liquid Hydrocarbon.

The announcements multiply respecting the extraordinary properties of the inflammable hydrocarbon liquid introduced by M. Friedel. The *Journal de l' Eclairage au Gaz* states that at a recent meeting of the Société d'Encouragement des Arts, etc., some remarkable experiments were made with this liquid, which boils at about 100° Fah., and is said to burn with a brilliant white flame of a comparatively feeble temperature. On the occasion in question, a large can containing a supply of the liquid was set on fire by applying a light to its mouth, the spirit was then poured while flaming into lamps. The flame, spreading on all sides, simulated the beginning of a great conflagration, but was eventually extinguished by the lightest puff of wind. Any one in need of a light, but without a lamp for properly burning this liquid, may do so by dipping the corner of a pocket-handkerchief or the finger of a glove into it; and thus may be made a temporary torch, which when blown out will be found to leave the improvised wick without the slightest injury. Lamps intended to burn this spirit are constructed in such a manner that they are extinguished if thrown down. It is said to be extremely difficult to form an explosive mixture with the vapor of the new spirit and air, and that in any case the explosion cannot be made violent. The liquid has a slight and not disagreeable odor, and is not dear. It is sold at present at 1 franc per kilogramme (8 cents per pound), and its production is said to be unlimited. It has on other occasions been said to be a product of the Galician mineral hydrocarbons.

Mariette Bey.

Mariette Bey, the celebrated Egyptologist, who died this winter at Cairo, was born at Boulogne-sur-Mer in 1821. In the year 1847 he began to undertake, in his native town, the study of Egyptian hieroglyphics; and, although he possessed very few books to guide him in his researches, made himself master of the principal difficulties to be encountered in the science which Champollion was chiefly instrumental in creating.

In 1850, upon the recommendation of the Institute of France, Mariette Bey, who was attached to the Egyptian Museum of the Louvre, where his knowledge was much valued, was charged with a scientific mission to Egypt with the object of searching out and examining the Coptic manuscripts preserved in the convents; but scarcely had he arrived at Cairo than his attention was drawn to ancient Memphis, whose monuments lie covered by the sand near to the pyramids. Assisted by the guidance obtained from the authors of antiquity, he began excavations and discovered the Serapeum, the sanctuary of the god Serapis, the tombs of the Bull Gods, as well as other archæological remains of the greatest interest.

Spending four years in the midst of the desert he continued his excavations at Memphis, at Abydos, and at different places in Upper Egypt and Nubia. He unearthed the famous colossus of the Sphinx, which is cut, as is known, in a natural rock at the foot of the pyramids of Ghizeh, and brought to light a number of bass-reliefs, inscriptions, and gold and silver ornaments.

On his return to France, Mariette Bey was made conservator of the Egyptian Museum at Paris. In 1858 he undertook the direction of the excavations in the valley of the Nile, and made fresh discoveries.

We owe to him the unearthing of the Temples of Edfou, Karnak, Medinet Abou, and also the foundation of the Museum of Boulaq, at Cairo, where he has been engaged during the last few years in arranging all the valuable objects which have been brought together by his energy and skill. In 1873 the Institute of France awarded him its biennial prize of 20,000 francs.

For some years the health of Mariette Bey had been much affected, and it may be said that he died in harness—a victim of his devotion to archæology. —*The Architect.*

Mines in Maine.—Cinnabar.

It has at last been generally admitted that we have *mines* in Maine. We have not, to be sure, been able to show deposits of fabulous richness—ores assaying thousands of dollars to the ton or "chunks of native silver as large as a man's head"—but it has been abundantly proven that Maine contains bodies of silver and copper ores which, with skilled labor, suitable machinery, and honest management, may be mined and sold at a large profit. What more could be asked? It is also a fact that more than two-thirds of our territory has never yet been prospected, although, from time to time, specimens of native gold and rich ores of silver and copper have been brought to us from the almost unknown regions of the State. We have recently seen a piece of pure cinnabar weighing nearly a pound which was taken from the surface with a pick less than 100 miles distant from Bangor.—*Maine Mining Journal.*

Tomato Canning.

The Baltimore correspondent of the *Grocer* estimates the total pack of tomatoes last year in this country at 38,400,000 cans, costing the packers $3,200,000. The business was distributed as follows:

	Cases.
In Baltimore and Hartford County, Md., and other parts of the State and Virginia	330,000
New Jersey	520,000
Delaware	180,000
New York	165,000
Massachusetts, Connecticut, Rhode Island	155,000
California	50,000
Ohio	80,000
Pennsylvania, Michigan, Iowa, Indiana, and other Western States	120,000
Total number cases	1,600,000

Business and Personal.

The Charge for Insertion under this head is One Dollar a line for each insertion; about eight words to a line. Advertisements must be received at publication office as early as Thursday morning to appear in next issue.

Wanted—Address of Novelty Works. S. Pay, Peoria, Ill.

Improved Skinner Portable Engines. Erie, Pa.

$800.—Ent. Pat. Household Art. H., Sta. F., Phila.

Wanted—Good Party to Manufacture Improved Store Seat on Royalty. Wood or metal. S., Box 1973, Phila.

"Rival" Steam Pumps for Hot or Cold Water; $32 and upward. John H. McGowan & Co., Cincinnati, O.

Care for your feet if you would keep comfortable. Use German Corn Remover. Sold by druggists. 25 cts.

Skinner's Chuck. Universal, Independent, and Eccentric. See adv., p. 268.

Women cry and children shriek for Van Beil's "Rye and Rock" when sick.

Engines and Boilers. 16 x 48 and 13 x 30 inch Second-hand Horizontal Engines. Full stock of new Engines; also new and second-hand Locomotive and Horizontal Tubular Boilers. Send for circulars. Belcher & Bagnall, 40 Cortland St., New York.

Blake's Belt Studs are the best fastening for Rubber and Leather Belts. Greene, Tweed & Co.

Drop Hammers, Power Shears, Punching Presses, Die Sinkers. The Pratt & Whitney Co., Hartford, Conn.

Portable Railway Track and Cars for Railroad Grading, Sugar Plantations, Mines, etc. F. W. Corey & Co., 162 Broadway, N. Y.; 95 Washington St., Chicago, Ill.

Perfection Belt Clamp. Cheapest and simplest clamp in the world for all kinds belting. Not patented. Engineers make it themselves. Full description, 50 cts. R. H. Black, Box 128, Bruin, Butler Co., Pa.

When your boiler front is covered with mud from the try cocks, it is a sure sign that no time should be lost in applying Hotchkiss' Mechanical Boiler Cleaner. Send for circular. 84 John St., New York.

Beauty in the feet may be found by using German Corn Remover. Sold by druggists. 25 cts.

For the best Jig Saw Blades, go to Wm. Cuddy, 108 Hester St., New York.

Money to Invest in Manufacture. Box 1084, Batavia, N.Y.

Wanted, for Cash, Engines, Boilers, and Wood-working Machinery, in good order. Belcher & Bagnall, 40 Cortland St., New York.

Walrus Leather. A choice lot for Polishing Metals. Greene, Tweed & Co., 118 Chambers St., New York.

Safety Boilers. See Harrison Boiler Works adv., p. 252.

Wanted—Patents and Specialties to sell. Special advantages offered. S. M. Thompson, Providence, R. I.

Inventors sending a three cent stamp to Inventors' Institute, Cooper Union, New York city, will receive a copy of the *Industrial News* free.

Rock Drill, with Hose and Portable Boiler. Machinery Exchange, 261 N. 3d St., Philadelphia, Pa.

The Eureka Mower cuts a six foot swath easier than a side cut mower cuts four feet, and leaves the cut grass standing light and loose, curing in half the time. Send for circular. Eureka Mower Company, Towanda, Pa.

The Newell Universal Mill Co., Office 7 Cortlandt St., New York, are manufacturers of the Newell Universal Grinder for crushing ores and grinding phosphates, bone, plaster, dyewoods, and all gummy and sticky substances. Circulars and prices forwarded upon request.

L. Martin & Co., manufacturers of Lampblack and Pulp Mortar-black, 236 Walnut St., Philadelphia, Pa.

Pure Oak Leather Belting. C. W. Arny & Son, Manufacturers, Philadelphia. Correspondence solicited.

Wren's Patent Grate Bar. See adv. page 237.

Jenkins' Patent Valves and Packing "The Standard." Jenkins Bros., Proprietors, 11 Dey St., New York.

Presses & Dies. Ferracute Mach. Co., Bridgeton, N. J.

Wood-Working Machinery of Improved Design and Workmanship. Cordesman, Egan & Co., Cincinnati, O.

The "1880" Lace Cutter by mail for 50 cts.; discount to the trade. Sterling Elliott, 262 Dover St., Boston, Mass.

Experts in Patent Causes and Mechanical Counsel. Park Benjamin & Bro., 50 Astor House, New York.

Split Pulleys at low prices, and of same strength and appearance as Whole Pulleys. Yocom & Son's Shafting Works, Drinker St., Philadelphia, Pa.

Malleable and Gray Iron Castings, all descriptions, by Erie Malleable Iron Company, limited, Erie, Pa.

Power, Foot, and Hand Presses for Metal Workers. Lowest prices. Peerless Punch & Shear Co. 52 Dey St., N.Y.

National Steel Tube Cleaner for boiler tubes. Adjustable, durable. Chalmers-Spence Co., 40 John St., N. Y.

Corrugated Wrought Iron for Tires on Traction Engines, etc. Sole mfrs., H. Lloyd, Son & Co., Pittsb'g, Pa.

Best Oak Tanned Leather Belting. Wm. F. Forepaugh, Jr., & Bros., 531 Jefferson St., Philadelphia, Pa.

For Light Machinists' Tools, etc., see Reed's adv., p. 221.

Stave, Barrel, Keg, and Hogshead Machinery a specialty, by E. & B. Holmes, Buffalo, N. Y.

Wright's Patent Steam Engine, with automatic cut off. The best engine made. For prices, address William Wright, Manufacturer, Newburgh, N. Y.

Rollstone Mac. Co.'s Wood Working Mach'y ad. p. 237.

Nickel Plating.—Sole manufacturers cast nickel anodes, pure nickel salts, importers Vienna lime, crocus, etc. Condit, Hanson & Van Winkle, Newark, N. J., and 92 and 94 Liberty St., New York.

For Mill Mach'y & Mill Furnishing, see illus. adv. p. 237.

Clark Rubber Wheels adv. See page 236.

Saw Mill Machinery. Stearns Mfg. Co. See p. 237.

Presses, Dies, Tools for working Sheet Metals, etc. Fruit and other Can Tools. E. W. Bliss, Brooklyn, N. Y.

Saunders' Pipe Cutting Threading Mach. See p. 237.

For Machinists' Tools, see Whitcomb's adv., p. 237.

For the Cheapest Process of Manufacturing Bricks, see Chambers Bros. & Co.'s adv., page 254.

Cope & Maxwell M'f'g Co.'s Pump adv., page 254.

For Pat. Safety Elevators, Hoisting Engines, Friction Clutch Pulleys, Cut-off Coupling, see Frisbie's ad. p. 252.

Mineral Lands Prospected, Artesian Wells Bored, by Pa. Diamond Drill Co. Box 423, Pottsville, Pa. See p. 252.

For Thrashing Machines, Engines, and Horse Powers, see illus. adv. of G. Westinghouse & Co., page 253.

Fire Brick, Tile, and Clay Retorts, all shapes. Borgner & O'Brien, M'f'rs, 23d St., above Race, Phila., Pa.

Turbine Wheels; Mill Mach'y. O. J. Bollinger, York, Pa.

For best Portable Forges and Blacksmiths' Hand Blowers, address Buffalo Forge Co., Buffalo, N. Y.

The Brown Automatic Cut-off Engine; unexcelled for workmanship, economy, and durability. Write for information. C. H. Brown & Co., Fitchburg, Mass.

Brass & Copper in sheets, wire & blanks. See ad. p. 269.

The Chester Steel Castings Co., office 407 Library St., Philadelphia, Pa., can prove by 15,000 Crank Shafts, and 10,000 Gear Wheels, now in use, the superiority of their Castings over all others. Circular and price list free.

Diamond Drills, J. Dickinson, 64 Nassau St., N. Y.

The Improved Hydraulic Jacks, Punches, and Tube Expanders. R. Dudgeon, 24 Columbia St., New York.

The I. B. Davis Patent Feed Pump. See adv., p. 269.

Moulding Machines for Foundry Use. 33 per cent saved in labor. See adv. of Reynolds & Co., page 269.

Eagle Anvils, 10 cents per pound. Fully warranted.

Akron Rubber Works, Akron, O. Moulded goods and special work of every description.

Geiser's Patent Grain Thrasher, Peerless, Portable, and Traction Engine. Geiser M'f'g Co., Waynesboro, Pa.

For Superior Steam Heat. Appar., see adv., page 269.

For best Duplex Injector, see Jenks' adv., p. 269.

Steam Engines; Eclipse Safety Sectional Boiler. Lambertville Iron Works, Lambertville, N. J. See ad. p. 253.

Pat. Steam Hoisting Mach'y. See illus. adv., p. 268.

New Economizer Portable Engine. See illus. adv. p. 268.

Rue's New "Little Giant" Injector is much praised for its capacity, reliability, and long use without repairs. Rue Manufacturing Co., Philadelphia, Pa.

For Shafts, Pulleys, or Hangers, call and see stock kept at 79 Liberty St., N. Y. Wm. Sellers & Co.

Skinner & Wood, Erie, Pa., Portable and Stationary Engines, are full of orders, and withdraw their illustrated advertisement. Send for their new circulars.

Wm. Sellers & Co., Phila., have introduced a new injector, worked by a single motion of a lever.

The Sweetland Chuck. See illus. adv., p. 269.

Machine Knives for Wood-working Machinery, Book Binders, and Paper Mills. Also manufacturers of Soloman's Parallel Vise, Taylor, Stiles & Co., Riegelsville, N.J.

Peck's Patent Drop Press. See adv., page 236.

Toope's Pat. Felt and Asbestos Non-conducting Removable Covering for Hot or Cold Surfaces; Toope's Pat. Grate Bar. C. Toope & Co., M'f'g Agt., 353 E. 78th St., N.Y.

Use Vacuum Oil Co.'s Cylinder Oil, Rochester, N. Y.

Don't buy a Steam Pump until you have written Valley Machine Co., Easthampton, Mass.

Use the Vacuum Oils. The best car, lubricating, engine, and cylinder oils made. Address Vacuum Oil Co., No. 3 Rochester Savings Bank, Rochester, N. Y.

Houston's Sash Dovetailing Machine. See ad., p. 269.

Notes & Queries

HINTS TO CORRESPONDENTS.

No attention will be paid to communications unless accompanied with the full name and address of the writer.

Names and addresses of correspondents will not be given to inquirers.

We renew our request that correspondents, in referring to former answers or articles, will be kind enough to name the date of the paper and the page, or the number of the question.

Correspondents whose inquiries do not appear after a reasonable time should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them.

Persons desiring special information which is purely of a personal character, and not of general interest, should remit from $1 to $5, according to the subject, as we cannot be expected to spend time and labor to obtain such information without remuneration.

Any numbers of the SCIENTIFIC AMERICAN SUPPLEMENT referred to in these columns may be had at this office. Price 10 cents each.

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(1) J. A. M. asks: Is there any instrument made for determining the moisture of soils? A. We know of no special instrument for this purpose. The moisture is usually determined by weighing accurately a small average sample of the soil and then drying it at 212° Fah., until it ceases to lose weight. The difference between the first and last weights corresponds to the weight of moisture.

(2) H. K. T. asks for a formula for a paste which will cause labels to adhere to tin without first brushing the surface of the metal with hydrochloric acid. A. Try the following: Water, 1 pint; borax, 1 oz.; shellac, 5 oz.; boil until the latter is dissolved. Thin with boiling water if desired. It works most satisfactorily while hot.

(3) E. P. M. asks: Can you give the formula for preparing good common logwood chrome ink? A. Distilled water 1,000 parts (by weight); logwood extract, 15 parts; carbonate of soda (cryst.) 4 parts, chromate of potassium, 1 part. Dissolve the logwood extract in 900 parts of the water by aid of heat, and let it stand to settle; draw off the clear liquid, heat to boiling, and add the carbonate of soda; lastly add, drop by drop, with constant stirring, the chromate (yellow chromate) previously dissolved in 100 parts of water. The color is not fully developed at once, but on standing for a few hours gradually deepens to a full bluish-black. The ink thus prepared flows well and dries quickly. The addition of a trace of clover oil will prevent mouldiness.

(4) S. R. J. asks (1) for a receipt for silver wash. A. The following bath for silvering by cold dipping gives excellent results: Dissolve in a small quantity of cold water an ounce of fused nitrate of silver, and gradually add, with constant stirring, a strong aqueous solution of good bisulphite of soda until the precipitate at first formed is just redissolved. A momentary immersion of the thoroughly cleansed articles (copper, brass, or bronze) is all that is necessary. 2. Electro silver plating. A. See article on Electro-metallurgy, page 81, current volume.

(5) J. K. asks (1) if there is any such thing as waterproof powder. A. We know of no waterproof gunpowder. Dynamite, dualin, gun cotton, and other blasting substances are not affected by water, but they are unsuitable for use in fire arms. 2. How long will powder last in an air-tight cartridge? A. If put up in a dry airtight cartridge ordinary powder will remain unchanged for an indefinite period. 3. Give the name of the best powder to use. A. Common war powder—*a*. Saltpeter, 75 parts; sulphur, 10 parts; charcoal, 15 parts. *b*. Saltpeter, 75 parts; sulphur and charcoal, each 12½ parts. Sporting powder—Saltpeter, 76·9; sulphur, 9·6; charcoal, 13·5. Blasting powder—Saltpeter, 62; sulphur, 20; charcoal, 18. See column of Business and Personal and Hints to Correspondents.

(6) E. K. B. writes: 1. Referring to SCIENTIFIC AMERICAN SUPPLEMENT, No. 160, what are the long terminal points of the induction coil made of? A. Brass. On a large coil they might be tipped with platinum with advantage. 2. How are carbons made as for Bunsen battery? Will you please give the degrees of heat, etc.? A. Powdered coke or gas carbon is mixed into a uniform paste with thin coal tar, moulded by pressure, dried slowly in an oven, and then gradually heated to whiteness in muffles which exclude air. Repeated soaking in thin tan and reheating makes the surface hard and dense.

(7) C. F. M. asks: 1. Can dry plates be worked by Newton's process in a room lighted through yellow panes of glass? A. Yes. 2. In any photographic process, what is the exact color and shade of the glass which should be put in the window of the dark room? A. A clear dark yellow approaching orange. 3. Will not colored sheets of gelatine do as well as glass? A. Yes.

(8) E. F. C. writes: Some time ago you published a formula for a concentrated fertilizer to be used on potted plants, etc. Among the ingredients was biphosphate of ammonium. As no drug store or chemist's shop here has this chemical in stock, and no work on chemistry that I have consulted makes mention of it, I would be obliged to you if you would give the formula for making it. A. Macerate, for twenty-four hours or more, 81 lb. fine bone ash with 147 lb. strong sulphuric acid: dissolve 24 lb. carbonate of ammonia (or a quantity of ammonia water containing 18 lb. real ammonia) in 15 gallons of soft water, and gradually stir in the paste. After standing several hours draw off the liquid portion, agitate the remainder with a little fresh water; let settle, draw off the clear liquid, add it to the first liquid drawn off. If desired boil down this solution of acid ammonium phosphate until it will solidify on cooling. The portion insoluble in water is chiefly lime sulphate.

(9) J. M. H. asks: 1. Is there any difference in a troy ounce and an avoidupois ounce? A. The troy pound contains 5,760 grains, the avoirdupois pound 7,000 grains; the troy pound contains 12 ounces of 480 grains each, the avoirdupois pound 16 ounces of 437½ grains. 2. What is the lifting capacity of one cubic yard of hydrogen gas? A. A cubic yard of air at 60° Fah., weighs about 11 ounces (avoirdupois), a cubic yard of hydrogen about ¾ ounce; the difference or "lifting power" is therefore about 10¼ ounces per cubic yard of gas. 3. Will hydrogen penetrate common tin, or waste if confined in such a vessel? A. Hydrogen will not penetrate tin or tinned iron.

(10) E. E. T. asks: 1. How can I take a gallon of silver solution and find out how much silver and cyanide it contains? A. Draw off two half-ounce samples, and to one add gradually (in the open air to avoid inhaling the fumes) about two ounces of pure hydrochloric acid, shake together, heat to boiling, and let settle. Decant the liquid, throw the precipitate on a small filter, wash with hot water, cover and set aside in a warm, dark place to dry; when dry weigh on an accurate balance, and multiply the weight by 153·6—the result is the weight of metallic silver (approximate) per gallon of solution examined. Evaporate the other half ounce to dryness, weigh, multiply by 192, and deduct the weight of silver found. The result (if the bath was plain silver potassium cyanide solution) will indicate the weight (approximately) of cyanide of potassium per gallon of solution. 2. Will the same rule work on a copper and gold solution? A. No. 3. What can I dip brass into to turn it black without destroying the surface of the metal? How do they get the deep yellow color so much worn on jewelry? A. Dip the article bright in nitric acid, rinse, and place it in the following solution until it turns black: one ounce each white arsenic and iron sulphate and twelve ounces of hydrochloric acid; rinse, dry in sawdust, and polish with black-lead or lacquer. See article on Electro-metallurgy, page 116 current volume.

(11) A. F. writes: My table gives size of drive pipe for No. 5 hydraulic ram, 2 inches; discharge pipe, ¾ inch. My friend claims I cannot use a larger discharge pipe. I claim it makes no difference what size is used after leaving nozzle of ram, whether ¾ inch or 36 inch, save that there would be less friction in using the larger pipe. Which is right? A. You are right. Strictly, the proper proportions depend upon the relative height from which the water is received and that at which it is delivered, but makers have satisfied themselves that for general use, the delivery pipe should be about half the diameter of the receiving pipe, and so make them.

(12) R. Q. T. writes: 1. We desire to supply our town with water; have a reservoir about 150 feet above the town, 4½ miles distant—area 100 acres, depth 30 feet. What size of pipe will we need to supply, say, six hydrants in case of fire? A. 10 inches. 2. To what elevation can water be thrown? A. About 70 feet, depending upon length of hose. 3. What should be the size of the mains to furnish water to a population of 10,000? What would be the probable consumption for three months in the winter? A. Allow 35 gallons per day for each inhabitant. The above are only approximate. If you wish accurate information you should employ a hydraulic engineer to survey, examine, and estimate.

(13) W. M. A. wants information in regard to preparing brimstone in a paste form. I am engaged in working what they call locust timber into wagon hubs, and I want something to fill up the cracks or checks in the timber. Brimstone is cheap and it is the same color and it becomes hard. A. Heat the sulphur in an iron pan over a moderate fire until it melts to a thin liquid; too much heat thickens it. On cooling the sulphur regains its former appearance and qualities. It can be used advantageously in the liquid form as a filler.

(14) J. C. A. asks: How may I increase the cold of an ice box? My experiments teach me if I apply salt to ice in open air the ice will melt. Now, if I should make an ice box, and confine the ice crushed with salt, mixed in tubes, would the salt have the same effect on the ice, or would it have the opposite tendency and save the ice? A. Other conditions being equal, salt will liquefy ice in a closed tube as quickly as in the open air. The volume of salt ice water resulting will not absorb a greater total quantity of heat than the ice from which it was produced, though the salt liquid will be sensibly much colder than ice at first. Ice liquefied by salt in tubes will freeze water surrounding them, but the ice thus produced will be considerably less in quantity than the ice melted by salt to produce it. There is no way by which ice may be melted by chemical means without making the ice water unfit for potable purposes. See Tyndall's "Heat as a Mode of Motion."

(15) A. A. D. writes: In the SCIENTIFIC AMERICAN, of February 5, 1881, page 87, in article entitled "Filtration and Decolorization," by C. G. Pfander, London, occur the following sentences: "Three parts dried clay to four of blood, sometimes vegetable charcoal is added. The mixture is moulded into lumps, dried, mixed with equal bulk of granulated clay, and then carbonized in a retort." If blood is carbonized are not its peculiar cleansing qualities destroyed? I supposed the albumen of blood, coagulated by heat, formed a drag net or screen, which swept impurities to the surface of the liquid. Would not clay mixed with molasses and then carbonized answer as well as clay mixed with blood and then carbonized? It would obviate objections and difficulties. A. The product is similar in its action to the animal charcoal used extensively in sugar refiners' filters. It does not depend upon the action of albumen, but upon the decolorizing action of animal charcoal in a finely divided state. Blood or albumen clarifies by removing suspended impurities; charcoal chemically deprives of coloring matter, etc. Clay and molasses would not answer as well.

(16) A. G. asks for a recipe for a preparation known as Allen's crystals for the bichromate battery. A. To 3½ oz. of finely powdered bichromate of potassium (or ammonium) gradually stir in 1 oz. cold sulphuric acid, and rub thoroughly together.

(17) J. C. asks for a deodorizer for benzine and the proportions. A. Agitate it violently and repeatedly with about three per cent of sulphuric acid, let stand a few hours, draw off the clear portion, and slowly redistill, the vessel receiving the distillate being replaced by another from time to time. Select the contents of those receivers containing the portions freest from odor and discard the other portions.

(18) H. F. B. asks: 1. How are the leather packings for hydraulic jacks pressed or formed to prevent fulling at the edges? A. The leather is well softened in water, and then pressed in cast iron formers and dried. 2. How can I straighten a long two-inch brass tube which is slightly bent? A. Draw the tube carefully on the hollow side.

(19) M. B. asks (1) how to braze steel wires without a blowpipe. A. This is sometimes done by placing the wires, properly charged with flux and silver solder, between two white hot blocks of cast iron. 2. Is there a composition of some kind of a hard solder which, if kept in a molten state in a crucible, we could put on, and in which we could dip the ends of such wires for a moment for the purpose of brazing them? The blow pipe takes out temper. A. Brazing cannot be done in the manner proposed, and it cannot be done in any way without destroying the temper. The blowpipe method of brazing or soldering small articles is the best.

(20) J. K. writes: 1. I have sunk a tube well to the depth of about forty feet through blue clay, on to what is termed hard pan, which seems very hard and unyielding, so that I can drive deeper only with great difficulty. Now, how shall I proceed to drive clear through that hard pan, under which I expect to find plenty of water that will not be affected by drought? A. We think you should use a drill (inside the tube) to drill through the hard pan, before driving the tube. 2. How can I take the first muddy and sandy water from the tube? My pump will not work on account of mud and sand, which stop up the openings in the screen at the bottom, thus preventing the water from entering the tube, also works up into pump cylinder and locks the pump. A. Use a rough sand pump that will not clog. 3. How can I tell when deep enough down and when to stop driving, so as to leave the screen or bottom of tube in the best bed or supply of water, and thus obtain the best well? There is water in the well now, but I cannot pump it on account of mud that accumulates on the point which adheres and sucks into the openings of the screen so close that the water cannot enter the tube, but is shut out so perfectly and complete that the suction of the pump is not sufficient to suck it through into the screen and pump. This is the main difficulty: is there no remedy? A. We know of no way except by trial. You had better consult some one of experience in putting down drive wells.

(21) T. R. asks (1) how phosphorus is made from white burnt bone. A. The ground bone ash is mixed into a cream with twice its weight of water and a quantity of sulphuric acid (bone ash, 100; water, 200; acid, 78 lb). In twenty-four hours more water is added, and the mixture is heated in a leaden pan until it has lost its granular character. It is then diluted largely

with water and transferred to tall casks to settle, after which the clear liquid is drawn off, the residue washed with water, the clear washings added to the liquid, and the whole evaporated down in copper or leaden pans. The clear liquid is then drawn off from the calcareous deposit, the sediment drained on a filter, and the liquid evaporated to the consistence of honey and mixed with charcoal powder (9 lb. for 100 lb. bone ash). The mixture is then dried in iron pots and heated to incipient redness, cooled, and put into earthen retorts well luted and dried. Heat is applied around the sides of the retort in an air furnace. The beak of the retorts are connected with copper tubes which dip a quarter inch beneath the surface of lukewarm water, at the bottom of the vessel containing which the phosphorus which distills over collects. It is purified by squeezing it through chamois leather under water. While melted (under water) it is drawn up into glass tubes and transferred to cold water, where it solidifies and drops out of the tubes. These sticks must be kept under water. 2. What per cent of phosphorus do they contain? A. About 20 per cent.

(22) E. M. asks: Can you give me a good receipt for making manifold paper? A. Saturate fine unglazed paper with the following preparation. When dry it is ready for use: Tallow, 2 oz.; graphite (blacklead) in finest powder, ½ oz.; linseed oil, ¼ pint; lampblack, q. s. to make it of the consistence of cream; melt and rub well together in a mortar.

(23) H. S. W. asks for the best method of cutting a double, triple, and quadruple thread. A. There is no difficulty in doing it on a screw-cutting lathe; you determine the pitch of the thread, and you can then divide the thread into two, three, or four parts by changing the position of the cutting tool.

(24) N. B. P. asks: What will remove grape stains from a carpet? A. Wash out with warm soapsuds and a little ammonia water.

(25) S. R. B. writes: A wart has been growing on the right side of my nose for several years, and is now about the size of a large shot. Can you inform me how to remove it without leaving a scar, and whether there would be any bad result afterward? Several friends have suggested means for its removal, but I prefer to hear from you. A. By the system of Dr. Barnes—the use of an ordinary burning glass—the excrescence could be removed, leaving as little of a scar probably as by any method.

(26) H. D. P. writes: I have a piece of machinery which is almost constantly covered with a light rust: what can I apply to keep it off? A. Camphor, ½ oz.; dissolve in melted lard, 1 lb.; take off the scum, and mix in as much fine blacklead (graphite) as will give it an iron color. Clean the machinery and smear with this mixture; after twenty-four hours rub clean with a soft linen cloth. It will keep clean for months under ordinary circumstances.

(27) A. C. S. writes: I have a compound engine, small cylinder, 3 inches diameter by 6 inches stroke; large cylinder, 7 inches diameter. I wish to build a boat suitable for the engine. Please give me dimensions, also diameter and pitch of screw. A. About 16 feet long, and 3 feet 8 inches to 4 feet beam; screw about 18 inches diameter and 2 feet 9 inches pitch. 2. What should be the stroke of treadle for foot lathe, driving wheel, or large cone, 26 inches diameter? A. From 6 to 8 inches. The stroke should be adjustable to the ease of the person using it. What would be right for one would be too long or too short for another.

(28) J. S. asks: 1. Which is the best gasoline gas machine in use? A. For this information see our advertising columns and Hints to Correspondents. 2. What is the best absorbent for gasoline? A. Infusorial silica is about the best thing. Sisal hemp is often used.

(29) H. S. H. asks: 1. What pressure will a copper boiler, ¼ thick, 2 feet long, 18 inches diameter; with 40 one-inch copper flues, depth of fire box from grate to crown 8 inches, space between fire box and outside shell ¾ inch, copper flanged head and flue sheet the same, copper rivets ¼ inch diameter and double riveted both ways, or every seam and head to be double riveted. A. 35 lb., if all parts are equal in strength to the shell. 2. I would like to know what horse power it would be, burning coke or hard coal? It is to be a vertical boiler. A. About 2 horse power. 3. What would be the power of two cylinders, 2 inches bore and 3 inches stroke, connected at right angles, running 300 revolutions per minute? A. With 80 lb. steam, 2 horse power. 4. What would be most durable, brass or iron cylinders? A. Cast iron.

(30) R. B. F. writes: We are in search of a handy and rapid means of retaining a copy of short notes, telegrams, etc., without the aid of the copying press. The stylographic process seems to be about the thing, but the manner of using the carbon sheet in the several ways we have been able to secure are unhandy and not adopted to our wants. I want to try and improve the methods employed, and would like to know how to prepare the carbon sheets. The sample inclosed is good, durable, and furnishes a clear line free from smut, more like ink than the usual smutty sheets used produce. Can you explain the process in your paper of making the sheets? A. Try the following: Tannic acid, 10 parts (weight); pure sulphate of iron, 15; glycerine, 35; indigo sulphate paste (nearly neutral), 1; warm the glycerine, add the tannic acid, and rub together in a mortar to dissolve; powder the iron salt, divide into two portions, and calcine one by stirring it about on an iron plate over a fire until it becomes brown. Mix with the other portion, and gradually triturate into the glycerine; add in a similar manner the indigo, and rub all well together. Saturate thin unsized paper with this (adding more glycerine if too thick), hot, pass between a pair of smooth iron rolls under strong pressure, and hang up in the air for half an hour before packing for use. See answer to E. M., this page.

(31) M. A. H. writes: I wish to put in a new boiler to run a 12x24 engine, to be run at 60 revolutions per minute. Am divided in opinion between these boilers, namely: *a*. A two flue (flues 15 inches diameter), 42 inches diameter, 24 feet long. *b*. A Norton flue (flues 6 inches in diameter), 48 inches diameter, 16 feet long. *c*. A twenty-four flue (tubes 4 inches diameter), 46 inches diameter, 14 feet long (tubular). I am aware that these are not the same horse power, but either will answer, and I want your opinion on the following points: 1. Is there any difference in the durability under the same treatment in the boilers? A. The two-flue boiler will wear longest and is easiest cleaned. 2. Which will use the least fuel to produce the steam necessary for engine? A. Boiler with 4 inch tubes. 3. Which is the most likely to leak first, the tubular at end of tubes, or the flued to crack at end of flues? A. The tubular at the tube heads. 4. Which do you consider the best for economy of fuel, safety from explosion, and general use for the engine named? A. Either is safe from explosion under proper care, but the two-flued boiler is easiest managed.

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

C. C. D.—The sulphur colored substance is pine pollen—carried by the wind.—F. M. D.—Silica similar to your sample is used in the preparation of cements, glass, enamels, silicate of soda, and artificial stones. It is also used for polishing and scouring purposes, and also filtering. See Hints to Correspondents.

COMMUNICATIONS RECEIVED.

On the Cheops Pyramid. By G. V.
On the Propulsion of Ships. By J. G.

[OFFICIAL.]

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FOR WHICH

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

March 29, 1881,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

A printed copy of the specification and drawing of any patent in the annexed list, also of any patent issued since 1866, will be furnished from this office for one dollar. In ordering please state the number and date of the patent desired and remit to Munn & Co., 37 Park Row, New York city. We also furnish copies of patents granted prior to 1866; but at increased cost, as the specifications not being printed, must be copied by hand.

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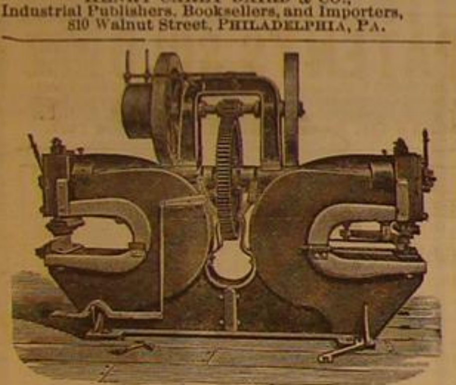

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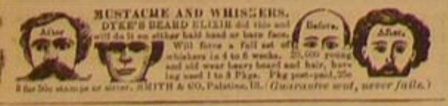

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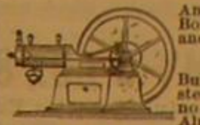

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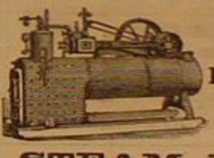

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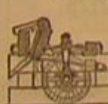

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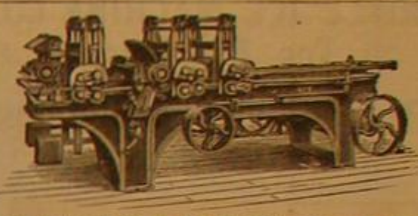

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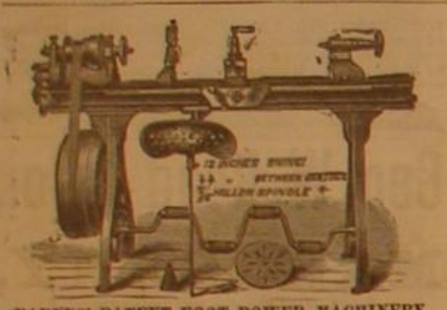

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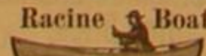

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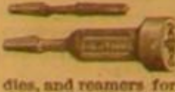

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