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IMPROVED FULLING MILL.

A new fulling mill, which has lately come into use in many of the largest hat-making establishments in the country, is represented in the illustration given herewith. Hatters, and makers of felted goods generally, understand the difficulty of making hats or other fabrics out of bodies that have not been well washed, and from which the gum, grease, and soap are not thoroughly discharged after milling. The goods from the mills below described, having been made much quicker, quit the soap fresh and lively, and, it is claimed, are much more easily and cleanly washed than those prepared in the old apparatus. It is also stated that there is less wear and waste to the stock, for the reason that the quicker action to which they are submitted, and the shorter time during which they are under the operation, allow the goods to remain warm until finished, so that very poor, short, or waste stock, that would be injured or destroyed by the old mills, will go through these without being damaged. For the same reason, much less soap is used.

The construction of the machine is very simple, it consisting in a driving shaft on which are located friction cams, A. These impinge against shoes, B, and thereby lift and let fall the heavy hammers, C, which last work upon the stock. Any wear between the faces of the cams and shoes is taken up by the rod, D, which is set up as required. The hammers by this device are given a much more rapid action than is usual, and at the same time a uniform fall or blow, whether the mill be full or nearly empty. The invention can be attached to any of the common falling hammer mills by simply removing the tappet wheels and gears. It dispenses with the pit, leaves the floor clean and level, and does away with the disagreeable noise of the old tappets. No more power is required than for the ordinary mill, and less room is occupied. Finally, it produces one millful in half the time, or two millfuls in the same time in which the old device now produces work, and, in addition, turns out much better work.

For further information, apply to the Patent Fulling Mill Company, Middletown, N. Y.

PROCEEDINGS OF THE NATIONAL ACADEMY OF SCIENCES.

The regular spring meeting of the National Academy of Sciences opened at Washington, D. C., on April 20, with Professor Joseph Henry in the chair. At a business session with which the proceedings began, five new members, Professors R. E. Rogers, Asaph Hall, Alpheus Hyatt, Joseph LeConte, and Mr. L. H. Morgan were elected, after which the regular reading of and debate upon papers presented was commenced. The subjects thus far discussed are not of extraordinarily popular interest; and in fact the learned treatises are rather more ponderous than practical. Our usual brief abstracts will be found below.

Professor Elias Loomis, on

STORMS AND SPELLS OF WEATHER.

said that the progress of storms is not uniform during the day, either in different years or different months. It appears that the average velocity of storms from 4.35 to 11 P. M. is about 25 per cent greater than during the remainder of the day. This excess varies for different months, ranging from 14 to 32 per cent. The maximum diurnal velocity is at about 8 P. M. During the three years last past, the most rapid progress of a storm center observed on one day occurred on February 22 1874, being 1,280 miles, or 53.3 miles per hour;

the least velocity occurred August 21, being 228 miles, or 9.5 miles per hour.

From other investigations, it appears that, when the course of a storm is most northerly, the axis of the rain area is inclined to the storm's path, nine degrees toward the south; but when the course of the storm is most southerly, the axis of the rain area is inclined to the storm's path only four degrees.

Under the head of sudden thermometrical changes, Professor Loomis stated that the quick fall of temperature which frequently succeeds a great storm should be ascribed to the

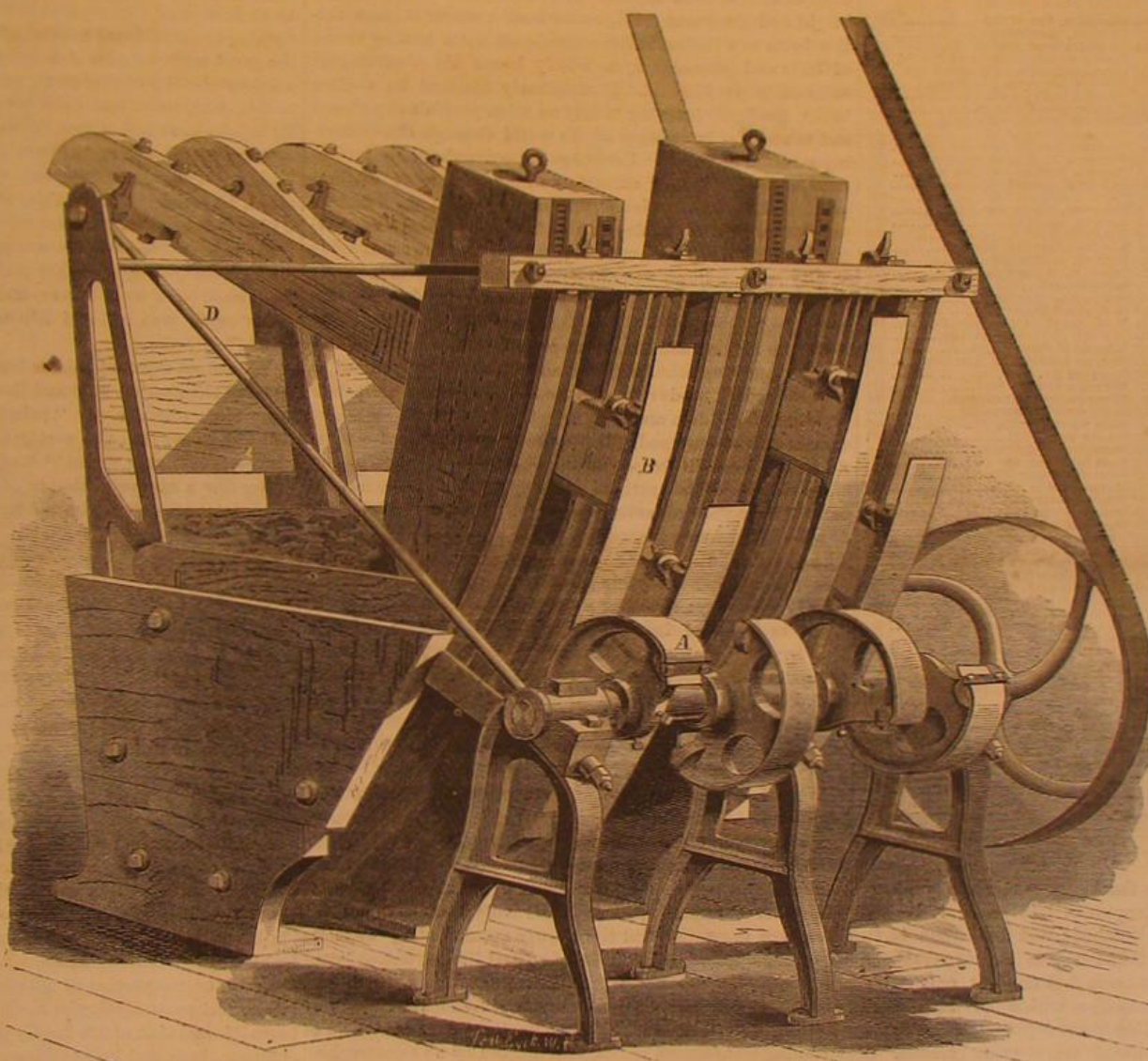
diffused or unsteady, by the cessation of any undulation across the center of the ligament or black drop. The times, both of formation of drop and tangency of limbs, depend on the definition, the first being earlier, and the latter later, the worse the definition. The same care and attention should be devoted to external as to internal contacts.

Professor George Davidson sent a letter to the Secretary containing recommendations for the next transit, the principal of which was that, to get the best results, observations should be made from great and isolated elevations, where the atmospheric disturbance is a minimum.

One of the most interesting papers read was that of Professor Marsh on the

SMALL BRAINS.

In *dinoceras*, the largest mammal of the eocene, nearly equal to the elephant in bulk, the brain was comparatively the smallest in any known mammal, being not larger than in a tapir. *Brontotherium*, of the miocene, which was about as large as *dinoceras*, had a brain several times as great, and with the hemispheres better developed. In the mastodon, from the pliocene, the brain had greatly increased in size and convolutions, and in a species of this genus from the post tertiary the brain was nearly as well developed as in the living elephant, but not quite as large. A similar increase of brain capacity was shown in the horse family, from *orohippus* of the eocene, through *mesohippus* of the miocene, *pliohippus* of the pliocene, to the existing horse; the same brain growth was shown from the tapiroid eocene mammals, through the miocene and pliocene rhinoceroses, up to those of recent times, and also for the suilline and ruminant mammals. In the monkeys, carnivora, insects, and rodents, the



DRAPER'S FULLING MILL.

sudden descent of the atmosphere whose temperature at the time is unusually low.

Professor J. P. Lesley followed with an interesting sketch of the second geological survey of Pennsylvania, which he concluded with a description of the structure of the valley of the Schuylkill, showing that the river had in course of time cut a channel for itself through a mountain 1,500 feet high.

THE REPORT OF THE METRIC COMMISSION

detailed progress during the past three years, and referred more especially to the metrological congress in Paris. Since the completion of the standards, the casting of which has been described in detail, a conference has been called of the nations interested, and this body convened in Paris about a month ago. It has been agreed to establish an international bureau of weights and measures, having its seat in Paris, to be charged with the care of all the delicate apparatus which has been employed in the construction of the standards, and to make future comparisons and verifications.

Professor A. Guyot read a paper on the

CATSKILL MOUNTAINS,

in which he stated that the names given to several of the peaks were wrongly applied. On measuring heights, he found to his surprise that several of the mountains exceeded 4,000 feet in height.

Professor Simon Newcomb, on the

TRANSIT OF VENUS,

remarked that the only phase of internal contact which it is worth while to observe is that of true contact. When the definition is sharp and steady, this phase is marked by the breaking or formation of the thread of light; and when it is

same law of development of the brain holds equally true, so far as the speaker had continued his investigations, and in the higher of these groups the changes since the eocene were most remarkable.

Mr. Justice Bradley, of the United States Supreme Court, submitted a communication on

A PROJECT FOR CHANGING THE CIVIL YEAR.

in which it is proposed to make the civil year correspond with the solar year. For the present century the first day of the year would fall on December 21, and the sun would arrive at the cardinal points on the first days of January, April, July, and October respectively.

English Agricultural Machinery at the Centennial.

The English manufacturers of agricultural machinery do not propose to exhibit their products at the Centennial. The reason is that our duties on the importation of foreign devices of this character is from 30 to 40 per cent, and hence is practically prohibitory. As there is no paying trade for the goods in this country, manifestly the producers have no incentive to exhibit, and hence they decline to incur the expense to make a show "to please and instruct others," which will be of no benefit, as they think, to them.

A CANAL project has been formed by which it is hoped to connect the mouth of the African river Betta, on the Atlantic, with the northern bend of the Niger at Timbuctoo, a distance of 740 miles.

It is said that sugar barrels and boxes can be kept free from ants by drawing a wide chalk mark around the top near the edge.

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SCHOOLS OF OBSERVATION.

With all their changes for the better which the work of our primary schools has undergone of late years, it is still ingeniously perverse in its methods and barbarous in its aims; almost hopelessly so, for so great is the conservatism, the inertia rather, of these schools that they not only withstand any radical improvement from within, but make such improvement all but impossible in the higher schools also.

Every college professor—still more every teacher in scientific institutions—complains that the youth who come up to him for instruction have been, as a rule, so blunted in sense and intellect by a vicious preparation, so fixed in bad habits of thought, that more time has to be spent undoing and re-doing the work of the lower schools than is left for genuine college work. Thus the whole weight of the elementary school system, and it is great, bears dead against the improvement of the upper schools, wherein unfortunately all educational reforms have to begin.

Hence we see the colleges tardily adapting their work to the needs of the times, the high schools tardily following the example of the colleges, and the primary schools bringing up the rear a century or so behind: behind the colleges that is; they are twenty centuries behind the discovery and announcement of their proper work by thinkers independent enough to break with the tradition of their day. There is not a common school or an elementary private school in the land that approaches in its mode of operation the ideal of youthful culture set down by Plato: not one that does not violate, more or less atrociously, the primary requirements of young humanity in its entire scheme of operation. And yet we flatter ourselves that our schools exemplify the finest fruits of modern civilization!

We marvel at the logical blindness of our forefathers, who sought for personal freedom, yet could not see the absurdity of trying to erect a free government on a foundation which had slavery for a cornerstone. To those who shall celebrate the second centennial of our country's existence, we of to-day will probably appear quite as illogical in educational as they were in political matters. We know what should be done, yet submit to the habitual performance of the opposite. We brag about the school of marine observation which Agassiz set up at Penikese, and say: "That is the way a school

should be conducted." We cry "well done" and "God speed" to Professor Shaler for the projected school of inland observation to be camped next summer at Cumberland Gap, looking upon such enterprises as the proper outcome of the best system of public education in the world. And we are blind to their biting satire upon our entire work of instruction!

Just think of it. We take our children at the age when observation is instinctive, when every sense is keen and hungry, the whole world fresh and new, and every object and phenomenon a challenge to their curiosity: when "what is it?" "what for?" and "why?" are the burden of their speech, and "what are you?" "what can I do to you?" "what can you do to me?" the language with which they approach all things: we take them at this stage and—aid and encourage their attempts to master their environment? Not a bit! On the contrary we shut them up, literally as well as figuratively, at home and in school. "Don't bother me with so many questions!" is the mother's response to incessant queries. "It isn't polite to ask questions" is the reproof a child gets when it turns to strangers for the gratification of a curiosity, sure to be impertinent if unwisely repressed where it should be wisely guided. "That has nothing to do with your lesson: attend to your book" is the teacher's reply when the eager child wants to know about something not set down in the day's exercises.

The fruitless quest is not long persisted in. The mind, even of adults, soon wearies of rebuffs; and the naturally bright and observant child, under such treatment, soon settles down to a listless indifference to all but a narrow round of facts and phenomena, or wisely keeps his observations and doubts to himself. If studiously inclined, he studies books, gradually learning to rely on other people's experience and to seek for knowledge of the world through the distorting medium of words. Language becomes the only instrument of intelligence or culture; and his powers of original perception, at first undeveloped, and by being stultified by years of unobservant going to and fro. And then we set before him the happy chance of becoming one of the twenty-five or fifty lucky fellows who are permitted to supplement their college life with a six months' training in a school of observation!

Give to Agassiz and Shaler all credit. The Penikese and Cumberland Gap schools are germs of a new life, destined, it is to be hoped, to develop downward till, by the time our great-grand-children are ready to go to school, the whole school system will be leavened. But to ourselves we must reserve unlimited discredit for permitting such a "reform" to be possible. Schools of that sort are properly not the crown but the basis of a sensible educational system. What they propose to do should be made unnecessary by the work of every primary school, for childhood is the time for cultivating the art of observation, when everything in Nature and Art is new and open to discovery: not after a quarter of a lifetime has been spent in habitual inattention to all save books, when a shadowy familiarity has bred such contempt of common things that the would-be observer has to resort to the wilderness or to the bed of the sea for objects to excite his dormant curiosity.

THE ANTIQUITY OF LIFE.

When Lyell and the rest of the uniformitarian school of geology began to attribute all geological changes to the protracted operation of the influences now remodeling the earth's surface—sunshine and showers, rivers and seas, arctic frosts and tropic heats, slow risings and sinkings of the earth's crust, with their attendant quakings and volcanic outbursts, the growth of vegetation and the slowly accumulating deposits of coral polyps and other forms of animal life—it was objected that time was too short for such proceedings. Men had scarcely begun to question Usher's six thousand years of Biblical chronology, and their imaginations were incapable of spanning monotonous milleniums marked by no catastrophes. The Niagara could not have carved its six mile gorge at its present rate, for that would leave no time for antecedent operations!

By Darwin's day, such objections were worn out. Men had become accustomed to granting hundreds of milleniums for the periods of the geologist; yet they stood aghast at the demand for more. Geology had been modest in its requirements compared with the rising science of biology. Allowance was asked, not merely for the geologist's rock-recorded ages, but for gaps in the record for pages destroyed, and for measureless periods during which no records were kept in parts accessible to man. Darwin's theory called for an extension of time compared with which that of the geological record was small; and his opponents refused. A theory, they said, which requires such boundless concessions of time cannot possibly be true.

Now we learn that, whatever objections may be urged against the evolution theory, lack of time for the slow development of creation is not one of them. The soundings of the Challenger expedition give a clue to ages of life whose duration dwarfs to insignificance that of the periods between the Lower Silurian and the present, the limits formerly set for the duration of life upon the earth. The addition of the vast periods covered by the deposition of the many thousand feet of Cambrian and Laurentian rocks, with their shadowy traces of life, does not bring us sensibly nearer the beginning; nor is the light they hint of any guide to a comprehension of the swarms of living things which sported in the waters of those primeval oceans, or inhabited their shores.

We have given elsewhere a *resumé* of the grounds on which Professor Wyville Thompson and his colleagues base their belief that the red clay, which covers such vast areas of the deeper ocean beds, is a residuum representing less

than two per cent of the mineral matter of the microscopic animal and vegetable life which inhabits those waters; and that it is identical with the basic clays of the extensive azoic formations known as slates, schists, and even gneiss and granite. If this position is sustained, as there is reason to expect it will be, by further observation, the antiquity of life surpasses the most extravagant demands of biologists; even the oldest known rocks, the fundamental granites as they have been considered, cannot be taken as sufficiently ancient to mark the time when life first made its appearance on earth. We must say of the organic as Hutton did of the inorganic world: "We find no vestiges of a beginning": for the farther back we go, the vaster are the measures of life's duration, and their number is countless.

The slow development of a thousand feet of coralline limestone covers a period not incommensurable, however vast. Something like an approximate estimate can be made for the time required to deposit a thousand feet of sand in a lake bed or along a sea coast. But what arithmetic can number the ages required for the deposition of thousands of thousands of feet of the basic material of rock which at most can represent in its mass not much more than the hundredth part of the mineral constituents of animal and vegetable life, so minute and so distributed that it barely tinges the deep sea water with a shade of green?

If the great deposit of red clay, now forming in the eastern valley of the Atlantic, were metamorphosed into slate and then upheaved, says Professor Huxley, it would constitute an azoic rock of enormous extent; and yet that rock is now forming in the midst of a sea which swarms with living beings, the great majority of which are provided with calcareous or silicious shells and skeletons, and therefore are such as, up to this time, we should have termed eminently preservable. He might have added that the sea whose bed is so barren in organic remains lies between continents abounding with highly organized animal and vegetable life, with ancient cities, imperishable pyramids, and countless other traces of a higher than animal existence. Yet were the present continents submerged with the supposed elevation of the azoic sea bed, the geologist of that period might say—as our geologists have been used to say, under similar circumstances—"the earth was void of life when these slates were laid down!"

Who shall say that higher forms of life could not have inhabited the shallow seas and the dry lands surrounding the deep seas wherein our "primary" rocks were deposited? Who shall say that the vestiges of higher life discovered in the comparatively recent "fossiliferous" strata afford anything like a complete history of life on earth, or deny to the student of biology unlimited time for bringing about the results he observes?

DANGEROUS HOUSES.

Four deaths from diphtheria, recently occurring in Brooklyn have attracted the attention of the health authorities of that city to the condition of the house in which they took place. The report which a sanitary committee made upon the dwelling sounds a note of warning which is certainly timely at this especial period when moving is everywhere in progress. The house in question was new, and damp in every room from cellar to attic, for there appears to have been no effort made to dry the walls. This is precisely the condition of scores of dwellings into which families have entered on the first of this month; and unless proper precautions be taken, further cases of illness and death will be the cost of neglect.

If any reader of this journal, therefore, finds himself located in a dwelling on the walls of which the moisture condenses in beads, as on the outside of an ice pitcher, or the rooms of which cause a chilly, damp, sensation, with a strong odor of plaster, or any portion of which does not, on wall, ceiling, or floor, feel perfectly dry to the hand, let him, as he values his own life and that of his family (or hopes to escape from rheumatism, lung and kidney diseases, and the like) start fires at once. Better waste a few tons of coal than pay five times the amount in doctors' bills or a still greater value of the money in suffering. Build a big fire in the furnace and in every grate, and keep all up night and day; and if the weather admits, throw open the windows and doors, but keep out of the drafts. The object of the fires is to dry out the walls, not so much to warm the rooms for comfort. Then as the weather becomes warm, let all go out but the furnace, retaining that until its use becomes a discomfort.

We offer these suggestions to persons who have already moved into new houses, but of course it is much wiser not to enter a dwelling that is not thoroughly seasoned. In all cities, blocks of houses are constructed, of the flimsiest materials, in incredibly short spaces of time, for spring occupancy. Many of these have been frozen from top to bottom during the recent severe winter; and instead of the water drying out, it has remained in the walls in the condition of ice. In an ordinary three-story house, 30,000 gallons of water are absorbed by the brick and mortar used in the construction; and this immense quantity must all or nearly all be got rid of before they are safe as dwellings.

THE COMING ARCTIC EXPEDITIONS.

The arctic exploring expedition which has been projected by the English government, and which for some time past has been fitting out, will, it is stated, sail from England on or about the first of June. Two vessels, the *Alert* and the *Discovery*, commanded respectively by Captain Nares and Commander Markham, have been rebuilt so as to be immensely strong and fully capable of withstanding the severest ice nip. The sides are composed of three thick skins of solid oak, each five inches through, and iron girdled tiers of beams run all around the interior, which is finally lined with

a sheathing of plank covered with thick felt. Nothing which the most experienced arctic voyagers could suggest has been omitted in preparing the vessels for their arduous service, so that the failure, of the *Polaris* and of the other expeditions which were despatched in a condition far from that required by the exigencies of the undertaking, is not likely to be repeated.

The route to be followed is directly to Cape Farewell, the most southerly point of Greenland, thence to Cape Shackleton, in 74 degrees north latitude, and through the ice in Melville Bay to the open sea at Smith Sound. The *Alert* will push northward as far as possible, and then go into winter quarters, preparatory to sending out parties polewards in the spring. The *Discovery*, on the other hand, will not proceed beyond Newman's Bay, in 83 degrees north. Here she will winter, carry on such scientific observations as are possible, and be prepared to open up communications in the spring with the *Alert*, and also with a third ship, which will be sent out from England with fresh supplies and to bring back the news.

The total sum appropriated by Parliament for the expedition for the first year is \$493,100. The anticipated subsequent expenditure per annum is placed at \$65,000. From these figures it will be seen that the difficulties are to be grappled with in earnest, and with every aid which Science can suggest and ample appropriations procure. The *personnel* of the expedition is composed of officers and men who have already tasted the discomforts and privations of arctic life, and who, besides, will maintain that rigid military discipline, the absence of which contributed so greatly to the ill success of the unfortunate *Hall*.

This makes the thirty-third expedition sent in quest of the North Pole since 1848. The first ten were made by British sailing men of war; and the balance included merchant vessels and steamers, specially chartered from both the United States and England.

A Swedish expedition is also now being fitted out by a well known merchant named Dickson, of Gottenburgh. Professor Nordenskjöld will accompany it, and the start will be made from Tromsø early in June. The course proposed is by the western coast of Nova Zembla, and thence (from the most northerly point) north easterly, to explore this unknown portion of the polar basin.

PATENT LITIGATION IN ENGLAND AND THE UNITED STATES.

Under the present law of Great Britain, patents are granted to every applicant who chooses to pay the fees, without any official examination as to novelty. All the patents are printed, and the applicant, or his agent, makes his own examination, or none as he prefers.

Some people hold the theory that this plan of granting patents, without official examinations, must be bad, necessarily leading to many litigations, which would be avoided if the government were to examine, before granting the patent. But this theory is in practice, fallacious. Mr. W. Lloyd Wise, of London, in a recent paper on the subject, shows that the total number of common law and chancery cases litigated per annum in Great Britain is, in round numbers, 30,000, out of which only eight are patent cases.

In this country, by reason of our system of official examinations, we have a species of patent litigation totally unknown in England. As nearly as we can estimate, there are between ten and fifteen thousand cases annually, that are litigated, to a greater or less extent, before our Patent Office authorities. To search up answers to litigants, to cut down their claims, attend to hearings, write out and record decisions, and maintain the legal paraphernalia, necessary for the adjudication of our twenty thousand applications for patents yearly, gives employment to an army of five hundred officials, fed and supplied at a cost of about six hundred thousand dollars per annum. This represents only the government side of the litigations. On the opposite side the applicant must either appear in person, or employ a solicitor, and the aggregate amount of time, labor, and money thus spent, is quite large.

Having passed the ordeal of Patent Office litigation, the American patentee is then in the same situation as the English patentee, who went through no such operation: namely, both patentees have the privilege of litigating in the courts, where alone the validity of their patents can be finally settled.

DEADLY BALLOONING.

The names of Croce-Spinelli and Sivel, two of the most daring and successful of French aeronauts, are now to be added to the long list of those who have laid down their lives in the cause of Science. In company with M. Gaston Tissandier, they attempted to ascend to a higher altitude than had ever before been reached. At 29,000 feet elevation, all three men became unconscious. The balloon soared higher and higher and then descended. Tissandier regained his senses on reaching respirable air, to find his companions dead from suffocation.

This voyage which has resulted so disastrously was the second of two recently projected by the French Society of Aerial Navigation. During the first, which was safely accomplished, the balloon was kept aloft for twenty-three hours, and a number of interesting observations of natural phenomena of the atmosphere were obtained. The aeronauts, during the second ascension, were to test the atmosphere at the highest possible altitude, make experiments for carbonic acid, conduct spectroscopic observations, and in general to obtain scientific data relative to the upper aerial regions with greater accuracy than heretofore attained. Thus it was

believed possible, through the respiration of oxygen, to enable the investigators to exist in a highly attenuated atmosphere, a fact already apparently practically demonstrated by the previous ascension of Croce-Spinelli and Sivel to a height of 25,000 feet, described in these columns a year ago.

The balloon *Zenith* started on its voyage from Paris at 1 P. M., on April 15. It shot directly upward, reaching the height of 21,000 feet in a very few minutes. At this elevation Tissandier says: "My companions were pale; I felt weak, but inhaled a little of the gas, which somewhat revived me. We still ascended." In response to Sivel's request, he acquiesces in throwing out ballast, and three of the nine eighty-pound bags of sand were emptied. "All at once," he continues, "I found myself so feeble that I could not even turn my head. I wanted to exclaim 'we are at 8,000 yards,' but my tongue seemed paralyzed." Tissandier then faints—but revives and finds the balloon falling rapidly. Greatly alarmed, he arouses Sivel, who has fallen into a stupor, and the latter, seizing the respirator, inhales large quantities of oxygen. "Shall we go up?" exclaims Tissandier; "yes," replies Sivel, gaily, "and happy the one of us that returns." Sivel becomes intoxicated with repeated doses of oxygen, and in his exhilaration throws over the respirator, besides the ballast and a number of the instruments. Again the *Zenith* soars aloft, and Tissandier, as he lapses once more into stupor, reads from the barometer an altitude of 29,000 feet. Spinelli and Sivel, he states, were still conscious, though apparently incapable of any exertion. How high the air ship ascended will be known when the test barometers are examined by the French Society. When Tissandier awoke, two hours later, the balloon was falling at a fearful rate. He hurriedly cut away the grapnel and other articles which had escaped Sivel, checking the speed; and then, on attempting to rouse his companions, he found both stone dead, their blackened faces and blood-suffused mouths denoting their struggles against the suffocating atmosphere.

There is no definite period stated by the survivor at which he surmises the death of his comrades took place. Tissandier was the weakest, physically, of the three, and his loss of consciousness at an early period undoubtedly saved his life. Glaisher and Coxwell, at Wolverhampton, Eng., in 1862, ascended, according to the calculations of the former, to an altitude of 37,000 feet; but this record cannot be regarded as accurate, inasmuch as it was only by superhuman exertion that Coxwell was enabled to open the valve by pulling the line in his teeth, and both aeronauts had so far succumbed to the cold and rarefied air as to make their observations under such conditions not very reliable.

It is sad to chronicle that two such men as the deceased lost their lives fruitlessly, but we see no other conclusion. Their death does not fix the limit of human existence in the heights of the atmosphere, and the most that can be gained will be the indications of the test barometers, and the knowledge that the aeronauts died before the marking shown was made. The fact of a semi-delirious state being produced by the oxygen materially reduces the practical value of that gas as a life supporter in rarefied air, in cases where a person requires his wits about him. It certainly was of little use in the present instance, as its effects caused Sivel to throw overboard the apparatus—probably while deprived of self-control—and thus to abandon the only means of safety in the higher regions which, by lightening the balloon, it was his object to reach.

Les Mondes, in commenting on this unfortunate casualty, points out that the way of avoiding similar disasters in future is to render the means of respiration completely automatic. Either the aeronauts should have been provided with dresses similar to those of divers, or, as suggested by M. Toselli, the car of the balloon should be a metallic cylinder, perfectly airtight, into which, or into the dresses, a small pump, easily worked by hand, should force air until a constant pressure is obtained, sufficient to maintain life.

THE LAWS OF STORMS.

When the United States Signal Service was organized and first began to attract attention, it was claimed that any law respecting the motion and direction of wind and storms was clearly beyond the grasp of the human mind. But now, in all large cities and in many country towns, the "probabilities" and weather maps are eagerly scanned every morning, greatly to the advantage of all classes; and seamen closely watch the cautionary flags displayed—as occasion requires—from the frequent signal stations along our whole coast. They have learned the lesson of giving careful heed to these monitions. Though the whole work of the Signal Service is interesting as a fairy tale, we propose at present to call attention only to some of the deductions of Professor Loomis respecting storm laws. This savant commenced his investigations in 1872, and has reported his results at three several meetings of the National Academy of Sciences. The last was at the session of this learned body at Washington, which has just adjourned, and a report of whose proceedings will be found on another page.

It is now fully accepted that all storms are circular, and most of those reported by "Old Probabilities" extend over a space hundreds of miles in extent, and often a thousand or more. The storms are not only circular but rotary, and advance across the country at a rate varying from two or three hundred to much more than a thousand miles per day. Their average direction is a little north of east, and they seem to originate either in the northwestern part of the United States, if not in the Pacific Ocean, or in the vicinity of Texas and the Gulf of Mexico. Storms are not necessarily accompanied with rain; they may be only of wind, like the small whirlwinds we often see carrying around sand and leaves, yet, at the same time, they progress slowly forward. But

they are usually accompanied with rain, and the rain extends hundreds of miles (500 is the average) to the east of the storm center, but a much shorter distance to the west. The barometer, whose normal height is about 30 inches, is usually low at the center of these vast, advancing whirlwinds. We now proceed to notice the means by which these facts, and others to be mentioned, were deduced, and some of their suggested causes.

On the weather map, which the signal service of the United States army daily distributes, Professor Loomis divided the field covered by a storm into four quadrants, and noted the observed directions of the wind in each. He did the same on all the weather maps showing a position of the storm center suitable for his purpose. By taking a mean of all these observations, he found that winds blow in a circular direction; not, however, in the line of the tangent to a circle having its center at the eye of the storm, but directed inwards more than 45° from the tangent. Hence the wind's direction is more nearly central than tangential. Of course the currents, blowing in from all directions towards one central point, can escape only when moving upwards at the center. This makes a kind of suction at this point, which diminishes the weight of atmosphere and consequently lowers the barometer. When swift, rotating, upward currents of this kind occur on the ocean, they sometimes produce the waterspouts of which we read. The causes which produce this inward motion of the air currents must be looked for in those distant quarters where the storm originated. They may be due to the collision of moist air with some cold mountain peak. This would condense the moisture; the condensation would produce heat, which would expand and lighten the air; and then the heavier air on all sides would move towards this central point of diminished pressure. The air, heated by contact with the warm earth, takes up a large quantity of moisture; and then, on being carried up into colder regions, becomes condensed, and precipitates the moisture, thus showing us the cause of rain. The real center of a storm is probably one or two miles high at least; and from the average of a month's observations on the velocity of wind at the top of Mount Washington, compared with its velocity in neighboring places near the level of the sea, the Professor calculates that the velocity of wind at 6,000 feet high is five and a half times greater than at the sea level. The high currents, moving so much more rapidly than the base of the storm resting on the earth, would of course carry the ascending water-charged air forward. This gives a reason for the fact that the rain area is in advance of the storm center.

Professor Loomis also learned, by deductions from his tabulated data, that the more rapid the storm, the greater was the extent of rain area to the east of it; that the velocity of the storm increased more rapidly than the extension of the rain area; and that the direction of the storm for 24 hours was in general the same as the direction of the major axis of the rain oval for the preceding eight hours. The second of these facts seems to be a little anomalous, but the first and last are as we should expect them to be, because the velocity and direction of the most freely moving part of the storm should harmonize with the velocity and direction of the eastward upper air current, to which all parts of the storm, in the main, owe their motion. If the comparison had been made with the direction of the storm paths for the succeeding eight hours instead of twenty-four, the conclusions on the last point would probably have been still more satisfactory.

But the upper current is not the only cause of the eastward motion of the storm. The condensation which causes rain expands, by its heat, the air which rises and comes down outside of the rain area. Hence we have low barometer in front of the storm center, and the descending air behind makes it high there. So the center is not only drifted forward by the upper air currents from the west, but is pressed forward by the fact of a high barometer behind it and a low pressure before it. He also determined that the state of the barometer at the center, or its rate of fall in front, had little or nothing to do with the velocity of the storm's progress, but that the rate of rise behind it was directly proportioned to the velocity of the storm.

Again, he finds, by taking the mean of the velocities of wind in the four quadrants and comparing it with the storm's velocity, that, when the wind in the east quadrant has a greater average velocity than in the west, the storm moves faster than its mean rate, but slower when the wind's velocity in the west quadrant is the greatest. He explains this by supposing the upward movement would be greatest in the quadrant which had the greatest velocity of wind; then here would be the lowest barometer, and diminished pressure would tend to make the center move in this direction. Now if the excess of the wind's velocity in the west quadrant were sufficient, it might cause a westward instead of an eastward movement to the storm center. This movement has occurred several times, and caused the storm's path to make a loop upon itself. In one case the storm was made to change its direction more than 360° in a little over 24 hours. This explanation seems a little defective, for it apparently assumes a separate upward movement in each quadrant, whereas it is presumable that the rotary centripetal motion of the wind on all sides contributes to one grand upward movement in the center. Again it would seem that the greater velocity of a west wind would tend, by its superior momentum, to veer the central cylinder of ascending air to the east rather than to the west.

For making architectural ornaments in relief, a molding composition is formed of chalk, glue, and paper paste. Even statues have been made of this material.

IMPROVED CHISEL TOOTH SAW.

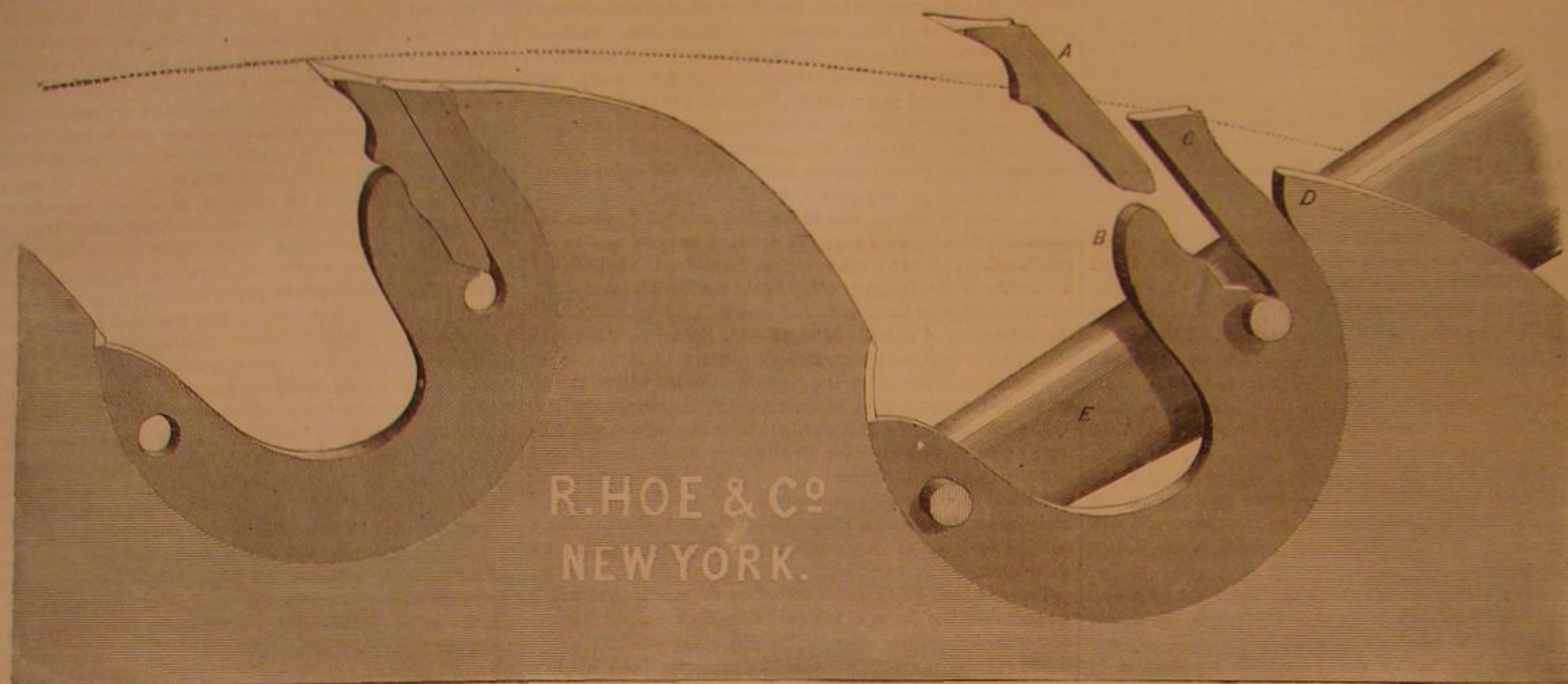
The engraving given herewith represents a new chisel tooth saw, in which the teeth are highly tempered bits of steel, about one inch and a quarter in length, confined securely in place without wedges. No filing is required to keep the teeth in order. They are capable, we are informed, of cutting 45,000 feet of timber at an expense of not over three cents per thousand, and require no expert work to replace or keep them in order.

The mode of removing and inserting the teeth is shown on the right of the illustration. E is the wrench, which is

will always be in communication with the passages, D or E, corresponding with the end of the stroke at which the piston, P P', may be. H is a passage communicating with the interior of the main cylinder, and terminating in an annulus or ring opening in the middle of the exhaust, C. With the parts in the position shown in the engraving, steam is admitted into the steam chest, N, and will pass through the passage, F, and force the piston, P P', from left to right, until the part, P, passes the passage, D; and then the steam will pass through D to K, and force the valve piston, A A', from right to left, carrying with it the slide valve, B. Before the

Collodion.

The physical properties of films of collodion (such as one obtains after pouring collodion on clean glass and letting it dry) having been recently studied by M. Gripon (*Comptes Rendus*). The separated membrane reflects light like glass, and polarizes it both by reflection and by transmission. The index of refraction is 1.5108, a little less than that of crown glass; and with a thickness of 0.00039 inch, the membrane allows the passage of a considerable proportion of radiant heat; but it is less diathermanous the lower the temperature of the source. One may make polarizing piles of collodion



HOE'S CHISEL TOOTH SAW

applied to the shank and turned forward sufficiently to relieve the jaw, C, which will open and allow the tooth to come out. In the act of turning in, the projection on the inner edge of the jaw, B, closes into the depression in the front of the tooth, holding the latter thus firmly.

The first trial of this saw took place during the competitive tests conducted during the Cincinnati Exposition of last fall. The diameter of the tool was 56 inches; teeth, 36; gages 5 eye, 7 teeth, and 2 kerf. An oak log, 16x16, was to be divided into 12 boards, and a poplar log, 20x20, into 16 boards.

The following is the record of the saw: For oak—revolutions, 602; feed, 2½; time, 1m. 58s.; number of perfect boards, 12; horse power indicated, 98.82; square feet of lumber per minute, 90; percentage of power used, 0.720. For poplar—revolutions, 605; feed, 3½; time, 2m. 45s.; perfect boards, 8; imperfect, 8; horse power, 114.73; square feet of lumber per minute, 109.1; percentage of power used, 0.689.

From the table showing the performances of this and other saws, which will be found in another column, the chisel tooth appears to be the only one which cuts a whole log into perfect boards. The tool was patented May 19, 1874, and is manufactured by Messrs. R. Hoe & Co, 504 Grand street, of this city, who may be addressed for further particulars.

ENGINE VALVE MOTION.

Our engraving represents an improved method of operating the slide valves of reciprocating engines, the construction of which will be clearly understood from the annexed engravings.

Fig. 1 is a longitudinal vertical section of Fig. 2, taken on the line x x. Fig. 2 is a plan view of the main cylinder with the valve chest removed, showing the steam passages and valve ports of the engine.

M is the cylinder, having steam passages, F and G, exhaust passage, C, and valve, B, as in ordinary engines. N is the steam chest, which is accurately bored out, having two pistons, A and A', accurately fitted to the same. W and O are two collars on the rod which connects the two pistons, A A', which form a yoke for the slide valve, B. D is a passage which communicates with the interior of the main cylinder. At the right hand this passage communicates with the small cylinder at K. F is a passage communicating with the main cylinder and with the left hand end of the small cylinder at L. I is one of a number of grooves cut in the main piston between the parts marked P P'. The number of these grooves is such that one or more

piston, A A', moves from right to left, the left hand end of the small cylinder, at L, is full of steam, which has a tendency to resist the movement of the piston in that direction. The escape of this steam is through the passage, L E, and groove, I, in the main piston, to passage, H. The slide valve, B, will open the passage, G, communicating with the steam chest, and also open the passage, F, with the exhaust, C. The passage, H, terminates in an annulus in the center of the exhaust, C, as before stated. Now, the high tension of the exhaust steam will induce a draft or current through H,

(serving for either heat or light). They are much more transparent than the piles of mica which are usually employed in study of heat; and, if more fragile, are easily renewed.

Enlarging of Photo Negatives.

Among the various methods of enlarging, either suggested or carried into practical operation, that explained by Mr. V. Blanchard, at a recent meeting of the London Photographic Society, is received with much favor.

For a small negative an enlarged transparency on glass is obtained by the collodion process in the usual manner. The enlarged transparency is to be fully exposed, so as to possess every bit of detail existing in the small negative; and it must be a strong one, to permit its being used as a cliché in the printing frame. If there be any spots or defects, the pencil or brush may be used freely in removing them.

Here, then, we have obtained an enlarged, intense transparency. The next step is to place this in the printing frame in contact with a sheet of ordinary sensitized paper, either plain or albumenized. A paper very slightly albumenized is found to give the most pleasing results. When this is exposed to the light, the image printed upon the paper is not a positive but a negative, owing to a transparency being used as the cliché.

The printing must be carried very deep; this is of importance both as serving to secure all the detail, and also because of the lowering of the image by the subsequent operations. Fixing in hyposulphite of soda follows, the toning being omitted for obvious reasons.

The paper negative, which is the result of these operations, possesses a fine red color, which is very non-actinic and favorable to the production of bold, vigorous prints. But as paper is dense and stops much light, it is desirable, if not necessary, to impart to it some degree of translucence, for which

purpose the negative is laid upon a hot plate or other surface, and is rubbed with white wax, which melts, fills up the pores of, and renders translucent, the negative thus treated the superfluous wax being removed by blotting paper.

A negative prepared in this manner is now ready to be used in the printing frame for the production of positive proofs, and from the fact that this new negative is upon paper, the opportunity is afforded to those so inclined to touch or work it up in a much easier way than could be effected upon a glass negative. Proofs printed from a paper negative of this kind possess the qualities characteristic of the fine calotypes.

Fig. 1.

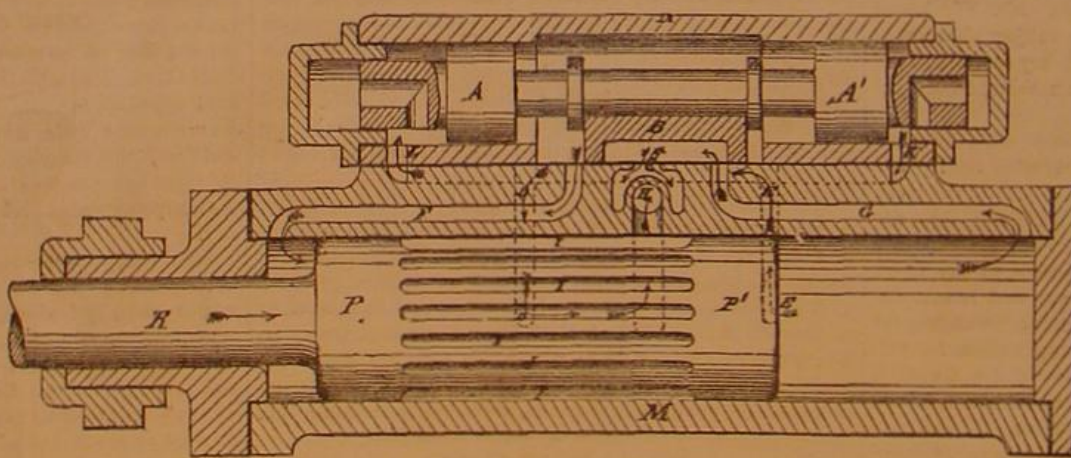
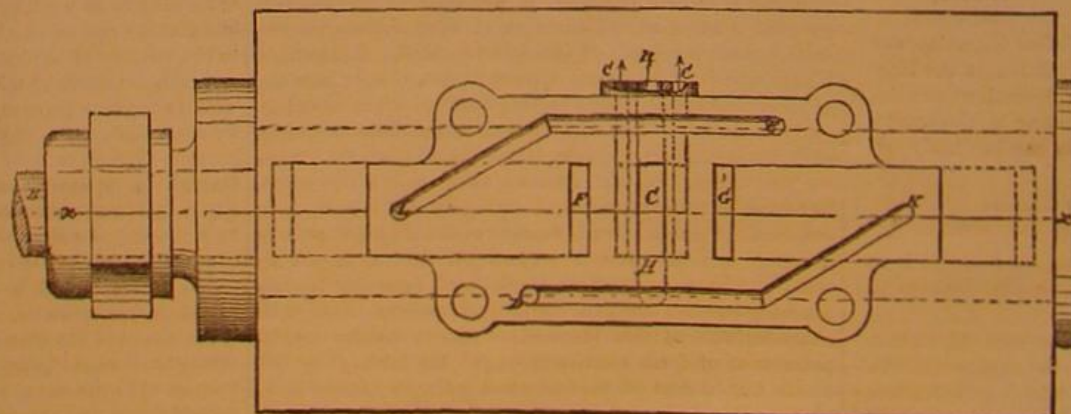


Fig. 2.



ENGINE VALVE MOTION.

which will assist the exhausting of the steam from either end of the pistons, A A'. When this is effected the parts will be in a position to move from right to left in a similar manner.

Patented November 17, 1874, through the Scientific American Patent Agency, to James Brandon and Albert W. Trankle, New York city.

Amateurs or others who use hand lathes will find that the chattering of the hand tool may be stopped by placing a piece of leather between the tool and the rest.

IMPROVED ATTACHMENT FOR INJECTORS.

Injectors of almost any form are liable to uncertainty of action, after becoming heated; as, for example, when, after a stoppage, steam is let on to start the apparatus before it has cooled. There are other conditions, the inventor of the device below states, under which an injector is also likely to fail, and thus to imperil the boiler; but all such difficulties, he considers, are effectually avoided by the novel attachment represented in the illustration.

The apparatus is to be attached in the discharge pipe and between the nozzle of any injector and the boiler, and it consists of a lateral tube, A, introduced between the nozzle and a check valve, B, to the pipe which leads to the boiler. In the tube, A, sectional view, Fig. 1, is placed a valve, C, the stem of which passes through guides, and which is held open by a spiral spring when the steam is shut off, and the pressure thus removed. On the admission of steam, and as soon as the pressure of the same becomes greater than the power of the spring, the valve, C, closes. The steam, being thus prevented from escaping, opens the check valve, B, and passes into the boiler. The object of the check valve, placed between the overflow and boiler, is to shut off the boiler pressure from the overflow. If desired, the spring on valve, C, can be dispensed with and the same worked by hand.

A perspective view of the device is represented in Fig. 2. It requires no skill for its operation, as it is entirely automatic. With any injector, we are informed, it will lift hot water or feed under pressure. It is also claimed to obviate entirely the use of the pump. The simplicity of the invention is obvious, and its practical efficiency, it is stated, has been thoroughly proven by experience. It is now in successful use at the works of the Lehigh Zinc Company, Bethlehem, Pa., the Bethlehem Iron Works, Coleraine Iron Works, Redington, Pa., and in various other localities.

Patented through the Scientific American Patent Agency, February 9, 1875. For further particulars address the inventor, Mr. David Lees, or S. C. Stewart, Tyrone Forges, Blair county, Pa.

STEWART'S IMPROVED STOVE DAMPER.

From the engraving of the device herewith presented, it will be observed that the means used for closing more or less the interior of the pipe consists in double plates, instead of the single plate commonly employed. The double in-



clines thus formed, it is claimed, oppose the draft with less abruptness than the single plate damper, and besides may be more tightly closed than the latter.

The two plates, A, are pivoted separately, and are arranged so that they meet and close in the middle for shutting the damper. The pivots are geared together outside the pipe by segmental wheels, B, so that both are worked simultaneously by the same handle. When partially open, the plates incline upward toward the middle opening in a way which facilitates the draft, by directing it to the center of the pipe.

Patented April 6, 1875, through the Scientific American Patent Agency, to Dr. Jacob Stewart, of Moline, Rock Island county, Ill., who may be addressed for further particulars.

Amalgamation of Battery Zincs.

The simplest and quickest method is that of M. Berjot (a chemist at Caen), which consists in immersing the zinc in a liquid composed of nitrate of mercury and hydrochloric acid. A few moments is sufficient for the complete amalgamation of the zinc, however soiled its surface may be. With a quart of this liquid, which costs less than 50 cents, 150

zincs can be amalgamated. The liquid should be prepared in this manner:—Dissolve in warm water 200 grains of mercury in 1,000 grains of aqua regia (nitric acid one part, hydrochloric acid three parts). When the mercury is dissolved, add 1000 grains of hydrochloric acid.

The Galvanic Battery.

In regard to the economical application of electricity, no subject is so important as the relative merits of different forms of batteries. For illuminating purposes and lecture demonstration, we have hitherto had to rely upon the Bunsen or Grove battery. But, during the siege of Paris, a form of bichromate of potash battery, known as the Chutaux battery, was frequently employed to yield the electric light used on the ramparts. Count Moncel gives a full account of

Fig. 1

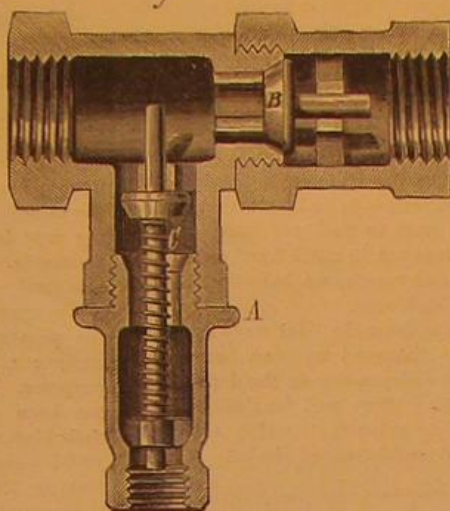
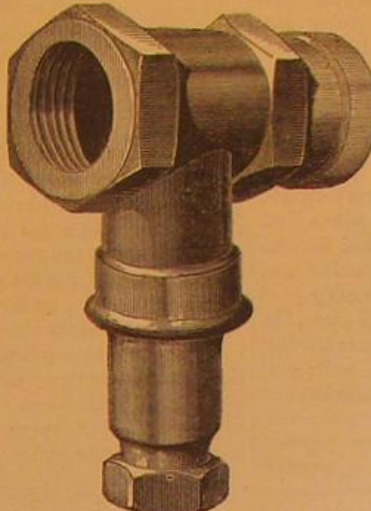


Fig. 2



LEES' ATTACHMENT TO INJECTORS

different forms of the Chutaux battery, and furnishes some interesting data for the comparison of the Chutaux and Bunsen battery when giving the electric light. The following results were obtained from the two batteries, each being composed of 48 cells, and each working for two hours:

BUNSEN'S BATTERY.			
At beginning.	End.	Mean.	Surface of zinc employed.
109	66	87.5	318.61 square inches.
Carcel lamps.			

CHUTAUZ BATTERY.			
At beginning.	End.	Mean.	Surface of zinc employed.
132	63	97.5	92.88 square inches.
Carcel lamps.			

In working each of these batteries, for half an hour successively, the following results were found:

	BUNSEN.	CHUTAUZ.
	Light equal to	
1st period of half an hour.....	109 Carcel lamps.	132 lamps.
2nd period of half an hour.....	Beginning 134 lamps. 128 "	End 137 " 100 "
3rd period of half an hour. ...	Beginning 108 " 80 "	End 97 " 51 "
4th period of half an hour... ..	End 66 " 63 "	

According to these figures, the bichromate of potash battery flags much quicker than the nitric acid battery, a fact which evidently depends on the polarisation of its plates, to which it is always liable. It is, however, more economical.

One rather important advantage of these batteries is that they can be kept in a closed place without giving out any odor or unhealthy emanation; besides this, the liquid evaporates slowly. The author had also been able to verify the statement that, after a battery had been charged for more than a year, and then left alone, it had hardly lost anything of its power. The relative consumption of zinc and acid, and the comparative cost of working of the whole battery, are not given; but so far as the foregoing data are concerned, the Chutaux evidently promises extremely well. So says the *Telegraphic Journal*. For lecture purposes, an electric light is rarely wanted for more than half an hour, the great desideratum being a rapid means of charging and discharging the battery. In this respect nothing could be better than the Chutaux; being a single fluid battery, the plates can be raised and lowered easily and rapidly. One of the characteristics of this bichromate battery is the constant percolation of fresh solution through the battery; by this means a good deal of the bad effect of polarisation is got rid of. Here is the composition of the solution for his batteries, recommended by M. Chutaux: Water, 1,500 grains; bichromate of potash, 100 grains; bisulphate of mercury, 50 grains; sulphuric acid, 200 grains. The electromotive force of such a cell is at first more than twice that of a Daniell cell, but in duration it cannot, of course, be favorably compared.

The cost of working the Chutaux, Count du Moncel finds to be about 35 cents, which he states is less than that of a Daniell cell, the advantage being that in the Chutaux an electromotive force of nearly double is obtained, and an internal resistance less than half that of the Daniell, besides other obvious advantages noticeable in the working of the two forms. A battery of 24 Chutaux cells, according to our author, can furnish a rarely brilliant electric light at a cost of about 15 cents per hour. If this be the case, the Chutaux

battery will rapidly come into use for the purposes of lecture demonstration.

The Lightning Rod Man.

He drove his team close up to the fence, got down, and rapped at the door. The widow Gilkens opened it, when he said: "Mrs. Gilkens, I am cognizant of the circumstances by which you are at present surrounded, left as you are to trudge down the journey of life through a cold and heartless world—no longer sustained and encouraged by the noble one to whom you gave the treasures of your heart's affection, and bowed down by the manifold cares and responsibilities incidental to the rearing of eight small children on forty acres of sub-carboniferous limestone land; yet, Mrs. Gilkens, you are aware that the season is now approaching when dark, dismal, dangerous clouds at frequent intervals, span the canopy of heaven; and when zigzag streaks of electricity dart promiscuously hither and thither, rendering this habitation unsafe for yourself and those dear little ones; hence, therefore, let me sell you a copper wire, silver tipped, and highly magnetic lightning rod."

The woman staggered back a few paces and yelled: "Narcis! unfasten old Cronch!" In another instant a savage bulldog came darting round the corner of the house with bristles up, thirsting for gore. The dog had already mangled a machine agent and a patent soap man, and was held in great esteem by the better class of citizens for his courage and service; but when his eye met the hard, penetrating gaze of Mr. Parsons, his chops fell, and he slinked off and hid in the currant bushes. Then the man said: "My dear lady, you seem to be a little excited. Now, if you will allow me to explain the probably inestimable—"

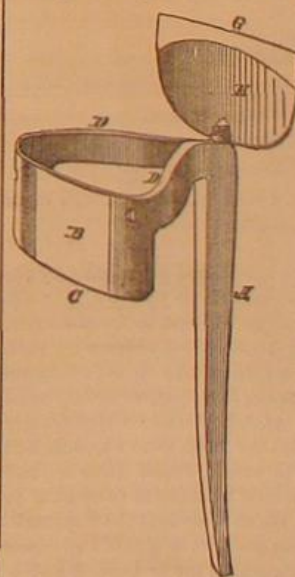
"Dern ye, I know what will start ye," said Mrs. Gilkens, as she reached under some bed clothing, and brought forth a horse pistol; but owing to the shattered condition of

her nerves, her aim was unsteady, and the charge of buck-shot missed save where a few scattered ones struck his cheek and glanced off. A hard metallic smile spread over his countenance, as he leaned his shoulders against the door frame, and again commenced: "My dear madam, such spasmodic manifestations of your disinclination to make a judicious investment of a few paltry dollars—"

"Hi—eo!" shrieked the widow, and collapsed into a kind of jerking swoon, and before she had recovered a highly magnetic lightning rod decorated her humble domicile, and Parsons had the blank note filled out already for her signature.—*Madison (Ind.) Courier.*

IMPROVED TURPENTINE TOOL.

In gathering turpentine, it is necessary to have a tool for



scraping the tree downwards, and one for pushing upwards. Mr. Walter Watson, of Fayetteville, N. C., has recently patented, through the Scientific American Patent Agency, an implement which combines the two appliances, as shown in the engraving. The shank, A, is to be inserted into a handle of any convenient length. B is the scraper, the edge, C, of which is sharp. The arms, D D, are made so strong that the pressure on the edge, C, may not deflect them from the horizontal position. The blade, E, has a sharp edge at G, and is attached to the shank, A, by the enlargement, F. By using one or the other of

these blades, any globules of resinous matter which exude from the bark of the tree can readily be detached.

Steam Transportation on the Canals.

As soon as the Erie canal opens, the Baxter Steam Canal Boat Company will resume operations with twelve boats, each having a carrying capacity of about 225 tons. Contracts have been made for the construction of six additional boats, which are expected to be ready for use in July. When these boats are built, it is the purpose of the Company to send one from this city daily. It is believed that fifteen days will be the average time consumed by each boat in making the trip from New York to Buffalo and return, not including the time occupied in loading. Improvements have been made in construction by which space is gained fore and aft, but no attempt has been made to secure greater speed. As the canal is occupied by boats drawn by horses, the steamers must run carefully to avoid collisions.

The following method is used in Germany for the preservation of wood: Mix 40 parts chalk, 50 resin, 4 linseed oil, melting them together in an iron pot; then add one part of native oxide of copper and afterward 1 part of sulphuric acid. Apply with a brush. When dry, this varnish is as hard as stone.

The Cincinnati Circular Saw Test.

During the Industrial Exposition held in Cincinnati last fall, a competitive trial between the circular saws of nine well known makers took place. The contest was briefly alluded to by us at the time; and since its occurrence, we have noted the fact that the prize offered, namely \$100 in gold, was carried off by the solid-toothed saw made by Messrs. Emerson, Ford & Co., of Beaver Falls, Pa. The results obtained, owing to the thorough manner in which the competition was conducted, were very complete. We find them in tabulated form in the official report of the jurors, and reproduce them below, not doubting but what they will be of much interest to woodworkers generally.

The saws were of a uniform diameter of 56 inches, and each was required to cut a poplar log, 20 x 20 inches, and an oak log, 16 x 16 inches, and to make from each timber, respectively, 16 and 12 boards; or in other words, to saw through 300 and 176 square feet of lumber.

It will be observed from the annexed table that the competition was exceedingly close, and that the winning saw was narrowly pressed by the Hoe planer tooth tool. Comparing the times, the Hoe was but one second behind on the poplar log, and fifteen seconds on the oak log; but on the other hand, the Emerson had the advantage of slightly more revolutions, and in one case a faster feed. The Hoe furthermore produced twelve perfect oak boards, and in this respect stands ahead of any saw on the list. Taking results through, however, the award of the prize to the Emerson was a just one, but substantially the distinction between it and the Hoe saw is so small as to amount to nothing in practical use. There is no doubt but that both saws are exceptionally good tools; perhaps we may say each is the best of its class, the Emerson of the solid-toothed, the Hoe of the planer-toothed implements. At all events, both did admirably well; and for this reason, both are entitled to the best consideration of the public.

The following is the table above alluded to

CONTESTANTS IN THE TRIAL OF SAWS AT THE CINCINNATI EXPOSITION, 1874.										Kind of Wood.			Diam. of Saw.	Revolutions per Minute.	No. of Teeth.	GAUGE.			Size of Log.	No. of Boards.	Time.	Square feet of Lumber.	Horse Power Indicated.	Feed.	Perfect Boards.	Imperfect.	Square feet lumber per minute.	Percent. of power used.	
															Eye.	Teeth.	Kerf.												
2.	E. Andrews	Poplar	56	648	40	5	7	3	20x20	16	2.53	300	95.48	33	16	105.8	775												
1.	E. Andrews	Oak	56	690	40	5	7	3	16x16	12	2.05	176	111.98	24	12	104	789												
1.	Hogan & Sowden	Poplar	56	600	42	7	11	7	20x20	16	2.50	300	100.68	24	14	84	592												
3.	I. W. Baldrige & Co.	Poplar	56	640	48	8	9	4	20x20	16	2.53	300	99.23	24	14	104	655												
3.	I. W. Baldrige & Co.	Oak	56	690	48	8	9	4	16x16	12	2.03	176	118.62	24	8	85.8	966												
4.	American Saw Co.	Poplar	56	634	40	6	8	3	20x20	16	2.31	300	104.95	33	13	119.5	576												
4.	American Saw Co.	Oak	56	638	40	6	8	3	16x16	12	2.02	176	97.66	24	6	86.5	743												
5.	Emerson, Ford & Co.	Poplar	56	615	50	6	7	3	20x20	16	2.44	300	120.16	33	12	109.7	718												
5.	Emerson, Ford & Co.	Oak	56	610	50	6	7	3	16x16	12	1.43	176	121.63	33	10	102.5	778												
6.	Woodbridge & McParlin	Poplar	56	656	40	7	8	5	20x20	16	2.34	300	117.33	33	14	91.3	694												
6.	Woodbridge & McParlin	Oak	56	696	40	7	8	5	16x16	12	1.45	176	109.49	33	11	71.8	745												
5.	Emerson Planer Tooth	Poplar	56	590	34	7	8	3	20x20	16	3.17	300	112.89	24	4	116.9	643												
5.	Emerson Planer Tooth	Oak	56	632	34	7	8	3	16x16	12	2.27	176	114.34	24	12	100.5	1000												
7.	R. Hoe & Co., Solid Tooth	Poplar	56	519	36	5	8	2	20x20	16	2.09	300	112.18	44	8	159.5	527												
7.	R. Hoe & Co., Chisel Tooth	Poplar	56	605	36	5	7	2	20x20	16	2.45	300	114.73	33	8	109.1	659												
7.	R. Hoe & Co., Chisel Tooth	Oak	56	602	36	5	7	2	16x16	12	1.58	176	98.82	24	12	90	720												
8.	James Ohlen	Poplar	56	634	30	6	7	3	20x20	16	2.53	300	102.5	44	8	104	648												
8.	James Ohlen	Oak	56	638	30	6	7	3	16x16	12	1.59	176	112.12	33	4	88.8	850												
9.	Curtis & Co.	Poplar	56	681	50	8	10	6	20x20	16	2.51	300	84.24	33	16	105.2	507												
9.	Curtis & Co.	Oak	56	680	50	8	10	6	16x16	12	2.30	176	101.42	24	2	70.4	945												

Correspondence.

The Cause of the Tides.

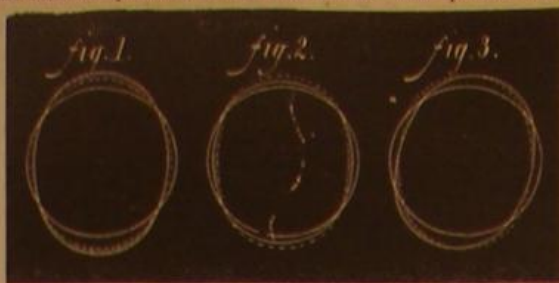
To the Editor of the Scientific American:

On page 273 of your current volume, Professor S. H. Trowbridge inquires into the cause of tides. I will try to disperse his doubts in as few words as the subject will admit of.

It is beyond doubt that tides are caused principally by the action of the moon, as their periods keep pace with the apparent motion of the moon, and have done so for centuries. We know that the earth and moon are attracted by each other; and on the other hand, we know that these two bodies are not approaching. There must, therefore, evidently exist another force which balances the attraction. It is generally said that the moon rotates round the earth once a month, but in reality both moon and earth rotate round their mutual center of gravity. By this peculiar rotation, a force akin to centrifugal force is produced, which prevents the approaching of the two bodies. Now we see that there are two forces acting between earth and moon, which are in perfect equilibrium in the centers of either of the two bodies. But the attractive force is greater in those parts of the earth that are nearer the moon, and causes an upheaval of water on that side. On the opposite side of the earth the contrary is the case, namely, the attraction towards the moon is less than in the center of the earth, and that force, which keeps moon and earth apart, gets the overhand and causes an upheaval of water on that side also. The tidal wave produced by the moon must, therefore, be necessarily a double one. The wave caused by the sun is double for the same reason. On the side of the earth nearest the sun the attraction is greater, and on the opposite side the centrifugal force, caused by the orbital motion of the earth, is gaining on the diminished attraction.

A tidal wave caused by the moon alone would have the shape shown by dotted line in Fig. 1 (greatly exaggerated in dimension, of course). If now the sun and moon form a straight line with the earth, no matter whether on the same or on opposite sides, the solar wave will be produced in addition to the lunar wave; and the real tide is shown in the diagram, where the additional solar tide is cross-lined. We see that spring tides are produced in both cases. When, however, sun and moon are in quadrature, the solar flood will be on the lunar ebb, and the solar ebb on the lunar flood, as indicated in Fig. 2. A glance will show that the results are

not four floods a day, as your correspondent supposed, but merely a diminution of the lunar tide. When the sun and moon form an angle of 45°, or 135°, or any other oblique angle, the solar wave is on one side of the lunar wave, causing, as it were, an inclination of the resulting wave, which may be in advance or in rear of the lunar wave, according to the relative position of sun and moon. The period of the



high tide is, therefore, subject to slight variations; but the mean duration coincides mathematically with the mean apparent motion of the moon.

The height of the wave is in proportion to the depth of the sea, or to the quantity of water exposed to the tidal influences.

The velocity of a wave must not be confounded with the velocity of the transmitter of the wave. The height of the tidal wave is so small in comparison to its length that the motion of the transmitter is next to nothing, comparatively speaking, and it can therefore not do much harm in dashing upon the shore. For the same reason, we have no means of observing the wave on the high seas.

The tidal influence tends to draw the tidal wave round the earth at a rate of about one thousand miles an hour, while the natural velocity of waves (depending on the depth of the sea) is considerably less. The effect will be similar to that of ringing a bell by pulling at intervals which are not in harmony with the period of oscillation of the bell. Such a

motion will be very irregular, and will be nearly nil at times. The original tidal wave, transmitted with the greater velocity, will interfere with the naturally transmitted tidal waves from other portions of the same sea; and as this interference is of a purely local character, it will be easily understood how it happens that, on some shores, the tidal wave does not exceed 2 or 3 feet, while on others, where the interfering waves meet each other, the tide may rise even to a height of 30 or 40 feet.

The water of the English Channel is very shallow, and therefore the original tidal wave is very small. However, the reaction of the tide of the deeper Atlantic produces a wave in the channel which progresses towards the east and reaches the North German coast more than 12 hours after its origination. This and other similar facts are not in the least in opposition to the present theory, which the most careful criticism only confirms.

Philadelphia, Pa.

Salicylic Acid.

To the Editor of the Scientific American:

Your very well written and explicit account of salicylic acid, appearing in a recent number of the SCIENTIFIC AMERICAN, leaves but little to be said upon that subject. However, the statement that salicylic acid has not yet been experimented with in contagious maladies will admit of modification. Almost the first experiments ever made with this acid were made by myself, in Leipsic, at the time of its discovery by the learned Kolbe, who requested me to make such experiments and report them to him. They are briefly as follows (see *The Lancet*, London, November 28, 1874): Taking two vessels, a portion of the defections of a patient suffering with violent intestinal catarrh (there being no cholera then) was left in each; into the one was thrown two drachms salicylic acid, into the other nothing. A microscopic examination afterwards revealed parasites (*leptothrix* and *infusoria*) in the second, while the first remained entirely free from organic matter. Salicylic acid also eradicates the urate of ammonia from urine. It is, in the crude state, a salmon-colored glistening powder, and it is used in this form to disinfect vaults and cesspools.

It has been urged against this acid that it is not so easily soluble as carbolic acid; but the trifling delay may be overcome by the addition of one part of the phosphate of soda, which makes the solution perfect at once, and does not in any manner affect its disinfecting agency. When thrown in spray from the atomizer, it does not evaporate like carbolic

acid. It is of great value in certain forms of venereal diseases, which, according to the last developments, are of parasitical nature.

The first specimens of salicylic acid ever brought to America were brought here by me in June last, and given to Professor N. R. Smith of this city, and to the Academy of Medicine in Ohio, who adopted it (on trial) into their hospital; they afterwards published my investigations and their report, edited by Professor Orr, in *The Clinic* of November 7, 1874.

The first article ever written upon the use of salicylic acid as a disinfectant was written by myself in Leipsic in May, 1874 (*Cholera Asiatica*, published under the auspices of the Medical Board, afterwards translated into English for the *Baltimore Gazette* of July 10, 1874).

My object in thus particularizing is to present my claim to having introduced salicylic acid into this country. I hope you will do me the justice to insert this.

GEO. HALSTED BOYLAND, M.A., M.D.

Maryland Academy of Sciences.

American Steel Manufacture.

To the Editor of the Scientific American:

We notice in your paper of May 8, 1875, an article entitled "The Recent Remarkable Progress in the Steel Industry," which, we think, does us an injustice, unintentional, no doubt; but at the same time, we think you ought to correct the same. You say "the Port Henry product yields seventy per cent in the furnace, and the deposit is seeming inexhaustible. The ore, however, is not capable of being smelted into steel."

The remark is correct as applied to our Old Bed ore; but the person furnishing you with information overlooks entirely our New Bed ore, which is used for Bessemer steel purposes. The whole supply, nearly, for the last four years, has been used by Messrs. Witherbees and Fletchers, in their blast furnace, for making pig iron, all or nearly all of which was sold to Messrs. John A. Griswold & Co., of Troy, for making Bessemer steel. Witherbees & Fletchers shipped them about 3,000 tons of the same in this present winter and spring. The Cedar Port Iron Company of this place have a new blast furnace nearly ready to blow in; and they expect to use this same ore for making iron for Bessemer purposes.

WITHERBEES, SHERMAN & Co.

Port Henry, N. Y.

To the Editor of the Scientific American:

In an article in your issue of May 8, you speak of the Crown Point ore "from which steel can be at once produced, without admixture of other ores." By this the reader will understand that the pig iron from the Crown Point ore is of a quality that, by itself, will make first quality Bessemer steel.

We believe that you will, by inquiry, find that this is not correct; and while the Crown Point iron can be and is used for Bessemer steel, it is with a mixture of other irons which are lower in phosphorus and sulphur. The furnace at Crown Point is allowed a maximum limit, in its pig iron, of 0.35 per cent of phosphorus, and 0.23 per cent of sulphur, proportions which are not admissible in Bessemer steel irons without an admixture of other irons which will bring down the average of phosphorus and sulphur.

Cleveland, Ohio.

H. B. TUTTLE.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

Mr. F. W. Clarke, of Cincinnati, Ohio, was appointed, at the last meeting of the above named society, to make an effort to obtain a full attendance of chemists, manufacturers, and others interested in the progress of chemical science, a subsection of the Association being especially and permanently devoted to that science and its branches. He asks us to state that the next meeting will be held at Detroit, Mich., commencing on August 11.

RECENT ASTRONOMICAL DISCOVERIES.

The first calculations based on the data obtained by the transit of Venus observations have been announced by Pirseux. The solar parallax determined is 8.879 seconds, data noted by the French observing party at Pekin being used.

A telegram from the English eclipse expedition at Bangkok, Siam, announces success in photographing the spectrum of the chromosphere, during the recent solar eclipse. Eight good pictures of the corona were taken.

The discovery of another small planet, No. 144, has been made by Perrotin of Marseilles.

FAULTS OF CONSTRUCTION IN BATTERY CONTACTS.

Emile Girouard points out that one great obstacle in the way of our obtaining cheap electricity lies in the defect of the contacts. The rivets which connect the zinc to the carbon are often ill made; and after having been in use for some time, they are corroded all round, and the oxidation prevents the contact from being perfect. The current, consequently, is unable to pass, unless the tension is considerable enough to overcome the bad conductivity of the oxides. The author proposes to obviate these defects by having all connections, etc., made of platinum.

O. E. W. says: "The SCIENTIFIC AMERICAN is now in its thirtieth year; and during the entire time, I have scarcely missed reading a dozen numbers of it. All that you claim for it and much more is true; it cannot be excelled, and no other paper of its kind equals it. I want to thank you now for the thousand useful things that I have gathered from it, and I hope that its pages may never be less."

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXIII.

ROUGHING OUT.

Our work, being countersunk, is now ready to be turned down to nearly the required size all over, before any one part is made to the finished size. The reasons for doing this are as follows: Upon the outside skin of all metal work, a tension is produced. In wrought iron and other forged work, this is caused by the working of the metal by the blacksmith, or, to a lesser degree, by the rolling mill, if the metal has been rolled. In iron, brass, or other castings, it is produced by unequal cooling after the metal has been cast, especially if the casting has been allowed to cool rapidly, as, for instance, when the casting has been taken from the mold, as is commonly the case, while at a red heat. The effect of blows delivered upon forged work by the blacksmith's tools, is not only greater upon the exterior than upon the interior of the metal, but is greatest upon that part of the forging which receives the most working, and upon that part which is at the lowest temperature during the finishing process: because the blows delivered during the finishing process are lighter than those during the earlier stages of the forging, and hence their effects do not penetrate so deeply into the body of the metal. Then again, on that part of the metal which is coolest, the effects of the light hammering do not penetrate so deeply; and from these combined causes, the tension is not equally distributed over the whole surface of the forging, and hence its removal, by cutting away the outer surface of any one part, and thus releasing the tension of that part, alters the form of the whole body, which does not, therefore, assume its normal shape until the outer skin of its whole surface has been removed. While the metal is at about an even heat all over, and is above a red heat, the effect of working the metal by forging it is simply to improve its texture, to close the grain, and thus to better its quality, especially toward and at its outer surface; but as the tension commences, while and after the metal loses its redness, it is an excellent plan, after forging anything of irregular shape, to heat it all over to a low red heat, and to then lightly file its surface so as to remove any protruding scale; then allow it to cool of itself, without any forging being performed upon it at that heat. This process will nearly, if not entirely, remove the tension created by the forging.

The tension upon the outer skin of castings is greatest upon that side or face which has the greatest area in proportion to its length and breadth, providing that the conditions under which its cooling takes place are practically equal at all parts, or, on the other hand, is greatest upon the part which cools the most rapidly, and is in all cases greater upon iron castings than upon forgings. It is so great in the former as to form the most important of all considerations in determining the order of procedure in getting up cast iron work, especially if it be slight in body in proportion to its dimensions, or of irregular shape. But even in massive bodies its effects are great, as may be instanced in the casting of cannon. A few years ago, when the cooling of castings received less attention than it does at present, it was found that a cast iron cannon made of more than a certain thickness gained nothing in strength by reason of the increase of thickness, because the contraction of the metal, from cooling unequally, caused it to fracture; and it was not until the introduction of the Rodman method of compensating by artificial means for the tendency to cool more rapidly in one part than another (by assisting the cooling of the one part and by retarding the cooling of the other) that cast iron cannon of a larger size than those known as sixty-nine pounders were possible of manufacture. In ordinary workshop practice, the effect of tension upon castings is most experienced in piston rings and slide valves. As to piston rings, the matter has been fully treated upon in a former chapter; and we will now treat of its effect upon slide valves, and clearly demonstrate the practical importance of the subject.

FACING SLIDE VALVES AND SEATS.

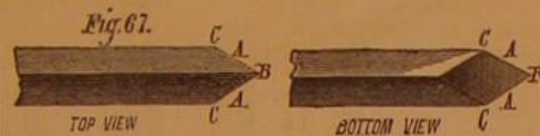
There are two methods employed by which to bed slide valves to their seats: one is to surface the flat face and the edges of the valve in a planer, and then to scrape up the flat face to fit the cylinder face, which has first been scraped up to a surface plate; and the other is to leave the planer tool marks upon the valve seat or cylinder face, and then to surface the valve face in a planer, holding it in such a position that the planer tool marks upon the valve face will cross those on the cylinder face when the valve is placed in position, and to put it in without any further surfacing than that performed by the planer. It is admitted that the valve will move more easily, and the surfaces will be in a better condition to wear smoothly, when the surfaces are true and scraped than when the tool marks are left upon them; but if, after the engine has run for a day, the valves are taken out and examined, it is very often found that the scraped surface of the valve is no longer true and does not fit to its seat, and that, although the surface of the planed valve is not true, it fits more closely to its seat than does the valve which has been scraped. The omission of the scraping is only justified upon the plea that the valve in that case beds more readily to its seat. The explanation of this anomaly is that, when the valve becomes heated, the tension upon its back area becomes partially relieved; hence the shape of the whole valve alters, and it retains this alteration of shape when cold, and at all times when subject to a temperature less than that of the steam or other medium through which it was heated. If, however, it is subjected to a higher temperature, the alteration of its form will, in nearly all cases, take place to a greater degree. The direction in which this

warping occurs depends upon the inequality of the thickness of the valve in its various parts (it being always thicker in one part than in another), and upon the evenness with which it was allowed to cool after being cast.

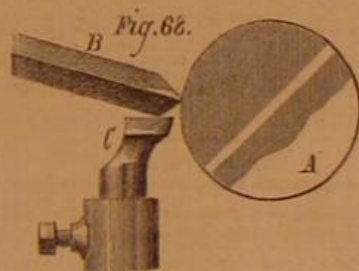
A valve whose face is scraped up very true will show any alteration of form much more plainly than one which has been merely surfaced with a planer; and the amount of surface in contact with the seat being proportionately large, it does not wear away so readily. Then, on the other hand, the valve and seat, whose surfaces have been only planed, bear or fit together merely upon the tops of the planer marks, and the consequence is that, when under steam, the whole pressure of the steam upon the back of the valve is sustained by a comparatively very small area of metal, which, therefore, abrades and wears quickly away, and thus permits the valve to bed itself, despite the alteration in the shape of the valve. To remedy this defect, the valve (or other casting) should, after it has been planed, be heated to the temperature at which it will be heated when it is in practical operation, and should be scraped to its seat so soon as it is cool enough to handle, after which it will remain true. From what has been said, the importance (in work which requires to be kept very true) of roughing the work out all over before any one part is finished will be obvious, since the breaking of the skin in any one part releases the tension on that part, whatever be the temperature it is under when in operation. It is not practicable, on lathe work, to at all times rough the work out all over before finishing any part; but in our present operation, of turning down a plain piece of iron held between the lathe centers, we are enabled to pursue that course, and we will therefore commence the roughing-out process with a graver.

THE GRAVER.

is formed by grinding the end of a piece of square steel at an angle to the main body, as shown in Fig. 67, A being in

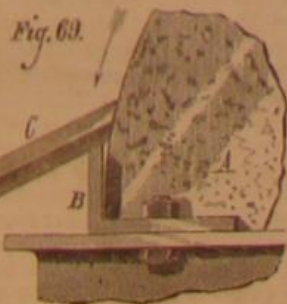


each case a cutting edge, B, the point, and C, in each instance, a heel of the tool. The graver is the most useful of all hand tools used upon metals. It can be applied to either rough out or finish steel, wrought iron, cast iron, brass, copper, or other metal, and will turn work to almost any desired shape. Held with a heel pressed firmly against the



hand rest (the point being used to cut, as shown in Fig. 68, A being the work, B, the graver, and C, the lathe rest), it turns very true and cuts easily and freely. This, therefore, is the position in which it is held to rough out the work.

The heel of the graver, which rests upon the hand rest, should be pressed firmly to the rest, so as to serve as a fulcrum and at the same time as a pivotal point upon which it may turn to follow up the cut as it proceeds. The cutting point of the graver is held at first as much as convenient towards the dead center, the handle in which the graver is fixed being held lightly by both hands, and slightly resolved from the right towards the left, at the same time that the handle is moved bodily from the left towards the right. By this combination of the two movements, if properly performed, the point of the graver will move in a line parallel to the centers of the lathe, because, while the twisting of the graver handle causes the graver point to move away from the center of the diameter of the work, the moving of the handle bodily from left to right causes the point of the graver to approach the center of that diameter; hence the one movement counteracts the other, producing a parallel movement, and at the same time enables the graver point to follow up the cut, using the heel as a pivotal fulcrum and hence obviating the necessity of an inconveniently frequent moving of the heel of the tool along the rest. The most desirable range of these two movements will be very readily observed by the operator, because an excess in either of them destroys the efficacy of the heel of the graver as a fulcrum, and gives it less power to cut, and the operator has less control of the tool.



The handle in which the graver is held should be sufficiently long to enable the operator to grasp it with both hands and thus to hold it steadily, even though the work may run very much out of true. For use on wrought iron, the flat

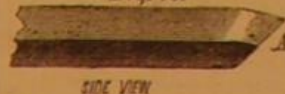
sides of the graver should not be ground upon the stone, the end only being ground, in the position shown in Fig. 69, A being the grindstone, running in the direction of the arrow, B, the tool rest, and C, the graver.

To cut smoothly, as is required in finishing work, the graver is held as shown in Fig. 70, C being the work. The edge on the end of the graver and between the corners, A and B, of the graver, performs the cutting operation.

By holding the graver in the positions described, and in various modifications of the same, the work may obviously be turned parallel, with either round edges, curves, or square shoulders, and it is possible to turn almost any shape with this one tool. For finishing curves, however, the end of the graver (the cutting edge, on the end and between the curves, A and B, in Fig. 70) should be rounded. Even parallel work should be finished by being filed with a smooth file while the lathe is running at a high speed. As little as possible should, however, be left for the file to do, because it cuts the softer veins of the metal more readily than the rest, and therefore makes the work out of true.

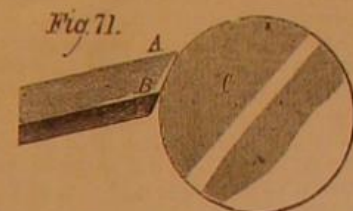
For use on brass and other soft metals, the two top flat sides of the graver should be ground away, as shown in Fig. 71, A being the cutting edge for that side. The strain on

Fig. 70.



SIDE VIEW

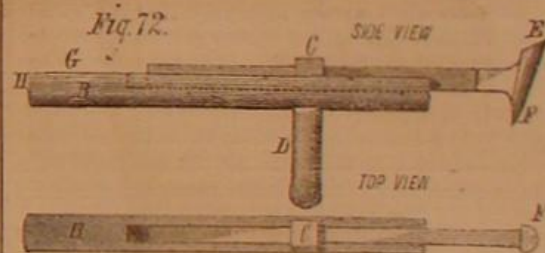
Fig. 71.



the tool, when cutting soft metals, is comparatively slight, so that the graver is rarely applied to such metals in the position shown in Fig. 68.

THE HEEL TOOL.

In those exceptional cases in which, for want of a lathe having a slide rest, it becomes necessary to perform comparatively heavy work in a hand lathe, the heel tool should be employed. This tool was formerly held in great repute, but has become less useful by reason of the advent and universal application of the slide rest. It is an excellent one for roughing work out, and will take a very heavy cut for a hand tool, because of the great leverage it possesses, by reason of its shape and handles, over the work. A heel tool is shown in Fig. 72, A being the tool, which is a piece of square



bar steel forged at the end to form the cutting edge. The body of the square part is held (in a groove formed in the wooden handle, B) by an iron strap, C, which is tightened by screwing up the under handle, D, which contains a nut into which the spindle of the strap, C, is screwed as the handle, D, is revolved. The heel, F, of the tool is tapered, so that it will firmly grip the face of the lathe rest, the cutting edge, E, being rounded as shown above. The tool is held by grasping the handle, B, at about the point, G, with the left hand, and by holding the under handle, D, in the right hand, the extreme end, H, of the handle being placed firmly against the right shoulder of the operator. The heel, F, of the tool must be placed directly under the part of the work it is intended to turn, the cutting edge, E, of the tool being kept up to the cut by using the handle, D, as a lever and the heel, F, of the tool as a fulcrum. Not much lateral movement must, however, be allowed to the cutting edge of the tool to make it follow the cut, as it will get completely beyond the manipulator's control and rip into the work. Until some knowledge of the use of this tool has been acquired, it is better not to forge the top of the cutting edge, E, too high from the body of the tool; since the lower it is, the easier the tool is to handle.

The heel tool should, like the graver, be hardened right out; but in dipping it, allow the heel, F, to be a little the softer by plunging the end, E, into the water about half way to F; and then, after holding it in that position for about four seconds, immerse the heel, F, also. After again holding the tool still for about six seconds, withdraw it from the water and hold it until the water has dried off the point, E; dip the tool again, and quickly withdraw it, repeating this latter part of the operation until the tool is quite cold. The object of the transient dippings is to prevent the junction of the hard and soft metal from being a narrow strip of metal, in which case the tool is very liable to break at that junction. The tool should be so placed in the handle that there is only sufficient room between the cutting edge and the end of the handle to well clear the lathe rest, and should be so held that the handle stands with the end, H, raised slightly above a horizontal position, the necessary rake being given by the angle of the top face, at E. It is only applicable to wrought iron and steel; but for use on those metals, especially the latter, it is a superior and valuable hand tool.

IMPROVED SKEIN SETTER.

The machine represented in the engraving is claimed to turn an axle to a pattern so as to make a perfect fit, the axle being produced in the exact form or shape of the inside of the skein or pattern used. At the same time the proper pitch is given to the wheels, all four of which are placed in a plumb spoke, this being necessary to secure an easily running wagon. The apparatus also gives any gather required.

In preparing axles for the machine, it is necessary, first, to chop off the corners as far back as the skein reaches on the axle. It is not needed to lay off the axle, as the machine does this part of the work itself. The skein is next laid in the clamps as shown, and one end of the bar, A, having a friction roller attached, is then placed inside of the skein or pattern, B. The bar is then moved back to the bottom of the skein or pattern, by turning the crank wheel, which is represented on the side of the frame. The axle is now placed between the clamping flanges, which are loosened or tightened by the right and left hand screw, represented in the engraving as holding the axle in position; and the machine is started by pulling the handle, which is attached to a lever in connection with a friction clutch, which works inside of the rim of the driving pulley, C. By means of a feed screw, the sliding frame cylinder and bar, with the knife attached at D, are fed upon the axle until the friction roller comes outside of the skein or pattern. The machine is then stopped by its own mechanism, and cannot be again started until the skein is removed from the clamps and another skein is substituted in its place for turning the opposite end of the axle. When the work is completed, the skein or pattern will fit the wood, it is stated, with perfect accuracy throughout the length turned. The time necessary for fitting the skeins for sixty-five wagons is said to be ten hours, and for fitting the ends of wagon poles, used by agricultural shops, is one minute per pole.

The manufacturers submit a number of testimonials from parties having the machine in use, in which its working is spoken of in the highest terms. They also refer to Messrs. Studebaker Bros., of South Bend, Ind., Brown Manufacturing Company, of Zanesville, Ohio, and a number of other firms employing the invention. The device is the subject of several patents, the latest dated August 18, 1874. For further particulars address the Union Foundry and Machine Works, Mansfield, Ohio.

IMPROVED YARN SPOOLER.

Two machines, one for winding yarn and the other for knitting, both of improved construction and possessing many valuable advantages, have already been described in these columns as manufactured by Mr. C. Tompkins, of Troy, N. Y. We now add a third device, by the same maker, regarding which but little explanation supplementary to the engraving is needed, as its uses, as well as its simple construction, will doubtless be obvious. Its object is to wind skein yarn upon spools for the sewing machine, and it is intended principally for hosiery manufacturers who color their yarn and match the goods. The pulleys are leather-faced; and the jaws, which hold the wire on which the spools turn, are hinged and made heavy enough to cause the spools to move with the pulley face. The machine is mounted on legs, so as to be independent of bench room. It is automatic, only requiring the attendant to keep the ends tied; the reels are light and adjustable to different sized skeins. It is also calculated to save the delay caused to the sewing machine user by spools irregularly wound, and the vexatious breaking of sewing machine needles from the same cause; and it saves time in getting the skein thread on to the spools. The manipulation of the machine is a very simple matter, a child being usually competent to attend it.

Further particulars regarding the invention may be obtained by addressing the manufacturer, as above.

A GOOD lacquer for philosophical instruments is composed of alcohol 8 ounces, gum gutta 3 ounces, gum sandarac 8 ounces, gum elemi 8 ounces, dragon's blood 4 ounces, seed lac 4 ounces, terra merita 3 ounces, saffron 8 grains, and pulverized glass 12 ounces.

Recovery of Salt Soils.

Along the Mediterranean coast of France, there are vast surfaces of ground that are entirely unproductive. The soil, however, which is of rich alluvium, contains the principles of a vigorous vegetation; but the presence of marine salt renders it quite sterile. M. Joannon states that he has succeeded in overcoming this pernicious feature in the following simple way: The land is first drained, and dug up to a great depth (about 20 inches), then covered with fresh water. The water filters through and dissolves the salt, which flows off by the drains. This process is maintained with continuous immersion for three to five months, and the

most of the surface; and (in contrariety to the latter) they have great tension, but small magnetic moment. Suppose, now, the austral pole of a magnet to approach. While it is still distant, it is subject to the predominating effect of the boreal layers of the bar, and is attracted. But when brought quite near the extremity, the austral points gain the predominance and there is repulsion; thus matching Galileo's mysterious stone (which, somehow or other, got lost).

Utilization of Power.

Mr. F. J. Bramwell said in his annual address to the Institution of Mechanical Engineers: "Do we, in our applica-

tions of power, make as much use of wind, water, and waves as we ought, remembering that their power may be transmitted to a distance? Do we resort, to any large extent, to sources of power in Nature other than coal? Is it not the fact that mechanical invention has gone back in these matters rather than forward? And do we utilize that primary source of power, the heat of the sun, the current heat from year to year, making the most of barren hill-sides, as it seems to me we might do, by planting quick-growing trees, which, fostered and matured by the sun, would yield large quantities of wood to be used as fuel for domestic purposes? Are we estimating at their full value the deposits of peat, and are we not tempted to pass by this large store of fuel because its use is attended with difficulties? Is it not true that we use coal in the

IMPROVED SKEIN SETTING MACHINE

ground is then suitable for agriculture. The general practice of this method, he says, would reclaim for France a whole department of fertile land.

Curious Magnet.

In the year 1607 Galileo wrote to a friend about a wonderful magnetic stone, one property of which was that the same pole would both attract and repel the same piece of iron. At a distance of four or five finger lengths, it attracted the piece, but at a distance of one finger length it repelled it. He found, on examination, that the piece of iron was magnetized steel. In a note to the French Academy, M. Jamin says he is able to produce the phenomenon in a quite intelligible way. He magnetizes a bar to saturation with a cur-

most grossly wasteful manner? How much of the fuel goes up the chimneys of our furnaces unconsumed, in the form of visible carbon, or in the worse, because less readily detected, form of invisible carbonic oxide? In the face of such faults and errors, Mr. Bramwell argues that it is the duty of mechanical engineers, "by precept, practice, and example, to do all that lies in their power to cause all to respect and understand the value of that which they have too long lightly treated and grossly abused."

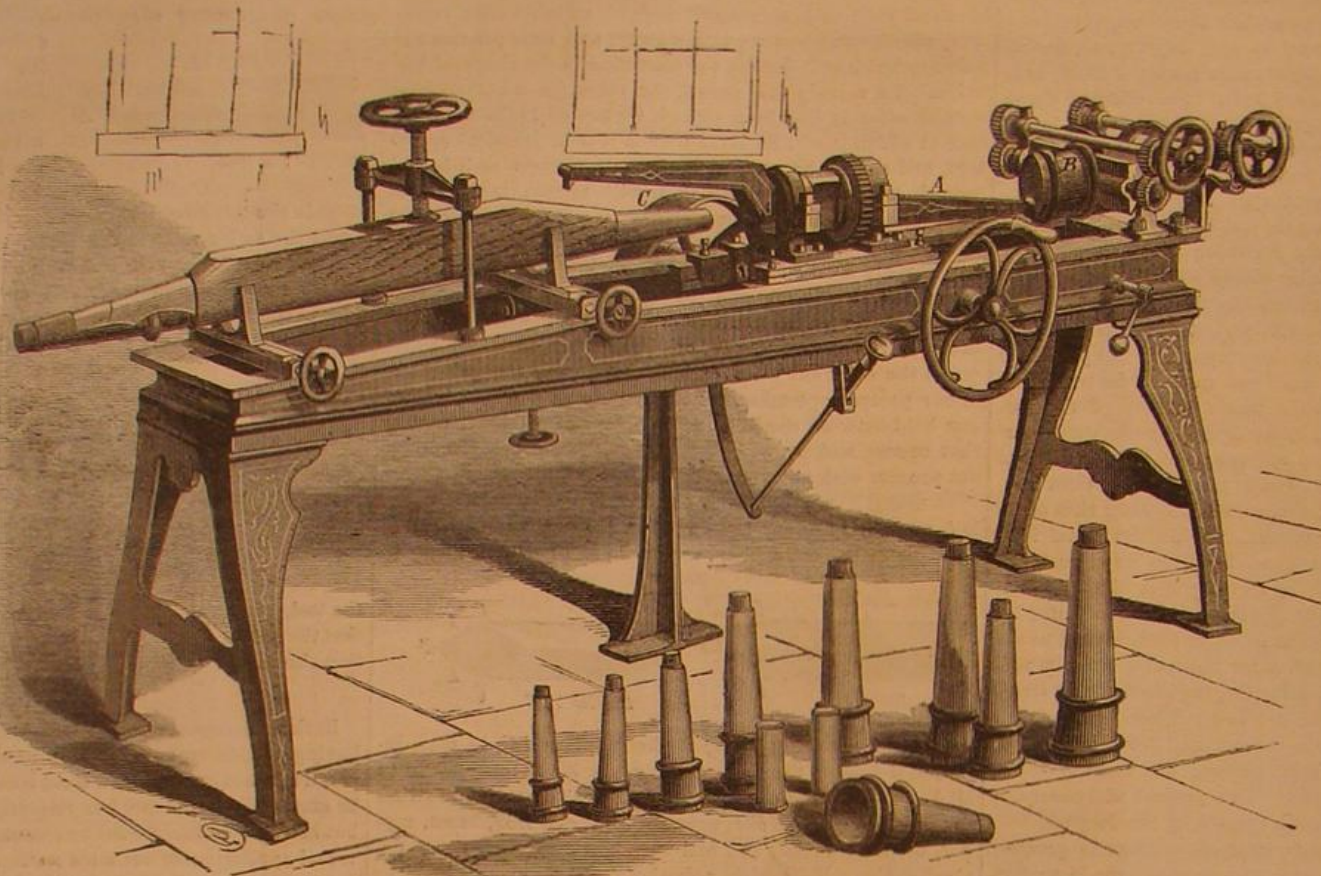
The Use of the Mosquito.

Apropos to our article in answer to an inquiring correspondent on the uses of the bedbug, here is something which imparts a value to the winged nuisance which aids and abets the aforesaid crawling individual in his Macbeth-like efforts toward murdering sleep. Dr. Samuel W. Francis says that it is his "firm conviction that the mosquito was created for the purpose of driving man out of the malarial districts," and "that no region where chills and fever prevail can be free from the pest." "Now," he adds, "if man will not go after the warning is given in humming accents, then the mosquito injects hypodermically a little liquid which answers two purposes—first, to render the blood thin enough to be drawn up through its tube, and second, to inject that which possesses the principles of quinine."

The difficulty with this roseate view of the mosquito family is that it imposes upon the propounder the necessity of explaining why it is that, in hundreds of perfectly healthy localities, the insects appear in swarms, also why the females alone have been constituted the biters, to the exclusion of the males, and why, if the fluid in the proboscis possesses quinine properties, it has been known to cause ugly ulcers. We do not propose to accept Dr. Francis' theory so hastily. We decline to admit that the mosquitoes are of any use save to the birds and the bats, to the inventors of patent mosquito bars, to that enterprising Yankee who devised an astonishing machine for capturing them in immense quantities and converting them into manure, and to Professor Mayer, who found out that they hear with their antennae.

THE expensive part of the Daniells' battery is the copper plate, the cost of which can be reduced two thirds in the following manner: Procure sheets of the ordinary sheet tin of commerce, brighten, and plunge into a very weak copper-plating solution, in connection with a voltaic battery of a very low quantity. In fifteen minutes a tenacious film of copper will have been deposited on the tin, and the plate can then be bent into shape and used in the ordinary manner.

A SILVERING powder for coating copper consists of nitrat^o of silver 30 grains, common salt 30 grains, cream of tartar 34 drachms. Mix, moisten with water, and apply.



TOMPKINS' YARN SPOOLER.

rent producing (say) austral magnetism. Then with an inverse current he communicates the certain amount of boreal magnetism, less than the austral, and leaving some of it in the deeper parts. Then he dissolves the steel with acid, which gradually removes the boreal layers, and ere long discloses the austral. Now, the latter are not disclosed equally all over; they make their first appearance at the extremity, on the edges and corners, the boreal layers still occupying

THE SCORPION FLY.

The return of warm weather and the awakening of the insect world are usually simultaneous; and our farmers and gardeners are on the alert, ready for battle against their puny but powerful enemies. The enormous fecundity of insects is, however, somewhat offset by the great appetite for mutual destruction which characterizes many species; and some of the most pestiferous of them are useful, as they frequently destroy myriads of creatures against which human ingenuity can avail little. The scorpion fly, which we herewith illustrate, while in its larval state burrows under the surface of the earth, and is supposed, with apparent reason, to prey on the roots of plants; but no sooner does it develop into a fly than it becomes carnivorous, rapaciously devouring any live insect that it can catch. Its appearance reminds us of the dragon fly; and although it is not so murderous as that celebrated marauder, it does good by destroying the leaf-rolling caterpillars which destroy the foliage (and the vitality) of so many currant and gooseberry bushes, depositing their eggs in the curled-up leaves, and so enabling their offspring to defy hellebore, salt, and other foes to their peace.

History carries back the name of scorpion fly to the days of Aristotle, who fancied these insects were winged scorpions of diminutive size. The joints of the abdomen do suggest a comparison between the two. Other observers have seen a resemblance between the shape of the head (in one species at least) and that of the horse. We miss the brilliancy and lustrous beauty of the eyes so observable in the dragon flies; but yet these organs are keen enough in the scorpion fly tribe. The wings are gauzy, as in the dragon flies, and spotted with shades of gray and brown, while the forceps at the tail of the male fly indicates another resemblance; this is said to have strength to pierce the human skin, but we incline to doubt this. The females, unlike the dragon flies, have an ovipositor or egg placer, rendered necessary by the mode in which the eggs are deposited; otherwise they are equipped as are their partners, and they subsist in the same manner. The legs of these insects, to which allusion has already been made, are well worth looking at under a moderate magnifying power, as they are surrounded with finely cut spines arranged in rings; while the knee joints are fringed and spurred, and the extremity of the foot bears toothed claws, which have been compared to those with which some spiders are furnished.

The larvae of the scorpion flies are cylindrical in shape, studded with tubercles, and with short fore legs; the head, somewhat flattened, facilitates the burrowing operations that are essential in their mode of life. Having reached maturity, each one scoops out for itself a cell, and there becomes a singularly squat pupa, exhibiting not much resemblance to the perfect insect that is to appear from it. It should be noticed that, if one of these flies is laid hold of, it executes such contortions that some persons are alarmed and speedily let it go.

THE DEATH'S HEAD MOTH.

Among the *lepidoptera*, an order which includes the butterflies and moths, the tribe of *sphinxina* is in many ways remarkable. Its specific title is derived from sphinx, and is attributable to a habit of the larva, of sitting with the head and forepart of the body raised, in some resemblance to the well known recumbent images of ancient Egypt. The hawk moth is one of the largest species of this order.

Another and well known member of the tribe is the death's head moth, dark brown in color, variegated with yellow, which has on the back of the thorax a deep orange mark, bearing considerable resemblance in shape to a human skull. This was once regarded as ominous, and the appearance of many of the moths was taken for a warning of an approaching pestilence. The omen is certainly portentous, but only to the potatoes, the larva being very fond of the plant; and the pupae are frequently turned up in digging potato grounds. The moths are very fond of honey, and will invade beehives to obtain it: yet the bees are not known to attack them, being apparently scared by the intruders, who emit plaintive squeaks when any one tries to interfere with their proceedings. Our engraving gives an accurate representation of this singular caterpillar, which has always been an interesting study to naturalists, and is evidently not unimportant to agriculturists and gardeners.

The Snapper Telegraph Sounder.

A little instrument is sold in the streets of New York city for 25 cents, for facilitating instruction and practice in telegraph manipulation. It consists of a little strip of ribbon steel mounted at one end in a soft metal block, indented in the middle by a hammer and punch, and fitted at the other end with a brass tip. By pressing down the spring a dis-

inct snapping sound is produced, which is repeated when the spring is allowed to resume its normal position. With the aid of this instrument—which is sufficiently portable to be carried in the waistcoat pocket—conversation can be carried on between persons initiated in the use of the Morse sounder.

Tyre Rolls.

M. Dallar, an engineer of Dusseldorf, has made a new arrangement for rolling tyres. The rolls are on vertical axes. The smooth faced roll, which corresponds with the inner face of the tyre, is mounted on a vertical arbor, which receives its movement through bevel wheels from a horizontal



METAMORPHOSES OF THE SCORPION FLY.

main arbor turned by a twin steam engine, of which the following are the principal dimensions, etc.: Diameter of cylinder, 10 inches; stroke, 36 inches; steam pressure, 8 lbs.; revolutions per minute, 70. The profile rolls are three in number, the first reducing the tyre after it has been forged under the steam hammer, and the two others completing the work. An arrangement like that adopted in lathes allows of giving two distinct movements to the three rolls, a longitudinal movement to bring the roll up against the tyre, and a transverse movement to bring each of the three in succession into action. The last movement is made by hand with the aid of a screw to which a wheel is attached, the transverse carriage bearing the three rolls being thus made to slide on the great carriage which has the longitudinal movement.



LARVA OF THE DEATH'S HEAD MOTH.

This latter is mounted somewhat after the fashion of a slide rest on the lathe beds, and its movement is effected by hydraulic pressure brought to bear upon two pistons fixed to the carriages which enter cylinders fixed to the bed. One piston and cylinder, much larger than the other pair, serve to bring up the roll and press it against the tyre, while the smaller piston and cylinder are powerful enough to withdraw it. When the roll is not working, the carriage may be moved by means of a rack and pinion worked by hand. The

apparatus is completed by two pulleys turned so as to serve as guides to the tyre, and the position of which is regulated by a hand wheel and screw.

When large tyres are to be rolled, the number of these guide wheels is increased. A horizontal roll also supports the tyre. The apparatus is said to do its work perfectly.

The Royal Society Soiree.

The recent annual soiree of the President of the Royal Society was very brilliant and successful. The Royal Society's apartments consist of five noble rooms on the upper floor and two on the ground, and in each a sufficiency of novelties were displayed. In the first were some models, interest in which was at once excited by their simple labels. One of them was a model of Valour's pile driving machine, used in the construction of the old Westminster Bridge, which was built in 1739 and following years; the other was the original machine, constructed by Heathcote in 1808, which had the effect of reducing the price of bobbin net lace from five guineas a yard to five pence; apropos of which a quotation from Lord Bacon was given on the card: "For upon every invention of value we erect a statue to the inventor, and give him a liberal and honorable reward." In this room two of the prettiest and most instructive experiments were shown by Professor Barrett, namely, the lengthening of a bar of soft iron within a helix of wire by heat; the other the remarkable and anomalous changes which take place in the heating and cooling of iron wire. Thus, while the iron is first heating there is a sudden contraction or cooling. And so again, when the heat is cut off, the wire cools a little, and then suddenly reheats and glows, afterwards quietly passing down to a blackness. Now, the notable points of these jerks or changes are that the iron, in the first instance, loses its magnetism, and in the last jerk or oscillation regains it. In the second room some simple delicate radiometers were shown by Mr. Crookes. These consisted of a glass stem supporting a little four-bladed windmill, carrying four disks, one on each end of the four slender glass rays. These work horizontally, supported by a steel point on a small topaz, and the radiation of light from a common candle at some distance away suffices to make them rotate with great liveliness, in vacuo in a small glass globe. In the fourth room was a working model of Sir David Salomons' system of automatic railway signaling. Each engine is supposed to carry

a battery and electric bell, and beneath it two metal wheels, insulated from each other, and pressing down on a signal line of small rails laid on the center of the sleepers. These central signal lines are double, and are laid in block lengths, one being a front signal line, the other a back signal line. On arriving at the termination of one block and the commencement of the next, one wheel will roll on the front signal line, while the other will roll on the back signal line, but at other places the left hand wheel will be free. Now one wire of the battery and one from the bell are taken to earth by being simply attached to the engine, the current passing through the ordinary rails of the permanent way. If, then, while a train was on one of the blocks, another train came on the same block, the bell on the engine of the following train would ring—a sufficient warning to stop and avoid danger. In the principal library, on the table beside the model of the fine telegraph ship Faraday, Mr. Siemens exhibited some large fragments of rock which had been dredged up in 1,400 fathoms, from the ocean depths, in the laying of the United States cable. Sir William Thomson's tide-calculating machines, in the same apartment, however, bore the palm of the exhibition. By means of the first one, observation of the rise and fall of the tide is made daily from the shore, and the facts so accumulated are the constants, and form the basis for setting the second or calculating machine, in which a continuous wire passes over a series of wheels placed at various distances, the result being that of harmonic motion of different periods and epochs, by which the year's facts can be ground out by turning a hand wheel, and recorded on the paper-carrying drum.

Novel Steam Launch.

During the last few days some interesting experiments have been made with a steam launch belonging to Sir Gilbert Clayton East. The boat itself is not new, having been built some four years ago by Messrs. Forrest, of Limehouse, and then fitted with engines for driving twin screws by Messrs. John Penn & Sons, the eminent marine engineers of Greenwich. Her owner, however, finding that the two propellers were constantly becoming entangled with weeds, applied a short time ago to Messrs. Penn to supply him with a new engine to drive a single screw, as less liable to that inconvenience. In order to make more cabin accommodation Sir Gilbert East gave directions that the engines should be fitted very far back in the stern—so far back, indeed, as to render the application of an ordinary launch engine impossible—and at the suggestion of Messrs. Penn he decided to

make use of a new engine recently patented by Mr. P. W. Willans (a gentleman connected with Messrs. Penn's factory), which could be easily placed in the limited space in the stern. The work connected with the fitting of this engine on board the boat has just been completed.

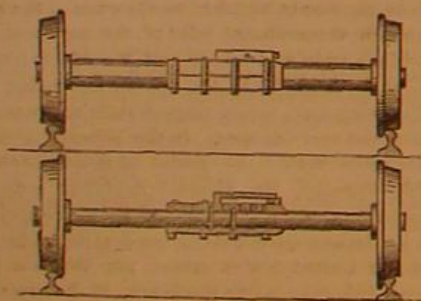
Mr. Willans' engine is constructed with three cylinders, and the only working parts are three pistons, three connecting rods, and a three-throw crank axle; these are enclosed in a cast iron casing, so that nothing can be seen of the engine itself except the two ends of the axle which appear through the casing. The cylinders are placed side by side; and it is by a system of ports which connect the cylinders one with the other, together with a peculiar construction of piston, that the piston of one cylinder acts as the slide, and admits to the next or third cylinder. All these ports meet in a three-way cock, and by turning this cock the direction of the steam is altered, and the engine is stopped or reversed with marvelous rapidity. It will thus be seen that all slides, eccentrics, link motion, and other complicated reversing gear are done away with; there is no exposed machinery to catch the dresses of people passing, no oil and grease flying about, and none of the other disadvantages which make steam engines in small boats so disagreeable. Besides this, the engine is so simple that it is completely under the control of any one, and is so compact that it can be lifted in or out of the boat by two men; two men can also take it to pieces, examine every part, and put it together again in less than an hour. The steam acts on one side of the piston only, and as the pressure is always downwards the engine is perfectly noiseless. By means of a very simple arrangement the engine is made to work expansively, and cuts off at $\frac{1}{2}$ of its stroke. Though in this particular case more than 380 revolutions per minute are not required, yet an engine of the kind has been constructed to make 1,000 revolutions; and at these great speeds, by allowing a small quantity of oil to remain in the bottom of the casing, the lubrication of the working parts is perfect, and such a thing as a hot bearing is unknown. The diameter of the cylinders of the engine under notice is 7 inches, the stroke being the same; and with 90 lbs. of steam and 380 revolutions, the indicator cards showed a little under 40 horse power. The weight of the engine by itself is 7 cwt.

No reliable trials of the speed of this boat have yet been made, but she steamed from Limehouse to Erith, a distance of thirteen miles, the other day, in 75 minutes against a slack tide. As the mean draft of the boat is $\frac{1}{2}$ greater than it was with the old engine, in consequence of the additions to the cabins, and as the trim of the boat is considerably altered, it would be scarcely fair to draw a comparison between the speed with the twin screws and with the new engine. Many engineers of eminence have inspected the engine at work, and have expressed themselves greatly pleased with its arrangement and performance. The length of the boat is 50 feet, beam 7'4". The engine was made for Mr. Willans by Messrs. Tangye, of Birmingham; and Messrs. Penn supplied and fitted the boiler, propeller, shafting, and all other gear.—*Iron*.

CAR AXLES AND COUPLINGS.

We continue below our series of extracts from Mr. E. H. Knight's "Mechanical Dictionary,"* selecting for the present paper a variety of interesting engravings of car axles, and a number of railway couplings.

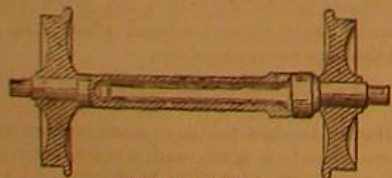
FIG. 1.



Divided Car-Axle.

In Figs. 1 and 2 are represented two forms of divided car axle. When the axle is constructed of a single piece of metal, with the wheels fixed firmly thereon, it is subject to severe torsional strain in turning curves. The outer wheel has a larger circle to traverse, thus compelling the wheel on the inner and shorter circle to slip. This torsion of the axle

FIG. 2.



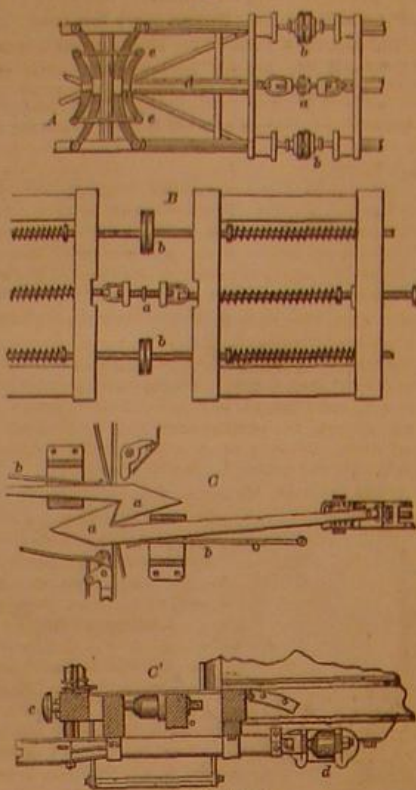
Hollow Divided-Axle.

a very detrimental, and the slipping of the wheel is equivalent to grinding on the rail, retarding the train. To avoid these difficulties, the axle has been made in two parts, examples of which construction are given in Fig. 1, in which the axle is divided at mid-length, the inner ends being supported in a box or sleeve, and in Fig. 2, which shows one portion of the axle hollow, forming a sleeve for the other part.

Figs. 3, 4, and 5 are sections, etc., of a number of car couplings. The English coupling, A, Fig. 3, is a right and left screw shackle, *a*, on the median line, making a connection sufficiently rigid to compress the buffers, *b b*. The draw

bar, *d*, of the coupling is connected to an elliptic spring, *e*, which diminishes the jerk of the cars in starting the train. Some of these features are also found in B, which is an old form of United States coupling, with buffers copied from the English. C and C' are respectively plan and elevation of the Miller coupling, which connects automatically as the

Fig. 3.

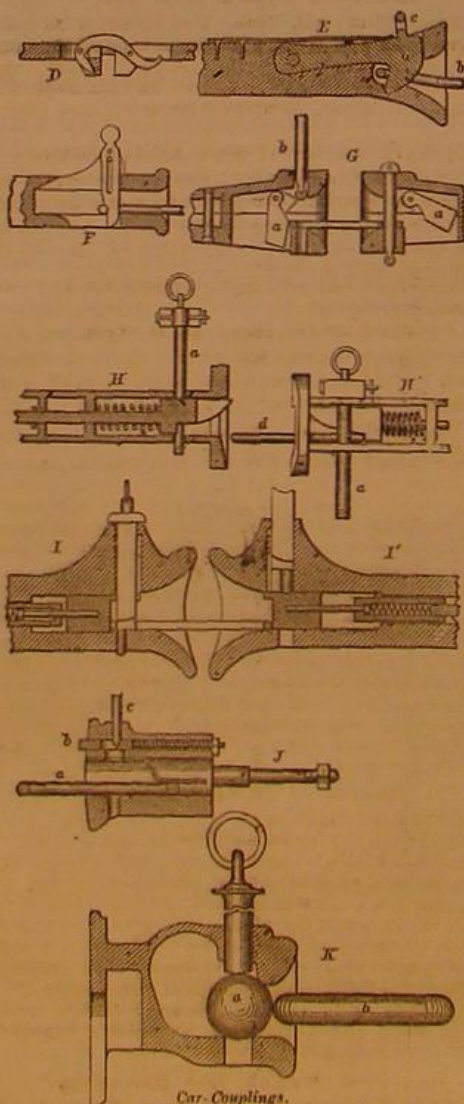


Car-Couplings.

respective point-headed hooks come in collision. The springs, *b*, keep the hooks together when connected. The lower view, C', exhibits also the spring buffers, *c*, above the hooks, which act as fenders to the cars and deaden the blow as the cars strike against each other when the speed of the train is checked. The coupling hooks have, besides, springs, *d*, for the same purpose.

In Fig. 4, D is a falling latch hook. E has a gravitating

Fig. 4.

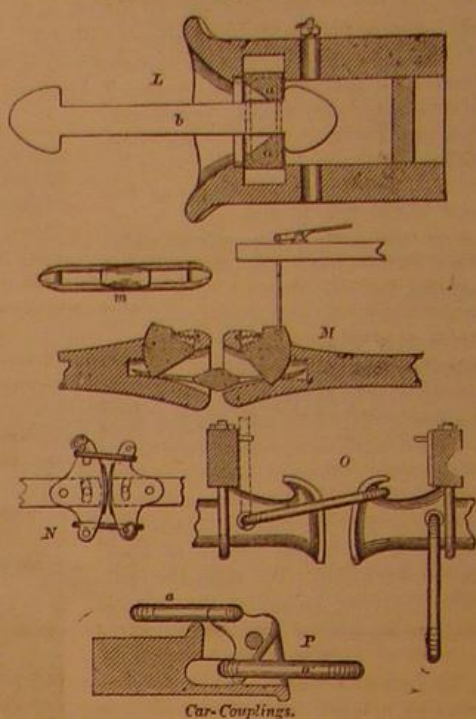


Car-Couplings.

hook provided with a spring, so that it yields to the thrust of the entering link in coupling. On the back of the hook, *a*, is a handle, *c*, which is lifted to uncouple the link. F has a vertically sliding bolt which rises automatically as the link collides with its lower inclined portion when coupling, and then falls down into engagement. G shows a pair of drawheads, in which the tumbling latch, *a*, holds up the pin until thrust back by the entering link. The pin, *b*, when fixed for coupling, rests on the toe of the latch. H H' are two drawheads, in the first of which the pin, *a*, rests on a sliding latch, which gives way before the thrust of the link, *d*, a result already accomplished in H'. I I' are two matching drawheads, in which sliding pistons hold up the link, and

are pushed back in the same manner as described in the preceding case. J exhibits a plate to hold the projecting link, *a*, in coupling position, and a small sliding latch, *b*, above, to hold the coupling pin, *c*, which is dropped, when the drawheads come in actual collision, and thrust in the latch. K has a ball, *a*, which holds up the pin but allows same to fall when pushed back by the entering link.

Fig. 5.



Car-Couplings.

In Fig. 5, L has an arrowhead bolt which is grasped between spring jaws. M has a bar, *m*, with two slots. As the end enters the drawhead, it thrusts up the gravitating latch, which immediately falls into the slot of the bar. N is a plan view of a coupling in which each drawhead has a link which couples over a horn on the corresponding drawhead of the other car. O is an elevation of a pair of drawheads, each of which has a link which may be coupled over a horn on the other. P has a two-horned tumbler, one horn of which carries a link, *a*, which may couple to a corresponding drawhead, and the other forms a latch for a link, *a'*, proceeding from the other drawhead.

The Brain Not the Sole Organ of the Mind.

Dr. W. A. Hammond, President of the Neurological Society, recently delivered an address before that body upon the above topic. The discourse included accounts of the speaker's original investigations, and in general advocated the theory that the spinal cord shares with the brain the faculties of perception and volition. The following is an abstract:

Dr. Hammond began by saying that, where there is no nervous system, there is no mind, and that where there is injury or derangement of the nervous system there is corresponding injury or derangement of the mind, and proceeded to review at length experiments conducted upon living animals, the brains of which had been previously removed. A frog continues to perform those functions which are immediately connected with the maintenance of life. The heart beats, the stomach digests, and the glands of the body continue to elaborate the several secretions proper to them. If the web between the toes be pinched, the limb is immediately withdrawn; if the shoulder be scratched with a needle, the hind foot of the same side is raised to remove the instrument; if the animal is held up by one leg, it struggles; if placed on its back—a position to which frogs have a great antipathy—it immediately turns over on its belly; if one foot be held firmly with a pair of forceps, the frog endeavors to draw it away; if unsuccessful, it places the other foot against the instrument, and pushes firmly in the effort to remove it. Still not successful, it writhes the body from side to side, and makes a movement forward. All these and even more complicated motions are performed by the decapitated alligator, and in fact may be witnessed to some extent in all animals. The speaker had repeatedly seen the headless body of the rattlesnake coil itself into a threatening attitude, and, when irritated, strike its bleeding trunk against the offending body.

Dr. Hammond then proceeded to explain a large number of experiences under his theory. He said that the phenomena of reverie are similar in some respects to those of somnambulism. In this condition the mind pursues the train of reasoning, often of a most forcible character, but yet so abstract and intense that, though actions may be performed by the body, they have no relations with the current of thought, but are essentially automatic, and made in obedience to sensorial impressions which are not perceived by the brain. In the case of a person performing on the piano, and at the same time carrying on a conversation, we have a most striking instance of the diverse though harmonious action of the brain and spinal cord. Here the mind is engaged with ideas, and the spinal cord directs the manipulations necessary to the proper rendering of the musical composition. In somnambulism the brain is asleep, and this quiescent state of the organ is often accompanied in nervous and excitable persons by an excited condition of the spinal cord, and then we have the highest order of somnambulistic manifestations, such as walking and the performance of complex and apparently systematic movements. If the sleep of the brain be some-

* Publishers, J. B. Ford & Co., New York city.

what less profound, or the spinal cord less excitable, the somnambulistic manifestations do not extend beyond sleep-talking. A still less degree of cerebral inaction, or of spinal excitability, produces simply a restless sleep and a little muttering; and when the sleep is perfectly natural and the nervous system well balanced, the movements do not extend beyond changing the position of the head and limbs and turning over in bed. The phenomena of catalepsy, trance, and ecstasy are also indications of an independent action of the spinal cord, inasmuch as the power of the brain is not exercised over the body, but is either quiescent or engrossed with subjects which have made a strong impression upon it.

Dr. Hammond, in closing his address, said that he did not contend that the spinal cord, to say nothing of the sympathetic system, is, in the normal condition of the animal body, as important a center of mental influence as is the brain. The latter organ predominates, the very highest attributes of the mind come from it, and the cord is subordinate when the brain is capable of acting. But it seems illogical to deny mental power to the spinal cord after a consideration of such experiments and other facts brought forward, and hence we are justified in concluding:

I. That of the mental faculties perception and volition are seated in the spinal cord as well as in the central ganglia.

II. That the cord is not probably capable of originating mental influence independently of sensorial impressions—a condition of the brain also, till it has accumulated through the operation of the senses.

III. That, as memory is not an attribute of the mental influence exerted by the spinal cord, it requires, unlike the brain, a new impression in order that mental force may be produced.

Useful Recipes for the Shop, the Household, and the Farm.

To make perpetual paste—which will remain sweet for a year—dissolve a teaspoonful of alum in a quart of water, to which add sufficient flour to make a thick cream. Stir in half a teaspoonful of powdered resin and half a dozen cloves, to give a pleasant odor. Have on the fire a teacup of boiling water, pour the flour mixture into it, stirring well at the time. In a few minutes it will be of the consistence of mush. Pour it into an earthen vessel; let it cool; lay a cover on, and put it in a cool place. When needed for use, take out a portion and soften it with warm water.

A beautiful ornament for the sitting room can be made by covering a common glass tumbler with moss, the latter fastened in place by sewing cotton wound around. Then glue dried moss upon a saucer, into which set the tumbler, filling it and the remaining space in the saucer with loose earth from the woods. Plant the former with a variety of ferns, and the latter with wood violets. On the edge of the grass also plant some of the nameless little evergreen vine, which bears red (scarlet) berries, and whose dark, glossy, ivy-like foliage will trail over the fresh blue and white of the violets with beautiful effect. Another good plan is to fill a rather deep plate with some of the nameless but beautiful silvery and light green and delicate pink mosses, which are met with in profusion in all the swamps and marshes. This can be kept fresh and beautiful as long as it is not neglected to water it profusely once a day. It must, of course, be placed in the shade, or the moss will blanch and die. In the center of this a clump of large azure violets should be placed, adding some curious lichens and pretty fungous growth from the barks of forest trees, and a few cones, shells, and pebbles.

The following solder will braze steel, and may be found very useful in case of a valve stem or other light portion breaking when it is important that the engine should continue work for some time longer: Silver 19 parts, copper 1 part, brass 2 parts. If practical, charcoal dust should be strewn over the melted metal of the crucible.

A simple method of case hardening small cast iron work is to make a mixture of equal parts of pulverized prussiate of potash, saltpeter, and sal ammoniac. The articles must be heated to a dull red, then rolled in this powder, and afterward plunged in a bath of 4 ounces of sal ammoniac and 2 ounces of prussiate of potash dissolved in a gallon of water.

Recent American and Foreign Patents.

Improved Milk-Testing Process.

Alvin Middaugh, Scio, N. Y.—This consists in heating a given quantity of standard milk and a given quantity of each farmer's supply to be tested, in separate vessels, to about 90° Fahrenheit, then coagulating the standard and samples, and finally compressing the undrained and unsalted curd. The specified heat develops the odors of the impurities, and the quantity of curd or whey indicates the water present.

Improved Combined Cupboard and Sink.

Henry Cull, Marshalltown, Iowa.—The object of this invention is to combine a cupboard, provision, or milk safe with a sink in such a manner that, on being closed, it represents the appearance of a cupboard, while on being opened it furnishes a regular sink for the cleaning of dishes, etc. The invention consists of a cupboard with a hinged lid, constructed as a sink, and connected by a short pipe with a receptacle and waste pipe for conveying the water off.

Improved Boot and Shoe.

Charles F. Hill, Baltimore, Md.—This invention relates to certain improvements in boots and shoes; and it consists in the combination with the upper, the insole, and the outsole of a top sole, depressed without break or incision upon the upper side, and trimmed off upon the lower side, so as to leave a raised projecting edge for the vamp.

Improved Piston for Steam Engines, Pumps, etc.

Franz Feibinger and Johann G. Koch, Vienna, Austria.—This invention relates to pistons for steam engines, pumps, etc., having a series of small pistons, which operate to expand the packing ring by the pressure of the steam. The diameter and number of the small pistons may be varied according to the pressure and object for which the engine is intended.

Improved Gas Wrench.

Samuel B. H. Vance, New York city.—This invention consists in a key or wrench for turning the plugs of gas pipes in dwellings, etc., and relates particularly to the construction of the same, hollow hemispherical in shape, with an inner strengthening rib for each of the segments, into which its rim is divided by a series of notches. The ribs also strengthen the wrench, and so enable it to be made light and neat.

Improved Machine for Inserting Fibrous Screw Fastenings in Boots and Shoes.

George V. Sheffield, New York city.—This invention consists of a machine for fastening on shoe soles, or fastening together leather work, pieces of rubber, and other analogous substances, by screws made of petrified hide or other animal fiber. The machine is essentially a combination of a boring tool for making the holes, also feeding the work along, if preferred, a screw tap for cutting the threads in the holes, a chuck for inserting the screws, and cutters for cutting off the screws after they are inserted, together with apparatus for operating the said devices. It also consists of these instrumentalities so contrived that the boring tool, tap, and chuck move up to the place for operating on the work, perform their part, and then move away, while the work remains in position for work in which the fastenings are to be inserted in curved and irregular lines.

Improved Chemical Fire Extinguisher.

Jacob B. Van Dyne, Louisville, Ky.—This invention relates to certain improvements in chemical fire extinguishers, and it consists in a hollow truncated extinguisher having a swivel joint connection with a stand pipe, and a trigger and catch device connected with an operating rod, whereby the extinguisher may be inverted and operated from any floor. It also consists in the peculiar construction of the acid vessel, and the means for sealing the same.

Improved Elastic Force Cup.

John S. Hawley, 144 Chambers Street, New York city, whom address for information.—The invention illustrated herewith is for clearing the discharge pipes of wash bowls, bath tubs, stationary wash tubs, etc., when they become partially or entirely stopped. A is a rubber cup; B is a handle of wood; C is an iron disk. A screw passes from the rubber cup to the handle, thus holding the three pieces securely together, as shown in the engraving. In using this device, allow water to flow into the bowl or tub to a depth of three or four inches; the rubber cup is then placed directly over the vent, and the handle is forced down three or four times with a quick motion. The water beneath the cup is thus forced into the discharge pipe, with a sudden impulse, dislodging the obstruction and forcing it through the pipe. Patented through the Scientific American Patent Agency, January 19th, 1875.



Improved Earth Auger.

Don Juan Arnold, Brownville, Neb.—This consists in a spiral flange, provided with a series of V-shaped cutters, arranged on an inclination outward toward the circumferential edge of the auger, the object being to make the flange take hold of and work its way into the hardest soil.

Improved Cotton Bale Tie.

J. J. Holloman, Humboldt, Tenn.—This invention consists in a bale tie, formed of a wire having a horizontal hook on one end, and on the other end, at right angles to the first, a second hook arranged vertically. This is used in connection with an intermediate plate having an aperture therein, the whole forming a simple, cheap and reliable tie.

Improved Chemical Fire Extinguisher.

Jacob B. Van Dyne, Louisville, Ky.—This invention relates to certain improvements in portable wheeled chemical fire extinguishers; and it consists in the peculiar construction of the acid vessel having studs, in combination with the holder ring having notches and also vertical slots, whereby the security of the contents of the acid vessel is increased and the inadvertent mixture of the acid with the alkaline solution prevented.

Improved Carriage Bow Rest.

William E. Yeager, Lawrence, Kan.—This is a rest for the back bow of a carriage and buggy top, which consists of an arm fixed on the pivot of the bow prop, so as to be supported thereby when projecting back horizontally, and having at the rear end a groove into which the back bow falls near the top, so as to be supported and at the same time sustained against lateral play. The arm is made capable of swinging upon the pivot to a certain extent, and it is connected to the bow by links so as to swing up with it, to avoid projecting backward when the top is up. It is provided with lugs on its hub, to be held by a stop on the pivot in the horizontal position, and in the vertical position also.

Improved Lock for Pocket Books.

Bart M. J. Blank, Jersey City Heights, N. J., assignor to Charles Kohlmann, New York city.—This is a small lever plate, which is pivoted to the flap-closing frame of the pocket book, and provided with a recessed lower part, that enters and locks to a recessed plate attached to the pocket book, and defines the motion of the lever. By swinging the lever to either side until stopped by the binding frame, the book is placed in the direction of the slot, and at the same time released therefrom.

Improved Process of Manufacturing Ammonia.

Farnham Maxwell-Lyte, Paris, France.—This invention relates to an improved process for the manufacture of ammonia, and it consists in combining a triad or pentad element with a readily oxidizable element, so as to form an alloy of the two, which shall be of a spongy character to present increased surface. This said alloy is subjected to a moderate degree of heat in a closed chamber, and a mixture of nitrogen and hydrogen (or a hydrogen compound) is then passed over the alloy, which produces, under the influences of heat and chemical affinity, a combination of nitrogen and hydrogen to form ammonia. An alloy of antimony and sodium or potassium, for instance, which decomposes water at ordinary temperatures, and rapidly at the boiling heat, is of this nature.

Improved Wagon Seat Fastening.

Charles Dixon, Weedsport, N. Y.—This is a strong and durable fastening for attaching seats to wagons, sleighs, and other vehicles, and it consists of a main plate with perforated lugs for the bolt of the clamping piece, that is firmly secured by an incline and shoulder of the upper lug, in connection with a recessed cam-shaped lever, the required position of the clamping piece being obtained by a projecting shoulder of the same sliding in a recessed part of the lower supporting lug.

Improved Pocket Book Fastening.

Morris Rubens, New York city.—This is an improved means of locking the hinged jaws of pocket books, cigar cases, etc. Each jaw is provided, near its center, with a clasp that is soldered, so as to project toward the other jaw, binding on it, and producing thereby a double fastening. The clasps are made concave on the under side, and are provided with projecting knobs or buttons, which serve for the purpose of opening the frame by pressing with the fingers against them in opposite directions.

Improved Side-Bar Wagon.

Ephraim Soper, New York city.—A bolster mounted on the hind axle is used instead of the spring commonly employed for the support of the side bars, and to serve, at the same time, for a truss to stiffen the axle. The C spring, by which the side bar is attached to the bolster, is arranged to extend under the bolster, and up behind it, and over the top to the point of connection, so as to economize space.

Improved Barrel Hoop.

Leopold Well, New York city.—This invention relates to a mode of fastening bands or hoops on barrels, casks, kegs, or analogous packages, and consists in a hoop having a cross-slotted wide end to receive a narrow end, both ends being locked together by reversed lips rising from opposite sides.

Improved Railway Rail Support.

Samuel L. Porter and Duane Peck, Rochelle, Ill.—The main object of this invention is to so confine the ends of the rails that the usual fish plates will be dispensed with; and it consists of a bed plate having two strong ledges cast thereon, in combination with a cast iron block and key and a set screw, the latter passing through a ledge, and holding the key in place. It also consists in orifices through the top of the bed plate for the admission of screw nuts and bolts.

Improved Bedstead Fastening.

Wyly Merritt, Atlanta, Ga., assignor to himself and M. T. Castleberry, of same place.—The invention consists of a fastening plate contrived with a curved T head, which enters a curved undercut mortise in the post, and holds fast by the head without screws or bolts. The plate has a cylindrical enlargement, which enters a round hole at the bottom of a slot in the end of the rail, and holds it without screws or bolts, and without requiring the attachment of a special piece to the rail. The novelty lies in the contrivance of the fastening in one piece, and in the contrivance of the form so that the slots or mortises for connecting it to the post and rail may be quickly made by revolving cutters.

Improved Steak Broiling Pan.

David Burrell Smith, Bastrop, La.—The object of this invention is to provide an improved device for cooking steak and other meat, by means of which all the flavor and juices of the meat are preserved, the tendency to burn obviated, and the meat cooked free from ashes, and without the taste of smoke. It consists in two symmetrically shaped pans containing griddles, which pans, when placed together, fit tightly to form a closed chamber and hold the meat between the griddles in the center of the chamber, the pans being detachably connected by means of a curved lip and an extension at one end, and the two handles which are grasped together at the other end.

Improved Sliding Bench Vise.

Pierre Reinhold, San Antonio, Tex.—The object of this invention is to confine a piece of lumber of any length by pressure on its two ends instead of on its sides, for the purpose of holding the same while being dressed. It consists of a frame containing a sliding carriage, which is operated horizontally by a screw. This sliding carriage has an adjustable portion, which, being provided with a vertical screw and a guide rod, is capable of vertical adjustment above the table.

Improved Sash Holder.

Thomas Walker, Pleasantville, Md.—The object of this invention is to provide an improved fastening for window sashes, for the purpose of maintaining the same in any desired position. It consists in a bolt which is screw-threaded at one end, and provided with an adjustable friction pad, and pivoted at the other to a short crank. Said bolt carries a washer, between which and the friction pad, and surrounding said bolt, is a spiral spring which forces the pad against the edge of the sash to hold it in the required position, and the crank is rigidly attached to a shaft terminating in a knob, by means of which the device is operated.

Improved Plow.

David Burrell Smith, Bastrop, La.—This invention relates to certain improvements in plows; and it consists in the peculiar construction of a subsoling device, in which an adjustable foot cuts a straight line through the hard pan below the plow, which, while it meets all the requirements of a subsoller, lightens the draft, and enables the detachable device to be used in front of the plow for a coulters.

Improved Evaporator for Saccharine Liquids.

Thomas Scantlin, Evansville, Ind.—The primary objects of this invention are first to construct an evaporator consisting of a series of pans, all communicating one with another, without the use of solder or rivets; and second, to provide for a continuous side passage by which one pan of the series may be made, at will, to communicate with any one or more of the series, whether adjacent or not. To these ends, the evaporator is composed of a series of metal pans and communicating open side passages or channels, the latter being provided with sliding valves, stoppers, and plugs, so that the liquid may be conducted from any pan of the series to an adjacent one, or past an adjacent one to another which is remote in the series, and thereby the contents of the several pans may be kept separate, or commingled more or less, as required, or according as the heat varies in intensity in different parts of the furnace.

Automatic Governor for Hot Air Furnaces.

Solomon Kepner, Pottstown, Pa.—The object of this invention is to provide an automatic or self-regulating governor for hot air furnaces, in which the blast of hot air is made to regulate the draft to the fire box, or from the combustion chamber of the furnace. It consists in a pivoted lever provided with a valve and damper so arranged that, as the valve is moved by the blast of hot air, the damper opens communication from the outer air to the fire box or smoke pipe, and by diminishing the draft correspondingly reduces the generation of heat in the furnace. The lever is graduated and provided with a balance weight, by means of which the sensitiveness of the device may be regulated.

Improved Non-Explosive Lamp Collar and Filler.

James A. S. Hanford, Chicago, Ill.—The object of this invention is to obviate the danger attending the explosion of the accumulated gas or oil vapor in the body of the lamp; and it consists in the combination, with an ordinary lamp collar having side perforations, of hinged stoppers, which act as safety valves in the event of an explosion, and also afford a means for filling the lamp while it is burning, without danger. The invention also consists in a supplemental collar provided with the above devices, which said collar is screw-threaded, so as to be interposed between the collar and burner of any ordinary lamp, whereby the advantages of the invention are available in all kinds of lamps without alteration or injury.

Improved Thill Coupling.

Alfred W. Forwood, Georgetown, Ky.—An adjustable box fills the space between the journal and the clip, and is fitted into the jack. The forward side of the box is made a half circle to receive the journal, while its rear side bears against the clip. The arm curves from its upper side back over the clip, and near its end is an adjusting screw. When the draft pin becomes worn and the connection loose, so that the thills or pole rattle, the set screw is turned down which throws the arm up, and consequently the circle forward, so that the box fits closely to the journal.

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Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. B. Allen & Co., 189 & 191 Water St., N. Y.

Microscopes, from 50 cts. to \$500, for Scientific Investigation and home amusement. Magnifying Glasses, Spy Glasses, Telescopes, and Lenses. Price List free. McAllister, M'G. Optician, 43 Nassau St., New York.

5,000 Tinners and Grocers should manufacture and sell the A. A. Wilcox Patent Self-Sealing Fruit Can. No wax, no solder used. State and County Rights for Sale. For particulars, address A. A. Wilcox, West Meriden, Conn.

For Sale—Two recent U. S. Patents for improvements on Dental Laboratory appliances. Address C. D. Cheney, Canandaigua, N. Y.

Boilers and Engines manufactured especially for the trade. Send for reduced price list. Erie City Iron Works, 45 Cortlandt St., New York.

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Manufacturers of Chicory Root Cutters, please send their Circulars to M. O. P. O. Box 235, Stockton, Cal.

Hydraulic Elevator makers, send circulars to Bowditch & Co., Waterbury, Conn.

A Valuable Patent on Saw Mills, just issued; will sell part of the U. S. and the entire Canada right. F. E. Town, 181 Broadway, New York.

American Metaline Co., 61 Warren St., N. Y. City. 1/2 H.P. Engine and Boiler Wanted. Address G. L. R. Livingston, Troy, N. Y.

No good mechanic can afford to be without the Lightning Screw Plate. Dies are perfectly adjustable; wear does not spoil them. Wiley & Russell Manufacturing Company, Greenfield, Mass.

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Wooden Ware Patent for Sale. 2947 N. Y. P. O. Grindstones, 2,000 tons stock. Mitchell, Phila., Pa.

Lathe Gear Cutters, Wm. P. Hopkins, Lawrence, Ms.

The "Catechism of the Locomotive," a book of 650 pages, 250 engravings, fully describes the theory, construction, and management of American Locomotives. Price, post-paid, \$2.50. Address The Railroad Gazette, 71 Broadway, New York.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

Wanted—Machinery for splitting out or riving Pipe Staves 60 inches long, 3 to 5 inches wide, and 1 1/2 inch thick, from White Oak Timber, for the New Orleans market. Address Geo. G. Hughes, Jackson, Tenn.

Mills for Flour & Feed, White Lead, Colors, Ivory Black, Printing Ink, &c. John Ross, Williamsburgh, N. Y.

Telegraph and Electrical Instruments and Batteries, cheap. M. A. Buell, 86 Bank St., Cleveland, O.

Models for Inventors.—H. B. Morris, Ithaca, N. Y.

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Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N. Y.

The Baxter Steam Engine, 2 to 15 Horse Power. Simple, Safe, Durable, and Economical. "The Best are always the Cheapest."

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Engines, 2 to 8 H.P. N. Twiss, New Haven, Ct.

Agents—100 men wanted; \$10 daily, or salary selling our new goods. Novelty Co., 300 Broadway, N. Y.

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For Tri-nitro-glycerin, Mica Blasting Powder, Electric Batteries, Electric Fuses, Exploders, Gutta Percha Insulated Leading Wires, etc., etc., etc., result of seven years' experience at Hoosac Tunnel, address Geo. M. Mowbray, North Adams, Mass.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Army, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Genuine Concord Axles—Brown, Fisherville, N. H.

Price only \$3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 246 Canal St., New York.

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Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$6, with good Battery. F. C. Beach & Co., 246 Canal St., New York. Makers. Send for free Illustrated Catalogue.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 21 Cornhill, Boston, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

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made with pure clay, or such as contains little or no oxide of iron and is free from calcareous matter. The best clays contain the most silica, yet crucibles of pure clay are not absolutely infusible; and in the high temperature of a blast furnace, they sometimes soften so much as actually to fall into a shapeless mass. This defect can be somewhat remedied by mixing the clay with graphite or coke; either of these substances form a kind of solid skeleton, which retains the softened clay and prevents its falling out of shape.

(7) S. F. H. & Co. say: We have some leather lined with blue cloth, such as is used for carriage curtains. The color of the cloth is blue, and it rubs off. Can the color be made so as not to come off by applying a solution to it? A. Try dipping it into a solution of India rubber in naphtha.

(8) A. C. J. asks: Are the numerals and punctuation marks commonly used in telegraphy? A. The numerals are, but punctuation marks are not very generally used, except the full stop.

(9) S. S. W. asks: How long should locust seeds be boiled before planting? A. Take three times as much water as you have seed, by measure. Boil the water, and pour it boiling hot over the seeds and let them soak till the next day; then plant them. The plants are as tender as melons, and the least frost will kill them, so do not plant too early. Some of the plants will have thorns, and some not; save the thornless ones to plant for shade trees; the rest you can use for hedges or throw away, for they are too disagreeable to keep in a civilized community. Both the thorny and thornless plants are perfectly hardy, require no shelter after the first start, and are about the safest tree to transplant (at any age) that grows in this latitude; while their foliage and peculiar growth render them almost indispensable where variety is desirable.—H. H.

(10) W. Y. asks: What tools does a man need to run a small engine with? A. A hammer, an assortment of files, a flat chisel, a cape chisel, scrapers (3/4 round and flat), a straight edge, an assortment of wrenches, a screw driver, and a belt punch.

(11) F. W. asks: In manufacturing our common red brick, is there any way of coloring them, either by glazing or mixing, to produce some pleasing tint, without adding materially to the expense? A. This can be done by facing them with a coloring preparation, as is now done in the case of encaustic floor tiles, but not without considerably enhancing the price.

(12) W. R. H. asks: How much greater is the resistance of the ordinary railroad rail, made of wrought iron, than that of a rail of the same size and length of Bessemer steel and of malleable cast iron, respectively, in respect to resisting the shocks or strains of locomotive or car wheels when in motion? A. The steel rail is about 1-5 times as strong as the wrought iron one, within the limit of elasticity. Malleable cast iron is not well suited to resist shocks.

(13) H. R. T. asks: Which is correct, "burr stone" or "burr stone"? A. Both are correct, but "burr stone" is the more usual way of writing it.

(14) R. C. M. says: I am putting in two 8x10 engines, to run together, and I wish to use cistern water. If I exhaust into a four inch pipe, extending from the cistern upward, and keep a small stream of cold water running through it from the second story, 10 feet above the engines, will it condense the most of the steam? A. This plan will not answer. Your best plan would be to use a proper condenser. 2. How will I get most power out of two 8x10 cylinders, coupled rigidly together or run independently and connected with one line shaft with belts? Part of the time I shall use only one cylinder for light work. A. It would no doubt be better to run them independently.

How can I ascertain the number and claims of a patent? A. Either by making a search of the records, or engaging some one to do it for you.

(15) A. A. asks: I have a steam heater of the following capacity, and desire to know what pressure it will stand without bursting. It is 18 inches long, 14 inches wide, 2 1/4 inches deep and 1/4 inch thickness of the iron. The boiler pressure is 45 lbs. The pipe that connects with the heater is 5/8 of an inch in diameter, and is about 60 feet in length. The exhaust pipe is 1/4 inch in diameter, and is not quite free. A. Under the conditions stated, the heater will have sufficient strength.

(16) D. asks: Can the area of an octagon inside of a circle be ascertained with mathematical exactitude, if the diameter of the circle be known? A. Yes. It is composed of eight equal isosceles triangles, of which two sides and the included angle are known. The two equal sides are each equal to the radius of the circumscribing circle, and the included angle is 1/4 of 360°, or 45°.

(17) C. C. asks: In your issue of April 17, 1875, in answer to the following question: "At what power would you rate an engine that is 8 inches bore and 15 inches stroke, running at a speed of 20 revolutions with 80 lbs. steam": you say: At about 12 horse power. By what formula do you calculate this? Do you mean that the real effective power of an engine under these conditions is 12 horse power? According to Roper's formula, as well as Haswell's, I should figure it at 36 horse power, with (say) 10 per cent off for friction, making about 32 horse power. A. We do not consider that either of these rules gives very correct results. Our answer was based on a personal knowledge of the actual performance of such engines. The answer referred to effective horse power. It is quite true that the rules you mention will give you true results, if they represent the conditions of actual practice; but in general they do not.

(18) J. W. asks: How many inches from the fulcrum must a ball of 12 1/2 lbs. weight hang to give 80 lbs. pressure on the square inch on a safety

valve 1 1/2 inches in diameter, the valve being between the fulcrum and the ball, with its center 1 1/2 inches from the fulcrum? A. You can work it out for yourself by the aid of the following rule: Multiply together: (1) The pressure of steam, the area of valve, and the distance of center of valve from fulcrum. (2) The weight of the valve, and the distance of its center from the fulcrum. (3) The weight of the lever, and the distance of its center of gravity from the fulcrum. (4) Add together the products obtained by (2) and (3), and subtract the sum from the product obtained by (1). (5) Divide the difference by the weight of the ball.

(19) C. H. D. asks: I enclose you a photograph of a windmill which is erected on an eminence near York, Pa. It was built in 1870 by an ingenious German, and has been regarded as a curiosity, being the only windmill for many miles around. The sails are not constructed on the principle put forth in your recent article on windmills, but have a uniform inclination to the plane of revolution. They seem, however, to be very efficient, and I am informed that the power varies from 5 to 10 horse power, according to the velocity of the wind, the sails being 3 feet wide, and the diameter of the wheel 25 feet. The shaft is inclined to the plane of the horizon at an angle of about 6° and is arranged to swing around a vertical shaft, when the wheel is shifted to face the wind. The power is transmitted by a pair of bevel wheels, and is utilized for crunching bones. This windmill is a model of workmanship and utilizes a power which is certainly cheap. A. We have no doubt our readers will be interested in this account; for while it is probable that a wheel constructed with the proportions noted in our recent article would be somewhat more efficient, this is a little simpler to construct.

(20) P. F. asks: In a cylinder 6 feet high containing 6 cubic feet of air, how many lbs. pressure on the piston will be required to compress the air into 1, 2, 3, 4, 5 feet of volume respectively? A. If the temperature is constant, the pressure varies inversely as the volume.

(21) L. H. R. asks: 1. Can you explain the principle of the gyroscope? A. It may be explained generally on the principle that, though the force of gravity is constantly acting downwards, there are other forces with which the force of gravity is resolved. See p. 91, vol. 31. 2. Was there a marine governor built some time ago upon that principle? A. There have been several.

If a locomotive engineer be called upon to stop his engine as soon as possible, would it be advisable to shift the eccentric, thereby causing great resistance at every stroke, until the engine has stopped? A. It would be better to shut off the steam, and apply the brakes.

(22) J. W. H. asks: What is the difference in strength between an iron and a steel shaft, 4 1/2 inches in diameter? How far will it spring without breaking, being 3 feet long between boxes? A. The steel axle will be about twice as strong. It would not be advisable to strain the shaft so as to spring it sensibly; and, though it might not break at once, it would take a constantly increasing set.

(23) M. P. S. says: We have a 60 horse power horizontal return tubular boiler, set in brick in the usual way. Length is 15 feet, diameter 54 inches, and there are 56 three inch tubes. At rear of boiler is a combustion chamber, 3x5 feet, and the chimney is on one side, at front of boiler. The heat passes under the boiler, returns through tubes, and passes through a square flue, 12x12 inches, into the round iron stack, 48 inches in diameter and 30 feet high. This stack is lined with brick for about 20 feet up, reducing the area to about 40 inches. The draft is sluggish, and the cast iron covering of the rear combustion chamber has given way with the excessive heat. A. We think the stack is too large, and you might improve matters by contracting it at the bottom.

(24) P. A. asks: What is the correct rule for getting an engine into line and squaring the shaft? A. Set up two lines, one parallel to the axis of the cylinder or through the cylinder, if possible, and the other perpendicular to the first, in the same plane. These are reference lines to measure from, to bring the shaft and guide into line.

(25) B. & C. say: 1. We are building a boat about 60 feet long and 20 feet wide, with a flat bottom and a light top, to be used as a trading boat on a small river. What engine power will be necessary? A. The boat is of a very bad model, and will probably require an engine of from 15 to 20 horse power. 2. Can the motion of a vertical engine be reversed? A. A vertical engine can be reversed by being fitted with a link, or with two eccentrics and books. 3. Can a propeller be used on a flat-bottomed boat to advantage? A. If you build such a boat, it would be better to propel it with a stem wheel.

(26) R. B. W. asks: Would a 12 horse power engine be sufficient to run a 65 saw cotton gin and a 30 inch grist mill? A. Not if they were driven up to their full capacity.

(27) D. S. S. says: I have a steel spring, 4 feet long, 1 1/2 inches wide, and 1/2 inch thick, which was bent to its utmost for a period of 1 week, at the rate of 100 times a day. I find that it now retains a bend which weakens it. Is it impossible to make one that will always retain its natural straight position when left alone? A. All springs, however good, take a set in time.

(28) J. B. K. says: I claim that a balance wheel on an engine does not give additional power to the engine, but only regulates it and gives a steady motion. My opponent claims that the balance wheel gives the engine additional power. Who wins? A. You do. Your opponent appears to assert that the fly wheel has more power than the machine which moves it. If this were the case, it would be a very desirable kind of perpetual motion.

(29) R. H. McI. asks: What is the best cement or packing to use under a soft patch on boiler or in a steam joint? A. Red and white lead, to which fine iron filings may be added.

In a low pressure boiler, with mercury gauge showing 15 lbs., is the actual pressure upon the piston 15 lbs. to the square inch or 15 lbs. + 14 $\frac{1}{2}$ (the atmosphere) which (with the vacuum) is about 45 lbs. per square inch actual working pressure? A. The actual effective pressure is the total pressure above a vacuum on one side of the piston, diminished by the total pressure above a vacuum on the other side.

(30) B. B. B. asks: Will two hydraulic rams, with the same fall, with separate feed pipes, playing into the same landing pipe, work? If so, will they force up more water than one ram with the same fall? A. They would work satisfactorily, and, under favorable conditions, the two would deliver about twice as much water as one.

(31) F. A. C. says: I have an upright boiler, 30 inches high above firebox, 15 inches in diameter, with shell and heads of wrought iron $\frac{3}{4}$ inch thick, with 40 flues each $\frac{3}{4}$ inch in diameter. How great a pressure will it safely stand? A. If well made, you can carry from 150 to 175 lbs. of steam. 2. Of what power ought an engine for this boiler to be? A. From 1 to 14 effective-horse power.

(32) J. N. C. asks: What is your opinion about the use of compressed air for street car locomotion in lieu of steam (or horse) power? What is to prevent the compressing of air into suitable receivers, attached to each car and made to contain air to last long enough for one trip? A. There are numerous difficulties in the way; but they may be overcome, as many inventors are turning their attention to the subject.

(33) R. A. K. asks: Of what dimensions should a boiler, engine, and propeller be, to draw a yawl 22 feet long and 5 feet beam, drawing 20 inches, at a speed of 6 miles an hour? A. Engine, 3x5; propeller, 2 feet in diameter and 8 feet pitch; boiler, 2 to 3 feet in diameter, and 3 or 4 feet high.

(34) C. R. H. asks: If I take a boiler, fill it full of water, and seal it up so as to have it properly airtight, and place a fire under the same, what will cause the boiler to burst? Will it be the expansion of the water, or the steam? A. As water expands rapidly by heat, it is probable that the boiler would be torn open long before the boiling point of water was reached.

(35) W. S. B. says: We have a machine called a cool air blower, situated in a small room in the attic of our mill. The room is so small that, when the atmosphere outside is damp and heavy, we cannot dry our yarn. The air in the room is so moist that the beams and plaster overhead become wet. A ventilator on the roof, with a fan inside, is a benefit; but as moist air remains low and does not rise, I am thinking of putting a fan to one of the windows at the end of the room, the windows coming down to the floor. I will box in the window on bottom, put in a suction fan, and open the window at the bottom opposite the fan, more or less. Am I right? A. Your general idea is right; for if you cannot get a natural draft, you must create one, either by a heated flue or a revolving fan. It is probable that you might get over the trouble by the use of a well devised flue.

(36) J. B. S. asks: How is it that the wheels of a car are stationary on the axle while the wheels (of the same size) are going round a curve, the outside track of which is of course longer than the inside? A. One of the wheels slips in such a case.

(37) A. F. & Co. say: We have been thinking of using our exhaust steam by turning it into a tank containing cold spring water, thereby heating our supply water and saving fuel. We have been advised by experienced men not to do so, as they say we should burn out our boiler in a short time; they claim that the grease contained in the exhaust steam would form into globules, which would sink to the bottom of the boiler and prevent the water from touching the plates, thereby burning them out, and that they know this by actual experience with lake water in Chicago. With hard water or water containing much lime, it might be feasible; but with spring or soft water, it would be disastrous. Are these opinions sound? A. There would not be much danger unless you use a very large amount of grease in the cylinder. In nearly all ocean steamers the condensed steam is used for feed water. With a proper oil cup, the amount of lubricant used in the cylinder is very small, and is as effective as a much larger quantity admitted carelessly. It is not well to use tallow in such a case.

(38) F. S. L. asks: Are not the cubic contents of a stick of timber, 12 inches square at one end and 18 inches square at the other, of a uniform taper, equal to one of the same length, 15 inches square throughout? And is not the answer No. 49, p. 251, vol. 32, incorrect? A. The answer is correct. The rule is as follows: Multiply together the area of the two bases, take the square root of the product, add the areas of the two bases; and multiply by $\frac{1}{3}$ of the height. If A=area of lower base, a=area of upper base, and h=altitude, then

$$\text{solidity} = \frac{(A+a+\sqrt{Aa}) \times h}{3}.$$

Applying the rule to the given example, solidity = $\frac{225+144+\sqrt{225 \times 144} \times 12}{3} = 3166\frac{2}{3}$.

(39) A. W. asks: What horse power are we using with an engine, diameter of cylinder being 15 $\frac{1}{4}$ inches, stroke 32 inches, revolutions 73 per minute, average pressure throughout stroke being 46 $\frac{1}{2}$ lbs.? A. Do you and many others who continually write to inquire the horse power of engines ever read our replies on the subject? We have published the rule in a dozen different forms, and have explained that, with the mean pressure as ascertained by the indicator, the indicated horse

power can be calculated; but that the effective horse power can only be found with precision by a test with the friction brake or dynamometer. Once more: Multiply together the area of the piston in square inches, the mean pressure throughout the stroke diminished by the mean back pressure in pounds per square inch, and the speed of the piston in feet per minute, and divide the product by 33,000. If you can ascertain the pressure in lbs. per square inch required to overcome the friction of the engine—by subtracting this from the mean effective pressure, as determined by the indicator, and using the remainder for the effective pressure—you can calculate the useful horse power by the aid of the above rule.

(40) G. W. G. says: We have buried here (Galena, Ill.) one Lytton, whose friends claim that he was the original inventor of the paddle wheel, and the first to put it in practice. Is this so? A. No. The paddle wheel was used by the ancient Egyptians, and later by the Romans.

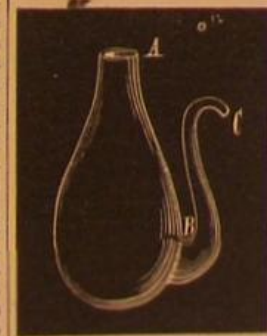
(41) L. K. Y. asks: Please give me a recipe to make a varnish to put on the outside of a silver plated cup, that I am going to gold plate on the inside; it must be thin and easily taken off. The object is to prevent the outside from being gold plated. A. Coat it with wax.

(42) G. M. H. asks: 1. Can a strong electric current be sent through successive coils of fine platinum wire for gas-lighting purposes? A. No. Can the current be divided at each platinum coil by some simple means, so that a part only may pass through the coil? A. Yes, by shunting the coil.

(43) B. R. H. says: I have a mirror for a reflecting telescope, 14 inches in diameter, with a focal length of 12 feet 2 inches. I wish to construct a telescope on the Cassegrainian plan. 1. What ought the diameter of the small mirror to be? A. Two inches. 2. What focal length should it have? A. Sixteen inches. 3. What should be the size of the hole in the large mirror? A. Two inches. 4. How can I test the accuracy of the curvature of the mirrors? A. By trial on a drop of mercury in the sun. 5. Is there any other method than Draper's of silvering the surface of the mirrors? A. English method of silvering glass: Solution A: Nitrate of silver crystals 90 grains, distilled water 4 ozs. Solution B: Potassa, pure, by alcohol, 1 oz., distilled water 25 ozs. Solution C: Powdered milk sugar $\frac{1}{2}$ oz., distilled water 5 ozs. A and B will keep in stoppered bottles; C must be made fresh and filtered. To silver an 8 inch glass speculum: Pour 2 ounces of solution, A, into a glass vessel capable of holding 35 fluid ozs. Add drop by drop, stirring with glass rod, as much ammonia as is just necessary to obtain a clear solution of the gray precipitate first thrown down. Add 4 ozs. of solution B. The brown-black precipitate formed must be just redissolved by the addition of more ammonia as before. Add distilled water until the bulk reaches 15 ozs., and add drop by drop some of solution, A, until a gray precipitate, which does not re-dissolve after stirring three minutes, is obtained; then add 15 ozs. more distilled water. Set aside to settle without filtering. Finally add 2 ozs. of solution C; stir gently and thoroughly in a round dish 3 inches deep and 2 inches larger than the speculum. Suspend the speculum face downward in the liquid, which should rise $\frac{1}{4}$ inch up the side. The mirror is attached to a wooden block by pitch at the back after wetting the back with turpentine.

(44) J. H. asks: Could a galvanic battery be made of sufficient current to stun birds, so as to catch them if they were to alight upon the wire? A. No.

(45) S. H. asks: What is a Florentine receiver, used for separating essential and other oils? A. A Florentine receiver is conical in form, and at the side is a spout, B C, communicating with the bottom, the orifice, C, of the spout being much lower than the mouth, A, of the receiver. The distilled product being poured into this vessel, the oil separates from the water, and occupies



the upper part of the vessel. The water, as it rises above the bend of the spout, flows off at C, while the oil may be from time to time removed by means of a pipette.

(46) W. P. J. says: In the report of the Hartford Boiler Insurance Company, it is stated that common soda is as good an absorbent as anything. Does this mean sal soda, or carbonate of soda, or some other kind? A. Common washing soda.

(47) A. L. asks: Will a blowpipe drill a hole in the best safes manufactured? A. No.

(48) C. F. R. asks: Can you give me a recipe for mixing dry pigment, as water colors, for painting on paper? A. Mix the pigment with water to a thin paste. Add pure gum arabic (heavy) sufficient, when dry, to make a soft dry cake, which may be used as a body color.

What can I put on drawing paper to make it transparent and still retain its smoothness and toughness? A. See p. 236, vol. 32.

What is the heaviest metal? A. Platinum is (with the exception of iridium and osmium, which are equally dense) the heaviest form of matter yet known.

I often hear people say it is too cold to snow; is it ever too cold to snow? A. Yes. An extremely cold, dry air is one from which the moisture in great part must have previously precipitated.

If an ice house be built on the side of a hill, the

walls being of stone 12 inches thick and two stories high, and the ice packed in the upper story, and the lower one used for a sort of refrigerator, would the temperature be sufficiently low to preserve fresh meat and other perishable articles? A. We do not think that this arrangement would be satisfactory.

(49) R. D. asks: 1. What distance apart should the lenses for a celestial eyepiece be placed, their diameters and focal lengths being as follows? 1. $\frac{1}{2}$ inch focus, $\frac{1}{8}$ inch diameter, plane. 2. $\frac{1}{4}$ inch focus, $\frac{1}{8}$ inch diameter, plane. A. Lenses $\frac{1}{4}$ inches apart. 2. Where should the diaphragm be placed, and of what size should the aperture be? A. Diaphragm aperture $\frac{1}{8}$ inch, distant $\frac{1}{4}$ inch from eye lens at its inside focus. 3. What distance apart should the lenses for a terrestrial eyepiece be placed, their focal lengths and diameters being (1) 2 inches focus, $\frac{1}{2}$ inch diameter, plane; (2) $\frac{3}{4}$ inches focus, $\frac{1}{2}$ inch diameter, double; (3) $2\frac{1}{4}$ inches focus, $1\frac{1}{4}$ inch diameter, plane; (4) $1\frac{1}{2}$ inches focus, $\frac{1}{2}$ inch diameter, plane? A. A or front lens to B=2.8", B to C=3.5", C to D=2.7". 4. Where should the diaphragm be placed, and what the size of the aperture? A. Diaphragm aperture $\frac{1}{8}$ inch, 1.5" in front of D, also diaphragm aperture 0.25", distant 1.64" from A. 5. What will be the power of these eyepieces with a 3 inch achromatic of 48 inches focal length? A. Equivalent focus 1.75", power 27.

(50) J. D. W. says: I would like to know why the pile of my Léclanché battery bothers me as it does. The top of the pile swells up, and some kind of whitish stuff comes out. It smells somewhat like hartshorn, and after it appears the battery gets weaker. What is the cause of it? A. Probably it is owing to defective manufacture. The genuine Léclanché battery is cemented at the top with gutta percha, but an article has been made in this country in which paper is made to take the place of gutta percha. Now the paper absorbs the moisture from the solution and draws it out of the cell by capillary attraction, and hence the appearance of the whitish deposit. The smell of hartshorn is due to the action of the battery, ammonia being set free at the negative electrode.

(51) R. O. T. says: 1. I wish to make an induction coil, about 10 or 12 inches long, with a center bundle of iron wires of about $\frac{3}{4}$ inch diameter. The inducing coil consists of No. 18 wire, and the secondary coil, of No. 28, both American gage. The primary coil is to be about 35 yards long, and what I want to know is how much of the secondary wire ought I to wind on the primary to get a spark at least $\frac{1}{2}$ inch long? A. It would be better to use finer wire for the secondary coil, say No. 35 wire. Your secondary coil should be at least thirty times as long as the primary. 2. How must I make the condenser? A. Condensers are made of alternate layers of tin foil and paper saturated with paraffin, arranged like the leaves of an interleaved book, the metal plates being the printed leaves and the paraffined paper the blank paper. Each alternate metal plate is connected so as to form two distinct series, insulated from each other, one of which is to be connected with each end of the primary coil. The spark of an induction coil cannot take the place of a battery for general purposes. 3. I tried to make a condenser of sheets of tin foil, glued on each side of a large sheet of common newspaper; and after doubling it up so that the two sides did not touch each other, I connected each sheet with each end of the inducing coil. Will this do? A. You cannot make a condenser by rolling the sheets up separately as proposed. 4. Why cannot I use the induced current of a small coil for the inducing one of a larger? A. The reason why you cannot use the induced current of a small coil for the inducing one of a larger is that the induced current is one of tension, whereas quantity is required. The effects produced by the secondary coil result from the transference of electric quantity in the primary to electric tension in the secondary.

(52) J. J. J. asks: 1. If I make a square copper box 8x8 inches deep, and suspend therein a square of zinc, I will have a sulphate of copper battery. How many such cells will I require to plate with nickel and silver? A. Two. 2. How many such will be required to make the electric light? A. 100. 3. If I make a silver solution by dissolving two silver dollars in acid, and put this solution into three quarts of water, contained in a one gallon stone jar, can I, by suspending the articles to be plated in this solution and connecting them to the negative pole of a battery, plate them? A. Use 100 parts of water, 10 parts cyanide of potassium, 1 part cyanide of silver.

(53) C. asks: Is there such a preparation as chemical ink, becoming invisible or fading after writing, to reappear on exposure to heat? A. Use a dilute solution of chloride of cobalt.

(54) R. W. W. asks: 1. What causes the liquid, commonly called smoke water, to form in stove pipes? A. A certain amount of water as well as smoke is formed in the combustion of fuels. As long as the temperature of the flue is kept high enough, this water is carried off in the form of vapor; but if the temperature is lowered, it is condensed and acquires an acid reaction from the sulphurous, sulphuric, and carbonic acids generated in the burning of the fuel. 2. What will effectually prevent the dripping nuisance? A. See that your flue is not chilled, has a good draft, and is free from elbows, etc., where vapors may be condensed and collected.

(55) B. H. A. says: I wish to procure a vat for boiling a solution of 1 part sulphuric acid and 11 parts water; I want it to hold about 60 or 70 gallons. Of what material should it be made, in order not to corrode? A. Porcelain lined iron pots have been used with advantage for this purpose.

(56) H. L. asks: What is the formula for a terrestrial ocular with plano-convex lenses, for an objective or speculum of 48 inches focus? A. Focal: A=1.58", B=2.38", C=2.65", D=1.50". Dis-

tances, A B=2.57", B C=4.70", C D=2.45". Focal point, 0.713" in front of A. Aperture of A=0.7", B=0.7", C=1.15", D=0.7". Diaphragm aperture, 0.2", distant 1.29" from A. Diaphragm aperture, 0.75, at inside focus of eye lens. Cap. 0.26, aperture distant 0.44 from D. Length of eyepiece=10 inches. Field of view=30 minutes. Power=57. A and B plane side to objective, C and D plane side to eye.

(57) W. R. B. says: 1. In Dick's "Practical Astronomer" is a description of Rogers' plan of an achromatic telescope consisting of a small correcting lens of flint and crown glass to correct a large object glass of crown. I do not understand the formula for computing or constructing such a lens. I have a good double convex lens of crown glass, 5 inches in diameter and of 97 inches focus. Will you please give me the diameter and focus of both the convex crown and concave flint composing the correcting lens, for such an object glass? A. Professor H. L. Smith gives the following formula for a 6 inch dialyte telescope of 8 $\frac{3}{4}$ feet focus: Crown objective, outside radius, 76.266 inches, inside radius, 175.109". Corrector composed of a plano-convex crown, radius 8.9915", and a double concave flint lens, radii 161.14" and 9.973". Flat sides of the corrector together, and crown next to object glass. 2. What is the distance at which it should be placed from the object glass? Is there any great difficulty in obtaining a satisfactory effect in this manner? A. The corrector, 4 inches diameter, is placed about half the focus of crown objective from it, and moved until it corrects the chromatic aberration; and then the lenses of the corrector are separated more or less by 3 bits of card, about $\frac{1}{2}$ inch, more or less, until the spherical aberration is corrected. The correction is now perfect at center of field only; and the field lens of the Huyghenian eyepiece must be put in a sliding tube and slid out until the correction is complete throughout the field, except a slight aberration at the margin. 3. I desire to attempt the construction of an achromatic object glass for a telescope. Will you please give me the radius of the different curves of the crown and flint for an object glass 4 inches diameter, 60 inches focus? A. Tables for the curves of any pair of disks, given the index of refraction and dispersive power of the flint and crown, to the fourth place of decimals are to be found in Precht's "Praktische Dioptrik," being Barlow's extension of Herschel's tables. 4. Where can I obtain the flint and crown glass disks for the above? A. At Heroy & Marenner's (Chance's agents), Duane street, New York city. 5. Is there any work published which would aid an amateur in the making, (grinding, polishing, and testing) of lenses? A. Get Draper's book, and also Precht, to read with the help of some intelligent Teuton. You will then be on the road to success.

(58) H. W. W. says: In your most interesting article in No. 10, on solar chemistry, you say that the gaseous substances which constitute the photosphere contain lime, magnesia, and iron. Are we to infer that our sunshine contains these? What is the proof? A. The sunshine does not contain lime, magnesium, etc. Its spectrum, however, contains certain dark bands which, when compared with the spectra of the metals in the state of incandescent vapor, correspond with the bright spectral lines formed by these incandescent vapors. But it is a property of incandescent vapors to absorb light of the same refrangibility as they emit. Hence the dark bands in the solar spectrum are absorption bands, due to the absorption of certain portions of the sunlight by corresponding incandescent vapors.

(59) C. A. says, in reply to E. G., who asks what speed to give a foot power circular saw: I run mine at 4,500 revolutions per minute. My saws are five inch, of No. 26 gage. The balance wheel is about 75 lbs. in weight, and I increase motion with countershaft. I enclose sample of cuts made with a cut-off saw. Are they good work for a foot powersaw? A. Yes, very good indeed, and give evidence that the sawyer is an expert. E. G. and others will be much obliged for the information.

(60) R. H. H. says, in reply to J. S., "who asks if a belt would hug a smooth iron pulley closer than one covered with leather, and you say that you are not sure that a pulley covered with leather is better than one with a smooth iron face; I know it is better, for we put on a 10 inch iron pulley with a 4 inch face, and the belt would slip, no matter how tight it was. We changed it to a 10 inch wood pulley with 4 inch face covered with leather, and it does the work now without any slipping."

(61) G. B. says, in reply to A. B., who asks What is the material used in the manufacture of corduroy, which gives that fabric so disagreeable an odor when wet? Animal size, made chiefly of dead horses, put in to give the fabric more body.

(62) F. V. J. says, as to the needed improvements in the rail joints on street railroads: A piece of rubber put under the plate would prevent the evil to some degree. As the rails are now, they damage the cars; but rubber put under the rails would act as a spring and deaden the jar.

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

J. H. N. D.—The brilliant golden scales are films of muscovite, a variety of mica, which have acquired their color by the oxidation of a small percentage of iron which the mineral contains under the influence of heat in a current of air.—J. U. E.—You are mistaken in supposing that the sun's heat is attributed by scientists to combustion. A great many suns made up of coal would have been entirely consumed during the time the sun has been the source of heat to the solar system.—M. H.—It is sulphuret of lead or galena.—M. R. K.—We regret to say that the jewelers will not purchase these river pearls. We have had a pearl from

the Wabash river many times the size of the largest specimen, but it is not salable.

B. M. asks: Which is the best way to bottle lager beer to avoid a second fermentation?—R. H. M. asks: If a heavy sphere, whose diameter is 4 inches, be dropped into a conical glass full of water, whose diameter is 5 inches and altitude 6 inches, how much water will run over?

COMMUNICATIONS RECEIVED.

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

On the Tides. By W. H. P., and by Z.
On Poetry and the Locomotive. By J. H. B.
On the Vital Principle of Organic Matter. By W. H. B.
On Lighting Tapers. By F. W. D.
On a Parasite of the House Fly. By D. V. D.
On Boiler Explosions. By S. N. B.

Also enquiries and answers from the following:
M.—F. C. R.—H. C.—O. C.—H. S. E.—W. S. D.—P. B.—H. H.—C. C. M.—W. H.—J. M. E.—H. J. D.—J. P.—J. C. R.—A. P. E.—E. W. P.—S.—A. W. P.—C. H. A.—J. M.—F. H. W.—S. T.—R. G.—J. R. D.—A.—L. F. M.—J. F. J.—J. H.—R. A. K.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes the best steam trap? Who sells the best three horse engine? Who makes the latest improved steam cut-off? Who sells the best sewing machine motor? Whose is the best tool steel?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,274, 8,275.—BREASTPINS.—L. S. Beals, Astoria, N. Y.
8,276.—POTTERY.—J. Coxon, Trenton, N. J.
8,277.—COFFIN SCREWS.—N. Hayden, Essex, Conn.
8,278.—BADGE.—H. C. Lees, Philadelphia, Pa.
8,279.—HITCHING POSTS.—L. Schaefer, Cleveland, Ohio.
8,280.—PICTURE MOUNTS.—R. Trautmann, New York city.
8,281.—VASE.—W. Tweeddale, Brooklyn, N. Y.
8,282.—PITCHER.—H. Vaseur, Wallingford, Conn.
8,283.—SPOONS, ETC.—C. Witteck, New York city.

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2,390.—LARD.—G. C. Naphys & Son, Philadelphia, Pa.
2,391.—PETROLEUM.—Power & Co., London, Eng., et al.
2,392.—MEDICINE.—J. H. Rutledge, San Francisco, Cal.
2,393.—JAMS, ETC.—P. J. Ritter, Philadelphia, Pa.
2,394 to 2,397.—TOBACCO.—J. Sarrasin, New Orleans, La.
2,398.—STOVES.—Summer King Co., Pittsburgh, Pa.
2,399.—COPYABLE INKS.—F. de B. Bertot, New York city
2,400.—SILKS.—A. De Greiff & Co., New York city.
2,401.—COFFEES, ETC.—Focht & Co., Philadelphia, Pa.
2,402.—SPIRITS.—Freiberg & al., Cincinnati, Ohio.
2,403.—STARCH.—Glen Cove Starch Co., New York city.
2,404.—CORN FLOUR.—Glen Cove Starch Co., N. Y. city.
2,405.—RAPS AND FILLS.—Heller & al., Newark, N. J.
2,406.—SOAP.—Lincoln Mfg Co., Providence, R. I.
2,407.—GLOVES, ETC.—Passavant & Co., New York city
2,408.—TOTS.—H. Jenkins, Brooklyn, N. Y.
2,409.—CONCRETS.—B. Kleinberger, New York city.
2,410.—FISH.—Eagle Fish Co., New York city.

SCHEDULE OF PATENT FEES.

On each caveat.....\$10
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On filing each application for a Patent (17 years).....\$15
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On application for Design (14 years).....\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
April 16 to 21, 1875.

4,636.—Wm. T. Root et al., Ingersoll, Ont. Radiator and steam heating apparatus. April 16, 1875.
4,637.—J. L. Adams, Montreal, P. Q. Tobacco cutter April 16, 1875.
4,638.—J. D. Stark, Brooklyn, N. Y., U. S. Elastic wheel lubricator. April 16, 1875.
4,639.—A. H. Swain, Winchester, Ind., U. S. Adjustable table and ironing board. April 16, 1875.
4,640.—R. F. Cooke, New York city, U. S. Elastic horse shoe. April 16, 1875.
4,641.—J. E. Wisner, Friendship, N. Y., U. S. Horse hay rake. April 16, 1875.
4,642.—M. D. Murray et al., Johnstown, N. Y., U. S. Breast collars for harness. April 16, 1875.
4,643.—A. L. Carey et al., Ypsilanti, Mich., U. S. Chain pump bucket. April 17, 1875.
4,644.—Wm. H. Gibbs, Oshawa, Ont. Middlings purifier. April 17, 1875.
4,645.—R. W. Jeffery, Woodbridge, Ont. Bolt lock for pitman box. April 17, 1875.
4,646.—J. Currie, Toronto, Ont. Boiler foam preventer and fuel saver. April 17, 1875.
4,647.—J. F. Webster, Hamilton, Ont. Screw machine. April 17, 1875.
4,648.—L. W. Russell, Ganarogue, Ont. Fence corner April 17, 1875.
4,649.—B. Sloper, Montreal, P. Q. Hydrogen generator and carburetor combined. April 17, 1875.
4,650.—S. R. Bailey, Boston, Mass., U. S. Wood-bending machine. April 17, 1875.
4,651.—W. G. Rawbone, Toronto, Ont. Cartridge creaser April 17, 1875.
4,652.—S. H. Hall, Belle Plaine, Iowa, U. S. Tan vat April 20, 1875.
4,653.—J. B. Porter, Yarmouth, N. S. Ironing machine. April 20, 1875.
4,654.—E. Tiffany, Bennington, Vt., U. S. Circular knitting machine. April 20, 1875.
4,655.—A. G. Gray, St. John, N. B. Mowing machine. April 20, 1875.
4,656.—S. Ryabeck, Red Wing, Minn., U. S. Mortising machine. April 20, 1875.
4,657.—I. Levy, Ellaville, Fla., U. S. Fence picket machine. April 20, 1875.
4,658.—Wm. Peaker et al., Erampton, Ont. Hot air dumb stove. April 20, 1875.
4,659.—J. S. Kemp, Magog, P. Q. Manure-spreading machine. April 21, 1875.
4,660.—B. Curtis, Jr., Boston, Mass., U. S. Buckle attachment. April 21, 1875.
4,661.—Wm. Shea, Trenton, Ont. Milk and liquid cooler April 21, 1875.
4,662.—Wm. J. Mansell, Toronto, Ont. Self-acting car coupling. April 21, 1875.
4,663.—W. H. Landon, Princeton, Ont. Parlor cooking stove. April 21, 1875.
4,664.—W. J. Wauchope, Niddrie, Scotland et al. Gas manufacture. April 21, 1875.

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Vol. XXXII.—No. 22.
[NEW SERIES.]

NEW YORK, MAY 29, 1875.

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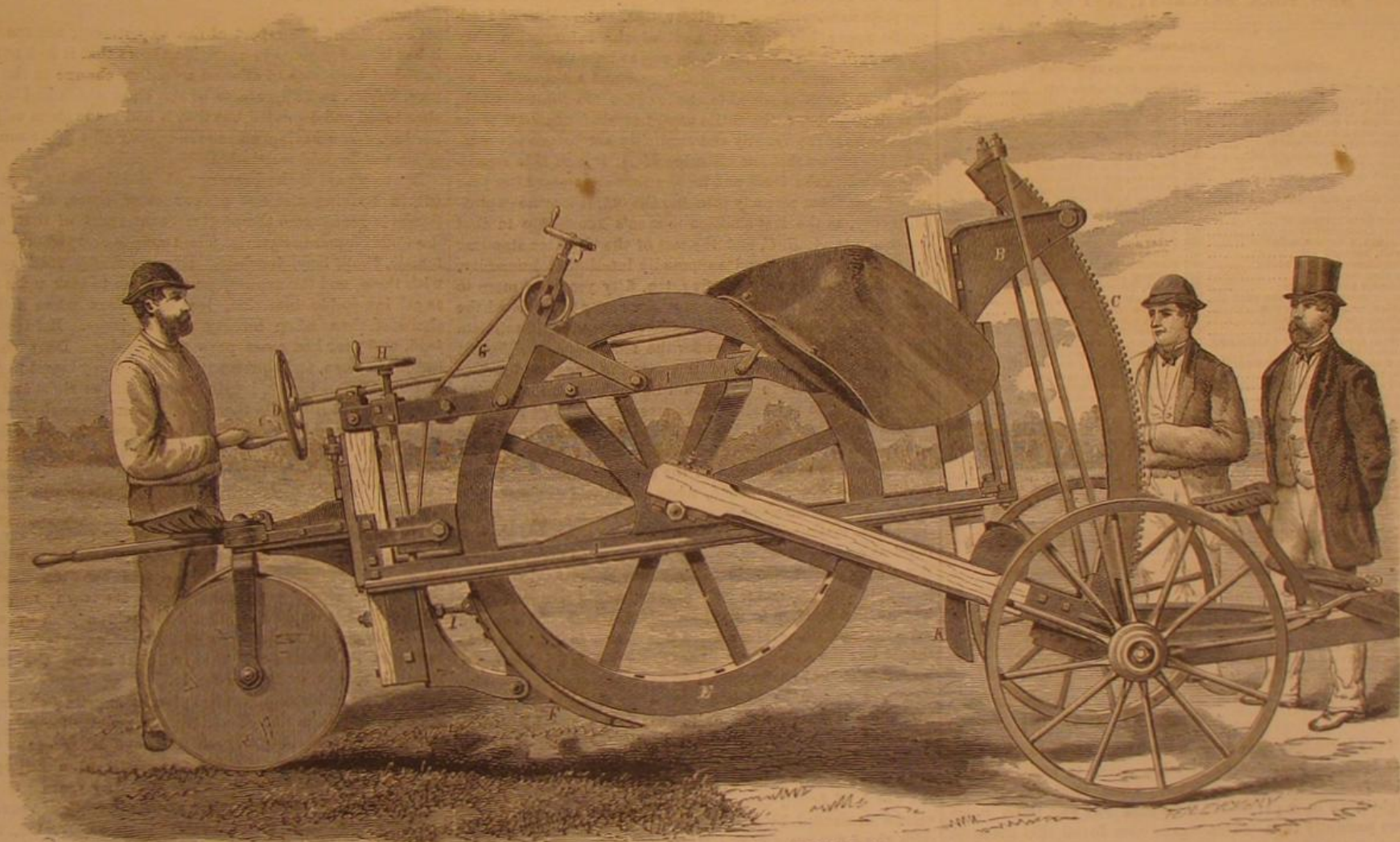
THE VIRGINIA DITCHER.

Some writer has said that drainage is to the earth what breath is to man. Good drains are earth's lungs. Science and experience have demonstrated, beyond intelligent dispute, that the producing capacity of the earth, not to mention its healthfulness, is largely in proportion to its ability to receive Nature's nourishment, namely, heat, air, and moisture, and to expel the poisonous secretions left within the earth.

The intelligent farmer should as soon expect health to his body and vigor to his mind with congested lungs, as life-

by the bracket, B, in the forward part of which is a pinion which engages with the rack, C. A worm gear, meshing with the pinion, is actuated by a rod which extends to the rear and terminates in the hand wheel, D, so that, by turning this hand wheel, the bracket pinion may be rotated on the rack; and thus the forward end of the frame, A, upon which the ditching wheel is suspended, is raised or lowered as desired. The rack, as well as the driver's seat, is supported on the forward axle. Suspended in bearings in the frame is the cutting wheel, E. This consists simply of the strong, circular, sharp-edged steel flanges, of such width apart and depth

piles regularly, convenient for refilling the ditch or removal. The construction and mode of adjusting the shoe, E, should be particularly noted, for herein, it is claimed, lies the simple and effective mechanism that renders rotary ditching practicable and very economical. The adjustable shoe and plow effectually prevent the machine from clogging; the pivoted plow, resting on the sliding shoe, is readily raised or lowered; and thus any temporary excess of earth or unexpected impediment can be removed or relieved, or any deficiency in cutting promptly made up. The pitch of the shoe is adjusted by the set screw, I, by means of which its upper or lower



RANDOLPH'S VIRGINIA DITCHER.

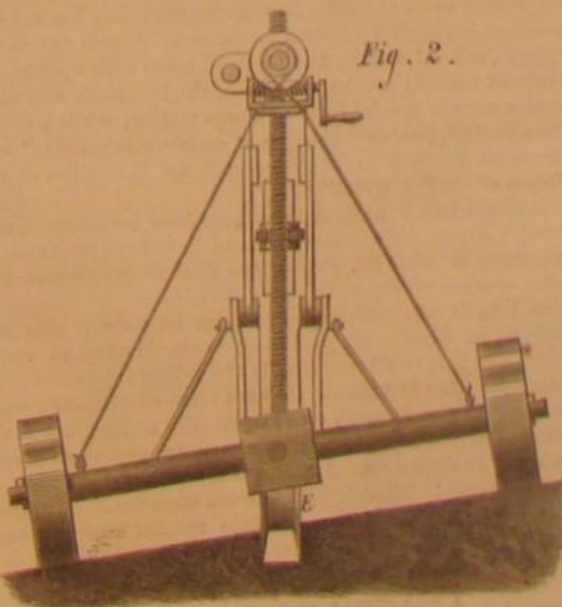
giving power in his acres when clogged, soddened, or even of heavy soil. Even the lightest soils lack porosity. Respiration, then, must be set down, by the farmer who would be successful in the largest sense, as being absolutely as essential to his acres as to himself.

Nor is the capacity to receive Nature's gifts (air, heat, and moisture), which drainage secures, the limit of its advantages. That the richest of natural soils, when undrained, will not compare with much inferior soil when drained, all intelligent persons know; but the utility and wonderful economy of the drainage system is best illustrated when fertilizers come to be used. The drained land receives and retains, almost without loss, the fructifying qualities of fertilizers; while, from obvious causes, the undrained land receives slowly, wastefully, and always coldly, the expensive helps to its productiveness. The best of fertilizers, used on undrained soil, will yield but a temporary benefit; while much poorer land, drained and fertilized, will be almost inexhaustible.

We devote the initial page of this issue to the representation of a new and simple apparatus, which, for the slow, costly, and uncertain ditching process of the past, substitutes the certain, cheap, and reliable labor of machinery. It is the invention of ex-Governor (now United States Senator) Theodore F. Randolph, of Morristown, N. J. It is fully covered by patents, both in this country and abroad, taken out through the Scientific American Patent Agency. The machines are of two constructions, one having three traction wheels, as shown in the engraving, Fig. 1, and the other having four traction wheels, differing only from the first in its adaptability to side hill cutting or use on very uneven ground. Fig. 2 represents all that is material to be shown in the latter, the four-wheeled ditcher.

Turning to Fig. 1—the three traction wheel machine—we describe as follows: A is the supporting frame, which rests in the rear on the following wheel, and is held up in front

of cut as is desired. When the frame is lowered, these cut into the ground, dividing it, and forming the perpendicular sides of a ditch. Directly in rear of the wheel, and between the flanges, is a steel-pointed shoe, F, the forward edge of which makes a horizontal cut, generally, on a line with the lower edge of the flange.



The shape of the ditch is thus defined on sides and bottom; and the earth, loosened at all points, is carried up, by the revolution of the ditching wheel and between the flanges, until it reaches the chute on the forward upward portion of the machine, out of which it passes to the ground, whereon it

extremity is drawn from or set toward the rim of the ditching wheel. Provision is thus made for the different strata of soil, frequently found under a common surface. The hand wheel, J, is simply a belt tightener. The cutters, K, on the lower end of the front post relieve the work of the ditcher somewhat, and can be made to give almost double width to the ditch, without widening the flanges. Knives of proper strength are also arranged for the rear post, by which sloping sides are made in ditching, when required.

The machine can be used for digging narrow and deep tile ditches, or open and broad ones. They vary in size and capacity, and require animal power from two horses, necessary to draw an apparatus weighing 1,500 lbs., to six horses, pulling a machine of 2,500 lbs. weight, and fitted for work in the stiffest soils. The machine does not undertake to dig stumps, or to remove stones larger than the capacity of the flanges.

From reports of practical trials, we learn, the machines cut perfectly smooth ditches, of any depth and of any width desired, the power to work them being increased in a diminished proportion to their larger size and capacity. The usefulness of the machine is not confined to ditching. As an excavator, it shows considerable capacity; the machines of six horse power dig from 250 to 300 lineal feet a minute, ten inches wide, and three or four inches thick. This will be found to be equal to 5,000 lbs. solid earth, and nearly two cubic yards, per minute. As a road maker, for pipe trenches, railway embankments, underground telegraph wires, and the like, it would seem to be of much utility. A machine is now being constructed, we understand, for digging irrigating canals in Texas. The agents suggest that, as a single machine will do the work of many farms, the club system would be the best in purchasing, thus making the cost to each person comparatively small.

Full particulars can be had by addressing Randolph Brothers, agents, 111 Broadway, New York city.

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A WANT.

Many ingenious experiments have been made to determine how long, on the average, it takes a man to receive a mental impression and respond to it by some simple action. As might have been predicted, some men feel and think much more promptly than others. It is also found that the same man's mental and nervous actions are not the same at all times; the quickness of the response varies, too, with the nature of the signal, and with the practice the observer has had in noting the same or similar phenomena.

A series of corresponding investigations of the rate at which the human mind acts in bulk is also very much needed. In them it would be not the mental action of individuals, but of classes, that would be studied: how long it takes the various grades or classes of men to receive a new idea; how long it is before the idea is generally accepted by the class and carried into practice; and what are the relative periods required for the acceptance of different sorts of ideas by different classes.

The investigation would have to be made historically, by such a man as Francis Galton or Herbert Spencer, assisted by specialists in the several departments of human progress, who would compile tables of the great discoveries in their special fields, setting opposite to each discovery of important fact or principle the time required for the several stages of its progress to general acceptance. One table, for example, would record the more important discoveries in Science, giving the date of each, the date of its endorsement by some prominent man of Science, then the time elapsing before it was accepted generally by the leaders of that particular department of Science, the time when the scientific world at large received it, the date of its adoption by men of culture, by practical men, and lastly by ecclesiastics. Other tables would mark in like manner the advance of human thought along other lines of progress, so that a comparative statement could be drawn up, showing the relative rapidities of different sorts of intellectual movements in different classes of society.

That such a scheme could not at once be carried out, with any degree of perfection or completeness, is no argument against it. It is true that only a very few scientific and other discoveries have yet permeated all classes; nevertheless the very gaps in the tables would be instructive, as evidences of the hollowiness of the pretended culture of

many respectable classes, and the impenetrability of other classes to large congeries of truths. Even approximate tables would be immensely valuable; they would save such a world of anxiety!

For example, a man makes, after years of patient study, an important discovery—say in optics. He hastens to lay his achievement before the world, and naturally expects that the world will be as glad to receive as he is to publish the new truth. But somehow the world does not see it. Most likely, if the discovery be of prime importance, it will be disputed with the intensest vigor by the very men who ought to welcome it. In such a case, our unfortunately fortunate student would have simply to turn to his table book to learn that, on the average, it takes so many months for a discovery of the kind to be accepted by some acknowledged master of the science of optics; so many years before it commands the assent of opticians generally; so many decades before it is incorporated into advanced optical teaching, and so reaches the world of general culture, and so on. Then he would be able to possess his soul in patience, knowing how useless it is to expect the thoughts of the world to transcend their usual capacity for speed.

Possibly there are men, like Dr. Draper, who have learned from long experience—at least in their special departments—pretty much all that such tables would teach them; but for younger men and men of more hasty temperaments, they would be exceedingly useful. And they would be not without their uses to other than discoverers. The editor of a scientific paper has frequent need of the information they would furnish to keep him from undue impatience with the slowness of men to receive intelligence and act upon it.

A vital truth is added to the world's too limited stock, changing, perhaps, the entire aspect of a science. He takes pains to have it promptly and explicitly set before his readers. He knows that the attention of *A*, *B*, and *C* is repeatedly called to the truth and its bearings; yet year after year he will see them serenely teaching the old, it may be exploded, theory, as the last addition to men's knowledge in that department: *A*, *B*, *C*, and the rest of the alphabet standing for classes of honest and supposedly intelligent humanity, requiring respectively one, five, ten, fifty years, or more to learn anything. If our afflicted editor really appreciated the natural sluggishness of class intelligence, and could estimate the probable period required for the incubation of different ideas in different orders of men—as the suggested tables would enable him to do—would he chafe so at the persistence of error, or the halting progress of knowledge?

Personally, we often feel the need of just such specific knowledge of the varying rates of speed at which intelligence becomes incorporated in the mental furnishing of various classes of men. Then, when we should see some scientific doctrine atrociously misstated by some "leader" in literature, metaphysics, or theology, the knowledge that it requires on the average so many years, or so many generations, for a clear conception of any new scientific thought to penetrate that particular body of men, would reconcile us to its slow illumination in that particular instance. We should say—not that the misdoer was a knave or a fool, but merely that it was too soon to expect anything better in that quarter. We should not be surprised even to learn that a sensation was caused in certain circles by the bold assertion that the world is not flat; or to hear that a like effect was produced in theological circles where one of the most liberal and talented men of the English church plucks up courage to say, as Dean Stanley did the other day, in a sermon on the death of Lyall, that "it is now known that the vast epochs demanded by scientific observation are incompatible with the 6,000 years of the Mosaic chronology, and the six days of the Mosaic creation," implying that geology is right and Genesis wrong. And we might possibly be patient at still another infliction, upon confiding readers, of the mythical Three Buttes of the solar spectrum by one who professed to present the latest scientific aspect of "Chemical Radiation" in a periodical of the standing of the *Popular Science Monthly*.

"There are three spectra," says the writer: who quotes Dr. Draper as an authority in solar matters, but has not yet heard of his most important discoveries: "there are three spectra, one of which, the thermal, takes action upon all kinds of matter; another of which, the luminous, acts only upon a certain special form of nerve matter; while a third, the chemical, produces changes in certain compounds;" and the usual figure is given, showing "the Intensities of the Forces of the Spectrum."

It would be a comfort to know just how long we can reasonably expect such popularizers of Science to continue in ignorance of what Dr. Draper has done to demonstrate the utter absence of any such triple division of the sunbeam; how long it will probably take them to discover that red light is as capable of producing chemical effect as violet light, and that in all probability the yellow rays seem most luminous simply because they act most energetically upon carbon compounds, such as compose the retina; but in the absence of the investigation we have suggested, such consolation is denied us. And there are such a multitude of similar cases! Therefore, we assure whoever shall prepare the tables demanded that a certain market awaits at least one copy. We will take it for personal use.

A PRACTICAL CURE FOR VAGRANCY.

When Count Rumford became the friend of the King and virtual ruler of Bavaria, he found the country swarming with beggars. In the large towns, beggary was an organized imposture, insolent, clamorous, persistent. The rural districts were overrun with tramps of all ages and every na-

tionality, who levied contributions, robbed, and tyrannized everywhere: and not only their impudence and clamorous importunity were boundless, to use the Count's own words, but they had recourse to the most diabolical arts and the most horrible crimes in the prosecution of their infamous trade. All the regular machinery for the repression of vagrancy was unavailing. The people were disheartened. Industry was well nigh paralyzed by the parasitic multitude, and the honest peasantry had become so corrupted by bad example that they would leave their work in the fields to beg of travelers on the highway. Beggary had become so common and customary that it no longer seemed shameful or infamous.

Yet the whole system fell in a day when attacked by the Count's resolute will and sterling sense. His remedy was work, fairly rewarded, so presented as to make industry as attractive as possible, but rigorously insisted on. His plans for housing, feeding, and employing the beggar class were quietly perfected; then, on the first day of January, 1790, every beggar was arrested and set to work.

The law was: No idleness, no begging, no dirt or debauchery; but work for all, good food, kind treatment, and instruction in the ways of honest living. In one day the plague of beggary was stopped. And it was not long before the majority learned to prefer the comfort, decency, and respectability of honest industry to their former squalor, idleness, debauchery, and crime. And the experiment paid financially.

Count Rumford's report of the experiment, written after it had been five years in operation, shows that it had not only banished beggary and effected an entire change in the manners, habits, and appearance of the class which had been so abandoned and degraded, but that it had made them self-supporting. The saving effected in cutting off a great source of crime was beyond estimation.

In every part of the Eastern and Middle States, especially within walking distance of our chief cities, an order of things is growing up the precise counterpart of that which the Count found in Bavaria. The tramp is everywhere—male, female, limp, lazy, insolent. Every country road swarms with them, and the country people begin to look upon them as an inevitable infliction, less dangerous when fed and sheltered than when hungry and at large. Refuse them food, and your hen roost pays the penalty. Deny them a bed in the barn, and they set it on fire. They travel in gangs and disperse to forage, levying contributions right and left. Their vagrant life suits them; and miserable as they seem to be, no proffer of honest wages for honest work will induce them to leave the road. Every season their number increases, and competition only increases their audacity. Unless the evil is differently dealt with, it will soon become as intolerable as it was in Bavaria.

No method of treatment involving large preliminary outlay for workshops, concert of action, or central authority can be looked for here; we need not one but ten thousand Rumfords. Every town must apply its own remedies: nevertheless it would not be hard to devise a plan by which the whole system of tramping could be as quickly broken up as it was in Bavaria, and that without taking the tramps from the roads they love so dearly.

Any town can inaugurate the plan by enacting and enforcing a regulation to this effect: Fix the penalty for begging—that is, professional begging—at ten days' labor on the highways for each offense; there is no danger of a failing demand for that sort of labor for the next fifty years. Give to every citizen the power to make arrests in cases of vagrancy; and for every ten days' labor by the party so arrested, credit the person making the arrest with five days toward the working out of his road tax. For his labor, give the tramp decent board and lodging, and from ten to fifty cents a day as wages, according to his efficiency. Let such a law be rigorously executed, and in a little while we should have better roads and fewer tramps.

The honest seekers for work would suffer less under such a system than they do now, when they are apt to be confounded with professional beggars, who are always in search of a job—somewhere else. If seriously in need of work and money, the temporary tramp would simply have to apply to the road master, who would never be without employment to give and fifty cents a day to pay for it. The work hunter would not be long in acquiring enough to pay his way further or to support himself until he found work in the neighborhood. Farmers and others in want of help would soon learn to resort to the road gangs to pick their men, the volunteers being free to engage themselves at any time, those under arrest when their ten days were up. The professionals would more or less quickly learn to prefer free labor at high rates to enforced work on the roads at low rates; in the meantime an enormous "waste product" would be utilized, and the highways improved at small cost to the residents. It is safe to predict that any community adopting such a plan would soon have better roads or fewer beggars—possibly both.

THE WRECK OF THE SCHILLER.

A terrible marine disaster occurred on May 7, off the Scilly Islands, near the English coast. The Schiller, a new and magnificent steamship belonging to the Eagle line, was entirely wrecked. The ship was on her voyage from New York to Hamburg, and was endeavoring to reach Plymouth, England, in the midst of a thick fog, which, for three days, had prevented observations. The captain probably mistook his position, and at ten o'clock at night the vessel struck on Retarriere reef, while under almost full steam headway. A strong gale and heavy sea speedily caused her to drift broadside on the rocks, the waves sweeping her decks, and finally, as the tide rose, carrying away her masts, which were loaded

with passengers who had ascended the rigging for safety. But two of the boats reached shore; and out of three hundred and eighty-five people on board, but forty-three were saved. Ordinary life preservers, it appears, were on board; and after the shock, every woman was secured in one. It is curious to note, however, that, despite this precaution, all, with one exception, were drowned.

It is impossible to suggest any means of safety which could be provided, which would preserve life under such circumstances as these, in the midst of a raging sea; but we are not without hope that some inventor will yet devise a life preserver capable of meeting all emergencies. The apparatus must be such as to support the person entirely independently of his own exertions; it must prevent his becoming drowned by constant submersions by the waves breaking over his head; it must be capable of easy application, and be as self-adjusting as an old coat. There must be but one way of getting into it, and that perfectly obvious under extreme excitement; and to sum up all, it must possess the element of simplicity to such a degree that a thoroughly frightened woman cannot by any possibility mistake what it is for, and what to do with it.

The Schiller had eight boats, and seven watertight compartments. Her length was 375 feet, beam, 40 feet, and tonnage, 3,000. Her engines were of 3,000 indicated horse power. She made her first trip in February, 1874. Her cost was \$800,000, gold.

A SUCCESS FOR THE FISHERY COMMISSION.

"Never see'd nuthin like it, Sir; I've been a settin' nets on this 'ere river for more'n ten year, and there aint been no time when North River shad was as many as they are now. They're as plentiful as porgies, and we can't get nothin for 'em. Why we used to get our two dollars or a dollar an' a half a piece for them in the early spring; but now—why there's an old woman a sellin' 'em out of a keg for twenty-five cents a pair. It's ruinous, this is; them fishery fellers have just busted the business; I might jes' as well sell the nets, and take ter mackrel fishin'." Thus remarked a Washington market fish dealer to us the other day, after we had requested his opinion on the sudden increase in the shad catch, which over 30,000 fish taken already this spring denoted. "Them fishery fellers," in other words the State Fishery Commission, had stocked the river anew, broken up the fish famine, and filled the Hudson with finer and better shad than have been seen in it for years. The use of nets extending clear across the stream, which now, we believe, is forbidden by law, had resulted in practical depopulation; for the fish were completely barred out of the head waters where they were wont to spawn. Gradually they diminished until North River shad became a dainty far beyond the reach of the average pocket.

Three or four years ago, Science, under the guise of Mr. Seth Green and his assistants, set to work to make up the deficiency. Five million young fish were placed in the Hudson and its tributaries, and the result we are now gathering. This is a grand success for the pisciculturists, and the people will appreciate it. We trust that it is but the precursor of other palpable proofs of the possibility of enlarging our supply of finny food; for an increased popular interest, which will thus be engendered, is sure to be followed by substantial contributions through which the labors of the fish culturists can be aided and their value further augmented.

DESIGN PATENTS AND TRADE MARKS.

The importance, to manufacturers, merchants, and others, of securing protection for the use of emblems, vignettes, or names on their goods, whether of domestic manufacture or imported, does not seem to be sufficiently appreciated. Trade marks are granted to any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, and extend for 30 years. A great many agents of foreign manufacturers, residing in our large cities, have availed themselves of the simple provision of our law by securing trade marks on imported goods. But our own manufacturers do not seem to be alive to the importance of availing themselves of that protection, afforded under our patent laws.

The "centennial" year is approaching, and we should think that any manufacturer would do well to secure a trade mark on the word as applied to a great variety of articles, such as hats, caps, collars, shirts, shoes, knives, inkstands, stoves, ranges, etc.

The above remarks apply with equal force to all persons who neglect to take patents on any new and original designs for busts, statues, stove plates, picture frames, crockery, cutlery, stoves, or any other ornamental articles. Patents are also granted on any new and original design for the printing of woollen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture. Design patents afford protection for different periods (three and a half, seven, or fourteen years) as the party applying may elect, and the cost varies accordingly.

For information on the securing of trade marks and design patents, address the publishers of this paper, who will be pleased to impart, free of charge, all necessary advice.

THE NEW INTERNATIONAL POSTAL RATES.

On and after July 1, uniform postal rates will be collected on mail matter sent between the United States and Germany, Austria, Hungary, Belgium, Denmark, Egypt, Spain, Great

Britain, Greece, Italy, Luxembourg, Norway, Holland, Portugal, Roumania, Russia, Servia, Sweden, Switzerland, and Turkey. After January 1, 1876, France is also to be included in the union.

These new rates have been established by treaty between the different powers, and offer in some cases great reductions on the charges now existing, while in others the tariff is increased. To all the above countries, the tax for letters, paid or unpaid, per half ounce, is ten cents; postal cards, two cents each; newspapers under four ounces, two cents; other printed matter, samples, etc., two cents per two ounces or fraction. The registration fee on any letter is fixed at eight cents. For letters, these rates are less than the present to Spain, Egypt, Greece, Portugal, Russia, and Turkey; to other countries, with the exception of Italy, Norway, Holland, and Roumania, they are increased. The newspaper postage is largely reduced in every case, excepting in that of Great Britain, to which country it remains practically the same. The postal card rate is an innovation, and the fact that a missive may soon be sent from San Francisco to Constantinople for two cents is certainly a remarkable indication of progress.

The public will be greatly the gainers in thus having a fixed and reduced rate of postage, to nearly all the civilized countries, substituted for the numerous and different charges now in existence.

SUCCESSFUL TRANSPLANTATION OF BONE.

Speaking of surgical operations in a late issue, we said that attempts had been made to substitute healthy for diseased bones by a sort of grafting process, but they had fallen short of complete success.

A peculiarly interesting, because completely successful, operation of the sort is reported in a recent German medical journal. The patient was a young officer, twenty-four years of age. In 1870, he received a gunshot wound which resulted in a false joint in the middle of the right ulna—the large bone of the fore arm. The functions of the limb were seriously impaired, notwithstanding the smaller bone, the radius, was uninjured. To relieve the deformity, the false joint was laid bare, and the cartilaginous ends of the bone, together with the false ligament, were removed by strong scissors. Then the upper part of the ulna was sawn half through, about two inches above the end of the bone, and the upper piece, with its enclosing sheath—the periosteum, by which the nutrition of the bone is effected—was split off with a hammer and chisel, leaving, however, a small bridge of the periosteum to keep the bone alive. The detached bone was neatly fitted into the place of the false joint; the fatty and indurated soft parts were divided so as to set up an inflammatory reaction; the bleeding was checked by a stream of carbolic water, the wound closed by sutures, and a fenestrated plaster of Paris bandage applied. A single splinter of dead bone subsequently came away. The patient made a perfect recovery, regaining such full use of his arm that he was appointed to a regiment.

OUR NATIONAL UNIVERSITY OF TECHNOLOGY.

The late Hon. J. C. Osgood, to whom we owe the canal dredge and other useful inventions, became an inventor, it is said, through his lively sense of the ridiculous. He was in an upholstering establishment one day, where he saw a number of people at work picking and curling horsehair. The systematic waste of time and labor involved in the operation seemed to him so ridiculously absurd that he laughed heartily, rushed out of the shop, and—so the story runs—invented a picking and curling machine which "produced a revolution in that branch of industry." Having tasted the sweets of invention, he went on to more serious achievements.

Volumes of similar incidents might be compiled from the experience of inventors in this country. There is scarcely an industry which has not been more than once revolutionized by means of labor-saving inventions; scarcely an inventor whose inventive genius has not been awakened by some seemingly trifling circumstance, some happy thought, and afterwards developed by creative exercise.

The rationale of such occurrences is worth inquiring into. Why do such things happen so frequently here, so seldom in other countries?

It was a Frenchman who said it was to be expected that a Yankee would be sharp at a bargain. It was dinned into his ears from earliest infancy; the burden of his mother's lullaby was: "Buy low, baby!" Still more, according to the facetious Englishman, is it to be expected that a Yankee will invent. It is born in him. While the baby lies in his cradle he invents an improvement on it, and says to himself: "When I'm a little bigger, I'll take out a patent!"

Seriously, there is more in the idea than the Englishman gave himself credit for. The great incentive to invention—an incentive which has made us a nation of inventors—is the possibility of taking out a patent easily and cheaply. Every American knows that, for an almost nominal sum—which might be further reduced to the country's advantage—the Patent Office will give him a certificate of exclusive proprietorship in any new idea he may develop, and that the courts will protect him in making as much money out of it as he can during the term of seventeen years. He knows that there is no more profitable investment for capital than a good patent; no way by which a man without capital can command capital so surely as by a good invention; no property more productive than a good patent; no way by which brains will bring to the possessor a greater portion of this world's goods than through invention; no means of self-culture so effective or so sure to have its good results so promptly re-

cognized by the world. Consequently the country swarms with inventors, each doing his best to make life easier and richer to every inhabitant of the land. The inducements which the government holds out to men of ideas have thus made the Patent Office practically a National University of Science and Art, with millions of students. Its functions are those of a true university, to encourage study, to examine and certify results, irrespective of the age, sex, or nationality of the applicant; and its degrees are such as practical men covet.

Where our literary institutions graduate hundreds, our National University graduates thousands. Its degrees cover the widest possible range of merit, yet their worth is not exceeded by the degrees of Harvard or Yale. Notwithstanding the multitudes of unimportant patents issued, the multitude of patents which, for one cause or another, are never practically developed, the average value of a patent to the possessor and to the country at large is greater than the average value of a farm. We owe this enormous addition to national wealth, not so much to national genius for invention, as to the fact that inventions are encouraged by a liberal system of granting patents, and a spirit of great liberality in their interpretation by the courts.

The opinion prevails in some circles that the inventor, like the poet, is born, not made; that great inventions are, like great poems, the fruit of inspiration; and that the inventor needs none of the inducements and favorable conditions required for less creative work. Nothing could be wider from the truth. Invention is an art to be acquired by persistent effort, just as any other art is: the fact that men differ in natural capacity for such work no more proving the art unacquirable than similar diversity in capacity for other arts proves them to be altogether innate. And though many striking inventions have been made, like Goodyear's, through accident, and by men whose attention had never before been directed that way, still, as a rule, such accidents are few, and happen only to men on the watch for them, men so accustomed to regard all things as open to improvement that they are ready at all times to follow up the slightest clue to a new process or application.

To any writer who wishes to cultivate a new and profitable field, we could not suggest a more promising one than the interior history of inventions and inventors, to discover the process by which great inventions and great inventors have been developed. Their beginnings and failures would be peculiarly instructive. For of many a man, known to the world only as a successful inventor, the Patent Office has records of a slow development from weak and insignificant beginnings, often in an entirely different field from that where in he has achieved his successes. Time after time he has come up to the great university for a degree, only—to use a bit of scholastic slang—to be plucked. Not unfrequently men begin so low even as to attempt a perpetual motion, in utter ignorance of all mechanical principles, and by study and experiments work themselves up to an honorable standing, sometimes becoming public benefactors of no mean order.

Where patents are less freely given, such developments are impossible. Heavy fees and unfavorable conditions discourage every effort; the poor man—and most inventors are poor to start with—cannot patent his invention if he makes one; without a patent it is useless to him; so, though he has the crude idea, or has the natural capacity for great inventions, he never makes any, and the world loses what might be of inestimable value.

A New Cause of Trichinae in Pork.

Some new cases of deaths, due to the eating of pork infested with *trichinae*, which are being quoted in Western journals, should be the means of directing public attention anew to the horrible disease of swine, called *trichinosis*, and to the fact that, when once the parasite attacks a human being, the result is prolonged suffering and, in a multiplicity of instances, death. The worm existing in the pork literally bores its way out of the stomach and into the muscles.

It has lately been found that swine may become infested with trichinae through eating carrion, or even decayed vegetable substances. This is a point worth consideration by farmers who incline to the belief that dead chickens, putrid swill, or any other filth about the place is legitimate food for the pig. The animal is not dainty in his tastes, and will lunch off his dead relatives with infinite gusto; but it is the poorest economy to permit him to assume the rôle of scavenger. No milk dealer will allow his cows to eat garlic if he can help it, though the brutes are crazily fond of the odoriferous weed; and there is certainly more reason for the farmer to see that his porkers have no access to unclean food. In the one case, if precaution be neglected, the taste of the milk is affected; in the other the entire flesh is rendered poisonous and dangerous food.

The Coming Cincinnati Exposition.

It will be seen, from an advertisement in another column, that the sixth Grand Industrial Exposition held in Cincinnati is to be open for the reception of goods on August 2 next. An important feature in this Fair is the thoroughness, accuracy, and honesty with which the tests of machinery are conducted, in contrast to the irregular and unreliable manner in which the same have been carried through of late in some other well known exhibitions. A large number of valuable prizes are offered, and excellent opportunities will be afforded for the exhibition of goods. Applications for space should be made at once. The Fair opens to the public on September 2, and closes October 9.

IMPROVED WALK AND ROAD CLEANER.

In large pleasure grounds, such as the Central Park in this city, or in extensive country seats, the labor of keeping the walks and roads clean and free from weeds is both arduous and constant, requiring the employment frequently of a large number of men. A new machine has lately been devised for this purpose, which, drawn by a horse and guided by one man, does the work far more effectually and expeditiously. It is the invention of Mr. Robert McKinley, a practical gardener of Hyde Park, N. Y., and its construction and capabilities will be understood from the annexed illustration.

A is the hoe, which flares forward so as to work close up against the edges of the walk, cutting the same square and clean. This is hung to the forward axle, and is also suitably jointed to a lever, B, by means of which it can be depressed to cut to any required depth, or raised out of action altogether. Following in rear of the hoe is a rotating rake, which may be also lowered or raised through jointed bars connecting with the hand lever, D. The rake is provided at one end with a pinion which is revolved by a gear wheel which, in turn, is rotated by the cog wheel on one of the main wheels of the apparatus, said main wheels being loose on the axle. The teeth of the rake are kept clear by the comb, E. Lastly, in rear of the machine is a gathering rake, F, which may be governed by the lever, G.

The hoe, A, serves to cut out the weeds, after which the ground is raked and the weeds shaken clear of earth by the revolving appliance. Lastly, the gatherer collects the refuse and deposits the same at proper points according to the will of the operator. By replacing the hoe with another of different form, the machine may be utilized for cultivating and other purposes of the farm.

The invention is manifestly a labor-saving one, and is of timely importance just at present. For further particulars the inventor may be addressed as above.

THE MERRIMAN LIFE-PRESERVING DRESS.

We recently published an account of Captain Boyton's daring attempt to swim from Dover to Boulogne, in the life-preserving dress invented in 1869 by C. S. Merriman. Although the adventurer did not complete his task, a journey of probably 30 miles, lasting 15 hours, must be considered a triumph for the inventor, as well as a proof of Captain Boyton's courage and endurance.

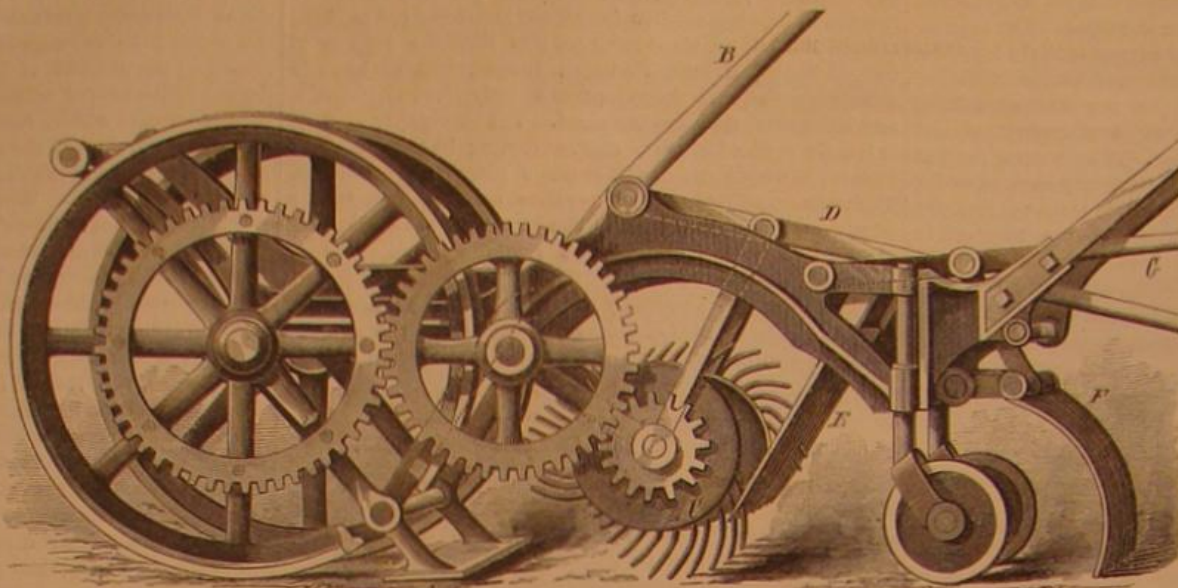
Our illustration gives a clear idea of the manner of using the invention, which certainly seems to be a comfortable and pleasant mode of traveling by sea. Under full sail, with the paddle for steering apparatus, the voyager seems to be as safe on the crest or in the trough of the waves as he would be in a boat; and the reclining position is much less wearisome than either standing or sitting. The steamer Rambler conveyed him across the channel, and he was much applauded when he landed from that vessel in Boulogne harbor.

The Philadelphia Exhibition.

In little more than twelve months the largest exhibition building that the world has yet seen will be opened at Philadelphia. We have already published some descriptive particulars of the huge structure now springing up in one of the principal centers of American commerce. The most recent advices from the States tell us that within the next two months no fewer than ten thousand hands will be actively employed in its construction. The circulars of the British Commission have been issued by Mr. Cunliffe Owen, and applications for space must at once be sent in. It is not too early, then, to consider what the project really means, and we can assure our readers that the subject deserves their best attention. Although the exhibition is, after all, to be nominally provincial, and government aid is withheld, it cannot be denied that the magnitude of the undertaking will really confer on it the dignity of a national enterprise. So far, therefore, the Philadelphia Exhibition cannot well be regarded as inferior in its scope to that of Paris in 1867, or of Vienna in 1873. Many engineers and manufacturers of Great Britain will therefore contemplate the sending of their productions to the other side of the Atlantic. Our purpose now is to urge upon these gentlemen the importance of considering very carefully what they are about before they incur any expense in carrying out this idea.

In plain English, international or provincial exhibitions are

simply great bazaars, in which space is taken and to which goods are sent, either to effect sales, or to serve as advertisements. The latter scheme has been so thoroughly carried out, indeed, that instances have occurred in which manufacturers have agreed for space, and exhibited nothing after all but dozens of photographs of their wares, and cases of the medals which they had previously obtained elsewhere. The Philadelphia Exhibition will prove no exception to the general rule. It will constitute a gigantic bazaar, in which a good trade may or may not be done, according to circumstances.



MCKINLEY'S WALK AND ROAD CLEANER.

But the question arises here: Is what England is likely to receive, in return for her trouble, worth having? In one word, will it be a good speculation to exhibit at Philadelphia in 1876? We call spades spades, it will be seen, and have no fear of shocking our readers when we state that the work of exhibiting in the present day has become a speculation, which can only be justifiable when it affords a fair prospect of proving remunerative. Let us take this consideration as the basis of our reasoning regarding the propriety of exhibiting at Philadelphia, and we venture to think it can easily be shown that no exhibition has ever existed which holds out so little promise of being serviceable to English manufacturers. The principal things we have to sell as a nation are coal, iron, machinery, and woolen and cotton goods. It is not likely, for obvious reasons, that any English coal owner will do at Philadelphia as continental coal owners did

America. On woolen goods, for example, a tax of fifty cents a pound, and 40 per cent *ad valorem*, must be paid before they can be taken out of bond. Under such conditions, what possible value can accrue to our Leeds or Huddersfield houses by exhibiting in the United States? As regards iron, again, it is obvious, in the first place, that we can show nothing which America cannot produce equally well, albeit at a much greater cost; and the idea of establishing any trade in iron with the States as a result of exhibiting iron in 1876 is simply absurd. The duty on machinery is just as prohibitive,

and the value of the machinery which we send to the States now would certainly not be augmented by a single dollar if every engineer in the United Kingdom exhibited at Philadelphia. It may be urged, perhaps, that, at all events, goods sent for exhibition would be admitted and sold duty free, and in so far would pay for the sending. This is a mistake. Goods sent to the States for exhibition will be virtually in bond in Fairmount Park, and the exhibitor can carry them back to England without paying duty; but if he sells anything for use in the States, the custom house officers will demand and must obtain the tax before it will be suffered to leave the building. In the fact that a prohibitive American tariff intercepts the course of trade between the two countries lies the

reason for which we assert that English exhibitors can secure no possible benefit of any kind by sending their productions to Philadelphia.

We are not singular in holding this opinion. The weavers of Kidderminster have determined that they will send no carpets for exhibition. The implement makers of Birmingham will keep their goods at home. The leading agricultural engineers have already held a meeting, to discuss the propriety of exhibiting in 1876. After careful discussion, the following resolution, moved by Mr. James Howard, Bedford, and seconded by Mr. Shuttleworth, Lincoln, was unanimously passed: "That, looking to the prohibitory duties—from 30 to 40 per cent—imposed by the United States upon English agricultural machinery, the Association of Agricultural Engineers recommends its members to hold aloof from the Philadelphia Exhibition, considering the imposition of prohibitory duties to be out of harmony with the objects of international exhibitions." Members of nearly the whole of the great firms, and many of the smaller ones, were present, and the feeling was that no good could accrue to the English makers from exhibiting, although it would unquestionably be of advantage to American makers to have our best specimens of agriculturing engineering displayed before their eyes.

The fact that the United States *pin their faith on protection*, both in theory and practice, renders it impossible that exhibiting at Philadelphia could repay English exhibitors. A nation which carefully excludes the wares of other countries has no right to expect those whom she treats as trade foes to send their choicest productions to her for inspection.

There is yet another reason why Englishmen should hesitate before taking part as exhibitors in the Philadelphia enterprise. Apparently the matter may be regarded as of little importance, but it really deserves very careful consideration. Up to the present moment all experience goes to show that the Americans are unable to carry out with success the organization of an exhibition. The questionable transactions which disgraced the administrative department of the American section of the Vienna Exhibition are, no doubt, more or less familiar to all our readers. Scarcely a "fair" can be held in the States that is not attended with some more or less unworthy squabble among officials, exhibitors, or both. Have we any reason to expect that everything will be done in Fairmount Park during the summer of 1876 with a strict regard for the best interests of British exhibitors? The United States have availed themselves of their opportunity to show that they can do without us. The chance of manifesting a reciprocity of feeling on this point is now afforded to British manufacturers. We trust they will not suffer the occasion to slip. They will have truth and justice on their side if they say to the people of America: You will not buy from us; why should we trouble ourselves to show you what we have to sell? Of course, it may be said that this is a very selfish and illiberal policy. Those who talk in this way are ignorant of the true character of such exhibitions, and practical men, whether engineers or journalists, must deal with things as they are, not as they are believed to be by amiable enthusiasts.—*The Engineer*.



CAPTAIN BOYTON IN MID-CHANNEL.

at Vienna, and exhibit trophies of mineral fuel, so that we may dismiss coal from our list at once. All the remaining articles are so heavily burdened by import duties that it is vain to expect that we can trade successfully in them with

IMPROVED BOILER FEED REGULATOR.

Messrs. Bede & Co., of Verviers, Belgium, have recently introduced a new device for automatically controlling the supply of water to a steam boiler, which, they claim, insures a uniform height of water in the boiler, thus avoiding danger of explosion and diminished pressure from too sudden or over feeding. It consists, principally, in the water cistern, B, which communicates with the boiler through check valve, M, and stop valve, O, and it is fed by the pipe, C, through the valve, K. When the water in cistern, B, rises so as to lift the smaller float, E', the extension lever, E', is moved so as to disengage the larger float, D, which has previously been held down by the lever, E; and the float, D, lifting the lever, E, actuates the bell crank, J, to open steam valve, L. The entrance of the steam at L closes the valve, K, shutting off the water supply.

Equal pressure is thus established in the receptacle, B, and the steam boiler, and the water may then pass through the valves, M, O, into the latter. The valve, O, is regulated by the boiler float, P, so as to be opened or closed, to maintain a uniform height of the water in the boiler. The smaller float of the receptacle, E', follows the falling water, and strikes a pin or stop at the lower end of its guide rod when the receptacle is nearly empty. The weight of the small releases the large float, D, which presses on the link, J, closes the valve, L, and opens the water supply valve, K, and an exit valve, Q. The steam escapes through the valve, Q, into the reservoir, where it is condensed, while the water fills the receptacle, B, through valve, K. The supply is thus kept continuous through the alternate action of the apparatus, which is also provided with a registering device, indicating how often the receptacle is emptied and filled, and consequently what amount of water has been used. By comparison with the quantity of fuel consumed, a simple and reliable test of the operation of the boiler and engine is afforded, the control of the engine by the attendant is facilitated, and economy in the use of fuel necessarily follows. The regulator was exhibited at the Vienna Exposition in 1873, and received a premium medal at the Paris Exposition in 1867. A number of these appliances are in use in Europe.

HEIGHT OF WAVES.

J. W. Black, in a recent letter in *Nature*, says: "Dr. Scoresby's observations in the North Atlantic record 24 feet, 30 feet, the highest 43 feet, and the mean 18 feet in westerly gales; and the frigate Novara, 20 to 30 feet off the Cape Promontory. French observers in the Bay of Biscay state a height of wave of 36 feet; Capt. Wilkes, U.S.N., writes of 32 feet in the Pacific, and Sir J. Ross of 22 feet in the South Atlantic. Heights of waves in N.W. gales off the Cape of Good Hope were computed at 40 feet, those off Cape Horn at 32 feet, in the Mediterranean Sea at 14 feet 10 inches, and in the German Ocean at 13½ feet; but in British waters they are only found to average 8 to 9 feet. The velocity of ocean storm waves was observed by Dr. Scoresby in the North Atlantic to be about 32 miles per hour; Capt. Wilkes recorded it at 26½ miles in the Pacific, and French sailors in the Bay of Biscay at 60 miles an hour. Dr. Scoresby has estimated the distance between or breadth of his Atlantic storm waves at about 600 feet from crest to crest, which is only about half of that stated in the letter, and with a proportion of only ½ for height to breadth. Dr. Scoresby states that his waves of 30 feet in height move at the rate of 32 miles per hour.

The accompanying diagram is constructed according to Dr. Scoresby's scale of measurements, 600 feet breadth, 30 feet height, and 220 feet vessel, with rates of wind, wave, and vessel; and from it one may ponder on what small dimensions these terrific-looking waves are constructed, and that a ship after all looks only like a cork or chip on the great seas."

MOTIVE POWER FROM WAVES.

At a recent meeting of the Institution of Naval Architects a paper was read by Mr. B. Tower, on a method of obtaining motive power from wave motion. He said that this inquiry originated with Mr. Deverell, whose proposition was to suspend a heavy weight on board a ship by means of springs, and to obtain motive power by the oscillation of this weight through a distance not exceeding the height of the waves.

It however appeared to Mr. Tower that, since the centrifugal force of wave motion in a vertical direction is alternately added to and subtracted from the force of gravity, thereby causing a virtual variation of the intensity of that

force, the question might be broadly stated as follows: Supposing the force of gravity to vary in intensity at regular intervals, that is, to become alternately greater and less than its normal amount, what is the best means to obtain the maximum amount of energy from a given weight oscillating under the influence of these variations? For example, supposing the force of gravity to be for three seconds one fifth greater, and for the next three seconds one fifth less, than its

that if, ten foot tons; or if moved through one hundred feet, it would exert one hundred foot tons during each interval of three seconds.

The first experiments Mr. Tower made, with a model apparatus constructed on these principles, showed him that the best arrangement would be to put a weight on the end of a revolving arm, whereby the centrifugal force of the wave motion might be utilized as well as the rising and falling motion.

The diagram shows the position of the vessel and of its revolving arm at all parts of a wave; the arrows show the direction of the centrifugal force of the wave motion according to the generally received theory. This force is upwards at the crests, downwards in the hollows, and horizontal midway between the crests and hollows. If the weighted arm is compelled to assume successive angular positions, so that it is always at right angles to the force, it is evident that the force will be continually acting to cause the arm to rotate. It is easy to see how the work is taken out of the waves; for when the vessel is descending, the weight is performing the upper half of its revolution, and is consequently exerting an upward centrifugal force; and when the vessel is ascending, the centrifugal force is pushing down and resisting the vessel's ascent, so that the revolving weight affords a resistance against which the vessel can push just as if it were a fixed point in space. The shaft of the revolving weight can be made to turn a screw in the stern of the vessel by means of a proper system of gearing; and by a delicate arrangement of electric brakes and hydraulic accumulators, Mr. Tower proposes to regulate the revolving arm so as always to keep it at right angles to the centrifugal force of the waves.

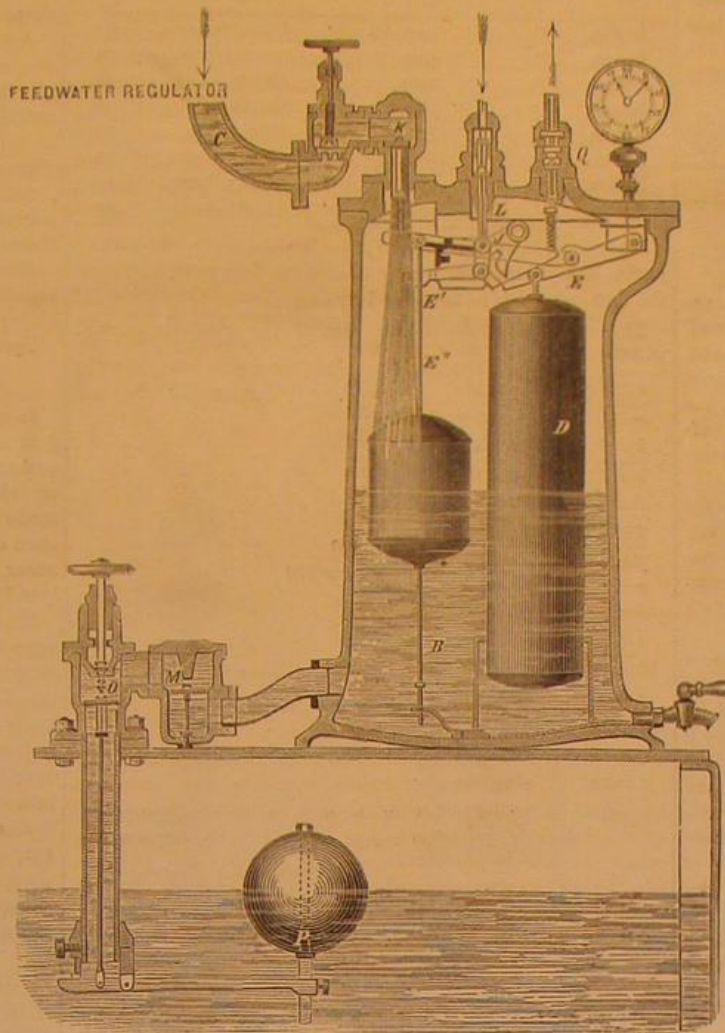
New Asphalt Paving.

A specimen of street paving has just been laid in Glasgow, the material employed being the rock asphalt which is obtained in the Val de Travers, near Neuchâtel, in Switzerland. During last autumn several portions of wood paving, on the same system, were done in Glasgow by a London company; and as they were well executed, they seemed to give very general satisfaction. Profiting, apparently, by the experience gained by witnessing the system of wood paving in operation, the Scottish Val de Travers Paving Company determined upon attempting something similar.

According to this system, a foundation is first formed of Portland cement concrete, about 9 inches in depth, and on this the paving proper is laid. The rock asphalt from the Val de Travers, the material employed in the paving, contains about 12 or 13 per cent of bitumen, and the remainder of the rock consists almost entirely of hard limestone, through which the bitumen is very uniformly diffused. This material is first broken into pieces of convenient size in a crushing mill, and is subsequently put into a disintegrator, in which it is reduced to a very fine state of division. When it has been treated in this way, the asphalt is thrown into a revolving cylinder, in which it is subjected to a temperature of about 260° Fah., which brings it almost to a pulverulent condition. While it is in the state of hot powder it is

filled into cast iron molds, in which it is pressed and made to assume the form of bricks, about nine inches long by four inches broad and two inches in thickness. The tendency of its particles to cohere is very great at that temperature. The cast iron molds are so formed that the bricks cast in them have a chamfer or bevel about half an inch broad imparted to them, all round what is intended to become the upper surface; and thus, when the bricks are placed in the causeway, they are separated above by a series of grooves, by means of which an excellent bite is secured for the feet of the horses passing over it. When the cement concrete, forming the substratum, is sufficiently well set, the asphalt bricks are laid in a manner somewhat similar to that of ordinary causewaying with dressed granite or whinstone setts. Instead of bedding them in sand, however, they are laid in a thin stratum of liquid rock asphalt, just as ordinary bricks are laid in mortar, bottom, sides, and ends all being coated with the agglutinating material. The bricks are placed about a quarter of an inch apart, and the space thus left is filled in with a hot liquid, which consists of Trinidad pitch and crude shale oil, and which long remains very tough and elastic, in addition to which it most effectually prevents any water from passing through the pavement.

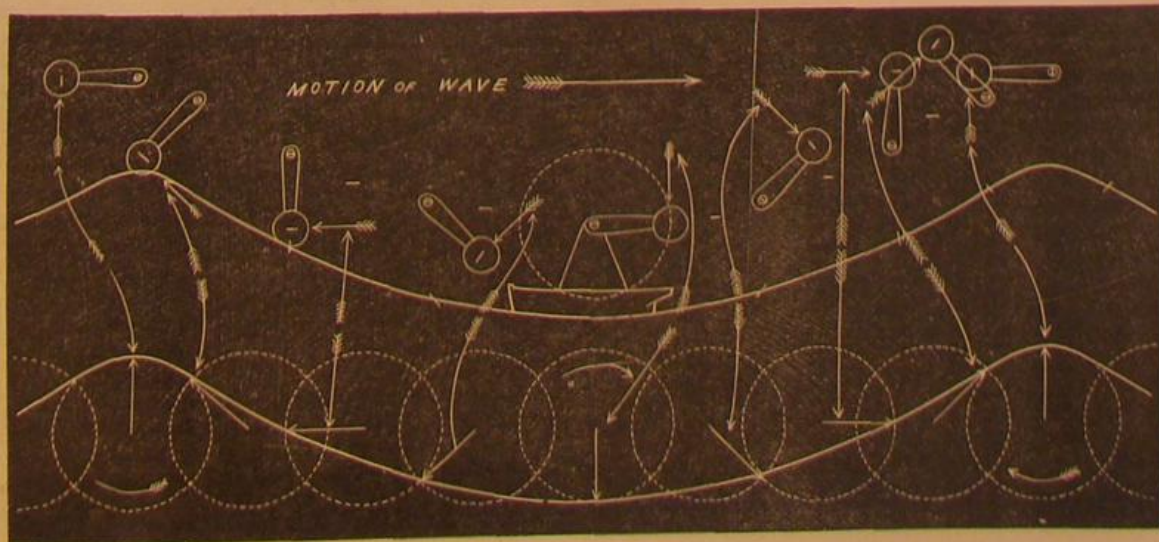
The portion of roadway executed in Glasgow in the above manner seems to give satisfaction, and will apparently be very durable. Of course there is no actual information avail-



BEDE'S FEED WATER REGULATOR.

natural intensity, and suppose that we have a weight of five tons suspended by a spring, with an infinitely open scale, so that the spring will continue to exert a uniform upward force of five tons, no matter how far the weight moves up and down, it is clear that, during the three seconds' interval, during which gravity is one fifth more than its normal intensity, the five-ton weight will virtually weigh six tons, and

will thus exceed the upward force of the spring by a downward force of one ton; in the same way, when the force of gravity is one fifth less, the weight will only weigh four tons, and the spring will then exert an unbalanced upward force of one ton. Now, as energy or power is defined as force moving through distance, it is clear that the quantity of energy or power to be obtained by this system will depend on the distance through which this weight is caused to move during each successive variation of gravity. Thus, supposing that during the plus interval it moves downwards through one foot, and during the minus interval it moves upward through one foot, it is clear that during each of these intervals it will exert a force of one ton moved through one foot, that is, one foot ton; but if, instead of one foot, it moves through ten feet, it will exert ten times the power—



able regarding the durability of the particular specimen of paving under notice; but the experience gained from the Rue Bergère, in Paris, which was laid in 1865 with Val de Travers asphalt, is quite sufficient on the point in question. After having been in use for fifteen years, a portion of it was lifted in 1880, when it was observed that its thickness had only been reduced from two inches to one and three eighths inches; but while it had diminished in thickness only five-eighths of an inch in fifteen years, it had undergone considerable compression, inasmuch as the actual loss in weight was not more than five per cent. The special feature of the new paving in Glasgow is the almost absolute immunity from slipping which horses enjoy when passing over it.

Correspondence.

Invention of a New Numerical System.

To the Editor of the Scientific American:

In our common decimal system, distinct characters are given to the numbers from one to ten; and it is very well known that, instead of ten, any other number—for instance, eight, or twelve, or sixteen, or even two—may be selected for a base. Such systems have actually been calculated, but they have not come into use: the advantages not being sufficient to counterbalance the inconvenience of changing one system into another.

The subject may be treated, however, in quite a different manner. There is no necessity for taking any base at all, and the numbers may be made to progress in their own natural succession; or, to express it in other words, every number, even one, may be made to serve as a base for a certain time. This can be accomplished as follows:

Instead of dividing off the original units in sections of ten, as in our common numerical system, we divide them in the natural succession of the numbers themselves, first one, then two, then three, etc., and for each division we make a mark in the second column. If, in the first column, a rest should remain, such rest can never be greater than the number of marks in the second column, because if the rest were one greater, a new mark would be made in the second column.

There is no necessity at present for going through the whole process, which would require a great deal of writing and many diagrams. It has taken me nearly twenty years to construct the first twenty numbers. Suffice it to say that the final result is very simple, and can be readily understood by everybody without studying the details.

The whole theory is based upon the fact that the rest in any column can never be greater than the number of marks in the next column. If the marks in the second, third, and all following columns, and all the rests, are divided in the same way, that is, in the natural succession of the numbers one, two, three, and so forth, the numbers will appear in a very simple form, each consisting of a base and a rest; this rest, however, is sometimes naught.

Of course there must be certain characters for the numbers, and the characters of our common numerical system are neither suitable nor sufficient; there must be twenty new characters instead of ten. Hence we have either to invent new characters or use the common letters. The first would require new types for printing, which is too expensive, hence we use letters.

Let the first twenty letters, excluding *j*, represent the first twenty numbers, so that *a* stands for 1, *b* stands for 2, etc., until *u* stands for 20; and let one of the last letters, for instance, *z*, stand for 0. Let us write these numbers in the following triangular shape:

					<i>u</i> 20
				<i>o</i> 14	<i>t</i> 19
			<i>n</i> 9	<i>r</i> 13	<i>s</i> 18
		<i>e</i> 5	<i>h</i> 8	<i>m</i> 12	<i>r</i> 17
	<i>b</i> 2	<i>d</i> 4	<i>g</i> 7	<i>i</i> 11	<i>q</i> 16
<i>x</i> 0	<i>a</i> 1	<i>c</i> 3	<i>f</i> 6	<i>k</i> 10	<i>p</i> 15

These letters and numbers mean:

z stands for 0, *a* stands for 1, *b* stands for 2, etc.

It will be seen that the vowels *e, i, o, u* stand at the head of their columns; if the letter *j* were used, this order would be disturbed.

These letters and numbers are to be used as follows:

Naught with the rest naught equals naught, equals <i>x</i>						
One	"	"	naught	"	one	" <i>a</i>
One	"	"	one	"	two	" <i>b</i>
Two	"	"	naught	"	three	" <i>c</i>
Two	"	"	one	"	four	" <i>d</i>
Two	"	"	two	"	five	" <i>e</i>
Three	"	"	naught	"	six	" <i>f</i>
Three	"	"	one	"	seven	" <i>g</i>
Three	"	"	two	"	eight	" <i>h</i>
Three	"	"	three	"	nine	" <i>i</i>
Four	"	"	naught	"	ten	" <i>k</i>
Four	"	"	one	"	eleven	" <i>l</i>
Four	"	"	two	"	twelve	" <i>m</i>
Four	"	"	three	"	thirteen	" <i>n</i>
Four	"	"	four	"	fourteen	" <i>o</i>
Five	"	"	naught	"	fifteen	" <i>p</i>
Five	"	"	one	"	sixteen	" <i>q</i>
Five	"	"	two	"	seventeen	" <i>r</i>
Five	"	"	three	"	eighteen	" <i>s</i>
Five	"	"	four	"	nineteen	" <i>t</i>
Five	"	"	five	"	twenty	" <i>u</i>

This shows that every number may be supposed to consist

of a base and a rest. After 20, the progress of the numbers is very easily seen, and may be stated as follows:

Six	with the rest	naught	equals	twenty-one,	equals	<i>fx</i>
Six	"	"	one	"	twenty-two	" <i>fa</i>
Six	"	"	two	"	twenty-three	" <i>fb</i>
Six	"	"	three	"	twenty-four	" <i>fc</i>
Six	"	"	four	"	twenty-five	" <i>fd</i>
Six	"	"	five	"	twenty-six	" <i>fe</i>
Six	"	"	six	"	twenty-seven	" <i>ff</i>
Seven	"	"	naught	"	twenty-eight	" <i>gx</i>
Seven	"	"	one	"	twenty-nine	" <i>ga</i>
Seven	"	"	two	"	thirty	" <i>gb</i>
Seven	"	"	three	"	thirty-one	" <i>gc</i>
Seven	"	"	four	"	thirty-two	" <i>gd</i>
Seven	"	"	five	"	thirty-three	" <i>ge</i>
Seven	"	"	six	"	thirty-four	" <i>gf</i>
Seven	"	"	seven	"	thirty-five	" <i>gg</i>

The general rule for writing these numbers is: The second part is to be increased until it equals the first part, and then the first part is to be increased by one.

This table shows the construction of the numbers from 0 to 359026206.

<i>x</i> =0	<i>q</i> =16	<i>gd</i> =32
<i>a</i> =1	<i>r</i> =17	<i>ge</i> =33
<i>b</i> =2	<i>s</i> =18	<i>gf</i> =34
<i>c</i> =3	<i>t</i> =19	<i>gg</i> =35
<i>d</i> =4	<i>u</i> =20	
<i>e</i> =5	<i>fx</i> =21	<i>uu</i> =230
<i>f</i> =6	<i>fa</i> =22	<i>f x x</i> =231
<i>g</i> =7	<i>fb</i> =23	
<i>h</i> =8	<i>fc</i> =24	
<i>i</i> =9	<i>fd</i> =25	
<i>k</i> =10	<i>fe</i> =26	<i>u u u</i> =26795
<i>l</i> =11	<i>ff</i> =27	<i>f x x</i> =26796
<i>m</i> =12	<i>gx</i> =28	
<i>n</i> =13	<i>ga</i> =29	
<i>o</i> =14	<i>gb</i> =30	
<i>p</i> =15	<i>gc</i> =31	<i>u u u u u u u</i> =359026205
		<i>f x x x x</i> =359026206

FERDINAND EISSFELDT.

Room 30, 33 School street, Boston, Mass.

An Invention Wanted—Five Thousand Dollars Reward Offered.

To the Editor of the Scientific American:

Believing that the horse has served his time before the street car, and that American ingenuity should allow him to retire before our Centennial anniversary, by inventing some improved motor for street passenger railways, we offer five thousand dollars reward to any person or persons who will invent, perfect, and present to this company any satisfactory device that will propel our cars and can be used on the streets of Philadelphia, provided it is acceptable to this company and its control placed exclusively with us.

R. W. FLOWER, JR., President.

West End Passenger Railway Company of Philadelphia, No. 206 South Fourth Street, Philadelphia. May 7th, 1875.

Useful Recipes for the Shop, the Household, and the Farm.

In using Paris green to exterminate the potato bugs, the poison should be mixed with the cheapest grade of flour, one pound of green to ten of flour. A good way of applying it to the plants is to take an old 2 quart tin fruit can, melt off the top, and put in a wooden head in which insert a broom handle. Bore a hole in the head, also, to pour the powder in, and then punch the bottom full of holes about the size of No. 6 shot. Walk alongside the rows, when the vines are wet with dew or rain, and make one shoot at each hill.

In some parts of the country, there have been large numbers of the orchard or tent caterpillars which have left their rings of eggs on the young twigs. If these are now cut off with a clipping pole, it will prevent in every instance a large nest of caterpillars, and be much more easily done than after the latter have grown.

Equal proportions of turpentine, linseed oil, and vinegar, thoroughly applied and then rubbed with flannel, is an excellent furniture polish.

Tin can be removed from copper vessels very thoroughly by immersing the objects in a solution of blue vitriol.

The German washerwomen use a mixture of 2 ozs. turpentine and 1 oz. spirits of ammonia well mixed together. This is put into a bucket of warm water, in which $\frac{1}{2}$ lb. soap has been dissolved. The clothes are immersed for twenty-four hours and then washed. The cleansing is said to be greatly quickened, and two or three rinsings in cold water remove the turpentine smell.

Five parts of sifted whiting mixed with a solution of one part glue, together with a little Venice turpentine to obviate the brittleness, makes a good plastic material which may be kneaded into figures or any desired shape. It should be kept warm while being worked. It becomes as hard as stone when dry.

Artificial malachite which is susceptible to a fine polish is made by precipitating a solution of sulphate of copper in the cold by carbonate of soda or of potash. The precipitate, which is voluminous, should be allowed first to cohere, and is then dried and washed.

Water containing about seven grains of salt in each pint, is, when used continuously, a poison to the weaker forms of vegetation.

The alloy popularly known as orolide, from which a large number of cheap watches, chains, and trinkets are now manufactured, is made of pure copper 100 parts, tin 17 parts, magnesia 16 parts, sal ammoniac $\frac{1}{2}$ part, quicklime $\frac{1}{2}$ part, tartar of commerce 9 parts. The copper is first melted, then the magnesia, sal ammoniac, lime, and tartar in powder are added little by little and briskly stirred for half an hour. The tin is lastly mixed in in grains until all is fused. The crucible is covered, and the fusion maintained for 35 minutes, when the dross is skimmed off and the alloy is ready for use.

A simple way of preparing paper for bank checks, bills, etc., so that no writing can be erased without leaving plainly visible marks, is to pass the sheets through a solution of gallic acid. One milligram (0.01543 of a grain) is dissolved in as much pure distilled water as will fill an ordinary soup plate to a moderate depth.

Sandarac varnish is the best material for mending plaster models. Saturate the broken surfaces thoroughly, press them well together, and allow them to dry.

Silver ware may be kept bright and clean by coating the articles (warmed) with a solution of collodion diluted with alcohol.

Dampness will cause honey to become thin and watery.

The Suet Butter Manufacture.

In spite of the prejudice which exists against suet butter, it is a fact that the manufacture has of late made great progress; and the quantity of the material now consumed is certainly now larger than ever before. We illustrated the mode of making the butter many months ago. The process then described is the same as now practised in this city and other places, under the original patent granted to M. Hippolyte Mège.

There is a large factory in Hamilton, Canada, from which some 2,000 lbs. per week of imitation butter are shipped to all parts of the world. Another and still larger establishment in Boston, Mass., turns out a very great product. In many cases, it is said, this butter finds its way directly to the butter producing districts of New York and New Jersey, and then is sent to market as genuine spring butter. It is certain that immense quantities of the oleomargarin are sold by dealers as true butter, and that the profits of the trade are very large. We see it noted in a daily contemporary that the suet compound is in use in some of the principal hotels and restaurants in this city, and that the frequenters of these places have as yet not discovered the fact. We do not pretend to the skill of the professional butter taster; but we have no difficulty in instantly recognizing the artificial compound. We may add that, not long ago, we discovered it on the table of one of our New York hotels; and after satisfying ourselves as to its identity, we taxed the proprietor with its use. He strenuously denied the charge; but at a subsequent meal, we found the "ox butter" (as the Harvard students have named it) replaced by "cow butter."

We do not mean to say that the oleomargarin is unsavory or unwholesome. On the contrary, it is made with the utmost nicety from the cleanest of materials. Neither is it unpleasant in any marked degree to the palate, nor to the stomach. It certainly is infinitely better than the abomination sold by grocers under the generic name of "cooking butter." Still most persons have a prejudice against suet butter, and that feeling, so far from being weakened, has been strengthened by the knowledge that the reprehensible practice of selling the imitation as the genuine is so widely practised. If the material were advertised and sold uniformly for what it is and on its merits, we have no doubt but that the prejudice against it would in a great measure subside. For shipping to hot climates, it is, no doubt, far better than the butter usually sent to southern ports.

Parliamentary Signal Light.

The gas signal light on the clock tower of the Houses of Parliament is now shown from its new position, 30 feet higher than formerly. The new lantern is constructed to run in and out of a loophole in the roof of the tower—similarly to a ship's gun—so that during the daytime nothing is seen of it, and it is now no disfigurement to the appearance of the tower. The illuminating power is a Wigham's patent gas light, as used for lighthouses, and at present is shown naked, no lenses being used. The light is only visible while the House of Commons is actually sitting. Immediately on an adjournment, the light is extinguished. This light is fully described on page 403, volume XXVIII, and page 40, volume XXIX.

A New Indication of Death.

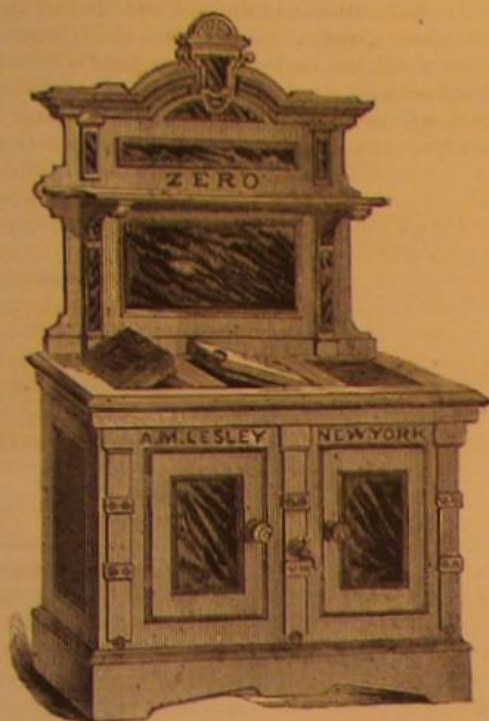
Is the patient really dead or not? is at times a very anxious question. A medical practitioner of Cremona proposes a simple method by which the question may be answered with certainty. It is to inject a drop of ammonia beneath the skin, when, if death be present, no effect, or next to none, is produced; but if there be life, then a red spot appears at the place of the injection. A test so easily applied as this should remove all apprehension of being buried alive.

ELECTRIC science occupies a place of no mean importance in the new opera house in Paris. A special room is set apart as a battery room, in which 360 Bunsen's cells, arranged in sets of 60 on rough plate glass tables, are manipulated to pass a current to any part of the stage, so as to direct the electric light upon any point of the scenery. The sunlight and startling effects produced by French scenicists are really beautiful. The rainbow in the opera of *Mosé in Egitto* is wonderful.

AN agreement without consideration is void.

SIDEBOARD REFRIGERATORS.

The season for refrigerators being at hand, persons about to purchase will be interested in knowing what is new in this line. The last improvement we have seen is in the form of a sideboard, as shown in our engraving, made by Mr. Alex. M. Lesley, No. 226 West 23d street, New York city.



As all the refrigerators thus far brought out are only adapted to the kitchen or the hall, the handsomest of them having no claim to any beauty, and much less deserving to be called ornamental, it was for a long time the desire of many housewives to have a refrigerator that would not disgrace a dining room. To Mr. Lesley belongs the credit of having brought out such a refrigerator, in the exterior form of a sideboard, and therefore called the "Sideboard Refrigerator." It is constructed in the most tasteful style, of solid wood—oak and black walnut—and, as the engraving sufficiently shows, is a decidedly ornamental piece of furniture, well adapted for even the most stylish dining room.

It is scarcely necessary to sum up the advantages of having the refrigerator in the dining room instead of in the kitchen. 1st. It is less under the control of the servants, which may be of some importance, especially when wines and delicacies are preserved in it. 2d. It is out of the heat of the kitchen. 3d. It is not exposed to the unavoidable flavors of the kitchen, which may affect certain delicate articles of food. 4th. If a refrigerator diffuses some coolness around it, especially on being opened, it is better that the dining room should have the benefit of it than the kitchen.

In regard to the interior arrangement of these elegant sideboard refrigerators, they are the same as those of Mr. Lesley previously described by us, and this arrangement has been proved very satisfactory in all respects. The water proceeding from the melting of the ice is stored in a separate tank, and can be drawn off for drinking purposes, while the water of condensation, always tainted with the odors of the meats and fruits preserved, is drawn off by a separate channel. This elegant appliance costs about double one of the plain kitchen or so called Zero refrigerators, which has been described in these columns.

Prize offered by the King of the Belgians.

A recent *London Gazette* contains a translation of documents which have been received at the Foreign Office respecting the \$5,000 prize which the King of the Belgians proposes to award annually for the best work on a subject of national interest. His Majesty explains his design in a letter to M. Delcour, the Minister of the Interior, who, in conjunction with the king himself, is to choose the jury of seven members—namely, three Belgians and four foreigners—the president to be a Belgian. The first award is to be made in 1878 for the best work on the national history of Belgium; the second in 1879, for the best work on architecture; the third in 1880, for the best work on the development of the commercial relations of Belgium; and the fourth in 1881, for the best scheme of harbor improvements on low and sandy coasts like those of Belgium. The first three competitions will be limited to Belgian subjects, but the fourth will be open to foreigners. In each succeeding four years, there will be three restricted and one open competitions. At King Leopold's wish, regulations have been drawn up and published by the Minister of the Interior.

The New Twenty Cent Coin.

Dr. Linderman, director of the mint, has selected the design for the new twenty cent silver piece. The obverse will bear a sitting figure of Liberty with the word "Liberty" inscribed on the shield, the whole surrounded by thirteen stars. Beneath the figure is the date. On the reverse is an eagle with the words "Twenty cents." The edge of the coin will be perfectly smooth in order to distinguish it from the twenty-five cent piece.

A Boiling Lake.

Mr. J. Sturge favors *Iron* with the following: "A discovery of some interest has been made in the Island of Dominica, West Indies. Drs. Freeland and Nicholls, Captain Gardner, and Mr. Watt, exploring the steep and forest-covered mountain behind the town of Roseau, came upon a boiling lake about

3,500 feet above the sea level, and two miles in circumference. When the wind cleared away, for a moment, the clouds of sulphurous steam with which the lake was covered, a mound of water was seen, ten feet higher than the general level, and caused by ebullition. The margin of the lake consisted of beds of sulphur, and its overflowing found exit by a waterfall of great height."

ARRANGEMENT OF GALVANIC BATTERIES.

The arrangement of the elements into batteries varies according to the purpose they have to serve. A maximum magnetic effect may be obtained from a given number of elements, if they be so arranged that the resistance in the battery is equal to the resistance in the closing wire. A given number of elements can be combined in very different manners. For instance, eight elements can be arranged in four different ways, as shown in Figs. 1, 2, 3, and 4. Which one of these combinations should be selected, in a given case, depends upon the resistance to conduction of the circuit. That combination must be taken, the resistance of which is nearest to that of the given circuit.

In Fig. 1, the elements are connected, one after another, into a battery containing eight successive pairs of plates, and the current has to pass in succession through each of the eight elements.

Fig. 1.



Fig. 2.



Fig. 2 represents the reverse, all the zinc cylinders being connected together to form one zinc pole, and all the copper cylinders connected together to form one copper pole, the whole forming a single element of eightfold surface. In this case, the elements are connected side by side for the production of the largest quantity of current through a circuit of the least resistance. In the former case, the elements were connected for the purpose of producing the greatest quantity of current through a circuit of the most resistance.

Between these two cases, there are the two others, represented by Figs. 3 and 4. In Fig. 3, the four elements, 1, 2, 3, and 4, one after another, are connected as one battery, as are also the elements 5, 6, 7, and 8. The corresponding poles of both batteries are connected with each other, and hence this battery represents a voltaic pile of four pairs of plates, of which each has double the surface of the pair of plates shown in Fig. 1.

Fig. 3.



Fig. 4.

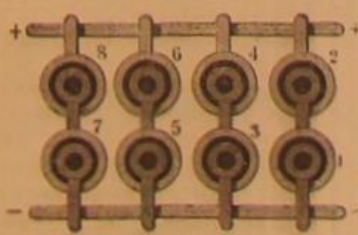
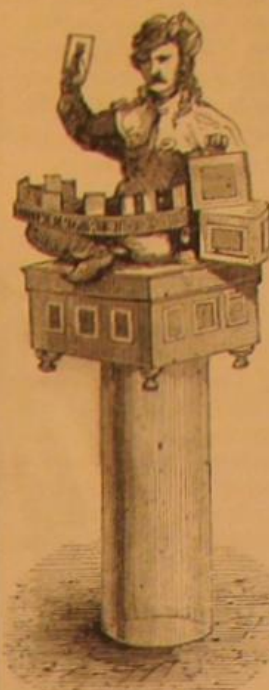


Fig. 4 represents the connections in which each two elements, 1, 2—3, 4—5, 6—7, 8, form a battery of two pairs of plates, whose surface is four times as large as in the pairs of plates shown in Fig. 1. Supposing the resistance of an element to be 4 ohms, the resistance of battery shown in Fig. 1 would be 32 ohms; in Fig. 3, 8 ohms; in Fig. 4, 2 ohms, and in Fig. 2, 0.5 of an ohm. Considering the different combination of the 8 elements represented, it is seen that, as the pile is shortened, it becomes broad in the same proportion; and hence, by making the pile one half as long and twice as broad, the resistance is reduced to one fourth of its former amount.

Now, in determining which combination of the above elements would be the most suitable for any given circuit, reference must be had to the resistance of the circuit; and if the greatest magnetic effect was desired upon each, the resistance of the closing wire, including the electromagnet, must exactly equal the resistance of the battery.

PSYCHO EXPOSED.

An exhibition is now being held in the Egyptian Hall, London, England, of which an automaton, called Psycho, until recently, formed a part. The figure performed many curious tricks, solving mathematical problems, and playing cards with great skill and accuracy.



Psycho is an oriental personage, sitting on a box some three feet square and eighteen inches high, while he himself is about twenty inches in height, placed on a glass cylinder to show that there is no connection with the stage under the table. The movements were, of course, caused and governed by a secret force, but the method of communication with the figure defied detection for a long time. Mr. Maskelyne, the inventor, allowed any one to inspect the figure. One night a military gentleman, among others, sent up his card for that purpose. He examined the glass pedestal and other parts, but could see nothing of any mechanical contrivance. Subsequently, however, the mystery was solved by Mr. W. H. Coffin, son of Dr. G. W. Coffin, an American dentist in London, Mr. Maskelyne being unwilling to submit his figure to the test proposed.

The solution is that Psycho is worked by the condensation and diminution of the column of air in the glass cylinder on the top of which he sits. Beneath the carpet at the bottom of the cylinder is a perforated plate of zinc, connected with the operator behind the scenes, who, at his will, may increase or decrease the column of air, the figure moving one way or another in accordance with the pressure put upon it. The conjuror was at first disposed to deny the explanation, but Mr. Coffin told the audience that it could easily be tested by Mr. Maskelyne allowing him to put a newspaper between the figure and the cylinder. This the conjuror declined to do, and then followed great applause, when it became recognized that Psycho, as a mystery, had passed away.

London Fires.

The actual number of fires in London in 1833, as returned, was 458. The population then was 1,710,059. This gives one fire to every 3,734 persons. Last year the fires were 1,573, in a population of 3,400,701, or at the rate of one fire to every 2,162 persons. The population of London in 1874 was not quite double that of 1833, but the fires last year were more than three times as numerous as at the earlier date. Had the fires simply increased in the ratio as the population, the number last year would have been 911 instead of 1,573. The actual excess, therefore, is fully 72 per cent. A further investigation of data shows that this disproportionate growth of the London fires is a persistent phenomenon during a considerable series of years.

Reverting to the simple question of fires, apart from the success achieved in extinguishing them, there is a remarkable fact pervading the statistics—namely, that fires have a tendency to outstrip the population.

The frequency of fires in London far exceeds anything known in ordinary country towns. Moreover, we have the statistics of London itself, showing that, when it had half its present population, it had less than one third its present number of fires. The conclusion which appears warranted is this—that a population distributed over a number of separate towns is less liable to outbreaks of fire than the same population brought together within the compass of one town. In order to explain this social phenomenon, we may allude to the greater density of population in large towns as compared with small ones, though, on the other hand, this very density would seem to afford means of protection by rendering it less likely for a fire to pass beyond the incipient stage without being detected. On the whole, we are warranted in concluding that there are circumstances connected with the furnishing of houses, the storage of goods in ware houses and elsewhere, and the general hurry and pressure of metropolitan life, which involve contingencies more favorable to the occurrence of fires than are likely to be found in many country towns. The fact that fires increase more rapidly than the population creates a danger in large and growing communities lest the arrangements for extinguishing fire should not keep pace with the real necessity. There is also the circumstance that large cities have large buildings, so that fires in such localities are likely to be not only numerous but extensive. Examples of this kind are not wanting in London, and the peril is increased by the enormous height to which buildings are carried where the ground is costly.—*The Engineer*.

ELECTRIC "armored" cables are to be experimented with on board the torpedo school ship *Vernon* at Portsmouth, England, in connection with torpedoes laid down for harbor defense. Should these invulnerable cables prove a success as a means of connecting torpedoes with the shore, the value of these machines for defensive purposes will be considerably increased.

IMPROVED HUB BORER.

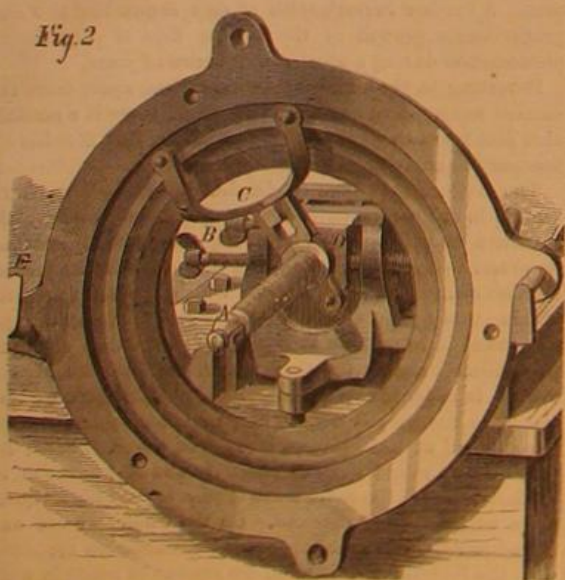
The greatest strain which a wagon is subjected to falls upon the wheels; hence it is at such portions that the best and nicest workmanship is required in order to insure the maximum of strength, close fit, and durability. The first boxes ever put into wagon hubs were placed in holes which fitted at one end, but which, at the other extremity, were large enough to admit being set over to one side, the intervening space being filled with wedges. This was and is, at best, but a clumsy operation, for the work is certainly inaccurate, and at a part just where accuracy is required; but despite the knowledge of the fact, carriage makers, in many cases, still cling to the antiquated method, though for what reason, while machinery, which accomplishes the labor far better, is extant, it is difficult to explain.

We present, in the annexed engravings, a rear view, Fig. 1, and a front view, Fig. 2, of new device for boring hubs, for which a large number of important advantages are claimed. The hole is made perfectly true with the rim of the wheel, and of the right size and shape for the box, it being possible to cut out deeper at the spokes or at any other part, so that the box can be caused to bind at any desired place. The machine requires no adjustment for different sized wheels. The knife is set the same for one sized hole as for another, the size and taper being regulated entirely by setting the shaft out of the center or on an angle. This obviates the trouble of setting the knife more than once for each wheel. The latter is handled but once, and does not leave the machine until the box is fitted. The hole for the nut is cut true with the box aperture, so that the nut will go on after the box is driven as well as it will before, while it cannot rub the wood, and so cause the axle to heat.

From the engravings, it will be seen that the machine is of that class in which the wheel is turned while the cutting is done by a bit, A, Fig. 2, placed on the end of a mandrel. The latter can be quickly set at any angle or for any size desired, the size of hole and degree of taper being regulated by the thumbscrews, B, in the side of the box. The bearing is placed near the spokes and within the limits of the hub, so that the weight of the wheel is carried without any cramping or sideways pressure.

The feed is actuated by an arm, C, which projects under the inner ring of the bearing, and which merely pushes the feed nut, D, around and does not cramp when put on a ta-

Fig. 2



per. The feed nut is closed over a projection on the end of the block in which the shaft runs; so that when placed on an angle, there is no tendency to cross the thread of the screw. The irregular motion, which is inseparable from a machine which makes a taper hole, occurs, it is stated, only at the point where the arm touches the feed nut, and is simply a sliding back and forth of the former as the wheel is turned.

In operation, the wheel is fastened to the face plate by the grips, E, and caused to run true by the set screws, F, which connect the face plate with the outside ring of the bearing. The hole for the taper part of the box is cut, then the hole for the shoulder at the back, and, lastly, the hole for the nut at the front. This completes the work with the exception of driving the box.

The machine is, in fact, a small and complete lathe, in which the wheel and tyre serve as a balance wheel. It is guaranteed to be capable of boring an ordinary set of wheels in less than one hour, and we are informed that it has performed that work inside of twenty minutes. Its weight is about 50 pounds. It is durable, one firm having bored some 2,000 sets of wheels with a single machine. The use of

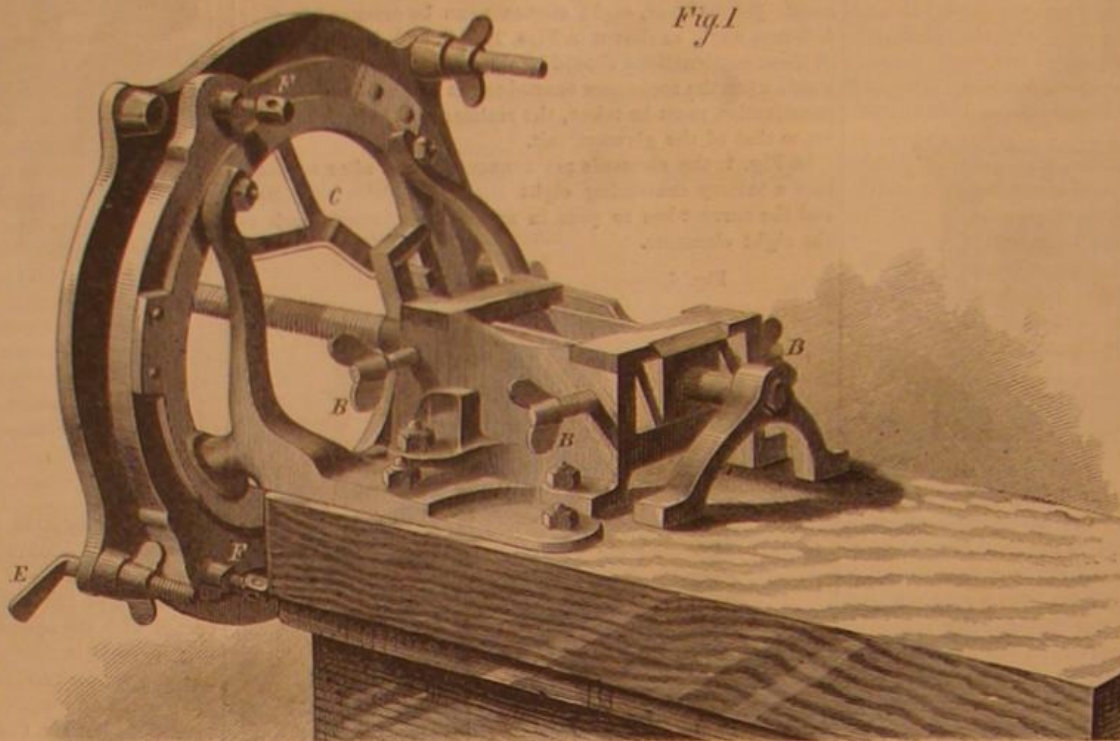
wedges it obviously dispenses with altogether, and thus insures the tight working of the wheel.

Patented January 5, 1874. For further particulars and machines, address H. W. Pell & Co., Rome, N. Y., or Wilcox, Bros. & Co., Adrian, Mich., or any dealer in carriage hardware.

Cleaning Photo Plates.

Dissolve 1 lb. potash in 2 quarts water; pour it into an earthenware dish or tray. Introduce each glass separately into the liquid, taking care to prevent air bubbles. The plates are allowed to remain at least twenty-four hours in this solution; they are then taken out one by one, placed

Fig. 1



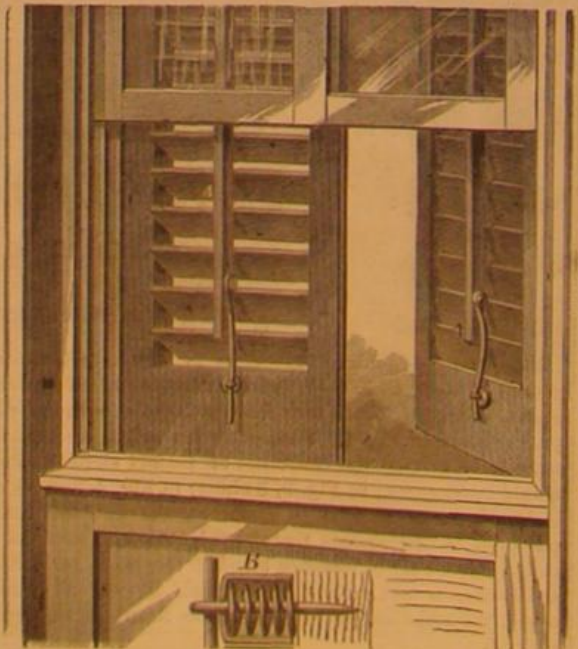
ABBOTT'S LITTLE GIANT HUB BORER.

under a tap, and well scrubbed with a cocoanut fiber brush until all the old collodion and varnish disappear. They are then plunged into another dish containing a solution of three per cent of hydrochloric acid, well washed under a tap, and wiped dry with towels. On no account must they be left to dry spontaneously, or they will become stained. Before the plates are used they required to be cleaned with a solution of rottenstone into which a few drops of ammonia have been introduced.

SMITH'S BLIND SLAT HOLDER.

After a blind has been exposed to the weather for some little time, it is very rarely thereafter that the slats can be made to stay in any required position. They may be closed by turning them up, or partially opened by turning them down all the way; but they will not rest squarely across the opening so as to admit a breeze, or remain slightly tilted so as to ward off the sun's rays, unless adjusted and fastened in place by temporary wedges.

Mr. Ira H. Smith, of Topeka, Kansas, has devised a very simple little attachment, which anybody can affix to a blind, and which appears effectually to overcome the above difficulty. It consists of a piece of curved wire, pivoted to the shifting bar, at A, in the annexed engraving, and passing down through a staple on the frame of the blind. Around the shank of the staple is a coiled spring which is covered with a neat cap, the effect of the spring being to push the



latter outward, and so bind the wire between the cap and staple. A sectional view of this arrangement is shown at B. The blind slats may be set in any position, and are held by the wire.

Patented April 21, 1874. For further particulars regarding agencies for selling, etc., address the inventor as above.

Preservation of Wood by Lime.

M. Lostal, railway contractor, of Ferminy, has communicated to the Society of Mineral Industry, at St. Etienne, France, the results of his observations on the effect of lime in preserving wood, and his method of applying it. He piles the planks in a tank, and puts over all a layer of quicklime which is gradually slaked with water. Timber for mines requires about a week to become thoroughly impregnated, and other wood more or less time, according to its thickness. The wood acquires remarkable consistence and hardness, and it is said, will never rot. Wood has been prepared in this manner for several mines, so that the plan will shortly be tested on a considerable scale. Beechwood has been prepared in this way for hammers and other tools for several iron works, and it is said to become as hard as oak without losing its elasticity or toughness, and to last much longer than when unprepared. It has long been known that wood set in lime or mortar is preserved from decay, but no systematic plan for its preservation has until now been attempted.

A Million Dollar Hammer.

A German paper informs us that the famous steel works of Frederick Krupp, of Essen, are about to receive a very important addition to their machinery. The largest steam hammer in use at these works, at the present time, is one capable of working a mass of steel 50 tons in weight, and erected at a cost of \$560,000. It is now in contemplation to build a new steam hammer capable of beating up a mass of steel of double the weight, namely, 100 tons. The new machine, it is estimated, will cost \$1,000,000, and will be the most powerful in the

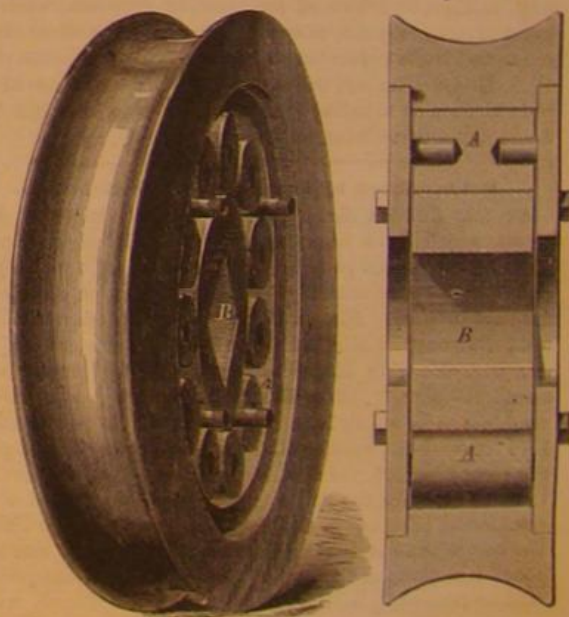
world; and it may be expected that the size and weight of the German artillery will be enormously increased, as the new steam hammer will permit the working-up of larger masses of metal than, up to the present time, has been thought to be possible by scientific engineers.

SMITH'S IMPROVED SHEAVE.

The principal advantage in the improved sheave illustrated herewith lies in the pin having secured to it a cylindrical core, which is of sufficient size to bear against several of the

Fig. 1

Fig. 2



friction rollers arranged within the disk. This distributes the strain over a larger surface, rendering the operation easier, and subjecting the parts to much less wear than is the case in the ordinary arrangement of a small pin, which may readily fall in between two of the rollers and so crush the same.

The construction of the device is represented both in perspective, Fig. 1, and section, Fig. 2. At A are the friction rollers, and at B the cylindrical core above referred to. The pin which passes through the latter is square in section, and is thus prevented from turning in the block while it is confined in the strap, in such a manner as firmly to secure the ends. The sheave, we are informed, cannot run against the side of the block and wear away the same. It is a strong and durable device, one of considerable merit, and especially adapted for marine use.

For further particulars address E. B. Smith & Co., Pat chogue, N. Y.

AN ORNAMENTAL GOURD.

The exceedingly graceful plant which is shown in our illustration is a miniature gourd, the seeds of which were brought from Africa to Europe by Sir Samuel Baker, who states that the plant, when in a wild condition, covers dwarf trees and shrubs with its slender climbing shoots, which are loaded at every joint with pretty little fruits, which, in a young state, are bright green, striped and spotted with white; but which, when ripe, change to scarlet, a color which sets off the white spots and pencillings to increased advantage. The fruits, as will be seen, are borne in clusters of about three or four together. The foliage, being of a distinct shade of green, renders the plant effective, even when not in fruit. It has been grown in a melon house, in which it quickly covered a large trellis, and became loaded with fruits which, were it not for their white marblings, might easily be mistaken for those of *solanum capsicastrum*. Some of the African tribes use the long slender shoots of this gourd for garlands and head dresses, purposes for which its habit of growth eminently fits it. Long festoons of it, laden with fruit, might be usefully employed for garnishing stands on the dinner table, or the sprays of crimson fruit might be allowed to hang naturally and gracefully from the margins of ornamental vases. Gourds of this description, says a correspondent of the *English Garden*, well deserve more attention than they have hitherto had.

Fog.

Angus Smith gives an account of a remarkable fog observed at Reikjavik, in Iceland. It appears that, on a bright afternoon in July, "as soon as we left the house, a cloud came down a street from southwards, and some one said: 'Let us cross out of the way of the dust.' I looked more carefully, and, finding the cloud moving very slowly on the ground, concluded that it was smoke from a chimney, but smoke mixed with larger particles than we generally see. Gradually it came to us; there was no smell, but a distinct chill."

Perceiving that it was a fog, Dr. Smith ascended a rising ground, and saw the fog rising out of the small lake behind the town, and rolling into the streets very slowly. A similar fog rose from the sea, and rolled also into the town. Hence it appeared that the wind had nothing to do with the matter, but that both fogs rolled because they were too heavy to remain suspended. The peculiarity of the fog was in the size of its particles, larger than any the author had ever before seen, and which he estimates at from $\frac{1}{100}$ to $\frac{1}{50}$ of an inch in diameter, in the flatness with which it fell on the ground, and in its lumbering mode of rolling, whence all observers at first took it for dust. The author found that the particles were perfectly spherical, and not hollow, but concrete throughout. "They all tended downwards, they were falling, evidently; it was a falling dew, or a slight incipient rain, rapidly disappearing into the earth." Dr. Smith adds: "It seemed evident to me that, to make a distinction absolute between fog, rain, and dew, was a waste of words. There is a broad observable distinction, but no narrow line, and we cannot tell the end or beginning of either."

Examining the common opinion of the vesicular nature of clouds and mists, he declares that it "rests on a foundation too weak to be worth much attention." A vague notion that the globules of fog are analogous to soap bubbles seems to lie at the foundation. Dr. Smith has repeated the experiments of Saussure, but without meeting with any signs of vesicularity. "Indeed," he remarks, in summing up, "I see no reason for going far for a mode of keeping clouds up. Times without number I have observed, on calm summer evenings, a cloud of smoke from a steamboat funnel lying for miles in length at a height very little different from that of the funnel out of which it issued. . . . At other times I have found the smell of a cigar, used by a person fully a quarter of a mile off, over the road, at about the same height as his mouth, nothing being visible. In these cases, have we anything to look to but the size of the particles? They are so small that their resistance to the atmosphere is diminished to its utmost, as the resistance of the air is increased so much, in proportion to the weight, that they cannot fall rapidly."

Curiosities of Ebullition.

Dr. T. L. Phipson, in the *Chemical News*, says that water, strongly acidified with hydrochloric acid, and containing a small quantity of benzole, was found to enter into violent ebullition every sixty seconds; after a while the boiling ceased completely, and then recommenced suddenly every thirty seconds for some time. The flask still being kept over the spirit lamp, the periods between quiescence and violent ebullition dropped to twenty, ten, and finally to eight seconds, at which interval the phenomenon continued for some considerable time. The temperature of the vapor in the flask was 214° Fah., in the liquid 218°, during the whole time of the experiment.

When methyl alcohol was added to the above mixture of water, hydrochloric acid, and benzole, and the flask placed

over a spirit lamp, no ebullition at all occurred for a very long space of time, and then it took place very suddenly and continued.

Ballooning Experiments.

Captain H. B. Dight recently ascended in his balloon Fairy from Wolverhampton, to illustrate the action of his steering apparatus prior to his experimental trip across the English Channel, for which he announces he has arranged with the British government. The ascent occasioned much interest, and drew together many thousands of spectators. The ascent, however, was not a success. In a torn state, the



BRYONOPSIS LACINIOSA.

balloon and steering machinery fell in a neighboring meadow, after Captain Dight had been in great jeopardy.

A SPRING BUTTON HOLE BOUQUET.

The tasteful arrangement of a small bouquet of choice flowers, shown in the annexed engraving, is made up of a leaf of lily of the valley at the back, upon which lies one spray of that flower mixed with four or five very small pieces of maidenhair fern. These portions of a frond are so arranged that they break the hard outline of the leaf behind them,



and also tone down its bright green by their glaucous shade of color. In front of these is placed a fine thickly petalled bud of climbing *Deconiensis* rose. This, of course, has been properly wired, and slightly blown open. The base of the bud is concealed by two well chosen leaves from a fairy rose, by which means another shade of green is introduced into

the bouquet, which not only serves to set off the rosebud to the best advantage, but also contrasts well with the foliage previously used. If it were a necessity that hardy plants be employed in making up such bouquets, some well selected leaves from *thalictum minus* would prove such an efficient substitute for the maidenhair that ninety-nine people out of a hundred would regard it as a fern, and not as a leaf from a flowering plant. Those who do not possess means for growing *adiantum cuneatum* are strongly recommended to cultivate the hardy *thalictum*, which does best in a calcareous or magnesian soil.

COTTAGE HORTICULTURE.

THE SELECTION OF OUTDOOR PLANTS.

The choice of flowering plants, suitable for culture in the limited space usually available for the above purpose, is comparatively limited, because of the many qualifications requisite to each plant: for instance, its height, the length of its blooming period, and the color of its bloom. For if the flowers in a bed are of irregular height, part of the bloom must be hid. If the arrangement of the color of the bloom is inharmonious, the effect will be anything but pleasing to the eye; and the more of the plants which are in bloom at the same time, the worse the bed will look. To those possessing a hothouse, greenhouse, or forcing beds, in which a succession of plants may be reared to supply each bed with plants so soon as the old ones have ceased to flower, hyacinths, crocuses, tulips, snowdrops, and lent lilies may be followed by verbenas, stocks, asters, etc., and thus a continuous blooming bed may be secured; but with a proper selection of plants and ordinary care in their culture, three plants (scarlet geraniums, yellow calceolarias, and the deep blue lobelias) will give us the best attainable arrangement of color and of height, and will at the same time produce a flower garden from spring time till the frosts of winter cut them off, which qualifications are not combined in any other plants.

In selecting the plants, choose those whose leaves are of a deep green, and in all cases those which are short and bushy and have no bloom upon them. If, however, they are in bloom, cut off the flowers before planting, which will only delay the blooming a few days, and will greatly strengthen the plant. If the plants have been reared in a greenhouse or under frames, keep them a few days before setting them in the beds, placing them out of doors in the daytime, and taking them in at night, in order to make them hardy and prevent them from suffering from the cool night air. If the plants are placed in a cold frame, either before or after being planted in the beds, be careful to lift the frame during a great part of the daytime, otherwise the sweat which gathers on the inside of the glass will fall upon the plants and infallibly kill them by what is called damping off.

PLANTING.

The bright scarlet horseshoe or fish geranium, and not the pink, should be selected, and planted ten inches apart in the center of the bed. Next come the calceolarias, about ten inches from the geraniums and about ten inches apart, and then the lobelias, about six inches apart, surrounding the calceolarias. All these plants will bloom together and continuously, the geraniums growing tallest and the lobelias shortest; hence we shall not only have a true arrangement of the prismatic colors, but all the flowers will be visible from almost any point of view. The effect may be considerably heightened by planting a standard perpetual rosebush in the center of the beds; but in such case, let the standards be of various heights and the colors to a pattern if the beds are arranged to a pattern, as should be the case. For a red rose, John Hopper is one of the very best. For a yellow one, *Gloire de Dijon* is very superior. In the absence of roses, a white lily may be planted in each bed. If there are border beds, white lilies, or any of the broad-leaved, red, or variegated plants, will form a pleasing contrast.

PROPAGATING.

To propagate geraniums and calceolarias, do not let the plants flower too soon; but pinch off the first appearing bloom and pinch out the eyes of all straggling branches, which will immediately throw out side shoots, thus forming bushy and shapeable plants, besides very healthy and strong ones. Give preference to those plants which have their branches close to the surface of the soil. A strict attention to these rules is indispensable to obtaining a fine and freely blossoming plant.

TO DISCOVER INSECTS.

If the leaves of the plant turn reddish or yellow, or if they curl up, a close inspection will generally disclose that the plants are infested with a very small green insect, or else with the red spider, either of which must be destroyed. For this purpose, scald some common tobacco with water until the latter is colored to a yellow, and when cold sprinkle the leaves of the plants with it; but a better plan is to pass the stems and leaves of the plants between the fingers, and to then shake the plant and well water the bed immediately afterward. The latter operation destroys a large proportion of the insects shaken from the plant. This latter method is the only infallible one.

It sometimes happens that the fertilizer used to enrich the soil will germinate insects which destroy or impair the roots of the plants; the indications of such being the case are that the leaves will turn red or yellow, and will flag or droop during the warmer portions of the day. If this occurs while the plants are in pots, an effectual remedy is to let the mold in the pots get so dry that the leaves of the plant commence to droop; then place the hand over the surface of the mold, letting the stem of the plant pass between the fingers; then turn the flower pot upside down, and slap the bottom of the pot with the other hand. After one or two such blows, the pot may be lifted off without disturbing the mold from the roots of the plant, and the insects will be found on either the outside of the mold or on the sides of the flower pot. After removing them, the pot may be replaced, and the plant watered. If, however, the flower beds are infested with insects, the soil should be allowed to get comparatively dry, and a piece of carrot, parsnip, or turnip placed upon the surface as a bait and covered over with two or three cabbage leaves. An inspection early in the morning will discover the insects around the bait.

PEGGING DOWN CREEPING PLANTS.

To propagate lobelias and verbenas, the first bloom should be picked off, and the branches, as they extend, should be pegged down closely to the surface of the mold. The branches will then take root as they lengthen; and by thus drawing a large amount of sustenance from the soil, they will bloom very freely and cover a large space. A verbenas may thus be made to cover a square yard, and a lobelia a square foot, of ground. When a plant is permitted to bloom, the growth of its branches is very seriously retarded. For example, a balsam, or lady's slipper, as it is commonly termed, kept free from bloom and continuously repotted (as the roots extend) into a larger pot, may, under favorable circumstances, be grown as large as a good-sized gooseberry or currant bush. Asters and stocks require transplanting from the seed bed so soon as the plant has six leaves, to another bed, placing them about six inches apart; then when they are large enough to set into the beds, they should be well watered both before and after removal.

TRANSPLANTING.

The object of transplanting is to check the growth of the top, and to extend the growth of the roots of the plant, thus enabling it to draw increased proportionate sustenance from the soil.

As soon as the plants in the seed bed have four leaves, the weakly ones should be removed to give room to the healthy ones, otherwise the abundance of leaves will draw the plants up, causing them to grow tall, slender, and weakly. Before removing them, however, it is well to water the bed, so that those removed can be drawn from the earth without disturbing the soil around those remaining.

Flowers require a light soil, to obtain which sand may be mixed with heavy soil. Sufficient ammonia to just taint the water will be found an excellent means of promoting the growth of the plants; soap-suds will also have the same effect. Watering should take place in the morning during the spring, and at night during the summer months; for the reason that, in the spring, the nights are apt to be cold, and the watering would make the soil still colder; and in the summer the water evaporates very quickly from the soil if applied during the day. Water which has been exposed to the open air should be used, and not that drawn from a hydrant or a well; and if after watering, the surface of the soil becomes caked, it should be disturbed with a rake, or the growth of the plants will be seriously impeded. The water should be applied in as fine spray as possible, and in no case poured upon the plants. All plants should be planted deeply into the soil, which should be pressed moderately firmly to and around the roots.

POTTING PLANTS.

The mold for potting should be light and loamy, the fertilizing material used being well decayed. If the soil is rich of itself, it is better to be either very sparing with the fertilizer or to dispense with it altogether. In the bottom of the pot, place several small broken pieces of crockery or similar material to assist the drainage; and in setting the plant, be careful to keep it well down in the pot and to press the mold moderately around the roots. The surface of the mold should be about half an inch below the level of the top of the flower pot. Slips should be planted close to the sides of the pot, and in small pots.

When a plant becomes pot-bound, that is, when the roots have become matted around the sides and bottom of the pot, the plant, so soon as it has ceased blooming, should be repotted in a larger pot. It is not necessary to remove any of the mold from the roots, but simply to fill in the space in the larger pot with new and rich mold.

Plants kept in the windows should be turned every morning, or the light, striking on one side only, will draw the plant to that side so that all its branches and leaves will turn towards the window. The water in the saucers should never be applied to the plants. In cutting slips of any plant, all ways choose the youngest branches; and cut off the slip at the junction of a joint or leaf, since the roots shoot more readily from such joints. If you follow these directions and put sufficient sulphate of ammonia to just taint the water applied to your plants, you may cultivate with success almost any plant, even though you are an entire novice.

Ashes and Iron for Flowers.

The observation of practical and experimental gardeners seems to confirm the fact that, to procure brilliant colors in flowers, it is necessary to supply the soil with an abundance of ferruginous constituents and silica. The latter supplies

a material (says S. E. Todd, in one of our foreign exchanges) which is of vast importance in the production of that brilliancy of the petals and the dark green luster of the leaves. Then, if potash be added, or the ground be dressed round about the growing flowers with unleached wood ashes, an increased brilliancy will appear in every petal and leaf.

Any person who cultivates only a few flowers in pots, or between grassy lawns, or on spacious parterres, may readily satisfy himself of the exceedingly useful part the foregoing materials play in the production of beautiful flowers. Even white flowers, or roses that have petals nearly white, will be greatly improved in brilliancy by providing iron sand, and unleached ashes for the roots of growing plants. Ferruginous material may be applied to the soil where flowers are growing, or where they are to grow, by procuring a supply of oxide of iron, in the form of the dark colored scales that fall from the heated bars of iron when the metal is hammered by the blacksmiths.

Iron turnings and iron filings, which may be obtained for a trifle at most machine shops, should be worked into the soil near flowers; and in a few years it will be perceived that all the minute fragments will have been dissolved, thus furnishing the choicest material for painting the gayest colors of the flower garden. When there is an excess of vegetable mold in a flower bed, and a deficiency of silica or sand, the flowers will never be so rich in color, nor so brilliant, as they would be were a liberal dressing of sand, or sandy loam, worked down into the bed, where the growing roots could reach it. If wood ashes can be obtained readily, let a dressing be spread over the surface of the ground, about half an inch deep, and be raked in.

A dressing of quicklime will be found excellent for flowers of every description. It is also of eminent importance to improve the fertility of the soil where flowers are growing, in order to have mature, plump, ripe seed. Let the foregoing materials be spread around the flowers, and raked in at any convenient period of the year. When soil is prepared for flowers in pots, let some sand, some oxide of iron, and ashes be mingled thoroughly with the leaf mold.

SCIENTIFIC AND PRACTICAL INFORMATION.

TESTING TINNED PLATES FOR LEAD.

M. Fordas recently communicated to the French Academy of Sciences the following simple method of determining the presence of lead in tin vessels employed for packing articles of food. The metal to be tested is first touched with nitric acid, and then heated, when the acid evaporates. If lead be contained, stannic acid and nitrate of lead remain. Iodide of potassium is then applied, forming yellow iodide of lead; while the stannic acid is white. The yellow stain, therefore, indicates lead, the white, tin.

NEW TESTS OF STEEL.

MM. Trève and Duvassier have lately conducted extended investigations into the nature of steels, and their coercitive force. Fifteen bars of steel, divided into five series of three each and differently carbonized, each received a peculiar temper. They were then magnetized to saturation, and their magnetic force determined by the method of deviations. A bar containing 0.950 per cent of carbon and tempered in cold water gave a maximum deviation, represented by 47. Another bar, with a similar percentage of carbon, but tempered in boiling water, gave 44. A third bar, with a like percentage, but tempered in oil, at 50° Fah., gave 43. The influence of the tempering liquid is here evident.

The effect of the proportion of carbon contained in different bars was also very marked. Thus a bar containing 0.950 per cent gave a maximum of 47; another, with 0.250 per cent, gave but 13. By describing the curves of variations for the different series of bars, the influence of the carbon and of the tempering liquid becomes clearly apparent. It is a remarkable fact that the curves of elasticity and the magnetic curves of the bars are closely similar, the carbon appearing to give elasticity to the steel, and at the same time to increase its magnetic capacity.

ALLOYS OF PLATINUM AND IRON.

M. H. Sainte-Claire Deville says: On analyzing platinum, iridium, and iron are united in the state of oxides intimately mixed. If this matter is treated with a current of hydrogen, oxide of iridium is reduced at common temperatures from 392° to 1,112° Fah. The metals are then alloyed; for if digested with hydrochloric acid, a few bubbles only of hydrogen escape, and very little iron is dissolved, even when it exists in the alloy to the extent of 10 per cent. Iron and iridium are thus capable of combining at low temperatures, and the same is probably the case with iron and platinum. Under these conditions, the alloy is evidently not homogeneous. Breithaupt admits the existence of platinum ores containing 14 to 19 per cent of iron. Berzelius, only once however, found a specimen containing as much as 12.98 per cent; and M. Debray and the author have never found more than 12. Platinum may be freed from iron by cupellation in chlorine gas. If heated from 2,192° to 2,732° Fah. in this gas, it is volatilized in the form of brilliant crystals, and deposited in all the hot parts of the apparatus.

THE utilization of the sewage of Paris on the plains of Gennevilliers, containing an area of 800 acres of light sandy soil, is now being practically carried out. A large sewer is now being constructed to carry away the sewage from the main sewer at Clichy-sur-Seine. The new sewer will be of 5 feet 6 inches internal diameter, and about 4,100 yards in length; and when completed, half the sewage of Paris will be utilized.

Paper Barrels and Boxes.

The manufacture of paper barrels, boxes, and similar vessels, for use in place of those generally made of wood, is rapidly increasing, seven patents and an equal number of factories for producing the articles being now in operation, all in the Western States.

In the first of these patents, the paper used in the fabrication is prepared principally from straw, and is pressed, several sheets at a time, into a firm, compact sheet, which when dry becomes tougher than wood. The sheet is then bent into cylindrical form, and its opposing edges, which are previously cut into dovetails, fitted together. Double pointed nails are drawn through the dovetailed ends from the outside of the barrel, and are clinched upon the inner surface of a strip of wood placed vertically along the inside of the joint. The heads are of wood, fitted into the ends with a flange resting against the edge, and are secured by nails driven through the sides of the barrel. Hoops of wood or iron are added to protect the latter from abrasion or wear, and the paper is thoroughly waterproofed.

Another mode of making the barrels is to form them directly from the paper pulp, the latter being taken from the cylinder of the wet paper machine and carried around an expanded cylinder until it becomes of the requisite thickness. The cylinder is then contracted and removed, leaving the barrel all formed and ready for passage between two rollers. These are so arranged that one presses on the inside and the other on the outside of the barrel, moving the latter between them, and at the same time compressing and hardening the paper. The vessel is then a jointless cylinder, and nothing remains but to insert the heads and secure the hoops in place.

Securing the heads in paper barrels appears to be a difficult portion of the manufacture, and there are two patents on this especial point. In one the invention consists in fastening manilla or other strong paper around the head so as to form a flexible edge. This, after the head is inserted, is crimped so as to line the rim of the barrel, over which it is bent and secured by hoops.

The second inventor proposes either to press one head into shape from paper pulp, at the time when the barrel is formed about the cylinder, or else to make the heads separate and turn up their edges around the peripheries. This turned-up portion serves the same purpose as the flexible paper in the case just described, but differs in construction, being riveted to the cask through iron hoops.

Another plan for making barrels differs essentially from those already described, in that each barrel is formed of two cylinders instead of but one. One cylinder is placed inside the other, so as to serve as a lining, and, being shorter, to form shoulders on which the heads are rested. Thick paper is interposed between the cylinders, and all are pasted firmly together. The interposing paper is carried up above the rim and folded over the edges. Paper packages for lard, butter, and similar materials are composed of sheets glued together and pressed into shape in dies. This is done while the paper and glue are still moist, and a sheet of muslin, placed under the substance in the concave die, prevents cracking or tearing at the joints.

A Large Mass of Native Copper.

A few days since, a mass of native copper, said to be the largest ever discovered, was brought from Lake Superior to St. Louis, Mo. The mass is heart-shaped, and weighs 6,000 lbs., exceeding nearly double the weight of the famous copper boulder which was transported many years ago from the same region to the Smithsonian Institute. The new specimen exhibits the pure copper to the eye, and contains 98 per cent of the metal. It was taken out from an ancient digging, sixteen and a half feet below the surface, by a Mr. Davis, who had spent 25 years in copper mining. The mass, when found, had evidently been detached from its bed by the ancient miners. A number of pieces of copper were found besides the mass, weighing from 1 oz. to 17 lbs., which were evidently clippings by the old miners. Stone hammers weighing from ten to thirty pounds have been found in cart loads, several specimens of which were brought away with the copper.

These were the primitive tools with which these ancient miners had to do their work, and are found either perfect or broken from use, and the fragments are found scattered through the debris. It has been computed that two hundred of these old miners with their rude methods could barely be equivalent to two of the skilled miners of the present day. Who, and to what race they belonged, and at what time these people flourished, is not satisfactorily known, and can only be the subject of conjecture. The only plausible assumption is that they belonged to the ancient mound builders, and worked in metals, anterior to the Indian races, as evidences of their occupancy were seen by the early Jesuit explorers, and specimens which they clipped from the copper rocks are found scattered over the whole continent.

CEMENT FOR MARBLE AND ALABASTER.—Mix 13 parts of Portland cement, 6 parts of slaked lime, 6 parts of fine sand, and 1 part of infusorial earth, and make up into a thick paste with silicate of soda. The object to be cemented does not require to be heated. It sets in twenty-four hours, and the fracture cannot be readily found.

THE results of the experiments for testing the proportion of carbonic acid in the air, made during the first ascension of the Zenith, show that, at the altitude of 2,260 feet, the volumes of carbonic acid contained in 10,000 volumes of air are 2.40; at 3,200 feet, 3.00.

[For the Scientific American.]

THE ORIGIN OF COLD SNAPS.

One of Agassiz's oft-repeated expressions was: "Facts are stupid things unless they are made to teach some principle." While true Science consists chiefly in the discovery of laws and principles, these can be gained only by an abundant collation and a careful study of undoubted facts. Whether it was Nature's plan to make us study out the laws which govern them, we cannot say; but that a frequent observation of certain facts of meteorology has been forced upon us by the rigors of the past winter, none will deny. And while we are just recovering from the shivering and freezing which these entailed, it may not be uninteresting or unprofitable to consider briefly the meteoric principles upon which cold is produced.

The sun is the cause of all motion, from the wind, the rain fall, and the Niagara cascade to the muscular exertions of beast and man. And anomalous as it may seem, it is also the indirect cause of cold. The very heat that warms us so gratefully during these spring days melts the frozen matter and evaporates the water. Changes from solid to liquid, and from liquid to vapor, require an enormous amount of heat, which, being taken from the sun's rays, leaves the air damp and chilly. Thus the change from cold weather to warm is less sudden and enervating; and by a reversion of the same principle, the cold of fall is more gradual in its approach. Though this principle will produce a greater amount of cold than we are apt to suppose, it will not account for the cold snaps which drive us to the fire and into our furs and wrappings during the winter.

In a recent article in the SCIENTIFIC AMERICAN, on laws of storms, it was shown that our storms are monstrous whirlwinds covering half a continent, in which the wind, blowing from all directions towards a central point, escapes by rushing upwards, and thus diminishes atmospheric pressure. To compensate for this rise of air, there must be a descent somewhere else. As the air rises into the upper regions, it gives off into space the heat it abstracted from the earth, and its increased weight causes its return to the surface. Observations, similar to those mentioned in the article above referred to, have enabled Professor Loomis to show that, in regions of high barometer, the winds blow outwards in all directions. High barometer is often constant for days, and a week or more together, in one locality; and there the thermometer is low for about the same length of time. He attributes this to downward currents, at the center of high barometer, from the cold upper regions, and believes they are made up of air from the upward currents of low barometric centers. From this, he concludes that our sudden and long spells of extreme cold are not due to currents from a northern latitude, but to these downward currents. There seems one difficulty in his theory here. He has shown that the storm center advances at a rate varying from 238 to 1,280 miles per day; and if air from this came down and produced a region of high barometer, from which the winds diverge in all directions, we would expect the high barometric center to accompany the storm center at about the same velocity; but instead, it sometimes remains stationary for weeks.

The Professor admits that, during the cold spells of December, 1872, and January 1873, northerly winds did prevail; but he considers these as attending high barometer, according to laws already established, and that north winds alone would not be a sufficient cause of the suddenness and magnitude of the thermal depression observed. In substantiation of his views, he cites a storm which came up from the Gulf of Mexico, choosing a southern storm so that he could find observations taken to the north of it. This reached the northern coast of Lake Ontario in three days, and on the last day, in northern Florida, the thermometer was lower than it had been on either of the preceding days at Knoxville, Nashville, Cincinnati, Louisville, and Memphis. This indicates that the cold did not come from the north or northwest, but must have descended from colder regions above. The same phenomenon prevails in the far north, even in the coldest regions ever visited by man. At Melville Island, during a strong wind, the barometer fell to 29.10, and in four days it had risen to 30.75, the highest point reached during the year. During the same time the thermometer fell from -5° to -43°, the lowest temperature observed during the year. At Van Rensselaer Harbor, the same point was illustrated. At Yakutsk, Siberia, latitude 62°, the mean temperature of January is -44° Fah.; but on January 21, 1838, the thermometer fell to -76° Fah. Dove's chart records no place on the earth's surface where the mean temperature of the coldest month is much below that of Yakutsk. And if the temperature suddenly falls 32° below the mean in the coldest part of the earth, the conclusion seems almost inevitable that the cold must come from the upper regions. The distinguished investigator concludes: "If this is the true explanation of periods of unusual cold in Siberia, a similar phenomenon in the United States is doubtless to be explained in like manner."

The suddenness of thermometric changes also points with equal conclusiveness in the same direction. When, in restricted localities, the thermometer falls 18° or 20° in an hour, or, in thunderstorms, 5° or 10° in a few minutes, we are apparently shut up to the conclusion that the cold cannot be borne from the distant north, but must be due to a down rush of cold air.

Professor Loomis makes his conclusions appear quite clear and reasonable; yet at the late meeting of the Academy of Sciences, at Washington, they excited considerable discussion. Professor Ferrel, of the Coast Survey, who is investigating the laws of cyclones, and Dr. Woelfel, of Russia, announced as their opinion, based on recent researches, that descending air would produce heat instead of cold, because

of the increased atmospheric pressure to which it is exposed as it approaches the earth.

The increase of pressure would diminish the air's capacity for heat, and this would be given off to the surrounding air at the rate of one degree for every 325 feet of descent. This objection seems hardly conclusive, for we have no adequate means of measuring the temperature of the air in the regions from which it descends. It may lose one degree of heat for every 325 feet of descent, and still be much colder than air at the earth's surface. Dr. Woelfel gives the height of thermometer at several places of different elevations, which goes to show that low places are as cold as high ones. Later, he says, cold may be generated on the spot by simple radiation. This statement seems to weaken the force of his previous observations; for evidently the greatest radiation would occur in the highest regions, for there is less to obstruct it, and of course this would make the elevated regions colder, as Loomis claims. The Russian scientist denies that cold snaps are caused—except in a few cases of special local conditions, or in thunderstorms—by cold air descending, but rather by winds from the vicinity of the meteoric poles. He attributes the sudden low temperature to which the Atlantic coast is subjected to the fact that the Appalachian Mountains are not high enough to break off the currents from the meteoric pole to the northwest of these mountains.

If this theory is correct, we may conclude that the cold air from the meteoric pole, somewhere to the west of Hudson's Bay, sweeping across the unobstructing lakes and prairies, is the cause of the notoriously variable temperature of Chicago.

As doctors in the same line of scientific investigation so widely disagree, our only resource is to await future developments for a satisfactory settlement of the question.

S. H. T.

New Snow Spectacles.

Mr. William White Cooper, oculist, London, has devised a new kind of spectacles to prevent snow blindness. It is well known that a long exposure to the glare of the intense white of the snow in the polar regions is most harmful to the sight; to meet this difficulty, spectacles of green tinted glass, surrounded by gauze, have been proposed. These will, however, fail in practice, as the glass part of the spectacles is liable to get dim and cloudy, while the gauze and the wire, by means of which the spectacles are fastened behind the ears, will in an arctic climate become so cold that to the human skin they will have the sensation of being made of red-hot wire. Mr. Cooper's snow spectacles have neither glass nor iron in their composition, for they are made of ebonite, and are tied on to the head by a velvet cord. They resemble somewhat two half walnut shells fastened over the eyes. Their great peculiarity, however, is that the wearer sees through a simple slit in front of the pupil of the eye. The sides of each eye box are perforated with minute holes, in order that the wearer can get a side view of objects. These glasses will also prove useful to travelers by railway, inasmuch as they keep out the glare of the sun, and prevent the admission of dust into the eye. To engine drivers, therefore, they would be invaluable, especially when exposed during sleet, snowstorms, or very windy weather. They are also very agreeable when reading at night by lamp or gas light.

A New Lifeboat.

There has just been exhibited to the brethren of the Hull Trinity House, and to the principal ship owners of the port, a new patent lifeboat, patented by Messrs. Anderson and Burkinshaw, of Burlington Quay, and it is by them termed the "Reversible Lifeboat." As its name implies, it is top and bottom both alike; and if in launching, before it touches the water, it should, by the rolling of the vessel or any other cause, turn over, there are thwarts and seats running around the side just the same as there would have been had the boat gone in the other way up. Whichever side the lifeboat takes the water, when she is once afloat, a couple of flaps running the whole length will close and form the bottom of the boat, and there is provision for drawing a further flooring out, which will rest upon strong beams. The boat receives its buoyancy from a massive belt of cork, which is encased in canvas, and runs from stem to stern on each side, and forty separate airtight tanks, ten on each side of both the upper and lower parts of the boat. Still further buoyancy is obtained by large tanks at each end of the boat, but it is intended to use these latter compartments as storerooms for provisions, spirits, medicines, etc., the whole supply being protected from damage by either rain or sea water. On each side of the belt of cork outside the boat there are numerous life lines, which will hang in the water, so that any one falling overboard on leaving a vessel may readily gain the boat and hoist themselves on board.

Burning Iron.

A Berlin experimenter has demonstrated the combustibility of iron in a peculiar manner. He takes a straight bar magnet of some power, and sprinkles iron filings on one of its poles. These filings arrange themselves in accordance with the lines of magnetic force; and however closely they may appear to be placed, of course no two of the metallic filaments are parallel, and consequently, a certain amount of air is enclosed as in a metallic sponge. The flame of any ordinary spirit lamp or gas burner readily ignites the finely divided iron, and it continues to burn brilliantly for some time, the combustion being, apparently, as natural and easy as that of any ordinary substance. If the experimenter with this operation stands on a slight elevation and waves the magnet to and fro while burning, a magnificent rain of fire is said to be produced.

DECISIONS OF THE COURTS.

United States Circuit Court—District of Massachusetts.

PATENT CAR WHEEL.—CHANDLER NEEDHAM vs. NATHAN WASHBURN & CO.

[In equity.—Before Clifford and Lowell, J. J.—Decided October, 1874.]
Opinion of the Court by Mr. Justice Clifford.
Damages are claimed by the complainant for an alleged infringement by the respondents of certain letters patent granted to him, January 3, 1871, in which it is represented that he is the original and first inventor of a certain new and useful improvement in casting car wheels, as more fully described in the specification of the letters patent.

The principal defenses upon the merits are as follows: 1. That the alleged improvement is not new, in the sense of the patent law, because the process was well known and in public use long before the date of the supposed invention. 2. Because the respondents have never infringed the patent as alleged.

Both of these defenses make it necessary to ascertain what the invention is when the patent which secures it is properly construed. Enough may be learned from the description of the invention in the specification of the process which he pursues to manufacture the patented car wheel, when weighed in connection with the claim of the patent, to furnish a satisfactory answer to the inquiry as to the true nature and scope of the alleged improvement.

His first step, as pointed out in the specification, is to cast a suitable quantity of steel to form the tyre of the wheel into an annular ingot, about fifteen inches in diameter, with an opening at the center of the diameter, of four inches. He then hammers the ingot upon an anvil by means of a steam hammer, by which its diameter is extended to eighteen inches; and he gives a description of the anvil which he uses, and of the manner of conducting the hammering. Forming rolls are then employed, by which the ingot is enlarged to the proper size and shape to form the tyre of the wheel. Having formed the tyre, he then places it in a heated furnace, and heats it to a bright cherry red, when it is taken from the furnace, and, having removed every foreign substance from its surface, he places it within the mold in which the body of the car wheel is to be cast, said mold having previously been formed and prepared for the purpose. Care, it is said, should be taken that the heated tyre should be properly adjusted in the mold; and when that is accomplished, the direction is that the flask shall be immediately closed, and the molten iron be poured into the mold, which, as it comes in contact with the highly heated steel, fuses the surface of the latter, there by forming a perfect union between the two, and, as the metal cools, the body of the wheel and the tyre are welded into one solid mass. Extended remarks upon that part of the described process are unnecessary, as nothing there described is embraced in the claim of the patent; and if it had been, it would not have benefited the complainant, as every part of the process there described is substantially the same as that set forth in the patent granted to Zadoc Washburn, which was introduced in evidence, and is of prior date.

Two matters are then introduced into the specification of the patent in question, which, it is insisted, distinguish it from the invention of Zadoc Washburn, which, it is admitted, is the older of the two: 1. That the molten iron is introduced into the mold through a series of openings at the rim of the wheel, just inside the tyre, and that it flows thence to the center, carrying away from the inner surface of the steel tyre all dirt and dust, if any, which might otherwise prevent the welding of the parts. 2. That the ingot is expressly set forth under the second head as a matter pertaining to the described improvement, but the patentee points out what he represents as a defect in the process of the other patent, which is that the cast iron, instead of lying still in the mold and forming a perfect weld, is agitated and caused to bubble by the gas generated by the molten iron as it comes in contact with the flux used in the process, whereby, as he states, the perfect and desired union of the iron and steel is prevented. Everything described in the patent to Zadoc Washburn is disclaimed by him in express terms. What he claims is the described method of introducing the molten cast iron into the mold, through a series of holes, directly upon the inner unfluxed surface of the cast steel tyre, by which a perfect union and weld of the metals are produced.

Car wheels manufactured by first forming a rim of cast steel, and then heating and placing it in a mold previously prepared for the purpose, and by pouring molten cast iron into the mold to complete the manufacture of the wheel, by the union or weld between the two, into one solid mass, are certainly old. Nor is that proposition denied. Nothing, therefore, but a new and useful improvement in the method or process of such manufacture can be regarded as the proper subject of a patent. Doubtless it may be true that the molten iron was formerly poured into the mold at the center of the mold, and it may be that it is better to construct the openings in the mold for the purpose—whether they are called by that name or are called "springs" or conduits—just inside the inner surface of the heated rim which is placed in the mold; but the respondent is not satisfied from an examination of the product, or from any evidence in the case, that such a change, without more (even if new, which is not admitted), is the proper subject of a patent, as it is scarcely possible that it could have required any invention to make it. Changes of the kind are nothing more than common knowledge and experience would suggest, and every workman, whether skilled in the art or not, would know how to apply the suggestion. Nor can it make any difference that the patentees used a series of such openings in the mold in their method or process, as the proofs are full and satisfactory that a series of holes has been used in making such castings at a much earlier period than the date of the complainant's invention, and on several occasions, as appears by the testimony of an unimpeached witness.

2. Suppose that is so, still it is insisted by the complainant that his method or process is new and useful, because he does not use flux in making the described wheels, but, as he insists, distinguishes his method or process from the invention described in the Zadoc Washburn patent, and from all others known at the date of his invention. Much reason exists for holding that the second feature of the claim is invalid, because not embraced in the description of the method or process used by the complainant, as required by the act of Congress; but inasmuch as the alleged invention consists merely in omitting an ingredient often employed in welding steel and iron, or two pieces of iron, the act is not incited to rest the decision entirely upon that ground. Nor is it at all necessary to do so, as the court, in view of the facts and circumstances of the case, is of the opinion that it is matter of common knowledge, that iron, or iron and steel, may be successfully welded with or without the use of flux, and that such knowledge has existed among mechanics accustomed to work at the ordinary forge, for a very long period, whereof the memory of man runneth not to the contrary.

It is not necessary to examine the question of infringement.

Bill of complainant dismissed with costs.
[James B. Hobbs for complainant,
A. K. P. Joy for defendants.]

United States Circuit Court, Eastern District of Pennsylvania.

PATENT PAPER COLLAR.—THE UNION PAPER COLLAR COMPANY vs. HENRY J. WHITE.

[In equity.—Before McKennan, C. J.—Decided April, 1875.]

McKennan, Circuit J.:

The complainants are the owners, by several means assignments, of a patent granted to Walter Hunt, on the 24th of July, 1834, for a new article of manufacture, consisting of a collar made out of paper and muslin, so combined, formed, and manipulated as to adapt it to use as such. This patent was duly extended for seven years from the date of its expiration, and was released on the 23d of October, 1871, No. 5,109. The validity and infringement of this released patent are the subjects of this contention.

I do not think the legal presumption that Hunt was the first and original inventor of the article of manufacture for which he obtained a patent is at all shaken by the proofs in the case. It is true that paper and muslin or other fabrics were before united, and used as a fabric for caps, etc.; but this was not analogous to the use to which Hunt adapted them, nor was it in any wise suggestive of his invention. He was the first to discover the adaptability of this material to a use not cognate to any to which it had before been applied, and, by appropriate manipulation, to give it a useful and practical form. He thus not only supplied the public with a new article of manufacture, but he demonstrated unknown susceptibilities of the material out of which it was made. This is something more than the mere application of an old thing to a new purpose. It is the production of a new device by giving a new form to an old substance, and, by suitable manipulation, making its peculiar properties available for a use to which it had not before been applied, thereby distinguishing it from all other fabrics of the class to which it belongs. This seems to me to involve an exercise of the inventive faculty, and, in view of the great practical benefits resulting from it, to invest the product with special patentable merit.

The patent in controversy is the seventh reissue of Hunt's original patent. This multiplication of reissues is, of itself, suggestive of a purpose to cover intervening improvements, and some phrases in the specification of the last reissue may, not without semblance of reason, be treated as having that significance. It is difficult to suppose that so many reissues, with considerable intervals of time between them, were necessary to correct accidental or inadvertent mistakes in the specification and claims of the original patent. And yet the correction of these is the only legitimate purpose of a reissue. This practice has been strongly disapproved by the Supreme Court on more than one occasion.

In *Carlton vs. Boker*, 17 Wall. 471, Mr. Justice Bradley remarks: "We think it proper to reiterate our disapprobation of these ingenious attempts to expand a simple invention of a distinct device into an all-embracing claim, calculated by its wide generalizations and ambiguous language to discourage further invention in the same department of industry, and to cover antecedent inventions."

Whatever reason there may be to suspect that the motive of the patentee was to give undue elasticity to his patent, still the law presumes that the reissue was granted to correct an inadvertent omission in the original, because it commits to the Commissioner of Patents the conclusive determination of that question, and the only test of the validity of his action is whether he has allowed a reissue for a different invention from that covered by the original patent, or for what was not therein described, claimed, or indicated.

The claim in the release which, it is urged, avoids it is as follows:
A shirt collar composed of paper and muslin, or its equivalent, so united that the muslin will contract the paper, and the paper will contract the muslin, in connection with the specification, its obvious import is that the parties sought to secure as his invention a shirt collar composed of paper and muslin, or its equivalent, united by paste, glue, or other appropriate means, by means of which the union of the paper is reinforced by the fibrous strength of the muslin, and the necessary cohesiveness of the fabric is thus secured.

Does the defendant infringe this patent?
Hunt's invention consists of two elements or parts: First, of a collar, with reference to the materials out of which it is made, and their union, so as to secure certain qualities; and, second, of the subsequent manipulation of this collar, by which a smooth surface is given to it, and it is rendered impervious to moisture.

The defendant manufactures and sells shirt collars made of muslin or linen cloth pasted to a sheet of paper. Fundamentally they are the same with the collar described in Hunt's patent, because they are composed of muslin (or its equivalent) and paper, so united as to utilize the same properties contemplated by Hunt in the union of the same elements. But it is sought to differentiate them, for the reasons that the defendant attaches a sheet of paper to but one side of the cloth, and that the collar is turned down with the cloth surface only furnished and exposed to view.

The first reason rests upon an undue limitation of the scope of Hunt's invention. In his original patent, in explaining a mode of carrying his invention into practice, he describes a collar with paper on both sides of the cloth. Although he does not limit himself to any form of collar, yet the description is evidently applicable to the standing collars then in fashion, and the double coating of paper was suggested as best adapted to collars of that class. But, as has already been said, his invention was more comprehensive than this, and it was clearly indicated in his original specification. It is appropriately claimed in the released patent in controversy, the authorized purpose of which was to protect it fully. Clearly the terms of that claim are broad enough to embrace the collars made by the defendant; but, at any rate, I do not think a double coating of paper on one side of the cloth changes the identity of the fabric described by Hunt. It is still composed of the same constituents, so united as to embody the same properties which he first proposed to utilize, and the difference is only apparent and formal. Characteristic resemblance is the fairest test of substantial identity.

Nor is there any better foundation for discrimination in the fact that the defendant's collars are turned down and the cloth surface only is exposed to observation. Hunt's patent is not limited to any particular form of collar, and the polishing of the cloth surface pertains exclusively to the manipulation of the collar, after it is made, to fit it for use. It does not, in any sense, change the fundamental character of the fabric out of which it is formed, and therefore does not affect the applicability of the first claim of the release.

The defendant also manufactures collars entirely of paper, with patches of muslin pasted on the button holes to give additional strength at these points; and these are claimed to infringe the patent. I do not think so. Hunt did not contemplate any such restricted combination of paper and muslin. His collar was composed, throughout its whole body, of paper and muslin, and this was necessary to secure and embody the properties which he intended to make available. Nor could he successfully claim such a device. He did not invent paper collars, nor the application of cloth to button holes to strengthen them. Such re-enforcement had been long before applied to buttonholes, in leather curtains, sails, and other fabrics. It merely, therefore, the application of an old device to an analogous and well known use, for which no one could obtain a patent.

The complainants are entitled to an injunction, to continue in force until the 25th day of July next, when the patent will expire, and to an account, and a decree will be entered accordingly.

[George Harding for complainant.
J. J. Coombs and E. W. Moore for defendant.]

In Memoriam.

U. S. PATENT OFFICE.
Washington, D. C., April 24, 1875.

Hon. S. H. Hodges, who died on the 23rd of this month, was appointed Commissioner of Patents by President Grant in the fall of 1852, and remained as such until the incoming administration of President Pierce.

In 1851 he was appointed a member of the Board of Examiners-in-Chief, and remained its senior member until his death.

Of the many excellent qualities of the deceased, his eminent learning, his patience, his courtesy, and deep sense of justice were the most remarkable.

Out of respect to his memory the Patent Office was closed at 12 M. the 23d of this month, by order of the Commissioner of Patents.

At a meeting of the Examiners and employees of the Office, at which the Commissioner of Patents presided, the following resolutions were passed, expressive of the high sense entertained of the worth and talents of the deceased:

Resolved, That we recognize in the death of our late associate, Hon. S. H. Hodges, a grievous loss, both to the Office and to ourselves personally. His long connection with the Bureau as Commissioner and Examiner-in-Chief, his large experience in its affairs, his laborious habits, his accurate and careful observation, his just and impartial judgment and unswerving integrity, all combined to make his services invaluable. Our personal connection with him has been made pleasant by the kindness of his disposition and by our confidence in him as a man—upright and beyond reproach. His removal from us by death is no ordinary event. We grieve that we shall enjoy his society and counsel and see his venerable form no more. The memory of his character and example as a true and faithful man, we shall cherish as sacred, and the best legacy that man can leave to men.

Resolved, That we deeply sympathize with his family in their affliction, and in testimony of our respect and sympathy forward them a copy of these resolutions, and will attend the funeral in a body.

Recent American and Foreign Patents.

Improved Milk Cooler.

Addison P. Myers, Prattville, N. Y.—This invention relates to improvements in milk coolers, by which a regular flow of cold water around the pan is secured, a better support of the milk pan produced, and a tight faucet connection of pan and vat without leakage obtained. The improvements consist in supporting the vat on a longitudinal rubber-lined partition strip, and a vertical extension of the same at the partition wall between water chamber and vat, compelling the water to enter at one side of the partition and leave through a waste pipe at the other. A rubber sleeve with a top collar fits snugly around the exit pipe of the pan, and into the exit pipe of the vat, and connects the same without leakage of water.

Improved Rock Drill.

William W. Goodwin, National P. O., Iowa.—The mortises in the trimmers are so contrived, in respect of the distance from the tenons, that the lower gib will press down on the lower end wall of the mortise in the blade, while the upper gib presses the trimmers at the upper end of the mortise in them, and thus binds the trimmers firmly endwise by pressing them into the sockets, while the heads of the gibs keep the trimmers against the side of the blade.

Improved Car Brake.

Sebastian Glizinger, Glasco, assignor to himself and Abel A. Crosby, Kingston, N. Y.—A car frame of the usual construction is provided with the common pin and link coupling. In connection with the coupling is arranged, at each end of the car, on the platform or top, a wheel and lever mechanism that is connected at one end to the coupling pin, while the other end may be placed in connection with the bell rope of the locomotive, which rope has to pass over a pulley below the lever, so as to actuate the same from the locomotive for uncoupling the drawheads whenever required in case of danger or accident. The bell rope has to be applied to the front lever of the last car; but the uncoupler may be operated also directly by the conductor or automatically by the accidental detaching of any car, so that a whole train can be brought wholly within control from any part thereof.

Improved Wagon Seat.

Sebastian Glizinger, Glasco, assignor to himself and Abel A. Crosby, Kingston, N. Y.—This is an improved spring seat for vehicles which may be readily swung out of the way, if required, for loading, and adjusted to any desired height above the wagon body. The invention consists of a seat hung by stationary corner braces to the ends of strong spiral springs, which are secured by their middle parts to sliding standards, which are adjustable by links and guide bands on the stationary side standards of the seat.

Improved Dental Articulator.

Charles D. Cheney, Canandaigua, N. Y.—On the lower plate is an extension, the circular edge of which is serrated and enters the slotted end of a shaft, where it is confined by the pivot pin, which allows it to be raised and lowered to form any desired angle with the shaft. The shaft is a tube, and a screw works therein, the end of which engages with the serrated edge of the extension, and thereby holds the plate in any desired position. A saddle on the shaft allows of the latter sliding and rotating when not held by the set screw. By suitable devices the two parts of the articulator may be placed (after being separated) in the exact position they occupied, and the upper plate may be turned in any position on the pivot rod and fastened wherever desired. The arrangement of the plates (or jaws) is such that they can be moved near each other, and thus diminish the quantity of plaster used in making the mold.

Improved Apparatus for Operating and Locking Switch Signals.

Smith H. Finch, care H. Moore, 7 Park Place, New York city.—The levers for locking and levers for moving the switches or signals are made to work from one side to the other side of a frame, and lock and unlock the switches and signals thereby, locking bars provided with two shoulders each catching and holding the levers. These locking bars have at each end a portion turned at a right angle, and through which portions are pivot bolts, upon which the bars turn. These angular portions have each a slot in their extreme ends, which engage with latches which work in slots through the frame confined by joint pins. The latches are connected together by the bars on the outside of the frame which are parallel therewith. The inner ends of the latches are curved and slotted much like the end of a wrench, and receive a staple on the levers, and thereby hold the lever in a locked position, while the bars are locked by other latches, which are thrown into the slots in the angular portions. When the other lever is unlocked, the switch or signal levers are locked.

Improved Hand Corn Planter.

John W. Cleland, Nevada, Mo.—In using the planter the handle is grasped by the hand, and, by pressing downward with the outer part of the hand, a lever will be operated to force the slide back into the seed box; then, by relaxing the grasp of the hand, the slide will be forced forward by springs, dropping the seeds into the space between the boards. The plates are then forced into the ground, and a lever is again operated, to force the dropping slide to the rearward. This movement separates the plates and allows the seed to drop into the ground. The planter is then raised from the ground, and, as it is being carried forward to the place for the next hill, the hand is again relaxed, and the seed for the next hill is dropped into the space provided. The principal advantage of the device is that but one hand is required for its manipulation.

Improved Horse Collar.

Thomas Cheal, St. Paul, Minn.—This is a wooden horse collar, consisting of two back pieces hinged at top, front pieces beveled to receive the hames, and a padding secured between the parts. The broader back piece carries the trace away from the shoulder, so as not to bruise the same. The collar is stronger and better fitting than the common kind of collars in use, and may, with suitable iron bindings, be used advantageously for the heaviest work.

Improved Detachable Ash Pan for Stoves.

Albert T. Bleyley, Conception, Mo.—A perforated bottom and drawer extends under the entire stove, in addition to the ordinary stove grate, so that the coals which drop from the stove grate will rest on the bottom, while the ashes will pass through into the ash drawer. When the grated bottom and drawer are intended only for the hearth, the hearth is made on a level with the bottom of the stove.

Improved Insertable Saw Tooth.

Erasmus Smith, Norwich, N. Y.—The saw plate and the tooth wedge are provided with openings, arranged with the joint of wedge and plate diagonally, one portion in the wedge and the other in the plate, so as to allow the said wedge to be tightened against or loosened from the tooth by keys.

Improved Hay and Grain Elevator.

Thomas Powell, Stockton, Cal.—Two sections of netting are attached to stretchers of wood. The stretchers connect the sections together by hooks and eyes, also by a revolving hook, which has a crank for turning it by a trip cord, for unlocking the sling. This crank is held fast by a spring catch until it is required to unlock it. The sling is spread upon the bed of the wagon to be loaded, with the ends so disposed that they can be connected to the derrick hook when the load is to be removed. After the load is removed and laid on the stack the two parts of the sling are unlocked by the trip cord, so as to disconnect and pull out from under the load, and leave it when the derrick chain is hoisted.

Improved Preserve Can Holder.

James Henry Winslow, Lynn, Mass.—This invention consists of a pair of rubber-lined clamping jaws, with the contrivance for opening and closing them and holding them closed; also, with clamp screws for detachably connecting the clamping jaws to a table or other support. The whole is contrived and adapted for holding glass fruit jars while screwing the covers on or off, and the holder is arranged so as to hold jars of different sizes.

Improved Carriage Spring.

William F. Dusenbury, New York city.—The wooden part of the side bar is made shorter than the space between the cross springs of the wagon, and to it is secured a steel spring, which is connected with the ends of the cross springs. A rubber block, through which the end of the spring passes, is placed in the hook of the cross spring. The ends of the springs and the rubber blocks are then secured to each other by a bolt. The rubber blocks prevent the springs from coming in contact with each other, and thus prevent wear and rattling.

Improved Bottle.

Lewis F. C. Schmidt, Pittsburgh, Pa.—In the packing of glass bottles for storage or transportation, whether they are filled or empty, it is essential that they be packed snug, and so that they cannot move about. To facilitate such packing, the bottle is made long and tapering from the bottom upward; and a heavy ring surrounds the bottle at or near the bottom of the neck, which outer surface of the ring is equal to the diameter of the body of the bottle.

Improved Drill for Drilling Metal.

John B. Shaw and Simeon H. Lucas, Chicago, Ill.—This improved drill for drilling holes in metals is so constructed that it may be used for forming a small and a large hole, that it will not clog, and will enable oil to be introduced to the point of the drill without being wasted upon the chips. In the opposite sides of the inner part of the drill are formed two grooves, the outer parts of the sides of which, for about half the depth of said grooves, are parallel with each other, and with the diameter that passes through their centers. The inner parts of the sides of the grooves incline toward each other and meet at an angle of about eighty degrees. This form of the grooves causes the chips to break in pieces, and thus prevents the drill from becoming choked. Other grooves conduct oil to the point.

Improved Cultivator.

Frederick W. Tolley, Coxsack, N. Y.—Through the ends of the curved bars of the frame are passed rods, which are kept apart by tubular washers placed upon and interposed between the curved bars. The latter and washers are pressed together, making the whole frame firm and strong by nuts screwed upon the ends of the said rods. The draft hook is pivoted to the tongue a little in front of the forward rod. To the draft hook is pivoted a link which, when the cultivator is in working position, is hooked upon a hook placed upon the forward rod, and which, when the cultivator is in position for transportation, is hooked upon another hook attached to the tongue. The tongue is pivoted, and, with the frame, is adjustable in slotted guides.

Improved Bee Hive.

George H. Mobley, Nevada, Mo.—The bottom of the honey box is raised and is narrower than the box, to allow the bees to pass therein and up through suitable spaces.

Improved Car Stopper and Starter.

Absalom B. Sharp, Plaquemine, La.—The object of this invention is to utilize the power employed to stop a railway car by using the same to start the car. It consists in a rack which is made to mesh with a pinion upon the axle of the car wheel by means of a hand lever and crank shaft, the said rack being attached to a framework that compresses a spring to form the brake. The framework is provided with pawls which may be made to engage, through a second hand lever, with ratchet wheels upon the car wheels, and the said pawls are located upon the opposite side of the axle from the rack, so that, after the pawls are applied and the rack released from the pinion, the pressure of the spring is shifted to the opposite side of the car axle, and the car urged forward in the same direction in which it was going previous to applying the brake.

Improved Stereoscopic Print Cutter.

Thomas W. Smilie and Albert Siebert, Washington, D. C.—This invention relates to novel means for cutting, by machinery, stereoscopic pictures, which are taken in duplicate and require to be separated, trimmed, and reversed in position. It consists of two pairs of dies, intervalued and operated simultaneously by a treadle mechanism, together with holding springs, gages, and means of adjustment. It is found in practice to do its work rapidly, with great uniformity, and with but little labor to the operator.

Improved Gate Latch.

John L. Gessler, Clinton, Iowa.—This invention relates to an improvement upon the ordinary gate latch which is now so frequently opened by animals, and consists in so arranging two latches that both must be simultaneously operated in order to allow the gate to be opened.

Improved Car Coupling.

John Hardey, East Saginaw, Mich.—This consists of a drawhead which is provided with a suitably guided coupling pin, supported in raised position ready for coupling on a sliding plate operated by a slotted elbow lever, which is pivoted sidewise at suitable height to the coupling pin, and acted upon by a band spring. The action of the link on the pivoted elbow drops the pin and couples the link, whose horizontal position for coupling is produced by end notches and shoulders of the elbow lever bearing thereon.

Improved Mechanism for Operating the Adjusting Screws of Rolls.

John Sharpless Worth, Coatesville, Pa.—This is an improved spanner, which may be readily reversed and adjusted to work both screws at a time or either singly.

Improved Apparatus for the Manufacture of Coke and Illuminating Gas.

John T. B. Bennett, Birmingham, England.—The ovens in which the coking is to be effected are arranged in connection with gas retorts, so that, by means of stop cocks and dampers or valves, communication between the said coke ovens and gas retorts may be opened and closed and controlled. Around the gas retorts is a channel through which the heated air and products of combustion from the coke ovens may be caused to circulate and heat the said gas retorts. During the first stage of the coking process, the heated air and products of combustion from the coke ovens are made to circulate around the exterior of and heat the gas retorts. When all are sufficiently heated, air is shut off from the said coke ovens. The heat of the coke ovens and their contents then causes the coking process to be continued, the volatile matters given off now being unburned in consequence of the exclusion of air. The volatilized matters are made to pass through the heated gas retorts, which are charged with gas-producing material, and thus are resolved into permanent illuminating gas, which mixes and passes off with the illuminating gas produced from the materials in the said gas retorts.

Improved Cork Sole for Shoes.

Charles Thackeray, New York city, assignor to Barrows & Boyd, same place.—The cork is secured in a die-cut box by some adhesive substance. The unbroken continuity of the box overcomes the objection to free ends—that they work loose—while, as a middle sole, it can be sewn by a machine with great facility.

Improved Cotton Seed Drill.

Henry Steckler, Jr., New Iberia, La.—This invention relates to an improvement in the class of cotton seed planters whose dropping wheel is operated by a bevel gear with a wheel which travels on the ground either in front or rear of the seed hopper. The dropping wheel is provided with a series of holes near its edge, and the wires inserted therein, and their ends projecting, to serve as teeth to draw the cotton seed out of the hopper.

Improved Filter Rack.

Moritz Leiner, New York city.—This is a rack to be placed in funnels for filtering liquids into bottles or other vessels. It is adjustable as to size, and is made in the form of a hollow inverted truncated cone, placed in an ordinary funnel, and used with filtering paper placed on the inner side, which leaves a space equal to the diameter of the wires of the rack between the paper and the inner side of the funnel for the escape of the air contained in the vessel.

Improved Washing Machine.

Thomas J. McWane, Versailles, Ill.—In this invention, the suds box is hung on trunnions and vibrated by means of a vertical lever attached to its side. The rubber does not vibrate, but is made vertically adjustable, to adapt it to rise and fall according to the thickness of the clothes which may be interposed between it and the suds box at any time during the operation of the machine.

Improved Spring Bed Bottom.

George L. Shepard, Columbus, Ohio.—Strips of metal form the top, middle of spring material, and are bent down inside, so as to afford relief by straightening out to some extent whenever a section is sprung down. The invention consists, also, of a mode of connecting the strips so bent down within the volute springs by a ring laid in the bent down portions, and secured by cross pieces of wire passing over it and under the top coil of the spring, and fastened to the strips which pass over the top coil.

Improved Cut-Off for Shot Boxes.

Herman C. Wey, Hiawatha, Kan.—The discharge valve or cut-off is attached to a perforated hopper bottom, and consists of an outer guide casing with a spout, and an inner turning and sliding recessed tube, adjusted by a lug and guide slot to the open and closed position of the valves.

Improved Vine Rake.

Joseph W. Dunn, Corpus Christi, Tex.—This invention consists of a forward curved fork or double toothed rake, attached by eyebolt and braces to a common plow beam. The teeth pass under the vines and tear them loose from the ground, carrying them along until the rake becomes choked or full.

Improved Door Latch.

Jonas H. Crane, Schenectady, N. Y.—This door lock is constructed without the use of springs, and consists of a sliding bolt, which is operated by pivoted and horizontal toggle levers, in connection with a thumb lever acting thereon. The release of the thumb lever carries the toggle levers, by the action of the weight, instantly in a downward direction, and shoots the bolt forward.

Improved Automatic Fan.

Lorenzo D. Stamps, Galveston, Tex.—This consists of powerful clockwork mechanism, arranged in a bracket to be fastened to the ceiling and adapted to oscillate a vertically adjustable fan.

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The Charge for Insertion under this head is \$1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

For Sale—Large lot second hand Machinists' Tools, cheap. Send for list. I. H. Shearman, 45 Cortlandt Street, New York.

Microscopes, from 50 cts. to \$500, for Scientific Investigation and home amusement. Magnifying Glasses, Spy Glasses, Telescopes, and Lenses. Price List free. McAllister, M'F'g Optician, 49 Nassau St., New York.

Fleetwood Scroll Saw, with Boring Attachment, for all descriptions of light Scroll Sawing. See adv't. page 285. Trump Bros., Manufacturers, Wilmington, Del.

Priority of Invention legally established; expense, \$3. Send \$1 to E. Redmond, Rochester, N.Y., and learn how.

For Sale—A Surveyor's Transit and Steel Tape. L. R. Burns, Port Chester, New York.

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The best goods are the cheapest in the long run, when wear of machinery and difference in power required are considered. All who have tested E. H. Kellogg's Engine, Spindle, Signal, Cylinder, and Sewing Machine Oil freely acknowledge the fact. Manufactured only by E. H. Kellogg, No. 17 Cedar St., New York.

Wanted—Parties experienced in canvassing, to introduce Hood's Adjustable Brush Handle. See description in this paper. Send 50 cents for sample to Hood & Joseph, Indianapolis, Ind.

"Book-Keeping Simplified." The whole system briefly and clearly explained. Cloth, \$1. Boards, 75 cts. Sent postpaid. Catalogue free. D. B. Waggener & Co., 434 Walnut Street, Philadelphia, Pa.

Coddling's Steak Tenderer—Sample by mail, 50c. Agents Wanted. Address Desper Mfg. Co., Barre, Mass.

Our Lightning Screw Plate will do ten times the work of common tools, and do it ten times as well. Wiley & Russell M'F'g Co., Greenfield, Mass.

A complete bedroom earth closet for \$5. Send for pamphlet. Sanitarian M'F'g Co., 41 Courtlandt St., N.Y.

Experienced Engineer, Draughtsman, and Machine Salesman wants a situation. Address Wells, 97 Liberty St., New York.

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Hydant Hose Pipes and Screws, extra quality, very low. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

A Valuable Patent on Saw Mills, just issued; will sell part of the U. S. and the entire Canada right. F. E. Town, 181 Broadway, New York.

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The "Catechism of the Locomotive," a book of 625 pages, 250 engravings, fully describes the theory, construction, and management of American Locomotives. Price, post-paid, \$2.50. Address The Railroad Gazette, 23 Broadway, New York.

For 13, 15, 16 and 18 inch Swing Engine Lathes, address Star Tool Co., Providence, R. I.

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Three Second Hand Norris Locomotives, 16 tons each; 4 ft. 8½ inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 365.

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Moles & Queries

A. L. B. will find a recipe for cement for grindstones on p. 251, vol. 31.—A. K. can temper millpicks by the process described on p. 202, vol. 31.—D. F. B. will find a description of silicate of soda on p. 225, vol. 23.—A. N. can destroy the trunks of trees by the method given on p. 219, vol. 31.—F. B. will find directions for preparing gun cotton on p. 282, vol. 31.—R. J. can proportion cone pulleys by the rule given on p. 180, vol. 26.

(1) A. asks: Can I study chemistry without a knowledge of Latin? A. Yes.

(2) F. F. asks: What will whiten a person's skin? A. We do not know of anything that we can recommend for this purpose.

(3) A. S. asks: How can I take wrinkles out of parchment paper? A. Moisten it with water and place in a book under pressure.

I have a brass watch which has been quicksilvered. The silver comes off and leaves a nasty gray color. Can you tell me how to silver it? A. The best method would be to detach the case and subject it to a sufficiently high temperature to vaporize the mercury. You had better electroplate the case with silver. See p. 209, vol. 31.

(4) L. F. H. asks: In the substance of the cerebrum, beneath the folding of the gray matter, are various divisions and subdivisions. What special uses do they perform? A. Consult Dalton's "Physiology."

(5) A. N. W. asks: 1. What would be the cost of a Grove electric battery, consisting of 40 cells? A. \$80. 2. To make the above would cast iron cells do as well as earthenware? A. No. Use glass. 3. Would tin answer? A. No. 4. What cheap material will do for inside porous cells? A. Clay cells. 5. What are the proper dimensions for a single cell? A. Four inches high by 3½ wide. 6. Is the U the proper shape for the amalgamated zinc? A. W will answer. 7. Is 1 plate of platinum inside the porous cell? A. Yes. 8. How is the zinc fastened to the cell and in the battery? Is zinc joined to zinc, and platinum to platinum, or zinc to platinum? A. The zinc of one cell is joined to the platinum of the next. 9. Can you recommend any good practical handbook on electricity? A. Yes, Ferguson's.

(6) W. Y. T. asks: I have seen it reported that cryolite has been discovered in Nevada. Is this so? A. It is probable that, if the report were true, a specimen would have been forwarded to us for examination. We have glauberite, salt, gay-lussite, borax, saltpeter, sulphur, and crytomorphite from these localities, but no cryolite.

(7) S. A. T. asks: How can I dye the enclosed sample of yellow leather black? A. Steep the leather for a short time in a strong solution of copperas (sulphate of iron) in water.

Please give me a recipe for making stick pomatum, perfumed. A. This pomade is generally composed of mutton suet, but is sometimes made of hard body, to which is added in summer 1 oz. wax for every lb. body. Hard body can also be used, but the proportion of wax must be increased. In its preparation, always melt the least fusible body first. In molding, care must be taken not to run the pomade while too hot, as cavities will occur in the center, rendering the sticks liable to break. To perfume, the usual odors are, for 1 lb. pomade, essence bergamot, lavender, thyme, orange peel, of each 1 drachm. Color with annatto.

Please give me a recipe for a waterproof cement with which I can join canvas. A. Place in a wide-mouthed bottle a number of pieces of gum rubber, and pour over them a quantity of bisulphide of carbon. Close the bottle, and allow it to stand for some time, until the rubber has all gone into solution; then add to this an equal quantity of a solution of rosin (colophony), in spirits of turpentine. Allow to evaporate in the open air until of the desired consistency.

How can I soften brushes which have become hard with paint? A. Place them in turpentine for a short time.

How can I make marine glue? A. Cut 3 parts India rubber into small pieces, and dissolve it, by

heat and agitation, in 34 parts of naphtha, chloroform, or benzine; add to this 65 parts powdered shellac, and heat the whole with constant stirring until the shellac is dissolved, then pour it while hot on metal plates, to form sheets. When used, it must be heated to 248° Fah., and applied with a brush.

Can a kettle lined with porcelain be repaired in any way? The lining is burnt. A. It would be necessary to have the whole interior cleaned and re-enamelled. See p. 137, vol. 27.

(8) C. D. C. asks: What is the effect of buckwheat on the blood? Does it drive the impurity of the blood to the outside, or does it make the blood more impure and, by reason of excess, cause impurities to come to the surface? A. The harm is not due to any injurious ingredient in buckwheat. It is to be ascribed to the large amounts of butter and fatty matters eaten at the same time.

(9) J. O. A. Y. says: A friend of mine and myself had a dispute as to polar or magnetic attraction. He said the needle of the surveyor's compass in all latitudes pointed to the true north. I maintain that the needle only points true north in two places. Which is right? A. The declination of the needle is very different in different places; in some places it is 10°, 20°, 30°, and even 90°, west of the true meridian, and in other places it varies as much to the east.

(10) L. P. C. asks: 1. Is metallic lead useful for precipitating quicksilver from a solution of bichloride of mercury? A. No. 2. If sulphuric acid be poured into a solution of bichloride of mercury, would it cause the precipitation of an insoluble salt of mercury, such as sulphate of mercury? A. Yes.

(11) H. L. C. asks: 1. If I make two magnets, 2½ inches long with ¼ inch cores, and wind one with No. 22 wire until it is ¼ inch deep, and wind the other to the same depth with No. 14 wire, which will hold the heaviest weight? A. The latter. 2. If I make the cores 1 inch in diameter and use the same length of wire, will they hold more than before? A. No. 3. If two pairs of magnets of the same kind be put in the same circuit, will the two pairs hold more than one pair, or does the extra length of wire diminish the power of one pair in proportion to what is gained by the other? A. The maximum magnetic effect is produced when the resistance of the coils of the magnet equals that of the battery.

(12) L. R. K. asks: How can I crystallize grass? A. Dry the leaves, steep in a strong solution of alum for a few minutes, and dry again.

(13) C. P. W. asks: 1. Is it because electricity accumulates on the surface of bodies that lightning rods are made flanged, so as to expose more surface? A. Yes. 2. Are the inclosed specimens copper pyrites? A. Yes, twin crystals. 3. Please explain why has a man, born in the year 1800 and now living, not lived in both the eighteenth and nineteenth centuries? A. He has. A previous answer on this subject was an error.

(14) S. H. L. says: We have a telegraph line of galvanized iron wire, about 2,200 feet long. We use four Morse sounders. How many Callaud jars, 4½x7 inches, would it take to run such a line? A. Ten.

(15) T. A. J. asks: Why will sulphuric acid become frozen? I got some a few days ago and placed the bottle in the cellar. It was not very cold, but the bottle cracked by the acid being frozen into a crystal mass. A. The phenomenon was probably due to the acid in question being quite dilute or very concentrated. If the former, there is nothing remarkable in its freezing, as strong oil of vitriol freezes at -15° Fah. The most concentrated sulphuric acid, when exposed to a temperature of 32° Fah., crystallizes and remains solid even at a temperature of 45°. When the fuming acid of Nordhausen is exposed to a low temperature, a crystalline substance separates, which is a hydrate containing one half as much water as the common liquid acid.

1. I made a battery cell according to the directions on p. 132, vol. 32. Which is the positive pole? A. The wire leading from the plate at the bottom of the jar is the positive pole of the battery. 2. Can I connect this cell to a Smee cell in silverplating, to make more current? A. Yes; connect the positive pole of this battery with the zinc of the Smee cell. 3. I have a nickel solution; and the anode will not dissolve and go on the work to be plated. Is the solution too weak, or is the battery too weak? A. Probably the former.

(16) S. asks: Is the so-called aerated bread (made light with a gas generated from nitric acid and marble dust) injurious to health? A. It has been used in vast quantities, and has always been found wholesome. It is not as palatable to many as good fermented bread.

(17) H. M. says: A young man has lately experimented on vulcanized rubber (old shoes, etc.), and has obtained (by the action of certain re-agents) several substances of different colors. I send you samples of five of those colors. What do you think about them? A. May not the colors be due to the substances put in, and not to the bodies gotten out by the various reagents? For example, the brilliant yellow color on examination proved to be chromate of lead, which certainly does not exist in old rubber shoes.

(18) H. B. asks: 1. Are the ashes of coal of any value for manure? A. Coal ashes are not of great benefit as fertilizers. 2. Will they do for walks in gardens, if put on 2 or 3 inches thick? A. They are used extensively for this purpose. See p. 50, vol. 32.

(19) F. S. asks: 1. I hear that bichromate of potash added to glue would render it insoluble in water. I see (on p. 272, vol. 32) that bichromate applied to gelatinous films and exposed to light makes them insoluble. Is bichromate of potash?

A. Yes. 2. What proportion should be mixed with glue? A. The plates are flooded evenly with gelatin and allowed to dry. They are then placed in a bath consisting of an aqueous solution of bichromate of potash, which combines with the gelatin. The film so changed, on exposure to light, is rendered insoluble.

(20) J. O. B. asks: Which is the better conductor of sound, wood or glass? A. Glass. 2. Would glass conduct sound better when resting upon glass? A. Probably. As to your other question, consult some good work on the subject.

(21) L. T. S. asks: Is it as good to soak or boil green timber in hot coal tar as to kiln-dry the timber and then coat it with the same? The timber is to be used just beneath the surface of the ground. What is the ordinary increase in durability of pine timber when prepared with coal tar? A. The decay of the timber is due to a fermentation and putrefaction which take place in the sap, and this liquid portion is gotten rid of in kiln-drying, and its place occupied in part by the tar. If retained, it is difficult to prevent the decay from going on. No definite time is given, authorities say simply: "Much more durable."

(22) F. A. says: You state that wood ashes are good to scatter over the ground about fruit trees. Would an admixture of coal or coke ashes be deleterious? A. The benefit of using wood ashes is due to the large percentage of potash which they contain; and as this is present only in minute quantities in coal ashes, the latter would not be of much service as fertilizers.

(23) C. S. F. asks: Can you give me a recipe for the cure of moles and freckles? A. Corrosive sublimate 5 grains, muriatic acid 30 drops, lump sugar 1 oz., alcohol 2 ozs., rose water 7 ozs. Agitate together till all is dissolved. Apply night and morning.

You state that coffins can be made of papier maché made waterproof with asphaltum. Why cannot this preparation be put on wood placed underground or in the water, to prevent rot? A. It has long been used for this purpose.

(24) D. L. B. asks: What is good for sticking leather together? A. Melt together in an iron pot equal parts of pitch and India rubber.

What kind of cement will do to take a mold from type, which will bear heating to 200° Fah.? I want to make rubber stamps. A. Plaster of Paris.

(25) J. M. L. asks: 1. How can I procure pure tin from the ordinary block tin? A. Ordinary block tin is nearly pure tin. It may be still further refined by melting and briskly agitating for some time, and afterwards allowing it to remain quiet for several hours, first having skimmed off any impurities on the surface. The upper part of the melted metal may then be run off into iron molds and considered as refined tin, most of the impurities having been left behind in the lower portions of the pot. 2. Of what is type metal composed? A. Type metal is an alloy of lead, with one third or one fourth of its weight of antimony. 3. What alloy melts at the lowest temperature? A. Newton's fusible alloy is composed of 2 parts bismuth, 1 of lead, and 1 of tin, and melts at 201° Fah., so that it liquefies readily in boiling water.

(26) P. J. S. asks: How can I dissolve silicate of soda in large quantities? A. It may be readily dissolved by boiling in water for some time.

(27) W. R. G. asks: By what process can oxygen gas be obtained, and put in a tank or vessel so that it can be taken by inhalation? A. Oxygen is obtained for this purpose as described in answer to J. H. L., p. 218, vol. 32, the only difference being the addition of a small quantity of caustic potash to the water in the wash bottle, to remove all traces of chlorine and carbonic acid. In charging the tanks, an ordinary steam gage is attached to the connection; and by means of an air pump, the gas is forced into the tank until the gage indicates a pressure of about 24 lbs. The screw valve is then closed, and the reservoir is ready for use.

(28) G. E. L. asks: What is the best way to kill a bird or other animal preparatory to stuffing it? A. Use chloroform.

(29) C. S. F. asks: Can any fluid be solidified, so as to withstand a great amount of heat? A. Boila quantity of silicate of soda (water glass) in water for some time; allow to settle, and then decant the clear liquid. The addition of some muriatic acid to the liquid will convert it immediately into a stiff, hard jelly. This, if thoroughly washed with hot water, when heated, will resolve itself into nearly pure white sand, which will withstand a very high temperature.

(30) F. T. W. asks: What can be done to remove a bad smell from rain water? A. Allow it to be well sunned and aired. Filter through carbon filters, or deodorize with freshly burnt charcoal. Or add sufficient permanganate of potash to impart a permanent red color, raise to boiling point, allow to cool, and decant the water from the sediment.

(31) H. C. says: The pressure gage and the safety valve on my boiler do not agree. The steam blows off freely with the weight at 80 lbs. on the lever, while the gage shows but 60. The safety valve is ½ inch in diameter. I have examined the gage and find nothing wrong. How can I calculate the proper weight for the valve? A. When you have no steam in the boiler, secure the valve stem to the lever, and attach a spring balance to the lever just over the center of the valve stem. Then raise the lever slightly, so as to get the valve clear of the seat, and note the reading of the spring balance. Then divide this reading by the area of the valve in square inches (0.514 in your case), and the quotient will be the pressure in lbs. per square inch at which the valve opens. The attention of all who wish to test their safety valves is invited to this extremely simple and accurate method.

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It will be further demanded that said machine shall be taken back in part payment for a machine of two millions (2,000,000) pounds capacity, more or less, at an early date which may be specified in the proposal, and upon terms which shall also be stated in full in the proposal for the first named machine.
A satisfactory guarantee of efficiency and of completion within the specified time must accompany each proposal, and a forfeit of one hundred dollars (\$100) per day will be exacted in case of non-fulfillment of the conditions of the contract.
The general proportions of the machines are to be based upon a factor of safety of not less than six (6).
Proposals endorsed, "Proposals to furnish a Testing Machine," accompanied by complete specifications and general working drawings showing dimensions of the principal parts, must be addressed to the President of the Board, i. e., Col. T. T. S. Laidley, U. S. A., WATER-TOWN, MASS.
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VALUE OF PATENTS, And How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN PATENTS.

This is the closing inquiry in nearly every letter, describing some invention, which comes to this office. A positive answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his right.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct.

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such search, make out a written description of the invention, in your own words, and a pencil, or pen and ink, sketch. Send these, with the fee of \$5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, payable to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 30,000,000; Prussia, 40,000,000, and Russia, 70,000,000. Patents may be secured by American citizens in all these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

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MUNN & Co. will be happy to see inventors in person at their office, or to advise them by letter. In all cases they may expect an honest opinion. For such consultations, opinions, and advice, no charge is made. Write plain; do not use pencil or pale ink; be brief.

All business committed to our care, and all consultations, are kept secret and strictly confidential.

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice, address

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SCIENTIFIC AMERICAN

A WEEKLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

Vol. XXXII.—No. 23.
(NEW SERIES.)

NEW YORK, JUNE 5, 1875.

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A NEW SYSTEM OF GAS LIGHTING.

A new system of lighting public thoroughfares, which for a year past has been in operation in a street in Jersey City, is certainly something novel in the practice of gas illumination, and, if we may judge from a brief examination, aided by the inventor's explanations, is an advance of considerable value considered from an economical point of view. The scheme abolishes gas works, and machines which produce gas by the passage of air through or mingling of air in hydrocarbon vapor. Paradoxical as it may seem at first, there are no gas pipes—in short, the gas generator is located in the

the burner it is not necessary here to dwell upon, inasmuch as the essential features of the device are those relating to the oil-feeding arrangements.

In lighting a large number of lamps—from 100 to 5,000—it would be necessary to have a small steam engine or water power to compress the air and keep it at a uniform pressure, which may be from four to six pounds per square inch. Clock work may be used for any number of lamps under 100. A two inch main pipe, distributing right and left and as near the center as possible, the inventor informs us, would be sufficient to supply two or three thousand lamps distributed

when the latter is transmitted through pipes. The air costing nothing, if it should escape—except the labor of pumping—the actual displacement, we are informed, would be only 64 cubic feet in 2,000 lamps in 10 hours burning, and a half inch pipe could supply this in less than five minutes.

The cost of operating the system has been determined by the actual working of eight street lamps using a six foot burner each. In 35 days of ten hours each, eight gallons of material per lamp were consumed, or sixty four gallons in all. This at the present price of the oil—ten cents per gallon—

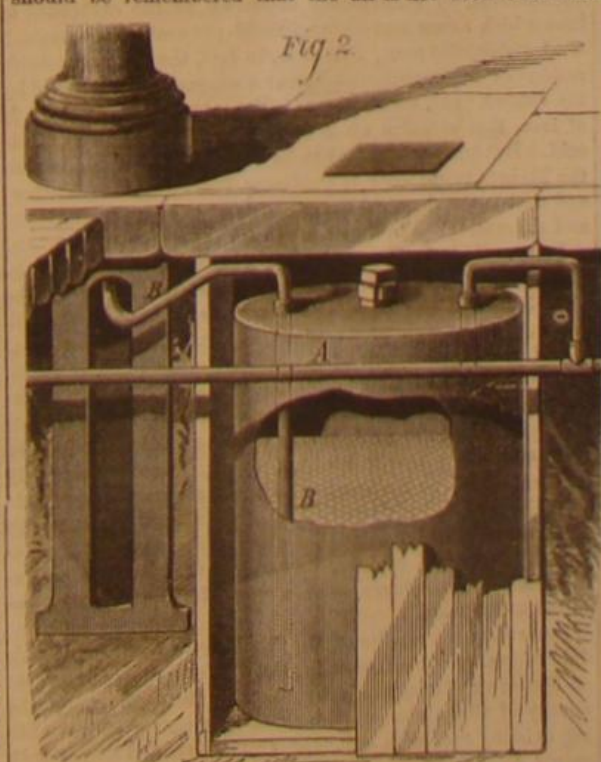


De GUINON'S SYSTEM OF GAS LIGHTING.

burner, and the invention reduces itself simply to the means of sending the requisite gas-producing material to that point in each post or fixture. Without further preamble, let us state that the entire apparatus consists of an air compressor at some central locality, several small tanks (one to each lamp post) laid under the side walk, a small air tube connecting with each from the reservoir filled by the compressor, and another small tube which carries a petroleum product up to the burner. This is the simple plant which it is proposed to substitute for elaborate manufactories, miles of heavy piping, and innumerable meters at special points.

From the large engraving, Fig. 1, given herewith, the general arrangement of the tanks in the street will be understood; a sectional view of one of these receptacles is presented in Fig. 2. The tank is made of galvanized iron, with top and bottom of copper, and holds forty-eight gallons, that quantity of oil being somewhat in excess of a six months' supply. The hydrocarbon used is a benzine, grade 75, a product of low value and for which there is but little or no industrial employment. It is fed into the tank through an aperture in the top, this being accessible through an iron cover and scuttle arranged in the side walk. The pipe, A, is the main air conduit leading from the central reservoir, and communicating with the tank by the short tube shown. Extending up from the bottom of the receptacle is another pipe, B, which leads to the gas burner. It is evident that, an air pressure being produced in the tank by the current from pipe, A, the same, acting on the surface of the oil, will force the latter up pipe, B, and so to the point of combustion. The burner employed is provided with a small retort in which the oil circulates. A portion of the oil burning below this retort converts its contents into gas; the latter subsequently passes through various passages in which it becomes mingled with the proper quantity of air, and finally escapes from the orifice, where it is ignited. The exact form and nature of

over a whole city. This may seem extraordinary, but it should be remembered that the air is not used otherwise



than to supply the displacement by combustion of the oil in the tanks and such accidental leakage as may occur. By such leakage, however, obviously there is no loss of gas, as

would cost \$6.40. The aggregate number of hours is 2,800, so that, with the six foot burners, a total of 16,800 cubic feet of gas was consumed. From these data it is clear that the cost per thousand feet is about thirty-eight cents, a mere fraction of the average cost of coal gas.

On visiting lately the locality in Jersey City now lighted by this process, we were enabled to examine the practical operation of the apparatus. The light seemed to be smokeless, and apparently is as powerful as that of ordinary street gas. The street in which the lamps are located is near the river and almost unprotected by buildings, a fact which suggested to us the question of how the intense cold of the past winter had affected the gas. In answer, the inventor informed us that, although the wooden boxes in which the oil tanks were enclosed became filled with water, which froze solid and so continued all winter, the lights remained entirely unimpaired. A large conflagration of a factory in the vicinity gave, besides, an excellent opportunity for noting the effect of great heat. This, though sufficient to melt the lantern frames and burners, showed no influence on the gas, nor produced any explosion in the oil contained in the tanks.

The invention would seem to be especially adapted for use in country towns and villages where no gas works exist, as it renders the lighting of the streets a matter of small expense and easily accomplished. It is also well suited for the illumination of gardens and pleasure grounds, as there can be no escape of gas to injure vegetation; and the necessity of tearing up the soil to lay heavy pipes is obviated. It may also be adapted to the lighting of buildings of any description. The tanks may be made to hold enough oil to last a year, so that filling need be done only at long intervals.

The system is protected by two patents, the most recent dated March 9, 1875. For further particulars address the inventor, Mr. R. V. de Guinon, P. O. Box 59, Jersey City, N. J.

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THE ORGANIC ORIGIN OF THE EARTH'S CRUST.

A popular theological dogma declares that life is the grand object of creation, that the composition as well as the contour of the earth's surface has special reference to its habitability, and that all things show a ruling design to fit the world to be the home of sentient creatures, more especially of man.

Strictly speaking, Science has nothing to do with such dogmas. It has no means of discovering the ultimate purposes of things, and no time to waste on their discussion. Nevertheless it is difficult sometimes not to take an indirect interest in the claims of those who presume to decide such questions, at least so far as to notice how aptly the facts of Nature contradict their assertions. Thus in the present case, it would be much easier to sustain the contrary thesis, namely, that so far from having been made what it is that it might be inhabited, the earth became what it is through being inhabited; in short, that life has been the means, not the end, of the earth's development.

In the light of recent discoveries, Byron's poetic extravagance: "The dust we tread on was alive!" becomes a simple statement of observed fact. And the earlier and more paradoxical assertion of Linnaeus, that not the superficial dust merely but the very framework of the earth is the product of life, would seem to be equally true. "Fossils are not the children but the parents of rocks," he said; and Huxley declares that the whole effect of the discoveries made since his day has been to complete a larger and larger commentary on his words. The deeper we go into the history of the earth's crust, the greater the part we find to have been played by life in determining its composition and character. Even the rocks heretofore accounted azoic, and of an age anterior to the beginning of life, are now shown to be, in all probability, of organic origin; still more remarkable, as in process of formation to-day.

The observations of Dr. Hooker during Sir James Ross's voyage of antarctic exploration, confirmed by those of Dr. Wyville Thompson on the Challenger expedition, leave no doubt that the antarctic sea bottom, from the fiftieth parallel to the eightieth, perhaps to the pole, if the sea extends so far, is being covered with a fine deposit of silicious mud composed of the shells of diatomaceous vegetation, the skeletons of radiolarian animals (all microscopic and inhabiting the surface water) with the spicula of sponges which live on the bottom. In many parts of the arctic sea beds, a similar deposit is known to be in process of formation. Thus, through the agency of minute life, immense beds of silicious rock are forming in the polar regions, similar in character to those of early geological strata. In many cases the soft and friable fine-grained sandstones thus formed in fresh water have been changed by the action of percolating water into a dense, semi-transparent, opaline stone; and there is no reason to doubt that the same metamorphic agencies may convert the polar deposits likewise into a form of quartzite, a kind of rock whose organic origin was formerly unsuspected.

Throughout the broad belt of warmer water between the polar caps of silicious mud, the same accumulations are going on, but they are obscured and overpowered by an immensely greater amount of calcareous sediment, chiefly composed of the skeletons of dead *foraminifera*, also microscopic. This forms the *globigerina* ooze, containing a large percentage of carbonate of lime and a small percentage of silica: a chalky deposit capable of conversion into limestone and even crystalline marble by ordinary metamorphic agencies.

The formation of coral reefs has long been a favorite illustration of the gigantic results effected by minute organisms; but great as these are—and the longest coral reef extends, like a huge wall two thousand feet high, as far as from Boston to Chicago—the work of the little reef builders becomes insignificant in comparison with the *débris* of microscopic life which covers the beds of all the seas to unknown depths; while the coralline limestones of the continents, vast and massive as they are, are immensely overbalanced by the strata which undoubtedly owe their existence to minute plants and animals.

The cretaceous *globigerina* ooze is the most widely spread material of the sea bottom throughout all the great oceans, at depths from a few hundred to over two thousand fathoms. In shallower waters—and they are extensive—the gray ooze is slowly transformed into a green deposit identical in character with the greensands of the geologists: a formation which Ehrenberg found to be mainly made up of casts in a silicate of lime and alumina of the interior cavities of *foraminifera*, after Professor Baily had discovered that such was the origin of the greenish mud from the sea bottom off the Florida coast. "In these casts, the minutest cavities and finest tubes in the *foraminifera* were sometimes reproduced in solid counterparts of the glassy mineral, while the calcareous original had been entirely dissolved away." In other places, in the Gulf of Mexico, in the South Atlantic, and in the Pacific, the same transformation of *globigerina* ooze to greensand is going on.

But the most remarkable change goes on in the extreme depths of the sea, especially below 3,000 fathoms. Professor Thompson reports that, in crossing from the shallower regions occupied by the ooze into the deeper surroundings, the calcareous formation is found universally to pass gradually into an extremely fine, pure clay, which occupies, speaking generally, all depths below 2,500 fathoms, and consists almost entirely of a silicate of a red oxide of iron and alumina. "The transition is very slow, and extends over several hundred fathoms of increasing depth; the shells gradually lose their sharpness of outline, and assume a kind of 'rollen' look and a brownish color, and become more and more mixed with an amorphous red-brown powder, which increases steadily in proportion until the lime has almost entirely disappeared." The geological importance of this red clay formation is shown by the fact that, in sounding between Tenerife and Sombroero, a distance of about 2,700 miles, two areas of red clay (aggregating 1,900 miles across) were discovered.

From his studies of the character and distribution of the red clay, Professor Thompson concludes that it is not a substance introduced from without, but that it is produced by the removal, by some means unknown, of the carbonate of lime which forms something like 98 per cent of the material of *globigerina* ooze; that it is, in fact, the ash or insoluble residue of calcareous organisms: a supposition sustained by the reddish mud, consisting of silica, alumina, and red oxide of iron, that remains after treating the ooze with a dilute acid. But one test remains to be tried to give, if successful, the highest probability to Professor Thompson's conclusion; and that is the chemical examination of *globigerina*, diatoms, and the rest, taken in the open sea for the constituents of the red clay. This done, we might rest satisfied that the clay is, as Professor Thompson believes, an essential element of the organic part of the ooze, and therefore to be classed, with chalk, as an organic product, not, as heretofore supposed, as in all cases the result of the disintegration of older rocks. The significance of this admission of clay to the list of organic products can scarcely be over-estimated, for it compels us to push back the probable antiquity of life to periods so remote that the Lower Silurian epoch becomes relatively modern. It is, as Professor Thompson observes, impossible to avoid associating the red clays of existing deep seas with the fine, smooth, homogeneous clays and schists of the remotest geological periods, formations which, more or less metamorphosed, obtain such a vast thickness in the so-called azoic strata.

Reviewing the results of the Challenger expedition in this field of research, Professor Huxley, assuming the correctness of Professor Thompson's hypothesis, shows how, by the agency of the microscopic plants and animals which are filling existing seas with silicious, cretaceous, and clayey sediments, the entire crust of the earth might have been developed. "Just as a silicious deposit may be metamorphosed into opal or quartzite," he says in conclusion, "and chalk

into marble, so known metamorphic agencies may metamorphose clay into schist, clay slate, slate, gneiss, or even granite. And thus by the agency of the lowest and simplest of organisms, our imaginary globe might be covered with strata of all the chief kinds of rocks of which the known crust of the earth is composed, of indefinite thickness and extent."

The agency of organic acids in precipitating from chalybeate and other mineral waters our beds of iron ore, our veins of copper and other metals, according to Professor T. Sterry Hunt, falls in here as another indication of the vast, almost omnipotent, influence of life in determining the earth's mineral character, and consequently its geology, geography, flora, fauna, and the rest.

PROGRESS OF RAPID TRANSIT IN NEW YORK CITY.

The State Legislature has granted authority to the Elevated Railway Company, to extend its line northerly to the Harlem river, and it is said that the new work will soon be commenced. At present there is a single track supported on single iron posts over the sidewalk, commencing at the southerly end of Greenwich street, near the North river, and extending north as far as 30th street on Ninth avenue, a distance of 3½ miles. It is well patronized, but its capacity is limited. Under the new powers given to the corporation, the work is to be enlarged. The company has lately repaired the present track, put on wooden cross-ties, changed the gage, etc. A small space is left between each cross-tie, and the bed of the road is not, therefore, quite a complete deck. The *Railroad Gazette* questions the propriety of using these cross-ties, believing them to be unnecessary in respect to strength, and likely to result in annoyance to pedestrians, owing to the drip caused by rain and snow.

With a view to strengthen the track, the Company has also lately added four braces or struts to each column, extending from the upper part of the column to the under sides of the track girders, with a longitudinal reach of about three feet. The *Gazette* says: "Whatever may be the object of these struts, their actual effect is the transmission of unbalanced longitudinal side thrusts to the columns, which bend, quite perceptibly, from the direction of approaching trains. These columns are ill suited to withstand side thrusts, and the frequent application of such can hardly fail to prove injurious. As every train bends all the columns over which it passes, more or less, it may be found a wise economy, in prolonging the life of the structure, to entirely remove these struts, which have just been attached at no small expense."

We are sorry that our cotemporary is not better satisfied with the improvements that have been made. Its fears as to the effects of the struts on the stability of the columns are in our view unnecessary. The Company appears to have done the best it knew how under the circumstances, and all the patrons of the road are pleased with the improvements.

A portion of the new Underground Railway, on Fourth avenue, has just been opened for traffic, namely, from the Grand Central Depot at 42nd street, northerly to 98th street, over two miles. All the trains of the Harlem, Hudson River, and New Haven Companies now run underground, and their withdrawal from the surface of Fourth avenue gives great satisfaction to the inhabitants residing on the line. The vibration produced by the passage of trains is scarcely noticeable in the adjoining houses. The avenue surface above the railway tunnels is now being repaved, and will soon present a most beautiful, attractive appearance. A stranger in passing through this portion of the avenue would be surprised if told that, directly under his feet, the trains of three great railways were flying along at lightning speed. The forty-ton locomotives are no longer seen or heard.

The underground tunnels are three in number, built side by side, consisting of a central single arch tunnel of 26 feet 8 inches width in the clear, for two tracks, and two single-track tunnels, 16 feet wide, one on each side of the central. The central tunnel is spacious, well aired, and tolerably well lighted, by frequent central openings through the roof. It is a complete success, being much more pleasing to the traveler, and far better ventilated, than any of the tunnels of the London Underground railways. The single track tunnels, however, are defective in respect to ventilation; but they could be easily rendered satisfactory by the use of mechanical means for introducing additional air.

The value of property along this portion of the line has augmented since the tunnels were authorized. The same may be said of property at the northerly or Harlem portion of the avenue, where the tracks, although not arched, are placed below the street surface, and bridged at the street crossings. But the contrary is the case along that portion occupied by the viaduct, from 98th to 116th street. The solid granite walls of this structure occupy the central portion of the avenue, for a width of 50 feet, and rise from 10 to 30 feet above the street surface. The prospect of a blank stone wall directly in front of one's window is not considered very inviting by householders, and the price of property here is comparatively low.

The State Legislature has also passed a general law, under which commissioners may be appointed in any city in the State, with power to locate a steam railway, and convey a franchise for construction, to stock subscribers.

GREAT GUNS.

It was thought by our government, not long ago, that a 15 inch cast iron gun, able to throw a 500 lbs. ball a distance of three miles, was about as big a thing in the way of armament as would ever be wanted. And so the forts in New York harbor and other places were supplied with them at great expense. The visitor at Forts Hamilton and Tompkins, down the bay, will see long rows of these grim monsters, arranged in battle line, vainly waiting for employment.

against floating enemies. Compared with more recent guns they are now mere pigmies, of no sort of consequence, and the quicker they are broken up and removed the better.

Mr. Menelaus, new President of the Iron and Steel Institute, England, says: "Mr. Longden informs me that they are making at Essen, at the present time, 14 inch guns of steel, which weigh, when finished, 57½ tons, carrying a shot of 9 cwt. 9½ English miles, using a charge of 210 lbs. of gunpowder. They are about to make steel guns of the following capacities and weights: 15½ inch bore, 30 feet long, weighing 82 tons, using 300 lbs. of powder, with a shell of 1,500 lbs. weight; guns of 18 inches bore, 32 feet 3 inches long, weighing 125 tons, using 440 lbs. of powder, with a shell of 2,270 lbs. weight. Mr. Longden demurely adds: 'It is calculated, for the present, that these guns will be heavy enough to destroy any armor a ship can carry.' In gloating over the destructive properties of these weapons, he is leaving out of his calculation, perhaps, the flash of lightning ships which Mr. Reed is about to build, and which may, under smart management, be able to get out of the way of such a conspicuous object as a shell weighing over a ton, even when fired with about a quarter of a ton of gunpowder."

THE DISTRIBUTION OF WEALTH.

We cannot hope to give, in the brief space here at our disposal, more than a passing notice to a few of the more salient thoughts in the admirable address recently delivered by Mr. David A. Wells, before the American Social Science Association, at Detroit. The subject, "The Accumulation and Distribution of Wealth," is one which relates to the much discussed relation of capital and labor, regarding which no one topic exists more encumbered with sophisms and popular fallacies. In these times, when the latter underlie a constant succession of agitations, ranging from the French commune to a local trade uprising, such views as those of Mr. Wells, boldly spoken and widely published, are doubly welcome. We commend them to those who would limit the distribution of wealth, who believe in the subversion of the relations of employee and employer, who denounce the substitution of machines for hands, and indeed all who, while ostensibly laboring for the imaginary rights of a semi-deified ideal dubbed the working man, are themselves the main obstacles to the advancement and to the amelioration of the real grievances of the laboring poor.

Mr. Wells points out that never before has man been able to produce so much with a given amount of personal effort. The productive power of this country since 1860 has increased 20 per cent, and there is no more curious incident of this continuing progress than the fact that, in staple manufactures, the abandonment of large quantities of costly machinery, and its replacement by new, is periodically rendered a matter of absolute economical necessity to produce more perfectly and cheaply, and at the same time to avoid the destruction of a much greater amount of capital by industrial rivalry. On the other hand, a highly increased consuming power on the part of the masses is evident, showing a corresponding rise in the standard of comfort. Despite this, however, the difficulties of earning a living are not lessened, the cry of the poor is as loud, and the discontent with the irregularities of social condition even more strikingly manifested. The relative position of poor and rich, in other words, remains practically unchanged, although every one knows that the benefits conferred by Science and invention have fallen on all equally. The humblest laborer of the present day possesses luxuries which kings not many years ago could not obtain; but still, if a disparity exists between him and other men, due no matter to what cause, he becomes the propounder of that interminable social problem which, stripped of all disguises, amounts to the reduction of all men to the level of the weakest in mind or body, and the prevention of any future inequality by the abolition of every species of reward for superior effort, skill, or attainment.

There is no doubt but that, as Mr. Wells in another portion of his address remarks, the doctrine of every man for himself is a pernicious one from a social point of view. Society must protect itself; it must labor for its own benefit as if it were a body physical, and each member is thus compelled to work for the welfare of his fellows in order to serve his own material interests. The conditions precedent, however, to the future progress and well being of society are not merely that shall be increasing abundance, but that it shall be distributed among the masses to the greatest extent consistent with the retention and exercise of individual freedom. To gain this last end, demands have been made extending to the cutting down of the working time to six hours per day, and the actual *per capita* division of all the wealth of the country or of the world.

Mr. Wells shows very clearly the fruitlessness of these propositions, by pointing out that, even with the better mode of living wrought by the introduction of improved machinery, people must labor as much as they do now, in order to maintain themselves in their present condition. There is not enough capital in existence to allow of reduced laboring hours. The maximum value of the annual product of this country is \$7,000,000,000; and of this, nine tenths must be immediately consumed in order that we may live, and to make good the loss and waste of capital. The result has been that, after 250 years toiling as a nation, we have only managed to get three and a half years ahead in the way of subsistence. If now, as a whole people, we should stop working, four years would be more than sufficient to starve three fourths of us out of existence, and reduce the remaining one fourth to barbarism. If the annual profits of the country could be divided among the inhabitants, it would give each an income of but \$175 a year. The average annual earnings of com-

mon unskilled laborers is about \$400; or allowing each man to support three other people, this would average \$100 to each individual. The wealth of the country, according to Mr. Wells' estimate, is \$25,000,000,000, which, if divided among the inhabitants, would be \$6,000 each. The division, however, would be of short duration, as the money would inevitably find its way back into the hands of the most prudent, cunning, and skillful.

In conclusion, Mr. Wells said that "it is entirely within the power of society to effect a remedy, by adopting agencies whose simplicity and effectiveness long experience has proven beyond all controversy. But herein lies the difficulty. Like Naaman, we are anxious to be cleansed, but, like him, expect to be called upon to do some great thing, and are apt to be disappointed when we are told that the simplest measures will prove the most effectual. In point of natural resources, we have all we can desire. To make these productive of boundless abundance, there must be industry and economy on the part of the individual; and on that of society, a guarantee that every man shall have an opportunity to exert his industry and exchange its products with the utmost freedom and the greatest intelligence. When society has done this, we shall have solved the problem involved in the relations of capital and labor so far as the solution is within the control of coöperative human agency; for in giving to each man opportunity, conjoined with freedom and intelligence, we invest him as it were with crown and miter, and make him sovereign over himself."

THE DURABILITY OF GLASS.

It is well known that many kinds of glass, especially when submitted to the influence of moist air, do, in the course of time, undergo certain changes; the polish is tarnished, the transparency diminished, while the surface becomes covered with thin iridescent layers, small fragments of which peel off, while threads show themselves in the mass. All kinds of glass are not equally subject to these changes; but certain qualities possess the tendency to undergo such modifications in the highest degree. They show, sometimes in the course of a few days or weeks, a very slight efflorescence on their surface, which we should be very much inclined to consider to be dust. But in order not to be deceived, it is well to apply the microscope and chemical analysis; and then, in many instances, the supposed dust is proved to be composed of transformed glass. Some kinds of glass soon become covered with an exceedingly thin layer of moisture, which causes the dust to adhere, and the glass never shows a fresh, clean, or brilliant surface.

These changes may be observed in the highest degree, and studied the most easily, in glass which has been buried a long time. Such glass, when unearthed, is found to be opaque, almost through its whole mass. It has often lost its solidity, and consists of a number of thin and opalescent layers. We have had the good fortune to obtain specimens of glass recently found in an ancient temple on the Island of Cyprus. It had been buried for 3,000 or 4,000 years, and most of it exhibits an opalescence, surpassing in beauty the finest mother of pearl. For these specimens we are indebted to General Di Cesnola, who made the collection of Cyprian antiquities known by his name, now belonging to the Metropolitan Museum of Art, New York city. General Di Cesnola has returned to Cyprus in order to continue his investigations, and, if possible, secure for our country a series of interesting antiquities forming the intermediate link which succeeded Egyptian and preceded Grecian art.

Colladon states that he discovered that, if our modern glass is buried for a long time deep in the earth, it becomes flexible, and may be changed in form without being broken; but that, when again exposed to the air for some time, it becomes hard and brittle as before.

The modifications which glass undergoes in the air are especially due to water and carbonic acid. It is well known that many of the hardest minerals, such as felspar, become disintegrated and change their nature entirely under the influence of these two agents. Their destruction is sure, and is only a question of time. All the particles soluble in water are gradually washed away; while, in regard to the others, when they are not carried off by mechanical action, they remain in the place where the disintegration happened. It is the same with glass. The silicic acid, which, in glass, is combined with an alkaline base, is set free by the carbonic acid of the air, which combines with the said alkali. The alkaline carbonate thus formed is dissolved by the water and washed away; and finally there remains, in the place of the glass, nothing but the almost pure silicic acid. According to Griffith, all very ancient glass proves by analysis to possess this composition. Hausmann has analyzed glass which had been buried for a long time. It possessed an opalescent surface, was opaque, and disintegrated; while only the interior layer was still transparent. He found that the opalescent surface contained almost no alkali, that the lime, as well as the sub-oxide of iron, had been carried off, and that the transformed mass contained nearly 20 lbs. of water. We found that the Cyprian specimens also, alluded to above, contained no trace of alkali, consisting as they did of an almost pure and beautifully opalescent silicic acid.

The first things carried off by the water are the soda and potash. Then follows the lime, which is less soluble. This was especially verified by Bingley, who analyzed specimens of glass which had, for various periods of time, been submerged in a lake. The action of water on glass was first investigated by Scheele, and is very remarkable. According to the old experiments of Bischof and Fuchs, if a good, hard glass is placed in water, after having been finely pulverized, the glass soon shows a blue reaction on red litmus paper, when placed in contact with it, which reaction can only be

due to carbonates of the alkalis. Pelouse made recently the same experiment; and not being aware of the older experiments, he announced it as a new discovery.

A glass containing 77 per cent silicic acid, and thus quite hard, when finely pulverized and treated with water, gives to the latter over 10 per cent of its substance. This consists, however, not entirely of alkaline ingredients, as a small portion of the silicic acid dissolves at the same time. In order to comprehend the latter statement, it must be considered that insolubility is only relative; there is scarcely a substance which is absolutely insoluble. Water drops constantly falling will at last perforate a stone, so that every drop must carry off some of the substance. Water kept in glass bottles will ultimately dissolve traces of the silicic acid of the glass, and many springs of water contain silicic acid, as the chemical analyses of several kinds of spring and well waters have demonstrated.

The influence of carbonic acid on moistened glass gives rise to many interesting experiments. Pulverized glass moistened with water absorbs carbonic acid from the air, and becomes effervescent. If the glass powder be boiled with the water, it will, after cooling, absorb carbonic acid more rapidly. The researches of Louis on pulverized felspar show that this mineral, which resists most chemical agents so successfully, is easily disintegrated by simple boiling in water. Experience shows that the various kinds of glass found in commerce behave in various ways when exposed to moist air. And why should it be otherwise? These various kinds of glass differ in their chemical composition, in the ingredients used, and in their proportions. They differ in molecular structure, in thickness, mass, and solidity, all of which details affect the properties. At the same time, whatever be the physical or chemical condition of the glass, that is, its molecular state or composition, it is certain that the destruction is more rapid in proportion as a greater surface is exposed to the attacking atmospheric agencies. This being the case, it is an interesting problem to find out which kinds of glass are, by their chemical composition, best adapted to resist these atmospheric agencies.

Government Tests for Metals.

Among the recently passed acts of Congress was a provision for the appointment of a Board of Experts to test the Strength and Value of Iron, Steel, and other metals. The President has appointed the following persons to constitute the Board, namely: Lieut. Col. T. T. S. Laidley, President; Commander L. A. Beardslee, Lieut. Col. Q. A. Gillmore, Chief Engineer David Smith, W. Looy Smith, A. L. Holley, R. H. Thurston, Secretary.

This Board of seven persons has organized and divided itself up into fifteen separate committees of three individuals each. W. Looy Smith is chairman of four of the committees, R. H. Thurston chairman of three, Lieut. Col. Gillmore chairman of two, A. L. Holley chairman of two, and Chief Engineer Smith chairman of one.

Most of our modern scientific discoveries are the results of investigations made under adverse circumstances, in many cases by obscure persons living in penury; in others, by teachers or college professors of limited means, oppressed by laborious professional duties. Of late the idea has begun to prevail that the true way to promote original investigation is to employ prominent men at the expense of the government, giving them good salaries, comfortable quarters, and first-rate apparatus for experiments. Relieved of all anxiety in respect to making a living by other duties, it is supposed they thus will be able to devote themselves so exclusively to Science that the boundaries of knowledge will be rapidly extended. The present Board has been created on the above idea. All the members are persons of ability, and if we do not now learn a thing or two that is new about metals, their strains and qualities, it will probably be because nothing remains to be discovered. But our expectations of the present Board are very exalted, and, as fruits of their labors, we hope to chronicle many early, interesting, and important discoveries.

SCIENTIFIC AND PRACTICAL INFORMATION.

THE PROPAGATION OF CELERY.

Celery is a native of Norway and Sweden, where it grows near the edges of swamps. This plant is rarely cultivated as it should be, hence the stunted specimens which appear in our markets. A deep trench should first be dug, at the bottom of which a layer of sticks of wood, say six inches thick, should be placed, a drain pipe being placed endwise upon one or both ends of the layer. The sticks should be then covered with about a foot of rich mold, wherein the plants should be set, in a row and about five inches apart. The plants should be kept well watered, the water being supplied through the drain pipes, so that, passing through the layer of sticks, which serves as a conduit, the water is supplied to the roots of the plant. In earthing up, care should be exercised to close the stems of the plant well together with the hand, so that no mold can get between them. The earthing process should be performed sufficiently frequently to keep the mold nearly level with the leaves of the outside stems. If these directions are carefully observed, the plant may be grown at least four feet in length, and this without impairing the flavor, which deterioration is commonly noticed in overgrown vegetables and fruits.

PHOSPHORUS CRYSTALS.

M. Blondlot announces that crystals of phosphorus may be obtained by heating dry phosphorus in a sealed tube at 112° Fah. The phosphorus volatilizes and forms crystals on the upper portion of the tube.

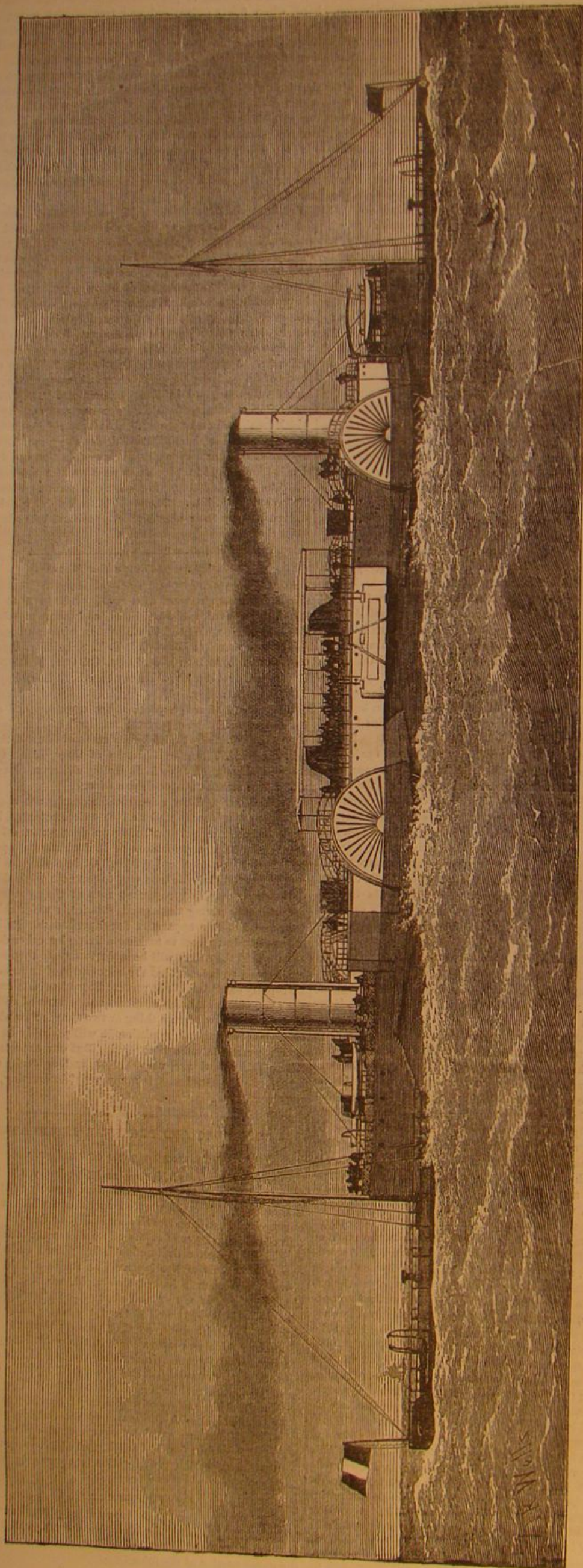


Fig. 1.—THE NEW SWINGING SALOON STEAMER BESSEMER.

THE BESSEMER CHANNEL STEAMER.

This steamer is now about to commence her regular traffic between England and France, and naval authorities will soon have their doubts as to the success of Mr. Bessemer's invention resolved. Whatever be the fate of the ingenious device of the renowned inventor, there can be no doubt but that the vessel is a magnificent experiment. The voyage is about 22 miles in length; and steamers of 400 or 500 tons burthen, and 300 or 400 horse power, have been hitherto found large enough for the traffic. But the Bessemer is 350 feet long and 40 feet broad, as large as many of the Atlantic steamers, although her tonnage is somewhat less than her dimensions would indicate, owing to the low freeboard at each end of the vessel, as shown in our first illustration. Her engines have already indicated 4,600 horse power, which aggregate is divided between two pairs of paddle wheels. Even if the suspended saloon does not answer all expectations, the new ship will be a great benefit to invalids, for she will shorten the time required for the passage to a little more than one hour. Our second illustration shows the general appearance of the deck of the steamer, with the promenade on the top of the oscillating saloon.

At a recent meeting at the Institute of Naval Architects, London, a discussion on this ship took place; and Admiral Sir Spencer Robinson stated that he was on board the Bessemer when she left Hull (where she was built), and the ship proved herself to be remarkably steady in a very heavy sea; and Mr. J. Scott Russell stated that Mr. Reed, the designer (who was present at the meeting), had succeeded in building a vessel of the maximum stability in a cross sea, besides endeavoring to gain an advantage by the use of the Bessemer saloon. All the speakers complimented the designer on the speed and behavior of his vessel, and anticipated very quick travel in her, without regard to wind or weather. It was stated by Mr. Scott Russell that it is in contemplation, by the French Government and the Northern Railway of France, to construct a deep water harbor at Calais, and so avoid the landing of passengers at half and low tides at the long wooden jetties which traverse the great width of sand that fringes the coast. This improvement would make a saving of perhaps 15 or 20 minutes in the journey from Dover to the Calais railway depot.

Mechanical Effects of Light—The Radiometer.

At a recent meeting of the Royal Society, at Burlington House, Mr. William Crookes, F.R.S., read a paper detailing his new discoveries on the action of light, and illustrated his remarks by experiments. It had long been supposed that no direct mechanical effects could be produced when luminous rays were allowed to fall upon one end of a most delicately balanced lever arm suspended *in vacuo*; but the author of the paper proved conclusively, by experiment, that not only heat, but also luminous rays, were capable of producing direct mechanical effects; so that, by the employment of a new instrument (called by him a radiometer), it was as possible to measure the intensity of the rays of light falling on it from either side as it was to measure the rays of heat with a thermometer.

The radiometer consists of four small pith disks, fixed at the extremities of two crossed arms of straw, balanced upon a pivot at the point where the straws cross each other, so that they can spin round on the pivot. The pith disks at the extremities of the four arms are white on one side, and blackened with lampblack on the other. The entire arrangement is inclosed in a glass bulb, from which the air is removed by the aid of a Sprengel's air pump. The disks and arms spun round rapidly when submitted to the action of light, but dark radiant heat had no effect on them. When submitted to the action of light, from which 95 per cent of the heating rays had been cut off, by means of the interposition of a plate of alum, the disks still rotated, though with slightly decreased velocity. Contrary to what might have been expected, it was the blackened surface of the disks which was repelled by light. In order to test Professor Osborne Reynolds' suggestion—that the effect of repulsion might be produced by residual vapor in the bulbs, and not directly by radiation—Mr. Crookes exhibited the same effects with a lever arm of platinum, suspended by an arm of platinum, the whole of which had been heated to redness again and again, during thirty-six hours of exhaustion by the Sprengel pump, so that it was difficult to suppose that any residual vapor, competent to produce the observed effects, remained in the bulb.

Mr. Crookes further stated that, in some refined experiments made by Dr. Balfour Stewart, at Kew Observatory, when rapid motion was obtained *in vacuo*, radiation was obtained outside; while in Mr. Crookes' experiments radiation was produced outside, and motion in the vacuum, so that the experiments appeared to be the converse of one another. The lever arms used in some of the experiments were suspended upon single fibers of glass, so thin that, when one end of the fibers was held in the hand, the other portion would float about like a spider's thread, and usually rise until it took a vertical position. The whole apparatus was of the most delicate description, and was made by Mr. Gillingham.

PETROLEUM OIL.—Good petroleum should be colorless or light yellow, or with the faintest tinge of violet. It should have no unpleasant odor, and at 59° Fah. should have a specific gravity not exceeding 0.804, or not less than 0.795. When shaken with sulphuric acid diluted with its own bulk of water, it should only color the acid a light yellow, becoming itself lighter in color by the treatment. At 95° Fah., it should not burn when a light is applied.



Fig. 2.—THE NEW SWINGING SALOON STEAMER BESSEMER.—THE DECK AND UPPER PART OF THE SWINGING SALOON

The International Exhibition of 1876.

English manufacturers have scarcely done with the Vienna Exhibition of 1873 before they are officially invited to take part in a similar international demonstration in 1876. This time, however, the scene shifts from the old world to the new—from Vienna to Philadelphia—the actual *raison d'être* of the exhibition being to celebrate the hundredth anniversary of American independence. For this purpose, a large part of Fairmount Park, one of the boasts of Philadelphia, has been allotted, and since many months engineers and contractors have been pushing on the work with untiring energy; for although a year has yet to pass before the exhibition opens, unceasing labor will be necessary to complete the task.

We shall in due time publish full drawings of the designs and construction of the various buildings, but we may take this opportunity of giving some idea of the scale of the exhibition. There will be five main structures—the Industrial Hall, the Machinery Hall, the Art Gallery, the Horticultural Pavilion, and the Agricultural Hall. Besides these, there will of course be the numberless smaller buildings in the park, which will spring up of necessity in all directions.

The main building is constructed chiefly of iron and glass, and in its general design bears a marked resemblance to the Great Exhibition of 1851. It lies about due east and west, and covers a rectangular area 1,880 feet by 464 feet in width. The greater part of this large building is only of one story, the height being 70 feet. At the corners are four towers 75 feet high, and in the center of the building the roof, for the space of 184 feet square, is raised, and at each corner is placed a tower 120 feet high. The total areas of this building are as follow:

	Acres.
Ground floor.....	20.02
In galleries.....	0.85
In towers.....	0.60
	21.47

In the direction of its length, the building is divided into seven parts. In the center is a main avenue 120 feet wide and 1,832 feet long; on either side is an aisle 48 feet in width, then two more avenues each of 100 feet, and between them and the wall of the building on each side are two other aisles of 24 feet. Three transepts of the same width, and divided in the same way, break up this enormous hall, and destroy the monotony of a long, unbroken roof line.

The Machinery Hall is also on a grand scale, but neither its design nor construction call for special remark here. It is 1,402 feet long and 360 feet wide, with an annexe 208 feet by 210 feet, and the area covered is 12.82 acres, the available floor space being 14 acres, including the galleries. This building is divided into two main avenues, each 90 feet wide, with a central aisle, and one on each side, all 60 feet wide. In the center is a transept 90 feet wide. The annexe already mentioned is to be devoted to the exhibition of hydraulic machinery.

The Art Gallery resembles somewhat in general design the corresponding building at Vienna. It is built of granite, iron, and glass, so as to be practically fireproof. It is 365 feet long, 210 feet wide, and 71 feet in height.

The Horticultural Building is a large and elegant structure of glass and iron, 383 feet long, 193 feet wide, and 72 feet high. The Agricultural Hall is also of great dimensions, and of some little architectural pretensions. The materials employed are wood and glass. The general plan consists of a long nave crossed by three transepts, and the leading architectural feature is a Gothic Howe truss. The nave is 820 feet long and 125 feet wide. The central transept is 100 feet in width, and the outside ones 80 feet, the height being about 75 feet.

Such is a very general outline of the exhibition buildings, which, covering an area of about 50 acres, will be opened in Philadelphia in May, 1876, and to which English manufacturers are invited to come with their exhibits. It should be mentioned that it is not a government undertaking, but simply a public enterprise, to which, however, the government has lent its support by a payment of some \$200,000. The responsibility of failure or success rests, therefore, with the promoters; but we believe we may say with certainty that American public spirit will carry through the exhibition to a triumphant conclusion, even if a pecuniary loss should be sustained. With this matter, however, we have little to do, but it is a question of paramount importance whether there exist sufficient inducements to English manufacturers to encourage them to come forward as they have done at previous foreign international exhibitions, or whether the probable disadvantages are too certain to justify their incurring the large expense and great trouble which must inevitably attend the representation of British industry.

It must be evident at once that the disadvantages, if not many, are at least serious. The distance to be traversed, and the cost attendant upon the transport of goods, are of themselves sufficient reasons to discourage many, and we think it is to be regretted that the English Commission can offer no facilities for free transport under government aid, such as will doubtless be afforded by some foreign governments. But the most serious objection is found in the existence of the prohibitive import duties, which rule in the United States, and which effectually check competition of foreign with native manufactures in many branches of industry. Again, the English manufacturer fears, and doubtless his fears have some good foundation, that any special merits possessed by the objects he exhibits will, unless protected by patent right, or by secret of production, be copied or improved upon by some appreciative American competitor. These objections must weigh most powerfully with a large

number of manufacturers, and especially with those who would, under more favorable conditions, crowd the space allotted to the British section in the Machinery Hall.

On the other hand, the Philadelphia Exhibition offers strong inducements to exhibitors, above all to some of a certain class. The facilities afforded by the United States patent law have been taken advantage of by a large number of inventors, who, having thus secured their inventions, have every reason for gaining as much publicity as possible, and may do so, not only without fear that they will be grossly pirated, as was the case in the Paris and Vienna Exhibitions, but with the certainty that, if the invention is of such a nature as to create a demand in the United States, they will be able to make advantageous arrangements during the period of the exhibition, either for the sale of their American patents, or for the granting of licenses under them. British exhibitors will also be dealing with an English-speaking, appreciative nation, always eager to adopt anything of promise.

Another powerful inducement is found in the fact that English manufacturers will not contribute their exhibits only for the inspection of United States visitors. For a long while past American manufacturers have been pushing their trade with great success in the various countries of South America, and these countries will look with interest to the Philadelphia Exhibition as a means for making them better acquainted with the United States market. If English exhibitors refrain from contributing, they will lose the opportunity thus afforded of entering into direct and profitable competition, as the objection of prohibitive tariffs does not apply in this connection, and English makers can far outstrip those of the United States in point of price.

In all branches of the industrial arts, English exhibitors have strong reasons for being present, because not only can the producer in this country compete even in the face of the high duties, but the people of the United States, while they possess keen appreciation of the beauty of form and material, are not able either to originate, or even to imitate, high class productions of this nature. That this fact is well known amongst manufacturers is evidenced by the numerous and extensive applications for space in the Industrial Hall made to the English commission. The area originally allotted to Great Britain and her colonies in the building was 46,000 square feet, and already the applications have exceeded a space of 60,000 square feet for the United Kingdom alone, while Canada demands 30,000 feet, and all the remainder of our colonies have yet to be provided for. These applications, moreover, do not include those for hanging exhibits, and for these 27,000 square feet for carpets alone have been applied for. These facts indicate that in the Industrial Hall, at all events, this country will be powerfully represented.

Regarded from a higher point of view than that of immediate trade benefit, it may be urged that a powerful and concerted action on the part of British manufacturers may do much towards breaking down the barriers existing in the channels of free trade with the United States. No better way of appealing to the people of that country in favor of this object could be found than by thus convincing them of the cheap producing power of England; but we think that the chances of success are too remote to encourage our manufacturers into such united action.

Fortunately English exhibitors will have facilities for bringing forcibly under the notice of the American public the difference in cost between free goods and those subjected to existing duty, by marking on each exhibit the actual price, and that made necessary through protective policy.

Judging from present appearances, we believe that the space in the Industrial Building allotted to this country will be crowded to excess, while that in the Machinery Hall will be but scantily filled. The Agricultural Building will, as we gather from (in our opinion) the somewhat premature announcement of the English agricultural engineers, be left without any exhibits of machines and implements belonging to this class, and we fear that but little space will be required in the picture galleries for English paintings or statuary.

Upon one all important point English exhibitors have good reason to congratulate themselves. The government has wisely placed at the head of the British commission the man who, of all others, is best suited for the position, and in whom those who had to do with the Vienna Exhibition have learned to place perfect confidence. Mr. Philip C. Owen will find, we feel sure, a far less onerous and ungrateful task before him than that of 1873, and the liberal grant made by our Government will enable him to render more assistance to exhibitors, and to carry through his work in such a way as to reflect credit upon the country and himself.—*Engineering.*

Purification of Metals by Filtration.

If the substance of which a filter is composed has no attraction for the particles of the liquid to be filtered—that is, is not wetted by it—the interstices of the filter do not act like capillary tubes, and the liquid will not pass through. Mercury will not run through a very fine sieve of iron or copper wire unless the wire be amalgamated; and if this be done, although the meshes be very fine, the mercury will pass through easily, while any pieces of iron, copper, or amalgam will be retained on the filter.

Lampadius, formerly Professor of Metallurgy at Freiberg, Germany, has attempted to make use of this principle in purifying the easily fusible metals, and with what success the following will show: Tinned sheet iron, as thin as paper, was cut into strips six inches long and four inches wide. Five hundred of these were placed face to face and fastened in an iron frame, with wedges driven in to bring them closely together. This frame was luted into the bottom of a graphite

crucible. Some impure Bohemian tin was melted in another crucible, and allowed to cool until crystals began to form on the surface, when it was dipped into the filtering crucible. The tin, which was still fluid, ran through almost chemically pure, while a pasty magma remained on the filter, which contained iron, arsenic, and copper chemically combined with iron.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for June, 1875.

Mercury.

On the 1st of June, Mercury rises at 5h. 53m. in the morning, and sets at 9h. 15m. in the evening. It is at its greatest elongation, east, on the 9th, and should be looked for after sunset, north of the point at which the sun disappears. On the 30th, Mercury rises at 5h. 32m. A. M., and sets at 7h. 51m. P. M.

Venus.

Venus is seen in the morning, rising on the 1st at 3h. 8m., and setting in the afternoon at 4h. 46m. On the 30th Venus rises at 2h. 47m. A. M., and sets at 5h. 48m. P. M.

Mars.

Mars rises on the 1st at 9h. 17m. P. M., and sets the next morning near 6 o'clock. On the 30th Mars rises near 7 P. M., and sets at 3h. 11m. the next morning.

According to the *Nautical Almanac*, Mars occults or hides from our view the star Σ *Sagittarii* on the 30th, at 1 in the morning. As Mars passes the meridian at 11 P. M., it will be in the southwest, when the occultation occurs, and, as its greatest height above the horizon is but $20\frac{1}{2}^{\circ}$ (in this latitude), it will not be very conspicuous; but the star is of the fifth magnitude, and a telescope of small power will show the phenomenon.

Jupiter.

Jupiter rises on the 1st at 3h. 11m. P. M., and sets at 2h. 17m. the next morning. On the 30th, Jupiter rises at 1h. 15m. P. M., and sets at 0h. 22m. the next morning.

On the 19th of June two of Jupiter's satellites will disappear by coming in front of the planet, and one by going behind the planet; so that for two hours a telescope (unless it be a powerful one) will show but one of the moons, and that the fourth, or the satellite farthest from the planet.

Saturn.

Saturn rises on the 1st just after midnight, and sets at 10h. 26m. A. M. the next day. On the 30th, Saturn rises at 10h. 9m. P. M., and sets at 8h. 24m. the next morning. The best time to look at Saturn is between 3 A. M. and 4 A. M., when it is about 34° in altitude and near the meridian.

Uranus.

Uranus rises on the 1st at 9h. 12m. A. M., and sets at 11h. 25m. P. M. On the 30th, Uranus rises at 7h. 25m. A. M., and sets at 9h. 35m. P. M.

Neptune.

Neptune can be seen to be a planet only by the use of the best telescopes, and at present is above the horizon almost wholly in daylight, so that it is useless to attempt observations.

Sun Spots.

The report is from April 20 to May 18 inclusive. The picture of April 20 shows, near the western limb, the pair of spots mentioned in the last report, one still distinct, the other divided into two smaller ones. On April 4 this group was seen on the very edge, while a small spot appeared, coming on. In the photographs of April 23 and 24, no spot is seen. On April 29 a large group, consisting of penumbra containing several spots and closely followed by two small ones, appeared coming on, while near the center of the disk was another small pair. The pictures of April 30, May 2, and May 3 show a change of motion and position of spots in the penumbra, independent of the motion across the disk.

Photographing was interrupted from May 3 to May 11 by clouds; and since that time till to-day, May 18, no spots have been visible with a glass of $2\frac{1}{2}$ inches aperture.

Paint.

At a recent meeting of the Society of Engineers, a paper by Mr. Ernest Spon on "The Use of Paint as an Engineering Material" was read. The author, in the first place, considered the necessity for the use of paint, and then noticed the composition and characteristics of the pigments usually employed by engineers. White lead, he observed, should be of good quality, and unmixed with substances which may impair its brightness. It is usually adulterated with chalk, sulphate of lead, and sulphate of baryta, the latter being the least objectionable. Zinc white is not so objectionable as white lead, but is dry under the brush and takes longer in completely drying. Red lead is durable and dries well; but should chemical action commence, it blisters and is reduced to the metallic condition. Antimony vermilion was suggested by the author as a substitute for red lead, and its qualities enlarged upon. Black paints from the residual products of coal and shale oil manufacture, and oxide of iron paints, are generally used for iron work, for which purpose they are peculiarly suited. Allusion was also made to anti-corrosive paints, and to those containing silica. Referring to the oils used in painting, the author stated that linseed oil was by far the most important, and that its characteristics deserved careful study. It improves greatly by age, and ought to be kept at least six months after it has been expressed before being used. It may be made a dryer by sim-

ply boiling, or by the addition of certain foreign substances. Nut oil and poppy oil are far inferior in strength, tenacity, and drying qualities to linseed oil, and are used to adulterate the latter. The author noticed the dryers employed, and alluded to the properties and means of testing the purity of spirits of turpentine. He then dwelt at length upon the mixing and practical application of paint to new and old woodwork, the preservation of cast iron by means of Dr. Smith's pitch bath, and the cleansing, painting, and care of wrought iron structures. He stated that, when used under proper supervision, no better protection could be found for iron structures than oxide of iron paints. He concluded by observing that the real value of any paint depended entirely upon the quality of the oil, the quality and composition of the pigment, and the care bestowed on the manufacture; and that the superiority of most esteemed paints was due to these causes rather than to any unknown process or material employed in their preparation.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NUMBER XXIV.

HAND TURNING—FINISHING TOOLS.

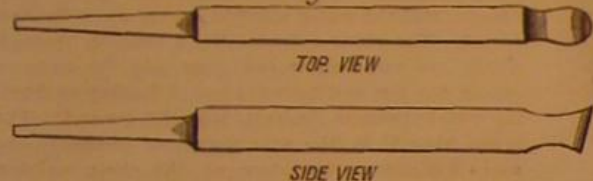
The tool shown in Fig. 73 is an excellent one for finish-

Fig. 73.

ing wrought iron or steel; it must, however, always be used with water, and should be hardened right out at and near the cutting edge, A.

For cutting out a round corner, a round-nosed tool, such as shown in Fig. 74, is the most effective; it will either rough out

Fig. 74.

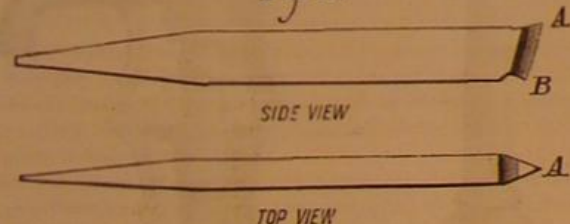


or finish, and may be used with or without water, but it is always preferable to use water for finishing wrought iron and steel. A is the cutting edge, and B, the heel of the tool. This is a sample of a large class, applicable to steel and wrought iron, the metal behind the cutting edge being ground away so as to give to the latter the keenness or rake necessary to enable it to cut freely, and the metal behind the heel being ground away to enable it to grip the rest firmly.

CUTTING A THREAD.

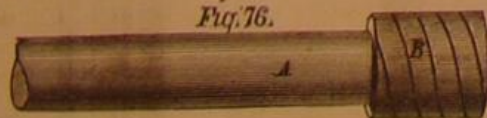
Our next operation will be to cut a thread upon an iron bolt, supposing it to be roughed out according to the instructions already given. The tools necessary for this purpose are a graver or V tool, with which to start the thread, and a chaser, with which to cut the thread after it is once started. Fig. 75 presents a V tool, A being the cutting point.

Fig. 75.



and B, the heel. To start the thread, the lathe should be run at a fast speed; and the heel of the tool being pressed firmly to the face of the lathe rest, the handle of the tool must be twisted from right to left at the same time as it is moved bodily from the left to the right, the movement being similar to that already described for the graver, save that it must be performed more rapidly. It is in fact the relative quickness with which these combined movements are performed which will determine the pitch of the thread. The appearance of the work after striking the thread will be as shown in Fig. 76, A being the work, and

Fig. 76.



B, a fine groove cut upon it by the V tool; from which it will be observed that the judgment alone must be depended upon to gauge the speed of the movement of the tool necessary to cut the fine groove, B, which must be the same width from one groove to the next as is the chaser from the point of one tooth to the point of the next.

The reason for running the lathe at a comparatively fast speed is that the tool is then less likely to be checked in its movement by a seam or hard place in the metal of the bolt, and that, even if the metal is soft and uniform in its texture, it is easier to move the tool at a regular speed than it would be if the lathe ran comparatively slowly.

If the tool is moved irregularly or becomes checked in its forward movement, the thread will become "drunken," that is, it will not move forward at a uniform speed; and if the thread is drunken when it is started, the chaser will not

only fail to rectify it, but, if the drunken part occurs in a part of the iron either harder or softer than the rest of the metal, the thread will become more drunken as the chaser proceeds. It is preferable, therefore, if the thread is not started truly, to try again, and, if there is not sufficient metal to permit of the starting groove first struck being turned out, to make another further along the bolt. It takes much time and patience to learn to strike the requisite pitch at the first trial; and it is therefore requisite for a beginner to leave the end of the work larger in diameter than the required finished size, as shown in Fig. 76, so as to have metal sufficient to turn out the first few starting grooves, should they not be true or of the correct pitch. If, however, a correct starting groove is struck at the first attempt, the chaser may be applied sufficiently to cut the thread down to and along the body of the bolt; then the projection may be turned down with the graver to the required size, and the chasing proceeded with.

After the thread is struck, and before the chaser is applied to it, the top face of the rest should be lightly filed to remove any burrs which may have been made by the heel of the V tool or graver; or such burrs, by checking the even movement of the chaser, will cause it to make the thread drunken. Where the length of the thread terminates, a hollow curved groove should be cut, its depth being even with the bottom of the thread; the object of this groove is to give the chaser clearance, and to enable you to cut the thread parallel from end to end and not to leave the last thread or two larger in diameter than the rest. Another object is to prevent the front tooth of the chaser from ripping in and breaking off, as it would be very apt to do in the absence of the groove.

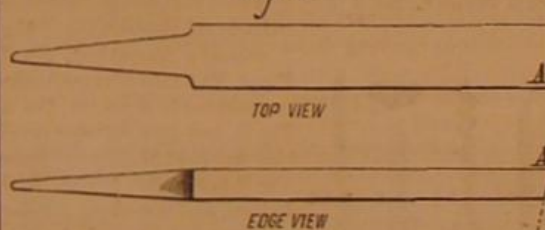
TO MAKE A CHASER.

Chasers are cut from a hub, that is to say, a cutter formed by cutting a thread upon a piece of round steel, and then forming a cutting edge by cutting a series of grooves along the length of the hub. These grooves should be V-shaped, the cutting side of the groove having its face pointing towards the center of the hub, as shown in Fig. 78. Hubs should be tempered to a brown color. A chaser is made from a piece of flat steel whose width and thickness increases with the pitch of the thread; the following proportions will, however, be found correct:

Number of threads per inch	Number of teeth in the chaser	Thickness of the chaser
24 to 20	12 to 14	1-4 inch
18 " 14	10	5-16 "
12 " 8	9 to 6	5-16 "
6 " 4	7 " 6	3-8 "

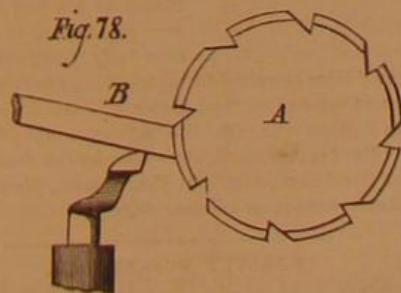
The end face of the chaser should be filed level and at an angle with both the top face and the front edge of the steel,

Fig. 77.



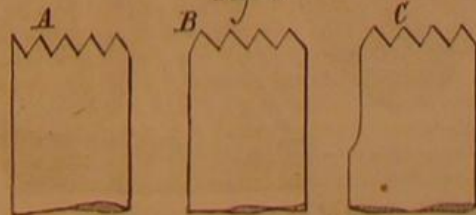
as shown in Fig. 77, the edge, A, being rounded off so that it shall not strike against any burr upon the face of the rest, and thus be retarded in its forward movement while being cut. The hub is then driven in the lathe between the centers, the chaser being held in a handle sufficiently long to enable the operator to hold it with one hand, and press the shoulder against the end so as to force the end of the chaser against the hub, which will of itself carry the chaser along the rest. The position in which the chaser should be held is shown in Fig. 78, A being the hub, and B, the chaser, from

Fig. 78.



which it will be seen that the chaser is held upside down while it is being cut, the cutting face resting upon the lathe rest. After the chaser has passed once down the hub, special attention should be paid as to whether the front tooth will become a full one; if not, the marks cut by the hub should be filed out again, and a new trial essayed. It must be borne

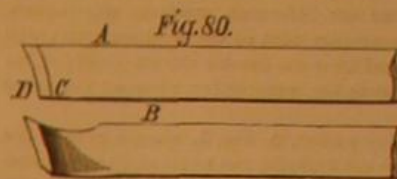
Fig. 79.



in mind that, the chaser being held upside down, the back tooth, while cutting the chaser, becomes the front one when the chaser is reversed and ready for use. The hub should

be run at a comparatively slow speed, and kept freely supplied with oil, it being an expensive tool to make, and this method of using preserves it. In Fig. 79, A is a chaser whose front tooth is not a full one; B is a chaser with a full front tooth; and C is of the same form as A, when it is, as far as possible, corrected.

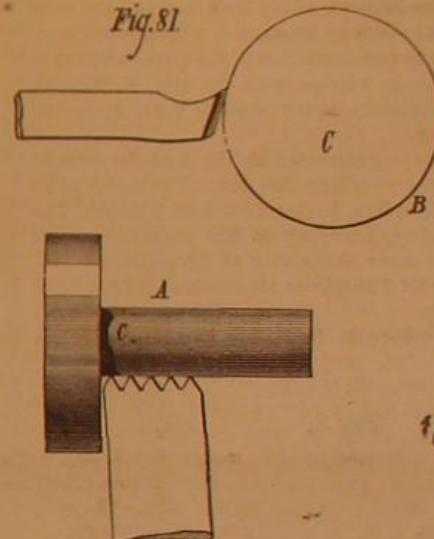
The cutting operation of the hub upon the chaser is continued until the thread upon the latter is cut full, when it is taken to the vise and filed as shown in Fig. 80, A being the



chaser as it leaves the hub, and B, as it appears after having the edge, C, and corner, D, rounded off.

The angles of the end face of the chaser to the top and edge faces of the body of the steel, and the uses thereof, are made apparent in Fig. 81, in which A is a top, and B, a side view of a chaser when in operation, C being, in each case, the work. From this it will be observed that the angle in the direction of the thickness gives rake to the teeth, while the angle in the direction of the breadth serves to keep the front side of the chaser from coming into contact with the head, shoulder, or other projection of the work. In the absence of a hub, a chaser may be made by cutting a slot in a blank nut, fastening the end of the chaser in the slot, and tapping the hole. The difference in shape between a chaser for use on wrought iron, as shown in Fig. 81, and steel, and one for use on cast

Fig. 81.

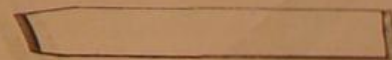


iron, brass, or other soft metal, is shown in Fig. 82.

The difference consists in making the teeth less keen, by beveling off the top face and cutting the teeth less hollow in their length. The latter object is obtained by moving the handle, in which the chaser is fixed, up and down while the hub is cutting it.

The lathe rest should be so adjusted that the chaser teeth cut above the horizontal center of the work. The teeth of the chaser should fit the thread on the bolt along all their length when the body of the chaser is horizontal, and then the least raising of the handle end of the chaser will present the teeth to the work in position to cut, while the teeth behind the cutting edge will fit the thread, being cut sufficiently close to form a guide to steady the chaser. This method of using will not only keep the thread true, but will preserve the cutting edge of the chaser. If a chaser has top rake, as shown in Fig. 81, and the handle end is held too high and so that the back of the teeth are clear of the thread, it will cut a thread deeper than are its own teeth; if, on the other hand, the top face is beveled off, as shown in Fig. 82, and the handle is held too high, it will cut a thread

Fig. 82.



shallower than are the chaser teeth.

The proper temper for the teeth is a deep brown, or, for unusually hard metal, a straw color. For chasing wrought iron, the lathe may be run so that the teeth will perform about 40 feet, for steel about 30 feet, for cast iron 50 feet, and for brass about 80 feet, of cutting per minute.

France and the Centennial Exposition.

We printed last week an extract from *The Engineer's* recent editorial on the Philadelphia Centennial, in which the general disinclination of English manufacturers of agricultural and other machinery was especially mentioned, and ascribed to the high duty which is charged in this country on the entry of such products. The same objection is now being urged in France to the contributions of French manufacturers. M. Herman La Chapelle, one of the largest engine builders of Paris, publishes a long letter in the *Moniteur Industriel Belge*, in which he strongly condemns the prohibitory nature of American duties, and points out that, with the exception of wines, silks, and works of art, of which France has almost a monopoly, it is useless to exhibit the principal industrial products of that country.

SIGNATURES made with a lead pencil are good in law

IMPROVED BELT-GEARED COTTON PRESS.

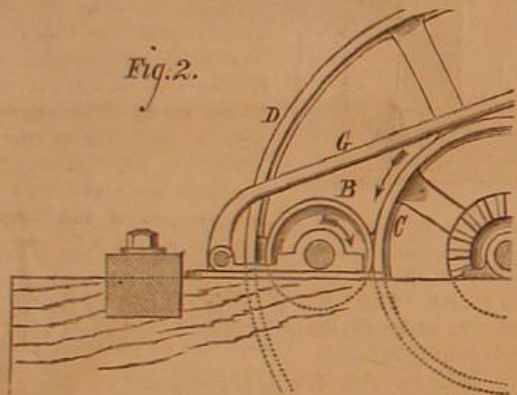
The improved cotton press herewith illustrated is driven by a belt in the same manner as a gin stand or mill. It is not necessary either to stop or slacken the speed of the driving shaft to reverse the motion of the screw, while the belt always runs in the same direction. The general construction of the apparatus is strong and durable, and it has withstood the strain of making bales ranging as high as 610 lbs. without breakage. The machine has now been in use for three seasons, giving, as we are informed, uniform satisfaction. The simple arrangement of the working parts will be understood from the details shown in Fig. 2, in connection with the perspective view of the same in Fig. 1.

The driving pulley, A, Fig. 1, always runs to the right, and at the opposite end of its shaft is secured a wooden friction pulley, B. The latter works in the space between the two rims, C and D, of a larger pulley, Fig. 2, which is attached to the end of a shaft or pinion, on which rotates the bevel gear, E, and so turns the screw, thus raising or lowering the follower, F, Fig. 1. G, Fig. 2, is a lever which moves the sliding journal box, in which the end of the shaft-carrying pulley, B, is supported either to the right or left, so that the friction pulley is thus brought into contact with either rim, C or D, and, engaging with either, gives motion in one or the other direction to the double rim wheel. There is sufficient space between the rims to allow pulley, B, to run idle, by not engaging with either rim, when the operator so desires.

When pressing the bale, the friction pulley is caused to work against the rim, C, turning the latter in the same direction as its own motion, and thus running the screw up slowly and with the full power. To carry the screw down, the friction pulley is moved over to engage with the rim, D, through which it obviously imparts a quick lowering motion to the screw.

The press is guaranteed by the manufacturer to make a bale weighing 500 lbs. The screw is of solid wrought iron, having a pitch of 2 inches. The driving pulley, traveling at 250 revolutions, will run up the screw at the rate of 20 inches per minute. The total weight of the machine is from 3,500 to 4,000 lbs.

Patented April 29, 1873. For further particulars address



the manufacturer, Mr. H. Dudley Coleman, 12 Union street, New Orleans, La.

NEW SHARPENING INSTRUMENT.

The utility of this invention, shown in our illustration, is so

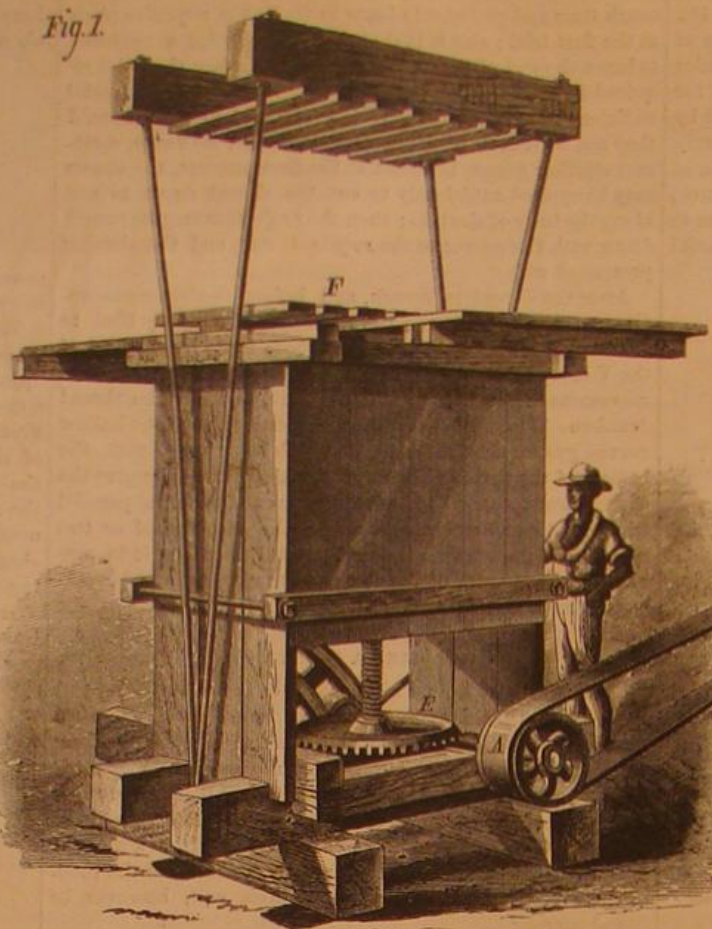
Fig. 1.



self-evident that any description is hardly necessary. Those who have struggled over a piece of tough beef with a dull

knife, until worked into a state of actual ferocity doubly intensified by the pangs of hunger and a large number to carve for, know that a good steel, which will stay in respectable condition and not wear smooth in a fortnight, is something very akin to a treasure. Therefore, when we introduce an ornamental implement which will sharpen knives at a mere

Fig. 1.

**SIMMONS' BELT GEARED COTTON PRESS.**

touch, which pulls out skewers, cuts cork wires, and which has a convenient corkscrew hidden away in its handle, always at hand at the right time and in the right place, we feel we are doing a large portion of the community a service.

The device shown herewith does all this. The implement consists of six blades of a very hard and tough steel, one of which is shown in No. 4, Fig. 2, which are grouped together radially, as represented in Fig. 1, around a central rod, No. 5, Fig. 2. The ends of these blades are secured in a socket, No. 3, Fig. 2, and by a suitable screw they are held tightly in place. The handle, No. 1, Fig. 2, is hollow, and is made of polished corrugated metal. It incloses a corkscrew, No. 2, Fig. 2, and holds the same by screwing upon a thread formed on the bolster. At the end of the steel portion is a short knife for cutting cork wires; and just inside the blade a notch is made which affords a ready means for grasping and extracting skewers.

The arrangement of radial blades is entirely novel and is very effective in use. Though especially designed for family use, the device is suited for sharpening the largest knives.

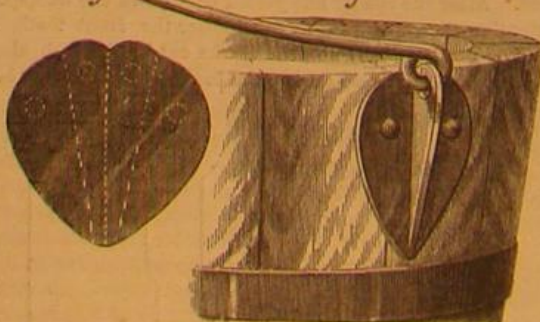
It is the subject of several patents obtained in this country and in Europe through the Scientific American Patent Agency. For further particulars address the manufacturers, the Radial Steel Company, 221 Pearl street, New York city. [See advertisement on another page.]

IMPROVED BUCKET EAR.

Mr. James D. Field, of Blue Rapids, Marshall county, Kan

Fig. 1

Fig. 2



Field, is the inventor of an improved bucket ear, herewith illustrated, which was patented March 16, 1875, through the Scientific American Patent Agency. The advantages claimed for the device are that it is out of the way of cover and bail

and not liable to catch in clothes; that it is strong, and cannot be readily broken off, and that it is cheap and easily made. It consists of a continuous piece of sheet metal, as shown in Fig. 1, which is folded as indicated by the dotted lines, so that a central rib is formed upon it. The rib is then perforated to receive the bail, and the side plate is similarly pierced for the admission of the screws which attach the appliance to the bucket. The completed ear in position is represented in Fig. 2. Further particulars may be obtained by addressing the inventor as above.

IMPROVED HYDRANT.

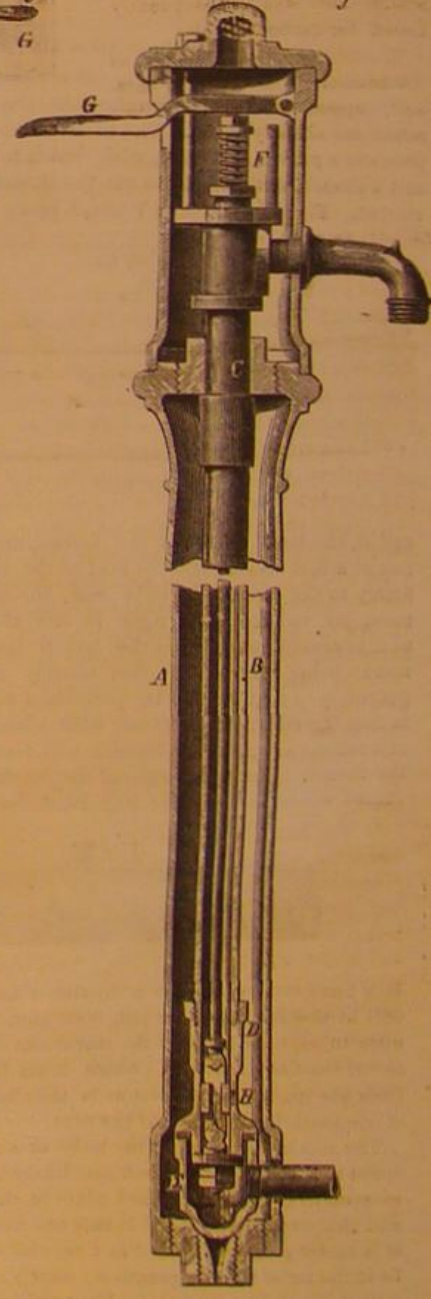
The advantage offered by the improved hydrant or street washer illustrated herewith is that the valve may be reached for repairs or clearing without necessitating the digging-up of the ground. To this end the entire interior mechanism may be lifted bodily out of the hydrant, so that the outer casing, when once placed, remains a fixture. The invention is represented in perspective in Fig. 1, and in section in Fig. 2. In the latter engraving, A is the outer casing which is set in the ground; B is an inner tube secured in said casing by a screw-threaded enlarged portion at C. Through this tube runs a rod which terminates below in a valve carrier, D, which is arranged to slide in a cylinder, which projects into the valve chamber, forming the seat of the valve, E, attached to said carrier. The inlet pipe screws into a branch of the valve chamber. The upper extremity of the rod is surrounded by a spiral spring, F, which raises it upward, and so keeps the valve pressed firmly against its seat, a packing ring located on the valve rendering the joint tight. Just above the end of the rod, the handle, G, is pivoted, so that, by pressing down thereon, the rod is depressed against the action of the spring, the valve opened, and the water allowed egress up to the exit faucet. The valve cylinder has a vent, H, through which the waste water can pass into the exterior casing, the screwed bottom piece, I, having an opening which permits leakage into the ground. The screw ring, C, is the sole means of confining the valve cylinder to its place on the chest; so that when access is to be had to the valve, it is only necessary to detach the nozzle, remove the cap and operating shaft, and then, by unscrewing the ring, lift out the interior apparatus.

Patented November 3, 1874, by Mr. B. E. Lehman, of Bethlehem, Pa., to whom inquiries for further information



Fig. 1

Fig. 2



may be addressed; also to the McNab and Harlin Manufacturing Company, 56 John street New York, sole agents for New York and the Eastern States.

THE FATAL BALLOON ASCENSION.

The story of the fatal balloon ascension in France, in which two of the most daring of living aeronauts, Croce-Spinelli and Sivel, lost their lives through suffocation in the highly rarefied air of the upper atmospheric regions, is told in detail by the survivor of the party, M. Gaston Tissandier, in *La Nature*, the journal edited by him. We have already given the main facts of this disastrous affair, but the following in addition thereto will also be found of interest. We extract from the periodical above named the engravings given herewith, one of which represents the aeronauts and their apparatus as disposed in the car of the balloon. Tissandier is shown noting the barometer indications, Croce is seated on the right, and is inhaling oxygen, and Sivel is about cutting loose the bags of ballast. The time chosen is after the balloon had mounted to a height of over 23,000 feet, and a sense of faintness and oppression was already stealing over the occupants of the car. The temperature was about 14° above zero, Fah. Sivel, who had relapsed into a kind of stupor, suddenly awoke, and turning to Tissandier asked the altitude; the balloon had nearly reached 24,000 feet. Then he cut loose the bags of ballast, and this action is the last remembrance which M. Tissandier possesses of the course of events until he awoke and found his companions dead.

The small balloons shown just above the car contained a mixture of air and oxygen (70 per cent of the latter gas) which the aeronauts inhaled until suddenly overcome. The reservoir hanging outside of the car is an aspirator for forcing air through tubes filled with caustic potash, which air was subsequently tested for carbonic acid.

The temperature of the air, as the balloon ascended, was carefully measured, up to the time when the observers succumbed.

At the surface of the earth it was 57° Fah. By the time an altitude of 20,000 feet was reached, about 50 minutes intervening, the mercury had fallen to 32°; the last indication noted, two hours after starting, and when the balloon was 23,680 feet high, showed 13.8° above zero, Fah. During this period the temperature of the gas within the aerostat was constantly noted; this reached 73.4°, when the mercury outside marked but 23°, and remained at that point. This fact accounts for the rapid ascension of the balloon in the upper regions, and its precipitous descent after sinking into the denser atmosphere.

We remarked in our previous article that the registering barometers, which were to be opened by the French Society, and which fortunately remained intact during the fall of the car, would show how high the balloon ascended after the aeronauts became insensible and before it began its downward course. These have been examined, and show that the lowest pressure corresponded to about 10.3 inches of mercury, which indicates a height of a little over 27,500 feet. From this point the balloon began to descend, falling swiftly to 20,500 feet. Here the aeronauts revived, and then cut away the aspirator and threw overboard more ballast, causing the balloon to rise once more to the same high altitude, and insensibility again to supervene. The track of the air ship forms a gigantic M, the ends about 150 miles apart.

In the smaller illustration, Fig. 2, are represented Sivel's sounding balloons, by means of which he recognized the presence of currents of air above or below. A rod, thirty feet long, was projected from the car and held in equilibrium by the upper balloon, which was 19 feet in diameter, and which was filled with gas. This was attached to a rope 3,000 feet long and allowed to ascend that distance above the car. The other small balloon was filled with air, and, being attached to a line of similar length, fell that far below. Mr. Donaldson uses an arrangement similar to this, kites being substituted, however, for the balloons.

Piracy on a Railroad.

Presence of mind at the right time averted the possibility of a serious disaster on the Hudson River railroad, recently. Five convicts managed to break away from the working gang at Sing Sing prison, and, reaching the railroad track, suddenly jumped into the cab of a freight engine which, at the time, was slowly dragging a heavily loaded train. Presenting revolvers at the heads of the engineer and fireman, they ordered both men to alight. The engineer, unable to reach any heavy tools to fight the intruders, resorted to strategy.

He noted that the fire was very low; and trusting that the convicts knew nothing of machinery, he seized his pump handle and, as he leaped from the cab, turned it far to the

right, thus admitting a steady stream of water to the boiler. The convicts then uncoupled the locomotive, which, as the steam gage stood at 200 lbs., leaped forward with a jerk.

As soon as the pumps began to operate, the water worked into the cylinders, and, in a few seconds, the head of one blew off, thus, of course, greatly retarding the speed of the machine.

Meanwhile a telegram had been sent to Superintendent Toucey, at the New York office, announcing the capture. Prompt action was necessary, as a locomotive, tearing over the line in utter defiance of time tables and trains ahead, was a dangerous intruder and liable to work considerable damage at stations and crossings. Recollecting that near Tarrytown there is a switch which runs parallel with the main track for a long distance and then abruptly ends in the river, Mr. Toucey, without an instant's hesitation, sent to the Tarrytown station master an order "to open the west switch and throw No. 89 into the river." The astonished official, although hardly crediting his senses, nevertheless prepared to obey the command. He threw open the switch and locked it, and then stood calmly by, watching the cloud of steam up the track get bigger, and waiting for \$20,000 worth of engine to go plunging, with whatever train might be behind it, down to the bottom of the Hudson.

Another explosion occurred, however, which saved the lives of the convicts and the destruction of the engine. The locomotive was within a mile of the switch when the other cylinder head was blown out. The machinery stopped, and the convicts, leaping out, took to the woods. The engineer, who had been running after his locomotive, well knowing that she could not travel very far, soon reached her, and, jumping into the cab, in a few seconds

had the fire out, and the steam down.

While the prison officials should be held to a strict account for the fact of the escape of the convicts and of their being possessed of arms, the railroad people are entitled to much credit for their part in the affair. And this is equally due to the engineer for his presence of mind, to Superintendent Toucey for his prompt application of an heroic remedy, and to the station master at Tarrytown for his implicit obedience to an order which the majority of men would have hesitated over or have refused to obey without explanation.

Steam Launches for Yachts.

A miniature steam launch, only 14 feet long by 4 feet 3 inches beam, has just been built by Messrs. Edwards and Symes, of Cubitt Town, Eng., as a tender to a sailing yacht for use on the fiords of Norway. The boat is to be carried at the ordinary davits, and it has, therefore, been made as light as possible, the total weight, including the machinery, being only 800 lbs. The hull is built entirely of mahogany, and it contains a vertical boiler with engine attached, the arrangement being such that the machinery can be detached from the hull in a few minutes, and hoisted out complete, and the launch then used as an ordinary boat, it being provided with oars and rowlocks. The boiler, which is worked at a pressure of 75 lbs. to 80 lbs. per square inch, is welded up throughout, there being no riveted seams. The boat will carry four persons and a good supply of coal; and during a trial trip made at Greenwich last week, it attained a mean speed of 6½ miles per hour.

Glycerin as an Illuminating Material.

M. Schering states that glycerin may be burned in any lamp so long as the flame is kept on a level with the liquid. The latter, on account of its consistence, will not ascend an elevated wick. As the flame, like that of alcohol, is almost colorless, and as the material is especially adapted for absorbing a large proportion of saline substances, M. Schering has recently made experiments in coloring the flame with various bodies, and with satisfactory results. By introducing substances rich in carbon, it appears that the flame may be rendered suitable for illuminating purposes. The low price of glycerin, and its property of not volatilizing at high temperatures, add to its advantages in this direction.

THE new British arctic expedition, which will shortly start for the north pole, is to go up through Smith Sound, on the west coast of Greenland, following the route of the last American expedition—Hall's.

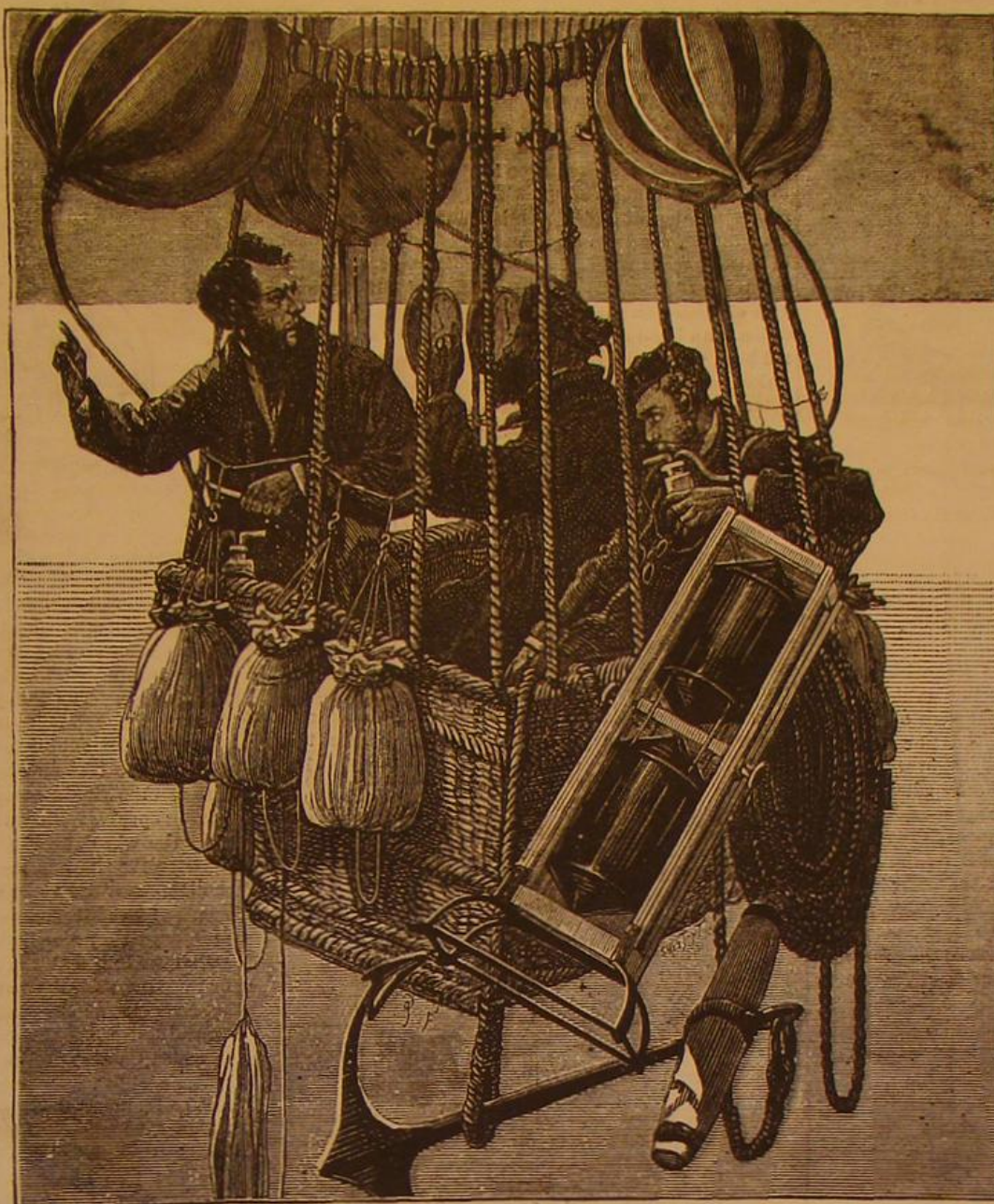


Fig. 1.—THE BALLOON "ZENITH."



Fig. 2.—SIVEL'S SOUNDING BALLOONS.

HOOD'S ADJUSTABLE BRUSH HANDLE.

Here is an invention which is just in time for spring house-cleaning, for which reason, together with that of its handiness, we have no doubt but that it will meet with general approval, especially from our lady readers, who are looking forward with no cheerful anticipations to that serious yearly



undertaking. It is a handle easily attached to any scrubbing brush, and so adjusted that it will enable the user to do her work standing up, and with much greater facility and ease than when kneeling on the floor.

A, in the engraving, is a conical plate secured by screws to the back of the brush. It has an aperture in the center, around which and on the under side of the plate an inclined plane is formed. A similar conical plate, B, is provided with a tapering socket to hold the handle, and fits over plate, A. The two plates are firmly clamped together by a key bolt, C, which, passing through plate, A, engages against the inclined underneath portion when turned. The upper flat surface of plate, A, and the under surface of plate, B, do not come in contact, the bearing being had between the outer inclined portions, and thus rendered firm and strong. Plate, A, is made higher on one side, thus causing the handle to assume an angle, more or less acute, with the back of the brush, according to the position in which it may be most convenient to use the latter.

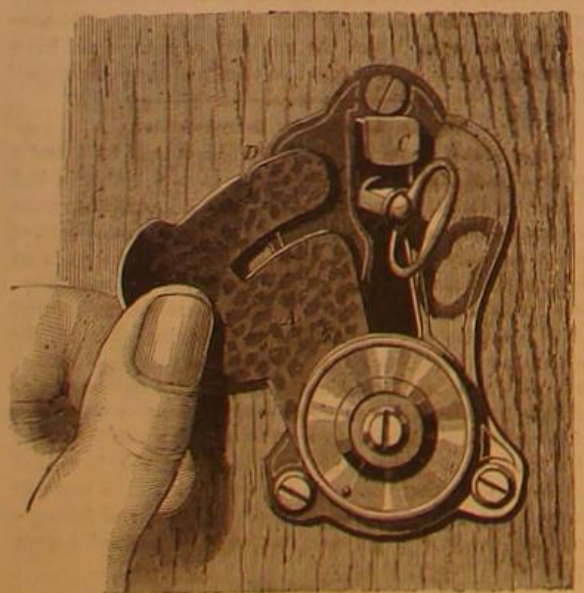
The brush may be placed nearly on a line with the handle, so as to facilitate working alongside the baseboard or near doors and windows.

Patented October 20, 1874. For further particulars regarding agencies for the introduction of the invention, address the patentees, Messrs. Hood and Joseph, Indianapolis, Ind.

ELDRIDGE'S SELF-ACTING KEY FASTENER.

The object of this invention is to provide a self-acting key fastener that will secure the key in a door lock on the inside of a room against turning, by burglars, with nippers and other instruments, from the outside.

The accompanying engraving represents a keyhole plate secured to the door, and to this, at the lower end, a movable arm, A, is pivoted. The arm is made concavo convex at the pivot end to contain a circular spring which operates it, one



end of the spring being secured to the plate and the other to the arm. A slot is formed on the upper end of the arm, to receive the shank of the key, which is filed square to fit the same; so that when the arm is closed by the spring, the key cannot be turned in the slot. The guide, C, and the shoulder on the arm form a stop, while the notch, D, passing under the guide, serves as a lock for the arm against outside pressure.

This little invention, we are informed, meets with much favor among Chicago architects. It has been patented by Mr. D. D. Eldridge, of 208 La Salle street, Chicago, Ill., from whom the manufacturing rights for the Eastern and Southern States may be obtained on reasonable terms.

Just So.

Snow's Pathfinder and Railway Guide (Boston) says, and we think truthfully, that, for a catalogue of all the most important inventions of the day, with scientific notes and explanations, the SCIENTIFIC AMERICAN has no compe-

titor in this country; and it should have none, for it entirely fills the field of scientific information and research. Its pages contain information of interest to the most thoughtful reader; and it is difficult for the most unscientific mind to lay down a copy without scanning its excellent illustrations and explanations.

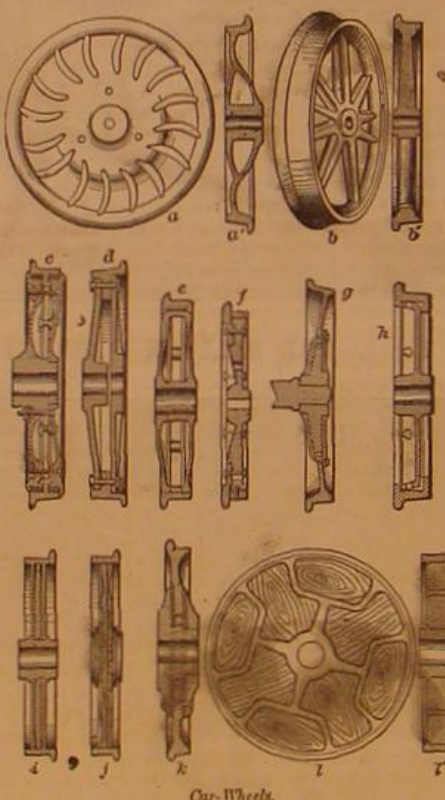
Dissolution of Hydrogen in Metals.

In previous researches on the metallic alloys formed by hydrogen, MM. L. Troost and P. Hautefeuille indicated the characters which distinguish these definite combinations from the solutions of hydrogen in metals. Potassium, sodium, and palladium combine with hydrogen, while a considerable number of other metals merely dissolve this gas. Iron, nickel, cobalt, and manganese offer striking analogies in the manner in which they behave with hydrogen at different temperatures. The facility with which they absorb or give off hydrogen gas depends greatly on their physical condition. An ingot of pure nickel gave out, in a vacuum, at a red heat, one sixth of its volume of hydrogen. Lamine of nickel, obtained electrolytically, gave out forty times their volume. Pulverulent nickel gave up one hundred times its volume, and remained pyrophoric after the escape of the hydrogen. An ingot of cobalt gave up one tenth of its volume, electrolytic lamine of cobalt thirty-five times their volume, and pyrophoric cobalt powder one hundred times. It also remained pyrophoric after the loss of the hydrogen. Soft iron in ingots gives off one sixth of its volume, and gray cast iron more than the half. Electrolytic lamine of iron gave off 260 volumes. In fine, it may be said that iron, nickel, and cobalt absorb directly hydrogen gas, but it cannot be said that combination ensues, just as has been already shown in the case of lithium and thallium. Finely divided iron has a property which is not shared by nickel or cobalt: it decomposes water slowly at common temperatures, and rapidly at 100°. In this respect iron approximates to manganese.

CAR WHEELS.

It has been estimated by good authority that there are no fewer than 1,250,000 car wheels in daily use on the railroads of the United States. Each wheel travels 88-75 miles per

Fig. 1.



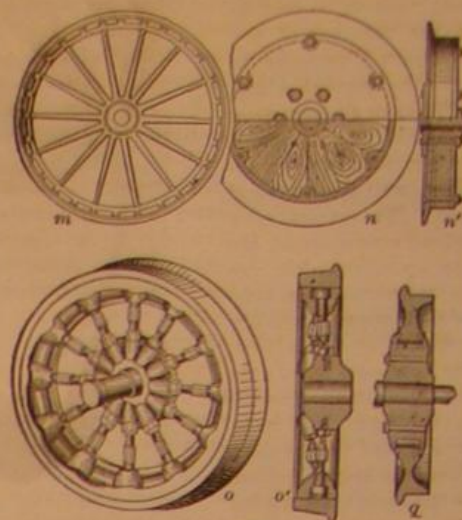
Car-Wheels.

day of 320 days per annum, and its average load is 3½ tons. With this stress, the life of the wheel is about 45,000 miles, or 1-58 years. On trains running at express speeds, the average life does not exceed 10 months' service, while wheels under tender trucks have a life of 18 months. A freight wheel, it is stated, often lasts over 3 years. Assuming the average life of car wheels under all kinds of service to be 5 years, the total number of wheels worn out annually in the United States may be placed at not less than 250,000. Allowing an average cost of \$18 per wheel, and calculating about one half for the value of the old wheel, the annual loss may be stated at two and a quarter millions of dollars.

We present, in Figs. 1 and 2, a few examples of the numerous inventions of this class. a a' represent the well known Washburn wheel; b b' are perspective and sectional views of a spoked wheel of rather antiquated form; c is a Woodbury wheel, which has a compressed annular elastic packing between the cylindrical faces of the body and rim. The body is sectional, having two webs bolted together. Each portion has a flanged rim, the combination of the two forming an annular seat for the tyre. d is a wheel cast in three separate pieces, consisting of a rim and two portions, each of which latter has a hub and a web, between which the inner flange of the rim is gripped and bolted. The wheel, e, has side plates cast in one piece with the hub and cross pieces, which connect the peripheries of the side plates. The encircling tyre is secured by rivets. In the wheel, f, the tyre has pins upon its inner side, which enter slots in the rim of the wheel to hold the tyre from shifting. The flange piece has a shoulder projecting on the inside, that fits in a circular groove in the body of the wheel, to which it is bolted. The wheel, g, has a circular recess to receive a collar on the axle, over

which is bolted a covering annular disk. This device is to allow the revolution of one of the wheels upon the axle on curves of the track. h is a car wheel constructed in two parts: first, a rim with two flanges forming an inner recess

Fig. 2.



Car-Wheels.

and second, a hub with a web, and a flange upon the same, flaring slightly outward. Slots in this flange permit it to spring past the flange of the rim into the inner recess. i and j are two forms of wheel, in each of which the cast hub and rim are connected by corrugated wrought metal disks. k is the Raddin wheel, in which the entire web and rim are cast in one piece. The hub has binding rings which are bolted together through holes in the web, with interposed packing rings of india rubber to lessen tremor and jar. l l' are two views of the Watson wheel, in which the space between the hub and the rim is occupied by a skeleton metallic frame, having openings filled with compressed panels of wood.

In the wheel, m, Fig. 2, the wedges of wood are driven between the rim and the tyre, in order to absorb the jarring motion. n n' are views of a compound wheel in which segments of wood form a web between the hub and the rim, and are secured by metal plates. o o' are views of a wheel in which the hub and rim are of cast iron united by wrought iron spokes, each alternate spoke leaning at an angle from the opposite side of the central circumference of the hub to the central line of the rim. q is a wheel somewhat similar to k, in which the web of the wheel is enclosed between binding plates, and has a packing between itself and the plates, and also on its inner edge.

Paper, when entering into the composition of car wheels, is tightly pressed in as a packing between the steel tyres and the cast iron hubs, so as to form a compact, strong, and yet somewhat resilient material, which deadens sound and diminishes the force of concussion.

The illustrations are selected from the pages of Mr. E. H. Knight's "Mechanical Dictionary."*

HAND SUPPORT FOR SHEEP SHEARS.

As the sheep-shearing season is now close at hand, a novel arrangement of a support for the hand while holding the shears, which we illustrate herewith, will doubtless



prove of timely interest. The object of the device is to enable the operator to have free use of his hand while the muscles of the same are firmly braced, and thus assisted during the fatiguing labor. He is thus enabled to exert greater strength, and may, at the same time, rest the hand without laying down the implement. The attachment consists of straps, of leather, rubber, or other suitable material, which are secured to one of the shears handles. Rings or loops are fastened to the other handle, and through these the straps are passed so as to form a cross over the back of the hand, the ends being secured and the length adjusted by suitable button holes and hooks. As illustrated in the engraving, elastic bands are employed, in which case the straps are riveted or otherwise permanently attached to the handles of the shears.

A caveat for the invention has been prepared by the Scientific American Patent Agency. Further information may be obtained by addressing the inventor, Mr. James L. Smith, P. O. box 290, Tuscola, Ill.

* Publishers, J. B. Ford & Co., New York city.

The Newly Elected Honorary Members of the Iron and Steel Institute.

The annual general meeting of the Iron and Steel Institute of Great Britain recently took place in London. Acting upon the authority vested in them at the last general meeting, the Council have elected the following gentlemen as honorary members: Professor Peter Tunner, Leoben, Austria; Professor R. Akerman, Sweden; Professor Grüner; Dr. Percy, London; Mr. Peter Cooper, New York; Mr. H. Schneider, Creusot; Mr. F. Krupp, Essen. The total number of honorary members, including the King of the Belgians, who was elected last year, is now eight.

The president, I. Lowthian Bell, Esq. said: "Most of you, I dare say, are familiar with the names and possibly also with the achievements of those gentlemen who have gained for themselves this distinction; but in the event of there being any here present to whom the names of those gentlemen are not familiar, perhaps it would be acceptable that I should mention the ground upon which we have accepted them. The first name on the list is that of my friend, Professor Peter Tunner, of Leoben, Austria. I have had the honor of personal acquaintance and, I may say, of personal friendship with this distinguished foreign metallurgist during the last five-and-thirty years, and can safely say, in practical acquaintance with every portion of the metallurgy of iron, it is impossible to imagine any one more proficient, or any one who takes a greater interest in the development and progress of our science.

The next name is that of Professor R. Akerman, of Sweden. Sweden, as you all know, is a classic country in the metallurgy of iron, and I am glad, and I am confident in the assertion, that the great repute of that very ancient country in the manufacture of iron is very well sustained by the exertions, by the knowledge, and by the learning of Professor Akerman, and the same may be said of Professor Grüner, of the *Ecole des Mines* in Paris. There is no subject connected with the progress of our art which does not receive the immediate attention of my friend Professor Grüner; but, in addition to that, I may say he has distinguished himself in the archives of scientific research in France, by his original investigations, many of which are of great value in connection with the smelting and subsequent treatment of iron.

Then comes the name of a gentleman, familiar, I am certain, to every one who has ever read a word upon the subject of the manufacture of iron in this country; I mean that of my friend Dr. Percy, of the School of Mines in Jermyn Street. If he had rendered no other assistance to iron manufacture than simply to have collated and extracted, from works written in almost every foreign language, an account of that which had been done in other countries as well as that which had been done in our own, I am quite sure that Dr. Percy would have entitled himself to this distinction at our hands; but in addition to that, the doctor has also distinguished himself by several very important investigations in connection with this chair.

The next name is that of my venerable friend Mr. Peter Cooper, of New York. I cannot pretend that, in the processes or the practice of making iron, he has done much to distinguish himself in America, but he has been connected for many years in the manufacture of iron with his son, Mr. Cooper, and with his distinguished son-in-law, the Hon. Mr. Hewett; but in addition to these recommendations, Mr. Peter Cooper has, with a singleness of purpose which cannot be too much admired, devoted a sum which would have been considered enormous even in this country, for the advancement of Science, by founding the Cooper Institute in New York, in which young persons are instructed in every branch of art and science; and if it were only to evince the appreciation which we have for efforts in that direction, I am of opinion that the Institute, in conferring this honor upon Mr. Cooper, honors itself by so doing.

The next name is that of Mr. H. Schneider, of Creusot. Most of you are aware that the social position of Mr. Schneider was sufficiently great some few years ago to cause his selection to fill the very responsible office of President of the Legislative Council of the Government in a neighboring country; but with this, of course, we have nothing to do. What recommends Mr. Schneider to our notice is not his social position, but the manner in which he has identified himself, to my own certain knowledge, for the last forty years with the advancement of the art of making iron in a neighboring country. The works with which Mr. Schneider is connected were founded by Messrs. Wilkinson and Manby. I forget the circumstances which led to the transference of those works to my friend Mr. Schneider; but suffice it to say that, under his direction and under his skilful management, they have grown to be, as many members here can testify, one of the most important establishments of that country.

The last name on the list is that of Mr. Krupp, of Essen. If we measure a man's merit by the extent of the operations he directs, and the rapidity with which those operations are carried into effect, I do not know that we could find a more signal instance of progression than that of Mr. Krupp, and we have thought it proper to recommend that Mr. Krupp, be added to the list of our honorary members."

The Eagle Wing Propeller.

An interesting report, by Mr. Richard H. Buel, on the Eagle Wing propeller will be found in our inside advertising columns. The results of that engineer's calculations are somewhat approximate, but they serve to show a high degree of efficiency in favor of the screw, inasmuch as he concludes that there is a gain effected of 20 per cent in power, and 22½ per cent in speed, as compared with a "true" screw tested under like circumstances. Further and more elaborate

investigations into these facts, especially in the light of fuller data, will soon be made, we are informed, by Judge Patterson, the inventor.

A SELF-LIGHTING GAS BURNER.—We have recently been shown a gas burner, which does away with the use of matches, and the dangerous practice of carrying lighted paper. Attached to the burner is a tube containing a slip of paper, on which are dots of fulminating composition. A hammer falls on one of these dots, igniting the fulminate. The hammer is operated by a spring and is controlled by the cock by which the gas is turned. An engraving of this convenient arrangement will be seen on reference to our advertising columns.

Recent American and Foreign Patents.

Improved Steam Trap.

James M. Meharge, Montreal, Canada, assignor to Richard Patton, of same place.—The invention consists of a hollow vessel balanced on a weighted lever, and connected with the boiler and a water-collecting receiver. A weighted steam valve of the vessel, with cross head at upper end of spindle, produces, by the rising and the falling of the vessel, the closing and opening of the valve, in connection with the stationary fork, so as to admit the steam and force the condensed water through the discharge pipe to the boiler.

Improved Umbrella Support.

Richard J. Welles, St. Joseph, Mo.—At the upper end of the stand is a socket which receives a head. The head is made in two parts, one of which is serrated, and is made to engage with the socket by screwing up a nut. A clamp clasp and holds the handle of the umbrella. By lowering the tightening nut the head will be loosened, and may be turned in any direction, and the staff of the umbrella will be released.

Improved Emery Grinding Machine.

E. William Gunn, New Woodstock, and George D. Wells and Harrison Wells, Erieville, N. Y.—This emery wheel machine, which is so constructed that the emery wheel may be turned into any position that the form of the work being ground may require without stopping the wheel or checking its speed. It expands and contracts as the band is twisted and straightened, and allows the bands to be readily slackened and tightened as may be required.

Improved Saw Set.

Robert J. Granville, Astoria, Oregon.—By this improved saw set the teeth may be alternately set in opposite direction, so that the operation may be finished by passing the instrument once along the saw. An operating main piece, with adjustable clamps and set screws, gives each tooth the exact degree of set required.

Improved Fastening for Tool Handles.

William M. Fisk, Lancaster, Pa.—This consists in a fastening bar having a button, to which a cap, having a chambered cavity, is applied and turned about one fourth of a revolution, and thereby fastened. It also consists of a spring in combination with the fastening bar to hold the cap in place.

Improved Lantern Handle.

Theodore James, North Adams, Mass.—A small block turns and slides freely upon a wire ring. Through a hole in the block is passed another ring, which is made with a small loop in its middle part, to prevent the block from sliding upon it. The block turns upon a wire ball, so as to enable the lantern to swing or oscillate without changing the position of the first ring. Upon the ends of the wire are formed hooks to hook into the lantern, and thus suspend it.

Improved Sash Fastener.

John Singer Wallace, Philadelphia, Pa.—This is an improved device by which the upper sash may be readily pulled down, and both sashes be locked securely, without interfering with the opening, closing, or cleaning of the window. The invention consists in suspending from a metal bracket, at the upper cross piece of the window, a stiff rod, which extends below the double cross piece of the sashes sufficiently far down to be used as a handle for lowering and closing the upper sash. This pendant rod is provided with a spring in the shape of an inverted umbrella spring, which locks over the lower sash. The rod swings like a pendulum in a metallic oblong socket attached to the upper cross piece of the lower sash, and may be taken out of the same through an open front recess, for being removed, while the unobstructed opening and closing of either sash are permitted by a side recess in the rear part of the socket, along which the spring is allowed to slide out.

Improved Device for Felling Trees.

Charles C. Curtis, Coos, N. H.—The object of this invention is to provide a device by which the felling of sawn or cut trees in any desired direction may be controlled, and the breaking of the saws prevented. The invention consists of a spiked pole of suitable length, that is applied to the tree and seated on an adjustable inclined piece that is hinged to a base frame, and raised to upset the tree by a suitable braced supporting collar and elevating mechanism.

Improved Lamp Extinguisher.

Milan Waterbury, Mason City, Iowa, assignor to himself and William H. Betts, of same place.—Should the lamp be upset, a ball will immediately be dislodged from its seat in a cup; and in falling its weight will draw a chain tight, and thereby pull a lever downward, which in its turn will cause the extinguisher to overlap the top of the wick tube, and thus immediately extinguish the lamp.

Improved Hitching Device for Straps.

Christian H. Bausch, Holyoke, Mass.—This invention relates to straps for hitching horses; and consists in a metallic slide or lock, through which the strap passes, and in which it is confined, the lock being adjusted to any desired position on the strap.

Improved Ash Sifter.

William Montgomery, Chicago, Ill.—To one side of the sifter are attached the edges of a semi-cylindrical plate, which passes through a hole in the screen, to form a spout, through which stones, slate, cinders, and other rubbish may be dropped into the ash box without raising the sifter.

Improved Cover for Beds, etc.

John Foster and William A. Weant, Salisbury, N. C.—The object of this invention is to furnish a convenient screen or cover for beds, cribs, tables, etc., for the purpose of excluding flies, mosquitoes, and other insects; and it consists of a cover of wire or thread netting having a pivoted movable section in combination with hinges which attach the same to the bed frame, and brackets which support the cover when raised integrally from the bed.

Improved Barrel Croze.

J. H. Morrison, Portsmouth, N. H.—The invention relates to the joints by which heads are secured in barrels intended to hold liquids, but especially beer. It consists in forming this joint of an iron form, so as to strengthen the edge of head and stave, thus preventing fracture or leakage from internal pressure or external percussion.

Inclined Guide Wheel for Locomotives and Railway Cars.

Turner H. Lane, Holly Springs, Miss.—The object of this invention is to increase the security and durability of the rolling stock of railways, by providing a means whereby the car wheels are prevented from leaving the track. It consists in the combination with the car wheel of an inclined guide wheel having a flange that rests against the under side of the top of the rail, the said guide wheel being contained in a detachable supporting frame, and provided with an elastic seat or cushion. The guide wheels may be located either between the wheels of the truck or upon one side, and may be either inside the track or outside.

Improved Railroad Crosstie.

Henry Reese, Baltimore, Md.—The object of this invention is to furnish at a minimum cost a practically indestructible and permanent crosstie for railroads, in place of those made of timber, which last but a few months, and whose removal is a source of great and never ending expense to the railroad corporations; and the invention consists in a T-iron crosstie, provided near each end with oppositely facing clips, between and beneath which the rails are placed and firmly fastened by wedges.

Improved Motive Power.

Henry Bolton, Brantford, Canada.—This invention relates to certain improvements in motors for driving sewing machines, etc., and it consists in a means for utilizing the power of a magazine spring through a secondary driving spring, the tension of which driving spring is relatively constant, and which said secondary spring is intermittently wound up by the magazine spring as fast as it spends its force, and while it is in operation; the two springs being so relatively constructed and arranged that the constant tension of the secondary spring is less than the weakest tension of the magazine spring at any stage of its operation, so that the magazine spring can always wind up the driving spring.

Improved Permutation Lock.

Mott B. Brooks, Brockville, Canada.—This invention relates to certain improvements in permutation locks. It consists in a semi-circular link having one end extended and pivoted in bearings in the case of the lock, and so arranged as to be drawn out and turned upon its pivots. The extended straight portion of the link is provided with a recess with which a transverse spring bolt is made to engage for the purpose of locking the link, and the transverse bolt is also provided with a recess with which a longitudinal bolt is made to engage for the purpose of locking the spring bolt. Upon said longitudinal bolt the permutating devices are arranged, which consist of three numbered rings, a clutch collar, and a disk, whereby an almost unlimited number of combinations may be had, and the device locked or unlocked by both an absolute and a relative key.

Improved Scaffold Clamp.

William C. Fellows, Toledo, O., assignor to himself and Charles Whittingham, of same place.—The bracket consists of a band which slips over the uprights, with a key fastened therein by a pin. The upper inner edge of the band is serrated to prevent the band from slipping on the upright. Confined by the bolt is an eccentric arm, in a recess of the key. Teeth penetrate the upright and secure the brackets. As the weight of crosstree and scaffold bears on the key, the band is cramped on the upright, the serrated edge penetrates the wood, and the arm, as the load is put upon the scaffold, works eccentrically on the pin, and increases the resistance.

Improved Process of Manufacturing Cider.

William H. Gilmore, Shiloh, Ohio.—This invention relates to the manufacture of artificial cider, and it consists in combining, with water, sugar, and tartaric or citric acid, a concentrated cider essence, which is obtained by freezing cider and drawing off the uncongealed alcoholic portions from the center. The said uncongealed alcoholic portions contain in solution all of the essential oils and flavoring essences which, being more volatile than water, are lost in cider concentrated by boiling.

Improved Tank for Retailing Coal Oil.

John H. Boardman, Baltimore, Md.—The object of this invention is to provide a case for coal oil barrels for retailing purposes; and it consists in a closed barrel case having one side of the lower part of it extended so as to form, with a portion of the drip tray, a closed dispensing tray with independent movable entrance thereto. The barrel is provided with a siphon and a bar for holding the same in place, and the drip tray has a trough which receives the leakage.

Improved Bill File.

Maurice Langhorne, Maysville, Ky.—This invention relates to certain improvements in bill files, and it consists in a sheet metal box having its sides cut away obliquely from the front to the rear for a part of the distance, and horizontally for the balance, so as to leave the front of the box flush with the top of the files, and yet allow the files, when pushed back against a spring, to be placed in such a position as to be readily inspected, the box being provided with a flange cover to protect the files from the damaging influences of weather and dust.

Improved Scroll Sawing Machine.

Charles N. Trump and Samuel N. Trump, Wilmington, Del.—A piece of metal is fitted to the shoulder of the arm of the machine by means of a set screw. The saw is driven by power applied by a friction wheel. The boring device is driven by the same friction wheel. A lever is connected with the arm piece, to which an eccentric is attached, which eccentric bears on the pin and throws the friction pulley in contact with the friction wheel. When the lever is thrown back, the pulley is drawn back from the wheel by the driving band of the boring bit. The saw rests against straight faces, so that, when the clamp is drawn up, its whole inner surface bears on and clamps the saw. The boring mandrel is supported on the arm of the saw by means of a bracket.

Improved Let-off Mechanism for Looms.

John Turner, of Lonsdale, R. I.—This consists of the yarn beam, geared by a system of reducing gears, and a pair of long cone pulleys and belt, with the cam shaft of the loom, with which there is a long, slowly revolving screw. The last gradually shifts the belt to increase the speed of the yarn beam in the proportion of the reduction of the size of the yarn roll, thus constituting a positive graduated let-off. For varying the delivery, to make the cloth more or less close, wheels of different sizes may be put in the reducing train; for instance, the wheel on the yarn beam, and the one gearing with it, may be removed and others put in their places.

Improved Car Brake.

Solon G. Howe, Detroit, Mich., assignor to himself and James W. Cheney, of same place.—This invention consists of double friction cones, which are placed on the axles and carried, by the action of a wedge ball on friction rollers, against corresponding double shells keyed fast to the axles. The friction cones are applied by the wedge ball, and released by spring braces, both being operated by intermediate rods and lever connection from the hand wheels at the ends of the car. The axle is lubricated through perforations in the center pins of the friction rollers, and the cones are secured in their regular position and motion on the axle by a stationary projecting pin of the axle entering annular grooves of the cone hubs. The spring braces are attached to the upper and lower part of each cone, and secured to their lever connecting rods by wedge shaped blocks with binding side ridges, by which the constant strain exerted on the cones, to withdraw them from the shells, is increased,

Business and Personal.

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Microscopes, from 50 cts. to \$500, for Scientific investigation and home amusement. Magnifying Glasses, Spy Glasses, Telescopes, and Lenses. Price List free. McAllister, M'Fg Optician, 49 Nassau St., New York.

Wanted—Situation as Engineer of Stations. Address N. C. Merriam, Leominster, Mass.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., 25 Whitney Avenue, New Haven Conn.

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A competent Civil Engineer is desirous of taking charge of the construction of Water Works. Address C. E. Lock Box 657, Poughkeepsie, N. Y.

For Sale by Geo. W. Grice, 426 Walnut St., Philadelphia, Pa.: One 2nd hand Dummy Engine, Cyl. 6x10, Gauge 4 ft. 5 1/2 in.; two 2nd hand Locomotives, 25 tons, Gauge 4 ft. 5 1/2 in.; one new Locomotive, 6 tons, Cyl. 6x10, Gauge 3 ft.; one new Locomotive, 10 tons, Cyl. 10x16, Gauge 3 feet 2 1/2 in.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

For Screw Cutting by hand or machine, use our adjustable dies. Work perfect on once going over, and each die good for 16,000 bolts. Wiley & Russell Manufacturing Company, Greenfield, Mass.

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Bolt Headers (both power and foot) and Power Hammers a specialty. Forsyth & Co., Manchester, N. H.

Lathes, screw-cutting, 24 H'd, for sale, good order. 2-10 ft. bed, 15 in. swing, each \$275; 1-9 ft. bed, 15 in. swing, \$240; 1-20 ft. bed, 25 in. swing, \$735; 1-12 ft. bed, 24 in. swing, \$125; 1-6 ft. bed, 15 in. swing, \$230. Also, 8 1/2 ft. bed, iron speed or drilling lathe, 18 in. swing, \$70; 1-15 ft. bed, double headed lathe, 20 in. swing, \$350. Crank planer, 14 in. stroke, 16 in. square 2 ft. bed, \$345. Forsyth & Co., Manchester, N. H.

Portable Engines, 24 H'd, in complete order, for sale. 25 h. p. Headley, \$1,475; 35 h. p. Headley, 1,600; 25 h. p., \$1,200; 5 h. p. Headley (19 h. p. boiler), \$600; 4 h. p. (with 6 h. p. boiler), \$250. Also, 50 h. p. "Chub-back" Upright Engine, \$1,300; 50 h. p. Horizontal Boiler, \$700; 15 h. p. Upright Boiler, \$225; 2 1/2 h. p. Boiler and Engine, \$200; 4 h. p. Engine, with 6 h. p. Boiler, upright, \$420. One 4 1/2 h. p. Bookwalter Portable Engine, \$240. Forsyth & Co., Manchester, N. H.

Wood-working Machines—new—for sale: 25 ft. Circular Saw Mill, with patent set works, \$400; Upright Bolt, Self-Setting, Shingle Mills and Joiners, \$300; Iron Frame Band Saws, \$150; 24 in. Rotary Bed Planer, \$300. 26 in. Double-belted, Rotary Bed Planers, \$350; Power Matchers, \$220; Box Board Matchers, \$60; Excelsior Machines (feed both ways), \$325; Swing Cut-off Saws, \$35 and \$60; Blind Slat Crimpers, \$50 and \$75; Sticking Machines, 3 heads, \$175; Emery Wheels, Circular Saws, Saw Gummers, Saw Tools of all kinds, Rubber and Leather Belting a specialty. Forsyth & Co., Manchester, N. H.

Wood-working and other Machinery, 24 H'd, for sale: 25 ft. Circular Saw Mill, set works, 48 in. Saw, Belts, and 70 ft. Drawing-in Rope—all \$280; 25 ft. Circular Saw Mill, with Lane set works, \$310; 5 ft. Whitney Turbine Water Wheel, \$400; Iron Felloe Machine, \$50; Shingle Sawing Machine and Joiner, \$75; Eureka Gang Lath Sawing Machine, 6 Saws, \$125; 41 in. Portable Grist Mill, Holmes & Blanchard, \$340; 25 in. Double-belted, Rotary Bed Planer, \$340; 22 in. Stationary Bed Planer, \$75; Daniel's Planer, wide bed, \$175; Iron Frame Blanchard Spoke Lathe, \$225; No. 2 Blake Steam Pump, \$110. Forsyth & Co., Manchester, N. H.

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The Baxter Steam Engine, 2 to 15 Horse Power. Simple, Safe, Durable, and Economical. "The Best are always the Cheapest." Over One Thousand in use, giving entire satisfaction. Address Wm. D. Russell, 15 Park Place, New York.

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Hydrant Hose Pipes and Screws, extra quality, very low. Send for prices. Bailey, Farrell & Co., Pittsburgh, Pa.

American Metal Co., 61 Warren St., N. Y. City. Grindstones, 2,000 tunstock. Mitchell, Phila., Pa.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price \$4, with good Battery. F. C. Beach & Co., 246 Canal St., New York, Makers. Send for free illustrated Catalogue.

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Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct. For Solid Wrought-Iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

All Fruit-can Tools, Ferracute W's, Bridgton, N. J.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Mechanical Expert in Patent Cases. T. D. Stetson, 25 Murray St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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Notes & Queries

C. G. V. D. B. will find full information as to the manufacture of bicarbonate of soda on p. 125, Science Record for 1875.—T. L. R. will find directions for tempering steel on p. 235, vol. 32.—J. M. L. and J. W. L. will find a full description of the paper process of stereotyping on p. 383, vol. 30.—J. T. H. will find directions for making clay crucibles on p. 230, vol. 32.—H. B. and many others should read Auchincloss on "Valve and Link Motions."—J. H. can transfer pictures to wood by the process described on p. 135, vol. 30. For method of transferring to glass, see p. 123, vol. 30.—A. B. will find an explanation of the floating iron mystery on p. 133, vol. 31.—J. G. will find a recipe for a hair stimulant on pp. 267, 363, vol. 31.—C. H. can polish walnut by the method described on p. 315, vol. 30.—J. P. A. will find a rule for finding the strength of cylinders on p. 186, vol. 32.—E. C. F.'s queries on water supply through pipes have been answered on p. 48, vol. 29.—H. E. N. will find a description of salicylic acid on p. 324, vol. 32.—W. R. B. can silver glass by the methods described on pp. 177, 268, 267, 331, vol. 31, and p. 234, vol. 30.—I. will find directions for painting boilers on p. 379, vol. 31.—J. H. M. will find directions for a black enamel on iron on p. 308, vol. 26.—J. H. J. will find directions for making a frost-proof pavement on p. 187, vol. 32.—J. M. W. will find a recipe for marking ink on p. 251, vol. 29.—A. B. will find directions for plastering a cistern on p. 203, vol. 32.—R. S. B. and many others are once more assured that there is no rule for ascertaining the horse power of a boiler.—H. B. will find full instructions as to lap, lead, and cut-off in our papers on "Practical Mechanism."—S. B. C. can make glass windows opaque by the method given on p. 264, vol. 30.—A. S. S. and G. F. D. must go at once to a physician, or to the clinic of a hospital.—C. D. J. can make white writing ink by following the directions on p. 75, vol. 31.—J. A. H. will find an explanation as to white being a color on p. 379, vol. 31.—S. B. will find a description of the madstone on p. 263, vol. 28. It is a vulgar superstition.—L. M. N. and T. H. G. will find a rule for determining the diameters of pulleys on pp. 26, 73, vol. 25.

(1) A. J. R. asks: What is the best plan of preventing dampness striking through a brick wall? A. You do not say whether the plastering is set off from the brick wall by upright wooden

strips, called furring. This should be done on all outside walls, and, if not now done, would most likely be a remedy in this case.

(2) J. B. Jr. says: It is proposed to put up a block of buildings one story high in front, two stories in the middle, and three stories in the rear, with separate chimneys to each section. Will the two story building, being higher, interfere with the draft in the flues of the one story building, and the three story building with that of the flues of the two story building? If so, what is the remedy? A. The probabilities are that the flues will not draw well three quarters of the time. The remedy is to build the third story of the same depth as the second, to draw the flues of the first story extension over to the rear wall of the second story, and carry the chimney shaft up against the said rear wall, topping out above the main roof of the building at the usual height above said roof.

(3) J. B. S. asks: What steel is used and how is it tempered, for making steel magnets? A. A very hard steel containing a high carbon percentage.

(4) T. C. N. asks: 1. What ingredients are used in the white glazing of cast iron pans? A. For enameling cast and wrought iron vessels, two compositions are in use; one has for its base silicate of lead, and the other boro-silicate of soda. One of these enamels is applied to the scoured surface of the metal in the form of a powder, which is fixed by heating to a sufficiently high temperature to fuse; it then spreads over and covers the metal with a vitreous varnish. The boro-silicate of soda possesses great superiority over the silicate of lead, for it is not attacked by vinegar, marine salt, or the greater number of acid or saline solutions, even when concentrated; and resists the action of agents used in cooking or chemical operations. The silicate of lead enamel is whiter and more homogeneous, which explains the preference given it by the public, but it gives up oxide of lead to vinegar or to common salt; it acts upon a great number of coloring matters, and it is attacked by nitric acid, which communicates a dull color to it. On evaporation the liquid leaves a white crystalline residue of nitrate of lead. This enamel is instantly darkened by dissolved sulphides, and also by cooking food containing sulphur, such as cabbage, fish, and eggs. 2. Can the same glaze be used on earthen tiles or other ware? A. Yes. 3. Can the glaze be colored green, blue, or yellow? A. To color the enamel green, mix with it before heating 1 to 2 parts oxide of chromium to 10 parts enamel. For blue, use prepared cobalt, red lead, niter, each 1 oz. For yellow, use lead and tin ashes, litharge, and antimony, each 1 oz., and niter 4 ozs. Gold and purple of Cassius are used for red and purple. For black, use calcined iron and cobalt, each 1 oz., or zaffre 2 ozs., manganese, 1 oz.

(5) S. C. D. asks: In blowpipe analysis what does the abbreviation B.B. mean? A. Before blowpipe. 2. What is ruddle? A. Ruddle is also called ruddle and red chalk. It is red ochre containing some clay.

(6) J. M. asks: 1. Will mercury evaporate if its surface is covered with water? A. It will not. 2. Can any one use an electro-coppered plate for the purpose of collecting gold from any composition which may contain it, without infringing on any patent right? A. Yes. 3. Can copper be coated with mercury without first being silver plated? A. Yes; clean the surface with a little sulphuric acid (dilute) and sand, rinse in clean water, dip in the mercury, and rub evenly over the surface with a brush. 4. Will an iron muffle answer in a furnace for the cupellation of silver in any form? A. An ordinary muffle is to be preferred.

(7) O. H. L. asks: How can I make a cylinder for compressing gas for the oxy-hydrogen light? Is there any special joint or seam, or any composition, in use for making the joint tight? A. These cylinders are made of boiler iron riveted together in the same manner as a steam boiler.

(8) S. T. asks: 1. How are magnetic fish made? A. See p. 218, vol. 32. 2. Is the paper of which they are made magnetized? A. No. What power of microscope is necessary for chemists' use, for examining blood corpuscles, etc.? A. Theoretically, the magnifying power of a lens bears a definite relation to its focal length; but practically this is not precisely the case, since the mechanical difficulties of grinding and fitting the component lenses produce slight variations in the focal distance, and, of course, in the power. A lens whose focal length is actually 1 1/2 of an inch, and its magnifying power, when arranged with an eyepiece as above, is about 45 diameters, may be sold as a one inch objective; or the error, as is more frequently the case, may be on the other side, so that the purchaser obtains, for the price of a 1 inch objective, a lens having an actual power, when combined, of 55 diameters. For the use of chemists, we would recommend a 3/4 inch object glass with an angular aperture of about 35°, magnifying, with the various eyepieces, from 75 to 450 diameters. For the use of physicians, a 1/2 inch object glass, with angular aperture of 100°, magnifying from 250 to 1,500 diameters, will be found most useful.

How can I make a sea green paint? A. The following will give a beautiful blue-green tint: Add to a solution of sulphate of copper a decoction of fustic, previously clarified by a solution of gelatin. To this mixture is then added 10 or 11 per cent of protochloride of tin, and lastly an excess of caustic potash. Wash and dry the precipitate.

What can I mix with common stable manure to make a good tobacco fertilizer? A. Lime, but ground bone is much better, or some reliable superphosphate of lime.

(9) C. A. K. asks: Is heat visible? A. Heat is a motion of the ultimate parts of a body, and is not visible.

(10) A. F. asks: What is the difference between ebonite and vulcanized india rubber? A. Ebonite is made by heating india rubber with half its weight of sulphur.

Is there any method of reducing tortoiseshell to a soft state, so that it could be easily molded? A. No.

(11) M. D. W. asks: 1. Can the same still that is used for distilling oil of peppermint be used for manufacturing sassafras oil? A. Yes, if well cleaned. 2. Is there any difference in the process? A. Very little. The peppermint oil generally requires rectification to render it bright and fine.

(12) J. J. KeK. says: My hair grows very low on my forehead, in fact it reaches my eyebrows and quite covers my temples, injuring my looks very much indeed. As I am a lady, I am vain enough to wish it removed, if it can be done without scarring my face. A. The following has been successfully used: Take sulphuret of calcium (fresh) and quicklime equal parts, reduce them separately to fine powder, mix, and keep the mixture in a well stopped bottle. When used, a portion is made into a paste with warm water, and immediately applied to the part, previously shaved close, a little starch being generally added in order to render the paste more manageable. It requires caution in its use. It should be applied to only a small surface at a time, and great care should be taken to prevent it from extending to the adjacent parts. The powder loses its properties unless entirely excluded from the air, and no liquid must be added until just before application, and then to no more than is required for immediate use.

(13) G. D. S. asks: Will Babbitt metal impart unhealthy properties to butter, when about 4 inches surface of the metal is in contact with about 4 gallons of cream? A. There would be some risk, especially if any souring took place.

(14) L. L. D. asks: Is it not good reasoning that, when an article is cut through with a saw, it ought to separate? Nevertheless, I have an article that I can honestly saw through ten times on the same line, and then band it back very nearly as strong as ever. A. We have frequently seen a similar result brought about by the proper use of magnetic force.

(15) A. McG. asks: What is the cheapest method of finding water in a light, loose sandy soil? A. Drive an iron pipe well.

(16) G. S. asks: How can I make laundry blue paper? A. Make a concentrated solution of indigo carmine, in which steep the paper desired to be coated, and evaporate the solution until the paper is coated with a heavy deposit of the coloring matter.

(17) J. G. H. asks: 1. What ingredient in the egg causes the spoon to be stained? A. Sulphur. 2. What chemical change takes place? A. A compound of sulphur in the albumen of the egg attacks the silver, forming a sulphide.

(18) C. D. P. F. asks: How can the steel on an engine be cleaned so as to look bright and burnished? A. Use fine emery paper.

(19) G. L. S. asks: Is there anything that can be used in making cologne that will make the perfume lasting? A. No.

(20) E. E. E. asks: 1. Should green apple wood for handles be cut into pieces the size of a handle, and let it dry before using, or would it be better to saw into boards and cut up when dry? A. The latter is best. Let the boards dry thoroughly before using. 2. How are light colored handles made black and polished to imitate ebony? A. See p. 299, vol. 30. 3. What is the usual way of polishing apple and other hard wood handles? A. See p. 72 vol. 28.

(21) C. E. C. asks: Is there any way in which the dates on coins can be made clearer? A. Carefully clean the coins with dilute nitric acid rinse with water, and polish.

(22) L. H. W. asks: How can I best remove a baked Japan surface from old sewing machines, in order to get a smoother surface for another coat of Japan? A. Use a steel scraper.

(23) G. S. R. asks: What size of cistern will it require to supply a school of about 75 pupils, collecting the rain water by spouting, about 80 feet of spouting being used? A. Make your cistern 6 feet in diameter in the clear on the inside, and about 5 feet deep below the crown. 2. Of what materials and shape should the cistern be? A. Build it of brick with 8 inch walls laid up in Rosendale cement mortar, and with brick bottom and crown. Make it circular. 3. How can I make the best filter? A. Partition off one third the space with a 4 inch brick partition; have small holes for the ingress of water at the bottom of this partition, and fill said one third space with a layer of gravel and clean coarse sand about 6 inches deep. Place on top of this a layer of charcoal about 3 inches thick, and then another layer of sand and gravel like the first. Let the water enter the cistern into the larger space, and be drawn from the smaller.

(24) H. A. M. asks: I intend to build an outdoor cellar of brick. Could I make it frost proof by having an eight inch wall outside and a four inch wall inside, with a four inch space between the walls, filled with dust from the bed of a charcoal pit? A. This would make a wall that should retain the warmth of the interior of the cellar; but care should be taken to bind the walls together to prevent their being thrown apart.

(25) J. V. says: I have just built a large fireplace 5 feet wide and 3 1/2 deep, opening about 6 feet high, in the basement of a building 2 1/2 stories high, connecting it with two flues about 8x8, in the room above, about 10 feet from top of fireplace. There is a good draft to both flues, but not enough to prevent the fireplace smoking terribly. How can I remedy it? A. If the flues are together, and it is practicable, you had better remove the dividing partition between them, and make them into one.

(26) D. J. F. asks: 1. How can I find the number of square inches on the face of a millstone or any other circle? A. (Radius in inches)² $\times 3.1416$ gives the area in square inches. 2. How can I find the number of square inches on the surface of a triangle? A. Half the height in inches $\times$ by the base in inches gives the area.

(27) W. W. N. says: I tempered springs made from Bessemer steel in oil at a very low heat, and then flashed them off. But most of them would set too much, and a very few were good. I tempered some in very cold running water, then dipped them in oil, and flashed them off. But most of them were too soft, some broke, and a few were good. There is a point of hardness and toughness that I am unable to hit. Can you suggest some pickle that will help me? A. If the springs set too much, do not continue the blazing so long, but dip them in water as soon as the blazing commences. If they are too hard after blazing, let them cool without dipping. Blaze them in a tank of oil placed over a fire.

(28) A. S. asks: Can a shaft be driven by a belt at an angle of 45° or any other than 90°, without the aid of a third pulley? A. Yes, by crowing the pulley and keeping the shaft in line.

(29) S. S. S. asks: 1. Is there anything better for house plants than clear water? A. Soapy water with a little ammonia is good. 2. Should the dust in the pots be loosened often? A. If it hardens on top, yes. 3. What kind of plants will blossom the most? A. Geraniums, calceolarias, and verbenas. 4. What kinds of plants are best for hanging baskets? A. Lobelias, musk, and ferns.

(30) H. R. asks: Is the motion of the valve uniformly the same in a locomotive engine and in a stationary engine? A. Yes, practically.

(31) F. G. says: In tempering steel, some mechanics use the lead bath. Is the molten lead in any way injurious to the steel? A. No.

(32) W. S. R. asks: Which is the best way to drill saw plate? A. Use a flat drill, and run slowly, with a little oil.

(33) G. W. L. asks: How can I harden files? A. Heat them to a red heat, and quench endways in salt and water.

(34) W. G. B. asks: How can I stick cloth on glass, so that it will hold firm, in order to sew it into an article? A. Try painting the glass with oil paint, letting it dry, and then using glue as a cement.

(35) W. B. asks: What is the best kind of pipe to connect a cistern with an iron pump where the water is to be used for drinking and cooking purposes? A. Use tin-lined lead pipe.

(36) W. F. M. asks: 1. I have almost completed a small steam engine, 1½ bore $\times$ 3 inches stroke, which I wish to run at a speed of about 200 revolutions per minute. I have made the steam ports $\frac{3}{8} \times \frac{3}{8}$, exhaust ports $\frac{1}{4} \times \frac{3}{8}$. I intend the fly wheel to weigh 10 lbs. The engine is a vertical link motion, so arranged that, by means of a lever and notched segment, I can cut it off at almost any point of the stroke. Will a $\frac{3}{4}$ inch tube be large enough to supply steam, and a $\frac{3}{8}$ one to exhaust it? A. Yes. 2. Will such an engine, working under a steam pressure of 20 or 30 lbs. per square inch, at the above-named number of revolutions, develop sufficient power to run a sewing machine? A. Yes. 3. If it is necessary to have a governor, will it answer to attach it to the cut-off lever and let it operate in that manner? A. A governor is not absolutely necessary. The method of attachment you mention would answer very well. 4. Will you be good enough to tell me what you think of the engine, as near as you can judge? A. Judging from your account, you have turned out a very creditable piece of work. 5. I never worked in any machine shop, nor attended any scientific school, but I have always had a great liking for machinery. I made all my drawings, patterns, etc., myself, as also the hand planer I use. From what I have written, do you think it advisable for me to enter a machine shop rather than any other business? A. It would be better for you to enter a good scientific school; but if you are determined and persevering, you can enter a machine shop, and get a good education out of shop hours.

(37) D. B. W. asks: What makes our gage, in very cold weather, show 60 or 70 lbs. pressure when there is no steam in the boiler? A. The gage must be frozen.

(38) M. C. says: I saw a notice in your paper about using zinc in steam boilers. I had a pipe to convey the feed water into a boiler some 25 feet long; it was gas pipe; and in about 12 months' use, it had many holes in it, some so round that they looked as if drilled. To stop them, I covered them with a sheet of zinc, and the next time that I cleaned the boiler I found many scales had left the tubes and shell, and were in the mud receiver. At the time, I did not know the reason; but seeing the account in your paper, I have continued the zinc until now, and only stop using it because my employer is afraid it will injure the boiler. Does it act on the iron injuriously? A. We do not think it will injure the boiler; and by keeping a careful watch, you can discover any corrosion, should it take place, before much harm is done.

(39) A. A. C. asks: What would be the proper length of a belt to drive a stone crusher? A. It depends on the distance between centers of pulleys, and will be a little less than the circumference of the driving pulley increased by twice the distance between centers.

(40) H. J. M. asks: Given a cistern 10 feet long $\times$ 10 feet wide $\times$ 10 feet high. What is the pressure on any one of the four sides, when full of water? A. The pressure is the area of the side, in square feet, multiplied by the distance of the center of gravity of the side below the surface in

feet, multiplied by the weight of a cubic foot of water in lbs.

(41) J. E. P. asks: Where can I get a book that tells about hunting and fishing? A. Address the publishers of "Rod and Gun," West Meriden, Conn.

(42) H. S. S. asks: What, if any, difference would there be in the power required to run a pulley with a given load and width of belt in the following three cases? (1) With a belt long enough to run loosely without slipping. (2) With a belt so much shorter as to require a tightener. (3) With a short belt stretched very tight. A. A general answer cannot be given to such a question. With narrow belts, there would be little, if any, difference in the three cases; but in the case of a wide and a thick belt, method No. 3 would probably give the most satisfactory results. We do not know of any work that treats specially of this subject; but we imagine many of our readers have information acquired by experience which they will be glad to impart, and which we shall be pleased to receive.

(43) J. A. W. asks: How can I put walrus hide on wooden polishing wheels, so that it will stay on? A. Use the best glue.

(44) L. W. asks: 1. Can I use a copper plate instead of platinum or silver in a Smee battery? A. No. 2. Will a galvanic pile, composed of 100 pairs of copper and zinc plates 1 inch square produce as heavy a shock as one of 100 pairs of 4 inch plates? A. Yes. 3. Will it produce a shock that can be felt by taking hold of the wire with the hands? A. Yes. 4. What is the best work on galvanic and frictional electricity? A. Noad's or De la Rive's are probably the most comprehensive published in English. 5. How can I make carbon for battery plates? A. See p. 186, vol. 32.

(45) E. L. G. asks: Can permanent steel magnets be magnetized so strongly that their power will not be increased by use? A. We think they can.

(46) S. asks: 1. How shall I proceed to silver plate lightly sheets of thin copper on one side? A. Cover the other side with wax. 2. Must I prepare a special battery, and how? A. Use Caland's or Daniell's battery. 4. Will the ordinary rolled sheet zinc of commerce answer to secure the negative action? A. It will answer for the positive plate. Use copper for the negative. 4. How shall I proceed to test a galvanic appliance to determine how many degrees it will deflect the magnetic needle? A. Connect the battery with a tangent galvanometer.

(47) B. D. asks: 1. Can a magneto-electric machine be made powerful enough to produce a two inch spark? A. Yes. 2. Is there any book explaining the construction of such machines? A. Yes, "Introduction to Chemical Physics," by J. R. Pyncheon.

(48) H. S. says: I put up 5 Tom Thumb batteries, and connected them by wires. By leading the current through a drop of water on a slate, the oxygen immediately rose in very small bubbles on the negative pole. After a short time a small blue lump appeared between the poles. By moving the wires to different places such lumps were formed at every place. What are they? I had well water to try it in. A. The lumps are blue oxide of copper. The bubbles which arose from the negative terminal were of hydrogen gas. Hydrogen, being electro-positive, is always drawn to the negative pole of the battery, as are all electro-positive metals, for the same reason. The oxygen of the water, united with the copper of the positive terminal, formed small lumps of blue oxide of copper, and for this reason the oxygen is classified as electro-negative.

(49) R. G. W., of Glasgow, Scotland, asks: How can I solder or otherwise join broken cast iron stove patterns? A. Use hydrochloric acid killed by zinc, and sal ammoniac for a flux.

(50) H. N. S. asks: How can I determine at what distance from the end of a stick of timber, of uniform size, a bar must be placed under it in order that three men, two taking hold of the bar and the third taking the other end of the stick, may carry the stick and each carry an equal share? A. Place the bar at $\frac{1}{4}$ the length of the stick from the end.

(51) H. H. asks: How can I true up paper cylinders? The cylinder is formed of disks of paper pressed together. A. Tools for turning wood will answer. Run your cylinder at a very high velocity.

(52) J. B. W. says: In answer to several inquiries concerning the strength of flues, you have replied: To determine the strength of any flue, made of good iron, well put together and perfectly cylindrical, divide 800,000 times the square of the thickness in inches by the product of the diameter in inches and the length in feet; but to K. K., who asked what would be the difference between the pressure necessary to explode a boiler from the inside, and that necessary to crush or flatten it from the outside, you say the internal pressure required to rupture it is the thickness in inches $\times$ tensile strength in lbs. per square inch $\div$ by the diameter in inches; while the external crushing force is 111,000 $\times$ (thickness in inches)² $\div$ by the diameter in inches $\times$ length in feet. Why do you use the unit 800,000 for the flue, and 111,000 for the shell when the cases are identical? In Roper's "Handbook of the Locomotive," I find that the unit is 800,000 $\div$ by square of the thickness in inches $\div$ by diameter in inches $\times$ the length in feet, and this sum $\times 3$. In the example given, the length of his flue is 10 feet; where does he get the 3 from, and why have you discarded the odd 300? A. The 111,000 should have been 800,000. In Roper's rule, he probably uses a factor of safety of 3, and so makes the flue 3 times as thick as it would require to be, if it were just strong enough to resist the pressure. Our rules had reference to the ultimate strength of the flue, and we would recommend the use of a factor of safety of 7 or 8.

(53) A. R. C. asks: I want to run an engine, 4 inches bore $\times$ 9 inches stroke, at 150 revolutions per minute, at 100 lbs. pressure. I will cut off when piston has traveled $\frac{1}{4}$ distance, or at 3 inches. I want to know what fire surface is necessary to keep up steam at that pressure. A. From 60 to 80 square feet.

(54) S. F. S. asks: Which is the most economical to carry, high or low water, in a boiler of the locomotive style? A. There is not a great deal of difference; but probably some of our readers have made experiments bearing on the subject, and, if so, we would be glad to hear from them.

(55) S. W. asks: Would a boiler 3 feet long $\times$ 1 foot in diameter be large enough for an engine of 4 inches stroke by 4 inches bore? A. No.

How long ought a person to be learning to be a good telegraph operator? A. A few weeks, if he is intelligent, and has a chance of learning in an office where much business is done.

(56) B. D. W. says: An engineer claims that the lead of an engine can be lengthened or shortened by turning the eccentric around on the shaft without touching the valve or connecting rod. I say it cannot be done without lengthening or shortening both ends of the valve. Which is right? A. The engineer.

(57) A. D. says: I am making a boiler of 12 pieces of 1 inch gas pipe, 12 inches long, connected at each end with Ts. Steam dome is 3 inches in diameter and 9 inches long. Grate surface is 8 inches square. All the pipes are exposed to the fire. Will the above be suitable for an engine 1½ inches in diameter $\times$ 2½ stroke? A. It is probably large enough, but you may have some difficulties in using it. We would be glad to hear from you again, after you get it done.

(58) J. B. says: I am building an engine 3 inches bore and 6 inches stroke. Will ports 2 inches long and $\frac{1}{4}$ inch wide be large enough to let the steam into the cylinder? A. Yes. 2. Will $\frac{1}{4}$ inch be large enough for the piston rod? A. Yes.

(59) E. G. C. says: 1. I am making a small upright boiler, 15 inches in diameter $\times$ 30 inches high, of $\frac{1}{8}$ inch iron, with heads $\frac{3}{4}$ of an inch thick, with flue 4 inches in diameter. What will be a safe pressure? A. About 100 lbs. per square inch. 2. What power from an engine, 1½ $\times$ 3 inches, would I get with 40 lbs. of steam, running at 100 feet per minute? A. Multiply pressure on piston by speed in feet per minute, and divide by 33,000.

(60) R. B. asks: How many horse power can be got from an engine of which the pulley is 32 inches and the belt is 9½ wide, running over a 20 inch pulley? The 32 inch pulley runs at 150. A. Under favorable circumstances, from 15 to 18 horse power.

(61) P. S. H. asks: Is the pressure the same in the steam chest as it is in the boiler? A. It is generally less, some pressure being lost by the steam in passing through the pipe, and some being required to give the steam the velocity of flow.

(62) R. H. M. says: I want to put an engine into a boat 28 feet long by 6 feet beam, drawing 1 foot or 15 inches of water. What horse power do I require to drive her at 6 or 8 miles an hour in still water? A. About 2 horse. 2. How large a screw and of what pitch will be required? A. Diameter, 28 to 30 inches; pitch, 3 to 3½ feet.

(63) J. F. asks: 1. Can the officers of a corporation of a town stop me from operating a steam engine within said town on the plea of danger from fire or any other cause? A. It depends entirely upon the local laws. 2. Can a steam boiler be supplied with water from a tank above it by a pipe running through upper shell of boiler to within an inch of lower shell by merely the force of water? A. Not unless the pressure of the column of water is greater than the steam pressure. Insert a steam pipe into the top of the tank, however, and you will have an arrangement similar to an equilibrium oil cup.

(64) S. N. M. says: To the questions lately asked by two of your correspondents, what is the force of the blow of a pile driver, and of a steam hammer of a given weight, falling a given distance, you reply that it can only be determined by experiment. You question whether the rule given in the books, that the "momentum of a falling body is equal to the weight multiplied by the velocity" will determine what weight, pressing steadily, will produce the same effect as the blow. By the rule, the momentum of 1 lb. falling 16½ feet is equal to 32½ lbs. I lately extemporized a simple, inexpensive apparatus. I took a small lever, of uniform size and density, and made a slight crease across the center of it; I balanced it on a dull knife edge in the crease and hung a weight of 32½ ozs. to one end; I kept the lever horizontal by a stop over it near the other end, and let drop a 1 oz. bullet just on to the end from a height of 16½ feet. It just sunk to end away from the stop, perhaps the $\frac{1}{16}$ of an inch. I next let drop a bullet about 2 dwts. lighter; it did not sink the lever away from the stop. Though my apparatus and experiment were necessarily somewhat imperfect, my result came so near the rule that I maintain that the rule does determine what weight, pressing steadily, will produce the same result as the blow.

(65) O. E. W. says, in reply to S. S.'s query as to cone pulleys: The offset from the size of the largest pulley in the treadle wheel must be the same as from the smallest cone to the second size of cone, and the offset from the second to the smallest size in treadle wheel must be the same as from the middle to the largest size in the cone.

(66) O. E. W. says, in reply to C. D., who speaks of water foaming and showing a boiler full of water, while in reality the boiler is nearly dry: This has been my experience. Our works having stood idle from February 30 to April 5, the scale in the boiler became loosened by successive freezing and thawing. It was then cleaned out and a boiler purge, composed of terra japonica, carbonate am-

monia, and soda, freely used. The result was foaming to such an extent that the water would show in every gage and to the top of the glass tube, and in the same minute would run down out of sight in the glass, with a steam pump working at its highest speed to fill the boiler. We use steam to heat dry house and factory, and to run the engine (20 horse power) and steam pump, and for several other purposes; but were obliged to shut off all except the engine and pump for an entire day.

(67) D. N. says, in reply to H. M. F., who asks for a method of determining the pitch line of a cog wheel, having the number of cogs and the pitch. A very simple rule is to multiply the number of cogs by number of thirty-second parts in the pitch, and point off the two right hand figures for decimals. For example: In a wheel of 2 inches pitch with 100 cogs, there are 64 thirty-seconds; then 100 $\times$ 64 = 6,400; or 85 cogs, 85 $\times$ 64 = 5,440 inches. Take any pitch, say $\frac{3}{4}$ and 25 cogs: 25 $\times$ 12 = 300 inches. This is the way that I have found the pitch line of wheels for the last 15 years, and it is perfect. The rule can be inverted and the number of cogs found if the diameter and pitch be given.

(68) O. E. W. says, in answer to E. R. C.'s query as to using lead pipe to convey steam: This should not be done if the pressure is more than 5 or 10 lbs. per square inch. I made an attempt to carry steam at a pressure of from 40 to 60 lbs. (underground), and the result was a reduction of the lead to a white paste or powder in a few weeks' time, and a consequent expansion and bursting of the pipe. I have found by many years' experience that lead in contact with steam under pressure of over 10 lbs. per square inch very soon loses its strength, and it is therefore good neither for packing joints nor conveying steam.

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

G. M. O.—Iron pyrites.—H. P. W.—It shows little particles of sulphuret of iron, but you must look farther if you suspect zinc or silver ore.—R. S. F.—It is a piece of ordinary spelter or cast zinc.—G. H. & J. S. C.—It is oxide of iron, with a large percentage of silica.—H. W. S.—It is not nitrate of potash; it is yellow magnesian limestone.—S. P.—It is brown hematite, an ore of iron extensively used.—T. H. R.—They are rock crystals or crystallized quartz.—H. W. B.—Iron pyrites.—B. E.—It is muscovite, or potash mica, containing about 10 per cent of potash. If spread upon the ground, it would decompose in the course of time, and the potash would be converted into a soluble form and would serve as a fertilizer to plants. It would be well to institute experiments of this kind with it. The other uses to which muscovite can be applied will be found in the *Science Record* for 1875, p. 157.—J. D. P.—The metal particles appear to be a sulphuret of some kind, probably pyrites. If you will send some of the metal free from the gangue, this can readily be determined. The amount sent was not sufficient for analysis.—C. G. O.—One of your specimens (from Yonkers, N. Y.) is beautifully white kaolin. The other contains a small amount of oxide of iron.—We have received specimens of porcelain clays of inferior quality from W. L., Central City, Col. Ter., and M. P. A., West Bloomfield, N. Y. The price depends largely on quality, etc. The purest is retailed in New York at 10 cents per lb.

S. L. G. asks: 1. Are violin tops and bottoms sawn thin and then bent? 2. Is there a block or anything of the kind inside the violin, to glue the neck to, or is the neck simply glued to the outside?—R. M. C. asks: How can I make blue marking ink, used by the express companies?—F. E. W. asks: Is there anything besides tin with which I can coat lead castings before covering them with vulcanized rubber?—T. C. H. says: I wish to run an engine of from 5 to 10 horse power in the smallest possible space. To do so I propose to use coke, with an apparatus for sprinkling small quantities of crude coal oil on the coke to increase the heat. Who can tell me of the results of this method?

COMMUNICATIONS RECEIVED.

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

On Drawing Ovals. By E. C. T.
On Light. By F. G. F.
On Criminal Entailments. By B. S. B.
On Chemical Elements. By W. T.
On Euclid, I, 47. By F. M. S.
On Curves in Nature. By E. C.

Also enquiries and answers from the following:

T. L. S.—O. P. S.—J. W. S.—P. O. H.—C. R.—W.—H. W. G.—X. Y. Z.—L. N. S.—J. S. L.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Whose is the best system of short hand? Who sells a book on the Turkish bath? Who sells works on chemistry? Where can I get a good microscope for laboratory use, and what will it cost?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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Granted in the Week ending

May 4, 1875,

AND EACH HEARING THAT DATE.

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DESIGNS PATENTED.

8,304.—VALISE LOCKS.—G. Bernheim, New York city.
8,305.—FANS.—G. S. Farwell, Boston, Mass.
8,306.—STAIR COVERS.—W. B. Gould, Montrose, N. J.
8,307.—FANS.—B. Hecht, New York city.
8,308.—TYPES.—H. Ihlenburg, Philadelphia, Pa.
8,309.—CLIPS FOR CARDS.—G. W. McGill, New York city.
8,310.—FANS.—E. W. Perry, Cincinnati, Ohio.
8,311.—HAT BOXES, ETC.—H. F. Reinecke, Jersey city, N. J.
8,312.—CUFF-BUTTONS.—L. S. Beals, Astoria, N. Y.
8,313.—TYPE.—J. M. Connor, Greenville, N. J.
8,314.—TYPE.—H. Ihlenburg, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,412.—WHISKY.—Adams & Taylor, Boston, Mass.
2,413.—GIN.—Adams & Taylor, Boston, Mass.
2,414.—WHISKY.—Adams & Taylor, Boston, Mass.
2,415.—GIN.—Adams & Taylor, Boston, Mass.
2,416.—WHISKY.—Adams & Taylor, Boston, Mass.
2,417.—GIN.—Adams, Blake & Taylor, Boston, Mass.
2,418.—SOAP.—J. P. Babcock & Co., Stonington, Conn.
2,419.—ESSENCE OF GINGER.—F. Brown, Philadelphia, Pa.
2,420.—LINTIMENT.—G. O. Clark, College Point, L. I., N. Y.
2,421.—LEAD.—Forest River Co., Salem, Mass.
2,422.—ALCOHOL.—U. H. Graves, Boston, Mass.
2,423.—GALVANIZED IRON.—McCullough Co., Philadelphia, Pa.
2,424.—MEDICINE.—J. Purley & Co., Atlanta, Ga.
2,425.—AXLE OIL.—C. C. Richmond, Boston, Mass.
2,426.—SODA WATER.—S. F. Bimes, Philadelphia, Pa.
2,427.—CARVINGS.—Sorrento Carving Co., Boston, Mass.
2,428.—OXYGEN WATER.—G. R. Starkey, Philadelphia, Pa.
2,429.—SEWING MACHINES.—Finkle et al, Mann. Co. Middletown, Conn.
2,430.—PAINTS, ETC.—D. F. Tiemann & Co., N. Y. city.
2,431.—SODA WATER APPARATUS.—J. W. Tufts, Medford Mass.
2,432.—COFFEE.—G. Boyd & Co., Philadelphia, Pa.
2,433.—BITTERS.—E. Brown & Co., Jersey city, N. J.
2,434.—COFFEE.—D. Focht & Co., Philadelphia, Pa.
2,435.—WOOLEN CLOTHS.—Middlesex Co., Lowell, Mass.
2,436.—CHAMPAGNE.—Mott et al, Epernay, France.
2,437.—LARD.—G. C. Napheys & Son, Philadelphia, Pa.
2,438.—MEDICINE.—J. R. Nichols & Co., Boston, Mass.
2,439.—OILS, ETC.—H. Phillips, New York city.
2,440.—MUSTARD, ETC.—Pinckney & Co., N. Y. city.

SCHEDULE OF PATENT FEES.

On each caveat.....\$10
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On filing each application for a Patent (17 years).....\$15
On issuing each original Patent.....\$20
On appeal to Examiners-in-Chief.....\$10
On appeal to Commissioner of Patents.....\$20
On application for Reissue.....\$30
On filing a Disclaimer.....\$10
On an application for Design (3½ years).....\$10
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On application for Design (14 years).....\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
APRIL 23 TO 29, 1875.

4,692.—A. Cummings, New York city, U. S. Screw.
April 28, 1875.
4,693.—E. Hill, Jr., South Norwalk, Conn., U. S. Lining
for cylinder. April 28, 1875.
4,694.—A. Mitchell, Wilkesbarre, Pa., U. S. Spark ar-
rester. April 28, 1875.
4,695.—J. J. Cobb, Grand Rapids, Mich., U. S. Sides
and wings for sleighs. April 28, 1875.
4,696.—R. Bentley, Owen Sound, Ont. Scantling roof.
April 28, 1875.
4,697.—J. E. Wisner, Friendship, N. Y., U. S. Fertil-
izer sower. April 28, 1875.
4,698.—C. R. Snyder, Minneapolis, Minn., U. S. Work
table. April 28, 1875.
4,699.—H. Behning et al., New York city, U. S. Name
board for pianos, etc. April 28, 1875.
4,700.—C. W. Jenks, Somerville, Mass., U. S. Shirt
bosom. April 28, 1875.
4,701.—C. Kennedy, Aurora, Ill., U. S. Wire fences.
April 28, 1875.
4,702.—P. Gendron, Toledo, O., U. S. Carriage wheel.
April 28, 1875.
4,703.—S. Morrell et al., Montreal, P. Q. Spring bed
bottom. April 28, 1875.
4,704.—J. Moulton, Ossipee, Conn., U. S., et al. Bark-
crossing machine. April 29, 1875.

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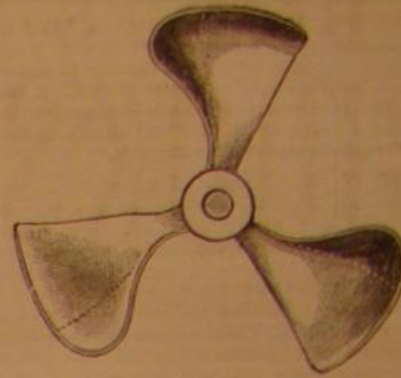
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(COPY.)

OFFICE OF RICHARD H. BUEL, Consulting
Mechanical Engineer, No. 80 Broadway,
New York, May 18, 1875.

N. A. PATTERSON, Esq.,
President Patterson Propeller Co., &c.
Sir: I present, herewith, the results of my calculations
in regard to the comparative performance of the Com-
mon Screw Propeller, and the "Eagle Wing" Propeller,
from data furnished by you.

The data referred are as follows:
The steam yacht of the New York Herald was originally
fitted with a propeller of constant pitch. This was re-
moved, and the "Eagle Wing" Propeller substituted.
The new wheel having the same diameter, (and about the
same) surface, and mean pitch as the former.

Before changing the propellers, a run was made from
the Battery to Hobbs' Reef Light House—about 4 miles
—and after the change, several runs were made over the
same distance. For the purpose of obtaining uniform
conditions, the run was made, in each case, 5 hours after
high water; and, the valve motion of the Engines was
adjusted, to admit steam for the same fraction of the
stroke— $\frac{1}{2}$ in each case. The conditions in regard to wind
were approximately the same in each run. The follow-
ing results of the runs were furnished to me:

1st. "True Screw".
Time of run, 19 minutes.
Revolutions per minute, 97.
Boiler Pressure, by Gauge, 55 lbs.
2nd. "EAGLE WING" PROPELLER:
Time of run, 15 minutes.
Revolutions per minute, 75.
Boiler Pressure, by Gauge, 55 lbs.
3rd. "EAGLE WING" PROPELLER:
Time of run, 15½ minutes.
Revolutions per minute, 80.
Boiler Pressure, by Gauge, 60 lbs.

It is required to determine the relative horse-power
developed by the engines in the cases cited above.

In order to calculate the relative horse-power exerted,
from the above data, it is assumed in the 1st and 2nd
cases that the mean effective pressure in the cylinder
was the same, so that the horse-power varied as the
number of revolutions per minute. To make a compar-
ison for the 3rd case, it is assumed that the clearance
space at each end of the cylinders is 5 percent of the piston
displacement; that the mean back pressure is 4 lbs.
per square inch; the mean total pressure in the cylin-
ders 9-10 as great as for a theoretical case where there is
no wire-drawing or exhaust lead; and that the loss of
pressure between the boilers and cylinders was practi-
cally the same in each case. While I am unable to verify
these assumptions, it is probable that they are approxi-
mately correct, and will give results which are not,
seriously, in error.

The results of the calculations will be found below:
I. For the same speed of vessel, the "Eagle Wing"
Propeller only required from 75 to 80 per cent as much
power as the "True Screw".

II. When the same power was used, the "Eagle
Wing" Propeller drove the vessel 22½ per cent faster
than it was propelled by the "True Screw".

These results are so interesting and important that it
seems desirable to confirm them by a series of tests in
which all the data necessary for a complete calculation
shall be determined by careful experiments.

Respectfully, RICHARD H. BUEL.

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