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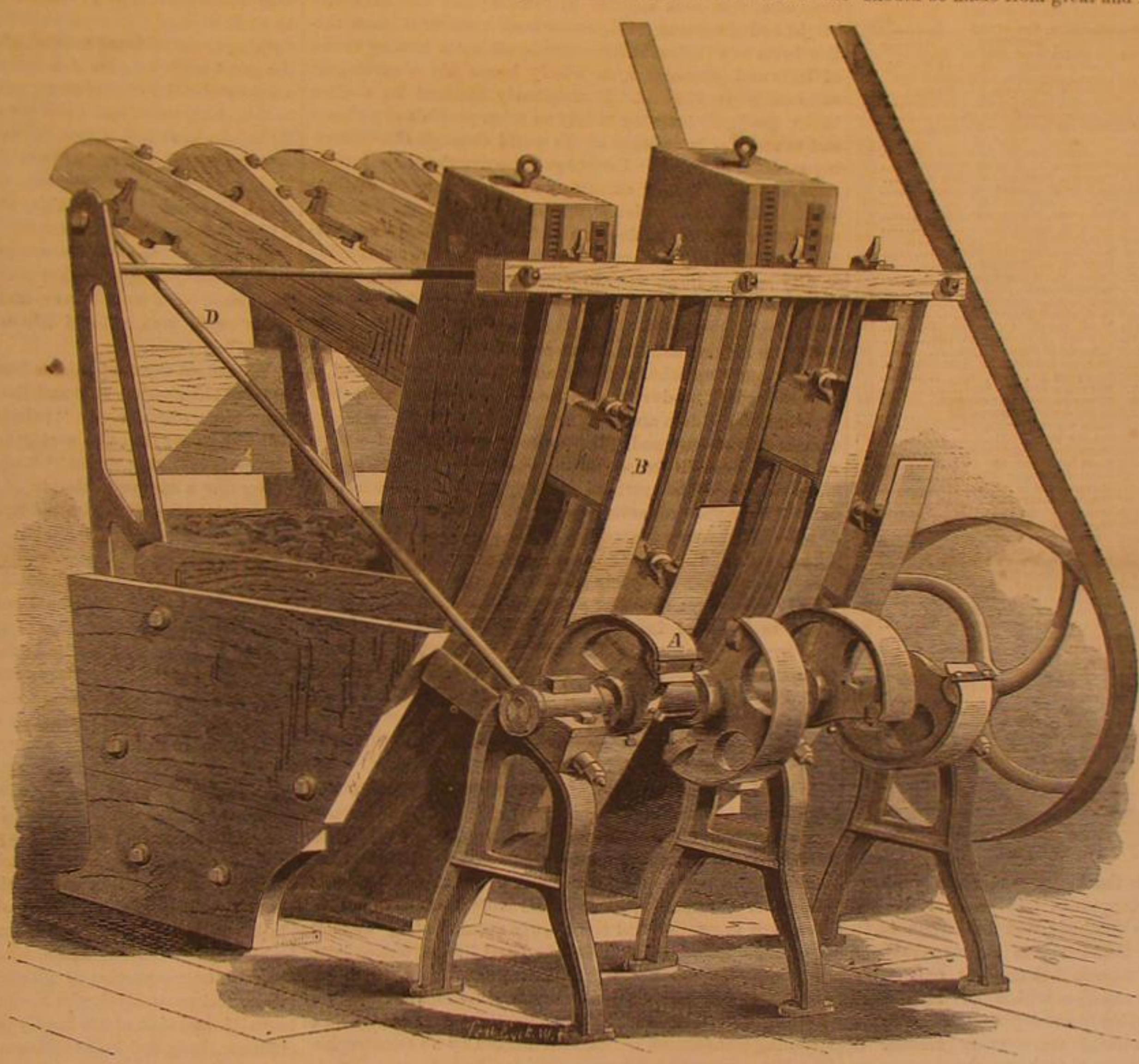
IMPROVED FULLING MILL.

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.



DRAPER'S FULLING MILL.

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 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 hights, he found to his surprise that several of the mountains exceeded 4,000 feet in hight.

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 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 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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NEW YORK, SATURDAY, MAY 22, 1875.

Contents.

(Illustrated articles are marked with an asterisk.)

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 conversatism, 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 redoing 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 corner-stone. 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 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, end 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 coraline limestone covers a period not incomputable, 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 tuns 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 girded 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 exigences 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 Nordenskjold will accompany it, and the start will be made from Tromsoe 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 afloat 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 hight 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 hight 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 hights 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 hight 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 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.

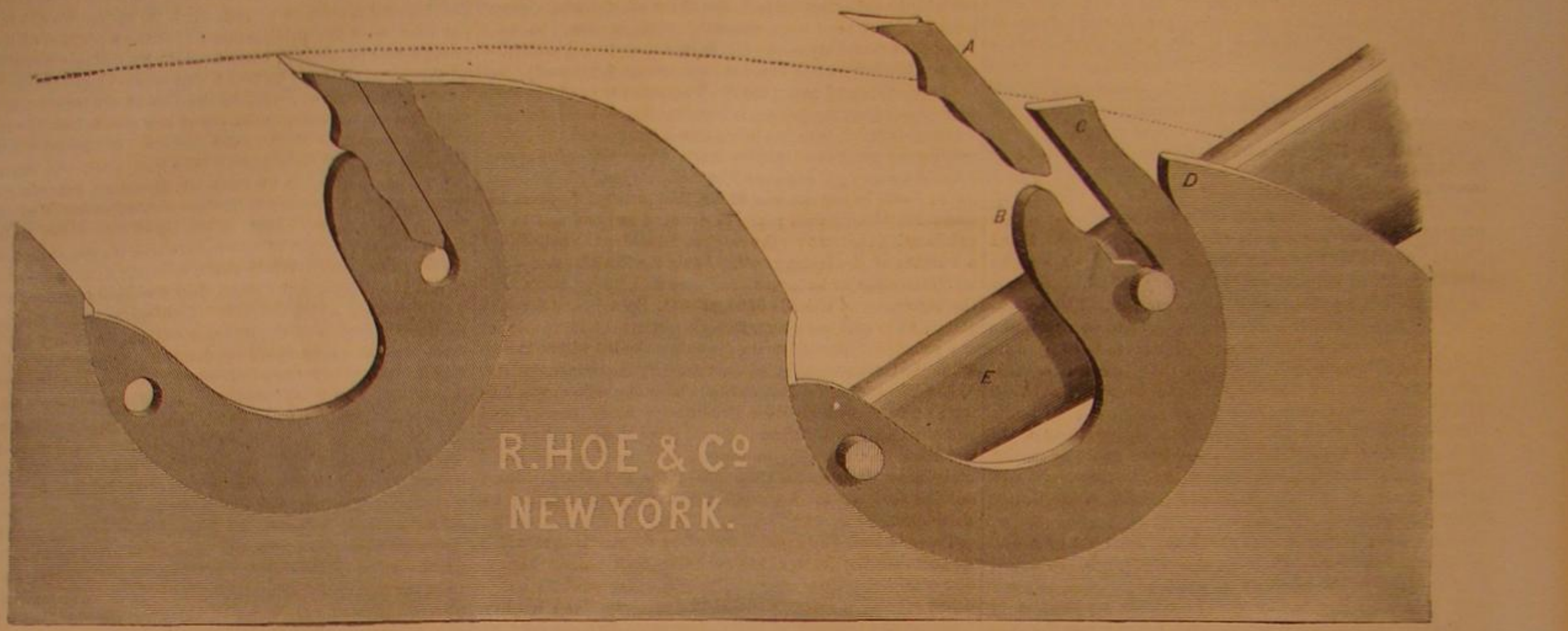
Again, he finds, by taking the mean of the velocities of wind in the four quadrants and comparing it with the storm's velocity, that, when the wind in the east quadrant has a greater average velocity than in the west, the storm moves faster than its mean rate, but slower when the wind's velocity in the 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 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.



HOE'S CHISEL TOOTH SAW

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, 3⅜; 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.

Fig. 1.

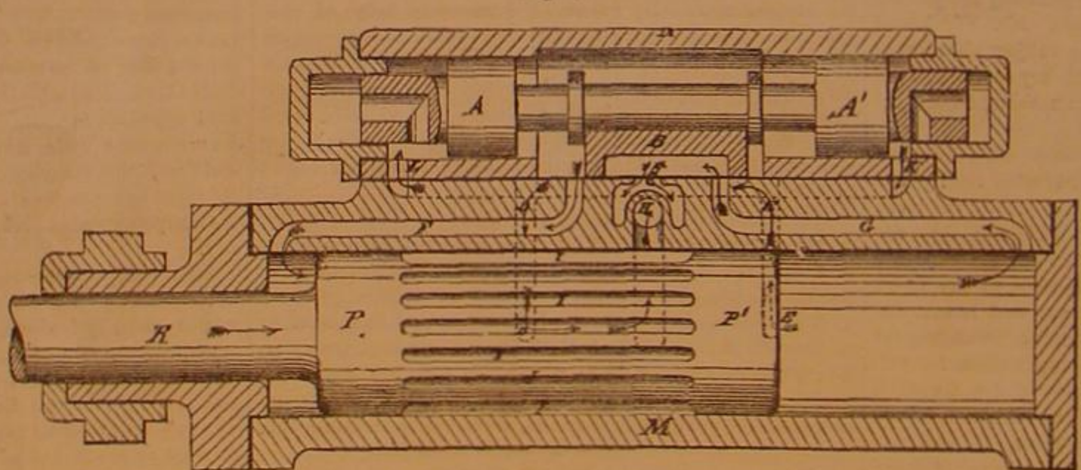
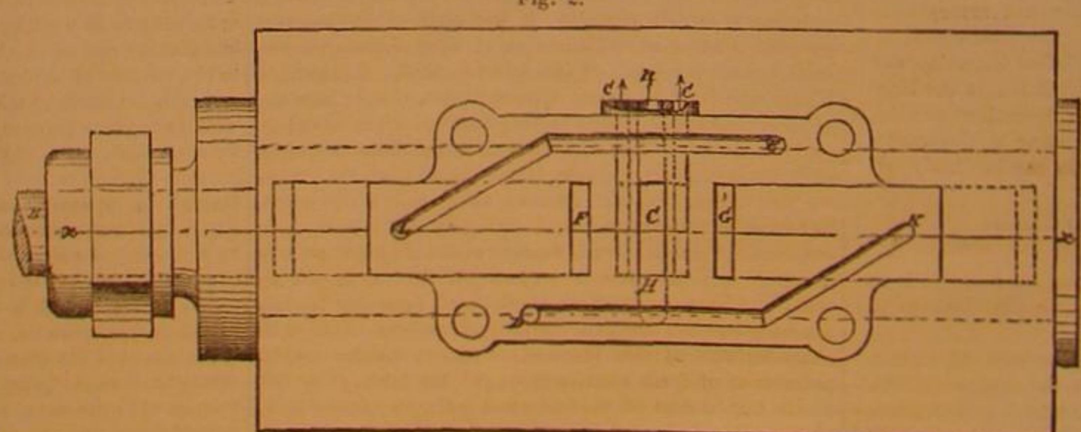


Fig. 2.



ENGINE VALVE MOTION.

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 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 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, 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.

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 0·0C039 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 (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.

IMPROVED ATTACHMENT FOR INJECTORS.

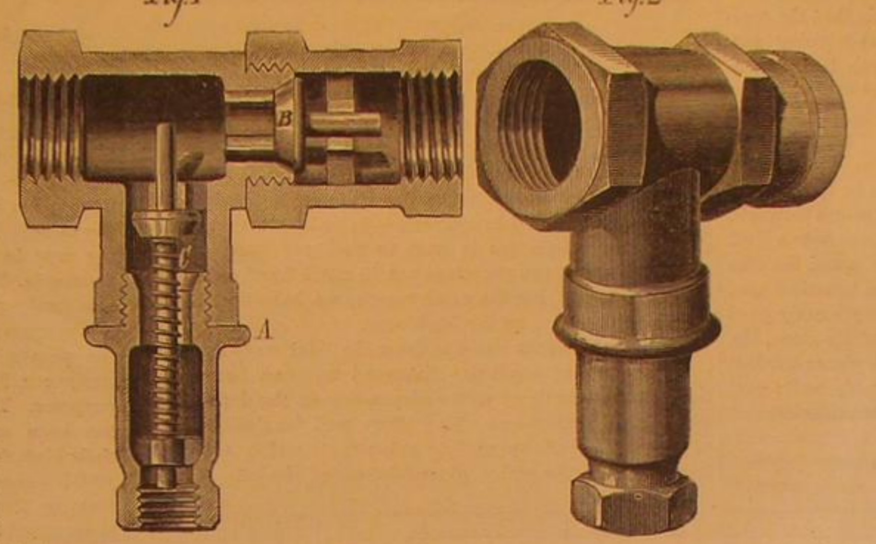
Injectors of almost any form are liable to uncertainty of action, after becoming heated; as, for example, when, after a stoppage, steam is let on to start the apparatus before it has cooled. There are other conditions, the inventor of the device below states, under which an injector is also likely to 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.

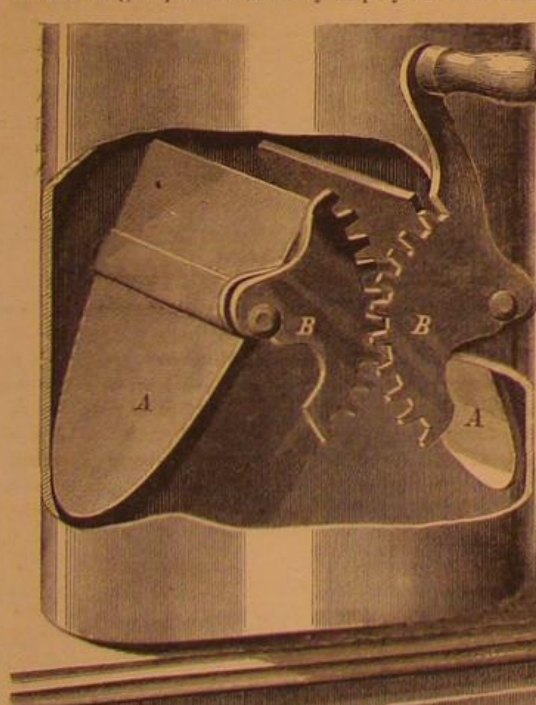
Fig. 1 Fig. 2



LEES' ATTACHMENT TO INJECTORS

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 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.

Light equal to — At beginning.	End.	Mean.	Surface of zinc employed.
109	66	87·5	318·61 square inches.
Carcel lamps.			

CHUTAUX BATTERY.

Light equal to — 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. (Light equal to)	CHUTAUX.
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	106 "	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."

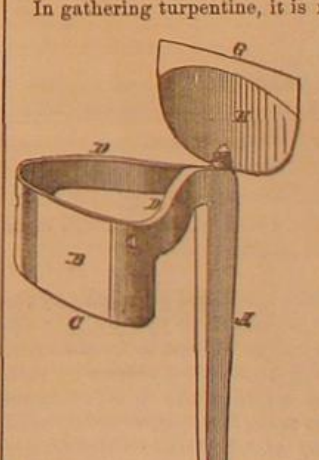
The woman staggered back a few paces and yelled: "Narcis! unfasten old Cronch!" In another instant a savage bulldog came darting round the corner of the house with bristles up, thirsting for gore. The dog had already mangled a machine agent and a patent soap man, and was held in great esteem by the better 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 buckshot 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 tuns. 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 wood workers generally

The saws were of a uniform diameter of 56 inches, and each was required to cut a poplar log, 20 × 20 inches, and an oak log, 16 × 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. Eye.	Gauge. Teeth.	Gauge. Kerf.	Size of Log.	No. of Boards.	Time.	Square feet of Lumber.	Horse Power Indicated.	Feed.	Perfect Boards.	Imperfect.	Square feet lumber per minute.	Per cent. of power used.
2. E. Andrews	Poplar	56	648	40	5	7	3	20x20	16	2.53	300	95.48	3½	..	16	105.8	.765
2. E. Andrews	Oak	56	660	40	5	7	3	16x16	12	2.05	176	111.98	2½	..	12	104.	.782
1. Hogan & Sowden	Poplar	56	600	42	7	11	7	20x20	16	2.50	300	100.68	2⅜	2	14	84 4	.592
3. I. W. Baldridge & Co	Poplar	56	640	48	8	9	4	20x20	16	2.53	300	99.23	2½	2	14	104.	.635
3. I. W. Baldridge & Co	Oak	56	690	48	8	9	4	16x16	12	2.03	176	118.62	2½	8	4	85.8	.906
4. American Saw Co	Poplar	56	634	40	6	8	3	20x20	16	2.31	300	104.95	3½	3	13	119.5	.576
4. American Saw Co	Oak	56	628	40	6	8	3	16x16	12	2.02	176	97.66	2½	6	6	86.5	.743
5. Emerson, Ford & Co	Poplar	56	615	50	6	7	3	20x20	16	2.44	300	120.16	3½	12	4	109.7	.718
5. Emerson, Ford & Co	Oak	56	610	50	6	7	3	16x16	12	1 43	176	121.63	3½	10	2	102.5	.778
6. Woodbridge & McParlin	Poplar	56	656	40	7	8	5	20x20	16	2.31	300	117.83	3½	2	14	91.3	.634
6. Woodbridge & McParlin	Oak	56	636	40	7	8	5	16x16	12	1.45	176	109.49	3⅝	1	11	71.8	.745
5. Emerson Planer Tooth	Poplar	56	590	34	7	8	3	20x20	16	3.17	300	112.89	2⅜	4	12	116.9	.843
5. Emerson Planer Tooth	Oak	56	632	34	7	8	3	16x16	12	2.27	176	114.24	2½	..	12	100.5	.1000
7. R. Hoe & Co., Solid Tooth	Poplar	56	519	36	5	8	2	20x20	16	2.09	300	112.18	4⅜	8	8	139.5	.527
7. R. Hoe & Co., Chisel Tooth	Poplar	56	605	36	5	7	2	20x20	16	2.45	300	114.73	3½	8	8	109.1	.689
7. R. Hoe & Co., Chisel Tooth	Oak	56	602	36	5	7	2	16x16	12	1.58	176	98.82	2⅜	12	..	90.	.720
8. James Ohlen	Poplar	56	634	30	6	7	3	20x20	16	2.53	300	102.5	4½	8	8	104.	.648
8. James Ohlen	Oak	56	638	30	6	7	3	16x16	12	1.59	176	112.12	3⅜	4	8	88.8	.850
9. Curtis & Co	Poplar	56	681	50	8	10	6	20x20	16	2.51	300	84.24	3½	..	16	105.2	.507
9. Curtis & Co	Oak	56	640	50	8	10	6	16x16	12	2.30	176	101.42	2½	2	10	70.4	.945

Correspondence.

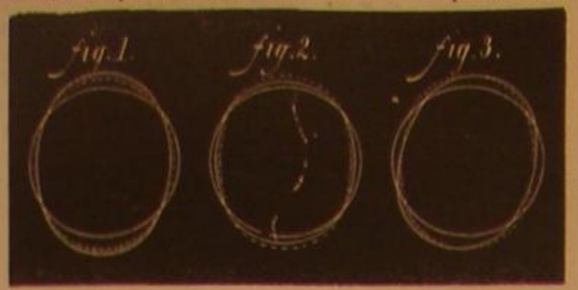
The Cause of the Tides.

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 hight 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 hight 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 hight 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. HUGO BILGRAM.

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 microscopical 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 inexhaustable. 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 tuns 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 Piriseux. 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.

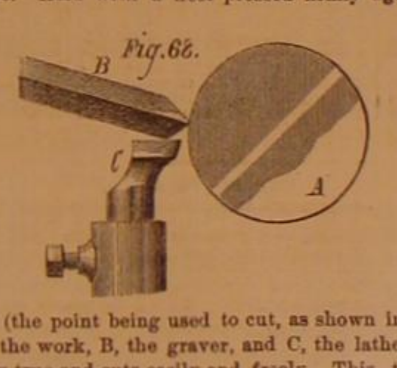
There are two methods employed by which to bed slide valves to their seats: one is to surface the flat face and the edges of the valve in a planer, and then to scrape up the flat face to fit the cylinder face, which has first been scraped up to a surface plate; and the other is to leave the planer tool 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 trued 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



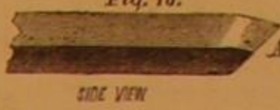
hand rest (the point being used to cut, as shown in Fig. 68, A being the work, B, the graver, and C, the lathe rest), it turns very true and cuts easily and freely. This, therefore, is the position in which it is held to rough out the work.

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.

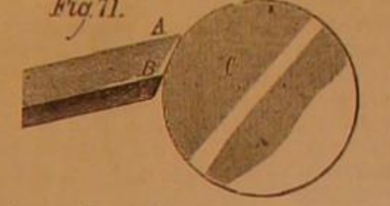
The handle in which the graver is held should be sufficiently long to enable the operator to grasp it with both hands and thus to hold it steadily, even though the work may run very much out of true. For use on wrought iron, the flat sides of the graver should not be ground upon the stone, the end only 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.



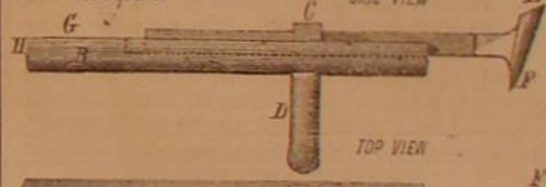
For use on brass and other soft metals, the two top flat sides of the graver should be ground away, as shown in Fig. 71, A being the cutting edge for that side. The strain on



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



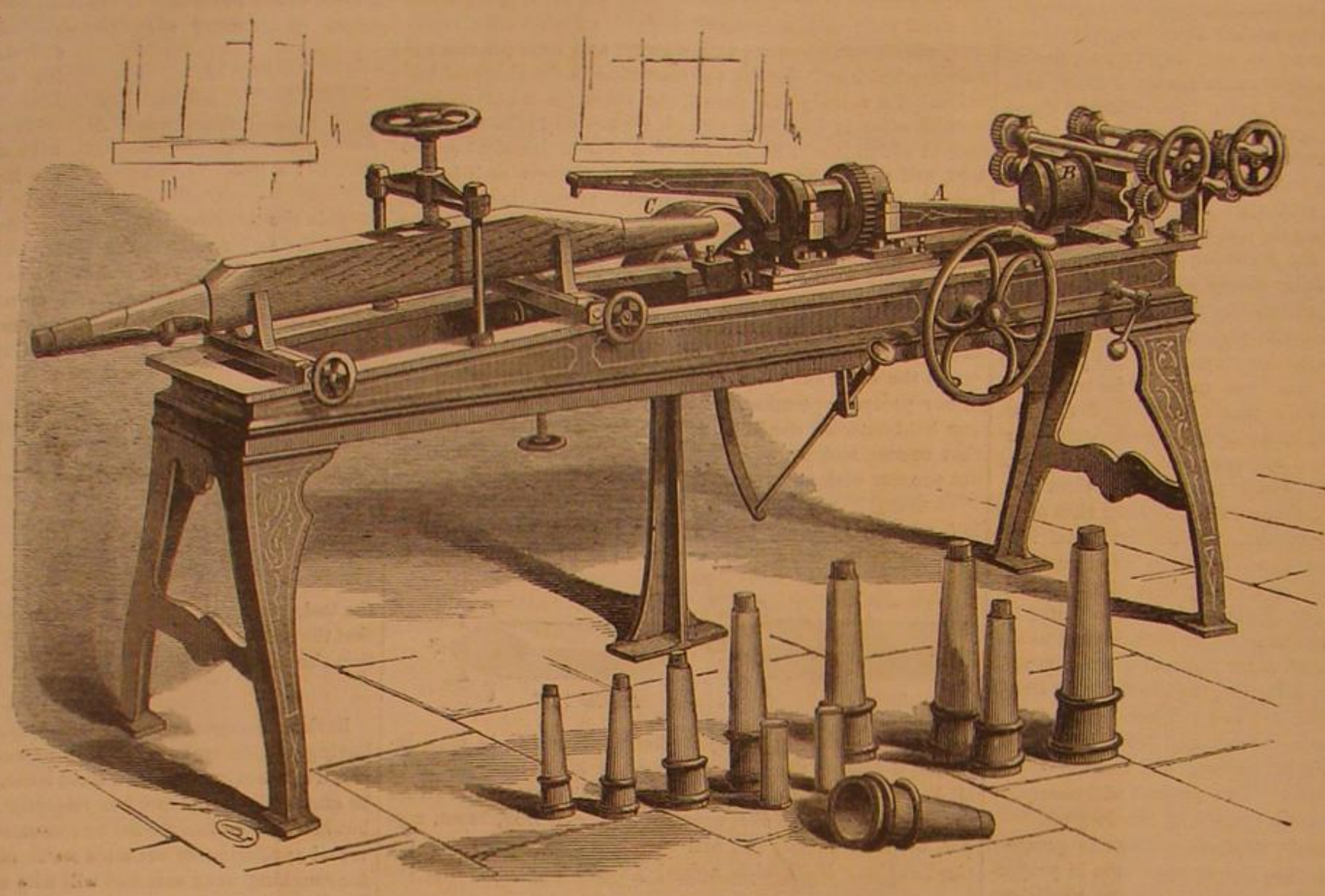
bar steel forged at the end to form the cutting edge. The body of the square part is held (in a groove formed in the wooden handle, B) by an iron strap, C, which is tightened by screwing up the under handle, D, which contains a nut into which the spindle of the strap, C, is screwed as the handle, D, 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.



IMPROVED SKEIN SETTING MACHINE

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 Foundery 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.

TOMPKINS' YARN SPOOLER.

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 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 current 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 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 applications 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 hillsides, 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 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 antennæ.

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 nitrate of silver 30 grains, common salt 30 grains, cream of tartar 3½ drachms. Mix, moisten with water, and apply.

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 develope 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.

METAMORPHOSES OF THE SCORPION FLY.

The larvæ 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 *sphingina* is in in many ways remarkable. Its specific title is derived from sphinx, and is attributable to a habit of the larvæ, 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 larvæ being very fond of the plant; and the pupæ 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.

LARVA OF THE DEATH'S HEAD MOTH.

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 distinct 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 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. 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 soirée 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.

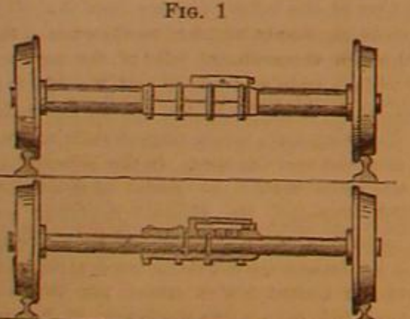
Mr. Willans' engine is constructed with three cylinders, and the only working parts are three pistons, three connecting rods, and a three-throw crank axle; these are enclosed in a cast iron casing, so that nothing can be seen of the engine itself except the two ends of the axle which appear through the 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 $\frac{5}{8}$ 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 $\frac{1}{4}$ 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,

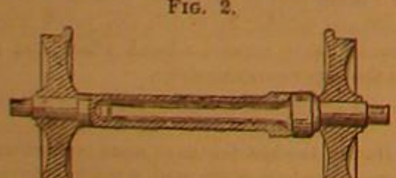
FIG. 1



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.

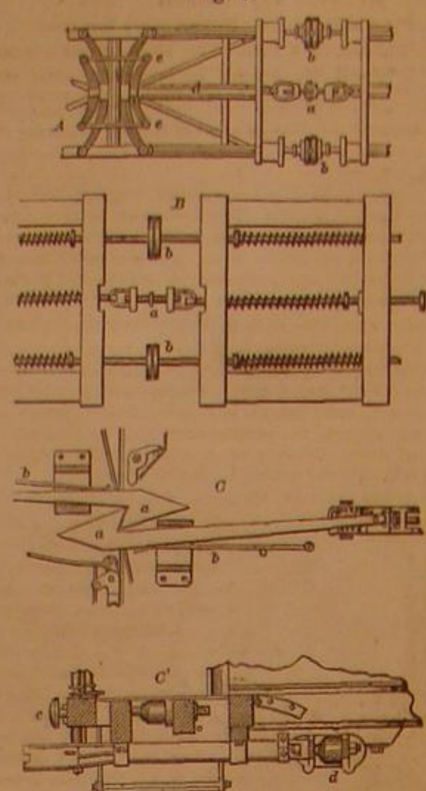


Hollow Divided-Axle.

is 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.

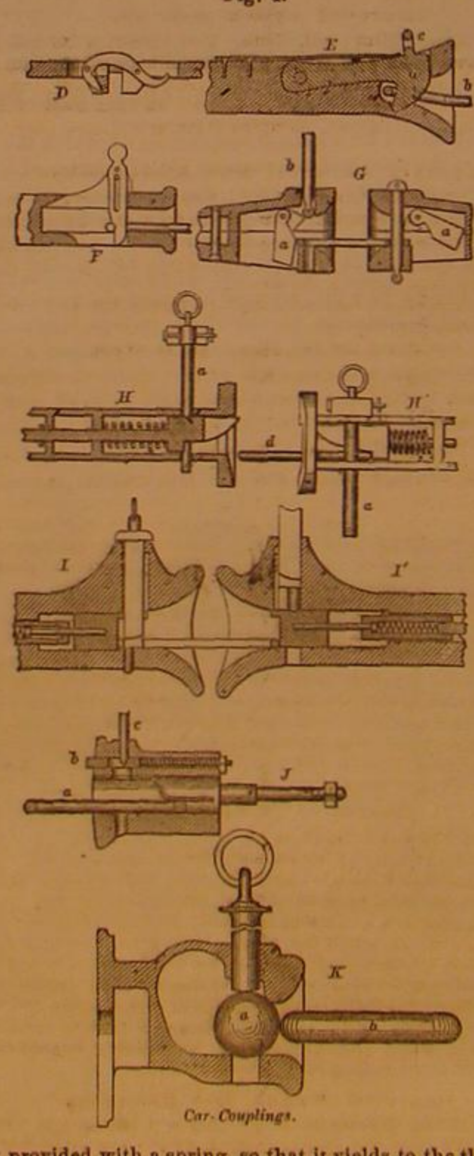


Car-Couplings.

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

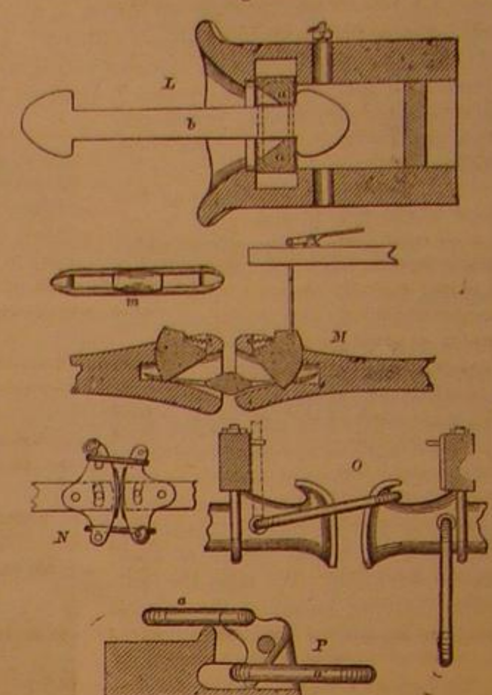
Fig. 4.



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 practicable, charcoal dust should be strewed 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 Felbinger 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 trunnioned 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 Hights, N. J., assignor to Charles Kohlmann, New York city.—This is a small lever plate, which is pivoted to the flap-binding 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 hook 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 spongeous 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 Weil, 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 undercu 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 Burrel 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 Reinbold, 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 car riage 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 Burrel Smith, Bastrop, La.—This invention relates to certain improvements in plows; and it consists in the peculiar construction of a subsoiling 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 subsoiler, lightens the draft, and enables the detachable device to be used in front of the plow for a coulter.

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.

Notes & Queries

J. G. B. ought not to remove the canceling ink from postage stamps, as it may lead to fraud. —G. S. can cleanse his iron for galvanizing by using the dip described on p. 107, vol. 31.—J. P. McC. can clean shells by following the directions on p. 122, vol. 27.—J. M. C. will find directions for casehardening on p. 202, vol. 31.—F. E. can deodorize butter by following the directions on p. 119, vol. 30.—F. W. K. can use rubber varnish for making waterproof cloth. See p. 11, vol. 32.—D. H. can separate silver from lead by the method described on p. 138, vol. 32.—G. M. will find a formula for thickness of a boiler on p. 155, vol. 32. Read Camus on the "Teeth of Wheels."—R. R. B. ought to know that no instrument can possibly point out where gold, silver, lead, etc., lie buried in the earth.—J. T. C. can dissolve pure rubber in benzine, naphtha, or carbon bisulphide.—D. can remove stains of iron rust from fabrics by the method given on p. 170, vol. 27.—H. B. can fasten leather to wood with marine glue. See p. 282, vol. 31.—J. A. W. can fasten chromos on thin canvas by following the directions on p. 91, vol. 31.—A. A. will find directions for separating aluminum on pp. 91, 116, vol. 32.—R. McA. can exterminate cockroaches by using the recipe on p. 43, vol. 31.—A. K. should consult Kü̈stel on the "Nevada and California Processes for Gold and Silver Extraction." —W. A. P. can galvanize his iron articles by the method described on p. 346, vol. 31.—I. G. will find a recipe for a hair stimulant on p. 363, vol. 31.—G. E. K. Jr. will find directions for making a black walnut stain on p. 90, vol. 32—G. C. H. can make window glass opaque by the method described on p. 264, vol. 30.—T. H. L. can utilize old rubber by the process described on p. 349, vol. 26.—J. S. F. can fill and polish his black walnut furniture by the method described on p. 315, vol. 30, and 347, vol. 31. —W. C. can render wood fireproof by the process detailed on p. 280, vol. 28.

(1) P. C. asks: What is the chemical reaction resulting from the adding of tartaric acid after bicarbonate of potash is added to butter? A. Carbonate of potash, being an alkali, neutralizes the lactic and butyric and other acids in the rancid butter, but the excess of alkali used has a burning taste. The tartaric acid added decomposes the potash salt, liberating carbonic acid, and the resulting tartrate of potash does not offend the sense of taste.

(2) S. R. asks: 1. For what particular purpose are lime and chalk used in the composition of soda glass? A. The addition of lime to glass diminishes its fusibility, while it increases its luster, but the addition of an excess of lime is apt to make the glass milky when cold, although it may be perfectly clear while hot. 2. What is the process that has been patented by a French gentleman for adding strength and elasticity to the glass? A. The agent of M. Bastie, the inventor, lately exhibited specimens of the glass at the office of the Scientific American, New York, and subjected the same successfully to the most remarkable tests. The process for treating the glass has not yet been made public.

(3) H. B. W. asks: How is rubber melted so that it can be run into molds? A. The rubber is simply rendered soft by passing between rollers heated by steam, in which state it is pressed into the molds.

(4) M. H. K. asks: What are the cheapest and best chemicals known, to be mixed together for use as a freezing mixture? To what degree Fah. will they descend, and what are the proper proportions to mix and use? A. One of the best, and one of the most economical, is the solution of sulphate of soda in commercial hydrochloric acid. Pour 5 parts of the acid upon 8 parts of the salt reduced to powder; the temperature may thus be reduced from 50° to 0°.

(5) G. E. K. Jr. asks: How can I remove oil stains from marble? A. First rub with benzine or turpentine, and then cover with powdered chalk or pipe clay and keep in a warm place for some time.

(6) E. M. D. asks: What kind of clay should I use to make crucibles? A. You do not state for what purpose you intend to use your crucibles. We cannot give definite directions unless we know. In order to render crucibles capable of withstanding great variation of temperature, several substances are used: sand, flint, fragments of old crucibles, black lead, and coke are used for this purpose. The most refractory crucibles are those 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 (½ 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, "buhr stone" or "burr stone?" A. Both are correct, but "buhr 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, 2½ inches deep and ½ inch thickness of the iron. The boiler pressure is 45 lbs. The pipe that connects with the heater is ⅝ of an inch in diameter, and is about 60 feet in length. The exhaust pipe is ½ 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 ⅛ 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 12½ lbs. weight hang to give 30 lbs. pressure on the square inch on a safety valve $1\frac{5}{16}$ inches in diameter, the valve being between the fulcrum and the ball, with its center 1⅝ 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, 4⅞ 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 36 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 hooks. 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 stern 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, 1½ inches wide, and ⅛ 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 gage showing 15 lbs., is the actual pressure upon the piston 15 lbs. to the square inch or 15 lbs.+14¾ (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: 1. I have an upright boiler, 30 inches high above firebox, 15 inches in diameter, with shell and heads of wrought iron ⅜ inch thick, with 40 flues each ¾ 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 1½ 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 2½ 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 slasher, 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 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 ⅓ of the hight. If A=area of lower base, a=area of upper base, and h=altitude, then solidity $=\frac{(A+a+\sqrt{Aa})\times h}{3}$. Applying the rule to the given example, solidity $=\frac{2.25+1+\sqrt{2.25\times 1}\times 20}{3}=31.66+$.

(39) A. W. asks: What horse power are we using with an engine, diameter of cylinder being 15¼ inches, stroke 32 inches, revolutions 73 per minute, average pressure throughout stroke being 46$\frac{1}{10}$ 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: 1. 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 ½ 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 disk 3 inches deep and 2 inches larger than the speculum. Suspend the speculum face downward in the liquid, which should rise ¼ 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. 208, 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. ½ inch focus, $\frac{3}{16}$ diameter, plane. 2. 1¼ inches focus, $\frac{11}{16}$ diameter, plane. A. Lenses ¾ inches apart. 2. Where should the diaphragm be placed, and of what size should the aperture be? A. Diaphragm aperture ⅝", distant ½ inch from eye lens at its inside focus. 3. What distance apart should the lenses for a terrestrial eyepiece be placed, their focal length and diameters being (1) 2 inches focus, $\frac{13}{16}$ diameter, plane; (2) 2¼ inches focus, $\frac{11}{16}$ diameter, double; (3) 2½ inches focus, 1¼ diameter, plane; (4) 1⅛ inches focus, $\frac{7}{16}$ 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 ⅜", 1·5" in front of D, also diaphragm aperture 0·23", 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 ¾ 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 ½ inch long? A. It would be better to use finer wire for the secondary coil, say No. 36 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 8x6 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. Foci: A=1·58"; B=2·38", C=2·65", D=1·50". Distances, 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 8¾ feet focus; Crown objective, outside radius, 76·896 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 $\frac{1}{32}$ 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 Prechtl'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 Prechtl, 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 power saw? 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 saleable.

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. R.—W. S. D.—P. B.—H. H.—C. C. M.—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. B.—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, 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: "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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8,272.—STOVES.—B. M. Anthony, Detroit, Mich.
8,273.—OIL CLOTHS.—J. Barrett, New York city.
8,274, 8,275.—BREASTPIN.—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. Vasseur, Wallingford, Conn.
8,283.—SPOONS, ETC.—C. Witteck, New York city.

TRADE MARKS REGISTERED.

2,383.—METAL CANS, ETC.—T. Burger, Plainfield, N. J.
2,384.—MEDICINE.—E. R. Burnham, Chicago, Ill.
2,385.—SOAP.—W. Conway, Philadelphia, Pa.
2,386.—MEDICINE.—W. M. Clarke & Co., Boston, Mass
2,387.—SHIRTS.—E. Jennings & Co., Chicago, Ill.
2,388.—WATCH MOVEMENTS.—L. & M. Kahn, N. Y. city
2,389.—LARD.—A. & J. M. Moses, New York city.
2,390.—LARD.—G. C. Napheys & Son, Philadelphia, Pa.
2,391.—PETROLEUM.—Power & Co., London, Eng., *et al.*
2,392.—MEDICINE.—J. H. Ruttley, San Francisco, Cal.
2,393.—JAMS, ETC.—P. J. Ritter, Philadelphia, Pa.
2,394 to 2,397.—TOBACCO.—J. Sarrazin, 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 *et 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.—RASPS AND FILES.—Heller *et al.*, Newark, N. J
2,406.—SOAP.—Lincoln M'f'g Co., Providence, R. I.
2,407.—GLOVES, ETC.—Passavant & Co., New York city
2,408.—TOYS.—R. Jenkins, Brooklyn, N. Y.
2,409.—CORSETS.—S. Kleinberger, New York city.
2,410.—FISH.—Eagle Fish Co., New York city.

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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, Gananogue, Ont. Fence corner April 17, 1875.
4,649.—B. Sloper, Montreal, P. Q. Hydrogen generator and carbureter 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. Rydbeck, 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.*, Brampton, 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. Wanchope, Niddrie, Scotland *et al.* Gas manufacture. April 21, 1875.

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