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HOT DRAFTS FOR STEAM BOILER FURNACES.

If cold air be injected into a furnace, it absorbs a large quantity of heat by its great increase of volume by the heat of the furnace; but if the draft be admitted hot, then it is already expanded to a degree corresponding to its increased temperature, and consequently it abstracts a less quantity of heat from the ignited fuel. A saving of fuel, it is evident, may thus be effected in proportion as the temperature of the air is the complement of that in the furnace, provided such air be warmed by the waste heat of the furnace itself. The percentage of fuel gained in each case depends on the degree of temperature of the draft as compared with that of the furnace; in other words, for example, if the heat in the fire box be 2,000°, and that of the alimentary air 300°, then a saving of 25 per cent will be realized. These facts underlie the widespread employment of the hot blast in metallurgical operations. It is the object of the inventor, in the device herewith illustrated, to apply the same, by simple arrangements, to the steam boiler (and in so doing to utilize the heat which is radiated, from the generators as ordinarily set, and so lost, or serves only to render the fire room uncomfortable) to heat the incoming draft. This he does by conducting the air, through suitable compartments, to the boiler setting, and ultimately through orifices under the grate. No modifications of the boiler itself or of the fire box are required, and the system is applicable to any type of generator.

A is the bonnet or outer shell, in the rear upper portion of which is the opening, B, into which the air enters to the chamber formed between said shell and the upper part of the boiler, or the brickwork covering the latter, if the top be arched over. Directly beneath the boiler, in rear of the fire box and in the masonry, are formed transverse flues, C, which open at each end into longitudinal flues, D. These last are simply passages in the bed brickwork at each side, the bottoms of which shelve downward until their outer ends are nearly on a level with the ash pit floor, and finally communicating with the ash pit, as above stated, by suitable orifices a little below the grate.

It will be seen that the chamber, B, and the flues, C and D, are practically one compartment, in which the heat radiated from the boiler, from all sides, is confined by the shell, A. As the air which passes up through the grate traverses the boiler and makes its exit from the chimney in the ordinary way, it is obvious that there will be a constant current entering at B, and having its course as already described, and that said current, through its contact with a large area of hot surface, must become heated to a considerable degree. It may be further noted that this modification of the setting necessitates no change in the ordinary practice of starting fires, as, while the single door which closes both fire box and ash pit is open, the draft will be taken from the outside as usual. The moment, however, the door is closed, the hot draft is established, and, save for supplying fuel or cleaning, there is no need of opening the door while steam is up, as the fire can be easily governed by a damper on the air supply orifice, B. The immediate result is a cool fire room, since but little heat can be radiated into the apartment.

We are informed that thirty boilers have already been set after the plan of this invention, and the testimonials of several well known concerns using them indicate a saving of one third the fuel previously employed. One firm asserts that it uses 4,000 lbs. less of coal per week in a boiler thus set than in a precisely similar generator, placed directly beside the former, but set in the ordinary manner. Other writers bear witness to a similarly large economy. Judging from the general construction of the invention, its application to the boiler need not be costly, since it consists principally of simple changes in the masonry; while its value to all steam

users, if the testimonials above mentioned may be credited, must necessarily be great. The advantage offered of a cool fire room is likewise of especial importance on sea-going steamers, and particularly so upon ironclads of the Monitor type, where the heat is often extremely oppressive and the ventilation inadequate. The invention, we are informed, may be adapted to locomotives, thus utilizing the large amount of heat which is radiated from the boilers, however well they may be felted and lagged.

Patented November 11, 1873. Reissue now pending through

pound allowed to cool. In ten or twelve hours, it becomes sufficiently hard to receive a brilliant polish and to scratch the surface of tin or gold. When heated it is plastic, but does not contract on cooling.

A New Use of the Sand Blast.

The producing, upon plated ware or silver, of a lusterless very finely grained surface, termed by the trade satin finish, has heretofore been accomplished by the use of swiftly rotating brushes made of fine wire. Messrs. Simpson, Hull, & Co., of Wallingford, Conn., have recently found that the sand blast performs this stippling work much more rapidly and effectually, and have introduced the necessary apparatus for its employment in their large silver-plate manufacturing establishment. From Mr. W. E. Hawkins, a gentleman connected with the above concern, we learn that air is compressed by the driving engine of the works into an ordinary reservoir, and thence distributed through pipes which extend along the front of the workmen's tables; and above the latter is a sand receptacle, V-shaped, from which a stream of sand falls, and is met by a downward blast from the pipe, which current drives the material in a stream through a small hole in the table, beneath which a receptacle to receive the sand is placed. The workman, whose fingers are covered with rubber to protect them, holds the article in the jet and

under the table, watching it through a pane of glass let into the top of the latter. The operation is necessarily very rapid, as the article has only to be turned so that the blast strikes the required portions, when the work is completed.

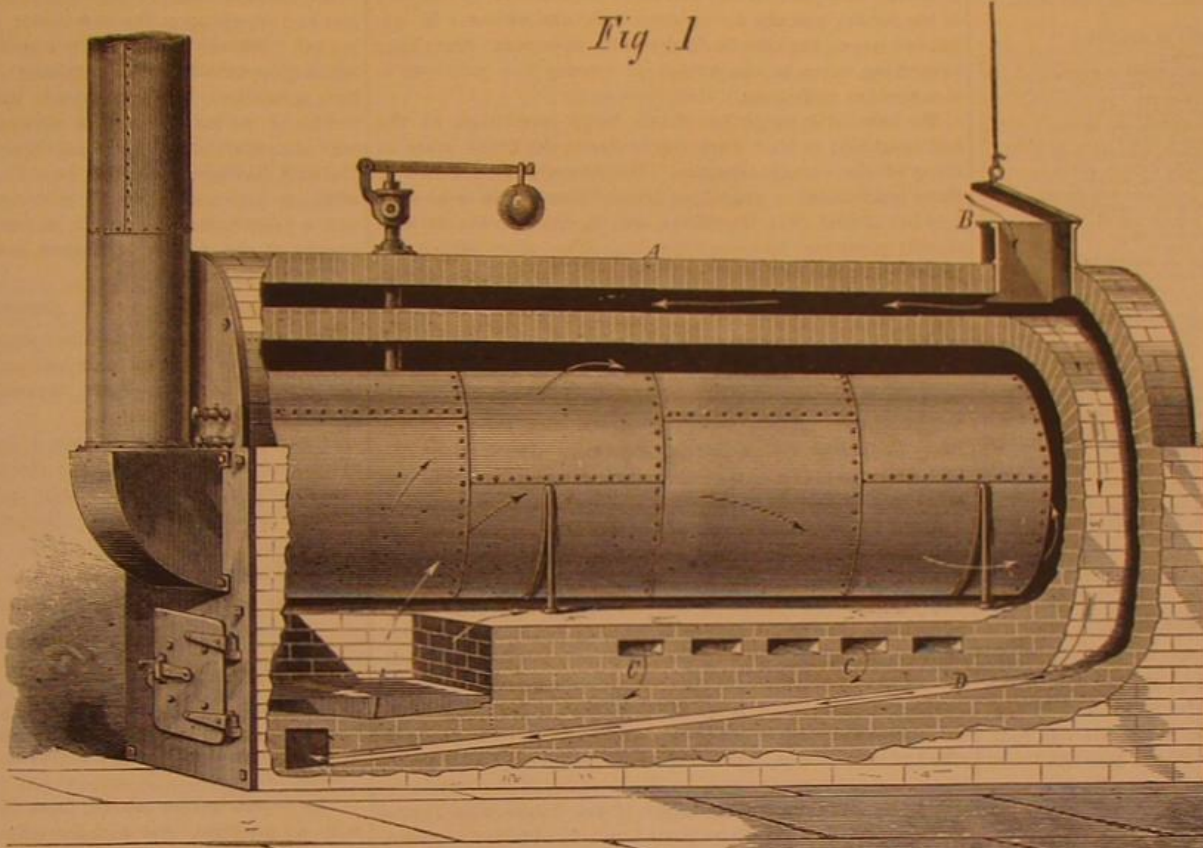
The exposure to the jet, even for an instant, would cut through the Britannia, upon which the plating is afterward deposited. By the interposition of rubber screens of suitable shape, against which the sand has no abrading effect, any fancy patterns or letters are easily imprinted on the surface, the latter of course being satin-finished, while the spaces protected by the screens are afterwards burnished. The screens or patterns are cut out by girls, of whom numbers are employed for that purpose.

Twisting Iron by Electricity.

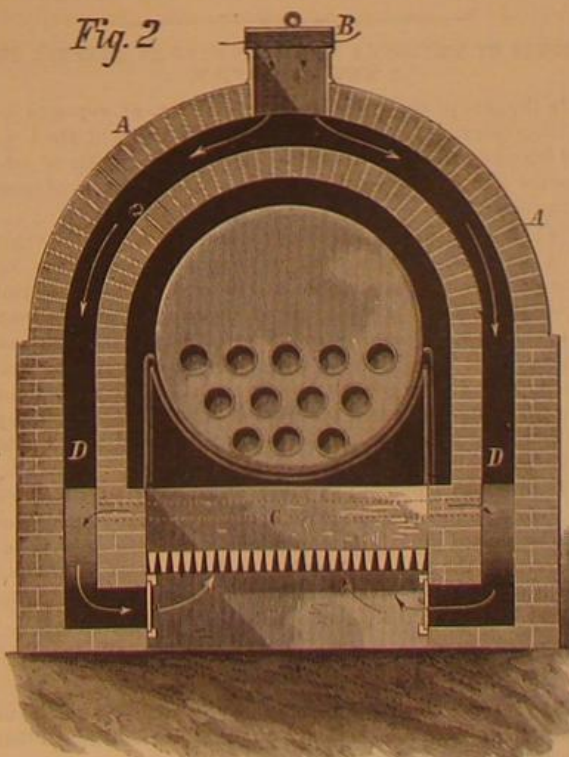
The remarkable phenomenon, first observed by Professor Gore, which consists in the very perceptible twisting of a bar of iron by the joint effects of currents of electricity passing longitudinally through and also around such a bar by means of the insulated wire of an enveloping helix, has been further investigated. Subsequent experiments have shown that such twisting may be made to reach fully one quarter of a revolution. It has also been ascertained that both currents are necessary to the development of the phenomena. Either current, when applied separately, simply produces the effects of magnetizing the bar. The direction of the twist is definitely related to the direction of the current in the helix. In order to produce the fullest effect, the currents must be simultaneous. When they are successive, a perceptible twist results in a lesser degree.

BENDING HEAVY IRON.—It is now possible, by the aid of hydraulic machinery, to bend iron shafts of 12 inches in diameter to any desired shape. Incredible as this statement may seem to some, crank shafts are now so made, instead of by the slow, laborious, and expensive method of forging. The bent shafts are also said to be much better than forged ones, from the fact that the fiber of the metal runs in one direction continuously, whereas in forged one it is often across the line strain.

IRON IN THE CENTENNIAL BUILDINGS.—The quantity of iron to be used in the construction of the Centennial buildings will aggregate about 6,000 tons, of which more than five sixths will be wrought



KEYES' IMPROVEMENT IN STEAM BOILER SETTING.



the Scientific American Patent Agency. For further particulars, address the patentee, Mr. Samuel Keyes, Bennington, Vt.

Copper Alloy that will Adhere to Glass.

The following alloy of copper will attach itself firmly to surfaces of metal, glass, or porcelain: Twenty to thirty parts of finely blended copper (made by reduction of oxide of copper with hydrogen or precipitation from solution of its sulphate with zinc) are made into a paste with oil of vitriol. To this seventy parts of mercury are added and well triturated. The acid is then washed out with boiling water and the com-

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NEW YORK, SATURDAY, JULY 3, 1875.

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CREMATION IN THE HOUSEHOLD.

For several weeks past, the daily papers of this city, how ever diverse their views on the currency, the tariff, and the next election, have exhibited a delightful unanimity in condemning the method employed in filling in the Harlem flats. Indeed, they have made such an outcry that at last the Board of Health have shown a little interest in the matter, and have applied disinfectants in some of the worst localities.

Our readers may depend upon it that the nuisance created by using garbage for filling in sunken lands was one of unusual magnitude, as it united all the daily papers in condemnation. As a general thing, when one of the great dailies of this city makes a discovery of local corruption or incompetence, all the other papers hold aloof and have nothing to say about it. It is only when the discovery is one of very great importance that the other papers consent to take part in its discussion and thorough development. For instance, if a contractor, in filling a tract consisting of three or four lots, should skillfully mingle a quantity of garbage with the earth and ashes, it must be difficult to excite much popular indignation at his conduct. It is, of course, a happy circumstance that the daily press is independent enough to endeavor to correct great local abuses, and anything but pleasant to find that the Board of Health need to be told by the papers that great abuses need correction. It is a reasonable inference, from the foregoing, that the Board of Health do not correct similar nuisances when they do not excite public attention; so that probably there are hundreds of lots, all through the city, in which the filling up to grade has been done with a very miscellaneous description of materials. It is pretty evident, also, that contractors, if left to themselves, can scarcely be trusted to make a thorough separation of ashes and garbage, in selecting the materials for grading. So that, as long as ashes and garbage are placed on the sidewalks by families, it is probable that they will be transferred to sunken lots, to form the foundations not only of future residences, but of discomfort, disease, and death. What, then, is to be done? The answer seems obvious. The garbage causes the trouble, and will continue to cause it, as long as it is put out by families for removal; cut off the supply, or allow no garbage to be deposited on the sidewalks. Such an ordinance can readily be enforced by the inspection of the police; and we believe the Board of Health have ample power to make a regulation of this character. But if the garbage is not carried off, what becomes of it, it will be asked. And this brings us to the subject indicated by the title of our article. As fast as the garbage is formed, throw it into the fire, and let it be consumed. A famous housekeeper said to us the other day: "My cook burns up everything that is not eaten or given to the poor, so that nothing is put into my ash can except ashes and broken crockery." We had not given much attention to the subject before; but we discovered, by inquiry and experiment, that the statement was perfectly correct, and that it was always easy and often profitable, while it is certainly desirable, to deposit in the ash can, so far as the garbage is concerned, nothing but the ashes of the garbage.

TAINTED MEAT.

Thirty-nine tons of meat were condemned as unfit for food in this city during the year 1874; and it is probable that, under the somewhat lax system of inspection which here prevails, this amount was but small compared with that which found its way from the hands of the retailing butchers, principally to the poorer classes. While it is known that certain races of people habitually eat meat in a high state of putrefaction, with impunity so far as immediate deleterious effects are concerned, it is well settled that the individuals are, as a rule, weak and possessed of slight power to resist disease. The weight of authority points to the fact that bad meat, no matter in what form consumed, is productive of illness, the mild symptoms of which are lassitude, headache, dullness, indigestion, and loss of appetite; while severe attacks are characterized by vomiting and typhoid indications.

In a recent English health report, it is asserted that, although it may be difficult to prove the fact by actual cases, there can be no doubt that unwholesome meat is one cause among many of the poverty of blood and intractable maladies of the poor, who flock to the dispensaries during the hot weather. Especially in summer is it a cause of diarrhoea; and instances are cited of both typhus and typhoid fevers being traced to its effects. In appearance, tainted meat is generally of a pinkish hue and more than ordinarily slippery to the touch; and the fat is very soft and yellow. In advanced stages, the odor is disagreeably apparent. Shrinkage in cooking, often to the extent of twenty-five per cent, is also another indication.

We have little doubt but that a large percentage of the bad meat sold in New York city is due to the filthy state of many of the slaughterhouses. We recently visited two or three representative shambles, located directly in rear of a number of first class dwellings, and in close proximity to a thickly populated tenement district. The odors which we traced to them were foul and sickening, and pervaded the vicinity over a considerable radius, almost constantly. Unless there be absolute cleanliness in such places (which, in fact, should not be allowed to exist near residences of any kind), the putrid emanations are sufficient in themselves to taint the meat kept in them, or even exposed for sale in the neighborhood. A late report of the Medical Officer of the Privy Council of Great Britain especially dwells upon the fact, and also states that even a low temperature will not serve as a protection to the meat against contamination.

Along the rivers on both sides of this city there are several slaughterhouses which form a standing nuisance as well as a source of danger to the residents of the neighborhood; and why the private interests of their owners should be allowed to override the considerations of sanitary welfare of the community—a fact indicated by the apparently flourishing condition of the establishments, and their permanence, despite repeated complaints—is a question which the public looks to the health authorities to answer. At all events, the probable effect of such places, upon the meat prepared in them, is worth serious consideration by the owners of the cattle, as well as by consumers generally. If the latter would take the trouble to find out where their butchers obtained supplies, and would refuse to purchase meat killed in shambles known to be unclean or ill smelling, and if the former would refuse to send stock to such slaughterhouses, remedies both for tainted meat and bad odors would soon be forthcoming.

RIGHTS OF EMPLOYER AND EMPLOYED IN RESPECT TO A NEW INVENTION.

In the case of the Evans Paper Collar Patent, reported in another column of this issue, the Supreme Court of the United States decides as follows in respect to the rights of employers and employees, touching the proprietorship of new inventions:

Where a person has discovered a new and useful principle in a machine, manufacture, or composition of matter, he may employ other persons to assist in carrying out that principle; and if they, in the course of experiments arising from that employment, make discoveries auxiliary to the plan and preconceived design of the employer, such suggested improvements are, in general, to be regarded as the property of the party who discovered the original principle, and they may be embodied in his patent as part of his invention. Doubt upon that subject cannot be entertained.

But persons employed as much as employers are entitled to their own independent inventions; and if the suggestions communicated constitute the whole substance of the improvement, the rule is otherwise, and the patent, if granted to the employer, is invalid, because the real invention or discovery belongs to the person who made the suggestions.

THE KEELY MOTOR DECEPTION.

Newspapers, from all parts of the country, come to us daily, laden with long accounts of the wonderful things that are to be expected from the astounding Keely motor discovery, which is to supersede steam power, hot air, electricity, gravitation, chemical affinity, and other laws of Nature. This is not the first time that the readers of the SCIENTIFIC AMERICAN have seen all these things done—on paper. Nor is it the first time that learned professors, like Rand, experienced civil engineers like Haswell, or good practical mechanics like Sergeant, Wood, and Boeckel, have been deluded into the support of strange deceptions like Keely's. But these gentlemen have only temporarily lost their common sense on this one subject. It will return to them again in due time.

In fact, there are indications that Professor Haswell is already recovering, and the others, no doubt, will soon fol-

low. Only those who invest their money will experience permanent loss.

In our paper for May 2, 1874, in an article on the Keely motor, we printed the following extract from the company's pamphlet:

"The following named gentlemen have witnessed the exhibition of the above tests, and may be referred to for the correctness of this statement: Charles H. Haswell, civil and marine engineer, New York city, and formerly Engineer-in-Chief, U. S. N.; William W. Wood, Chief of Bureau of Steam Engineering, U. S. N., Washington, D. C.; S. Parrish, gas engineer, Jersey City, N. J.; Joseph Patten, engineer, Elizabeth, N. J.; F. Glocker, machinist, Philadelphia, Pa.; William Boeckel, machinist, Philadelphia, Pa.

In connection with the foregoing statement, a professional report is given in the pamphlet, by Mr. Haswell, one of the referees mentioned above. He certifies, as the results of two actual working trials of the invention, as follows:

"Mr. Keely developed a cold vapor of a density that enabled it, when admitted to a cylinder having a piston 1-1/8 inches in diameter, to raise a weight of 150 lbs. suspended from a compound lever, connected as 1 to 42, which, with the weight of the lever and the friction due to the absence of a knife-edge or rotating joint, was fully equal to an energy of 7,800 lbs. per square inch."

Mr. Haswell was, at that time, professionally employed to test and report upon the new motor, and did so, as above reported. But the above is only a small portion of his report, which goes into the other details of the motor, not necessary here to mention, because they are based on statements made to him by the inventor. The portion given above, however, was the result of his personal observations in 1874. Mr. Haswell, having allowed his report of 1874 to stand, together with our comments thereon, without the least objection, for over a year, before the public, at last begins to see the absurdity of the matter, and now sends us, June, 1875, the following communication:

To the Editor of the Scientific American:

I am advised that, in the last number of your paper (June 26, 1875), I am referred to as having, with others, endorsed the alleged capacity of the invention of Mr. J. W. Keely, known as the Keely motor.

If you will point out wherein I have ever expressed an opinion of the integrity of the claims of Mr. Keely, of the foundation of which I am wholly uninformed, I shall be interested to learn of it. Respectfully,

CHAS. H. HASWELL.

New York, June 17, 1875.

He also publishes the following, in the New York Sun:

MR. HASWELL ON THE KEELY MOTOR.

To the Editor of the Sun—SIR: In an article in your issue of this morning you imply that I have endorsed the integrity of the Keely motor. As I am wholly uninformed of the foundation upon which Mr. Keely bases his claims, I have never expressed an opinion thereon. I am, respectfully,

CHAS. H. HASWELL.

The republication above, from Mr. Haswell's certificate, will, we presume, give him the information he now desires.

THE SEARCH FOR THE POLE.

The British Polar Expedition has sailed from Portsmouth amid salvos of artillery, cheers from congregated thousands, and other grand displays of official and popular enthusiasm. Until the vessels reach Disco, when Mr. Clement Markham will leave the party and return to England with a report of the prospects and general probabilities of success, as far as can be gathered from appearances at that far northern point, we shall have no tidings; and after that time, until the lapse of the three years allowed to the enterprise, the fortunes, good or bad, of the expedition will likely remain unknown. There is great hope, this time, as to the ultimate success of the attempt. Never before have ships started on any voyage of discovery so completely fitted out with everything which Science could suggest or experience counsel as these two quondam whalers; nor has any previous expedition been projected under that rigid military discipline for the lack of which Hall failed, and which, in the present case, will be maintained by officers already thoroughly conversant with the nature of the task before them, and the causes which have led to its non-accomplishment by their predecessors.

The Alert and Discovery are to proceed to Smith's Sound, taking the route by which Hall reached the furthest point of north latitude yet attained. It may easily be argued that, if the last mentioned commander, in a vessel wretchedly prepared for the work, could reach 82° 16' N. latitude, and then be foiled in further attempts to push onward, not through any fault of his ship, but through dissensions in his crew, there is every reasonable probability that the English ships will have no serious obstacles to encounter in steadily advancing until the open sea, which the peculiar glistening haze (seen above the ice mountains by Dr. Kane's mate from the masthead) indicates, is reached. Then three millions of square miles of water, possibly a frozen continent, unvisited by living things from the lower world, save by the birds which are known to emigrate to the northward of any point yet attained by man, lie open to exploration; and the explorers will doubtless traverse that now unknown region until they reach the end of their journey upon the "spot where the sun's altitude is equal to its declination, and where bearings must be obtained by reference to time and not to the magnet."

Then what? Science is rather vague in her answer, for she relies more upon entirely new discoveries being made than upon verifications of advanced theories. Mr. Clement Markham sums up about all that Science has to expect from

the exploration of the earth's apex, thus: "It may be shown," says he, "that no such extent of unknown area in any part of the world has ever yet failed to yield results of practical as well as purely scientific value; and it may be safely urged that, as the area exists, which is mathematically certain, it is impossible that its examination can fail to add largely to the sum of human knowledge."

In plain terms, the discovery of the pole has reduced itself to a matter in which the curiosity of mankind to know what exists at this *ultima thule* of the globe, a curiosity augmented by repeated baffling, is probably more the underlying cause of attempts to solve the problem than even the thirst for abstract knowledge. If there had been, or could be, any direct gain by reaching the open Polar Sea, we have little doubt but that it would have been penetrated long ago; for the arctic whalers' extremely powerful vessels, with proportionately strong engines, make their way through the ice with ease to regions, and spend months in localities, which the earlier explorers attained only by immense toil and hardships. If the masters of these ships had found out that more blubber could be got in the Polar Sea than elsewhere, the passage would have been made, and the world would probably have remained in ignorance of the fact, until some one had noted with astonishment the figures denoting latitude, which the captain would, quite as a matter of course, have jotted down in his log.

Curiosity, coupled with a patriotic desire to outdo the previous endeavors of other nations, is the motive of popular attention to the North Pole just at present. The problem once solved, the attainment of the South Pole will be as eagerly sought after; and there will be scores of attempts to penetrate the barriers of a region so vast that the moon might easily fall into it without affecting, by the impact alone, any portion of the world now known to man.

THE HYDROLOGY OF SOUTH AFRICA.

Mr. Froude the historian turned statesman, came back last winter from his self-appointed mission to South Africa big with the belief that he had seen the beginnings of an Anglo-African empire destined to rival our United States in power and prosperity; and he has just sailed thitherward again, bearing an official commission for the advancement of his scheme of confederation, the one thing needful, he thinks, to ensure the speedy development of the colonies of South Africa into the empire of his dreams.

There is much that is attractive in the thought that the continent so long given over to barbarism is about to be won over to civilization by British pluck and energy: nevertheless the prospect of its successful accomplishment is not nearly so bright as Mr. Froude imagines. Something more than men and money, however plucky and plentiful, is requisite for the up-building of an empire. First of all there must be a favorable physical basis, a fertile country, and a genial climate; and if any climatic changes are going on, they must be such as to make the country increasingly productive and habitable.

Unfortunately these conditions are not well met in South Africa. The drift of its climatic changes (and they are enormous) is in the wrong direction, and the operations of its inhabitants are now, and have long been, of a nature to hasten the natural course of climatic derangement. Already vast areas, recently well wooded, well watered, and of boundless fertility, have been converted into barren wastes, alternately parched by drought, ravaged by fire, and torn with torrents of untimely rain; and unless the settlers make a radical change in their mode of procedure in clearing the country, its conquest is much more likely to result in a great desert than a great nation.

By those who have followed the travels of Livingston and others through South Central Africa, the great interior basin of the continent will be remembered as a vast region of swamp, lakes, broad rivers, and trackless forests. To the south lies the basin more thoroughly drained by the river Zambesi, described by travelers as a region just emerging from a condition like that obtaining further north. The rivers have worn their channels deeper through the enclosing rim of the basin, the swamps are turning into grassy plains, the lakes to swamps or to salt-encrusted "pans."

Still further to the south is the southernmost basin of the continent, enclosed by mountains running parallel to the coast. The central part consists chiefly of rolling prairies with few springs, fewer permanent rivers, and forests gradually diminishing to a final destruction which cannot be long delayed. As a rule rain is infrequent, droughts of common occurrence, and irrigation absolutely necessary for the raising of European grains. Yet within the memory of men still living this has been a country of lakes and rivers, abundant rain, heavy timber, and plentiful pasturage. Rivers, now dry the most of the year, then ran with full banks and swarmed with hippopotami and other water-loving animals. And the whole country bears abundant evidence that it is but a little while, geologically speaking, since it was the counterpart of the lake regions traversed by Livingston in the central basin of the continent.

When Dr. Moffat first entered the country as a missionary, in 1821, the natives had not forgotten the floods of ancient times, the incessant showers which covered the very rocks with verdure, and the giant trees and forests which flourished on hills and plains now barren and desolate. They boasted of rivers which ran impassable torrents in the days of their forefathers, while the lowing herds walked to their necks in grass; and the ancient river beds, shore lines, and vestiges of enormous trees bore witness that their stories were not exaggerations. Since the missionary work began, streams, which then furnished drink for thousands of cattle

and water for the irrigation of miles of cornfields and gardens, are now absolutely dry.

Farther west the desiccation of the country is much more extensive and severe, forming the great Kalahari desert, the wastes of Namagualand, and the barren wilds of Bushmanland. Here the drying up of the country has all but reached its limit in degree, though not in area, for the desert steadily encroaches on the habitable land. To some extent, man is not to blame for the climatic changes thus going on. The natural wearing down of the outlets of the basin has drawn off the waters of the lakes, emptied the swamps, and converted the country into something less like a gigantic sponge than it originally was. But the most disastrous effects have been produced by human agency, by the destruction of the country's arborescent and herbaceous clothing by fire.

When Vasco de Gama first explored the coast four hundred years ago, he called the country Land of Smoke. How long the burning had been going on it is impossible to tell: it has certainly been going on ever since. The dominant native races in South Africa are comparatively recent invaders, and wherever they have gone the forests have disappeared. They are "a nation of levelers," says Mr. James Fox Wilson, who has given the matter much careful study on the spot, and "they are the prime cause of the advancing drought."

The practices of the Bechuas are especially fatal to the forest growths. They cut down and burn down everything, regardless of scenery or economy, stripping the country where they settle, then moving on to devastate other regions and prepare the way for the encroachments of the desert. Wild fires, started for the purpose of clearing the open country of the annual growth of tall grass, play no small part in the work of devastation, killing in dry seasons most of the shrubs and young trees that spring up in wet ones. In Namagualand, the same office is performed by the scorching sun, the effect of drought in this case being, as Mr. Wilson points out, an auxiliary cause of drought.

But the spreading of the desert is not confined to the areas beyond the European settlements. There are vast regions, in the basin of the Orange river and in Cape Colony itself, bare of timber and bush, largely in consequence of the pertinacity with which both native and European colonists adhere to the suicidal practice of burning the dry fields in winter that the flocks may find abundant pasturage as soon as spring sets in. In these bare regions, trees are hardly ever to be found, except on the banks of rivers or in high mountain passes, as the fire penetrates into all the ravines where the most luxuriant vegetation is found, and destroys it. The more denuded of trees and brush wood, and the more arid the land becomes, the smaller the rainfall. "The greater the extent of heated surface over which the partially exhausted clouds have to pass, the more rarefied the vapor contained in them necessarily becomes, and the higher the position which the clouds themselves assume in the atmosphere under the influence of the radiating caloric: consequently the smaller the chance of the descent of any rain on the thirsty soil beneath. And the more the short-sighted colonists and ignorant natives burn the grass and timber, the wider the area of heated surface is made, the farther the droughty region extends, the smaller become the fountain supplies, and the more attenuated the streams, until they finally evaporate and disappear altogether. Thus the evil advances in an increasing ratio, and, unless checked, must advance, and will finally end in the depopulation and entire abandonment of many spots once thickly peopled, fertile, and productive."

This evil prophecy was spoken ten years ago, before the British Association, and the occurrences of the past decade have only tended to confirm it. The progress of South Africa is plainly toward uninhabitability. The increasing severity of the droughts, the vast sweep of the forest and field fires, and the sudden and terrible cloud bursts of rain and hail experienced in the settled portions of the colonies are described at length in the work on the "Hydrology of South Africa," prepared by Dr. John Croumbie Brown, formerly colonial botanist at the Cape (and favorably remembered by our readers for his successful championship of Darwinism before the Evangelical Alliance two years ago). In 1869, after a long period of exceptionally dry weather, a tract of country 400 miles long and 150 miles in extreme breadth was swept by fire, destroying fields and forests, farm houses, grain stacks, wild beasts, and domestic animals, and in many instances the families of the settlers.

Smaller yet very extensive fires are of yearly occurrence. The effects of such wholesale denudations of the surface are necessarily widespread and disastrous. The uplands become naked, parched, and slashed with gullies; the lowland springs dry up, the streams fail, and the entire economy of Nature is permanently disturbed. Rains that should be distributed over the entire year fall in a few destructive deluges which wash away the soil and turn the rivers into torrents, roaring sometimes fifty feet above their natural level at high water. Details of a number of such storms are reprinted by Dr. Brown from the colonial newspapers. During one of them in Natal, 27 inches of rain are said to have fallen in two days: the destruction of property was necessarily enormous, even in a sparsely settled region.

A specimen hailstorm is described by a member of the Transvaal Geological Expedition. It occurred at Pietermaritzburg, Natal, April 18, 1874. Mixed with the hailstones—which averaged from one and a half to two inches in diameter—were irregular masses of ice from two to four inches in diameter and weighing from four to eight ounces. "On many roofs fully half the tiles were broken, not merely cracked, but very frequently masses went right through into the houses. None have escaped. Fortunately for windows, there was no wind, or the damage would have been much

heavier. Many of the corrugated iron roofs are dented all over and have a pock-marked aspect, while some corrugated iron roofs are completely riddled: the stones went right through as though they had but paper to encounter."

It is proper to bear in mind in this connection that Natal is the garden of South Africa.

During the following November, the newspapers complained of severe and long-continued drought in all the midland districts of Cape Colony. It was followed by a deluge toward the end of the month. Rivers which had been dry for months were suddenly filled with raging torrents, carrying away bridges to the value of \$1,500,000. In one case a bridge, built high enough, it was supposed, for any flood, was forty-five feet under water, and of course utterly destroyed. Several towns were flooded, and not a few lives were lost.

After reciting at length many incidents in connection with this and similar storms, Dr. Brown remarks that it often happens that, within an hour or two after such torrents of rain have been precipitated, the sky is cloudless and serene, and frequently within a month or two all is as arid as before. Yet in such a country, and with a people bent on courses calculated to intensify and perpetuate such climatic evils, Mr. Froude expects to see a great empire grow up!

It is but just to Dr. Brown to say that, while fearlessly recognizing the certain tendency of the climatic changes to make a desert of South Africa, he does not despair of the future of the colonies, provided the colonists cease to do evil and learn to do well. He strenuously urges upon them the one course which will enable them to hold their ground and possibly recover the advantages they have wasted, namely, to put a stop to field and forest burning, and then set to work to restore the forest growths. It is, he admits, a difficult and costly undertaking; but it is absolutely necessary.

SCIENTIFIC AND PRACTICAL INFORMATION.

ORIGINAL MICROSCOPICAL RESEARCHES.

To such of our readers as propose devoting the coming summer vacation to microscopical work, we can suggest the following investigations as offering excellent fields for original research: First, examine the theory suggested by Dr. Bastian as to occasional transformations taking place between the lowest forms of animal and vegetable life. Confine some minute vegetable tissue—if showing protoplasmic circulation, so much the better—in a live box, and watch with care. Notice if, in process of time, nuclei or any other parts should undergo any such transformations. A $\frac{1}{4}$ inch or $\frac{1}{2}$ inch objective is suited for the purpose. There is abundant opportunity for new work in relation to fungi. Cooke's recently published book on that subject should be well studied, and collections made in the field, enough to go over, if possible, the author's ground. The limits of present discovery will soon be recognized, and a line of further progress can readily be mapped out. There is yet plenty to be discovered about the insects. The foot of a fly, for example, its structure, method of use, properties, exudation, etc., would form an excellent subject of study for a long time. The student, if he faithfully perseveres, is pretty certain to hit upon something new. The microscopic changes of the tissues and fluids of the human body, in health and disease, also invite research. This requires vast patience, an excellent instrument, and no small degree of skill; but it offers results which, if gained, will well repay expenditure of time and energy.

MORE JAW WRENCHERS.

"Benzanishydroxamic acid" and "anisidibenzhydroxylamine" are two more chemical absurdities in the way of names recently coined, of course by a German chemist. Cannot somebody invent some rational plan for naming and re-naming organic substances that will relieve the science from these polysyllabic nightmares? Suppose the chemists begin by agreeing among themselves to limit the baptismal titles of their discoveries, say to four syllables. Or why not use some symbols which might mean any number of prefixes or suffixes, and thus express the idea without inflicting it on the mind through torture of the jaw?

A MOUTHFUL FOR CIGAR SMOKERS.

The products of the combustion of tobacco, if the combustion were complete, would be carbonic acid, ammonia, and water: in the process of smoking, however, most of the tobacco is distilled rather than burnt, and the products of this distillation are quite numerous and complex. Vohl and Euhlenburg, after burning 150 cigars, recognized with distinctness, in the smoke, cyanhydric acid, sulphuretted hydrogen, certain acids of the fatty acid series, namely, formic, acetic, propionic, butyric, and valerianic; also carbonic acid and creosote, pyridin, picolin, collidin, and other similar alkaloids. They found also ammonia, nitrogen, oxygen, and small quantities of marsh gas and carbonic oxide.

A LIVING RAFT.

The leaves of the gigantic water lily known as the *Victoria Regia*, in the Botanic Garden at Ghent, having attained a remarkably large size, Mr. Van Hulle, the chief gardener, recently undertook to determine their buoyant power. One leaf easily supported a child, and did not sink under a man. Mr. Van Hulle then heaped bricks over its entire area and found that, before the leaf became submerged, a weight of 761 lbs. was floated.

A CENTENNIAL CLERGYMAN.—On the 8th of June last, the Trinity Methodist Episcopal Church, at Jersey City, N. J., held a celebration in honor of the one hundredth birthday of the Rev. Henry Boehm. For seventy years or more he has been a preacher. On the occasion of the celebration, when he rose to address the audience, the clearness of his faculties was observable by all present.

IMPROVED THREE-CYLINDER PUMP.

We illustrate herewith a simple and novel form of three-cylinder pump, the suction of which is continuous, though unaided by an air chamber. Like the rotary pump, its delivery is uniform, but, unlike that machine, it requires no large expenditure of power.

The construction is obvious from the engraving. Three strokes of the piston are caused by one revolution instead of two strokes, as in the double-acting pump, while it is claimed to have the advantage over the latter of being much more free from friction and not to necessitate the stopping and starting of a column of water in the suction pipe at every change of stroke, involving a consequent loss of power. There are, besides, no crooked passages or ports through which the water must be driven; and the construction of the various parts is simple, strong, and lasting. In its smaller sizes, it may readily be worked by hand.

These considerations render the machine useful for railroads, both as a hand pump during the building of lines, and as a permanent power pump for filling tanks where a large volume of water is needed daily. It is also suitable as a fire pump for mills; and since its working parts are but little affected by grit, and it is not liable to choke, it may profitably be employed in quarries. By wind wheels, we are informed, it can be worked at a slow speed with the largest results. It is susceptible to a wide utilization in greenhouses, about farms, and, in fact, wherever a powerful suction and force pump is needed.

Further particulars may be obtained by addressing the Chase Machine Company, manufacturers, No. 36 Charlestown street, Boston, Mass.

A Lady Lecturer on Chemistry.

Lately, in Aberdeen, Scotland, Miss Charlotte Napier gave a lecture on chemistry, in connection with the Blackfriars Useful Information Society. There was a very numerous attendance; and the lecture, which was illustrated by a variety of experiments, and was of a highly interesting and instructive character, was listened to with the closest attention, an enthusiastic vote of thanks being awarded to the lecturer at the close. Miss Charlotte Napier is a young Aberdonian. Last winter she studied chemistry in Edinburgh, under the direction of Mr. Falconer King, with a view of assisting her father as an agricultural analyst.

RUDIMENTARY EXISTENCE IN FRESH WATER STREAMS.

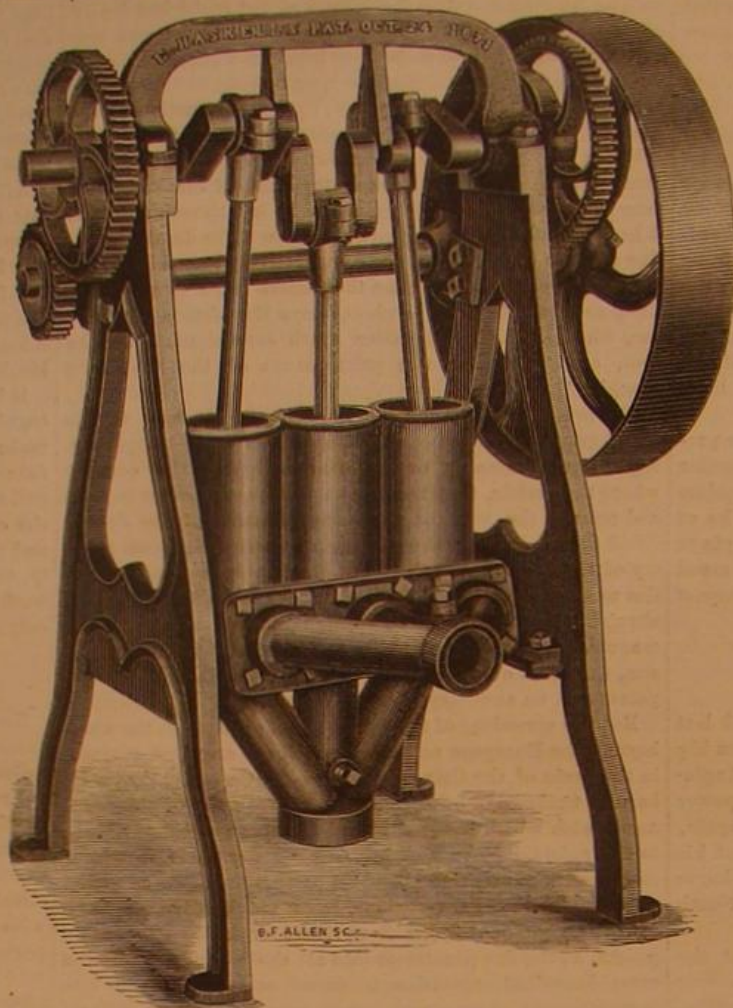
The marine aquarium and its inhabitants have been thoroughly studied by naturalists; but as yet, very little attention has been given to the many beautiful forms of life to be found in rivers and ponds. Mr. James Fullagar, of Canterbury, England, has recently found in a stream near that ancient city a specimen of the *lophopus crystallina*, and describes it as follows in the pages of *Science Gossip*:

"The *lophopi* are among the largest fresh water polyzoa known. They are about $\frac{1}{16}$ th of an inch in length, and are found attached to the roots of *Callitriche verna*, duckweeds, and other fibrous roots in shady dykes of slow-moving water, under thick masses of floating plants; for in their habits they are light-shunning animals, and are always on the under side of aquatic plants. They are very beautiful microscopic objects, and their being perfectly transparent renders them most interesting animals for examination, as the formation of their statoblast (f) can be seen in their different stages of growth, from their first appearance as a little swelling (at which stage they are quite colorless) to their perfect forms, when they become detached and fall free in the perigastric space (l), having become gradually colored, the center of a dark brown, and the margin a rich yellow. The process of their propagation by gemmation or budding, by which young ones are added to the existing colony of living polyzoa, can be plainly seen; while the statoblasts (f) are designed to propagate the species in the following spring, and are liberated from the polyzoan at its death, when the transparent sac is decomposed, and the statoblast escapes and sinks to the bottom of the water."

In our engraving, a is the region of the mouth; b, oesophagus; c, stomach; d, intestine; e, muscles; f, statoblast; g, parasitic globes; h, h, mouth; i, tentacles retracting within cell; k, outer transparent envelope; l, perigastric space; m, lophophore; n, tentacles extended to show mouth; o, vent; p, hollow globe; r, place where division commences; s, cell.

"The perfect transparency enables us to witness the internal operations of their system. The action of the stomach in the process of digestion can be observed with great clearness. The contents are seen at times to consist of small desmids, and other disk-shaped and globular bodies, together with decayed vegetable matter, etc. The action of the cilia on the expanded tentacles causes a current of water to set in towards the mouth (a, h, h), bringing with it the food required; and if in the vortex thus formed there should be any large and objectionable pieces, they are prevented from entering the mouth by a quick, lashing motion of the tentacle, which rejects and throws them out of the reach of the vortex. The accepted morsel passes direct-

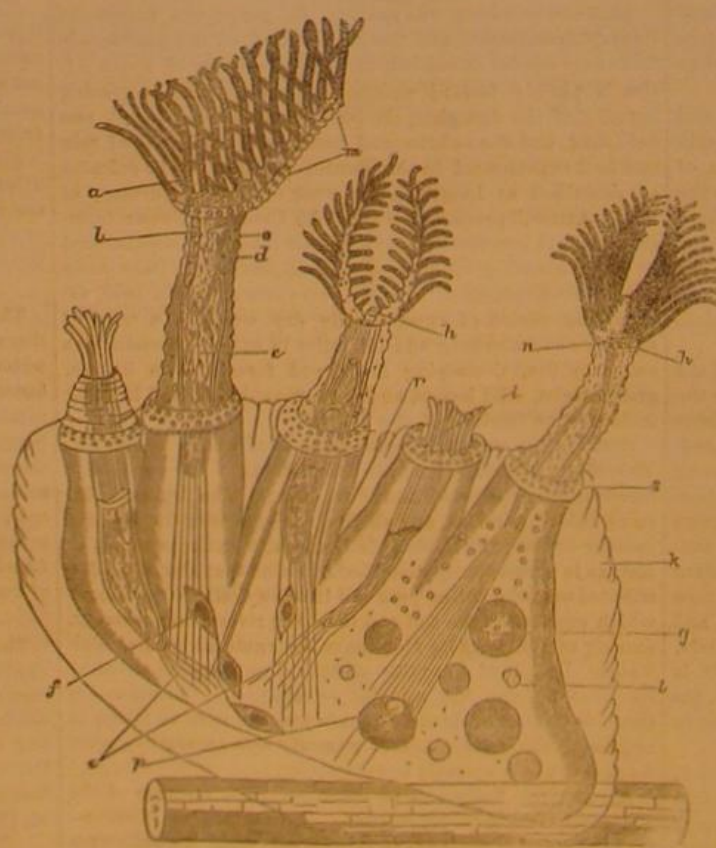
ly into the oesophagus (b), and thence into the stomach (c), where it is digested by the up and down motions, of a contracting and expanding nature, of this organ. The lower part of the stomach at intervals is seen to be contracted somewhat in the shape of an hour glass, in which for a moment part of the contents of the stomach are retained, then again released to mix with the rest. After being subjected to the action of the stomach for some time, the alimentary matter is delivered by degrees into the intestine (d), from



HASKELL'S THREE-CYLINDER PUMP.

whence it is expelled through the vent (o), in form of oval or egg-shaped pellets.

The perigastric space (l) is filled with clear fluid, which also extends up the lophophore (m), in which fluid are seen floating numerous particles of very varied forms and sizes, the smallest ascending to the tip of the lophophore (m). By the movement of those bodies, it is evident that there is a constant rotating motion in this transparent fluid, by which these particles are kept in a perpetual whirl, from one part to the other, and at times with rapidity. No doubt this motion is produced by vibratile cilia on the interior of the body, though not so as to be observable. In some of the colonies of the *lophopus* there are a number of globular bodies (g), varying in size from the $\frac{1}{16}$ th of an inch in diameter up to the



A FRESH WATER POLYZOON.

size of an ordinary *volvox globator*. These bodies are considered to be parasitical, as they do not appear to have any necessary connection with the economy of the polyzoa in whose interior they occur. This would appear to be the case from the fact that in some colonies not one of them is to be

seen, while in others they are very numerous. In one instance of a colony under my observation, they were increased in such numbers of all sizes that they entirely filled the perigastric space (l), forcing the smaller particles up even into the lophophore (m), and ultimately bursting the whole colony and escaping into the water, when all motion in them ceased, and they soon disappeared altogether. When they are few in number, and of various sizes in the animal, they form a novel and pleasing sight as they are carried up and down by the current before mentioned in the perigastric space.

On being alarmed, the *lophopus* quickly retracts within the transparent cell (s), and again protrudes when all is quiet, unfolding its beautiful crown of tentacles, in the course of which movement the action of the muscles is plainly seen (e). The expanding of the tentacles, immediately on the protrusion of the polypide from its cell, is one of the most pleasing sights that can be presented to the observer, as the cilia with which they are studded are instantly in full play, passing up on one side of the tentacle from the base to the tip, and down the opposite side, like an endless chain, thereby forming the vortices in the water by which the particles of food are brought to the mouth. Sometimes the colony consists of from six to twelve polypides, and will divide into two, commencing the division at p, and slowly separating down to the point where it is fixed to the plant, etc., each part moving in opposite directions. They then propagate by gemmation or budding."

"I would advise," says Mr. Fullagar, "those lovers of natural history who possess a microscope and live in a neighborhood where there are shady dykes or a millpond, etc., to search for them; when found, they will amply repay the trouble in the pleasure they afford in observing and investigating their wonderful mechanism and marvelous beauty. No pencil can portray nor pen describe them. I have had them under observation for over three months, have seen some of the colonies die out, and have their statoblasts in glass cells, from which I anticipate the pleasure of seeing the young polyzoa emerge in due time."

Stagnation in Business the World Over.

It is poor consolation in adversity to know, says the *Commercial Advertiser*, that we are not alone in our misery; such as it is, however, our iron manufacturers may take it to themselves. The depression of the iron trade is general throughout the world.

The production of pig iron in Scotland was less in 1874 than in any of the last twenty years. At one time there were only thirty-two furnaces blowing, out of one hundred and thirty-two erected, and the production was 400,000 tons less than in 1870. Russia, notwithstanding its activity in railroad building, imported only 5,231,000 lbs. of rails, against 7,119,000 in 1873. In Prussia the large steel works of Krupp have discharged some thousand workmen, and the Borsig manufactory of engines at Berlin—the most extensive in Germany—has had to protect itself by taking a similar step. Last month the largest Austrian manufactory of engines (Sigl) dispensed with two thousand hands for the reason that it had neither orders nor sufficient working capital. The government, however, in true Austrian fashion, remedied both misfortunes by advancing capital to the works, and by causing some of the railroads to give extensive orders for rolling stock.

A Queer People.

During the last season, says the *Academy*, Mr. Bond, an Indian surveyor, while at work in the Madras Presidency, to the southwest of the Palanci Hills, managed to catch a couple of the wild folk who live in the hill jungles of the Western Ghats. These people sometimes bring honey, wax, and sandal wood to exchange with the villagers for cloth, rice, tobacco, and betel nut, but they are very shy. The man was four feet six inches high; he had a round head, coarse, black, woolly hair, and dark brown skin. The forehead was low and slightly retreating, the lower part of the face projected like the muzzle of a monkey, and the mouth, which was small and oval, with thick lips, protruded about an inch beyond the nose; he had short, bandy legs, a comparatively long body, and arms that extended almost to his knees; the back just above the buttocks was concave, making the stern appear to be much protruded. The hands and fingers were dumpy and always contracted, so that they could not be made to stretch out quite straight and flat; the palms and fingers were covered with thick skin (more especially the tips of the fingers); the nails were small and imperfect, and the feet broad and thick-skinned all over. The woman was the same height as the man, the color of the skin was of a yellow tint, the hair black, long, and straight, and the features well formed. This quaint folk occasionally eat flesh, but feed chiefly upon roots and honey. They have no fixed dwelling places, but sleep on any convenient spot, generally between two rocks, or in caves near which they happen to be benighted. Worship is paid to certain local divinities of the forest.

Lead pipe will not do to conduct water to fish ponds. It is likely to poison the fish.

REVOLVING FIRE BARS.

The *Revue Industrielle* has recently published an illustration and description of a system of revolving fire bars recently introduced into France with good results. As will be seen, it consists simply of a series of straight tubes, placed either singly or coupled together, and pierced with openings of a suitable form. Means are provided by which these tubular bars can be caused to revolve. It will be seen that the tubes rest upon transverse bearers also cylindrical and hollow, and longitudinally they are supported by a cast iron plate fixed under the furnace door, and formed with a projection upon which the tubes take their bearing, either by a groove as in our Fig. 1 and the third design in our Fig. 2, or against a ring, as in the second type, shown in the second design in our Fig. 2. The bars are turned by means of a key that is introduced into the end of the bar, which is fitted with a ferrule having a six-sided aperture.

The first application of this system was made to a 12 horse power boiler, in which the steam was maintained by means of coke dust and slack containing 25 per cent of cinders. This boiler belongs to the Parisian Gas Company, which has a deserved reputation for investigating new and promising inventions. The success of their first experiments was so great that now some hundreds of these bars are employed by the gas company, so that the arrangement has passed from the phase of experiment into that of actual and large practice. It is claimed that, by the use of the Schmitz bars, the work of firing is rendered much less difficult, while a thick fire (from 8 inches to 10 inches) can be maintained economically. The draft is regulated for a given consumption of fuel, and the front of the ash pit may be closed, because sufficient air can be admitted through the open ends of the tubes. The inside of these tube is always visible to the fireman, who can at once see when any of the openings are choked. When this takes place he is enabled, by partially turning the tube, to present a new surface to the fire, while he is easily able to clear those passages which have been closed. In turning the tubes, the ashes and other debris are precipitated into the ash pit; and as shown in the second and third types of our Fig. 2, the bars are furnished with a spiral projection to assist in breaking up clinkers, etc.

The following are the results of this trial:

	Ordinary Furnace.	Schmitz Bars.
Water evaporated per pound of coal . .	4.678	5.563
Water evaporated per hour per square foot of heating surface	1.321	1.322
Coal burnt per hour per square foot of grate	6.79	5.70
Coal burnt per hour per square foot of heating surface	0.283	0.238

From trials made with a boiler on the Passy Gas Works, an economy of 26 per cent was claimed for the apparatus, while the fuel employed was of such a nature that it could scarcely have been employed in an ordinary furnace.

A Medical Strike.

A strike among professional men is certainly a novelty; and it has been reserved for Switzerland to produce the same for the astonishment of mankind. In the canton of Glarus, out of 23 licensed physicians, 21 declare that they will perform no more official duties until an efficient sanitary police be established and medical examinations be conducted by a committee of competent men. What a harvest must open before the dazzled gaze of the two disaffected individuals! We can imagine the doctors striking against the quacks; but for them to strike in favor of a sanitary police, in favor of a means for preventing the diseases by curing which they make their bread and butter, certainly passes the bounds of reasonable belief. If the doctors of New York should follow the example of these Swiss brethren for the last mentioned reason, what a vast relief to our stench-sicken citizens would be produced!

How to Reduce Telegraph Charges.

It is undoubtedly true that nine tenths of the messages offered for transmission, if delivered at any time in from six to twelve hours, would answer their purpose just as well as though delivered within a few minutes. On the other hand some of the messages are valueless unless transmitted and delivered immediately. It has been proposed therefore, to establish a class of express messages, which shall be guaranteed precedence and quick delivery, an extra price being charged for such service; a second class of messages which

do not require especial despatch, to be sent at the convenience of the lines, but within a special time, at say about the present rates; and a third class, to which even less importance is attached, to be sent at a considerable reduction from present rates.

If telegraph wires were continually occupied in the transmission of despatches, no doubt even lower rates than are now exacted would be profitable; but how few wires, comparatively, are thus continuously occupied! We cannot see any insuperable obstacle to the introduction of this system, and believe that something like it will eventually be adopted by our telegraph managers.

It has been urged, in opposition to such a system, that the

cal than beams, while they were also more beautiful. By way of illustration he referred to the bridge of St. Louis, at Cincinnati, which had a central arch of 520 feet in span. There was no reason why arches of 700 or 800 feet span should not be erected; and in some situations even these great spans would be economical in comparison with a number of smaller openings involving expensive foundations.

Crime the Result of Automatism.

A striking analysis of the mental status of the criminal classes, which seems to occupy a middle ground between the theory of morbid impulse of Dr. Hammond and Professor Huxley's ideas as to the automatism of all animals, has recently been made by Dr. Despine and confirmed by Dr. Thomson, resident surgeon of the General Prison for Scotland.

Dr. Despine arrives, after a thorough search of court records, prison statistics, habits of individuals, and of all other possible and available sources of information, at a belief in the entire absence of a moral sense in the criminal class. He says that free will, which in the normal man is only controlled by a sense of duty, in the criminal has no such counterbalance, this sense being wanting. His acts are therefore mentally automatic, the result of the strongest instinct, appetite, or passion prevailing at the time. Although intellectually cognisant of the moral standards of society, the criminal yields to natural passion or appetite, unrestrained and unreprieved by any feeling of impropriety. Hence the remarkable *sang froid* seen in hardened offenders under the most trying circumstances, and the superficial character of any apparent reformation or conversion.

How does a Spider Make its Web?

Here is a poser put by a writer in *Science Gossip*, which some of our readers, who have watched the habits of spiders, may be able to answer: How does a spider make its web, the lines of which, crossing at the center, are carried, some of them, to the surrounding objects, while others are fastened to an outer circular line, made evidently before the outer circular lines of the web are formed? Where does the spider place itself when it ejects the lines which form the spokes of the wheel?

Curious Fact.

Friction impedes the progress of the railway train, and yet it is only through friction that it makes any progress. This apparent paradox is explained when we remember that, by reason of the frictional bite of the drivers upon the track, they draw the train. The bearings of the wheel upon the rails are a mere line where they come in contact, iron and iron, yet this slight and almost imperceptible hold is sufficient to move hundreds of tons of dead weight with the speed of the wind.

A Monument at Sea.

Several years ago the famous obelisk, known as Cleopatra's Needle, was donated by the Egyptian to the British Government, but the latter, although several plans have been proposed, has heretofore considered no scheme as overcoming the engineering difficulties of removing the monolith from its present site near Alexandria to the shore, and thence transporting it by sea to England. We learn from the *London Times* that an attempt is now shortly to be made, and the project which has been adopted is as follows: The obelisk, which is quadrilateral in shape, is first to be changed into a cylinder. This will be done by attaching heavy beams, strongly connected together, to each face, until the desired form is obtained, the work being continued very carefully, and excavations being made, little by little, until the entire shaft, from apex to foundation, is enveloped. It will not be difficult then to roll the monument over a wooden road, laid over the sand hills which cover the intervening mile between its present location and the sea.

The wooden envelope, while increasing the mass will, at the same time, be such as to diminish the specific gravity of the whole, so that the great bundle will readily float. To this end, the diameter of the circle formed by a section of the cylinder will be 30 feet, or 12 feet larger than the breadth of the sides of the obelisk. Besides, in order to render the line of flotation horizontal, a diameter exceeding 20 feet will be necessary at the heavier base.

After the monument is launched, it will be towed out of the Mediterranean and into the Thames, to the nearest point to its future site. It will then be beached and rolled to its position, where it will be erected before removing its coverings.

This plan, it is believed, can be carried out very easily and with little expense, while it will be free from the dangers found in transporting the Obelisk of Luxor to Paris, as during its voyage that monument seriously damaged the vessel.

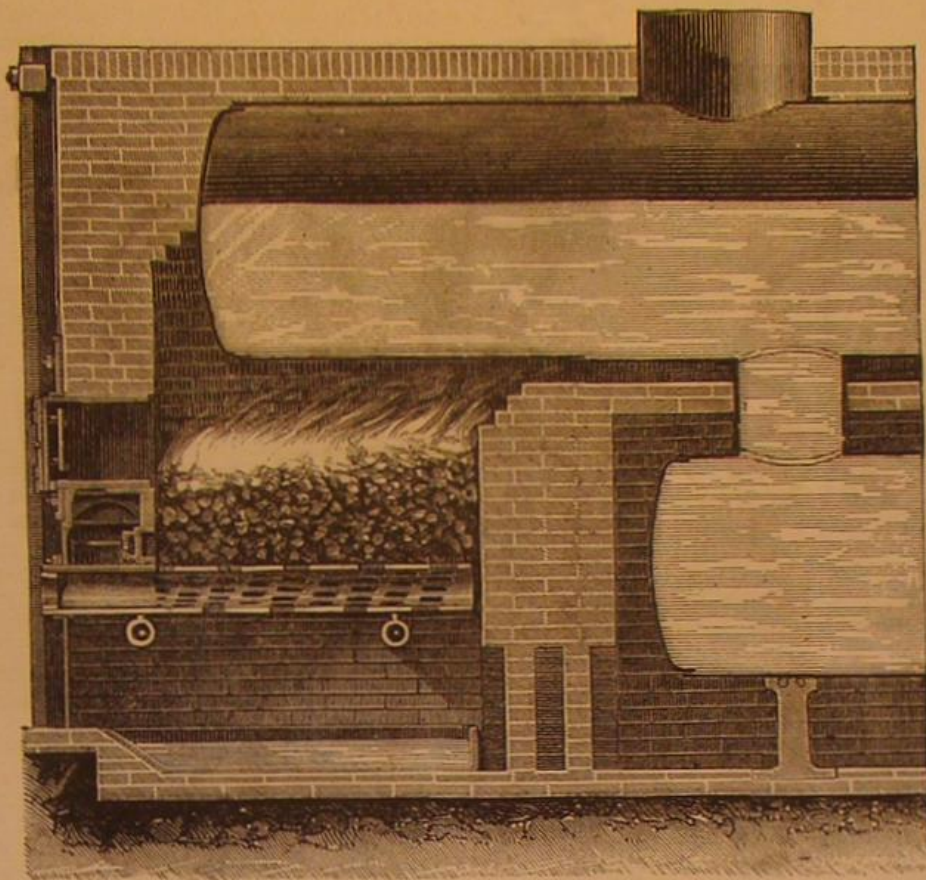


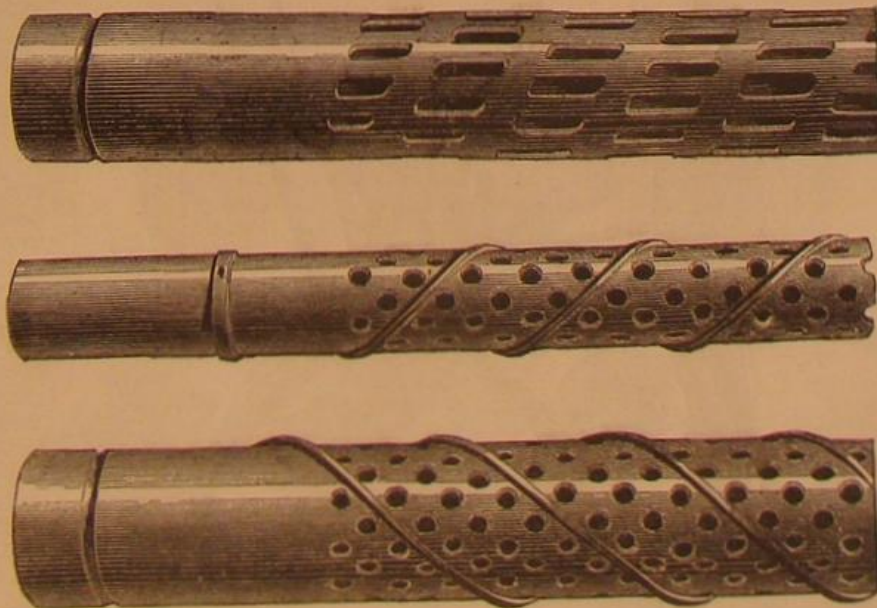
Fig. 1.—SCHMITZ' REVOLVING FIRE BARS.

laws of this State, and probably of most of the States, require messages to be transmitted in the order in which they are received. This argument is just as good against the half-rate night messages, as to which, so far as we know, it has never been raised. It is not in either case a valid objection, for both would be a special contract between the telegraph company and its customers, and therefore not within the scope of the law in regard to telegraphic service.—*The Telegrapher*.

Metal Arches.

The above was the title of a paper read last week by the President, Professor Fleeming Jenkin, at the closing meeting

Fig. 2



of the Edinburgh and Leith Engineers' Society. The Professor began by describing the stresses which occurred in the common masonry arch, illustrating the subject by means of a wooden model of novel construction, in which the arch was rendered flexible. He explained that, in papers by Professor Clark Maxwell, Mr. Bell, and Professor Fuller, of Belfast, methods were given by which the maximum intensity of stress on each part of a metal rib could now be determined with as great accuracy as the stress on the ordinary girders; and the reader of the present paper expressed a strong opinion that the great bridges of the future would be metal arches, which for large spans were essentially more economi-

IMPROVED HORSE HAY RAKE.

The invention herewith illustrated consists of a simple and novel apparatus for operating horse hay rakes, by means of which, it is claimed, both the rake and the clearer are more securely and readily adjusted, and at the same time more easily worked by the driver.

The thills are hinged to the axle, so that the latter, when released from the mechanism below described, is turned in its wheels by the pulling of the horse, the effect of such turning being to raise the rake. During the gathering, however, this revolution is prevented by the rod, A, which is bifurcated at its rear end and provided with several holes, so that it can be adjusted to the axle so as to permit the latter to turn rearward more or less, thus throwing the rake nearer to or farther from the ground, as desired. The forward end of rod, A, is pivoted to the hand lever, B, which lever is pivoted in the frame, C. On said frame, but not shown, is a downward-pointing hook, which receives the rod, A, just behind the lever end, which abuts against the hook, thus holding said rod firmly in the position represented in the engraving, and keeping the rake to its work until the rod is released by the driver by a suitable movement of the lever. The rake clearer, D, is connected by a forked rod to the lever, and is pivoted above the fulcrum of the latter, so that, whenever the lever is actuated for raising the rake, the forked rod will also be moved, and thus the clearer caused to do its work quickly and efficiently.

Patented through the Scientific American Patent Agency March 9, 1875. For further information address the inventor, Mr. Benjamin Mellinger, Mount Pleasant, Westmoreland county, Pa.

IMPROVED NAPPER AND BRUSHER.

The machine herewith illustrated has been especially designed to meet the requirements of manufacturers of hosiery goods. It takes in any width of cloth, from 24 inches down, brushes the cloth in a flattened web, works on both sides at once, cleans off the specks, burrs, seeds, etc., raises a nap, restores the pliancy and softness (of which the washing has deprived the goods), and leaves the web in a smooth roll, ready for the cutter. To those who wash and dry in the garment—in which case the brushing is done immediately after the cutting—these capabilities of the machine will render it of especial utility.

The brush is arranged to do its work thoroughly, and in order to do this the goods are smoothly and gently stretched, both in length and width, over a roller having a firm and true surface, such surface being so made as to hold the goods in this smooth, stretched shape. To accomplish this, rollers about 5½ inches in diameter, made of cast iron pipe, are used; the shaft runs clear through, and the heads are shrunk in; the surface is then turned off true, and, with a tool made like a comb, having V-shaped points, the roll is filled with parallel grooves; it is then grooved lengthwise with the same tool. This gives a surface similar to emery, but differing from it in being true, with no chance to come off; it is then given a thin coat of paint to prevent rusting.

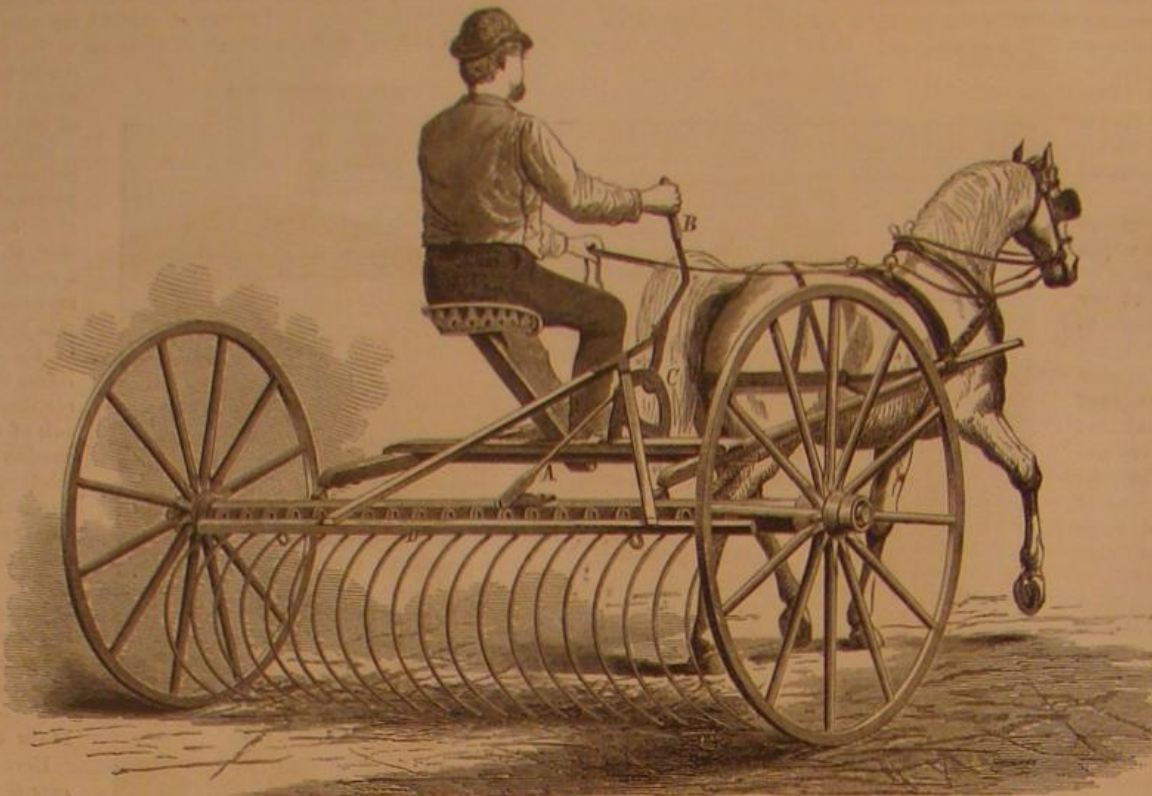
For the brush card, clothing is generally used, and the brush rollers are made of wood, so that the clothing can be easily tacked on. Its bearings are attached to long swing arms, which are held in place by spiral springs and adjusted by thumb screws and check nuts, so that the brush can be set parallel with the iron roller, and as close or far from the cloth as required. Its shaft and bearings are so made as to enable the user to turn it end for end in a few moments, the object being to keep the brush wire in working shape.

When a quarter or a seam, caused by basting on the end of another roll, reaches the brush, it should be raised for a moment to prevent injury to it. For this purpose, a handle on the left hand side of the machine is so connected as to raise both brush rollers at once. In case the cloth is brushed just as it comes from the knitting machine, the roll is placed in the bearings direct. The receiving pulleys are 5 inches in diameter, 3½ inches face, calculated to run about 240 revolutions, the top to turn from the machine, thus giving 800 revolutions to the brushes. As the large pulley that gives motion to the brushes is double-crowned, they can be driven with one open belt passing around all three pulleys, or by two separate belts, open or crossed as the user prefers.

For the take-up, change gears are sent, so that the user can hurry or retard the cloth, as circumstances require.

The spreaders are made with long dowel pins, and can be lengthened by slipping on to said pins anything to fill the space and keep them extended, so that a few spreaders will meet the needs of most mills.

The amount of work that can be passed through the machine and the durability of the brushes depend upon how thoroughly one wishes to brush. One party in Troy, we are informed, is using one brusher for eight sets of cards, using

**MELLINGER'S HORSE HAY RAKE.**

old fancy for the brushes. Another party, who has just started one, has new clothing made on purpose for it, and is brushing for eleven sets.

Further particulars may be obtained from the manufacturer, Mr. C. Tompkins, Troy, N. Y.

Death Belts.

Frequently in cases of shipwreck, especially in comparatively smooth water, life belts would furnish a means of temporary safety until boats were got ready on shore. They would have done so in the case of the Northfleet, and in the still more recent instance of the Schiller. But the life belts must be genuine, and not pretenses for the purpose of figur-

instead of supporting, the unfortunates who had trusted them, by dropping down towards their hips. In this way scores of dead bodies were picked up in the water, wearing belts which, if properly constructed, would have saved the life of the wearer.

Printing Telegraph Instruments Duplexed.

Another important step has been successfully taken in duplex telegraphy. The combination printing telegraph instruments, used to a limited extent by the Western Union Company, have been successfully adapted to duplex operation. Two of these instruments, specially arranged for working on the duplex system by Mr. G. M. Phelps, are now in operation, sending and receiving simultaneously on one wire, and the speed at which they are worked is represented as something remarkable. Mr. Gerrett Smith has been engaged for some time past in making the necessary arrangements of circuits, etc., to accomplish this, and it is a complete success. The ease and rapidity with which these new instruments work, and the advantages which they possess, will be likely to lead to a more extensive use of them by the Western Union Company. No doubt they can be adapted to quadruplex operation also; and with four improved combination printers working on one wire, the amount of business which can be transmitted will be likely to astonish not only outsiders, but a large proportion of even experienced telegraphers.

It would be another instance of the changes which time

brings about, if the printers, with their old time recommendation, "prompt, accurate, and reliable," should once more become leading and favorite instruments for commercial telegraphic purposes.—*The Telegrapher.*

To Prevent White Paint from Turning Yellow.

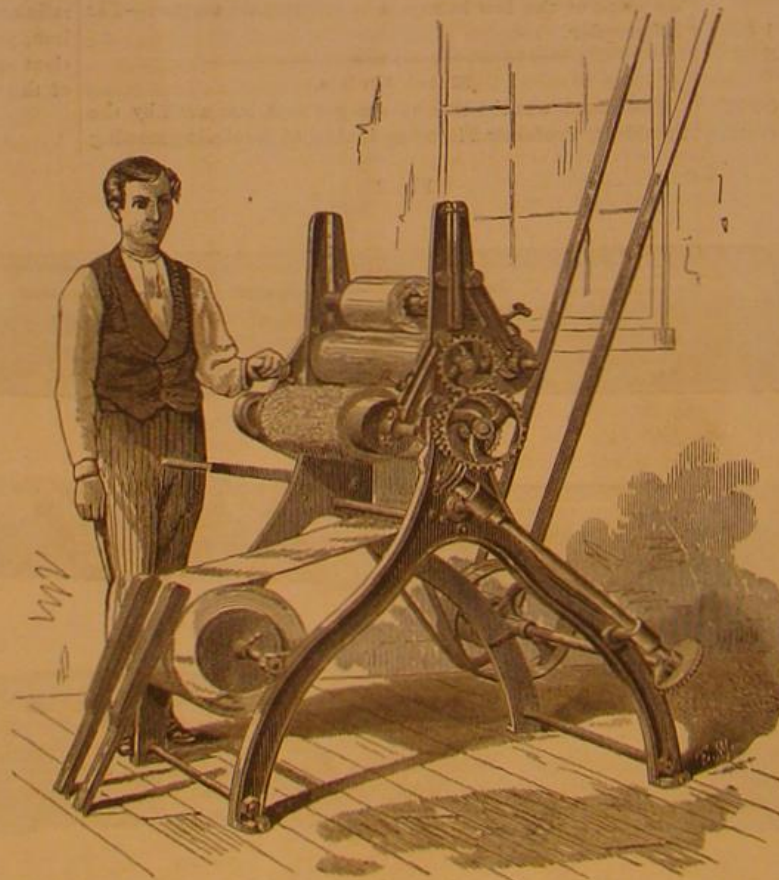
Dr. Luedersdorff, of Berlin, in discussing the cause of white paint turning yellow wherever it is excluded from the light, attributes this fault to an inseparable property of linseed oil, and believes that the only cure for it is to substitute some other material for the oil. The value of drying oils for mixing with pigments depends entirely on the property which they have of being converted, by the absorption of oxygen, into a peculiar resin. When entirely dry, this resin is the only bond of union, and to it the oil colors owe their stability. During this oxidation of the oil to a resin and the drying of the paint, especially where there is insufficient air and light, the yellowing takes place.

The author believes that if, instead of waiting for the oil to be gradually converted into a resin, an already formed and colorless resin were employed as binding material, the paint could not change in color. Out of the long list of resins to be chosen from, Luedersdorff selects two, one of which is soluble in alcohol, the other in turpentine; the former is gum sandarac, the latter gum dammar.

When sandarac is employed, it is first carefully picked over, and all pieces of bark or wood thrown out; 7 ozs. of sandarac, 2 ozs. Venice turpentine, and 24 ozs. of alcohol of 90 per cent Tralles, or specific gravity 0.833, are put in a suitable vessel over a slow fire or spirit lamp, and heated with diligent stirring until it is almost but not quite boiling. If the mixture be kept at this temperature, with frequent stirring, for an hour, the resin will all be dissolved, and the varnish is ready for use as soon as it is cool. The Venice turpentine is necessary to prevent too rapid drying, and more dilute alcohol cannot be employed because sandarac does not dissolve easily in weaker alcohol, and furthermore, the alcohol, by evaporation, would soon become so weak that the resin would be precipitated as a powder. When this is to be mixed with white lead, the latter must first be finely ground in water and dried again. It is then rubbed with a little turpentine on a slab, no more turpentine being taken than is absolutely necessary to enable it to be worked with the muller. One pound

of the white lead is then mixed with exactly half a pound of varnish and stirred up for use. It must be applied rapidly because it dries so quickly. If, when dry, the color is wanting in luster, it indicates the use of too much varnish. In such cases the article painted should be rubbed, when perfectly dry, with a woolen cloth to give it a gloss.

Dammar varnish is made by heating 8 oz. gum dammar in 16 oz. oil of turpentine to 60° or 70° R. (167° to 190° F.), stirring diligently and keeping it at this temperature until all

**TOMPKINS' NAPPER AND BRUSHER.**

ing in advertisements as proofs of the care taken by the owners for the lives of their passengers. Those found upon the Schiller's victims appear to have been of the latter sort, consisting, as they did, of a few slabs of cork fastened together and to the person by one or two pieces of tape, and were thus worse than useless to a good swimmer; for it is stated that those who recovered the bodies declare that in very many instances they were found with the head under water and the heels in the air, showing that the belts had really drowned,

is dissolved, which requires about an hour. The varnish is decanted from any impurities and preserved for use. The second coat of paint, when dry, is dead white, and does not take a gloss so easily as the alcoholic paint. To give it a luster, a coat of the pure varnish, to which half its weight of oil of turpentine has been added, may be applied. It is still better to apply a coat of sandarac varnish made without alcohol, because dammar varnish alone does not possess the hardness of sandarac, and, when the article covered with it is handled much, does not last so long.

These paints are, of course, inferior in elasticity to freshly applied oil paint; but for window frames and closet doors, which do not require much bending, this is a quality easily dispensed with.

THE ANIMALISM OF PLANTS.

A century ago, Dr. Erasmus Darwin, grandfather of our

contemporary scientist who wrote the "Origin of Species," published a book entitled "The Botanic Garden": the second part of which bore the name of "The Loves of the Plants," and was much laughed at for its strange theories and the fantastic manner in which consciousness and volition were attributed to specimens of the vegetable kingdom. It was reserved for our day to show, beyond question or cavil, that paralysis of a plant can be produced by external injury, and that the existence of a nervous system in a vegetable cannot be denied; that flowers display their gorgeous hues to attract the insects which convey the impregnating pollen gathered from specimens of the other sex of the same plant; that flowers can not only digest and assimilate animal matter, but can crush insects and drop them on the soil for purposes of fertilization.

We publish herewith engravings of some carnivorous plants, which were described by Dr. Hooker, the cele-

brated botanist who has charge of the Royal Botanical Gardens, at Kew, Eng., in an address before the British Association, at its recent meeting at Belfast. Dr. Hooker and Mr. Darwin examined them very closely, and found that, when a fly was caught, it was dissolved in a digestive fluid exactly like ordinary gastric juice, and the same happened with a piece of beef; but when a mineral substance was placed on the leaf, there was no contraction. The fine hair on the leaf closed gently on a piece of wet chalk, but soon opened again, and rejected it. The experiments also proved that the contraction of the leaf was precisely similar to the contraction of a muscle, so that, as Dr. Hooker explained, it is not only proved that the digestion of the plant is like that of animals, but that it has a nervous system, and in fact forms one more link in the continuity of Nature. As our readers will see by reference to the engraving, these plants are furnished with various kinds of traps or snares for the unwary insects upon



CARNIVOROUS PLANTS.

which they live. The *sarracenia*, the large plant on the left of the page, the *nepenthes*, in the center, and the *cephalotus*, which is immediately below it, have lids which shut down upon their victims. The *darlingtonia*, shown on the right, curls its leaf around them; the *pinguicula*, in the right hand bottom corner, shuts itself up and curls its leaves; the *dionaea* on the left, below the *sarracenia*, also shuts itself upon its prey, and the *drosera*, in the left hand bottom corner, has an arrangement of fine lines ending with little knobs, which it throws over its prey, and thus secures it.

"To Mr. Ellis," says Dr. Hooker, "belongs the credit of divining the purpose of the capture of insects by the *dionaea*. But Rev. Dr. Curtis made out the details of the mechanism, by ascertaining the seat of the sensitiveness in the leaves; and he also pointed out that the secretion was not a lure exuded before the capture, but a true digestive fluid, poured out, like our own gastric juice, after the ingestion of food."

"For another generation the history of this wonderful plant stood still; but 1868 an American botanist, Mr. Canby, who is happily still engaged in botanical researches, while staying in the *dionaea* districts, studied the habits of the plant pretty carefully, especially the points which Dr. Curtis had made out. His first idea was that 'the leaf had the power of dissolving animal matter, which was then allowed to flow along the somewhat trough-like petiole to the root, thus furnishing the plant with highly nitrogenous food.' By feeding the leaves with small pieces of beef, he found, however, that these were completely dissolved and absorbed; the leaf opening again with a dry surface, and ready for another meal, though with an appetite somewhat jaded. He found that cheese disagreed horribly with the leaves, turning them black and finally killing them. Finally, he details the useless struggles of a curculio to escape, as thoroughly establishing the fact that the fluid already mentioned is actually secreted, and is not the result of the decomposition of the substance which the leaf has seized. This curculio, being of a resolute nature, attempted to eat his way out. 'When discovered he was still alive, and had made a small hole through the side of the leaf, but was evidently becoming very weak. On opening the leaf, the fluid was found in considerable quantity around him, and was without doubt gradually overcoming him. The leaf being again allowed to close upon him, he soon died.'"

The foregoing description and illustration appeared in a special edition of the *SCIENTIFIC AMERICAN*, issued in December, 1874, and will be read with interest by all students of natural history and lovers of the marvelous in Science.

Sir John Lubbock has recently turned his attention to botany with special reference to the same thing, and has recently published "British Wild Flowers Considered in Relation to Insects," which will undoubtedly throw a great deal of light upon it. Meanwhile in this country no pains have been spared by those competent to investigate; and within the last year or two one lady in particular, Mrs. Mary Treat, of Vineland, N. J., herself both a practical botanist and a charming writer, encouraged in her pursuits by Professor Gray, of Cambridge, Massachusetts, has made diligent search for plants possessing these characteristics, and has patiently watched them through months of experimenting, keeping a diary and giving the information thus gained to the public. Mrs. Treat's latest experience is with bladderwort, which she carefully observed, and found ample proof that the little sacks are traps for water insects which are unsuspectingly drawn in and then consumed. She found that not only small insects were caught, but "innumerable moths, and butterflies two inches across, are held captive until they die—the bright flowers and brilliant, glistening dew luring them on to sure death." Some of these plants she took to the house, "away from atmospheric agitation," and began her experiments, pinning living flies "within a quarter of an inch of the most vigorous leaves; in less than an hour the flies' legs are entangled in the glands. I now take the long-leaved sun dew, which is more common and a more wonderful flytrap than either of the other species, place a struggling fly on a vigorous, healthy leaf; in less than three hours the leaf is folded completely around its victim. I take a bit of raw beef, placing it as nearly as possible on the center of the leaf; in twelve hours it is so enfolded in the leaf as to be completely hidden from view." Mineral substances, bits of chalk, etc., were not at all affected. Next she tried the round-leaved sun dew, whose leaves clasped a piece of raw beef in less time.

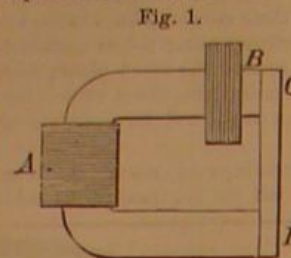
Killing Gophers.

The gopher is one of the most troublesome pests that the Western farmer has to contend with, and as difficult of extermination as any. Several inquiries have been made of us says *The Inter-Ocean*, as to the most effective means of disposing of them; and with a view of finding the most approved, we have consulted several farmers who have had extensive and painful experience with them. The plans for removal have been as various as the persons consulted, and have included poisoning, drowning, shooting, trapping, and other methods. But to our minds by far the best plan is that adopted and highly recommended by Dr. W. A. Pratt, of Elgin, Ill., and seems the most simple, least expensive, and most effective of any. He takes a light steel jaw trap, such as is used for catching rats, and crooks the catch (that passes over one of the jaws to the pan) a little, so as to allow the jaws to come nearer together than they do when set for ordinary purposes. He then sets the trap so that it will go off easily, and plants it bottom upwards over the gopher's hole, bringing the dirt a little around the edges so that the only apparent passage is through the jaws of the trap. The gopher, who generally comes out with some haste, rushes up, hits his head or paws against the pan of the trap, which unfastens it, and he is

caught securely in the jaws. Dr. Pratt says that a few days of persistent trapping in this way will completely clean out every vestige of the gophers from a large farm.

A NEW MAGNETO-ELECTRIC ENGINE.

In order to investigate the induced currents produced by the application of armatures to horseshoe magnets, Professor W. R. Morse recently constructed the simple apparatus represented in Fig. 1. This consisted of cylindrical horse



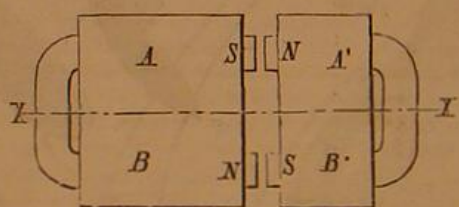
shoe electromagnets, the wires of which were wound about iron cores at the bend of the iron, so as to form practically straight electro-magnets with cores horseshoe in form. A is the coil of the electromagnet, and B the induction coil. Upon exciting the electro-magnet, induction currents

arose in the coil of fine wire, B, both at making and breaking the circuit. These currents were measured by a reflecting galvanometer placed in the circuit of the coil, B, and were compared with those obtained from the same electromagnet by placing a straight armature, C D, upon its poles, and then exciting the electromagnet. The results of experimenting show that a marked increase, amounting to nearly 25 per cent in the strength of the induction currents, is due to the application of the armature to the poles of the electromagnet. The first induced current after the removal of the armature, which results from again making the current in the electromagnet, shows the same increased effect, but the following current, resulting from breaking the circuit of the electromagnet, falls to its normal amount. This is noteworthy as indicating, according to the author, a certain molecular change in the iron due to the application of the armature.

Generally, it also appears that the induction currents, resulting even from the employment of straight soft iron armatures which had been carefully deprived of residual magnetism, are more than four times as strong as those obtained by merely slipping the induction coil on and off the limits of the electromagnet; and when electromagnet armatures are used, the effects far surpass those obtained by non-magnetic soft iron straight armatures.

Based on these facts, a magneto-electric engine of the fol-

Fig. 2



lowing construction is suggested by Professor Trowbridge: The horseshoe armature is made to revolve around the line, X X, Fig. 2, as an axis. It has been found by experiment that, when a north and south pole are opposed, the induction currents through B and A' are in the same direction, and those through B' and A are also in one direction. By a suitable commutator, the currents circulating through the coils on the stationary magnet can be sent through those on the armature, and vice versa. The residual magnetism in soft iron is sufficient to start the induced currents. Experiments, says the *American Journal of Science and Art*, are now being made upon the engine.

A Word to Young Mechanics.

"When Tubal Cain began to invent utensils and started to make a din in his forge, I suppose the first idea that struck him—for he must have been very observing in his youth—was that some materials are soft and easily manipulated, while others are of a more obdurate and ungovernable nature, and consequently require different treatment at the hand of him who would attempt to work them into new forms, so as to mold the shapeless mass to his uses, or engrave order and design upon chaos. With the lesson to be learned from the example of this pioneer of our order in view, I desire to say a word to young mechanics that would have been valuable to me while in the maze of study in the days in which I was learning a trade.

Every one that ever learned a trade knows that many a time he has been without any clear idea of what he was doing, having merely acted as the machine of a master who was credited with being a No. 1 mechanic and all which that should imply, but who just lacked one thing, and that a very important one—he did not understand how to tell another how to do what he could do exceedingly well himself, and, as a general rule, got into a passion because his 'cub' didn't do it just to his mind. Now I could drop a word of advice here to journeymen; but you know, boys, as well as I do, that it is not our place to tell a 'jour.' anything, for fear his dignity might suffer, and ours too in consequence. But my advice to you is simply this: In starting out to learn a trade, make up your mind to learn and study both at the same time. This combination of occupations, it unfortunately happens, is rarely agreeable at fifteen or seventeen years of age, when one has just left school, and all study is looked at as something belonging to bygone days. I have been told by many a young man that work was his portion now, and that he didn't have time to study, and besides he was so tired at night that it was out of the question. My reply to those who speak in this way is:

'But you misunderstand me, my young friend. The lessons you need to study now are not taught in schools, colleges, or seminaries. You never see the books you need to apply your mind to now in libraries.'

I lay a piece of wood before the carpenter and say, 'my boy, that is one of your books.' I present a piece of iron to the blacksmith in the same manner, and on through all the branches of mechanism. The carpenter answers:

'Why, this is only a piece of pine, or of oak, and nothing more.' The smith will say: 'A bit of iron, and that's all. But here comes the question, 'what do you know of the nature of the wood, or of the iron, and why should you know its nature? True, you may be able to work them after a fashion, and your powers of imitation may enable you to be as good a mechanic as the man who taught you; but you will never thus, in the nature of things, excel, and excellence is what every young man should have in view in any pursuit, for without it you will be termed just what you so often hear of—only a mechanic.'

Every mechanic should have as thorough a knowledge of the material he works as has the best chemist in the land; and this cannot be arrived at without close study and attention to its every natural feature—strength, power of resistance, and tension; in short, everything connected with its working or transformation from one condition to another. This knowledge is what is meant when you hear a man spoken of as an experienced mechanic."—*Paper Trade Journal*.

Correspondence.

The Fireless Locomotive.

To the Editor of the *Scientific American*:

The fireless method of using steam is one of those simple affairs which need but little experiment to develop its best results.

Locomotives of this kind with large tanks will probably prove more economical than those with small tanks. If a tank, 3 feet diameter and 10 feet long, is capable, with one charge, of propelling a car with from 25 to 40 passengers a distance of 8 or 10 miles, a tank of twice this capacity would probably do considerably more than twice the amount of work, owing to the greater body of concentrated power and heat in proportion to the weight and surface of tank. The weight of these tanks may be reduced to a minimum by making them with hemispherical ends.

A tank of this form, 4 feet in diameter and 15 feet long, capable of sustaining a pressure of 360 lbs. per square inch safely, would weigh only about one third as much as an ordinary locomotive boiler. A tank of this size once charged with cold air only, to a pressure of 350 lbs. would propel an ordinary horse car load of passengers about five miles, if I figure correctly; if charged with water and steam at the same pressure, it would probably propel the same load some twenty miles. Notwithstanding this difference in expansive power of the two mediums, condensed air might prove the more economical and satisfactory of the two, especially in localities where ample water power could be obtained for condensing the air into reservoirs for charging the locomotive tanks.

A foreign periodical recently contained an illustrated description of a car propelled by a series of coiled steel springs arranged upon a single shaft beneath the car; but nothing very satisfactory seemed to be developed by this device. At present there seems to be nothing so likely to supersede horses on street railroads as the fireless locomotive or a system of condensed air engines. When the possibilities of both of these systems are fully developed, city transit will be conducted much more cheaply and satisfactorily than it now is.

Worcester, Mass.

F. G. WOODWARD.

Fire Escapes Wanted.

To the Editor of the *Scientific American*:

The French church in which the Holyoke horror occurred was a large wooden building constructed of inflammable pine, with insufficient modes of exit in case of accident. Under such conditions, the best fire department in the world is helpless, and the only possible remedy is to rigidly require such buildings to be properly constructed. The only door by which escape could be made opened inwardly; and as was the case in the accident at a New York church several weeks ago, the frenzied crowd of men, women, and children pressed against it, barring their only way of escape, and became a prey to the raging flames.

There must be a remedy for all this. There must be responsibility somewhere for an arrangement that will crowd seven hundred strong men, timid women, and helpless children into a small church with no sufficient means of egress in case of an alarm. The church at South Holyoke is not the first that has been thus destroyed, and with it the lives of many human beings; yet that church, and many another like it, seems to have been constructed with a special view to occasioning a loss of life in the event of a stampede. This large and densely packed congregation were quietly seated in their church at a certain moment; and in twenty minutes thereafter, seventy-five of their number lay dead and dying, trampled under foot, crushed by fatal leaps, or blackened by the flames that rushed upon them. There was not a person in that church who could not, with an uninterrupted passage, have placed himself in security from danger in the space of one minute. If the means of egress had been sufficient to empty the church in five minutes, all would have been saved.

The estimates for the strength of gallery and floor are

based upon the largest crowds they can hold, and may be calculated with accuracy. Why should not similar estimates and calculations be made in determining the facility for emptying a place for public gathering? Why should not the architect picture to his mind's eye a great audience struggling for egress, as well as standing or sitting, wedged together, on the floor and gallery? There is need for the law to control these matters. Provision can be made, and it should be compelled to be. We forbid the building of frame structures in our cities; we maintain, at enormous cost to the public treasury, and by an onerous tax on private property, efficient and skillful fire departments; we cover the roofs of our cities with a network of telegraph wires that summon, at an instant's warning, the distant engine to the scene of a conflagration; we take every public precaution against the destruction of property by fire; yet we take none against the destruction of human life through the same instrumentality. To save some slight expense, an extra flight of stairs, or an extra door and a few convenient windows, the law permits hundreds of persons to be gathered into a pen from which there is no escape in case of confusion and alarm, to be seated, as it were, over a magazine that may be exploded in an instant.

There is just as much danger of fire in every church and public place as there was in the church at South Holyoke. Drapery and lights in close proximity may be noted anywhere. It chanced there, as it may in any such place, that the light touched the drapery; that a small stream of flame shot terror into some one's heart; that there was a cry, and, as the contagion of fright increased, a rush for the door. All this may occur in any place where a crowd is gathered; but it is not from every place that, when the rush begins, the crowd can escape. The crowd could not readily pour itself out of the South Holyoke church, nor can a startled crowd so pour itself out of anyone of two thirds of the churches and halls in this country.

Indianapolis, Ind.

L. K. Y.

The Motive Power of Light.

To the Editor of the Scientific American:

I read in your paper an account of Professor Crookes' instrument for proving the motive power of sunlight. In Dick's "Practical Astronomer," chapter 1, you will find a description of a device made for the same purpose thirty years ago.

R. L. TAYLOR.

914 Chestnut street, Philadelphia, Pa.

The following is the description to which our correspondent refers:

[From "The Practical Astronomer," by Thomas L. Dick, LL.D. Published in 1843.]

"Light, though extremely minute, is supposed to have a certain degree of force momentum. In order to prove this, the late ingenious Mr. Mitchell contrived the following experiment: He constructed a small vane in the form of a common weathercock, of a very thin plate of copper, about an inch square, and attached to one of the finest harpsicord wires about ten inches long, and nicely balanced at the other end of the wire by a grain of very small shot. The instrument had also fixed to it in the middle, at right angles to the length of the wire, and in a horizontal direction, a small bit of a very slender sewing needle, about half an inch long, which was made magnetical. In this state the whole instrument might weigh about ten grains. The vane was supported in the manner of the needle in the mariner's compass, so that it could turn with the greatest ease; and to prevent its being affected by the vibrations of the air, it was enclosed in a glass case or box. The rays of the sun were then thrown upon the broad part of the vane, or copper plate, from a concave mirror of about two feet diameter, which, passing through the front glass of the box, were collected into the focus of the mirror upon the copper plate. In consequence of this, the plate began to move with a slow motion of about an inch in a second of time, till it had moved through a space of about two inches and a half, when it struck against the back of the box. The mirror being moved, the instrument returned to its former situation; and the rays of the sun being again thrown upon it, it again began to move, and struck against the back of the box as before. This was repeated three or four times with the same success.

On the above experiment the following calculation has been founded: If we impute the motion produced in this experiment to the impulse of the rays of light, and suppose that the instrument weighed ten grains, and acquired a velocity of one inch in a second, we shall find that the quantity of matter contained in the rays falling upon the instrument in that time amounted to no more than one twelve-hundredth-millionth part of a grain, the velocity of light exceeding the velocity of one inch in a second in the proportion of about 12,000,000,000 to 1. The light in this experiment was collected from a surface of about three square feet, which reflected only about half what falls upon it; the quantity of matter contained in the rays of the sun, incident upon a foot and a half of surface in one second of time, ought to be no more than the twelve-hundred-millionth part of a grain. But the density of the rays of light at the surface of the sun is greater than that at the earth in the proportion of 45,000 to 1; there ought, therefore, to issue from one square foot of the sun's surface, in one second of time, in order to supply the waste by light, $\frac{1}{45,000}$ th part of a grain of matter, that is, a little more than two grains a day, or about 4,752,000 grains, or 670 pounds avoirdupois, nearly, in 6,000 years; a quantity which would have shortened the sun's diameter no more than about ten feet, if it were formed of the density of water only.

If the above experiment be considered as having been ac-

curately performed, and if the calculation founded upon it be correct, it appears that there can be no grounds for apprehension that the sun can ever be sensibly diminished by the immense and incessant radiations proceeding from his body on the supposition that light is a material emanation. For the diameter of the sun is no less than 880,000 miles; and before this diameter could be shortened, by the emission of light, one English mile, it would require three millions one hundred and sixty-eight thousand years, at the rate now stated; and before it could be shortened ten miles, it would require a period of about thirty-one millions of years. And although the sun were thus actually diminished, it would produce no sensible effect or derangement throughout the planetary system. We have no reason to believe that the system, in its present state and arrangements, was intended to endure for ever; and before the luminary could be so far reduced, during the revolutions of eternity, as to produce any irregularities in the system, new arrangements and modifications might be introduced by the hand of the All Wise and Omnipotent Creator. Besides, it is not improbable that a system of means is established by which the sun and all the luminaries in the Universe receive back again a portion of the light which they are continually emitting, either from the planets from whose surface it is reflected, or from the millions of stars whose rays are continually traversing the immense space of creation, or from some other source to us unknown."

Our Patent System.

"A Defence of our Patent System," and "Our Country's Debt to Patents," are the titles of two essays, written respectively by Mr. John S. Perry, of Albany, N. Y., and Mr. H. Howson, of Philadelphia, and published under the auspices of the United States Patent Association, in a handy volume, by J. R. Osgood & Co., of Boston, Mass. Mr. Perry's paper is a reply to the speech of Hon. H. B. Saylor, in the House of Representatives, last winter, in support of a bill permitting the free use of any article made under a single patent, on the payment of a royalty of 10 per cent and the filing of a bond by the user. The object of the measure was the prevention of such monopolies as those controlled by the sewing machine ring and the hat body people; but the provisions advocated, as we remarked in commenting upon them at the time, were objectionable and contrary to public policy for a variety of reasons, which need not here be recapitulated as the bill was not passed.

Mr. Perry does not confine himself to showing up the disadvantages of Mr. Saylor's proposition, but goes further and denies, *in toto*, the latter gentleman's statements as to the profits made by the various industries involving the manufacture of patented articles; and he fortifies his denials by the testimony of a number of manufacturers and inventors, and by the assertion that the census returns, from which Mr. Saylor gathered his statistics, are entirely unreliable. There are several points in Mr. Perry's statements as to the profits of the sewing machine people, and those of various other manufacturers, which are open to criticism; but, in the main, his views on the general subject of our patent system are sound and able. He says, very truly, that "a patent law compels the inventor, if he would avail himself of its benefits, to make the inventions known by spreading out a minute description of the same upon the public records of the Office, and, if he would reap pecuniary advantage, to publish them to the world, thereby giving an opportunity for their general adoption. . . . In no sense can a patent be considered an injustice to the public, because it takes nothing from them which they had ever before possessed; on the contrary, it gives them something new, some increased facility, some more advantageous method, a cheaper substitute for a rare and costly article. . . . In proportion as the patent system has stimulated and developed inventions among our people, have our mechanical arts risen in importance, until our power in this direction has become recognized throughout the world."

Mr. Howson's essay will, without doubt, interest every one who is himself interested in patents. He deals with the subject in a practical and lucid manner, and his remarks are well worth careful perusal. We give an extract below, and shall present other selections in future issues.

"We constantly hear the word 'patents' from the mouths of the manufacturer and mechanic, the wholesale merchant and retail dealer, and the farmer, and always in connection with something that is novel, or of superior quality, or something that can be obtained at a cheaper rate than usual.

Now and then we hear the word uttered in contemptuous tones by disappointed speculators, jealous manufacturers, men who would invent without being inventors, or by those who would attempt to cure the minor evils always accompanying even the most salutary and beneficent systems of public policy, not by attacking these evils in detail, but by the disorganization of the whole system.

Common as the word is, there are few who are aware how intimately related patents are to our present well-being and comfort, how much we owe to patents in the past, how much we have to hope from them in the future, and how intimately they are interwoven with our whole social system."

WHAT PATENTS HAVE DONE FOR US.

"I propose to show how grateful we ought to be for our patent system, not by any elaborate investigation of different branches of industry, not by any lengthy historical and statistical researches, but by confining my remarks to familiar objects within my reach in the room which I now occupy—a library furnished with the ordinary accessories which a professional man requires.

There is a tapestry carpet on the floor, a carpet with a tasty pattern woven in brilliant colors. Twenty-five years ago, a

skilled workman could weave by hand two yards per day of a carpet like this, but not equal in quality; and now a single power loom will weave twenty yards per day. 'The carpets, moreover,' to quote the words of a well known authority, 'are more exact in their figures, so that they are perfectly matched, and their surface is smooth and regular. They surpass, indeed, in their quality, the best carpets of their kind manufactured in any other part of the world.'

To-day these superior carpets can be purchased at half the cost per yard charged for the inferior hand-made carpets of thirty years ago; that is, if we take into account the difference in value of money then and now.

To what shall we attribute this rapid progress in the manufacture of carpets? To Erastus B. Bigelow, you will say. I shall not be detracting from the merits of this great American inventor in saying, as I believe he himself would say, that the rapid progress of this manufacture is due quite as much to our patent system as to Bigelow's ingenuity.

This accomplished patentee spent years of studious application in the production of his loom. Where was the incentive to this laborious mental task? The reward which our patent system held out to him. Where was the incentive for capitalists to invest money in the manufacture of these carpets on a large scale? The security which patents afforded for the investment. Mr. Bigelow, although the most prominent inventor in this branch of industry, was not the sole contributor to its progress. Crompton and hosts of other patentees, have aided in bringing this manufacture to its present perfection, or rather to its present state of excellence; for we cannot foresee the end which perfection implies. We must look for further improvements, based on future patented inventions, providing progress is not obstructed by legislation tending to destroy the motive to invent. It is safe to say that better carpets may be seen to-day in the cottages of hardworking artisans than were found forty years ago in the houses of the wealthiest citizens; and this is due to the ingenuity called out by the incentives which patents have presented, and continue to present. It is not the wealthy alone who are gainers by our patent system; it is the masses who derive the greatest comforts from that source.

Before I leave the carpet, let me say that its greater durability is insured by a cheap patented lining, for different styles of which a dozen or two of patents have been granted, and that the carpet is secured by patent fastenings, on the production of which much ingenuity has been expended; for patents for these little devices can be counted by the score."

To be continued.

The Inventor's Paradise.

"A thousand patents," says a London writer, "are granted every month in the United States for new inventions. This number exceeds the aggregate issue of all the European States, yet the supply does not equal the demand, and the average value of patents is greater in America than in Europe by reason of the vast number of new industrial enterprises and the higher price of manual labor. A hundred thousand dollars is no unusual consideration for a patent-right, and some are valued by millions. The annual income from licenses granted on the Blake sole sewing machine is over three hundred thousand dollars, and other patented inventions are equally profitable. Inventors are encouraged by the moderate government fee of thirty-five dollars, which secures an invention for seventeen years without further payment; the rights of patentees are generally respected by the public; and no national legislator, with a single exception, has ventured to propose the abolition of a system which at once secures substantial justice to inventors and proves of incalculable advantage to the nation."

GUTTA PERCHA and india rubber are brought hither chiefly from Brazil and Columbia.

DECISIONS OF THE COURTS.

Supreme Court of the United States.

PATENT PAPER COLLAR.—THE UNION PAPER COLLAR COMPANY, APPELLANTS, vs. ISAAC VAN DEUSEN, JOHN VAN DEUSEN, and HENRY BOEHMER, PARTNERS, AS VAN DEUSEN, BOEHMER & CO.

[Appeal from the Circuit Court of the United States for the Southern District of New York.—Decided at the October term, 1874.]

The purpose of a reissue is to render effectual the actual invention for which the original patent should have been granted—not to introduce new features.

Therefore in an application for reissue, parol testimony is not admissible to enlarge the scope of the invention beyond what was described, suggested, or substantially indicated in the original specification, drawings, or Patent Office model.

Whether a reissued patent is for the same invention as the original depends upon whether the specification and drawings of the reissued patent are substantially the same as those of the original; and if not, whether the omissions or additions are or are not greater than the law allows to cure the defect of the original.

Where the original patent for improvement in paper shirt collars, granted to Andrew A. Evans, May 26, 1863, stated the invention to consist, first, in making the collars of parchment paper, or paper prepared with animal sizing; and second, in coating one or both sides of the collar with a thin varnish of bleached shellac to give smoothness, strength, and stiffness, and to repel moisture, the claim being for "a shirt collar made of parchment paper, and coated with varnish of bleached shellac, substantially as described, and for the objects specified." Held, that a reissue thereof which describes a paper other than parchment paper, or one prepared with animal sizing, and which does not require either side of the collars to be coated with a varnish of bleached shellac for any purpose, the claim being for "a collar made of fiber paper, substantially such as is above described," is for a different invention from that embodied in the original patent.

Articles of manufacture may be new in the commercial sense when they are not new in the sense of the patent law.

New articles of commerce are not patentable as new manufactures unless it appears in the given case that the production of the new article involved the exercise of invention or discovery beyond what was necessary to construct the apparatus for its manufacture.

It appearing that the collars made by Evans, apart from the paper composing them, were identical in form, structure, and arrangement with collars previously made of linen, paper of different quality, and of other fabrics, and that Evans did not invent the paper used by him, nor the process by which it was obtained. Held, that he was entitled to a patent for the collars as a new manufacture.

The relation of employer and employé, in regard to the origin of inventions, stated.

The object in turning down a collar on a curved line instead of a straight line is precisely the same, whether the collar be all paper, paper and linen, or all linen. Hence, where it appeared that linen collars had been turned over on a curved line to prevent wrinkling and to afford space for the cravat. Held, that it was not patentable to apply the same mode of turning down to collars of paper or paper and linen.

Reissued patent of Andrew A. Evans for "Improvement in Paper Shirt Collars," July 10, 1866 (original May 26, 1863), and of Solomon S. Gray, March 29, 1864 (original June 23, 1863), pronounced invalid.

Mr. Justice Clifford delivered the opinion of the court.

C. A. Secord, for appellant.
J. J. Coombs & S. Wetmore, for appellees.

Recent American and Foreign Patents.

Improved Fence Post.

Myron W. Colwell, Dunlap, Iowa.—This invention consists in a tapered fence post made of wrought sheet iron, bent longitudinally into angular form, and having angular slots formed in its side edges, and holes formed in its angle. When the post is used for a wire fence, the wires are placed in the angular slots and tightened in the usual way; for a board fence, the boards are secured to it by wire bands, which are passed through the holes and twisted.

Improved Pantaloons Block.

James McCurdy, Look Haven, Pa.—This invention relates to an improved pantaloons block for forming and ironing pants, and it consists of a forming block made of a front intermediate wedge and a back part, and provided with a locking bolt at the broader end, and a bottom-stretching clamping device at the narrower end.

Improved Horseshoeing Harness.

Isaac P. Pickering, Table Grove, Ill.—This consists in a harness so constructed that the foot on which the shoe is to be placed is held up and in proper position by drawing upon a draft strap, thus avoiding the necessity of holding up the horse's foot in the usual manner.

Improved Railway Switch.

Minter H. Davidson, Pruntytown, W. Va.—This rail is made with a broad base piece, designed to keep it in place when it is moved back and forth. The operating lever plays longitudinally through a clip in which are two oblique holes, which the rounded end of the lever enters, and is locked by a pin. A rod connects the lever with the rail. To change the rail, the locking pin is withdrawn, and the lever is pulled back from the hole it now occupies, and is turned on its fulcrum pin. This, while shifting the rail, brings the end of the lever to the other hole in the clip, into which it is pushed and locked by means of the pin, as before. By this arrangement the adjustable rail cannot be changed or moved until the lever is unlocked and changed to the other hole in the clip, and so on for each change made.

Improved Spring Bed Bottom.

Alva P. Brown, Texas, O.—This invention consists of arched slats resting at the ends on cross bars, which yield to the end pressure of the slats by means of rubber springs. Over the arched slats are horizontal slats fastened at the middle, and resting at the ends on cross bars supported by coiled springs on the movable rests of the arched slats.

Improved Sand and Gravel Separator.

Nicholas J. Keller, Pittsburgh, Pa.—This invention improves the construction of the sand and gravel separator for which letters patent were issued to same inventor May 21, 1872. An elevator discharges the sand and gravel upon a concave wire screen. The screen is set at an inclination of fifty degrees, and is agitated from the driving mechanism of the elevator. Another elevator serves as an endless chain pump to raise water and discharge it through upon the screen. The finer parts of the material pass through the screen into a trough, while the coarser parts slide down the screen board, and the finer parts of said refuse drop through the holes in the lower part of the said screen board. The lumps of coal and other coarse refuse drop from the lower end of the screen board into a flat or other suitable receptacle. The sand and finer gravel, that pass through the screen, slide down the inclined spout into a box, whence they are taken by another elevator, and discharged upon an inclined slide, down which they slide into a convenient receptacle. The elevators last mentioned may be stopped without stopping the sand elevator and screen.

Improved Plant Protector.

Mrs. Martha E. Slocum, Hornellsville, N. Y.—This is a device by which flowers and other plants may be protected against freezing in cold weather. It consists of a hollow tapering standard placed on legs with side openings and shelves at different heights, on which the plants are placed to be heated by a lamp under the standard. A top cross piece supports a covering thrown over the whole to prevent escape of heat and moisture.

Improved Door Mat.

Orrin Rice, Adrian, Ill.—The invention relates to a mat formed of corn husks or analogous material, and a back plate having screw-threaded holes into which the tufts or bunches of husks are screwed.

Improved Blank for Corrugated Paper Boxes.

Albert L. Jones, Brooklyn, N. Y.—The invention consists in the formation of blanks of corrugated paper, by cutting the paper to the size of the designed box, and then creasing the blank across the corrugations, on one or both sides, wherever the blank is to be turned or bent to form the angles of the box. The blanks thus prepared may be packed or transported from place to place, and form an article of commerce, and allow the boxes or canisters to be made where they are used.

Improved Portable Lighter.

John A. Watson, Lexington, Miss.—The invention contemplates the introduction to the public of a very simple and useful device by which a person may quickly strike a light in the dark. It consists in a matchbox having three cells which receive respectively a folding candlestick, a lot of matches, and a spare candle.

Improved Washing Machine.

George S. Jones and Benjamin F. Kidd, Russellville, Ky.—This invention relates to certain improvements in washing machines; and it consists in the peculiar construction of the rollers, which are formed of end plates connected by small detachable metallic rods that are passed through sections of rubber tubing, which series of rubber-covered rods forms the periphery of the rollers. When the periphery of the roller becomes worn, the rods are turned and a new face of rubber presented to constitute a new periphery for the roller.

Improved Fertilizer Distributor.

Clemon Bailey, Kinston, N. C.—The invention consists in a hand sower consisting of a hopper having a bottom slot, and a crank shaft having blades and a long tube, whereby the fertilizer or a ground or powdered substance may be discharged close to the bottom of furrow or surface of ground, and with perfect regularity in the most windy weather.

Improved Washing Machine.

Thomas Addison and James T. Yates, Elliott City, Md.—This invention relates to certain improvements in washing machines which are designed to simplify the construction of the same, and lessen the wear and tear of the clothes. It consists of a receptacle for the water, having inside, and resting upon its bottom, a false bottom, upon which are disposed the clothes. Upon the inner sides of the machine are partitions which form lateral chambers that open into the main compartment both above and below the clothes. Fitting in this main compartment and moving vertically in the same, above the clothes, is a large plunger which is pivoted to and operated by a vertically moving lever. In the center of the plunger is a downwardly opening valve of large size. As the lever is operated the water is forced violently through the clothes, down the false bottom, up the lateral chambers, and falls over the top of the partitions into the main compartment, and through the valve upon the clothes for a repetition of the same action upon the next stroke of the lever.

Improved Low Water Indicator.

James Harding Brown, Porter's Mills, Wis.—This is an improved water gauge for steam boilers, which is provided with a governor for regulating the supply of water and thus keeping the water always at the same level. It also has an alarm whistle, to give an alarm when the water rises to high water mark or sinks to low water mark. It is free from gearing upon the inside, and thus is not liable to stick or work hard.

Improved Carriage Clip.

Alfred W. Doty, Windham Center, N. Y.—Simple and inexpensive springs may with this arrangement be used, the springs being in some form or other interposed between the bars and the body or fittings attached thereto. The invention includes an improvement of the metallic fittings, by making them in malleable iron to economize in the cost of them, and consists essentially of the contrivance of them to be applied or assembled with the other parts without special fitting, except in the shaping of the woodwork and the preparing of it as to size, also in the fitting of a few rivets or bolts.

Improved Machine for Washing Printers' Rollers.

Thomas Muir, Glasgow, Scotland.—This is an improved machine for cleaning, in a rapid and reliable manner, printers' rollers from all adhering ink and other impurities; and it consists of a cylinder that rotates in a trough, with lye or other washing material, transferring the same by its rotary and simultaneous laterally vibrating motion to the rollers hung to quadrantal arms that are fixed to a shaft, and thus may be swung on or off the cleaning cylinder, as required. Fixed to the shaft from below is a lateral plate, whose outer edge assumes a downwardly inclined position on raising the arms from the cylinder, and whose inner edge comes in contact with the same. The arms are held to the cylinder by a notched lever secured to their shaft and resting on a cross bar of the framework of the machine, and these are kept in an upright position by a hook that drops into a notch in the lever. Perforated water pipes are arranged vertically above the rollers to throw a spray of water on them, the drip water being prevented by the inclined plane from running into the lye trough.

Improved Folding Table.

Franklin C. Wheeler, St. Joseph, Mo.—By suitable construction, enabling the four legs to be brought into the same plane, the table top may be turned down against and parallel with the said legs, folding the table into a very compact form for storage or transportation.

Improved Step Ladder.

Henry P. Stichter, Pottsville, Pa.—This ladder has the upper ends of its brace legs held by hooks in groove seats of the body, to prevent the brace from slipping or folding up.

Improved Log Sled.

Hiram S. Bartlett, Midland, Mich.—Suitable construction allows the runner to adjust itself to uneven ground, while the beam is held in place by a reach passing from the forward beam to the hind one. A saddle also strengthens the runner, and renders it less liable to split or break.

Improved Harness Knife.

Alexis Friderick, O'Fallon, Ill.—This invention relates to edge splitting and beveling knives for beveling both edges of a strap; and it consists of a straight blade fastened obliquely to the guide roller for splitting one edge at a time, so that straps of different widths may be split. It is also provided with two cutting edges, contrived so that, when one end of the blade is dull, the other may be used by shifting the blade upside down.

Improved Step Ladder.

Jacob Blauvelt, Blauveltville, N. Y.—This invention consists of connecting or joining plates or hinges for joining the ladder and the braces together at the top, so contrived that they will lock when the braces are adjusted to hold the ladder in the position for use. The invention also allows the braces to fold up to the ladder for storing away, and will lock them in that position. The device further consists of plates contrived to allow the braces to swing up into line, or nearly so, and to lock them in that position, so as to utilize said braces for an extension ladder.

Improved Apparatus for Capsuling Bottles.

Antoine Bosquet, Paris, France.—This invention relates to improved apparatus for fixing metallic capsules on bottles and other necked vessels, the apparatus belonging to that class in which the necessary pressure is applied to the capsule through the medium of water or other fluid acting on an elastic diaphragm or chamber of india rubber brought in contact with the capsule.

Improved Lamp Extinguisher.

J. O. Soderstrom, Pepin, Wis.—The invention consists in two oppositely concaved, but differently sized jaws, one folding within the other, a spring arranged in a curve behind and attached to the jaws so as to slide them forward, and in arms that move on the inside of jaws in order to spread them apart.

Improved Water Filter.

Charles B. Cooper, Nashville, Tenn.—As the water to be filtered is admitted into and rises in an upper vessel, it flows through a siphon, a perforated cone on the short arm of which prevents the coarser impurities from entering the said siphon. The water is further filtered as it flows from the siphon through a sponge and perforated cone on the long arm into an inner cylindrical vessel. Thence the water passes through a large perforated cone at the bottom into the space between the vessels, rises through the sand and gravel in said space, and overflows into a concave ring through the holes, in which it flows into the middle part of the space between other inner vessels, percolates through the gravel and charcoal in said space, and flows out through the holes in the bottom of the lower vessel into a receiver placed beneath it.

Improved Harrow.

Addison H. Whiteside, Onarga, Ill.—This is a right-angle-shaped tooth, one end of which is let into the harrow frame obliquely to the cross section, and confined by a staple. The latter holds the tooth perpendicular when the harrow is drawn by one end, and allows it to swing outward and backward obliquely to the line of the beam, and also to the horizon when drawn by the other end, thus combining two different harrows in one. The staple is secured, so as to be readily detached, by a nut on one of the prongs, which goes through the beam, to allow of taking out the tooth readily.

Improved Nut Lock.

Horace L. Heaton, Lilly Chapel, assignor of one half his right to Benjamin F. Roberts, of West Jefferson, O.—This consists of a nut with a grooved shank, in connection with a double spring entering into grooves at opposite sides of the shank. Said spring is readily detached for removing or applying the nut by an intermediate pivoted cam piece with handle part and drop pin acting thereon for spreading and retaining the same.

Improved Whiffletree.

James Harding Brown, Porter's Mills, Wis.—Clevises are placed upon the end parts of the doubletree and pivoted to said ends by bolts passing through slots in said clevises, so that they may move forward to take up the wear. The rear ends of the clevises project in the rear of half-round end projections, and have rollers pivoted or blocks attached to them, which bear against said half-round projections. The whiffletrees are pivoted to the forward part or bow, or are rigidly attached to the upper arm of said clevises.

Improved Lumber Dryer.

Philipp Pfeffer, New York City.—This invention relates to an improved apparatus for drying lumber of varying thickness within short time by the influence of pressure and heat; and it consists in introducing the boards between press plates heated by steam, and provided with a perforated face lining, with connecting grooves at the inner side, for admitting the escape of the moisture in the lumber.

Improved Corn Sheller.

Frelinghuysen H. Hunter, Heltonville, Ind.—The invention is an improvement in the class of corn shellers having a ribbed surface, over which the ears are drawn by hand to free them of the kernels. A chaff box, which is formed of a sheet metal plate, is applied beneath the ribs of the sheller to catch the kernel husks or chaff that becomes separated from the cob.

Improved Coffee Pot.

Richard Law Bate, Adrian, Mich.—The coffee pot is seated by a bottom extension in the open top of the kettle. A central tube extends vertically from a bottom aperture to about the height of the coffee pot, and is provided with a detachable strainer, having a perforated bottom for the ground coffee. A detachable cap is attached to the central tube of the strainer, and serves to throw the steam on the ground coffee. A vessel with cold water is placed on the top of the strainer for condensing the steam passing from the kettle through the tube to the strainer. The condensed steam drops on the coffee, and passes through the perforated bottom of the strainer into the body of the pot below the same.

Improved Washing Machine.

Solomon Wells, Brownsville, Ky.—This improvement relates to the combination of a series of vertically adjustable rollers, the journals of which work in slots formed in the sides of the suds box, and a series of lower fixed rollers supporting the series of adjustable rollers, and provided with crank mechanism, whereby both series or sets are rotated together.

Improved Beer Cooler.

Wenzel Toepfer, Milwaukee, Wis.—This invention consists of a fan having a hollow and perforated shaft with pipe connections at the ends for receiving cold air from other blowers arranged over the vat containing the beer on trucks, which are caused, by suitable machinery, to reciprocate the fan and rotate it at the same time, so as to agitate the beer and cool it by the air delivered from the shaft. A bent tube is mounted on the trucks, with pipe connections for conducting cold water through the beer as a further means of cooling it, the pipe being contrived to move along in the beer or over it. There is also a new mode of fastening the bottom sheets of the vat together by key clamps and a couple of strips of metal fastened together, between which the edges of the bottom plates are wedged by the clamps.

Improved Plow.

Francis R. Bell, Marshall, Texas.—The object of this invention is to furnish plow mold boards to which the black land of Texas, and other similar soils, will not adhere, so that a furrow can be turned, however sticky and waxy the soil may be. The invention consists in a wooden mold board for plows, saturated with oil, and provided with a number of oil-receiving holes or reservoirs in its edges to keep it saturated.

Improved Truck for Brick Yards.

Edward Noonan, La Salle, Ill.—This is an improved truck for bearing off bricks in a brick yard, so constructed that the shafts may be readily detached from one truck and attached to another without unhitching the horse from the said shafts.

Improved Portable Medicated Hot Vapor Bath.

Robert R. Roberts, Hot Springs, Ark.—This is a box which encloses the body of the patient, containing an adjustable seat and foot rest, and also devices for warming an incoming current of air before the same reaches the person of the bather.

Improved Miner's Lamp.

James Sawyer, Freeburg, Ill.—The lamp is filled with sponge, except a well in the middle, from which the sponge is held by a spiral wire, to allow the wick to extend down into the lamp. The lower end of the wick tube is funnel-shaped, and the wick is flared out thereat to the sides of the well, to touch the sponge, so as to draw the oil held in it. The flame regulator consists of a tubular sleeve on the upper end of the wick tube, to slide up and down along the flame, and has a rubber-spring ring to hold it fast. There is a hook for connecting the lamp to the hat of the miner, and a spring for securing it. With this improved lamp, miners can safely burn gasoline and other light products of petroleum, which are much cheaper, and give better light, than the lard oil commonly used.

Improved Hames.

John G. Eberhard, Akron, Ohio.—This invention consists of a new manufacture of hames for harness, the same being a hollow hame of cast metal of ductile character, or iron malleable, the object being to obtain the requisite size for strength in such material without too much weight.

Improved Crib.

Henry Buttenberg and William R. Hodges, Memphis, Tenn.—The improvement relates to the arrangement of a sliding block and a clamping-screw hook with the slatted front rail of a crib, whereby said hook may be adjusted toward or from one which is stationary, thus adapting the crib for attachment to bedstead rails of irregular form.

Improved Clothes Dryer.

George Bent, Seneca, Kan.—This consists in a drying frame which will freely revolve with the wind, or may be placed or adjusted to take advantage of the sun in drying clothes. The dryer can readily be detached from the post with the clothes furled and carried under shelter in case of storm.

Improved Gas Burner.

Coleman D. Payne, Moselle, Mo.—The gas passes through fire chambers and intermediate perforations and passages, so arranged and constructed as to counteract the pressure from the gas reservoir and to admit a gentle and steady current to the burner.

Improved Implement for Loading Fire Arms.

Orson D. Phillips, Lisle, N. Y.—This is a gun-loading device for sportsmen, by which muzzle-loading guns may be charged with great rapidity; and it consists of a muzzle cap, with revolving cylinder, and a sliding rod, by which the charge is carried into the muzzle for being rammed down.

Improved Gas Purifier.

Joseph D. Patton, Trevorton, Pa.—This device consists of one or more scrubbers located outside of a gasometer tank, in connection with condensing chambers beneath the surface of the water within the tank, for removing condensable matter and cleansing the gas.

Improved Saw Guard.

Dwight Graves and Charles O. Howes, North Amherst, Mass.—The guard has its under side made circular to correspond with the diameter of the saw. The foot, which is hinged to the stationary stand on the guard, is serrated and rests upon the piece being sawn for preventing the rising of said piece, and to hold it firmly in position. When this foot is not required, it can be thrown back on the guard out of the way. Any other suitable device may be employed to render the saw guard adjustable as to height, according to the diameter of the saw or height of the room.

Business and Personal.

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

Dry steam dries green lumber in 2 days, and is the only Cheap House Furnace. H. G. Bulkley, Cleveland, O.

Headley Portable Engines. R. H. Allen & Co., New York, Sole Agents of this best of all patterns.

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

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

\$25 to \$50 per day to good agents to sell Well-Boring Machinery. A Horse Bore from 10 to 48 in. diam. Send for pamphlet. Pump & Skeln Co., Belleville, Ill.

Wanted—Situation as Draughtsman. Good reference. Address C. H. Lee, Easton, Pa.

The Original Skinner Portable Engine (Improved), 2 to 8 H.P. L. G. Skinner, Erie, Pa.

Chemicals for Making Self-Acting Copying Paper, 50c. Address E. Ford, Mendota, Ill.

For Sale—1 new 3 ft. Iron Planer, chuck & countershaft, pr. \$225. Davis Lovel & Tool Co., Springfield, Mass.

To Rent—Machine, Boiler Shop, and Foundry. Machine Shop, built of stone, 80x30. Two Stories and Basement; other buildings proportionately large. 25 horse power new American turbine water wheel. Located in a village of 2,000 inhabitants, with two Railroads, and in the heart of Western New York. The buildings and power are well adapted for any manufacturing business. Reason for renting, removal. Address A. G. Ridley, Phelps, N. Y.

Wanted—Catalogues of best Paper Making Machinery. Address Lock Box No. 1, Knoxville, E. Tenn.

Geo. P. Rowell & Co's Advertising Agency, No. 41 Park Row, New York, receives advertisements for all the newspapers in the United States, at the lowest cash rates, furnishing circulars and estimates free.—(Brooklyn (E. D.) Times.) It is a model business house. They give more for the money than any other house in the world.—(City Item, Philadelphia, Pa.)

Wrought Iron Pipe—For water, gas, or steam. Prices low. Send for list. Bailey, Farrell & Co., Pittsburgh, Pa.

J. S. Mundy's Pat. Friction Hoisting, Pumping, and Mining Engines, 5 to 60 H.P., 7 R.R. Av., Newark, N. J.

Woolen and Cotton Machinery of every description for Sale. Estimates furnished for erection of Factories of any size. A. C. Tully, 55 Dey Street, New York.

A Permanent Situation Wanted by an experienced Pattern Maker. I. C. Carter, Fort Wayne, Ind.

Rights for Sale—Wooden article. 247, N.Y. P.O.

Camp Lounge, \$5. C. L. Co., Troy, N.Y., and Newark, Ct. N. Y. City Salesroom, 171 Broadway.

For the best Animal Trap in the world, address John Dineen, Limestoneville, Montour Co., Pa.

For Sale, or on Royalty—Two Patents, Stationery Articles. Address Key Box, Spartenburg, S. C.

A Machinist and Draughtsman, acquainted with Erecting Oil Gas Works, 15 years' experience as foreman, wants employment. Letter Carrier 35, Philadelphia, Pa.

Room and 12 Horse Power to Let. Good Shipping point. Ainslie & Masten, Toledo, Ohio.

Money made by Consumers of Steam and Agents, with Fenn's Feed Water Heater and Purifier. Send for Circular. Pump & Skeln Co., Belleville, Ill.

Walrus Leather Wheels for polishing all Metals. Greene, Tweed & Co., 18 Park Place, New York.

Small Gray Iron castings made to order. Hotchkiss & Ball, Foundrymen, West Meriden, Conn.

"Book-Keeping Simplified."—The Double-entry system briefly and clearly explained. Cloth, \$1. Boards, 75 cts. Sent postpaid. Catalogue free. D. B. Waggener & Co., Publishers, 424 Walnut St., Philadelphia, Pa.

Wood Planers—Five 2d H'd for Sale Cheap; 1 2d H'd 50 H.P. Boiler. Wm. M. Hawes, Fall River, Mass.

Saw Ye the Saw 7—\$1,000 Gold for Hand Sawmill to do same work with no more power Expended. A. B. Cohn, 197 Water St., New York.

Moss Agates, Petrified Bones, Wood, Shells, and other curiosities, will be sent C. O. D. by S. H. Wright, Church Batten Station, Winta Co., Wyoming Ter.

Scale in Boilers Removed—No pay till the work is done. Send for 34 page pamphlet. George W. Lord, Philadelphia, Pa.

Hotchkiss & Ball, West Meriden, Conn., Foundrymen and Workers of Sheet Metal. Will manufacture a royalty any Patented articles of merit.

Wanted—To sell a half interest in a large, well established business, secured by original patents. C. H. Kirkpatrick, Lafayette, Ind.

Blake's Bolt Studs are the best fastening for Leather or Rubber Belts. Greene, Tweed & Co., 18 Park Place, New York.

The Best Wooden Pulley made; fastens without keys or set screws. Adjustable Dead Pulleys stop loose pulleys and belts when machinery to which they belong is not in motion. Cold Rolled Shafting, Improved Couplings and Hangers. A. B. Cook & Co., Erie, Pa.

File-cutting Machines. C. Vogel, Fort Lee, N. J.

Grind Winter Wheat—New Process. John Ross, Williamsburgh, N. Y.

Dickinson's Patent Shaped Diamond Carbon Points and adjustable holder for working Stone, dressing Emery Wheels, Grindstones, &c., 64 Nassau St., N. Y.

Boulton's Paneling, Moulding and Dovetailing Machine is a complete success. Send for pamphlet and sample of work. B. C. Mach'y Co., Battle Creek, Mich.

Pipe and Bolt Threading Machines. Prices from \$80 up. Address Empire Manufacturing Company, 48 Gold Street, New York.

Johnson's Universal Lathe Chuck. Medal awarded by the Franklin Institute for "durability, firmness, and adaptation to variety of work." Lambertville Iron Works, Lambertville, N. J.

For best Bolt Cutter, at greatly reduced prices, address H. B. Brown & Co., 25 Whitney Avenue, New Haven Conn.

American Metaline Co., 61 Warren St., N.Y. City. Grindstones, 2,000 tuns stock. Mitchell, Phila., Pa.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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

Three Second Hand Norris Locomotives, 16 tons each; 4 ft. 8 1/2 inches gauge, for sale by N. O. & C. R. R. Co., New Orleans, La.

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

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

Temples and Oilcans. Draper, Hopedale, Mass.

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

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

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa. for lithograph, &c.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass.

All Fruit-can Tools, Ferracute W. K's, Bridgton, N. J.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

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

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

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

Machinery Wanted—Edging, Milling, and other Gun Machines wanted, new or second hand. Address E., Box 1738, New York.

Single, Double and Triple Tenoning Machines of superior construction. Martin Buck, Lebanon, N. H.

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

Notes & Queries

W. F. P. will find an account of the termination of the phylloxera controversy on pp. 242, 385, vol. 32.—L. C. will find a recipe for a black ink with iron in it on p. 203, vol. 29.—W. R. W. will find an answer to his engine query on p. 321, vol. 30.—C. E. W. will find a description of silver-plating on p. 405, vol. 32. For plating without a battery, see p. 299, vol. 31.

(1) K. K. C. asks: In what way is mercury used in exterminating bedbugs? A. Take corrosive sublimate 1 drachm, sal ammoniac (chloride of ammonium) 2 drachms, water 3 ozs. Sprinkle the bedding with the mixture.

(2) F. T. J. asks: How can I handle hot iron without being burned? A. The hands, when wet, can be plunged for a moment in molten iron without injury.

(3) R. W. B. says: 1. I have a quantity of vinegar made from honey. It has a pure transparent color, but has a slightly sweetish taste. What can I put in it to correct that, and give a genuine sour vinegar taste? A. See answer to H. K. G., p. 106, vol. 32. 2. How can I keep moths out of the hives? A. It is very well known that a colony of bees, under a right system of management, has no enemies that it cannot overcome. The secret of all successful management is to keep your colonies always strong, and they will always protect themselves; and the use of hives giving you the control of every comb enables you always to secure this end. When an intelligent bee-keeper possesses this power, the moth has no terror for him, since a strong stock is never injured by it.

(4) J. W. E. asks: What varnish is used to varnish saw handles? A. Shellac varnish.—J. E. E., of Pa.

(5) J. G. P. asks: How can I harden circular saws from 1/8 to 1/2 of an inch in thickness, and from 3 to 4 inches in diameter, without warping? The saws are used to cut steel and iron. A. There is no way known to harden any kind of a saw without its springing. They may be flattened between two heated blocks when the temper is drawn, which will make the most of them nearly flat and some of them entirely so. For a good job, they must be straightened by a saw maker.—J. E. E., of Pa.

(6) W. A. M. says: 1. I am putting in a band saw (for sawing logs 6 inches wide) of No. 16 gage to run over a 4 foot pulley. Will it be a practicable machine? A. Such a mill is perfectly practicable if properly built and worked. 2. How many lbs. strain will it bear without breaking? A. Your pulleys will be too small for a band saw mill; they ought to be 6 feet in diameter in place of 4. The strain that the saw will bear depends upon the width of the blade. About 50 lbs. to the inch in width is a fair rule to work by. 3. How fast will it do to run the pulleys? A. You can run them at a speed that will drive the saw 9,000 feet per minute.—J. E. E., of Pa.

(7) J. S. P. asks: Will an 8x10 inches engine drive a four foot burr to any advantage? A. With a sufficient pressure of steam, it would answer very well.

(8) E. K. asks: How can I remove coal oil from cotton and woolen cloth? Boiling water and soap will not do it. A. Try steeping them for a short time in bisulphide of carbon in a closed vessel, and then allowing them to remain exposed to the air until completely deodorized.

(9) F. S. C. asks: 1. What is the difference between methylated ether and simple ether, and what is the meaning of methylated? A. Methol (also called wood spirit, pyroxylic spirit, and methyl alcohol) is a product of the destructive distillation of wood. The acetic acid of the crude product being saturated with lime, impure methol

is obtained by distillation, which, after rectification, constitutes the methylated spirit of commerce. Methyl ether is obtained by the same process as ordinary or vinic ether, namely, by distillation of the spirit in contact with sulphuric acid; the only difference being that, in the manufacture of vinic ether, alcohol is used, while methol is the spirit used in the manufacture of methyl ether. 2. What are spirits of wine and spirits of turpentine? A. Spirit of wine is an alcohol, usually obtained from wheat, rye, barley, corn, molasses, etc., by fermentation and distillation, and derives its name from first having been obtained by distilling wine for its yield of brandy, and then slowly abstracting the more volatile part of the brandy by a small fire and tall vessels. Oil or spirit of turpentine is obtained by distilling common turpentine, a semi-solid resin which flows from the *pinus abies*, a species of pine, when wounded. This resin yields nearly one fourth of its weight of the essential oil, which passes over as a volatile, limpid, very inflammable liquid, of a penetrating, well known balsamic odor. The residue in the retort constitutes the common rosin or colophony.

(10) H. S. J. asks: What is the best process of cooling lard in summer, so that it will stand up? A. Keep it immersed in cold water.

(11) P. S. says: 1. In your issue of April 10, I find a device for bronzing cast iron, which I do not quite understand. It requires a bath of melted chloride of copper and cryolite, to which chloride of barium is added. Does this mean that these three articles are to be mixed in a melted state, or are they to be dissolved in water? A. The recipe is to be taken as written. 2. I am about to reduce some old gold solutions, consisting of cyanide of gold dissolved in cyanide of potassium. I evaporated it to dryness; can I now melt it in a crucible with borax, to get metallic gold, or does it want to be treated in another way? A. The pure metal may be obtained, in the form of a black, finely divided powder, from its solutions, by the addition of a filtered aqueous solution of common sulphate of iron. If this be melted, a mass of the metal with its characteristic color may be obtained in its pure state.

(12) H. B. asks: I have a sign (which I believe to be zinc) which requires cleaning two or three times a week and needs a great deal of rubbing to obtain a good polish and remove stains and finger marks. How can I clean it? A. Rub the metal over with a strong aqueous solution of oxychloride of zinc; wash, and dry quickly.

(13) G. C. S. says: We are putting in two boilers, each having two 16 1/2 inch flues. Length of boilers is 24 feet. What should be the diameter of smoke stack, in order to insure good draft? A. Make the cross section of the chimney from 1/2 to 3/4 the grate surface.

(14) C. E. B. says: 1. In your issue of April 10, mention is made of too much oil in engine cylinders being the cause of priming. Can this be so, except by the use of an open heater where the oil would be forced into the boiler with the feed water, causing it to foam? A. No. 2. I built an engine 1 1/2 x 3 inches, with which I run a lathe, using a cylinder boiler, 10x18 inches. In surface blowing, I notice that the water is very dirty and oily, that blown off at bottom being much clearer. I always supposed that the oil would get into the boiler while making the connection. I exhaust into the air, and have not noticed any indication of priming; but the water appears to foam considerably. Will frequent blowing off remove all the oil from the boiler? A. Blow all the water out a few times, and cleanse with cold water.

(15) D. A. W. asks: In making an arrangement for heating the water for a bath tub, I unfortunately used second hand 3/4 inch pipe, which was badly rusted. The water is badly discolored from the rust in the pipes. Is there anything that I can place in the tank, to pass through the pipes, that will cleanse them of rust and stop the discoloration of the water? A. Take the pipe down, and coat the interior with coal tar.

(16) J. C. L. says: 1. I have a small mill, driven by a 30 horse engine; and on account of dry weather, my well has partially failed. At its lowest stage the Missouri river is 35 feet below the level of the ground at the mill, and nearly 1,000 feet distant. Can I get water from the river by laying a pipe so that the highest point would not be over 25 feet above the river, and terminating in a well 50 feet deep? I know that in theory I could, but have never seen or known a siphon so long. A. Much longer siphons are in successful operation. It would probably be necessary to draw the water from subsiding basins or through filters. The siphon should be fitted with a valve at the top, to let out the air which will collect from time to time. 2. How ought I to start the water? Could it be done by means of a jet of steam from the boiler down the well end of the pipe, on the principle that a jet pump (or steam siphon) works? A. You can use the jet of steam or a small pump to start the flow.

(17) G. F. says: The wells in this vicinity average about 80 feet in depth, in clay and soapstone. One is 84 feet with no sign of water yet. We have struck a number of dry crevices that are full of wind and are continually blowing off, etc., so that you can hear them for rods around. Is this any sign of water? A. The escape of gas sometimes precedes the finding of oil, etc. You had better follow up the matter.

(18) C. W. R. asks: 1. How does the cycloid differ from the ellipse? A. The ellipse is an algebraic curve, and the cycloid a transcendental. 2. How can the circumference of a cycloid be found when the major and minor axes are known? A. The length of a cycloid formed by one revolution of the generating circle is four times the diameter of this circle. 3. Is every section of a cone an ellipse except that which is at right angles to its axis? A. No.

(19) W. M. asks: At what distance above the rail is the center of gravity of an ordinary box freight car, when empty, situated? A. We have not the data at hand for a complete calculation, but believe that the center of gravity is a little below the top of the trucks.

(20) C. J. M. asks: In running a small boat with a horizontal engine, 1 1/2 inches diameter of cylinder and 4 inches stroke, what should be the size of screw? A. Use a propeller from 15 to 18 inches in diameter. 2. What sized boat would it run? A. The engine would answer for a boat from 12 to 15 feet in length. 3. Are two 13 x 18 inch engines more powerful than a 17x19 at 90 lbs. pressure? A. With the same mean pressure and piston speed, the double engine would develop about 15 per cent more indicated power than the single one.

(21) A. K. asks: Why is the fly wheel of an engine placed next to the bed plate, and the driving pulley next to the pillow block? A. This arrangement is by no means general; but where it is adopted, it is probably done for convenience in getting at the belt and pulley.

(22) J. K. W. asks: 1. What should be the size of a chimney large enough for three boilers with 38 three-inch flues in each? A. Make the chimney with a cross section of about 1/2 the area of the grate surface. 2. What is the comparative value of hard and soft coal for generating steam? A. There is very little difference between good qualities of either kind.

What length of 3 ply 1 inch hose (horizontal) will a common suction pump suck through, it having also a suction of about 10 feet perpendicular? A. Through several hundred feet, if every thing is well arranged.

(23) W. S. B. says: I have a boiler badly incrustated, and I am bothered also with hot water pipes coated with similar incrustation. Kerosene, applied to the lime on the pipe, will soften it so that it is easily removed. Would there be any danger if I put in the boiler 2 or 3 gallons of the oil, and apply it to the incrustation for the purpose of soaking loose the scale? A. You can use the oil with little fear of danger.

(24) E. R. J. asks: Can a knife blade be tempered without being taken from the handle? A. It might be done, but it would be bad for the handle.

(25) J. W. W. C. says: I am making a lathe of the following proportions: Pulley, 3 1/4 inches in diameter at end, 3 1/4 inches at center of face. Driver, 2 feet in diameter, weighs exactly 50 lbs. Crank, 2 1/4 inches long, 4 1/4 inches stroke. What should be the relative position and distance apart of the pivot, pivot of pitman, and point of foot pressure of the treadle? A. The arrangement is in a great manner a matter of taste, so far as we know; except that, of course, the movement of that part of the treadle to which the pitman is attached must be sufficient, without making the space moved through by the foot excessive.

(26) W. G. says: I am building a boat 6 feet wide and 40 feet long, to draw 10 inches of water. How fast will an engine 3x8 inches, with a boiler containing 30 square feet of fire surface, drive this boat on slack water, with a paddle wheel? A. Probably at 3 or 4 miles an hour.

(27) A. R. R. asks: 1. How many cubic feet are contained in a ton of anthracite coal? A. The specific gravity of anthracite coal is about 1.4, and as water is 1, and weighs 62.5 per cubic foot, you can easily work out the problem. 2. What are its heating qualities compared with those of hard wood? A. It is assumed in practice that the heating effect of good coal is very nearly that of wood charcoal, and twice that of dry wood. In smelting operations, the heating effect of coal is taken by bulk to that of wood by bulk as 3:1, and by weight as 15:8. According to Karsten's researches: 100 parts by bulk of coal in the reverberatory furnace=100 parts by bulk of wood; 100 parts by weight of coal in the reverberatory furnace=250 parts by weight of wood. In boiling operations: 100 volumes of coal=400 volumes of wood; 100 parts by weight of coal=130 parts by weight of wood.

1. I am easily affected with lead poison. Would rain water kept in an ice cooler lined with zinc be injurious? A. No. 2. I see you recommend (for use in cisterns) lead pipe lined with tin. What protects the outside of the pipe from poisoning the water? A. In this case it would be necessary that the outer surface be also protected.

(28) S. E. H. says: A flat bottomed scow is being built of No. 24 galvanized iron (weighing 1 lb. to the square foot), 11 feet long, 2 1/2 feet wide, and 10 inches high. What number of lbs. will it sustain? A. You must calculate the weight of the boat, and the amount of water it displaces at various drafts. The difference between the weight of the boat and the weight of the displaced water is the amount of cargo it will sustain.

(29) S. C.—The boiler is large enough for average work. Stopping off the opening for the forge will probably improve the draft, and increasing the height of the chimney will do still more, though it may be as well to exhaust into the chimney. The flue should join the chimney in a gradual upward bend, instead of an abrupt elbow.

(30) S. asks: How many cubic feet of space are required to stow a ton of 2,000 lbs. of Lackawanna chestnut coal? A. From 43 to 48.

(31) S. F. B. asks: How can I project the form and appearance of a rainbow upon a screen? A. A diaphragm or slide of metal or cardboard, having in it a small slit in the form of an arc, is placed before the condenser in the position ordinarily occupied by the transparency. The light passing through the slit, from the lantern, is caused to traverse a prism placed immediately before it. The image formed is defined or focussed by the ob ject glasses in the usual way.

(82) C. R. says: Please give me an explanation of the following formulae:—
 $\frac{144}{\text{degree Baumé} + 134}$
 = specific gravity, and
 $\frac{144}{\text{specific gravity}}$ = degree Baumé.
 I see these used constantly in describing the specific gravity of petroleum, but nobody can explain them to me. A. It is merely an arithmetical ratio which represents the relation in which the numbers obtained by the purely arbitrary divisions of the Baumé scale stand to the specific gravities. The second is derived from the first in the following manner:

$\frac{144}{\text{degree Baumé} + 134}$ = specific gravity.
 $144 = (\text{specific gravity} \times \text{degree Baumé}) + 134 \times (\text{specific gravity})$.
 $144 = (\text{specific gravity} \times \text{degree Baumé}) + 134 \times (\text{specific gravity})$.
 both terms by the specific gravity,
 $144 = \text{degree Baumé}.$

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

F. W. B.—It is *Holzia striolata*, an insect very injurious to young plants. It is of a polished black color, with a broad, wavy, buff-colored stripe on each wing cover, and the knees and feet are reddish yellow. Its length is considerably less than $\frac{1}{8}$ of an inch. We think the ravages may be prevented by watering the leaves with a solution of lime, a remedy employed in England for this purpose.—G. N. K.—The sample sent is pure hydrated red oxide of iron, and might answer for making a cheap red paint. But it is without action on either tin or lead, and the explanation of the corrosion is to be found by examining the water, and not from these settlements.—J. B. W.—The wood is in the course of that slow change (under water) which would slowly bituminize and mineralize it, and result in the production of a body resembling coal.—G. A. S.—It is silicate of alumina, and is useful for all the purposes to which a fine, soft, polishing powder can be applied.—E. L. P.—It is neither lead nor silver. It is blende, sulphuret of zinc. Follow up the coal outcrop.—G. E. S.—No. 1 is siliceous containing clay mixed with oxide of iron. No. 2 is tourmaline. No. 3 is crystallized quartz.—R. A.—It is composed of copper pyrites, iron pyrites, and sulphide of lead.—L. J. W.—It is copper pyrites.—M. A. H.—It is galena, valuable lead ore.—F. E. P.—It is stibnite, or sulphide of antimony, and contains sulphur 25 per cent and antimony 72 per cent.—H. E. S.—It is common mica, used in large plates in stoves, etc.

COMMUNICATIONS RECEIVED.

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

On Steam Boiler Explosions. By J. W. D.
 On a Preventive of Shipwreck. By J. F. J.
 On a Curious Fact in Flower Growing. By W. H. M.
 On a Theory of Dissolution. By W. T. D.
 On Utilizing Natural Forces. By T. A.
 On Extracting the Square Root. By E. C.
 On Ship Railways. By J. A.

Also inquiries and answers from the following:
 F. G. H.—W. J.—J. J. M.—W. M.—J. C. G.—E. F. N.—R. I.—N. W. T.—A. B. F.—H. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells lathes with engine-turning attachments? Who is the best dividing engine? Why do not makers of gas-making machines advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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June 1, 1875,

AND EACH BEARING THAT DATE.
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1,803.—F. E. Town, Boston, Mass., U. S. Gang saw mill. June 5, 1875.
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 1,805.—G. E. Dayton, New York city, U. S. Metallic skylights. June 5, 1875.
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(NEW SERIES.)

NEW YORK, JULY 10, 1875.

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IMPROVED FLANGING MACHINE.

We illustrate herewith a machine for forming flanges on metal bars, and on plates for constructing boilers and other vessels. It is the invention of Mr. David Hanson, of England, and attracted much attention at the Vienna Exposition.

A is a steel roller, revolving upon a bearing on the end of the segmental rack, C, the angle of the roller, A, to the flange, B, being adjusted by means of the rack, C, and the worm wheel attached thereto. B is the turning or bending flange of the cylinder, H, which can revolve by friction, but whose position is at all times stationary. The distance between the roller, A, and the flange, B, is adjusted, to suit various thicknesses of plate, by means of the slide upon which the head carrying the roller, A, and its attachment is affixed, the head being operated by the bevel gears, G, and a screw and nut operating upon the head in the center of the slide. H is the revolving cylinder, driven by the gearing, J, operated by the pulley, E. The roller, D, serves to guide and steady the cylinder, H, which would otherwise be apt to spring from its duty. In operation, the roller, A, is set to the required angle of flange to be made, and the head and roller, A, are set to suit the thickness of the metal to be flanged; then the slide set screws are set up to relieve the worm and rack, C, of any strain. The work is then passed between the roller, A, and the flange, B, the latter carrying the plate through and the former revolving by friction.

The machine is substantially made, and is well proportioned in all its parts, and it is of simple and durable construction.

DUPLEX WHEEL LATHE.

We illustrate herewith a very fine duplex lathe recently constructed by Messrs. New, of Nottingham, for the Great Eastern Railway locomotive works, at Stratford, England. The lathe is arranged with four compound rests, A, constructed to turn a pair of 6 inch locomotive wheels on their axle, and for bossing and boring, as described below. The headstocks and rest saddles are fitted on a massive bed plate, B, 18 inches

deep, and 23 feet long over all, with planed surfaces. The face plates are carried on cast iron spindles 15 inches diameter in the front neck, running in parallel bearings of cast iron, forming anti-friction working surfaces. They are driven by external wheels from a main shaft, 6 inches diameter, running the length of the bed, and supported by five bearings. On this shaft are two sliding pinions moved by

stock. To dispense with a crane, the dogs and bolts are arranged to be readily removed from the rests, so that the wheels may be run into the centers. Each saddle carries two rests, and it is recessed out in the center, so that each rest may be brought fairly opposite the tread of the wheel, and thus have full cutting power. For facility in working the saddles and tool pillars, they are each arranged to move by quick-thread screws, both longitudinally and transversely. The loose headstock shoot is worked by a hand wheel, and the headstock itself can be quickly traversed on the bed by a screw, so as to get adjustment of centers, if necessary, from 7 feet 3 inches to 10 feet.

This is a most complete modern tool for the purpose, being at once a special wheel-turning and general boring or bossing lathe, combined in the most simple and effective manner, so as to be readily used for whichever purpose is required. The lathe is a fine tool, and will maintain the reputation of the makers.—*The Engineer.*

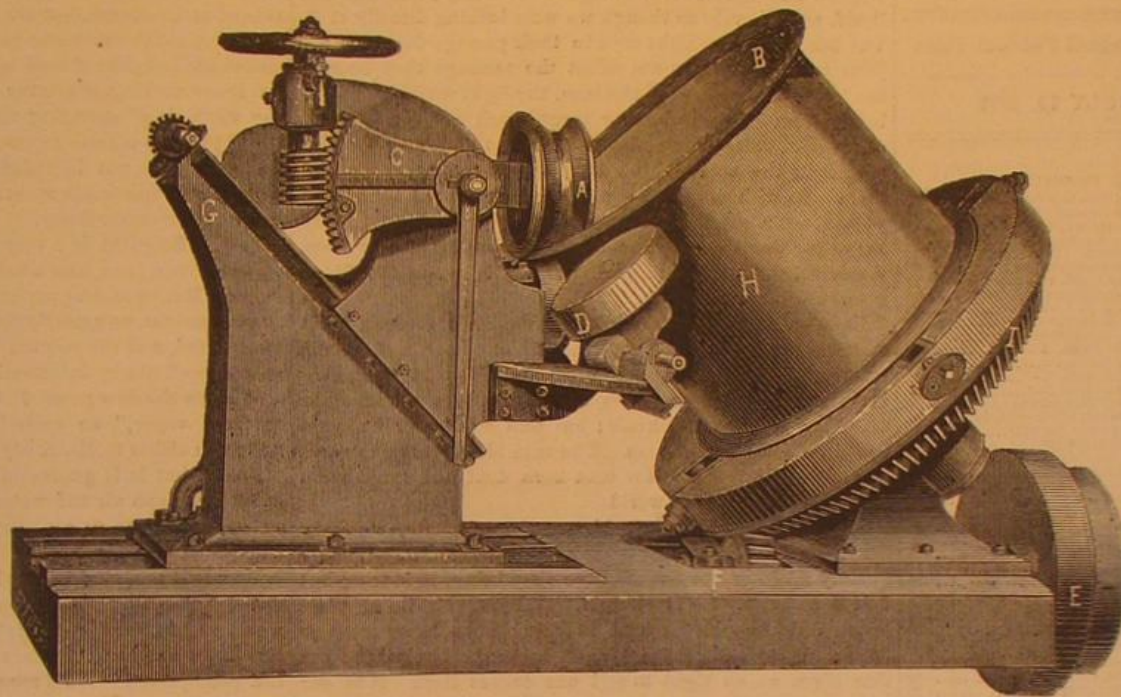
A Hint on Healthy Dress.

Multitudes of persons of both sexes lose health, and oftentimes life, by busying themselves until warm and weary, and then throwing themselves on a bed or sofa, without covering, or in a room without a fire, or by removing their outer garments after a

long walk. If you have to walk and ride both, do the riding first, and, on returning, go to a warm room, and keep on all your wraps until cool, even if you suffer some discomfort.

A Grasshopper Parasite.

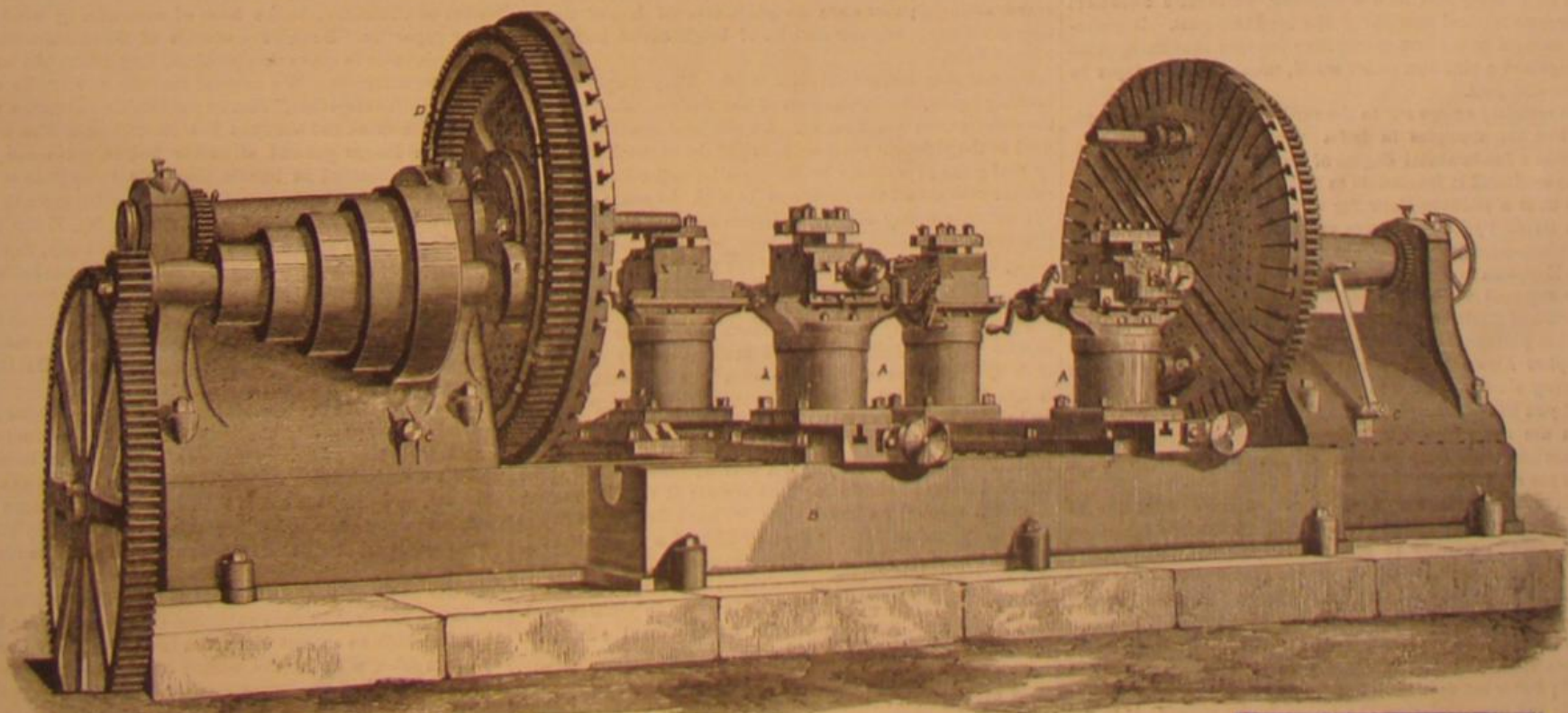
There appears to be a chance that, after all, the grasshopper infliction will not be productive of such widespread devastation as has heretofore appeared probable. Messrs. Dunkee and Stout, farmers of extensive tracts of land near Fort Scott, Kansas, according to a report in the *St. Louis Republican*, have examined by dissection large numbers of grasshoppers, and have found that about three quarters of them contained a well developed live maggot. As heaps of dead grasshoppers have been encountered, literally alive with the parasites, it is believed that the latter may ultimately cause an extinction of these most troublesome vegetable-destroying insects.



HANSON'S FLANGING MACHINE.

levers, C C, to give independent motion to each plate for bossing and boring, and to work simultaneously in turning. The plate for the fast headstock is also provided with an internal wheel, D, for giving an independent quick speed by means of a pinion, E, carried on the cone shaft; the pinion on the main shaft being drawn out of gear by the lever, C, this gives the necessary fast running for bossing or boring a wheel on this face plate, while a tyre is being worked on at the other face plate, for which purpose the plates are arranged with slide seats to carry portable gripping jaws. The driving power is given by a 6 inch belt and a 5-speeded cone through powerful double gear.

The compound slide rests have each a double swivel arrangement to enable the cutters to be placed at any angle of flange or tread, and they have a double feed traverse of seven cuts to the inch worked by an overhead rocking shaft lever and chain—each pair of rests from their own head-



NEW'S DUPLEX WHEEL LATHE.

Центральна Наукова
БІБЛІОТЕКА при ХДУ
№ 110625

Scientific American.

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NEW YORK, SATURDAY, JULY 10, 1875.

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THE TRUSTWORTHINESS OF THE SENSES.

This world is all a fleeting show, for man's delusion given, wailed poor Dr. Young, when the lady of his affections cruelly told him that, however much she might love his soul, she could not abide an alliance with the diminutive casket that enshrined it.

Since that day thousands have sung the mournful song without the author's excuse, and curiously unconscious of the terrible charge it carried against the Being they were professedly worshipping. If the world is really such a misleading affair, for our delusion given, surely the giver of it can be nothing less than a swindler, an infinite swindler! It was no original thought of the love-lorn poet. It probably occurred to the first speculative loungeer that thought he recognized a phantom under world, mimicking the upper in some still pool.

It certainly creeps out in the earliest speculative writings. It had its disciples in India thousands of years ago. It was a fundamental dogma of the founder of Buddhism, who confessed it impossible to tell how far the world without us is a phantom, how far a reality. The followers of the Greek Pythagoras were more positive; the world and its phenomena, they said, are all illusions. Centuries later the Egyptian mystic Plotinus taught the same doctrine, that the external world is a mere phantom; and the mystical schools of Christianity took it up in turns. Nor did Mahomedan philosophy escape the delusion. The Arabian philosopher Algazzali writes in this strain: "I said to myself: During sleep you give to visions a reality and consistence, and you have no suspicion of their untruth. On awakening you are made aware that they were nothing but visions. What assurance have you that all you feel and know when you are awake does really exist?"

In every age the mystically inclined have delighted in dreaming that everything is a dream. A favorite American poet does it prettily in one of his poems. He lies on a grassy river bank, watching the clouds sail across the sky, seemingly far down in the still water. The image of a kingfisher flits across his vision. He knows that a corresponding bird flew through the air above his head, while he gazed upon the phantom beneath his feet. He calls it a real bird; but what assurance has he that the kingfisher in the air is any more real than the image in the water? May not it be merely the visible reflection of an invisible reality?

"All this that you call material," said a fanciful friend the

other day, in response to some remark of ours implying the absolute existence of those "permanent possibilities of sensation" known as things, "all this is but the fleeting image, the reflection, as in a glass, of the truly real, that is the spiritual, to which we shall some day attain."

Just here, perhaps, in the misapprehension of the phenomena of reflection, we may find the key to the entire scheme of mystical philosophy, and prove it based, not on the refinement of reason, as its disciples fondly imagine, but on an optical blunder. We may possibly find also a sufficient answer to the aspersions which the same school of thinkers are wont to cast on the integrity of our senses.

Sitting at our table, we seem to see at this moment, in the broad window of a shop across the street, the image of a workman repairing the street. By direct vision, we can see neither the man nor the work he is engaged upon. Across the room hangs a mirror; in it appears the reflection of a window, and in the window the reflection of a passing cart. Neither cart nor window is directly visible from where we sit. Using a form of common speech inherited from an unscientific age, we say we see, in the glass and on the window, images of the objects mentioned; but in reality we see nothing of the sort. The cart seen through the double agency of window and mirror is no image of an image, but the cart itself, as positively as though we were looking directly at it. The bending of the light rays in their passage from the objects to our eyes does not affect the message they bear in the least. In the case of the man, the light which brings us information of him is bent or turned back once, in the case of the cart, twice; our vision is indirect, not direct; yet it is absolutely the man and the cart that we see, not images of them. So with the poet's kingfisher. It was the living bird he saw, not a phantom; the seeming under world was really the upper world indirectly seen. In this and all similar cases, the delusion lay in the mind of the mystic, not in the things seen.

Equally so with the Arab philosopher's dreaming. It matters not whether the reflection is at one or a thousand removes; it is the reality which we see. By what means the brain mingles and combines the impressions of sense in dreaming we may not know; but this we know, it always combines and never creates. The man blind from birth sees no visions in his sleep; the man born deaf and mute hears no voices in the dream world.

The alleged untrustworthiness of our senses, we flatly deny. In health, they invariably tell us the truth. We frequently misinterpret the message they bring, it is true, but that is no fault of the senses. The interpretation of sense impressions is something to be learned; we never learn it fully; we are liable to blunder throughout all our days; but that gives us no right to call our senses liars. It is our judgment, not the sense of sight, that is deceived when we stumble, with the mystics, into Alice's "World behind the Looking Glass."

We learn, for example, to associate certain plays of light and color with certain natural gems. When we see the same effect produced by artificial pastes, we mistake them for real gems; but it is not our eyes that cheat us; they simply report the flashing lights, and, through our lack of knowledge, we make an inference not in accordance with fact.

Again, when we see the same play of color, we say it is produced by a gem, natural or artificial,—and it may be neither, but only a bit of glass with tinsel underneath. We discover the imitation, and therefore know that there are three ways of producing that particular play of color, and we estimate the probable one in any case by the attending circumstances.

We witness a spectacular play, and see the actors luminous with—what shall we call them? Not real gems, for they are too numerous; possibly imitation gems, still even they would be too costly; we reason therefore that they must be tinsel-lined glasses. But we are wrong; there are no gems, real or artificial; there are no glass-covered bits of tinsel; they are simply angular cavities of bright metal bathed in colored light.

Did our eyes deceive us? Not at all. They simply told of flashing lights, the mechanism of the flashes being left for the other senses to determine. A child bred in a theater, and used to the phantom gems only, might be as much deceived by real gems as we were by the metallic reflections; but in neither case would the deception lie with the sense of sight. We not only wrong our honest senses but lose our grip upon this most substantial world of ours when we let mistaken metaphysics persuade us to doubt the testimony they bear.

THE KEELY MOTOR DECEPTION.

The value of any known substance as a heat or force generator may be determined and mathematically expressed with the precision of a simple sum in arithmetic. Thus, it has been settled that the combustion of one pound of coal yields a motive force equal to a weight of eleven millions of pounds; if the combustion occupies one minute of time, the pound of coal yields a driving force of over three hundred horse power during that period; if the combustion is spread through an hour's time, we have five horse power from the pound of fuel; while one fifth of a pound of coal, burned per hour, yields one horse power during that period. But our best engines and boilers are so imperfectly made and managed that so much power as this is never, in practice, realized. The best practical results rarely exceed one horse power per hour from 1½ lbs. of coal.

This result, although defective, although indicative of the need of improvements in steam apparatus, is, nevertheless, economical as compared with any other known method of generating power. Reduced to money, with coal at \$5 a ton, the cost for steam power fuel, in Philadelphia, using the best

engines and boilers, is less than three cents per day of ten hours for each horse power.

We think it will be hard for Keely and his assistants to supply motive power any cheaper than this, allowing them the full benefit of the extravagant assertions they set up.

They now aver that they cannot transmit the new "power" under a less pressure than 1,000 lbs. to the square inch, and expect to keep their "receivers" full of their "new cold vapor," at a pressure of 30,000 lbs. per square inch. To manage this pressure will involve expenses that steam power does not require, even though the air and water, out of which the "cold vapor" is manufactured, cost nothing.

But what is the new power, of what is it composed, from what is it generated, how is it prepared, what are the principles involved, what is the nature of the apparatus?

During the past week we have had conversations with Mr. H. C. Sergeant, of this city, who is one of the principals in the Keely motor concern, the chief machinist of the establishment, and one of the four persons to whom only, Mr. Sergeant assures us, the nature and *modus operandi* of the "great secret" has been communicated. Mr. Sergeant has long been known in this city as an able mechanic, and is a gentleman of the highest integrity. He informs us that neither Mr. Keely nor himself have anything to do with the sale of stock shares, but are honestly engaged in the endeavor to reduce the motor to practical working harness. The shares are bought and sold by other persons who have faith, but know nothing whatever of the principles involved or the method of operating the apparatus. This informant states that the official report, from which we made extracts last week, was not intended for publication, and contains statements which more recent experiments have shown to be untenable or unnecessary.

As Mr. Sergeant is a very practical man, we hoped to be able to obtain from him a full history and description of the motor. But he said he preferred to defer the matter until the new apparatus, now nearly finished, has been tried, its results ascertained, and the patents secured. However, he gave us a little preliminary information:

What is the new power? Our informant avers that it is a "cold vapor," an entirely new article, its composition unknown either to Mr. Keely or himself.

From what is it generated? It is generated, our informant states, from air and water, without fuel, heat, chemical action, or the use or consumption of any substance, save air and water.

How is it produced? Mr. Sergeant states that it is produced "purely by mechanical manipulation, which evolves a cold vapor; and by graduating his vaporizer or generator, Mr. Keely is able to produce a pressure of 10,000 to 15,000 lbs. per square inch in a receiver of greater volume than the total contents of the generator, with great rapidity and certainty."

What are the principles involved? The principles are not yet accurately determined, but appear to consist in the communication to the air and water, by mechanical means, of a certain sort of initial vibrations, the resultant whereof is the aforesaid "cold vapor."

What is the general nature of the apparatus employed? A series of simple pipes, nozzles, and check valves. Nothing more.

As to the properties of the "cold vapor," Mr. Sergeant gravely avers that its natural volume is over five hundred thousand times greater than the water from which it is derived; and that by a sudden enlargement of its containing chamber, the vapor suddenly condenses into water again.

These are curious statements, especially when we consider that the elementary gases resulting from the decomposition of a given body of water, H₂O, have a volume of only two thousand times that of the water from which they are obtained.

Our informant states that he has searched the principal fountains of knowledge and consulted the most eminent professors of chemistry, in the hope of ascertaining what the "new vapor" is. But all the oracles of Science are dumb; they are unable to grasp the problem, they afford him no information whatever. We suggest that the new article may be "luminiferous ether," that imponderable substance that fills infinite space and occupies the interstices of the molecules of hydrogen gas and all other bodies. No one has heretofore succeeded in imprisoning this intangible ether, for it passes through glass, metal, and all substances in Nature as if they were so much fog. But then, Mr. Keely, it is alleged, generates an enormous pressure, suddenly, rapidly, with certainty; and perhaps by this means, without knowing it, he compresses several of the atoms of the luminiferous ether into one, before they have time to escape, thus enlarging their size sufficiently to prevent their passage through the molecular spaces in the metallic walls of his generators. But this is merely a suggestion of ours.

Such, in brief, is the latest information we have been able to obtain, from probably the best informed individual connected with the affair. That our informant is laboring under a strange hallucination is most certain. That so able, practical, and excellent a man should, under the pressure of a delusion, become the unwitting assistant of a deception by which hundreds of innocent people are being led to loss of their property, is a matter of profound regret.

In our paper of last week we quoted from an article upon the Keely Motor Deception published the previous year, May, 1874, in which an extract was given from the Keely Company's pamphlet, wherein the names of several well known professional gentlemen were given, by the Keely people, as witnesses and referees to the correctness of the motor performance, and the truth of the statements given in the pamphlet. Among the witnesses so cited by the Keelyites was Wm. W. Wood, Chief of Bureau of Steam Engi-

neering, U. S. N. In view of the following letter, our Keely friends will have to cross out that gentleman's endorsement:

NAVY DEPARTMENT,
Washington, D. C.]

To the Editor of the Scientific American:

My attention has been directed to an article in your paper of recent date, relating to the so-called Keely motor. My name has been mentioned as one of the advocates of the alleged invention without my authority. I know nothing about the construction or operation of the device; and as I am not in the habit of endorsing inventions of which I am ignorant, of course I could not endorse the so-called Keely motor. I am, respectfully, your obedient servant,
June 24, 1875. Wm. W. Wood.

The editor of the *Leader*, of Cleveland, Ohio, has been to Philadelphia, seen with his own eye the Keely gage go up, has become a full convert to the wretched deception, and answers the strictures of the SCIENTIFIC AMERICAN by calling us a scientific ass. Well, it is better to be an honest ass than a blind hack-leader of a deception.

Every perpetual-motionist, for the last generation, has considered us an ass, because we could not recognize his errors as truths, or his deceit as facts. The Ericsson hot air stock-jobbers pronounced on us the same epithet. Paine and his water gas people did the same. So did the Paine electro-motors, of more recent date, and the pendulum motors, and the spirit motors, and now we have it from the cold vapor motors. We candidly admit that it requires but a small amount of intelligence to discern such deceptions, less even than that of the dullest member of the long-eared but useful family to which the *Leader* refers.

Besides the epithet mentioned, the *Leader* gives as a reason for its support of the Keely deception that the SCIENTIFIC AMERICAN is chiefly devoted to the puffing-up of inventions patented through its agency. It is true that a very large portion of all the patents granted for new inventions are obtained through the agency established thirty years ago by the proprietors of this paper. Our experience has undoubtedly been greater in this line than that of any house in the world. But it is equally true that the SCIENTIFIC AMERICAN is an impartial recorder of all interesting or important inventions and discoveries, and that its scientific information is in general reliable and valuable. This is shown by such facts as that, in patent trials in this country, the back volumes of the SCIENTIFIC AMERICAN are constantly produced as authorities upon disputed scientific points; while in the hundreds of libraries and reading rooms, scattered the world over, it will be found that the volumes and files of the SCIENTIFIC AMERICAN are more closely studied, more highly valued, and in greater demand than any other scientific publication extant.

When the editor of the *Leader* recovers from his present Keely delusion, when this attack of new motor epizootic passes over, he will, we feel confident, think better of the SCIENTIFIC AMERICAN.

We gave in our last number a few brief examples of ways whereby small quantities of "cold vapor" might be readily produced by concentrating water weights upon confined air. On this our friend of the *Leader* argues, in support of the Keely motor, that he could, by simply turning a hydrant pressure of 26 lbs. to the inch into a six-gallon kitchen water boiler, make the water issue from the boiler into a bath tub at a pressure of 240 lbs. to the inch. We will not dispute the hydraulic capabilities of our friend; but we feel confident that no one but an out-and-out disciple of the Keely-motor confederacy could accomplish what he claims, in the way he describes.

THE NATURAL HISTORY OF SWINDLES.

The swindler is perennial, and always busy. His methods vary with time and circumstance, but at bottom he is always the same. And there is, in the permanent propensity of men to be swindled, a never-ending inducement for him to concoct his swindling schemes. He simply furnishes what the public call for.

What is the basis of this irrepressible tendency to be "taken in"? What are the fundamental conditions of its development?

We refer chiefly to the amazing gullibility which induces or suffers men—practical men, so called—to honestly enter upon mechanical and financial schemes of enormous promise and certain failure. The swindler has a motive that cannot be mistaken; but what is the motive of the victim? Is it native stupidity, invincible ignorance, eagerness for sudden riches, or what, that makes capitalists, notoriously shy of taking hold of enterprises of real merit, so ready to invest their money in palpable frauds?

There is need of another Darwin to study the genesis of the various species of swindles. Do they follow a consistent law of evolution, and mark successive stages of individual unwisdom and popular incapacity for learning? It would be a curious study—a consumedly interesting study: we fear it would be as humiliating to human pride and disastrous to our theories of popular progress. To say the best, it does take mankind a terrible while to learn anything, by experience or otherwise.

A good deal of light has been cast on many phases of gregarious foolishness—of human sheepishness, as Sir Arthur Helps cleverly characterizes the tendency of men to "go with the crowd," right or wrong—by the study of epidemic delusions, wherein whole communities, often whole nations, have gone mad with some dominant idea, as of witchcraft or the like; but such studies throw little direct light on the philosophy of swindles. Those take possession of crowds; these are limited in their operations to individuals.

Besides, epidemic delusions are always of an emotional character, and have to do primarily with spiritual affairs,

though their manifestations and results are often enough grossly physical; while the swindle has always a material object. To use a rough but sufficiently accurate figure, the one usually speculates in corner lots in the New Jerusalem, the other in swamp lots in some wild cat city of the Far West. The one trades on the transmutation of the base metals of human weakness and wickedness into celestial gold by the violation of all social and moral principles; the other on the conversion of common lead into double eagles by some impossible circumvention of the laws of Nature.

In both there is a firm, often intense, belief in the incredible. In both there is a confident expectation of getting a very large something out of nothing, or what is worse than nothing. In both epidemic and individual delusions, too, the victims are often men who, on other subjects, are shrewd, sane, practical.

The social conditions and current beliefs, which prepare the way for the reign of the first, can be clearly made out. Is it possible to do the same for the second? To estimate how far the two rest upon a common basis of misconception as to the conditions of existence, and how far the swindle depends on individual conditions of heredity, environment, want of knowledge, and greed of gain?

We are inclined to think it is quite possible; but we leave it to the future Darwin of this department of natural history to undertake the task. It will be sufficient for us, when time and space permit, to notice a few of the determining conditions which make the trade of the swindler so enticing and remunerative.

RECENT IMPROVEMENTS IN GLASS MANUFACTURE.

The recent discoveries and inventions of M. De la Bastie, in France, in annealing glass, the improvements on his process by Mr. Charles Pieper, of Germany, and the method of hardening glass by Mr. Macintosh, of England, show that, whatever we may know about the chemical constituents of different varieties of glass, its physical properties are still almost a *terra incognita*.

We have been so accustomed to consider fragility as unavoidably connected with the conception of any glass object, that the idea of a glass bottle or goblet which may be knocked about and thrown on the floor, or of a glass pane which will not break when a stone is flung against it, appears an impossibility, if not an absurdity.

At the same time, all well informed persons know that the value of precious gems consists in their hardness, which enables them to keep their polish, while all glass imitations tarnish soon; that the test wherewith to distinguish a gem from a glass imitation is the application of the corner of a steel file, which will scratch glass but not a real gem. If now Mr. Macintosh finds a way to make glass as hard as a diamond, so that powder obtained from such glass can be used in place of diamond dust, what will become of all the comparative degrees of the value of gems? If paste (a soft lead glass imitation of diamond, which very nearly equals the diamond in luster) can be made as hard and as lasting as the genuine gem, what is the difference to the wearer, except that he knows that his ornament cost only \$5 or \$10 instead of \$1,000 or \$5,000? We have heard the most eminent jeweler of New York city declare that paste imitations are often so fine that, when worn in the evening, it is impossible to distinguish them from the real article. He confessed that he was unable to decide as to their genuineness unless he were allowed to have the articles in his hands under daylight illumination.

Glass appears, then, to have properties similar to those of steel which relate to hardening and annealing. We may change the temper of a steel tool by heating and slowly cooling, and this is what is done with glass by De la Bastie and Pieper, by the intervention of a proper bath, the chemical nature of which undoubtedly plays an important part. On the other hand, we may make steel hard by suddenly cooling it when very hot, and we may modify the nature of the steel by exposing it to the action of diverse substances, among which carbon is the most important, the influence of the carbon being very powerful, as the addition or abstraction of one half to one fourth per cent of carbon, to or from the steel, results in a great difference in its physical qualities. It is so with glass. Mr. Macintosh, after having pressed the heated glass to the proper shape in iron molds, according to the usual method, transfers it to thin platinum molds, brings it nearly to the fusing point, and then suddenly plunges it into a freezing mixture containing snow, ice water, and salt, or their equivalents, or in some other mixture producing an intense cold, different kinds of glass requiring different mixtures. This latter point is now under investigation, and the results promise to teach us a great deal more about the most remarkable and useful material, without which, as Liebig remarked, our progress in Science could only have been very limited. It is hardly necessary to enumerate our obligations to glass. Without it no telescope nor microscope, no barometer, could have been invented; and no modern astronomy, hardly any chemistry, and but a little physical science would have been possible.

THE PLANETARY ATMOSPHERES.

The most recent researches into the nature of the gaseous envelopes of the planets are embodied in a work lately written by Dr. Vogel, director of the observatory of Bolkamp, Germany, in which the author describes the results obtained by analyzing the light of each planet by the aid of the spectroscopic. A previous study with the telluric lines, lines produced in the solar spectrum though the absorption of the terrestrial atmosphere, enabled him to draw comparisons between the latter and the atmosphere of the planets, and to recognize in some instances a similarity.

The principal lines in the spectrum of Mercury coincide

absolutely with those of the solar spectrum; and it further appears that certain lines, which are not produced in the latter save when the sun is very low on the horizon, and when the absorption of our atmosphere is very considerable, permanently exist in the Mercurial spectrum. There is, therefore, a gaseous envelope about that planet, the absorption of which is equal to that of the earth's atmosphere at its maximum.

The light emitted by Venus resembles in its essential traits that of the sun, with a few lines added, which may be identified with those of the absorption spectrum of the atmosphere of the earth. Since the modifications of the solar spectrum which can be traced to the planet's atmosphere are very slight, it must be concluded that the majority of the solar rays are almost wholly reflected from the cloud envelope which encompasses the planet. According to Janssen's observations, the telluric lines are due largely to watery vapor, and hence it may be admitted as very probable that the atmosphere of Venus contains water.

A large number of the lines of the solar spectrum are found in the spectrum of Mars. In the less refrangible portions of the latter appear certain bands, which do not belong to the solar spectrum, but which coincide with the terrestrial absorption spectrum. It may from this be concluded with certainty that Mars possesses an atmosphere which does not differ essentially from our own, and which is rich in watery vapor. The red color of the planet is owing to a complete absorption of the blue and violet rays. There appear to be some lines which are peculiar to the planet, but their position has not been definitely fixed, owing to the too feeble luminous intensity.

The majority of lines which distinguish the spectrum of Jupiter coincide with the solar lines. The Jovian spectrum, however, differs from that of the sun in the presence of a few obscure bands in the less refrangible portion, and especially in one band in the red, the length of an undulation of which has been determined to be 2471.5 hundred millionths of an inch. The other lines foreign to the solar spectrum coincide with the telluric lines. The more refrangible blue and violet radiations are uniformly absorbed. The Jovian atmosphere, it is concluded, exercises on the solar rays which traverse it an action analogous to that produced by the earth's atmosphere, whence the presence of the vapor of water in the former may be predicated. It is doubtful whether the band in the red, above mentioned, results from the presence of some special body not found in our atmosphere, or from the fact that the gases encompassing Jupiter are mixed in different proportions from those in air. It is possible, however, that the two atmospheres are similar, but that their actions on the solar rays differ on account of circumstances of temperature and pressure. The spectra of the dark belts, observed on the disk of Jupiter, are characterized by the marked uniform absorption of the blue and violet rays. No new absorption bands appear, but the lines are broader and more marked than elsewhere, proving that the dark belts are deeper than the adjoining regions. The solar light penetrates more profoundly into the atmosphere of the planet at such belts, and hence is submitted to more marked alteration.

The spectrum of Saturn shows the most marked lines of the solar spectrum, and gives bands which, with one exception, coincide with those of the spectrum of our atmosphere. In general, the Saturnian spectrum is closely analogous to that of Jupiter. The spectrum of the ring, however, is very different, and shows no atmosphere, or at most a thin gaseous envelope of feeble density.

The faint light of the spectrum of Uranus does not admit of distinguishing the Fraunhofer lines. Certain bands have been noted, the undulations proceeding from which have been measured, and which without doubt result from the absorption of solar rays in the enveloping atmosphere of the planet. To what bodies such absorption is due, it is impossible to tell. One band, however, corresponds exactly with another found in the spectra of both Jupiter and Saturn. The spectrum of Neptune differs essentially from the solar spectrum and is characterized by a few large absorption bands, generally, it appears, identical with those of Uranus.

Among the small planets, M. Vogel has examined Vesta and Flora, with uncertain results, however, owing to their lack of brilliancy. There appear to be indications of an atmosphere about Vesta.

What Inventions Do.

The following colloquy recently took place between Recorder Hackett and a criminal before him for examination in this city. From it we conclude that, while human depravity is not less prevalent than formerly, modern inventions protect mankind from the depredations of the vicious, by rendering their operations considerably more hazardous.

"What is your business?" asked the Recorder.

"I am obliged to work."

"Don't you like it?"

"No."

"Why not? What was your business?"

"A cracksman." (Frank answer.)

"Well, then, you have given up that business?"

"Yes. You see, Counsellor, what with the burglar alarms in houses and stores, and the district telegraphs, and people growing economical and careful, and the newspapers hounding us, burglary, garotting, and highway robberies, and such things, is actually hazardous, and ain't so easy to be did."

To make waterproof packing paper, dissolve 1.82 lbs. white soap in 1 quart water. In another quart water, dissolve 1.82 ozs. troy of gum arabic and 5.5 ozs. glue. Mix the two solutions, warm them, and soak the paper in the liquid, and pass it between rollers or simply hang it up to drip.

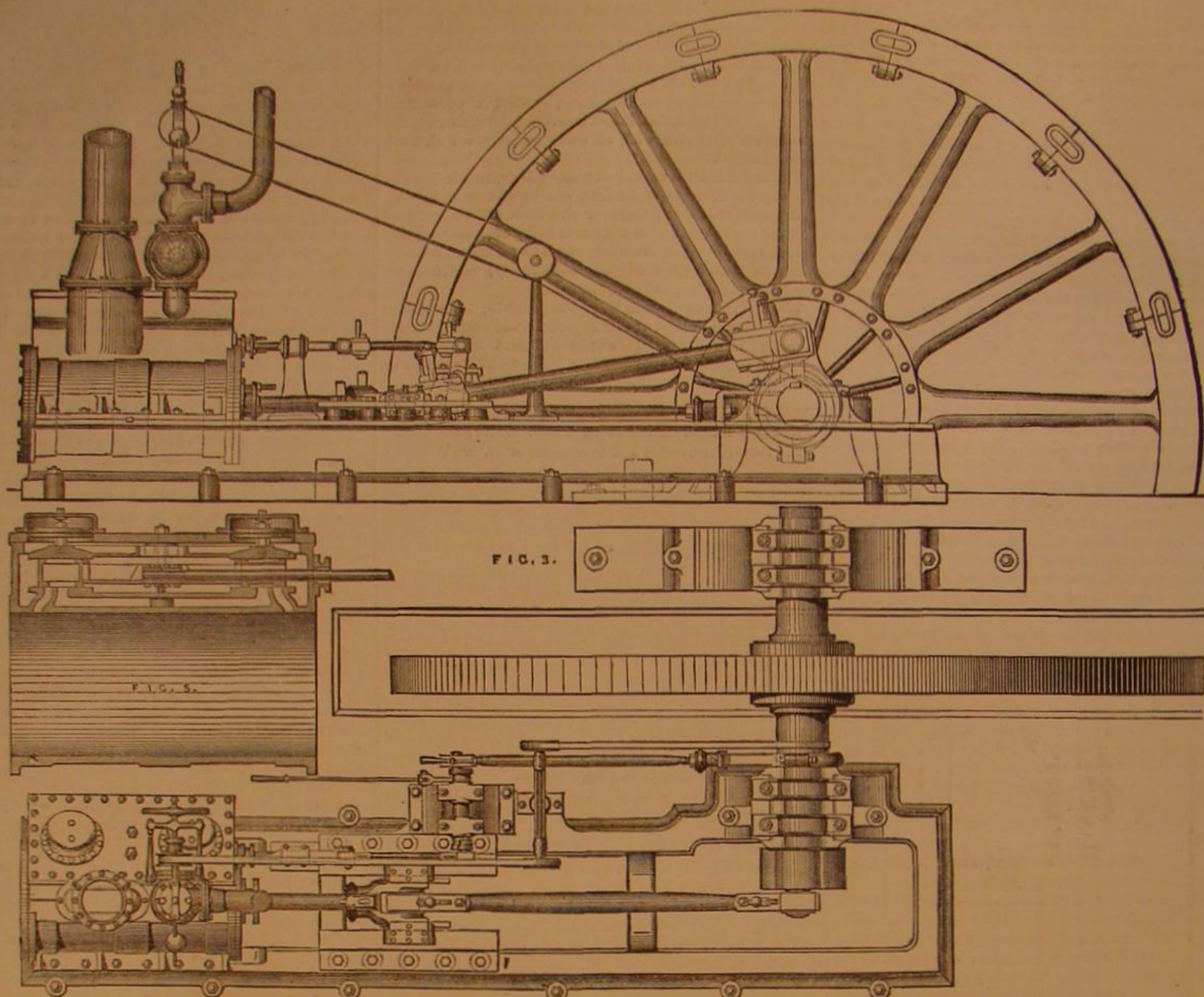
ENGINE FOR BLOOMING MILL USE.

The John Edgar Thomson Steel Works, near Pittsburgh, Pa., have recently been adding very largely to their extensive plant, and among the new machinery is a large and powerful steam engine, which deserves special mention for its excellent construction and the high finish that has been

when not deflected, is one sixteenth of an inch above the outer face of the steam chest lid. Bolting down the bonnet draws the edges of the diaphragm down to the steam chest lid, making the joint and securing the proper seating of the valve. The area of the inside of each bonnet is made equal to the area of the extreme edges of the corresponding valve,

Railway Liability for Freight.

In the case of a railway company that receives freight for transportation over its own and connecting lines, the Supreme Court of the United States holds that such receiving company is not liable for losses that occur on the connecting road, unless the receiving road contracts to be responsible.



BLOOMING MILL ENGINE AT THE THOMSON STEEL WORKS, PA.

put on all its parts. The engine has a 36 inch cylinder with 4 inch stroke, and the fly wheel, which is 25 feet in diameter, weighs 50 tons. The whole engine is of massive proportions, but the only detail of which we need speak here is the slide valve, which is shown in detail by Figs. 4 and 5. This is Hemphill's balanced slide valve, which, as shown, moves between the usual face and a relief plate. The relief plate is prevented from moving with the travel of the valve, by arms extending from its sides interlocking with lugs cast on the side of the steam chests, leaving the plate free to expand from the center towards the ends.

minus the area required to secure a sufficient downward pressure to hold the valve firmly to its face. The relief plate is thus held between two forces, the pressure of the steam downward on an area equal to that of the valve, and the pressure upward on the diaphragm.

The set bolt, shown at the top of each bonnet, is adjusted to leave a space of about one sixteenth of an inch between its point and the point of the diaphragm stem, thus allowing the valve to rise from its seat to allow the escape of water from the cylinder when necessary. Experience has proved that the flexibility of the copper is ample to secure the desired relief on the valve.

The Stevens Institute Commencement.

On the 4th ult., the great hall of the Stevens Institute, Hoboken, N. J., was filled with a large audience on the occasion of the first annual commencement. Governor Bedle presided; and the proceedings having commenced with music and prayer, Professor Morton delivered a pointed and practical address on the objects and scope of the Institute, and the nature and importance of the instruction there afforded. Three theses were read—one on a design for a fifty-ton floating derrick, by Adolph Sorge; another on the theory of the traction of locomotive engines, by James E. Denton; and a third on heating and ventilating, by J. Hector Fezandie.

Professor Thurston delivered an address to the graduates, giving them some sound, common sense advice as to their conduct and life in the world into which they were entering. Governor Bedle followed with an interesting speech, in which he eulogized the late Edwin A. Stevens, and spoke in fitting terms of his liberality and the noble institution on which he bestowed his wealth and his name. Degrees were conferred on eight gentlemen, the three above mentioned, and Messrs. Bachman, Rooley, Leavitt, Wall, and Yokichi Yamada. Mr. Bachman's thesis was on the subject of flouring mills, Mr. Rooley's on sugar refining, Mr. Leavitt's on overshot water wheels, Mr. Wall's on wire rolling and drawing; while that of Mr. Yamada, who is a native of Japan, was on a design for a turbine water wheel.

The luster of morocco leather is restored by varnishing with white of egg.

The receiving road becomes a contractor for the entire route when it fixes a price for the whole distance, and receives the goods for such transport.

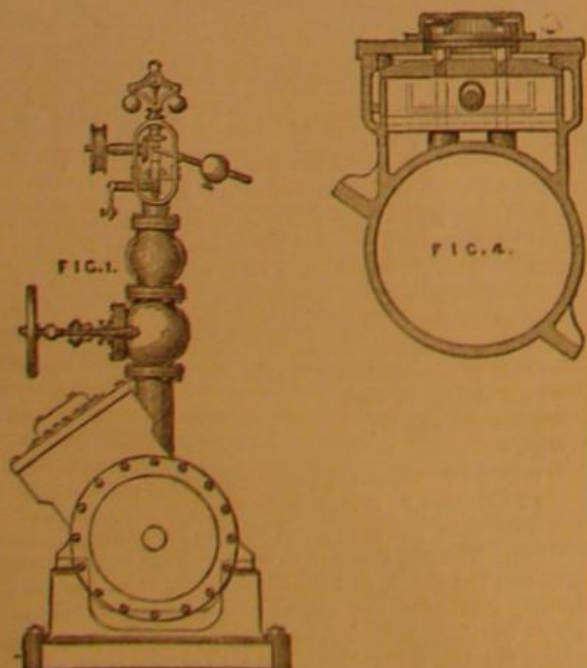
IMPROVED ROPE SOCKET.

This is a convenient rope socket connection, especially adapted to hoisting the shafting in oil wells, though susceptible to many other uses which will readily suggest themselves. The end of the rope, A, is first unlaid; and two sleeve-shaped tapering pieces, B, are applied so as to wedge against the collar, C, which is screwed into the connecting piece, D. This last is similarly attached to the shafting. The piece, D, might be made stationary, in which case the device would be useful in any arrangement in which it is necessary to fasten tightly the end of the rope.

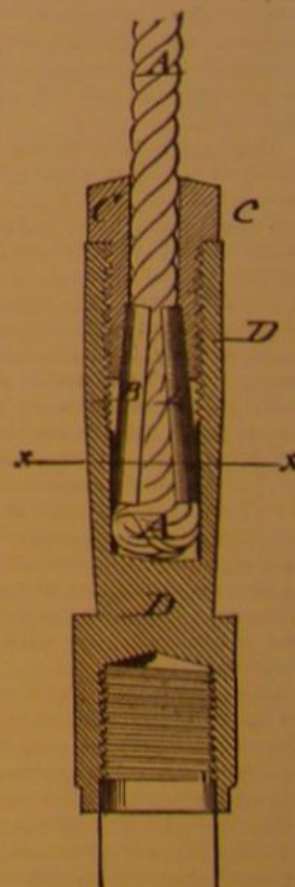
Patented through the Scientific American Patent Agency, October 27, 1874, to Mr. Bowen, of Peachville, Pa.

The Magnetic Curves.

Rev. G. H. Hopkins gives the following method for fixing the curves which steel filings take when under the action of a bar magnet. The filings, having been prepared so as to be as nearly the same size as possible, and that size very minute, are poured into a mortar, and a small quantity of finely powdered resin is added: these are



Near each end a stem is tapped into the relief plate, and on this stem are two disks, as shown. Between these disks is held a copper diaphragm about one sixteenth of an inch thick, covering the hole in the steam chest lid, and secured to the latter by a bonnet or cover. This copper diaphragm,

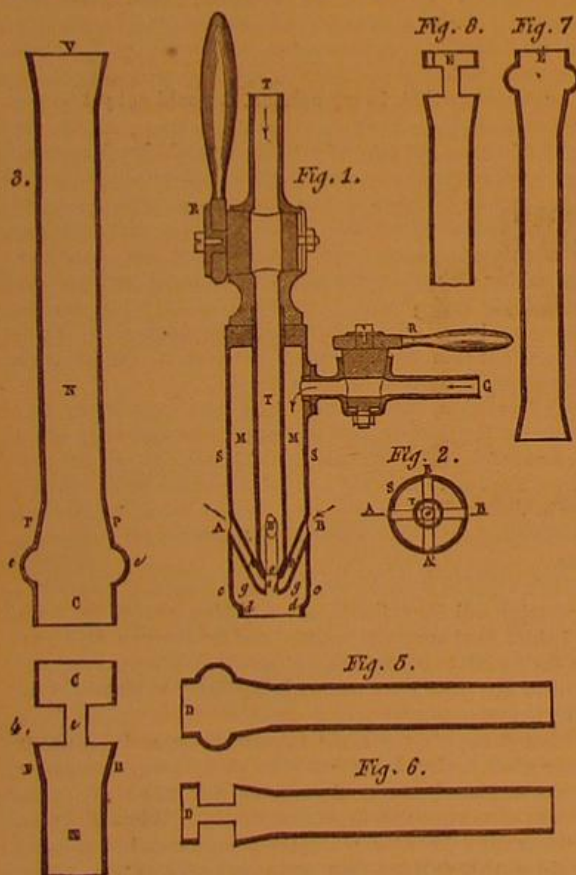


stirred together until the two substances are completely mixed, and then, considerable pressure being exerted upon the pestle, they are rubbed until the resin adheres to the fillings in a very fine coating. The fillings can then be sprinkled as usual, and the curves formed. It is best (after the curves are formed) to heat the plane surface (glass, paper, or wood, according to convenience) over a stove or in an oven, which easily allows it to be sufficiently as well as uniformly heated. For projecting the curves on a screen, the following, we believe, is a very effective method: Cover the glass with thin gum water, allow it to dry perfectly; obtain the curves on dry gummed surface; finally, breathe on the plate; the gum is thereby softened, and the curve permanently fixed. Substituting correspondingly shaped pieces of paper for the magnets (a pinhole can be used to indicate the north pole), the curves can be covered with a second plate of glass, and thus preserved as an ordinary lantern slide.

A NEW GAS BLOWPIPE.

The apparatus herewith illustrated, in natural size, is a new gas blowpipe burner, designed also for forges and for similar uses where intense heat is necessary. The advantages of the invention are that, when the air blast is supplied by water pressure, it insures the delivery of sufficient air completely to consume all the gas, and in a thoroughly dry state so as not to cool the flame.

The device, as shown, consists of a brass tube, T, to which the air blast is led, and which is screwed in an outer tube, S, which receives the gas from the pipe, G, the gas filling the annular space between the two tubes, and being regulated by the cock, R'. Cock, R', governs the air supply. The orifice, o, of the air tube terminates just within the interior of the tube, S. In order to augment the quantity of air injected into the gas, four copper pipes, A A', B B', are inserted in S, and are so arranged that the current is drawn into that leaving the tube, T, at o, mingling with the latter, and so filling the annular space, g, and escaping at d. A plan view of the tubes, A A', etc., is shown in Fig. 2.



To the orifice, at d, various mouthpieces, some of which are shown in Figs. 3, 7, and 8, may be attached. Each piece consists of a ring, which either slips over or inside of d, and this ring is joined to the main tube, N, Fig. 3, by two thin pieces of metal, e. The openings on the sides thus produced give an additional supply of air, determining a complete mixture within the tube, N, which burns at the exit orifice. A gas lamp under the tube, N, which is disposed laterally, serves to dry the current.

M. Cougnet, the inventor, claims that by this apparatus a very intense heat may be produced at a decreased expenditure of gas, owing to more perfect combustion.

Mr. Thomas Webster, Q. C.

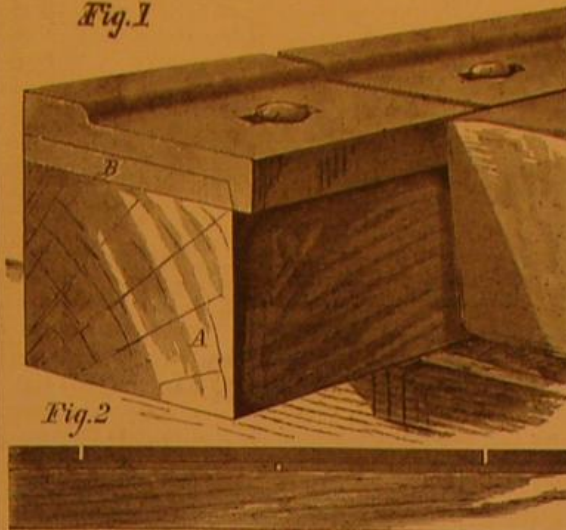
This eminent patent lawyer died suddenly on June 3, at his residence in London, England. On the previous day, he was engaged in the duties of his profession; and was in good health up till late on the day of his death, when he felt fatigued. In the evening, he rose to leave his room, and fell dead in the arms of his servant.

Mr. Webster had for many years held a high reputation for learning and forensic ability at the English bar; and his experience in patent matters, and his wise and strenuous advocacy of a peremptory protection, by all governments, of the rights of inventors, make his death a matter of regret with all who sympathize with progress and the arts and sciences. He visited Vienna in 1873, and was appointed a member of the International Patent Association which held its meetings there; and he expressed to Hon. J. M. Thacher, now United States Commissioner of Patents, who was also a member of the Commission, great admiration for the patent system of this country, and desired that the English practice should be, in its main features, assimilated to it.

NESSLE'S STREET RAILWAY RAIL.

In the invention herewith illustrated, the rails are supported by a continuous line of plates, thus, it is claimed, rendering the track firm and solid, and lessening the expense of repairing. The greatest advantage, however, is that, when the rails become worn out, they can be removed, leaving the plates in their places, when simply new top rails alone need be put down, thus, according to the inventor, decreasing the expense nearly one half.

Fig. 1



It is also claimed that the compound rail is stronger than a solid rail of the same thickness, and that, as it has no battering or bending points, the jarring so destructive both to rails and rolling stock is avoided.

A, in the engraving, is the timber ordinarily laid down to form the base for the track. On this is secured a series of flat plates, B, and on top of the plates are laid the rails, in such a manner as to break joints with the under plates. The fastening spikes extend through the rails and plates, securing both, suitable slots allowing of the contraction and expansion of the metal being made for their introduction.

Patented May 4, 1875. For further particulars address the inventor, Mr. John P. Nessle, 23 Frelinghuysen avenue, Newark, N. J.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for July, 1875.

Mercury.

Mercury cannot be seen in the early part of July, as it rises after the sun, on the 1st at 5h. 27m., and sets at 7h. 45m. P. M. On the 31st, it rises before the sun, at about half past 3, and sets a little after 6 in the evening. It can be best seen on the 27th, when it is at its greatest elongation.

Venus.

On the 1st of July Venus rises at 3h. 2m. A. M., and sets at 5h. 50m. P. M. On the 31st, it rises at 3h. 42m. A. M., and sets at 6h. 30m. P. M.

Mars.

Mars rises, on the 1st of July, at 6h. 50m. P. M., and is easily recognized by its ruddy light. Although very low in altitude, Mars will be very conspicuous all through the month, coming to the meridian at about 11 P. M. early in the month. On the 31st Mars rises at 4h. 37m. P. M., and comes to meridian at 8h. 45m. P. M., at an altitude, in this latitude, of $20\frac{1}{2}^{\circ}$.

Jupiter.

On the 1st, Jupiter rises at 1h. 12m. P. M., and sets a little after midnight. Jupiter rises on the 31st at 11h. 26m. A. M., and sets at 10h. 26m. P. M.

On the 5th of July the second satellite of Jupiter will disappear, by being behind the planet, for nearly three hours (in the evening), while the first is unseen in consequence of being in the shadow of Jupiter. The second satellite comes out from behind the planet, is seen for a few minutes, and then disappears by going into the shadow.

On the 7th, Jupiter, when first seen in the evening, will be without its largest satellite, that moon being behind the planet. On the 14th the same satellite disappears, after 10 P. M., by again going behind the planet.

Saturn.

Saturn rises soon after 10 P. M. on the 1st of July among the small stars of *Aquarius*.

Mars, Jupiter, and Saturn can all be seen in the evening hours throughout the month; when Mars is seen directly south, Jupiter will be seen in the southwest, and Saturn in the southeast.

On the 31st, Saturn rises at 8h. 3m. P. M., and sets a little after 6 the next morning.

Uranus.

Uranus is not in position for observations. It rises in the morning and sets early in the evening all through the month.

Sun Spots.

The report is from May 23 to June 17 inclusive. In the photograph of May 23 no spot is seen. Photography was interrupted by clouds from May 23 to May 27, and from that date till June 2 no spots were observed. In the picture of June 2, two small spots appeared coming on, and the pictures of June 4 and 5 show the regular motion of this group

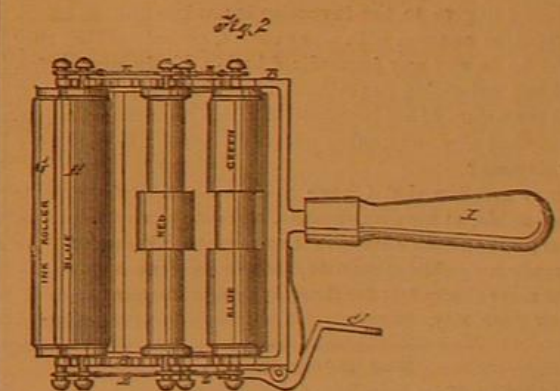
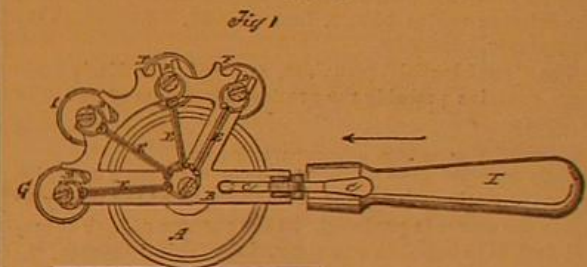
across the disk, on account of the sun's motion on its axis. On June 7 one of these spots was seen to be much smaller, and in the next picture, June 10, it had disappeared. The other did not appear to change, and was last seen, June 11, on the very edge. In the photographs of June 12, 14, and 15, no spots are observed. The picture of June 16 shows a group of spots on the eastern limb, which do not appear on the picture of the previous day, and the photograph of today, June 17, shows the motion to be regular. For a month past the spots have been very few and small.

Another Steam Horse.

Mr. Fortin Hermann, says *Les Mondes*, is testing a machine which is moved by articulated feet which are successively planted upon the ground. Two feet act from the front body and two from the rear, being pressed downward by steam, which besides, in a horizontal engine, oscillates rods which, acting upon the feet, cause the apparatus to drag itself along. From experiments cited, it appears that the feet, when shod with rubber and charged with a weight of 2.2 lbs. per 0.4 inch, indicated an adhesion equal to 0.75 of the weight of the motive machine. The apparatus travels at the rate of from 4 to 4.8 miles per hour; and by a new arrangement, in which one pair of feet trot while the other pair amble, it is expected to run at the rate of 12 miles. It will ascend grades of 1 in 10 with quite heavy loads.

BALDWIN'S ROTARY HAND STAMP.

Mr. Charles E. Baldwin, of New York city, has patented a hand stamp by which the operator is enabled to print any number of colors at one time by a single movement across the paper. In Fig. 1, in the engraving, A represents a cylinder, on which the type is set. The said cylinder has its bearings in the arms of the frame, B, and is held from making more than one revolution by the spring catch, C, which strikes against a pin or lug on the cylinder end. The ink and color rollers rest in slots, D, on the arc, forming bearings for them to revolve in, and are held in such a position by elastic bands, E, attached to rings slipped over their ends, and to a ring set over each end of the type cylinder journals, as shown in Fig. 1. F F F F represent notches or rests, into which such rollers as are not required to be used are lifted, so as to clear them from the type cylinder.



The engraving represents the device ready for printing in blue, red, and green, and showing the other rollers lifted out of connection with the type. When it is desired to print in black or any single color, it will be necessary to use a single roller, as G or H, and raise all the others off the type cylinder into their respective rests, F. The rollers are wrapped with flannel or its equivalent, so as to absorb a sufficient amount of coloring material to feed the type uniformly.

How can the Grasshoppers be Utilized?

The Minnesota State authorities have hit upon a way of clearing the four counties to which the grasshoppers have confined their ravages, which certainly deserves credit. It is praiseworthy for several reasons, for it has set the people inventing, provided them with lucrative work at a time when the destruction of their crops threatened to cut off all income, and actually put the grasshopper at a premium. The plan is simply to buy the grasshoppers from the farmers at ten cents a quart. The people have fairly jumped at the offer, and it is said that, in every town in the four counties, wagon load after wagon load of the hoppers is arriving, until now the pest is almost exterminated. In one county 1,000 bushels were paid for, and this was one day's catch. One farmer made \$55 for the labor of his family for twenty-four hours. Another has driven parties off his farm with a pitchfork since the bounty system has been adopted, claiming the grasshoppers as his, and that he alone had a right to catch them. Still another individual, of a pious turn of mind, who refused to aid in burning the hoppers, on the ground that they were a dispensation of Providence and should not be interfered with, as soon as the reward was offered set his entire family to work, and added his own labor all day Sunday, making a nice sum by his endeavors. Several ingenious traps have appeared, propelled by horse

power, by means of which from five to twenty bushels of the insects are easily taken in a day. When brought to the designated receiving places, they are immediately paid for and buried in a deep trench. Blue Earth county has already bought fifteen thousand dollars worth.

Now, who will invent a use for these millions of collected insects? There is an enormous fortune in the invention, and it seems a waste to dispose of them by simple burial. Will they not yield a coloring matter, or an oil? Desiccated and ground, would they of any use as a fertilizer? Cannot some of our chemical readers experiment and favor us with results?

Correspondence.

The Keely Motor Deception.

To the Editor of the Scientific American:

I was much pleased, as I have no doubt most of your readers were, with your recent able articles on the Keely motor, and which, I am sorry to say, are the only ones (that have yet appeared) calculated to expose to the public the deception of this so-called invention. All the other articles in the daily papers on the subject that have come under my notice have evidently been written to mislead persons, ignorant of scientific subjects, into investing their money in, or rather throwing it away upon, this chimera. Whether these articles were paid for or not, I am unable to say; but they certainly could not have been better advertisements.

The most remarkable feature of this deception is the endorsement it has received from such men as Haswell, W. W. Wood, and others, and which, I believe, has done more to bring the scheme into favorable notice than anything else. It is true that their expressions of opinion, so far as they are made public, are very guarded, and do not absolutely amount to anything; yet the fact of their names being associated with the invention in any but an antagonistic manner amounts to a tacit endorsement of the statements made by the promoters. The hallucinations of otherwise shrewd business men are not so extraordinary, as they must of course base their opinions on those of men conversant with the subject; and when these go astray, it is but a natural sequence that the capitalist should also. This was notably the case in the Ericsson engine bubble, first exposed, I believe, in the SCIENTIFIC AMERICAN.

The "confidential" pamphlet, got up by the Keely Company, contains probably the greatest percentum of the chaff of verbiage, compared with the wheat of fact, of anything yet published. The "experiments" therein and subsequently reported give neither a statement of facts on which to base any calculations, nor an explanation of the theory by which the power is produced. In the absence of both theory and fact, it is impossible to show, in a logical manner, the fallacy of an invention; and in this lies the unassailable position of the company, which can only be reached by generalizations. If the publicity which the company is evidently anxiously to give to the invention is not injurious to its interests, I, in common with many others, cannot see that they would be in any way jeopardized by Mr. Keely coming forward and informing us (without communicating his secret) what the nature of his invention is. Has he invented a costless method of decomposing water, or has he discovered a new element?

I may mention that I have made two attempts to go to Philadelphia, at my own expense, and see the engine in operation; but on both occasions it was either "dismantled" or not ready for public inspection, though there were, I believe, a few more shares left for those desiring to invest.

New York city.

ANGUS.

The Keely Motor.

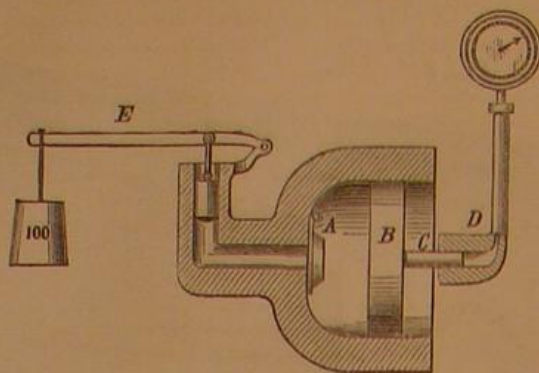
To the Editor of the Scientific American:

You are doing the public valuable service in exposing the Keely motor humbug. Not a week has passed during several months but one or more innocent enthusiasts have inquired: "What do you think of the Keely motor? Isn't it wonderful?" Wonderful indeed; Aladdin's lamp in the older, and the woolly horse in recent, times were not more so.

The motor is said to have generated a pressure of 10,000 lbs. per square inch, which appears to the uninformed to be unprecedentedly high; but it is in reality only a moderate one. In an article in the SCIENTIFIC AMERICAN of May 2, 1874, is an account of a pressure forging machine which worked at a pressure of 19,480 lbs. per square inch. Pontifex & Wood, of London, England, once informed the writer that, in making lead pipe, they employed a constant pressure of 17,000 lbs. per square inch. Messrs. Harding of London, England, produced in 1865 sufficient pressure to weld steel ingots together cold, the weld being equal in strength to the solid metal. Mr. Dudgeon will supply any one with an hydraulic jack, which, by interposing a piece of steel $\frac{1}{2}$ of an inch square between the ram and the duty, will exert far more than ten or twenty thousand pounds per square inch. Here is an hydraulic pump:

A is a cylinder, say 5 inches in diameter, provided with a piston, B, the piston rod, C, of one square inch sectional area, acting as a ram in the barrel, D, attached to the pressure gage. E is a lever, say 50 inches long, attached to which (and $2\frac{1}{2}$ inches from the end) is a pump plunger of a sectional area of a square half inch. Now supposing a boy to exert a force of 100 lbs. on the end of the pump lever, he could pump a pressure on the gage of 156,800 lbs. per square inch, if the various parts were strong enough to stand it. Of course in the absence of any air or other elastic fluid, the least motion of the piston, B, would destroy the pressure; in

the case of attaching an air receptacle of any kind, and suddenly releasing it after the pressure was obtained, an expulsion of the same nature in every respect as those made by the Keely motor may be given, the length of duration of time of the expulsion being in precise ratio to the quantity of air contained in the air receptacle. That this, in effect, is what Keely virtually accomplished is proved by the acknowledged



fact that his motor consists of chambers containing air and water, the initial pressure being the 26 $\frac{1}{2}$ lbs. per square inch supplied by the hydrant, which would of course compress the air (without any mechanical aid whatever) to the same pressure, the space of time necessary to do so being in proportion to the quantity of water passing into the motor, and the quantity of air to be compressed. If the cubical contents of the air space are very small, as would appear to be the case, from the small amount of time necessary to charge and exhaust the motor (as certified to by the operators themselves), a very short time would suffice to obtain the full initial pressure.

Then there are any number of devices by which a cubic foot of air, at a pressure of 26 lbs. per inch, could be compressed into 4 cubic inches of air at a pressure of 11,232 lbs. per inch, which, applied to a small model engine (having a very small conducting pipe so as to wire draw the compressed air, and cutting off the air supply at one twentieth of the stroke) would run it at a very high velocity for several minutes, as was done in the Keely trial.

If Mr. Keely has anything to exhibit as a force generator, and wishes to demonstrate that it will develop power, let him place a water meter and a pressure gage on the supply pipe while it is feeding the motor, and let there be a section of gage glass in the supply pipe, together with a small cock attached, so that visitors may ascertain what amount and at what pressure the liquid, be it water or otherwise, passes into the motor, so that they may see through the glass the appearance of the material, and (by means of the cock) draw off from time to time some of the entering liquid for examination; then let the motor drive a friction pulley, to which a brake is attached in the usual manner, to serve as a dynamometer. Thus we may ascertain what enters and leaves the motor in the form of power, neither of which conditions are complied with in the present exhibitions, neither of which conditions would interfere with a perfectly maintained secrecy as to the nature, design, or mechanical arrangement of the motor, and neither of which conditions can be dispensed with if a fair exhibit is to be made.

I am only astonished that any engineer can be found to certify to the generation of a cold vapor or gas, having unknown qualities and an enormously expansive energy, without taking one step toward definitely ascertaining, by measurement or otherwise, what entered and escaped from the device. It is true these gentlemen certified to little or nothing; but under color of their names, an unmeaning exhibition of hydraulic compression and re-expansion has been foisted upon the unmechanical public as a force generator, to the scandal of the whole profession of engineering.

New York city.

JOSHUA ROSE.

The Bastie Glass.

To the Editor of the Scientific American:

So many exaggerated and untrue statements have been made in journals at home and abroad concerning the new glass (called, from its maker, the Bastie glass) that it is the duty of someone to quiet the fears of manufacturers and dealers, who have thought that their occupation was gone and a revolution in their business imminent, by giving the true facts in the matter. Let me first make a few quotations from the journals, and then give the truth, as we understand it, from seeing the article and hearing an explanation of its properties.

It is called "malleable," or "almost malleable," and "unbreakable." It is said to be "annealed" in some oleaginous bath. It is said that "its fragility is diminished, while its transparency remains the same." It is stated that it can be polished, and cut, and engraved by the sand blast, wheel, or acid, just like ordinary glass. Finally, we read that "we may expect that glass will supersede the use of metals for household and manufacturing purposes."

I am aware that all these statements are not authorized by De La Bastie; but they have been so widely spread in the newspapers that many believe them, and interested parties ask each other: "Are these things true? Have we indeed malleable glass?" etc.

As the objective point of the whole business is, I suppose, the sale of the patent in America, for which millions are asked, it is well that a more correct account of the glass should be given.

1. The glass is not malleable, and is not claimed to be so by the inventor. Malleability and brittleness in glass are

incompatible; and only in the fabulous stories of ancient and modern writers is malleable glass named, and its possibility was, I think, never allowed by any practical glass maker.

2. The glass is not unbreakable. It is only much tougher than common glass, and will bear a much stronger impact. But there is no piece which cannot be broken, and many specimens are purposely fractured at every exhibition.

3. It is not annealed. It is only tempered, toughened or hardened, by its submersion in the hot, oily bath.

4. It cannot be cut and engraved like ordinary glass. Flint and other glass can be ground and cut on the wheel or by the sand blast throughout its entire thickness. Now, although a few specimens exhibited were ground by the sand blast to a very slight depth, yet, if the blast goes beyond a certain depth, it will break into a thousand pieces, just as a Rupert's drop is shattered when ground. I am telling you a fact, for I have in my possession a piece of the fractured glass as it came from the sand blast after being ground, perhaps through a third of its thickness, or about $\frac{1}{4}$ of an inch.

5. It does not preserve its transparency after its transformation by tempering, as most of the specimens exhibited were only translucent. The glass is thus robbed of one of its chief beauties, rendering it unfit for any use where clearness and transparency are required.

6. The glass cannot be cut with a diamond, making it of little or no value for window glass or photographic uses, both of which purposes frequently require the pieces to be cut more than once before exactly fitting the frame or the window sash.

I add, after the above statements, that it cannot supersede the use of metals. Can I call it anything more than an enlarged Rupert's drop, exhibiting many of its optical and crystalline properties? It is a great scientific curiosity, just as the Rupert's drops were 200 years ago, and has excited no more discussion than they did. Hundreds of pages were written upon them, and some of these drops were tempered in oil instead of water, and did not break as the others did. More than half a century ago, a writer in the "Gentleman's Magazine," in an article on tempering glass, gives this direction: "If the glasses are to be exposed to a higher temperature than that of boiling water, boil them in oil." These are curious facts.

I ought to say that, in my opinion, it would not yet be safe for glass makers to throw stones at those who pass for the impact of a stone, as generally thrown, would break any windows, even of the Bastie manufacture; and although, ordinarily, a saving is made in the squares cut from fractured pieces of window glass, the Bastie article is shattered into the minutest fragments, and entails a total loss. A stone-ware baking dish, if broken in the oven, would not necessarily spoil the loaf of cake it contained; while the accidental fracture and explosion into minute fragments of a Bastie article might ruin the contents of the oven, as ground glass forms a very dangerous article of food.

May I add that, before your readers take stock in the Bastie process, it would be well to consult the agents of other processes of a similar character, which are now represented in New York or in Europe? If the papers are to be believed, Baur in Vienna, Pieper in Dresden, Stahl in Berlin, and Meusel in Geierthal are busy with their processes of tempering glass.

While I do not wish to say, in these times of wonderful discoveries and inventions, that anything cannot be done, yet I think that our glass makers and dealers can still possess their souls in peace, and not lose their temper over the Bastie or any glass yet made, as being likely to make a revolution in their business.

Although formerly a glass manufacturer, and for many years a glass dealer, I am not interested in any tempering process, or glass business of any kind, and only write in the interests of scientific truth and accuracy. When M. De La Bastie, or any other man, can make glass which is malleable, as unbreakable as iron or tin, and tough, and is also transparent, which can be cut with a diamond, and cut and engraved deeply on a wheel, just like Baccarat's glass or that of Bohemia, we will not say "don't" to those who want to take stock.

GLASS.

Powder Mill Explosions.

To the Editor of the Scientific American:

When a powder mill explodes, the men at work are unable to explain its cause; this leads me to think that such calamities may be caused by electricity. At all events it is a well known fact that persons dressed in woolen clothing for the body and leather shoes for the feet can, when the air is dry, by moving and twisting their bodies so their clothing will rub against them, produce from their finger ends a spark of electricity sufficient to ignite a gas jet. Can it be that the men who work in powder mills, dressed as above described, in preparing for their work, create so much electricity in their bodies that, when their hands come in proximity with any metal, a spark is given off, which, even if insufficient in tension to explode the powder, may ignite some inflammable gas generated from the chemicals? The powder is exploded, the mill goes up, and the people cry "spontaneous combustion."

C. F. ROBERTA

Cottonwood Springs, Neb.

A Method of Destroying Grasshoppers.

To the Editor of the Scientific American:

I wish to suggest a cheap arrangement which, I believe, could be effectively used for the destruction of a swarm of grasshoppers. The instrument is a tin cylinder about five inches in diameter, flattened so as to be elliptical in form, and about ten inches in length. One end is closed completely, but it has a socket into which is fitted a stick or broom

handle; the other end is shaped like a grocer's scoop. At the extremity of the cylinder, where the bevel of the scoop commences, is a sliding door of tin, which, when shut, closes the cylinder entirely. Across the base of the scoop and immediately in front of the door is a groove; into it is fastened a piece of lamp wick saturated with alcohol. The cylinder is filled, through the sliding door, about one third with powdered rosin; the door is then pushed down until only a small space or slit is left, about $\frac{1}{4}$ inch or sufficiently to allow the powdered rosin to trickle in a shallow stream over the ignited alcohol, whenever the instrument is held at an angle downwards. The whole thing should cost about \$1. When the instrument is held by the handle in a nearly upright position, the rosin will not burn; but directly it is lowered, as in the act of striking, a flame will issue of the width of the cylinder and three or four feet long; and this flashing can be repeated in quick succession as often as the instrument is raised and lowered. Three or four men thus armed could in an hour traverse a large lot of planted corn. The sudden flash, directed to the corn, would be too brief to wither the plant; but it would spoil the appetites, legs, and wings of a mass of grasshoppers. It may be found necessary to mix the rosin with a small quantity of fine gravel or sawdust.

Omaha, Neb.

CHARLES PONTEZ.

PRACTICAL MECHANISM.

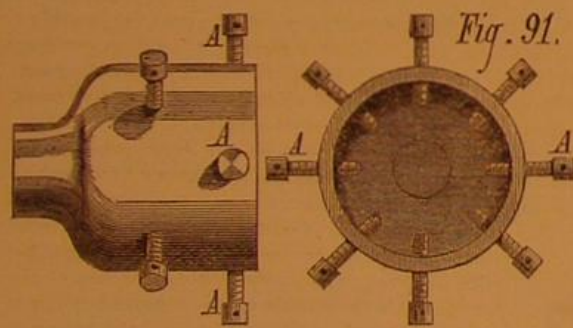
BY JOSHUA ROSE.

NUMBER XXVI.

LATHE CHUCKS.

That class of lathe work which, by reason of its shape, cannot be held and driven between the lathe centers, is what is termed chucked, that is to say, it is fastened to the face plate of the lathe by suitable plates and bolts, or held in special chucks. Of special chucks, the universal chuck is the most useful, and is so common that a description of it is unnecessary. When the running center of the lathe is removed in order to put a chuck on the spindle, the hole into which the center fits should be carefully plugged with either rag, cotton waste, or paper, to prevent the metal turnings or dirt from getting into it; and the screw on the lathe spindle and the face of the collar at the end of the screw should all be carefully wiped, as should the face of the hub or boss of the chuck, since the presence of any dirt there will cause the chuck to run out of true. When the chuck is removed from the lathe, it should be put away standing upright and not laid flat upon its face, in which position dust would accumulate in the thread.

If a piece of work requires to be operated upon at a distance from the face of the chuck, a universal chuck will not hold it sufficiently firmly; and the bell chuck, shown in Fig. 91, should be brought into requisition. In using this



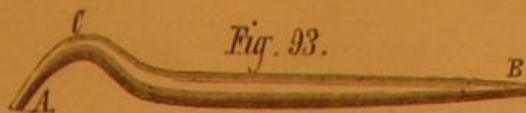
chuck, is best to set it the work as nearly true as possible, using the front screws, A A, before attempting to adjust the four back screws, and to set the work true near the front face of the chuck, striking the work with a mallet (on the end standing out farthest from the chuck) to true it; and then, when the work is adjusted as nearly true as possible, to set up the four back screws, until they each bear lightly upon the work, and then tighten them gradually and successively, giving them not more than a quarter turn each at a time, and continuing from one to the other until they are finally screwed sufficiently tight, which proceeding will prevent the springing of the work by the screws. The bell chuck will hold work very firmly, and obviate the necessity (in most cases) of a guide or cone chuck being placed upon the outer end of the work to steady it.

The screws should be made of steel, the ends being turned down below the depth of the threads, so that, if in the course of time the ends should bulge from the pressure of the screws, it will nevertheless be an easy matter to remove



them from the chuck, to replace them when necessary, or to straighten them if they become bent, as is sometimes the case. To prevent bulging, the ends should be tempered to a straw color. When tubes, brass work, or finished work, which is liable to be damaged by the pressure of the screws, is held in a bell chuck, a piece of soft metal, as copper or brass, should be interposed between the screws and the work; and here it is as well to remark that the same precautions should be taken in fastening a carrier, driver, or dog to work driven thereby. Pieces of copper, both flat and of circular

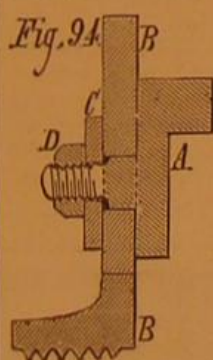
form, such as shown in Fig. 92, should be kept for this especial purpose. The object of leaving a space between the two ends is to allow them to close, when required for work of a smaller diameter than the ring of copper, it being obvious that the same piece can be opened or sprung outwards to accommodate work of a larger diameter. To hold rings or hollow work larger in diameter than the bell chuck, the screws may be inverted, that is, put into the chuck with the heads inside and the ends protruding outside the chuck; it is, however, at times difficult in such cases to obtain access to the heads of the screws, but whenever this can be done, the bell chuck will be found a most effective and serviceable tool. A special implement should be kept for inserting into the holes of the heads; for if promiscuous pieces of steel are used, they will destroy the screws by bulging outwards the edges of the holes, making them taper and causing the lever to slip outwards and away from the screw head. Such an implement is called a "Tommy," and is shown in Fig. 93;



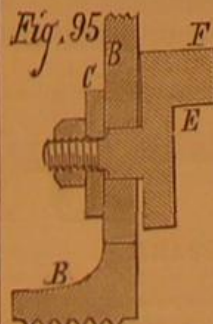
it is made of round cast steel and left soft, the sizes of the ends, A and B, being made to fit the holes in the screw heads. The object of curving the end, A, at C, is to enable the end, A, to be used in instances when the end, B, could not be employed, by reason of some obstruction or interposing projection upon the work.

The next form of chuck to be considered is the dog chuck; and of this there are two kinds, the first being one in which the screwing inwards or outwards of one dog operates one or more of the others, by means of gearing or other suitable devices, and the second being those in which the dogs slide in grooves or slots in the chuck plate, and are adjusted to accommodate the work and then bolted firmly to the chuck plate, the work being held by screws passing through the jaws of the chuck.

The first kind of chuck is a very useful tool for ordinary work, and is a necessity to every lathe; but however well it may be made, and no matter how carefully it is used, it will become in time out of true and unfit for work requiring great nicety. For work which does not require reversing in the chuck, it is of course at all times good; but if the work does require reversing, the jaws of the chuck will require adjustment to keep them true; and since such jaws are hardened they cannot be turned up in their places unless they are first removed from the chuck and softened. There can be no doubt that, in a majority of causes, ill usage causes these chucks to get out of true rapidly; and a common reason for their depreciation arises from the following causes: The jaws are, of necessity, adjusted to fit the slots or grooves in the chuck plate with great exactitude, after the manner shown

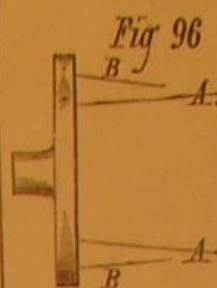


in Fig. 94, A being a jaw to which is secured a sliding fit in the slot of the plate by means of the plate and nut, C and D; from which it will readily be observed that the presence of any dirt upon the face plate will make it very difficult to move the jaw either towards or away from the center of the chuck, and that even the absence of sufficiently frequent lubrication will produce the same effect, because the dust and fine particles of metal collect upon and in the grooves of the chuck, and form a species of gum coating not unlike india rubber, forming a serious obstacle to the movement of the jaw. Instead of properly cleaning the chuck, to obviate the difficulty, the artisan, especially if his job is in a hurry, is apt to slack back the nut, D, thus causing the jaw to fit loosely to the thickness of the chuck plate, so that, when the jaw is forced against the work, it springs away from the face of the plate in the direction shown in Fig. 95, the amount to which the nut is loosened determining the degree to which the lower end of the jaw will spring away from the chuck plate in cases where the work is being held by the inside face, E, of the chuck. If, however, the outside face, F, of the jaw is gripping the work, the jaw will spring in the opposite direction, so that the lower end of the jaw (shown above to be away from the chuck) will be close to it, and the outer end will spring off, the conditions of pressure being exactly reversed. It will be at once perceived



that the wear of the face of the jaw and of the face of the plate, C, which fits against the face plate, B, will, if not taken up by the nut, produce in time the same defect; and it is this wear, together with that of the screws, nuts, and gearing, if there be any, to operate the screws, which causes this class of chuck to get out of true, even if carefully used.

Many cases arise in which it is necessary that the inside face of a piece of work requires when chucked to bear against the face plate if the jaws grip at F, and against the face of the jaw if the jaws grip the work at E, so as to ensure the work being set true with that face. When, however, the jaws of the chuck are loose in the slots or slides, as shown in figure, tightening the jaws upon the work will force the latter away from the face plate to an amount proportionate to a degree of looseness of the jaw, as is shown in Fig. 96, in



which the lines, A A, represent the direction in which the inside face, E, of the jaws would stand to the chuck when gripping the work, and B B the direction of the same when the outside face, F, is gripping the work, the effect being, in both cases, to spring or force the work away from the face of the chuck jaws as the case may be, rendering it very troublesome to set the work true, and entailing a great loss of time; for a very slight defect in a chuck is, by reason of reversing the work in the lathe, multiplied upon the work; and when it is considered how many times in a year that defect is encountered, how many times it has performed its duties imperfectly, and how much extra labor in fitting and adjusting has become necessary, it will be readily perceived that it is better to throw away a dozen imperfect chucks, if needful, to obtain a good one.

Chuck dogs are detached dogs which fit into the square holes of the chuck plate or face plate, as shown in Fig. 97,



being held to the plate by the nut and washer. These dogs are movable to any part of the plate, their position being regulated to conform to the shape of the work, which renders possible their employment in cases where a dog chuck would be of no service, such, for instance, as holding a triangular piece of work. The center line of the screw should stand exactly parallel to the face of the face plate, or tightening the screws, which in this case grip the work, will force the latter towards or away from the face of the plate, according to the direction in which the screws are out of true. The screws should have their ends turned down below the thread, and should be hardened as directed for bell chuck screws, since these screws may be also reversed in the dog for some kinds of work. The dog should be screwed very firmly against the face plate, so as to avoid their springing.

Universal or scroll chucks, containing screws or gear wheels which are enclosed, should be occasionally very freely supplied with oil, and the chuck worked so as to move the jaws back and forth to the extreme end of their movement, so as to wash out any particles of metal or dust which may have lodged or collected in them; for proper cleaning will reduce the natural wear to a minimum, and prevent the internal parts from cutting, as they are otherwise apt to do.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW USE FOR MAY BUGS.

Dr. Chevreuse, of Switzerland, announces a new and curious utilization of the may bug or cockchafer. It consists in decapitating the living insect one hour after it has fed, when, on opening the stomach, several drops of a colored liquid are obtained, which varies with the nature of the plant fed upon. This substance has been used as a water color for painting with considerable success, Dr. Chevreuse having formed a scale of fourteen different tones or shades. It is a permanent pigment, unalterable by air or light, and imparts this quality, it is stated, to other paints with which it may be mixed.

A CURE FOR SOOTY CHIMNEYS.

F. C. R. says: About fifteen years ago, a dwelling was raised one story higher, and a chimney had also to be raised some feet higher; and as the chimney was built up, it was plastered on the inside with salt mortar, to prevent the adhesion of the soot. The result is that the part plastered with salt mortar is white and clean to this day, while the other part gets filled with soot up to the very line where the salted part begins, and has to be cleaned each year, the chimney being in almost constant use. The proportions used were 1 peck of salt, added while tempering, to 3 pecks of mortar.

A NEW GENERAL ANTIDOTE FOR POISONS.

M. Jeannel gives the following formula for an antidote for a number of deadly poisons: Solution of sulphate of iron (D. 145) 100, water 800, calcined magnesia 80, washed animal charcoal 40. These ingredients are kept separate, the solution of sulphate of iron in one vessel, the magnesia and charcoal in another, with some water. When needed, the sulphate solution is poured into the last mentioned receptacle and violently agitated. The mixture should be administered promptly in doses of from 1-6 to 3-3 ounces. From experiments M. Jeannel finds that this antidote, employed in proper proportions, renders preparations of arsenic, zinc, and digitaline completely insoluble. It does not render oxide of copper absolutely insoluble, however, and leaves in solution notable quantities of morphine and strychnin. It neither decomposes nor precipitates cyanide of mercury nor tartar emetic. It saturates free iodine entirely, and acts but partially upon solutions of alkaline hypochlorites. Four ounces of the antidote are found to neutralize the poisonous effect of 1-6 ounces of arsenite of soda. It retards the toxic action of sulphate of strychnin, affording sufficient delay to administer evacuates. One third of an ounce is efficacious against digitaline injected into the intestines. The formula, says M. Jeannel, is certainly preferable to the official hydrated peroxide of iron, which, in course of time and at a temperature of 59° Fah., undergoes molecular modifications which render it unreliable as an antidote for arsenical preparations.

IMPROVED GANG PLOW SPRING.

The object of this invention is to afford a simple means whereby the plows may be easily raised and lowered while at work. The essential feature of the device, which we illustrate in the annexed engravings, is a coiled spring which acts upon a crank axle, turning the latter so that the plow may work to a depth of nine inches into the ground or be raised seven inches above it. The inventor points out that plows at present cannot work to a depth of over four inches and a half without requiring changing in some manner, and that it is very difficult to lift them while in operation.

The general appearance of the machine is shown in Fig. 1. From Fig. 2 the arrangement of the spring will be more clearly understood. The ends of the spring are attached to the crank axle, and to the frame of the implement, so that, when the crank, and consequently the frame, is lowered, thus allowing the plows to enter the ground, the spring is caused to wind tightly about the axle. The parts are then held by the lever, A, which is attached to the crank and secured as desired by a simple spring stop in a notched arc, B. To raise the plows so that they may operate at any less depth, or be lifted entirely free of the ground, it is only necessary to release the spring through the medium of the lever, A.

The elasticity of the spring then revolves the axle in such a direction as to raise the frame, and with it the plows, more or less, according to the space through which the said axle is allowed to revolve.

A long crank axle can be used, and thus a wide range of depths in plowing gained. The general construction of the implement embodying the invention is of the most durable description, all parts being of iron except the pole, foot rest, and plows, the latter being of superior cast steel.

Patented through the Scientific American Patent Agency. For further particulars address the inventor, Mr. H. N. Dalton, Pacheco, Contra Costa county, Cal.

IMPROVED DASHBOARD.

The novel feature, in the improved dashboard represented in the annexed illustration, is found in the construction of the frame, whereby the latter may be contracted or expanded should the leather cover be made too tight or too loose, and which, besides, enables all the stitching to be done before the cover is applied to the frame. The iron work, the inventor states, can be made for half the cost of the old welded frame, and the leather can nearly all be sewn by machine, the ends and tops only requiring hand-stitching. A good workman, we are informed, can, through these advantages, produce thirty or forty dashboards in a day, as against three, which would be considered fair work in the same space of time, if boards constructed in the usual manner were made. The inventor is a practical saddle and harness manufacturer, and has submitted the device to the test of experience, on the results of which he bases the above claims and statements.

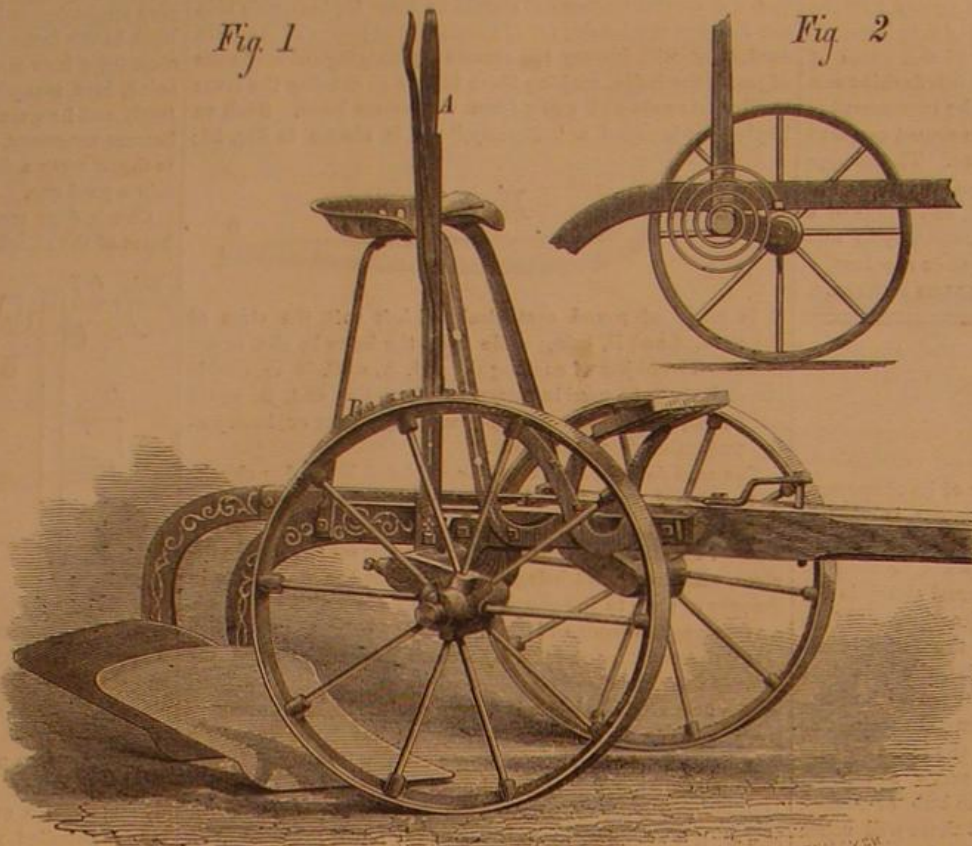
From Fig. 1 it will be seen that the frame is composed of iron rods united by T and elbow couplings, and that the construction of the latter enables a rail above and two handles at the sides of the board to be added. The opposite ends of the horizontal bars, A, and of the vertical bars, B, are screw-threaded in reverse directions, so that, by turning said bars in one direction the couplings will be drawn toward each other, and the frame will be contracted; by turning the bars in the other direction, the couplings will be pushed from each other, and the frame will be expanded, so that the leather or cloth cover can be adjusted as required. The center bar, C, may be secured to the top and bottom bars by T couplings, and the ends of the upper rail and the handles may be conical in shape and held in recesses in the elbows of the corner couplings, as shown in Fig. 3. The last mentioned figure represents an upper coupling, and Fig. 4 shows the shape of a lower coupling, with the manner of attaching the iron which secures the dashboard to the body of the wagon. The bars may be either solid or hollow, as desired.

In constructing the board, the cover is, as above noted, first partly stitched; the bars are then inserted, the couplings are put on and adjusted to give the proper tension. In case of breakage, the entire frame can be removed by ripping the end and top seams, and the device may afterwards be put together. With the old form of dashboard, in such case, it would be necessary to rip every seam, and to replace the cover would involve more labor than the making of a new one. Sheet metal may be used for covering instead of leather, if desired.

Patented through the Scientific American Patent Agency, February 16, 1875. For further information relative to royalties, price, etc., address the inventor, Mr. C. C. Schwaner, P. O. Box 153, Winterset, Madison county, Iowa.

India Rubber Sidewalks.

The *National Car Builder* says: India rubber sidewalks are coming into fashion out West. For small towns they are admirable, combining economy with durability. The first experiment was made in Danville, Iowa, where 300 yards were put down on one of the principal streets. All the boys in the place ran over it, but there was no noise. A leading merchant stopped in front of his house, then jumped on his heels. The elastic forces hidden in the rubber threw him over the gate to the roof of the piazza. But after a few trials he was able to alight on the steps with the graceful accuracy



DALTON'S GANG PLOW SPRING.

of a flying squirrel. The chief drawback to the walk is its odorous familiarity in hot weather, but it can be neutralized by a weekly wash of borax and coal tar. Its principal advantage is that it can be stretched. As the town grows, it is pulled out towards the suburbs. Two yoke of cattle can lengthen it three miles a day.

Window Ventilation.

A recent number of the *London Times* contains a glowing account of a new invention, just brought out in London, whereby it is alleged that apartments of all kinds can be ventilated by a contrivance placed at the window for the admission of air in upward currents. The air so admitted is intended to blow up against the ceiling, and thence spread

be allowed, but the evenness of the color is indispensable. (c) The solidity of the material must not be less than that of plaster, so that it may be used for the largest casts. (d) Casts made of this material must stand repeated washings with soap and lukewarm water. (e) The price of the material must not considerably exceed that of plaster, and the price of the molds for casting must likewise not considerably differ from that of plaster molds. (f) Competitors are to prove the practicability of their material by sending samples in applied and unapplied states, and also to give proof, if required, by the actual execution of casts.

General conditions referring to both of these prizes.—The Ministers reserve to themselves the nomination of a committee of experts, in order to examine the consignments which may be received. Competitors are to send with their consignments sealed envelopes, provided with mottoes, and containing the names of the senders. On the outside of these envelopes also is to be written the address to which the returned samples or any communications are to be sent. The consignments which have been found to correspond with the conditions stated above will become the property of the Government, and the names of the successful competitors will be published. The remaining consignments will be returned to the addresses given on the envelopes. Competitors are to forward their consignments to the Royal Prussian Ministry of Public Worship, Instruction, and Health, not later than 31st December, 1875.

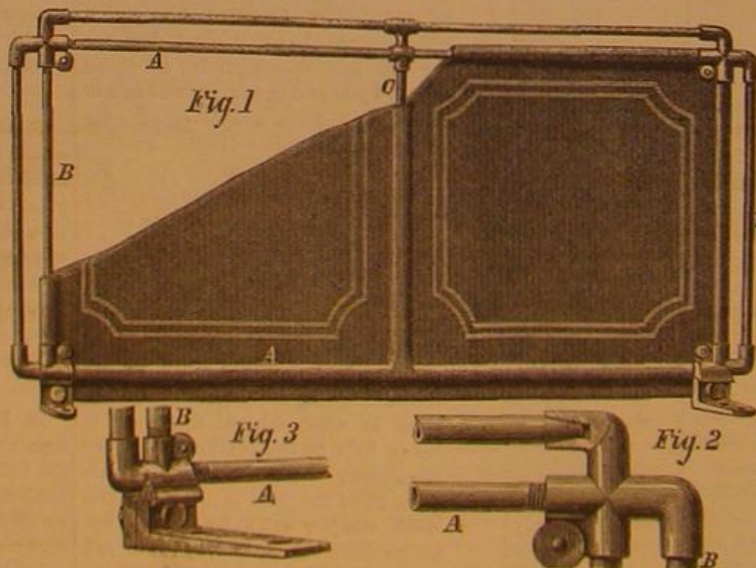
Decolorising Property of Ozone.

One of the most striking properties of ozone, says M. A. Boillot, is its bleaching power. The effects ascribed to chlorine are really due to ozone. Ozone employed directly acts as an oxidizing agent, laying hold of the hydrogen of the substance with which it is in contact, whence results bleaching, if the body is colored. On allowing chlorine to act upon any animal or vegetable matter, it decomposes a certain quantity of water and seizes its hydrogen, forming hydrochloric acid. The oxygen set free by this reaction is transformed into ozone, which, in its turn, lays hold of hydrogen present in organic matter.

Memory in Birds.

A carrier pigeon which was captured in a balloon during the siege of Paris, and sent by Prince Frederick Charles to his mother, recently escaped from captivity and returned to the house of its former owner in the French capital. This is certainly a remarkable instance of the exercise of memory in the lower animals, to which it would appear difficult to find a parallel case. The bird must have kept its former haunts in its recollection for nearly five years.

To DETECT sulphuric acid in vinegar, put in a little starch. Then add a minute portion of iodine. If sulphuric acid be present, the starch will not take a blue tint.



SCHWANER'S DASHBOARD.

throughout the apartments without creating drafts injurious to the health of occupants. Our British cousins think that this improvement is the greatest thing out in the ventilation line, and so new that they devote much space to its discussion in their leading papers. Mr. Tobin, a retired merchant of Leeds, is credited with the origination of the improvement.

We should be sorry to detract from the just claims of Mr. Tobin as an inventor, but the truth in such matters is always in order. Our readers will find on page 403 of the *SCIENTIFIC AMERICAN*, for December 23, 1871, an engraving and description of this method of ventilation, which was patented here in 1870 by S. C. Maine of Massachusetts. This device is extensively used in this country. It consists of air pipes set in a board placed under the window sill. The inner mouths of the pipes are bent upward, so that the rushing air impinges against the ceiling and spreads without creating drafts.

MODEL RESIDENCES.

Messrs. Isaac H. Hobbs and Son, of Philadelphia, Pa., have recently designed a villa residence for Mr. William M. Weigley, of Shaffersstown, Pa. The architects describe their work as follows: The design is an evolution of the oval laws of proportion, with a mansard roof. It is built of a very fine stone, of a peculiar rich, reddish brown color. The work will be rock-faced range work with draft base course, and other dressings of picked centers. All the stone work will be very fine; the building is to be finely finished in the interior, with hard, natural wood. The situation of the house rendered it of advantage to have a broad front and not to be deep. The building will cost \$22,000. The interior arrangements, as shown in Fig. 2, are as follows:

First story: V is the vestibule, 6 by 12 feet; H the stairway, 10 feet wide, connecting main hall 10 feet, separated by an ornamental arch connection; P the parlor, 15 feet wide, 30 feet long; L is the library and sitting room, 15 feet long by 15 feet wide; an octagonal corner room, 10 feet in diameter, forming an alcove of beautiful proportions; A is a conservatory, connecting the library and side porch by windows running down to the floor; D R is the dining room, 15 feet wide by 26 feet long; K is the kitchen, 13 feet by 17 feet; S is the scullery, 15 by 16 feet. This story is supplied with ample store room, butlery, pantry, and a lavatory under the main stair, also a lift from the cellar to this story.

The second story contains four fine chambers, C, Fig. 2, all of which are 15 feet wide and of the following length; one with octagonal projecting tower alcove, 15 by 15 feet, alcove 10 feet; second, 15 by 25 feet; third, 15 by 17 feet 4 inches. This story also contains a dressing room or boudoir, 11 by 13 feet; a bath room, 11 by 10 feet, with ample linen and other closets. There is a verandah in front and a covered verandah upon its side.

The third story will contain the same number of rooms and accommodations as the second story.

Weighted Silks.

M. J. Pierson states that an increase of weight is produced in silks by treatment with salts of iron and astringents, and with salts of tin and cyanides; this factitious increase of weight may be carried to the extent of from 100 to 300 per cent. It cannot be too widely known that, by this adulteration, silk is rendered very inflammable, and under certain circumstances, spontaneously so.

The Cost of Modern Guns and Armor.

The Engineer places the cost of a vessel, protected by the latest modern armor and armed with an eighty-one ton gun, at \$1,500,000. Ships carrying this tremendous weapon have yet to come in conflict; but when such combat does occur, it will probably be the question of but one well aimed shot to send either antagonist to the bottom. The same end may be more easily and certainly accomplished by a properly managed torpedo. The war of the future, on the water at least, bids fair to prove expensive to the losing side.

Celluloid—What is it?

In reply to various correspondents asking for a description of this substance, which is now coming into extensive use, we would state that celluloid is the name given to a kind of solidified collodion. The latter is composed of some fibrous material, such as cotton, which is dipped in sulphuric acid and nitric acid. The cotton then possesses the quality of solubility and sudden explosion, and is termed "gun cotton," or pyroxylin. This pyroxylin can be dissolved in ether and alcohol, and when so treated is called collodion, and is used in photography for covering the glass plates on which the negatives are made. The dissolved pyroxylin is poured on the glass plate. The alcohol and ether rapidly evaporate, leaving on the glass a fine transparent membrane or skin, of considerable toughness, something like fine horn.

Celluloid is made by using camphor in place of alcohol and ether, in connection with the pyroxylin. The following is the description given by the inventors of celluloid, Messrs. John W. Hyatt, Jr., and Isaiah Smith Hyatt, of Newark, N. J.

"In the practice of our invention, we prepare pyroxylin by

grinding it in water to a fine pulp in a machine such as is used in grinding paper pulp. We strain off the water as far as practicable, and then subject this pulp to powerful pressure—for example, in a perforated vessel—to further expel the aqueous moisture, and to bring it to a comparatively solid and dry state, yet still retaining sufficient moisture to prevent it from burning in the further stages of the process.

We comminute gum camphor by grinding it in water, or, preferably, by pounding or rolling it, and thoroughly incorporate, with the pyroxylin pulp in the condition last above described, this finely comminuted camphor, in about the proportion of one part, by weight, of camphor to two parts,

once resembling that of sole leather, but upon exposure to the atmosphere it hardens, by reason of a slight evaporation of the camphor. The ultimate product includes, however, a large proportion of the camphor as a permanent accretion to the mass, which accretion is not only a great gain over the use of ether, alcohol, or other solutions or volatile solvents, which would be entirely expelled or lost, but by its presence gives the solidified collodion or compound the new capability of being again rendered plastic by heat, and remolded into any desired form or shape, without requiring the use of solutions or volatile solvents, or the addition of fusible gums, as heretofore.

A recent improvement on the foregoing consists in transforming pyroxylin into solidified collodion or celluloid, by using a liquid instead of a solid solvent, which liquid solvent, like the solid, is latent at ordinary temperatures, but becomes active and dissolves the pyroxylin upon the application of heat.

The following is the process: We make a weak solution of camphor in alcohol, the proportions being, by weight, one part of camphor to eight parts of alcohol. This solution of camphor is not a solvent of pyroxylin at ordinary temperatures, and we therefore term it a latent liquid solvent, but it becomes an active solvent at an elevated temperature.

In using this latent liquid solvent we first reduce the pyroxylin to a pulp, and mix therewith such coloring or other matters, if any, as are suitable to the required character of the product. The aqueous moisture is then expelled from the pulp. We then add to the dried pyroxylin or pyroxylin compound the above described latent liquid solvent in about the proportions, by weight, of fifty parts of the solvent to

one hundred parts of the pyroxylin. The solvent is stirred into the pulp, and the whole kept in a closed vessel until the solvent becomes evenly diffused throughout the mass, no solvent action taking place to retard or prevent this even diffusion, as would be the case in the use of solvents that are active at ordinary temperatures. The compound is then subjected to heat and pressure in a similar manner to that employed when using the solid solvents."

Among the various uses for which celluloid is now employed is the production of dental plates for artificial teeth. It is regarded as superior to rubber in many respects. A beautiful species of artificial ivory is also produced from celluloid as follows:

"We take, say, one hundred parts by weight of ivory dust, one hundred parts of pyroxylin, and fifty parts of powdered gum camphor. The pyroxylin is ground into a pulp while moist, and it is afterward deprived of nearly all of its moisture, leaving it slightly damp, as a protection against its taking fire from any cause. It is thoroughly mixed with the ivory dust and gum camphor, in the proportions just named. After being mixed, the mass is deprived of all remaining aqueous moisture, preferably by pressure between absorbing pads. To this compound, deprived of moisture, we then add fifty parts of nitric ether, and keep the whole within a closed vessel for several

hours, or until the nitric ether has become evenly and thoroughly diffused throughout the mass.

The nitric ether permeates and semi-dissolves the ivory dust, the camphor, and the pyroxylin, and thus properly disposes them for final treatment, which consists in bringing the whole compound together into a solid within a heated cylinder or molds under heavy pressure, or by passing it through heated rollers. From 150° to 250° Fah., of heat is required. The result is a compound which, after being dried or seasoned, resembles natural ivory in compactness and homogeneity. It is free from grain, is not affected by moisture, and is with great facility remolded into any desired form by heat and pressure in suitable molds.

The proportions of ingredients above set forth may be considerably varied to suit the consistence required and the use to which the new compound is to be adapted.

To the mixture may be added such pigments as are appropriate to the production of various colors."

IRON may be cemented in wood by dropping in the recess prepared in the latter a small quantity of strong solution of sal ammoniac. This causes the iron to rust, rendering it very difficult to extract

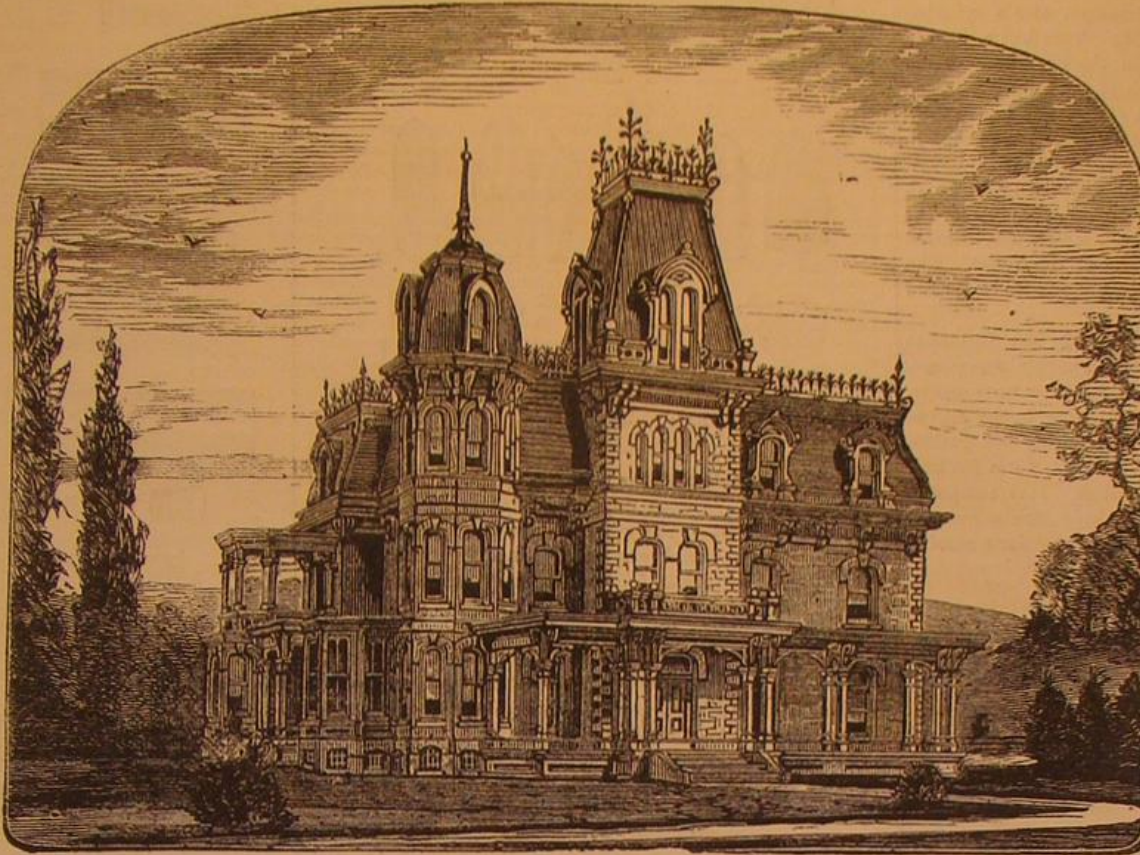
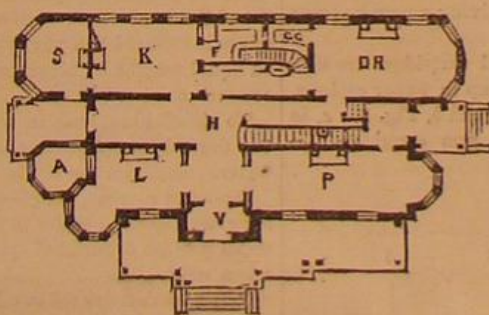
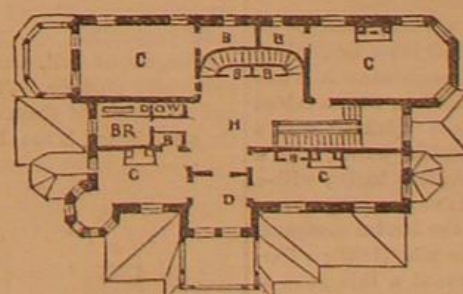


Fig. 1.—DESIGN FOR A MODEL VILLA.



SECOND STORY.



FIRST STORY.

Fig. 2.—PLANS OF A MODEL VILLA.

shall be in condition and place to exert its utmost converting power as developed.

The dried and compressed mass is next placed in a suitable mold or vessel open at the top, and into this open top is fitted a platen or plunger. The vessel is then placed in a hydraulic or other powerful press, and a heavy pressure, applied to the platen or plunger, is brought to bear upon the mixture, which, while thus under pressure, is heated up, by steam or other convenient means, to a temperature of from 150° to 300° Fah., varying according to the quantity of the mixture; and the mixture is kept at this temperature and under this pressure until the converting power of the camphor shall have been exerted upon the pyroxylin throughout the mass, the heat developing the latent converting power of the camphor, and the camphor exerting this converting power actively upon every atom of the pyroxylin, with which the pressure maintains it in close contact. The process of transformation is rapidly effected, and is completed almost as soon as the mass attains its maximum temperature, the resulting product being a homogeneous product, solidified collodion, or collodion compound having the qualities or properties hereinbefore specified.

This product, as it comes from the press, is of a consist-

BULLETS, CANNON PROJECTILES, AND CARTRIDGES.

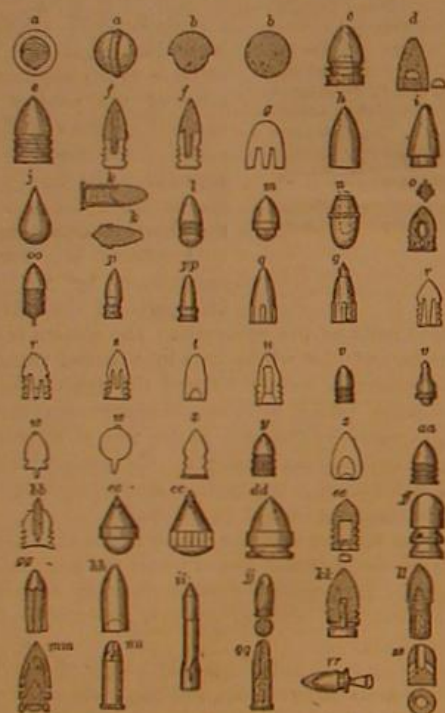
The extracts, from Mr. E. H. Knight's "Mechanical Dictionary," given below, comprise the most instructive illustrations and facts therein published on the subjects of projectiles and cartridges.

Fig. 1 represents a large number of improved bullets, beginning with the Brunswick, *a*, which was one of the earliest adaptations of the ordinary musket ball to the requirements of the rifle. This projectile was intended for a two-grooved barrel, and was provided with a simple circumferential belt. The Delevigne bullet, *b b*, involved the use of a sub-caliber powder chamber, and it rested, by an annular shoulder, upon a wooden sabot. It had a patch of greased serge. Minié and Thouvenel introduced an elongated bullet, with a cylindrical grooved body and a conical point. This had a greased paper patch, and was expanded to fill the grooves by being driven down upon a *tige* in the breech of the gun. This was adopted in the French service in 1846. Delevigne subsequently patented an elongated bullet with a recessed base, which he called the cylindro-ogival.

Minié produced, in 1857, the well known bullet, *c*, in which the *tige* was dispensed with, and the bullet expanded by the explosive force of the powder in the cup, which was inserted into a frusto-conical cavity in the base of the bullet. The English substituted a conoidal wooden plug in their Enfield rifle bullet, *d*.

In 1856, after a series of experiments by the Ordnance Department, an elongated bullet, *e*, with a cavity, was adopted for the United States army. Two varieties were made, precisely similar on the exterior, but differing in the size of the cavity; that for the rifle musket weighing 500 grains, and the one for the pistol carbine 450 grains. *f f* is the bullet of Thirouse, a French artillery officer. It is composed of lead backed by a sabot of wood, with three circular grooves near its base. The Nesler ball, *g*, was intended for a smooth bore.

Fig. 1.

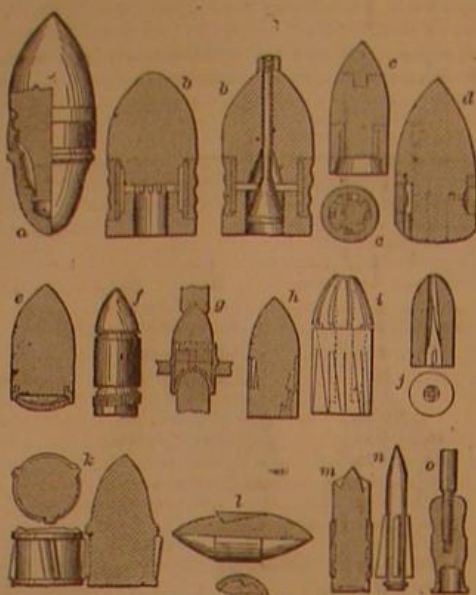


Bullets.

Of the other bullets in Fig. 1, some are celebrated on account of the ingenuity or success of their inventors, others as having been adopted by different governments. *h* is the American conoidal pointed bullet; *i* the Colt, with a rabbit for the cartridge capsule; *j* the American "picket," with a hemispherical base; *k k* Haycock's Canadian bullet, with a conoidal point and a conical base; *l* Mangelot's bullet, with a conoidal point, hemispherical base, and two circular grooves; *m* is the Prussian needle gun bullet; *n* the Norton elongated percussion rifle shell, fitted with wooden plug (1830); *o* Gardner's explosive shell bullet, cast around a thin shell of copper attached to a mandrel, which is afterwards withdrawn, leaving a fuse hole in the rear, through which the charge is exploded in about one and a quarter seconds; *o o* is a Spanish bullet, containing a charge of powder and a fulminate. The use of exploding projectiles for small arms, such as the three last mentioned, is now generally condemned, and the nation employing them would be adjudged to be without the pale of civilized warfare. *p* is the Swiss federal bullet; *p p* the Swiss Wurtemberger bullet; *q* and *q* are views of Mr. Jacob's bullet and shell; *r* and *r* are views of the Peter's ball, having an interior *tige*; one view shows it distended and battered. *s* is the Belgian bullet; *t* Pritchell's; *u* Mangelot's; *v* the Austrian; *w w* Deane and Adams' bullets with tails; *x* English bullet with wad; *y* Sardinian; *z* Beckwith's; *a a* steel-pointed bullet; *b b* the Charin bullet, with zinc or steel point; *c c* and *c c* Tamassier's steel-pointed bullet, one view showing it intact, and the other after compression in the grooves of a rifle; *d d* is the Saxon bullet; *e e* the Baden modification of the Minié, with tinned iron cup; *f f* Wilkinson's; *g g* Whitworth's hexagonal bullet; *h h* Lancaster's; *i i* Metford's sub-caliber bullet, with spiral grooves on the shoulder to impart rotation; *j j* McMurtry's bullet with spiral grooves; *k k* Williams' bullet with a headed *tige* to expand a rounding disk at the base; *l l* Dibble's bullet with a recess for the powder; *m m* Shaler's triple bullet, the pieces of which are intended to diverge after leaving the muzzle; *n n* Madell's

bullet, which is built up of interlocking portions, which part as they leave the capsule and muzzle; *q q* Shock's perforated bullet, with a sabot in the rear; *r r* Hope's bullet, with a bent tail to direct it in a curved path, and *s s* Matton's bullet having spiral openings.

Fig. 2.

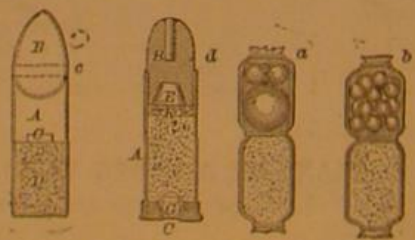


Cannon Projectiles.

Fig. 2 shows a few of the numerous kinds of cannon projectiles which have been devised. *a* is the Hotchkiss. At the moment of firing, the wedge-shaped piece, shown in section, is driven forward, expanding a soft metal ring which fills the grooves. *b b* is the James. In this the gas passes through the aperture at the back, driving out a number of pins, which expand a fibrous mass surrounding the slot and encircled by a metallic ring, which is thus forced to enter the grooves. In the second view, this is effected without the aid of pins. *c c* are vertical and longitudinal sections of a similar projectile, having a detachable point; *d* is the head, in which the gas enters through holes around the base and expands a band. In the Shaler, *e*, the gas drives forward a metallic cup, flattening it and expanding the sabot. A band of copper wire in the Cochran, *f*, is expanded by forcing forward a cup against a surrounding cylinder. *g* is the Boekel. The illustration shows the annular soft metal packing, being attached to the projectile by a swage and dies, while the point is held on an anvil. A packing of wire webbing in the Atwater, *h*, is expanded by wedges driven forward by plungers at the base of the shot. The Woodbury, *i*, is spirally grooved, having a sabot for firing from a smooth bore gun. The Taggart, *j*, has a spirally flanged central aperture intended to cause the projectile to rotate on its axis by atmospheric action when fired from a smooth bore. *k*, the Sigourney, has projecting spiral ribs to take the grooves, and annular belts which fit the lands and direct the flight. The Currie, *l*, is conoidal at each end, and has a soft metal packing ring in an annular groove. *m* is a bolt, with chisel-edged points for cutting through iron plating. The annular groove between the cutting edges and the point is filled with soft metal, to prevent retardation. *n* is an elongated bullet, with spiral flanges to impart rotary motion when fired from a smooth bore. *o* is an accelerating projectile. This has in front a plunger which, on striking an object, explodes (by percussion) a charge contained in a chamber, giving a new impetus to the projectile.

Plain, round ball, and buck and ball cartridges are now practically obsolete. These are done up in paper casings, and two forms of them are shown in *a* and *b*, Fig. 3. *c*, in the same figure, is the Prussian needle gun cartridge. In

Fig. 3.



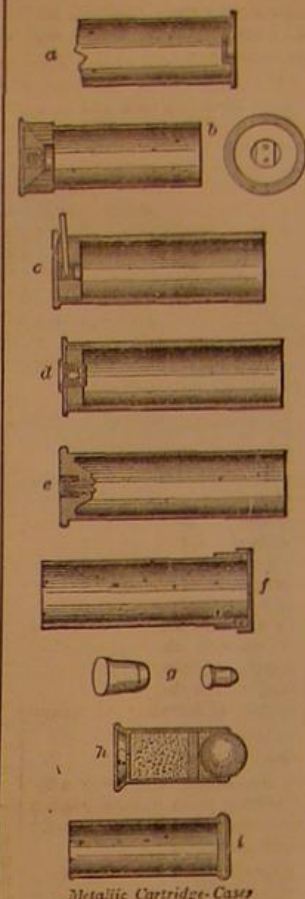
Cartridges.

this the outlet, *B*, has a sabot, *A*, separating it from the powder, *D*, and at its base a cavity, *C*, for fulminate. Snider's cartridge, *d*, is made up of a sheet brass cylinder, *A*, in which is inserted a bullet containing a plug of clay, *E*, in a recess. *G* is a sabot, in the cavity of which fulminate is placed.

Metallic cartridges are divided into two classes, rim fire and center fire, the first having the fulminate arranged within a cavity around the interior of the flange, and the latter having it at the center of the head or base. In 1826, Casalat patented the cartridge shown at *a*, Fig. 4, which has a receptacle with a waterproof cover for fulminate. *b* and *c* present two forms of the Lafranchet cartridge, one of the earliest of its kind. In *b*, the cap is secured to an anvil block; in *c*, a plunger, struck by the hammer, explodes the fulminate in a base chamber. *d* and *e* are modifications of the same with out the pin. In *f* there is an annulus at the base to contain fulminate. *g* is the Flobert cartridge, a charge of fulminate at the base of which does the duty at once of priming and propelling. *h* and *i* are Smith and Wesson's patents, 1854

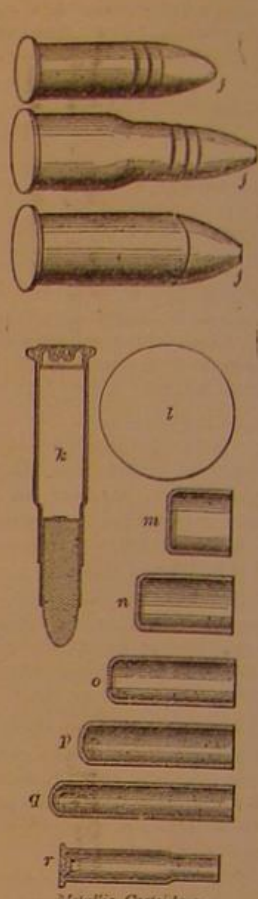
and 1860. In the first of these, the fulminate is contained in a capsule at the base, and in the latter, in an annulus within the flange, surrounding the base of the cartridge and secured in place by a pasteboard disk. *j j j*, Fig. 5, show some other forms of metallic cartridge. *k* is the Berdan cartridge;

Fig. 4.



Metallic Cartridge Cases.

Fig. 5.



Metallic Cartridges.

this has an exterior central recess in the bottom, to receive the cap, which is exploded upon an anvil. The mode now generally adopted for forming metallic cartridges is to punch the blank out from a sheet of brass and to draw it between successive rolls and punches until it assumes the required shape. The forms which the case assumes, during the different stages of the process, are shown in the views, *l* to *r*, Fig. 5.

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

In the Rhine district, grape vines are kept low and as near the soil as possible, so that the heat of the sun may be reflected back upon them from the ground; and the ripening is thus carried on through the night by the heat radiated from the earth.

A non-drying cement of great tenacity, useful to fastening plates of glass so as to exclude air, but which may be easily separated, is formed by adding freshly slaked lime to double its weight of india rubber, and heating to about 400° Fah., when the rubber will be converted into a glutinous mass.

To stop new boots squeaking, drive a peg in the middle of the sole.

To extract the silver from old watch cases and similar articles composed of alloys, dissolve in nitric acid and precipitate the chloride of silver with a solution of common salt. The silver is reduced to a pure state by mixing the chloride with an equal weight of bicarbonate of soda and smelting in a common sand crucible.

To bleach glue, soak in moderately strong acetic acid for two days, drain, place on a sieve, and wash well with cold water. Dry on a warm plate.

Diamond cement, for glass or china, is nothing more than isinglass boiled in water to the consistence of cream, with a small portion of rectified spirit added. It must be warmed when used.

It is said that dry rot in cellar timbers can be prevented by coating the wood with whitewash to which has been added enough copperas to give the mixture a pale yellow hue.

Mercurial steam gages can be kept clean by putting a little glycerin on the surface of the mercury. This serves as a lubricator of both glass and metal, and prevents their contact.

To guard belting against being gnawed by rats, anoint it with castor oil.

Old engravings, woodcuts, or printed matter, that have turned yellow, may be rendered white by first washing carefully in water containing a little hyposulphite of soda and then dipping for a minute in Javelle water. To prepare the latter, put 4 pounds bicarbonate of soda in a kettle over a fire; add one gallon of boiling water, and let it boil for 15 minutes. Then stir in one pound of pulverized chloride of lime. When cold, the liquid can be kept in a jug ready for use.

An excellent liquid glue is made by dissolving hard glue in nitric ether. The ether will take up only a certain amount of the glue, so that the solution cannot be made too thick. If a few bits of pure india rubber, cut into scraps the size of buckshot, be added, the mixture will, when dry, resist dampness to a considerable degree.

Some brands of albumen paper are subject to blisters when taken from the hypo solution. To prevent this, remove the prints, when fixed, from the hypo into a dish of salt water (a handful of salt to a gallon of water) before the regular washing, and allow them to remain therein for several minutes.

Recent American and Foreign Patents.

Improved Child's Carriage.

William Wuerz, New York city.—This carriage may be conveniently folded up into narrow compass after use. The invention consists in constructing the body and axles of the carriage of hinged sectional parts that may be folded up toward the central longitudinal axis of the carriage; each axle being made of two parts, an interior solid axle, and an outer hollow sectional part, which folds up by its sections on the withdrawal of the solid axle.

Improved Sash Holder.

Ripley R. Calkins, St. Joseph, Mo.—The invention consists of a screw bolt with a thumb piece passing through the sash, and acting on a flanged and spring-actuated clamping socket that is guided in a recess of the sash and a face ring of the same. The turning of the screw bolt in one direction carries the socket forward to project beyond the sash and bind firmly against the window casing, retaining the sash at any height, while the turning of the bolt in opposite direction releases the fastening socket.

Improved Ventilating Barrel.

E. B. Georgia, Clifton, Va.—The invention relates to a peculiar construction of barrel wherein fruits may be packed and transported long distances, and yet preserved with all their original flavor. It consists in perforating the staves with slots and forming a readily removable head, so that the fruit is aerated and the exhalations immediately carried off, while fruit may be entered or removed with great facility.

Improved Electric Fire Alarm.

Wilson E. Pacer, Toronto, Can.—This invention relates to certain improvements in non-interfering electric fire alarms; and it consists in the combination with the bolt of the fire alarm box door of a mercury balance operated by the armature of a magnet, whereby the said door bolts of all the instruments except the operating one are locked to provide against any interference of signals. It also consists in the peculiar construction of a notched disk and transmitting lever whereby the alarm signals are sent through the said transmitting lever. It also further consists in the combination with the actuating mechanism of a centrifugal friction governor, to regulate the speed of the clock gearing, and in the peculiar construction and arrangement of auxiliary details forming secondary features of the invention.

Improved Tobacco Knife.

E. T. Shelton, Laurel Grove, Va.—The invention consists in a tobacco knife having a blade provided with a push cutting edge, a draw cut edge, and an intermediate blunt edge, by which previously topped tobacco may be conveniently split and cut off.

Paper Lining for Metallic Shells of Cartridges.

Baker D. Wilson, Shreveport, La.—This invention consists in a paper lining for the metallic loading shells for breech-loading shot guns; the object of which said lining is to hold the load in tightly, keep the powder dry, and preserve the shell.

Improved Cracker Machine.

Adam and John Exton, Trenton, N. J.—The invention relates to an improved means of docking and finishing crackers, and automatically transferring them to the backing pans.

Improved Cracker Machine.

Adam and John Exton, Trenton, N. J.—The object of this invention is to furnish an improved means for conveying or transferring crackers from the molding to a docking and finishing apparatus; and it consists in a horizontally reciprocating rock shaft provided with radial arms or flingers, which work in parallel grooves or channels, and serve to push and roll the molded crackers along to the tubes by which they are conducted to the docking apparatus.

Improved Heel and Shank for Boots and Shoes.

Henry Freiburg and Wm. Meyer, Quincy, Ill.—This invention relates to certain improvements in boots and shoes having wooden heels and shanks; and it consists in a shank and heel made of a single piece of wood with a rabbet and a triangular recess upon its upper front end, to which the leather sole is attached in such a manner as to make a stiff and durable connection for the two.

Improved Windmill.

Geo. Desbrough, Utica, N. Y.—The invention is an improvement in the class of windmills in which the wheel is arranged in the center of a fixed frame, and the access of the wind or blast thereto is controlled by slides or gates. The improvement relates to the arrangement of an annular rack or toothed ring adapted to reciprocate circularly, and flanged friction rollers for supporting and guiding the same, also slotted gates which are pivoted to said rack or ring, and partake of its movement so as to be simultaneously opened or closed.

Improved Knitting Machine.

Albert Tompkins and Ira Tompkins, Troy, N. Y.—The invention consists, first, in combining the take-up roll or rolls with a pair of gear wheels differing in size, and so connected with intermediate mechanism that the operation of drawing the fabric from the needles or cylinder will take place at constantly varying points, and thereby avoid the now common objection of having the draw of the take-up always at the same point relatively to the cam, or some similar device, which never varies its position. The invention also comprehends an improvement in the means of connecting and disconnecting the take-up roll with the gear wheels that operate it.

Improved Thread Tension for Sewing Machines.

John Reece, Stanstead, P. Q.—The invention relates to an improvement in the manner of controlling the supply of thread to the needles. At certain times in the formation of the stitch, a spring clamping device releases the thread entirely from all tension, except that unavoidably due to friction of the thread in the guide hooks, etc., which conduct it to the needle, and during the remainder of the time it holds the thread immovable. The invention also includes an adjustment of the clamping device for governing the time and force of the clamping action.

Improved Hand Corn Planter.

John Beers, Greenville, O.—The planter is carried or suspended vertically by either hand of the operator, and provided with a foot which, when the weight of the planter comes on it, pushes up the seed slide and opens the jaws that form the discharge mouth or passage. The jaws enter the earth and are opened, to allow the escape of seed, by means of a trip mechanism, of which the seed slide forms the chief element.

Improved Electric Motor.

Charles J. B. Gaume, Williamsburg, N. Y.—The invention consists in the frame or box armature, made with four, more or less, plain or concave sides, having half round or square enlargements formed upon their outer or inner surfaces. With this construction of armature, the engine, it is claimed, will run and do its work with a much smaller battery than is ordinarily required.

Improved Spring Trace Carrier and Back Loop.

William Davis, Petaluma, Cal.—The back loop terminates at each end in circular joint pieces which are attached to the back iron. This loop is curved upward. The back iron is curved to fit a pad, to which it is fastened. The lines of the harness may be drawn through trace loops.

Improved Mousing Hooks.

Nels. E. Johnson and Samuel Adams, Chelsea, Mass.—This hook is moused securely when it is closed by a slide on the link of the hook, which is so fastened to the link that the hook is prevented from opening until the slide is moved.

Improved Whiffletree Hook and Clip.

Isaac N. Pyle, Decatur, Ind.—The clip is formed of two wire wrought metal rings, spread apart at one end and welded together at the other, to adapt it to different sizes of single trees. The hook is of twisted and doubled wire.

Improved Hand-Protecting Attachment for Drills.

William M. Hance, Dover, N. J.—In the body of an iron disk is formed a slot, the inner end of which terminates at the center of the disk, and is made of such a size as to fit upon the drill. In the outer part of the slot is placed a metal block, upon the inner side of which is formed a recess to receive a rubber block, and to its outer side is swiveled the forward end of a hand screw, which works in a screw hole in the said disk. When the disk is adjusted in place, the screw is turned forward, which forces the rubber block against the drill, so that the elasticity of the rubber may hold the disk from being jarred down by striking upon the drill with a hammer, and may bring said disk back to its place should it be struck. By this device the hand holding the drill will be protected from a miss blow, and from pieces of metal flying from the head of the drill.

Improved Stone Cutter's Gage.

Edwin R. Batchelder, Prospect, assignor to himself, Charles McLeod, of South Thomaston, and Thompson H. Murch and Henry J. Snow, Dix Island, Me.—This invention relates to an improved device to be used by stone cutters and carvers for facilitating the working of molding and carving, and also for ascertaining the different depth and angle of complicated members in carving in stone. The invention consists of an adjustable gage that is clamped to the tongue of a square, and capable of being set to any angle or depth of sinkage.

Improved Washing Machine.

Edward J. Robinson, Schenectady, N. Y.—This invention relates to the manner of attaching the journals of the cylinder and securing the same. The cylinder is revolved by means of a crank on one of the detachable journals. The latter are screwed into flanged plates cut into the ends of the cylinder. The journals and journal boxes, which are screwed into the box from the inside, and the screw nuts, through which the journals pass, may be removed at any time for the purpose of lubricating the journals or for taking the cylinder from the box.

Improved Traction Engine.

William H. Milliken, Sacramento, Cal.—In this machine the power can be applied to all the wheels, and they can at the same time be turned readily from right to left, and vice versa, for steering and for turning around. The body is mounted so that the weight will be equally distributed, and at all times borne on the wheels alike, no matter what irregularities there may be in the surface, and at the same time the connection is made by springs to obtain the necessary elastic support without the use of rubber. Each wheel is mounted on a short independent axle, which is supported in the lower end of a yoke extending up over the wheel, and pivoted vertically by its inner member to the body, so as to turn, and at the same time allow the body to rise and fall. The inner end of the axle is connected by a jointed section with a middle section having the driving wheel, and geared with the driving engines. For turning around, rock levers draw the wheels together on one side, and force them apart on the other side, and thus direct the machine as desired. The second part of the invention is effected by the use of equalizing supports.

Improved Machine for Sawing Staves.

William Barber, Cape Vincent, assignor to himself and Lewis Parker, Lyme, N. Y.—An adjustable guide or gage, by which the thickness of the stave or other article sawn is regulated, is made with a projecting lip, so that the bearing will be in about the middle of the piece sawn. The cylinder saw of any diameter and width is revolved on a series of rollers. Each roller is made in two parts, the latter of which is adjustable on the arbor to suit the width of the saw. There are wings on the side of the adjustable roller, by means of which a current of air is produced for expelling the sawdust. It is claimed that, with this invention, staves of any length may be sawn, as well as moldings and other stuff for joiner or cabinet work, or other purposes, and that the stuff sawn off is pushed through the same as when sawn by the common circular saw.

Improved Seed and Guano Distributer.

Robert Sappelt, Springfield, N. Y.—The distributing drums are secured sidewise of each other on a lateral shaft, and are revolved by suitable gearing. They are thrown in and out of gear by a spring clutch of the wheel axle, which is connected, by operating lever mechanism, with the handles at the rear part, for producing the instant interruption of the revolving motion of the drums and the dropping of the seed. The lever mechanism is set by a rack arrangement of the handles in the required position for causing the throwing in and out of gear of the drum-revolving parts, and giving thereby the full control over the depositing of the seed and guano. A lateral frame is rigidly attached to the side pieces, for the purpose of supporting the seed-conveying guard plate, which is provided with separate spouts for the seed and guano, so that the same are not deposited at the same point, but at a short distance from each other.

Improved Apparatus for Cutting Out Garments.

Kenneth McKenzie, Hamilton, Canada.—There is a strong iron frame, similar to a printer's chase. The cutters are thin flexible strips of steel, similar to printer's rules, but with sharp edges. For cutting irregular forms, a kerf of the desired form is cut in a pattern block, of wood, with a hand saw. The rules are then fitted into the kerf, and the block is secured in the chase by side and foot sticks, interfilling pieces, and wedges, in the same way as type are secured in a chase in making up a form. As thus constructed, the dies may be used upon an ordinary printing press, or upon any other kind of a press that has the requisite power.

Improved Car and Carriage Heater.

John Schmitt, Williamsburgh, N. Y.—This is a heater adapted to hang below a car or coach, and consists in a fire pot having a short pipe opening into a discharge pipe at one side of its outer casing, and held in position by springs.

Improved Sugar Skimmer and Cooler.

John L. Morgan, Savannah, Ga.—In the process of evaporating cane juice for manufacturing sugar, it is usual to have a hand whose special business it is to remove the scum from the boiler, and another to cool the contents and prevent overflow. The invention consists in a strainer, which is placed on the boiler, through which the boiling juice overflows, is cooled, and again descends, leaving the scum on the strainer, the strainer being suspended over the boiler from pulleys by cords attached thereto.

Improved Water Wheel Gate.

James M. Hart, Apple Grove, Va.—This invention consists in the combination of the chutes and cylindrical gate in one piece, so that the vertical adjustment of the chutes and gates delivers the water at full or partial gate, while the hanging of the chutes admits their turning in case of obstruction.

Improved Clothes Dryer.

Edwin S. Heath, North Hope, Pa.—Crooked hanging bars have holes in the ends, by which to hang upon pins in the wall. Cross bars are pivoted to the hanging bars at the projections of the crooks, to be held sufficiently far away from the wall for holding the clothes properly. The pivots allow the rack to be folded up compactly when it is put away.

Improved Coupling for Thrashing Machines.

Edwin Knock, Vermont, Ill.—Four balls are placed in separate cells of hemispherical form, and so loosely arranged that they can readily and freely revolve in all directions. These four balls are placed so that the shank of the coupling clevis is inserted between them. The advantage of this coupling is that it works with as little friction at an angle as when used on a level.

Improved Rotary Cultivator and Chopper.

George W. Fenley, Nacogdoches, Tex.—When the plows are desired to throw the soil to or from the center, standards are adjusted upon a shaft in V form, so that the two outer plows may strike the ground first, then the next two, and so on to the middle one. In chopping, the standards are adjusted upon the shaft at such a distance apart as to leave enough stalks for a stand between them when the machine is drawn across the rows. A lever projects into such a position that it may be conveniently reached and operated to raise and lower the rear end of the frame, and with it the plows, for convenience in passing obstructions, turning, etc. Caster wheels serve as gage wheels to regulate the depth to which the plows enter the ground.

Improved Derrick for Stacking Hay.

Henry John Hay, Omph Ghent, Ill.—A foot block sustains a pivoted upright shaft. The latter is further held up by braces, which may be adjusted to hold the shaft vertical, and to resist the side draft of the hay while being raised and swung over the stack. The derrick arm is composed of three bars, which may be adjusted at any desired height.

Improved Machine for Pressing Horse Collar Pads.

Arnold P. Mason, George Chamberlin, and Henry W. Chamberlin, Olean, N. Y., assignors to George Chamberlin & Son, same place.—This invention consists of screw-adjusted side jaws, sliding intermediate center piece, and a screw follower, corresponding in shape with the center piece to press the leather and sheet metal tree of the pads into shape thereon. Any size of pads may be pressed by inserting different sized center pieces and followers, and setting the jaws to the width of the same.

Improved Gas Regulator.

David P. Mayhew, Detroit, Mich.—This invention comprises a chamber receiving gas from the main, in which is an exit valve, which is balanced by a water valve, and is also connected by a lever and a couple of rods with another lever, having a counterpoise to be set according to the pressure wanted. The mechanism is arranged in relation to another water valve receiving the gas from the exit chamber, and acting upon the lever to close the exit valve whenever there is an excess of pressure in the exit chamber.

Improved Method of Booking Gold Leaf.

John Varley, New York city, assignor to Stephen Hickson, same place.—This method of booking gold leaf consists in applying each leaf to a perfectly dried sheet of tissue paper or other suitable backing, and then subjecting the same to heavy pressure. The gold leaf adheres intimately to the backing, and may be handled without difficulty, even by unskilled hands, being applied to the parts prepared by sizing to receive it by placing the leaf with the backing thereon, when the leaf will be retained and leave the backing on account of the great adhesiveness of the sizing.

Improved Wind Wheel.

John Julius Kimball, Naperville, Ill.—A stop bar is applied on the lee side of the buckets to hold them to the wind, and is controlled by a weighted lever, so as to serve as a regulator.

Improved Die for Forming Horseshoe Calks.

Leonard Prichard, Sweet Valley, Pa.—This is an improved die for forming, quickly and accurately, horseshoe calks of superior shape and quality. It has a base part to be secured in the anvil, and lateral top grooves, one for forming the shape and tapering base of the calk, the other for producing the central connecting spur.

Improved Fence Post.

John E. Warren, Westbrook, Me.—The standard is cast with upright extension arms, which are stiffened by outer flanges, which last support thereon a cast iron collar, that passes around the extension arms and studs for binding them rigidly together. The studs or half posts are made of such thickness that they fill, together with the intermediately placed rails, the space between the extension arms of the standard. The latter are extended to any desired height, and are made sloping or inclined at the outer sides, for securing a greater base, a better appearance, and, in connection with the collar, a rigid attachment of the whole wooden superstructure to the supporting standard.

Improved Slate Cutting Machine.

Thomas W. Parry, Danielsville, Pa.—A wing piece projects from the front, on a level with the top of the frame, in which are notches for receiving the back edges of the pieces of slate and squaring the same against the flange. The cutter plate is fastened to the top of the frame. The knife is attached to the end of a lever so as to cut with the cutter plate like a shears, and is composed partly of steel and partly of cast iron. A stand from the sill pieces of the frame is forked at its upper end to receive the cutting lever. The machine is operated by means of treadles connected with the lever at different points. The operator holds the piece of slate over the cutter plate, with its back edge resting in one of the notches, according to its width, and its straight side against the flange, which is at right angles with the cutter plate.

Improved Trace Fastening for Whiffletrees.

John L. Wingate, Mooers Forks, N. Y.—A thimble is made fast on the ends of the whiffletree and has a lug on the outer end. The thimble is stationary; and after the eye is slipped on it, a slot in the latter drops down from the lug, which securely confines the eye between the lug and a collar. In this position the eye plays freely on the thimble, the trace keeping it in position until the horse is detached from the vehicle, and then the eye is turned on the thimble till the slot and the lug correspond in position, when the eye is readily slipped off.

Improved Combined Hames and Horse Collar.

Ezra Stroud, Riceford, Minn.—At the neck the connection is made by a bow rod on each side of the hames, in the ends of which are holes, and also holes through the hames, which allow of an adjustment in width, and also in height, to fit the size of the horse.

Improved Saw Filing Machine.

William B. Bizzell, La Grange, N. C., assignor to himself and W. H. Hardee, same place.—This invention is an improvement on the saw-filing machine patented to the same inventor, July 1, 1873, which consists mainly of a circular frame which moves along the bed frame in which the saw is clamped, and carries the saw frame above the saw to shift the file from tooth to tooth. The saw frame is capable of shifting around the circular frame to adjust the file to the angle of the teeth. The invention consists of a peculiar feeding gage by which to shift the file frame and the circular frame in which it rests along the saw to shift the file from tooth to tooth.

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Scientific Expert, in Patent Cases, C. Gilbert Wheeler, 115 State St., Chicago, Ill.

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See N. F. Burnham's Turbine Water Wheel advertisement, next week, on page 45.

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Single, Double and Triple Tenoning Machines of superior construction. Martin Buck, Lebanon, N. H.

Notes & Queries.

R. J. will find a description of a steam lithographic press on p. 15, vol. 24.—N. F. S. will find directions for gliding carriage work on p. 288, vol. 24.—J. R. N. will find details of the two-battery spectroscopy on p. 355, vol. 24.—K. N. will find a description of fish glue on p. 408, vol. 24.—E. P. will find some interesting particulars as to the Australian blue gum tree on p. 165, vol. 30.—J. F. will find directions for building cement walls on p. 218, vol. 30.

(1) F. H. W. asks: 1. How should animal charcoal be used for filtering sirup? A. The bone black is placed in the form of small lumps on sieves in a tall cylindrical vessel, having at the top a large reservoir in which a constant level of the liquid is maintained by means of an automatic valve. The juice is allowed to gradually percolate through the mass of carbon, and is received at the bottom in large tubs or other vessels. 2. Could I burn the bones in a common cook stove, or would they have to be burnt in an oven made especially for the purpose? A. No. It would be necessary to first exhaust them of all fat and grease, by immersion in bisulphide of carbon. They must then be broken up, placed in iron retorts, and subjected to destructive distillation.

(2) E. F. K. asks: How can I make a cheap barometer that will indicate the changes with tolerable accuracy? A. Obtain a straight fine glass tube about 33 inches long, and as nearly cylindrical as possible, sealed at one end, and having an even uniform bore of about 2 1/4 lines diameter. The mercury to be used should be perfectly pure and free from all air and moisture. This latter requisite may be assured by heating the mercury in a porcelain dish to nearly the boiling point, previous to using it. The tube is then held securely with the open end uppermost, and carefully filled with the liquid metal. The open end of the tube is then securely covered with the finger, the tube inverted, and the end covered by the finger plunged below the surface of a little mercury placed in a small vessel to receive it. The finger is then removed, when the mercury in the tube will immediately fall to a level of about 30 inches above the surface of that in the small reservoir below. In order to attach the scale correctly, it will be necessary to compare the indications with those of some good instrument.

(3) J. B. S. says: In a recent issue you say, in answer to inquiry for a freezing mixture, that 8 parts sulphate of soda and 5 parts hydrochloric acid will reduce the temperature from 50° to 0°. I have tried it, placing one tin can inside another, with about 1/2 inch between, and I filled the inside can with cool water. I could not see that filling the space with the salt, and saturating with the acid, made any perceptible difference with the temperature of the water. What is the trouble? A. It will be necessary for you to use either thin glass, silver, or other metallic vessels not attacked by the acid used, as any such action interferes seriously with the success of the experiment. If the chemicals used are not worthless, and the proper proportions are used, failure is impossible. You should use a thermometer in the experiments, as the finger is hardly sufficiently sensitive. It should also be borne in mind that the low degree of temperature mentioned in the recipe, as attainable by the solution of this salt, is the temperature indicated by the solution itself; and it cannot be hoped that any large body of liquid contained in a separate vessel and immersed in the solution will immediately, or even ultimately, assume the precise degree of temperature of the other liquid.

(4) S. S. J. asks: 1. What is the philosophy of spontaneous combustion? A. At the ordinary temperature of the atmosphere, oxygen frequently enters (slowly) into combination, without any perceptible disengagement of heat, as when a bar of iron is gradually rusting in the air. In other instances, where the process is more rapid, the heat accumulates, and sometimes it rises high enough to cause the materials to burst into flame, producing what is called a case of spontaneous combustion. This phenomenon is often exhibited

in large piles of cotton waste saturated with machinery oil for a long time, moist hay placed in stacks, etc. These bodies expose large surfaces to the atmospheric oxygen; and considerable heat accompanies the rapid oxidation or fermentation that ensues. These bodies being very poor conductors of heat, the result is simply an accumulation of energy with a corresponding rise in the temperature, and this rise in temperature reacts to accelerate the rate of combustion, until a point is reached where the temperature is sufficient to decompose and inflame the gaseous products of the decomposition. The point of inflammation of various substances is, of course, determined by widely different degrees of temperature; phosphorus will sometimes become inflamed at the ordinary summer temperature, while bodies at the other extreme would require, perhaps, thousands of degrees for their ignition. 2. It is said that spontaneous combustion sometimes occurs in the human body. Has there ever been such a case? A. Liebig has demonstrated the impossibility of the living body ever taking fire and being more or less completely consumed through the agency of spontaneous combustion. He affirms that no amount of fat, alcohol, or phosphorus, which the living body could possibly contain, would render it combustible. Upon investigation, the alleged instances of spontaneous combustion were found in no case entitled to credence.

(5) W. T. C. asks: How can I reduce wood to a pulp? A. The fibers of the wood are first separated by passing between large rollers plentifully supplied with water. The excess of water is then removed by pressure, and the fibers are cut into small pieces by revolving cylinders. These pieces are placed in a stamping mill or beating machine with water, in which they are reduced to the consistency of pulp. After this the mass is transferred to another machine, and bleached by a solution of chloride of lime, chlorine water, chlorine gas, or other bleaching agent. To remove all trace of hydrochloric acid, the pulp is washed in solutions of potash, soda, or antichlorine, and then in water. In spite of careful chemical bleaching, it is found necessary to add bluing matter in sufficient quantity to neutralize the yellow cast of the pulp.

Will crude petroleum oil injure the skin? A. No.

What is meant by an atmosphere? A. The atmosphere (used as a degree of pressure) is equal to the weight of a column of air reaching from the earth's surface to the limits of the atmosphere, a distance of about forty-five miles. It corresponds to a barometrical column of mercury 30 inches high, and exerts a pressure of about 15 lbs. per square inch.

(6) B. B. asks: I am engaged in the manufacture of glue, and at times am troubled that the glue does not set quickly enough. Can you recommend something which I can use as a dryer? A. Your trouble is probably due to insufficient cleansing of the materials at the beginning of the operation, and imperfect drying of the product at the last.

(7) J. T. asks: What are the proper proportions of salt, manganese oxide, and sulphuric acid, to make chlorine? A. Chlorine may be easily prepared from a mixture of 7 parts by weight of oil of vitriol, previously diluted with 7 parts water, and allowed to cool, and 4 parts powdered salt, mixed intimately with 3 parts finely powdered black oxide of manganese. The gas comes off slowly in the cold, but freely on the application of a gentle heat. The small quantity of hydrochloric acid that comes over with the gas may be easily removed by passing it through a wash bottle containing a little water. 2. How is lime impregnated with the chloride to form chloride of lime? A. The slaked lime is placed in layers several inches in depth upon perforated shelves in airtight leaden chambers, and exposed to the action of chlorine. The gas must be admitted gradually, in order to prevent a rapid rise of temperature, consequent upon its quick absorption by the lime. 3. How much gas will 1 lb. slaked lime absorb? A. Good lime will absorb about one half its weight of chlorine gas.

(8) F. H. W. asks: 1. In manufacturing rubber stamps, do they oil the type before making the plaster of Paris cast? A. Yes. 2. How do they prevent air bubbles from forming? A. The type is first covered with a film of plaster of the consistency of cream. This is worked into all the cavities and around the lines with a camel's hair brush, thus excluding all bubbles of air. Immediately afterwards the thicker plaster paste is poured in, and the whole allowed to set.

(9) G. F. says: I have some silver-plated buckles to my harness, and the plating is all worn off. How can I silver them again without taking them from the harness? A. We think the metal work in question could not be satisfactorily replated without removing it from the harness. 2. How can I Japan them black without taking them off? A. A good Japan varnish may be made by mixing together 1 oz. of asphalt, 2 1/2 ozs. amber, and 1 pint boiled linseed oil. Thin with oil of turpentine until of the desired consistency.

(10) R. K. W. asks: What is meant by the radiation of steam cylinders? A. The term refers to the heat lost by radiation.

(11) G. B. says: There is a church basement floor which is very moist in winter. It is 70 by 120 feet. Which is the best cement to coat it with? A. Lay a concrete floor, 3 inches thick, of Rosendale cement, clean sharp sand, gravel, and small stone chips. It will take some time to set, but will ultimately become hard and dry.

(12) L. S. asks: 1. Is it better to paint wood work, inside and outside of dwelling houses, with paint mixed with raw linseed oil instead of boiled? A. Raw oil is usually used with a dryer added, but boiled oil requires no dryer. The work has a more shining surface with boiled oil than with raw. 2. How should inside shutters and front doors, which

are exposed to the hot rays of an afternoon sun, be painted, in order to prevent blistering? A. Give them a good coat of oil before painting, and give plenty of time for one coat of paint to dry before putting on another.

(13) A. F. A. M. asks: What is the composition of Babbitt metal? Why is it put in Journal bearings, and from what did it derive its name? A. It was invented by Isaac Babbitt, of Boston, and is used because it makes a good bearing without any fitting. Its composition, by weight, is: Tin 50 parts, antimony 5 parts, copper 1 part. There are numerous other recipes for Babbitt metal of different grades, but this forms a good composition for general use.

What is the fine and penalty for using a United States postage stamp a second time? A. The penalty is a fine of \$50.

(14) T. G. J. asks: What is the best method of filling the pores of cement put on the outside surface of wooden buildings? We propose to first lath and plaster in the usual way, and then cement over that in imitation of brown stone. A. A coat of linseed oil is sometimes put upon brickwork for the purpose of closing the pores of the brick and preventing the absorption of water; and this might also serve the same purpose upon a cement surface. We have very little faith, however, in the permanency of lath and plaster on the exterior of buildings.

(15) J. J. N. asks: I am having built an experimental canal boat, length 21 feet, beam 5 feet. What size of engine, boiler, and grate surface will be necessary? Would you use a long cylinder with small diameter, and an upright boiler? A. We should prefer an upright boiler and a vertical engine. We could not give you dimensions without knowing more particulars; but as your boat is an experimental one, you will doubtless find the best proportions most readily by experiment.

(16) N. A. V. says: The hydraulic tyre press, illustrated in your issue of June 12, has given a little interest to an old question: Is water compressible? If a perfectly tight vessel is full of water, at a pressure of 15 lbs. per square inch, can any more water be forced in? A. Water is slightly compressible. The efficiency of the hydraulic press depends upon the fact that a pressure applied to water is transmitted equally in every direction.

(17) W. P. B. says: 1. I have a small boat, 15 feet long and 1 foot wide, in which I use a double paddle. I would like to run it by steam, and want to know how large an engine I must have. Would an engine of 2 inches bore by 4 inches stroke be large enough to move her, using side wheels? A. Yes. 2. How large a boiler would it need? A. Put in one with from 8 to 10 square feet of efficient heating surface. 3. Would wood do for fuel? A. Yes.

A friend says that he or any one else can tell by the looks of the new moon whether the following month is to be dry or wet. I hold that he cannot. Which is right? A. You are.

(18) H. P. says: I have an engine which was cleaned to a very bright surface; and I was told that, if I whitewashed it, it would keep its polish. I did it, and now it is rusted very badly. How can I remove the rust, and get it bright again? A. Use fine emery and oil.

(19) A. S. says: I have a 60 horse power engine, and run it with 100 lbs. steam, making 60 revolutions a minute, for running a mill. I want to change the cog wheels, making the driving wheel on the upright shaft larger, and the cog wheel on the engine shaft smaller, and to increase the number of revolutions per minute to about 70. How could I best do this? A. Change the governor pulleys so that the governor will have the same speed as at present, when the engine is making 70 revolutions, and adjust the valve, if necessary, so as to give more opening. These directions suppose that you are using a governor adjusted to a certain number of revolutions per minute.

I have tried different experiments to manufacture varnish as used by the larger gun manufacturers to varnish guns and revolvers, but without success. It does not last, and has not the same bluish color. How can I prepare it? A. The coloring is generally effected by the use of acids, or by heating the metal. See p. 116, vol. 25.

Is there any invention which will save vessels at sea from sinking? If so, please state it. I have a plan which would answer very well, it being cheap, easily adjustable to the vessel, and sure to perform its duty. A. We think you have the market to yourself at present.

(20) E. D. D. says: Suppose a large steam generator be placed in each square of a city, would it not be profitable to connect the steam so as to warm the houses and extinguish any fire that may take place, particularly inside the houses, leaving the engines to play upon the outside? A. The idea is a very good one and has often been proposed. Nearly all modern steamships have steam pipes leading into the holds for extinguishing fire.

(21) P. S. F. asks: In plastering, how much lime, sand, and hair should be used to make a good solid material? A. Use 1 measure of quicklime to 5 measures of sand for brickwork; and 1 measure of quicklime to 4 measures of sand, and one third of a measure of bullock or horse hair, for plastering mortar. Put on the first or scratch coat 1/2 an inch thick, the second, or brown coat, 1/4 inch thick. The third, or finishing coat, 1/8 inch thick, contains no hair, and is made of 1 measure of lime to 3 of sand, and the purest sand is used; this is called stucco. Hard finish requires 1 measure of ground plaster of Paris to about 2 of quicklime, without sand.

(22) M. C. B. asks: What will remove white paint from all woolen brown goods? A. Try a mixture of equal parts of alcohol and chloroform.

(23) C. J. H. asks: Will water always seek its own level? We have in our factory a coil of pipes; and at about fifty feet from the coil, we have a tank which holds about 40 barrels. The bottom of the tank is about 12 feet above the top of the coil. We cannot induce water to flow through this coil from the tank. We can readily attach our pump and force it through, but the water will not flow through of itself. Can you explain the trouble? A. It is probably due to the accumulation of air at the high points.

(24) J. M. S. says: I am running a locomotive, and her slide valves are nearly worn out. They are 15 inches long and 5 inches wide, and flat on top. Will it reduce the friction caused by the steam pressure on the valve if I make the new ones in the shape of a half circle instead of flat on top? A. No.

(25) B. B. says: We have an engine with cylinder 8½ inches, furnished with steam at 60 lbs. pressure through a 2 inch pipe 550 feet long, the pipe being about 8 feet underground. Can we, at that distance, get the full benefit of the steam? A. The engine is large enough, but it is probable that the steam pressure is greatly reduced in passing from the boiler to the engines. If this is the case, it is due to an improper arrangement of the pipe; and you can easily satisfy yourself in regard to the facts by attaching a gauge to the steam pipe, near the engine.

(26) W. H. M. asks: In building a large smoke stack, is it advisable to have it octagonal in form? Would not storms have a better chance to blow such a stack down than if it were circular in form? A. One form will answer as well as the other.

(27) C. W. asks: Please decide who is right in the following question: The subject is the drive wheel of a locomotive engine supposed to be standing still on the track. I claim that, when the wheel slips, on the starting of engine or when the steam is let on suddenly, any point on the wheel makes a complete circle; but when it makes a revolution in running, it does not make a complete circle. My friend claims that the point on the wheel forms a complete circle in any case. A. When the wheel advances in revolving, each point in the periphery describes a cycloid, a curve resembling a series of semicircles or semi-ellipses.

(28) C. B. W. asks: 1. Is not the side of the firebox of a locomotive boiler the place where contraction and expansion is the least? A. Generally, yes. 2. What shall I put on my engine to keep the bright work from rusting? A. Keep it well oiled; but you will be obliged to clean it often.

(29) J. H. asks: 1. I have a boat 15 feet long by 4 feet beam, a vertical engine, cylinder 3 inches in diameter, by 2½ inches stroke, and 3 cylinder boilers 8 by 24 inches each, made of ½ inch steel with heads ¾ inch thick, connected by a steam dome. I mean to throw the exhaust into the smoke stack. What pressure can I carry with safety? The boilers have stood a hydrostatic test of 175 lbs. per square inch. A. About 150 lbs. 2. Will the boilers be large enough for the engine? The grate surface is very large, being 24x24 inches. A. Yes. 6. Will the engine be large enough for the boat? A. Yes. 4. What size of screw propeller shall I use? A. Diameter, from 15 to 18 inches; pitch, from 2 to 2½ feet.

(30) G. A. S. asks: 1. What is the horse power of the largest engine in the United States, where is it, and what is it used for? A. We are not sure that we can answer this question correctly; but if any of our readers will send us particulars, the matter can soon be decided. 2. How is the power of a locomotive estimated? A. Builders generally rate locomotives by the load that they can draw under given circumstances.

(31) A. W. says: In your issue of May 15 you say: "When you find that the water is below the bottom gage tap, and the steam is rising rapidly, you should haul the fire at once." If you are gaining steam, and then start and haul the fire, you will gain from 10 to 15 lbs. more, as I have experienced in locomotives. I would recommend this: Fill the furnace with coal so as to choke the fire, keeping the engine and pumps on until you get water in gage glass or steam gets low, then haul the fire if required. How would that do? A. In this case it might not be advisable to start the feed; and if you could stop forming steam more quickly by throwing coal on the fire than by hauling it, you would find the quickest way to be the best way. We believe that, in general, hauling the fire will be most efficient. 2. We have a direct acting locomotive engine with cylinders 16 inches in diameter, by 24 inches stroke. Steam pressure is 150 lbs., and driving wheels 5 feet, four wheels coupled. She weighs, when loaded and ready for running, about 47 tons. What is her horse power? A. We could not answer this question without having some idea of the mean pressure in her cylinders.

(32) C. E. R. asks: Will a brass spring ¼ inch wide, ½ inch thick, and 2 inches long, lose its elasticity under long ¼ inch depression in the middle? A. Not for a long time, and the elasticity can be restored by hammering.

(33) C. R. P. says: We have a brick smoke stack, 70 feet high, and burn wood shavings: when we have not sufficient shavings, we burn anthracite coal; the draft is strong enough to carry out large sparks, and we put a screen of No. 10 galvanized wire over the top, which was used up in 6 months so that we could pick it to pieces; and the copper wire (No. 10), with which it was fastened on, was also eaten up. Is there anything that will do for such a screen? A. Use heavier wire.

(34) C. T. S. asks: What fractional part of the breaking weight of the best steel wire rope, as used for mining cables, is allowed for a permanent load? A. About ¼ or ⅓.

(35) W. F. S. says: I have been using water for a steam boiler from a tank into which the drip from the engine cylinder goes, and the water is consequently quite oily. The tank also takes the drip from the heater. Do you think the water is injurious to the boiler? I have thought that the oil might adhere to the iron of the boiler, and prevent the water coming in contact with it, and so turn the iron. A. You will find it better to use clean feed water; although if the oil is of good quality, and is not excessive in quantity, it will not do any serious harm.

(36) M. A. R. asks: How long would either native or vulcanized rubber endure as a packing for kerosene oil? A. Possibly for a few days.

(37) A. B. says: 1. We have a pump with a steam cylinder 15 inches in diameter, and a water cylinder of 10 inches diameter. The ram is of 10 inches diameter, and discharge opening 5 inches, discharge pipe 6 inches; we pump the water vertically 200 feet. It requires 60 lbs. steam to run the pump. Would it require less power, or more, to pump the water through a 10 inch pipe? A. It would require less power, if the pipe were enlarged, but not much, unless the pump is run very fast. 2. Would the entire weight of the water in the 10 inch pipe rest on the pump ram? A. The pressure on the pump ram, due to the height of the column of water, is independent of the size of the pipe; but as this pressure is increased by the resistance of the water in the passages and pipe, it is greater for a large pipe than for a small one, if a similar quantity of water is discharged through each.

(38) A. M. P. C. asks: 1. I have a double engine, cylinders 1½ inches bore by 3 inches stroke. Will a plain cylinder boiler, 1 foot in diameter and 4 feet long, set in brickwork, be large enough to run it up to its full capacity? A. The boiler would be rather too small. 2. If the boiler aforesaid be constructed of ½ inch iron, how great a pressure could be carried with safety? A. If well made, it would be safe to carry a pressure of 150 lbs. to the square inch. 3. How much grate surface should be allowed? A. Make the grate 1 foot square. 4. What should be the dimensions of the smoke stack? A. From 5 to 6 inches in diameter.

(39) L. L. H. asks: Will Babbitt metal do to make a 3 x 1¼ inches cylinder for a steam engine? A. A hard Babbitt metal will wear very well.

(40) L. C. & Co. say: Your reply to E. A. (No. 14, January 30, 1875) regarding draft of street car interested us, but we are quite unable to agree upon the meaning of your reply. We admit and believe that, if the end of the axle of a wagon stands equally high with the point of draft on a horse's shoulder, it makes no difference how far the horse is from the wagon; but suppose the axle to be 2 feet high, and the point of draft on the horse's shoulder be 3 feet high, will the horse draw a load as easily 10 feet from the axle as he will 2 feet from the axle? Is it not easier for a horse, under ordinary circumstances, to be harnessed close to his load, so that the act of drawing lifts a certain amount upon the load? A. It is better to harness the horse so that his whole force is expended on traction, and none on lifting.

(41) N. O. P. asks: What is the rule for measuring the inside of a furnace stack? I wish to know the number of bricks it will take to line it. A. Find the solidities of two frusta of cones, each having for its altitude the height of the chimney, one having for its diameter that of the interior of the lining, the other of the exterior. The difference between these two volumes will be the volume of the lining.

(42) F. S. Jr. says: Bourne, in his "Catechism of the Steam Engine," states that "if we take the tensile strength of cast iron at 15,000 lbs. per square inch, a fly wheel rim of 1 square inch sectional area would sustain 30,000 lbs." Please elucidate the above for me by stating what is meant by a rim of 1 square inch sectional area. A. It means that, if the rim is cut in the direction of a line passing through the center of the wheel, the area of the cut end of the rim will be 1 square inch.

(43) W. asks: 1. Is it possible to drive a vehicle, large enough to carry a man, by spring power? A. Yes. 2. How large or strong a spring would be necessary? A. You can readily calculate the required strength of the spring for any proposed arrangement of a vehicle of given weight, assuming that the tractive force required, on a good road, will be from 80 to 100 lbs. for a vehicle weighing 1 ton.

(44) R. H. A. says: I have an engine with a utilized steam space of 8 cubic inches, more or less. The fly wheel (of 50 lbs.) is mounted on a pillar about 30 inches high, tapering from 3 to 2 inches diameter, with a strong pedestal of 12 inches, spread, bolted to a 3 inch oak platform. There is positively no spring in the standard. When this wheel runs 500 in a minute it is pretty steady; but as the speed increases, agitation begins, until at or about 800 the thing is fearful, and bystanders leave. It seems as if the thing must fly from its fastenings. There are two ways of checking it, one by turning on steam, and the other by turning it off. At about 1,100 revolutions a minute, which is by no means its maximum, it runs so quietly that hardly any vibration happens. Can you give the rationale of these movements? A. The trouble seems to be caused by a lack of balance. It may possibly be remedied by making the fly wheel run perfectly true.

(45) J. B. C. says: I have seen statements that decarbonized steel, for gun barrels, would withstand the strains of firing better than plain twist, laminated steel, or Damascus twist. I would like to have your opinion on the relative merits of each of the above barrels, considered in regard to strength and durability. A. The plain twist, we believe, is the best.

(46) A. C. says: We have a mill with an engine 14 inches bore x 30 inches stroke. Our boiler is 24 feet long by 32 inches diameter, with 12 seven inch flues. The engine makes 65 revolutions per minute, and is geared to an upright shaft with bevel wheels. We lack power, and it takes hard firing to make steam. What would be the result if we ran the engine at 100 revolutions per minute, and geared the bevel wheels to run the upright shaft as now? We would gain power, but would the boiler make steam any more easily than now? A. If the engine exhausts into the smoke stack, running it faster may increase the draft. Otherwise we do not see that you will gain much from the change.

(47) W. B. D. says: I am running a 56 inch flying saw, direct from water wheel shaft pulley 6 feet in diameter to pulley on saw mandrel 2 feet in diameter. I wish to get power into a shop standing in a direct line down stream 50 or 60 feet. I do not use the saw all the time. Can I get as much power on the saw if I run my belt to a line shaft, and then up to my saw, as I now have? A. Some power will be taken to drive the belt and shafting.

(48) C. F. says: H. S. S. asks: "What, if any, is the difference in power required to transmit a given amount to the same sized pulley, if the belt be long enough to run loosely without slipping, or be a short belt with a tightener, or be a short belt stretched very tight?" After many years' experience with belts of all kinds, I have learned that it will require the most power with the short, tight belt, especially if the pulley receiving the power be much smaller than the one giving it. With the tightener there is a greater length of belt brought in contact with the pulley, consequently the belt can be much looser, and thereby lessen the friction upon the bearings. The tightener should be only heavy enough to take up the slack of the belt, which should be quite loose when relieved of the weight of the tightener, which should always be close to the pulley receiving the power. If the power is carried horizontally, the long and loose belt will have a similar effect, as the slack of the belt will always be found on the side of the belt going from the giving to the receiving pulley, which will, if it be the top side, sag so as to bring a much greater length of belt in contact with the pulley than in the case of the short tight belt. A. We would have been glad to receive some facts, as the result of experiment, in corroboration of your views. Matters of this kind cannot be finally settled by mere reasoning, because there is a question of fact involved which can only be determined by experiment. Your views, however, strike us very favorably, and we shall be glad to hear from you again if you will send us some particulars of your experience.

(49) C. S. W. asks: Am I right in claiming that light travels faster than galvanic electricity? A. Yes, as a general rule.

(50) T. C. S. asks: What is the amount of heat generated by passing a current of electricity over a long, thin platinum wire, and the amount of zinc required to generate the necessary quantity of electricity? A. The amount of heat generated would be proportional to the amount of zinc consumed.

(51) E. E. M. says: I have a book on electricity which says that, if a current is sent through a hollow coil of wire, and an iron bar brought to the mouth, that it will be drawn in. I have tried this but have failed. How can I construct such a coil? A. Use 100 feet of No. 14 copper wire, covered with cotton and wound into a helix, and charge with Bunsen's cells whose zincs are connected together for one pole and carbons for the other.

(52) I. A. says: I have a Bunsen battery. The porous cup is 2 inches in diameter and as high as the cell, and about ¾ inch thick. I cannot get a current through. I think the porous cup is too thick. How can I remedy it? A. Soak the porous cup in warm water.

(53) G. H. A. asks: 1. In what respect do a relay and sounder differ? A. A sounder is wound with coarser wire. 2. How can I coat sounder wire with gutta percha for use in batteries? A. Melt the gutta percha and press it on. 3. In what respect is silk-covered copper wire better than cotton for making the magnets of a sounder? A. It is a better insulator. 4. Which is the most economical, as far as battery is concerned, to keep the circuit closed or open when not in use? A. Open. 5. For a line of telegraph a mile or less in length, what number and how much insulated wire will I need for the magnets to the sounder? A. Use 270 feet of No. 24 copper wire. 6. In batteries, should the surface of the zinc and copper be similar? A. Approximately. 7. How can I construct a battery using zinc and lead, so that the blue vitriol will cut the lead instead of the zinc, as is generally the case? A. By first turning your lead into zinc. 8. How can I nickel plate with a battery, using nickel 5 cent pieces? A. Rivet the 5 cent pieces on to a nickel plate.

(54) J. H. asks: Will a Leclanché battery answer for electroplating such articles as watches, chains, rings, etc.? A. It can be used, but Smee's or Daniell's is better.

(55) D. L. G. asks: 1. Is a lightning rod of any benefit whatever as a conductor of an electric charge? A. Yes. 2. Which is the best rod in use? A. Copper. 3. How much space will a rod protect? A. A space equal to its projection above the building. 4. What are the merits of a platinum point? A. It does not rust.

(56) A. O. B. asks: 1. Is there danger of lightning striking telegraph wires and entering the buildings to do damage, if we can cut the offices out and leave the circuit closed? A. Not much. 2. How much No. 11 iron wire (in length) will give 1 ohm of resistance? A. 190 feet.

(57) A. E. C. asks: How is shellac prepared so that it can be put on evenly, between the successive layers of the secondary wire in an induction coil? A. Put 1 oz. of shellac into a wide mouthed 8 oz. phial containing 5 oz. of well rectified naphtha. Close the bottle with a cork, and let it stand in a warm place until perfectly dissolved. Shake the mixture frequently and pass the fluid through a paper filter; add rectified naphtha to the solution from time to time in such quantities as will enable it to percolate freely through the filter. Change the filter when necessary.

(58) I. R. says: I would like to find the cheapest and simplest way of producing the electric light, and how to construct a battery for that purpose. A. You will require 50 cells of Grove's or Bunsen's, or 100 cells of Daniell's battery, to produce an electric light. Attach the two poles of the battery to two carbon pencils. Touch the pencils together and then separate them, and the light will appear.

(59) G. C. B. says: 1. I have an electric gas lighter which occasionally gives me a great deal of trouble. When I want to light up, it refuses to work altogether. What is the trouble? A. Soak the carbons for a few days in hot water. Thoroughly amalgamate the zincs, and put new solutions in your battery. 2. Is the Tom Thumb or miniature electric battery strong enough to work a wire from Newark to New York? A. Yes. 3. Is it difficult to telegraph? A. It is as easy to learn to telegraph between these two places as anywhere else. There is no difficulty in the matter. It requires practice to become a good operator on any line.

(60) H. P. M. says: I have just built a privy, the vault of which is 5¼ feet deep, being 24 feet from my neighbor's well of drinking water. The well is 33 feet deep in a gravelly soil. Will the use of the privy foul the water of the well? A. The probability is that it will, in the kind of soil that you name.

(61) W. F. S. asks: 1. How should one proceed who wishes to study practical chemistry? Is it best to work in some laboratory at first, and attend lectures on chemistry? A. Yes. 2. Can one have a good knowledge of the science without understanding pharmacy? A. The study of pharmacy is never included in a chemical course, except by those working for the degree of M. D., etc., as it pertains wholly to the preparation of medicines.

(62) P. S. asks: 1. What is considered the best and safest way to make gas for the oxyhydrogen light? A. You will find a full description of obtaining these gases, etc., on p. 215, vol. 32, in answer to J. H. L. 2. I see a notice of a self-condensing cylinder. Are they safe for a new hand to use? A. We cannot consider them safe in unpracticed hands. 3. I also want to know which is the most portable kind, for using with the magic lantern? A. In the larger cities gas may be obtained under pressure in small cylinders suitable for transportation. But as obtained in this form it is necessarily somewhat more expensive, and in the end it will be found more economical to manufacture the gases when required, and to use them in the bags manufactured for this purpose.

(63) A. K. says: 1. We have a brick cistern that was cleaned out a few months ago. The water has a very bad smell. When it is hot, there is a scum on it that is hard, like lime. What will remove the smell, and what causes the scum, as the water ought to be perfectly soft, being rain water? A. Try adding a small quantity of alum to the water before using, and allow to settle for a short time.

(64) O. R. asks: How can I calculate the flow of water in a trough 2 feet wide, 1 foot deep, and 20 feet long? The water runs through with great rapidity, and I do not know any certain method of ascertaining the velocity, and consequently the quantity in a given time. A. Your best plan will be to ascertain the velocity by means of floats, on the surface as well as submerged at different depths.

COMMUNICATIONS RECEIVED.

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

On Patent Politics in Ohio. By A. K. S.
On the Iron Horse. By F. G. W.
On Hydrogen. By T. G. B.
On a Universal Language. By J. C.

Also inquiries and answers from the following:

R. L. N.—J. C. Y.—R. J. F.—J. M.—S. C.—J. K.—A. C. J.—N. T. W.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells the best silk-covered wire for magnets? Whose is the best line wire insulator? Whose is the most economical turbine water wheel? Who builds the fastest steam launches? Why do not makers of drawing instruments advertise in the SCIENTIFIC AMERICAN?" 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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June 8, 1875.

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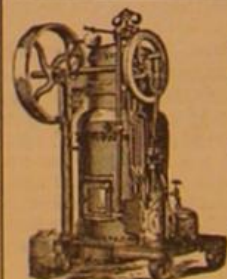
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4,827.—C. G. Herbert, New York city, U. S. Plumber's joint. June 9, 1875.	164,239
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4,831.—C. Hutchinson, Tonica, Ill., U. S. Nut lock. June 9, 1875.	164,250
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4,835.—J. C. Baker, Mechanicsburgh, O., U. S. Screw feed grain drill. June 15, 1875.	164,133
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Extract from the Cincinnati Daily Trade List, reported at the contest, September 25, 1874.

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

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HOW TO OBTAIN Patents.

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

How Can I Best Secure My Invention?
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NEW YORK, JULY 17, 1875.

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IMPROVED METHOD OF TRANSPORTING BRICKS DURING MANUFACTURE.

In the accompanying engraving, we illustrate a new method of transporting bricks about the yard, from the machine in which they are manufactured to the points at which the filled hacks are piled for drying and storage. The general design is to enable the work to be done more readily and rapidly, and with probably a less number of hands than is usually required. Before proceeding to describe the plan in detail, we desire to direct the reader's attention to the apparatus for manufacturing the bricks depicted in the foreground of the engraving. This machine has already been illustrated in these columns, but is here presented in a horizontal instead of an upright position. The clay is transported directly from the bed and at once dumped into the hopper, whence it passes to a pug mill, within which it becomes thoroughly ground, tempered, and reduced to a homogeneous mass of about the consistence of thick putty. Hence it passes to the molds which are formed in a mold wheel which revolves in face of the pug mill. A follower beside the wheel, traveling along an incline, forces each brick from its matrix with all the angles and faces smooth, sharp, and perfect, so that the brick as it emerges is deposited upon the endless belt, A. The various devices for conveying the bricks from this belt to their storage places will be found represented in the engraving and described in the following lines:

As the bricks are carried from the machine by the belt, they are removed from the latter by boys, who pile them six high upon the hack planks, B. The hack planks are board platforms constructed of three longitudinal boards, with suitable cross pieces and supports below, and resting on a series of fixed rollers which are inserted in socket rails, C, in the ground. After a hack plank is filled, it is easily slid over the rollers out of the way, and an empty one brought up in its place.

At right angles to the line of rollers over which the hacks are transported, and crossing said line, is an excavation which extends entirely across the yard. Running upon rails, laid in the bottom of this ditch, is a switch car, D, the platform of which is flush with the level of the ground, so that the filled hack planks are easily slid from the rollers directly upon said car. The latter is then pushed along until opposite the point where it is desired to stow the hacks. Tracks are laid from such points in sets of three, and terminate at the edge of the excavation, and upon them are trucks, E, which

consist of frames wider and higher than the hacks, and provided with a hand windlass, chains, and grappling hooks. As soon as the switch car is in place, a truck is run directly upon it and over the hack, the hooks are caused to catch beneath the latter, and then, by turning the windlass, the hack is raised from the ground. The truck is readily pushed by one man along the track to the point at which the hack is to be deposited, when the latter is let down by the windlass and detached from the truck, which returns for a new load. The truck runs on either pair of the three tracks so that the latter allow of the storing between them of two rows of brick.

The saddles, as represented at F, are stowed between the sets of track during the drying of the bricks. This completed, they are placed, as shown, in the distant heaps upon the tops of the piles.

In manufacturing brick on a large scale, the matter of removing them from the press and stacking them in a convenient place, without unnecessary handling, is a very important feature; and the arrangement, patented by E. R. Gard and shown in our illustration, seems to accomplish this object admirably.

Further particulars may be obtained by addressing the Great American Brick Company, 260 Eleventh avenue, corner West 27th street, New York city.

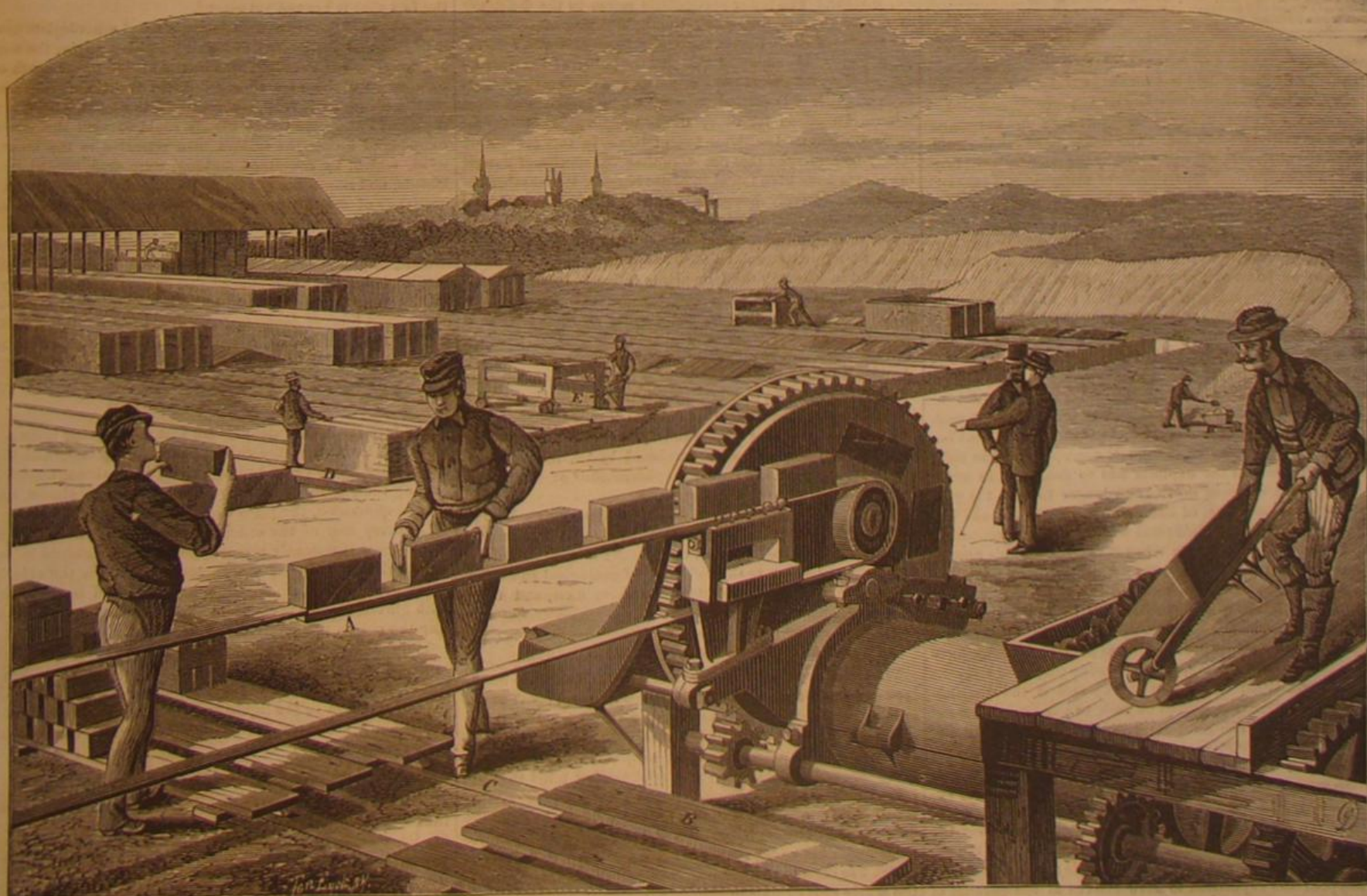
The North Polar Region.

In an article upon the occasion of the sailing of the new British discovery expedition to the north pole, the *London Times* says:

"So what we really begin this 29th day of May, 1875, is in all probability a progressive series of operations for the discovery of this planet's most intractable and inaccessible quarter. At present there lies within a few weeks of us, and right between us and inhabited continents, a circle, 1,400 miles across, of which we know not even whether it be land or water, or in what respect it is affected by some conditions wholly different from our own. Is it anything more than a great refrigerator for the production of cold—that is, for the absorption of heat? If water preponderate there, then the cold need not be so extreme as we imagine; and just as the equator is not everywhere hotter than the tropics, just as the eastern hemisphere is warmer by 10° in north latitude than the western, and the northern hemisphere very

much warmer than the southern, so even the arctic circle may have the benefit of some genial influences. It has at least half a year of continuous day. What if it be found sufficiently habitable for the establishment of stations in which the production and economy of heat will be the only serious difficulty? Science is sanguine, but it confesses itself to be hoping against hope as to the matter of its expectations. An animal or two, seeds that can stand any cold, some of the lowest forms of vegetable life, and perhaps organisms in the sea, the possible revelations of an atmosphere completely clear of aqueous disturbance, figure prominently in the catalogue of hope. If, as is suspected, there be ingredients in the earth's atmosphere too subtle for chemical analysis, the spectroscope may detect them in a region where humidity no longer embarrasses the question. Then what is the aurora? Is it of earth, or of heaven? Is it meteoric? Is it cosmic? Does it reveal a universal medium? Is it a magnetic phenomenon? At about the 70th degree of latitude the expedition will reach the other side of the magnetic pole, and will have to steer by rules the contrary of our own, and becoming more and more complex till the needle points finally to the center of the earth. At the pole not only the compass, but even the sun, moon, and stars will cease to be available for the usual purposes of observation; that is, if anything should happen to the chronometers, for all will then depend on the preservation of Greenwich time. The forlorn hope told off for the pole will have to mark its track very carefully if it would be sure of retracing its course back again. The geologists, ethnologists, and palaeologists fret at their exclusion, but they must admit their chances would be small indeed. They can wait, at all events. Perhaps the one hope widest felt and deepest is that of something unknown and un conjectured. Who would have guessed a few years ago that the interior of Africa was populous and delightful, that the ocean was full of life and undergoing change, or that the elements and fabric of the sun would yield to analysis? The expedition is a lottery, in which we know too well there are blanks, but in which there are sure to be some prizes, perhaps one or two great ones."

FERMENTATION of food should be guarded against as the warm weather approaches. This action is always liable to cooked vegetables when set aside. Instead of warming up cold messes, it is better to scald them.



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VOLUME XXXIII, No. 3. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, JULY 17, 1875.

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WORK FOR ARCTIC EXPLORERS.

The scientific work, laid out for the arctic exploring expedition which lately sailed from England, probably excelled in scope and variety that of any preceding expedition as remarkably as its material outfit did. The instructions for the guidance of the observers were prepared by the most eminent Englishmen in the several departments of research, and are minute and comprehensive enough to keep the explorers from idleness, whatever else may befall them.

Popularly the grand object of the expedition is to reach the pole; practically that is one of the least important of the many purposes of the voyage. And a couple of years spent in arctic regions can scarcely fail to be fruitful scientifically, even if the pole still remains unwon. There is much to be learned of the natural history of those frigid regions, and many physical phenomena await solution there. Chief of the latter may be regarded the magnetic condition of that portion of our globe.

Accustomed to the near coincidence of compass north with astronomical north in this part of the world, it is all but impossible for us to form any adequate conception of the magnetic confusion that the explorer has to deal with in arctic regions, when compass north is no longer toward the pole but toward an area west of Baffin's Bay, in north latitude 70°, —the magnetic pole. This point will lie to the astronomical southwest of the expedition when it reaches Smith's Sound, where the Alert hopes to go into winter quarters; in other words, astronomical southwest will there be identical with compass north, and the north pole will lie to the southeast by compass.

As a guide to the expedition, three provisional maps have been constructed, showing, for the whole unexplored area, the magnetic condition which may be expected if the distribution of terrestrial magnetism be such as our present knowledge indicates. The most important of these maps of the magnetic elements shows the assumed lines of compass direction over the whole circumpolar area, and the region of Greenland, Baffin's Bay, and Davis' Strait, and also, approximately, the lines of equal declination between the north pole of the earth and the northern magnetic pole over the same areas. The importance of such information to the explorers is shown by the following example:

Suppose the expedition to have arrived at the parallel of

85° in longitude 60° W. of Greenwich, at which point the pole will be due east by compass. They start in an astronomically easterly direction for a sledge journey along the parallel of 85°. In longitude 20° W. of Greenwich the north pole will bear northeast. When longitude 40° E. of Greenwich is reached, the astronomical and magnetic meridian will correspond; the north pole will lie between the explorers and the magnetic pole, and the compass will therefore point to the true north. In longitude 180° the pole will bear due west; and in longitude 112° W. of Greenwich, the explorers will have arrived between the north pole and the magnetic pole, and consequently the north pole will bear due south.

Should the expedition be so lucky as to reach the pole, all the points of the compass will be south; latitude and longitude will vanish; the north star will lie directly overhead, and all the other stars will revolve around it, neither rising nor setting. The moon will remain for days above the horizon, and the sun, in summer time, will make an unbroken circuit of the heavens, yet always in the south. Time in its ordinary sense will cease; morning, noon, and night will be one; the dial of the heavens will be a blank.

The astronomical instructions prepared by Mr. Hind, superintendent of the "Nautical Almanac," give data for two eclipses of the sun in the polar area in 1876 and 1877; also a list of occultations of stars by the moon visible in or near the probable winter quarters of the expedition, 82° N. latitude and 60° W. longitude, between September 1875 and March 1877, which will enable the observers to employ the best means of determining their longitude.

Special arrangements have been made for the spectroscopic study of the aurora, the instructions for which were prepared by Professor Stokes.

Professor Tyndall furnishes hints for the observation of glacial phenomena; the rapidity of the conduction of heat through ice; the rate at which the ends of glaciers advance into the sea; whether icebergs are formed by the buoyancy of the masses of ice thrust under the water, or by the weight of overhanging ice cliffs whose bases have been worn away by the waves; what kinds of matter are brought down from the interior by glaciers and transported by icebergs; the condition of rocks and hills along the sides of glaciers; the color of the ice and its veining at the ends of glaciers; also the color of the sky, the presence or absence of germs in the air, the range of sounds, and so on.

The solution of many weather problems will be looked for through continuous meteorological observations, especially with regard to storms which pass over the extreme northern part of Europe, many of them being connected with areas of barometrical depression which follow tracks lying within the arctic circle.

Especially attention will also be given to tidal phenomena, particularly of the tidal wave which sets southerly through the northern part of Smith's Sound, and indicates an open passage along the northern coast of Greenland. Pendulum observations will also be made, with a view to obtaining data toward the determination of the earth's figure in high northern latitudes.

The natural history of the region explored will be attended to with equal care. The instructions for biological and botanical observations were furnished by Professor Huxley and Dr. Hooker. The latter particularly refers to the deficiency of our knowledge respecting the hybridizing of certain of the species of arctic plants, especially those of *draba*, *saxifraga*, and *salix*. He suggests also that the pollen of the various species should be carefully examined, and observations made as to whether it is carried by wind or by insects, and gives minute directions for observations touching the power of seeds to resist cold without loss of life. In this connection it may be remarked that not more than 762 species of flowering plants have been found in arctic regions, the number belonging exclusively thereto being about fifty. Arctic Greenland furnishes 207 species, of which 195 are Scandinavian types, while only 12 are American and Asiatic types. Botanically, therefore, Greenland is much nearer to Europe than to America. Among the four plants collected by Dr. Bessell, of the Polar, in latitude 82° N.—the extreme northern limit of phanerogamic vegetation, so far as known—was a near relative of our familiar dandelion.

With microscopic plants and animals the arctic seas are abundantly furnished, and Professor Huxley directs especial attention to them in connection with the composition of the sea bottom for the testing of certain modern paleontological theories. Instructions for the collection and preservation of such low forms of life were furnished by Dr. Allman, who also directs attention to the phosphorescence of the sea, as far as it is due to living organisms.

The explorers are also furnished with descriptive lists of the mammalia which may be seen, with directions for observation and the preservation of specimens; also with instructions with reference to the collection of geological and mineralogical specimens, meteorites, meteoric dust, and other matters of interest.

INSTABILITY OF THE EARTH'S SURFACE.

We are so accustomed to consider the solid earth to be the type of perfect stability that it requires quite an effort of the mind to elevate itself to the thought that even the rocks, which appear to be the foundation on which everything else rests, are of an unstable nature, subject to upheavals, depressions, and dislocations. Every observing mind that has seen bold mountain regions, railroad cuttings, or mining shafts must have been struck with the evidences of mighty disturbances, although perhaps a book on geology never came under his eye. It is the study of these disturbances which has created this science, one of the most interesting in the whole field of human knowledge.

It was formerly supposed that the only cause of such changes was volcanic action, and that all the metamorphoses which have taken place were sudden and violent. The observations of volcanic action and of the changes which it rapidly produces in the earth's surface necessarily led to such conclusions; but patient investigation, during long periods of time, has led to the knowledge of a mode of change, formerly unsuspected, by slow upheavals and depressions, taking place gradually, at a rate of one or more feet in a century. Such changes have been and are now constantly taking place, and necessarily must, if prolonged for a sufficiently long period of time, essentially change the earth's surface, not only as to the relative heights of continents and islands, but, in connection with the ocean, as to the whole cosmography of our globe.

We will not speak of the supposed continent Atlantis, mentioned by the ancient mythological writers, which was, they asserted, sunken in the Atlantic ocean; but we will only mention positive facts, recorded as a result of careful observation. That the coasts and bottom of the Baltic sea are rising is an old and well established fact, the ancient shores being several thousand feet from the present water's edge; while Great Britain and part of the west coast of Europe, Holland, Belgium, and France are in a sinking condition. The evidences in and around the British Channel have long since proved the probability of this, while the Astronomer Royal has announced that minute observations prove that Greenwich Observatory, with the ground upon which it stands, has been sinking ever since its establishment.

In regard to our continent, it has been proved that the whole Pacific coast, especially California, with all its mountains, is perpetually rising, and that at a comparatively rapid rate. The land containing in its bosom our great American Lakes is slowly sinking; while southern Indiana, Kentucky, and the surrounding States are rising. Geological investigations prove that our great lakes, except Ontario, had formerly a southern outlet; until, by gradual northern depressions and southern upheavals, a northern outlet was formed from Lake Erie into Ontario, about 40,000 years ago. This outlet, the Niagara river, is still wearing away its channel. The division line, of the watershed south of the lakes and the Mississippi valley, has since that time been steadily traveling southward; and when Chicago recently turned the waters of Lake Michigan, through the Chicago river, into the Mississippi valley, the old state of affairs was artificially re-established.

New Jersey is sinking, with New York city and Long Island, at the estimated rate of about 16 inches per century. The coast of Texas is ascending at a comparatively very rapid rate, some observers stating that it is as much as 30 or 40 feet in the last half century.

Combining these observations with the results of the recent deep soundings of the United States steamer *Tuscarora* in the Pacific Ocean, we find that the bed is evidently a sunken continent, abounding in volcanic mountains some 12,000 feet high, many of them not reaching the surface of the ocean, and others which do so forming the numberless islands of the Pacific. The study of the coral rocks proves that this sinking has continually been taking place during several centuries, and observations of the coast will undoubtedly reveal the fact that it has not yet ceased.

The most eminent German geologists and ethnologists now maintain that the locality of man's primitive origin, the seat of the so-called Paradise, was in the Pacific Ocean south of Asia, whence the race slowly diffused itself northward to Asia, westward to Africa, and eastward to Australia. When the great Pacific continent slowly sank, so that the ocean commenced filling the valleys, man retreated to the mountains, which, by continued sinking, were transformed into islands, and now form the many groups of Polynesia. The insularity of the thus preserved races was not productive of civilization, which requires conflict, in which the superiors in the end gain the victory over the inferiors. In those islands, the inferior races were preserved for want of this conflict, hence their savage condition even at the present day; while primitively the greatest advance took place at the spot of the most intense conflict, the continent of Southern Asia. Even at the present day, it has been said that gunpowder is the greatest civilizer.

THE COLORADO POTATO BUG.

The farmers in our vicinity are just now having their potato fields invaded by the celebrated Colorado bug, and the demand for Paris green has become so great throughout the country that, were it not an article obtainable in almost unlimited quantities, the price would be greatly enhanced.

Let every user of the article keep constantly in mind that Paris green is a deadly poison, and great care should be taken in the handling of it. Hands from which the skin is abraded, or on which any sore exists, should be protected with gloves, and all precautions should be used against inhaling the poison while mixing it.

The following, from the *Maryland Farmer*, seems to be a practical mode of applying the poison to the vines. We would, however, suggest, that, on small patches, the dipping of a broom in the liquid and shaking it over the vines be used as a substitute for the appliance which our contemporary suggests:

THE COLORADO BEETLE—THE BEST EXTERMINATOR.

Sweeten a barrel of water with 1 gallon of cheap molasses; then add and well incorporate 1 lb. good Paris green, and apply the same in one application to 1 acre of potatoes. The best mode of applying the liquid to the potato vines is in the use of a can that will contain 4 or 5 gallons, which may be lashed on the back of a man, who may apply the liquid, very

uniformly and rapidly, by having two short pieces of $\frac{1}{4}$ inch india rubber hose attached to the bottom of the can, the other end of the hose terminating in a tin rose, similar to that on watering pots. The liquid should be well stirred at each filling of the can, and it should be frequently and violently shaken during the time of applying it. An active man can apply the poison to four acres of potatoes in a day with ease, and two applications, at proper intervals, will save the crop.

The cost is estimated as follows: Hauling water, mixing, and applying the liquid, 30 cents per lb., two applications, 60 cents; 2 gallons molasses, 60 cents; 2 lbs. Paris green, \$1.40; total, \$2.60.

THE POWER OF SMALL ENGINES.

One of the most frequently recurring questions, asked by our correspondents, relates to the power that can be obtained from an engine of given dimensions, with a specified steam pressure and number of revolutions per minute. As we have frequently explained, questions of this sort can only be determined definitely by means of tests. The rules, ordinarily found in works on the steam engine, for calculating the horse power of an engine, give results that rarely accord with those obtained in practice. Indeed, it is impossible to lay down rules that will apply to all cases, the construction and performance of different engines being so varied. We feel, however, that we must do something to satisfy the many readers who want information about the small engines which they are building or using. We have therefore compiled a table, from the best data at our own command, by which the performance of small engines of good design can be approximately estimated. We have also added some examples to illustrate the use of the table. It is designed for engines with cylinders up to 6 inches in diameter, and for piston speeds up to 400 feet a minute; the connection of the engine with the boiler being supposed to be tolerably direct, the ports and pipes being of sufficient size, and the steam valve closing when the piston has made $\frac{1}{2}$ of the stroke. Even with all these suppositions, which probably represent the average conditions of small engines, the table will give results that are too large in some cases and too small in others, for the very reason that it does represent average conditions. With these explanations, we will proceed to illustrate its use.

1. To find the area of a piston, knowing its diameter: Multiply the square of the diameter by 0.7854. Example: The diameter of a piston is 3 inches. What is its area? The square of 3 is 9. Multiplying 9 by 0.7854, we obtain 7.0686, as the area of the piston in square inches. It may be well to observe that, whether the piston has either a flat, rounded, or raised end, its effective area is to be calculated from the diameter, as explained above.

2. To find the speed of a piston in feet per minute, when the length of stroke and the number of revolutions per minute are known: Multiply twice the length of stroke, in inches, by the number of revolutions per minute, and divide by 12. Example: An engine has a stroke of 3 inches, and makes 300 revolutions a minute. What is the piston speed? Twice the length of stroke is 6 inches. Multiplying by 300, and dividing by 12, we obtain 150, as the piston speed in feet per minute.

3. To find the horse power of an engine, when the diameter of the cylinder, the length of stroke, the number of revolutions per minute, and the pressure of steam in the boiler are known: Find the area of the piston, in square inches, and the piston speed, in feet per minute. Find the number in the table, the nearest to the given steam pressure and calculated piston speed, and multiply it by the area of the piston. Example: An engine has a cylinder 2 inches in diameter and with a length of stroke of 2 inches. It makes 400 revolutions a minute, with a boiler pressure of 50 lbs. per square inch. What is the horse power? Square of diameter of piston $4 \times 0.7854 = 3.1416$, area of piston, in square inches. Twice the length of stroke $4 \times 400 = 1600 \div 12 = 133\frac{1}{3}$, speed of piston in feet per minute. Nearest piston speed in table is 130, and the number in table corresponding to piston speed of 100 feet per minute and boiler pressure of 50 lbs. is 0.074; add the number corresponding to piston speed of 30 feet per minute, 0.022; this will give the number corresponding to piston speed of 130 feet per minute, 0.096. Multiplying this by area of piston, 3.1416, we obtain, horse power, 0.3 +.

The power so calculated is that available for useful work, such as would be developed on a friction brake, in an experiment made by the method explained on page 273 of our volume XXXI.

If any of our readers test their engines in this manner, we would be glad to receive the results of their experiments, which will be useful in enabling us to correct the table, if necessary.

4. To find the diameter of cylinder for an engine to develop a given horse power, when the piston speed, in feet per minute, and the pressure of steam in the boiler are known: Find, in the table, the number nearest to the given piston speed and pressure of steam. Divide the required horse power by 0.7854 times this number, and take the square root of the quotient. Example: An engine is to develop 2 horse power, with a piston speed of 150 feet a minute, and a boiler pressure of 100 lbs. per square inch. What should be the diameter of the cylinder? The number in table, for piston speed of 100 feet, is 0.161, and for 50 feet is 0.081, giving a total of 150 feet = 0.242. Multiply this by 0.7854, and we have a result of 0.1900668. Divide the horse power by the figure 0.1900668, and the quotient is 10.5226 +. The square root of 10.5226 is 3.24 +, or about $3\frac{1}{4}$ inches, the required diameter of cylinder.

5. To find the length of stroke, in inches, when the piston speed, in feet per minute, and the number of revolutions per minute, are known. Multiply the piston speed by 6, and

divide by the number of revolutions per minute. Example: The piston speed of an engine is 200 feet per minute, and the number of revolutions per minute is 300. What is the length of stroke? Multiplying 200 by 6, and dividing the product, 1200, by 300, we obtain 4 inches, as the length of stroke.

In this article, we have presented the subject as plainly as possible, so that it can be used by all who have queries on power developed by small engines.

EFFECTIVE HORSE POWER OF AN ENGINE WITH A PISTON ONE SQUARE INCH IN AREA, FOR DIFFERENT STEAM PRESSURES AND PISTON SPEEDS.

Horse power corresponding to piston speed (in feet per minute) of		Pressure.		10		20		30		40		50		60		70		80		90		100		200		300		400	
10	0.008	0.010	0.013	0.016	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140
15	0.011	0.014	0.017	0.021	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145
20	0.014	0.017	0.021	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150
25	0.017	0.021	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155
30	0.020	0.024	0.028	0.033	0.038	0.043	0.048	0.053	0.058	0.063	0.068	0.073	0.078	0.083	0.088	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158
35	0.023	0.027	0.031	0.036	0.041	0.046	0.051	0.056	0.061	0.066	0.071	0.076	0.081	0.086	0.091	0.096	0.101	0.106	0.111	0.116	0.121	0.126	0.131	0.136	0.141	0.146	0.151	0.156	0.161
40	0.026	0.030	0.034	0.039	0.044	0.049	0.054	0.059	0.064	0.069	0.074	0.079	0.084	0.089	0.094	0.099	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.164
45	0.029	0.033	0.037	0.042	0.047	0.052	0.057	0.062	0.067	0.072	0.077	0.082	0.087	0.092	0.097	0.102	0.107	0.112	0.117	0.122	0.127	0.132	0.137	0.142	0.147	0.152	0.157	0.162	0.167
50	0.032	0.036	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170
55	0.035	0.039	0.043	0.048	0.053	0.058	0.063	0.068	0.073	0.078	0.083	0.088	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158	0.163	0.168	0.173
60	0.038	0.042	0.046	0.051	0.056	0.061	0.066	0.071	0.076	0.081	0.086	0.091	0.096	0.101	0.106	0.111	0.116	0.121	0.126	0.131	0.136	0.141	0.146	0.151	0.156	0.161	0.166	0.171	0.176
65	0.041	0.045	0.049	0.054	0.059	0.064	0.069	0.074	0.079	0.084	0.089	0.094	0.099	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.164	0.169	0.174	0.179
70	0.044	0.048	0.052	0.057	0.062	0.067	0.072	0.077	0.082	0.087	0.092	0.097	0.102	0.107	0.112	0.117	0.122	0.127	0.132	0.137	0.142	0.147	0.152	0.157	0.162	0.167	0.172	0.177	0.182
75	0.047	0.051	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170	0.175	0.180	0.185
80	0.050	0.054	0.058	0.063	0.068	0.073	0.078	0.083	0.088	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158	0.163	0.168	0.173	0.178	0.183	0.188
85	0.053	0.057	0.061	0.066	0.071	0.076	0.081	0.086	0.091	0.096	0.101	0.106	0.111	0.116	0.121	0.126	0.131	0.136	0.141	0.146	0.151	0.156	0.161	0.166	0.171	0.176	0.181	0.186	0.191
90	0.056	0.060	0.064	0.069	0.074	0.079	0.084	0.089	0.094	0.099	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.164	0.169	0.174	0.179	0.184	0.189	0.194
95	0.059	0.063	0.067	0.072	0.077	0.082	0.087	0.092	0.097	0.102	0.107	0.112	0.117	0.122	0.127	0.132	0.137	0.142	0.147	0.152	0.157	0.162	0.167	0.172	0.177	0.182	0.187	0.192	0.197
100	0.062	0.066	0.070	0.075	0.080	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170	0.175	0.180	0.185	0.190	0.195	0.200
105	0.065	0.069	0.073	0.078	0.083	0.088	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158	0.163	0.168	0.173	0.178	0.183	0.188	0.193	0.198	0.203
110	0.068	0.072	0.076	0.081	0.086	0.091	0.096	0.101	0.106	0.111	0.116	0.121	0.126	0.131	0.136	0.141	0.146	0.151	0.156	0.161	0.166	0.171	0.176	0.181	0.186	0.191	0.196	0.201	0.206
115	0.071	0.075	0.079	0.084	0.089	0.094	0.099	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.164	0.169	0.174	0.179	0.184	0.189	0.194	0.199	0.204	0.209
120	0.074	0.078	0.082	0.087	0.092	0.097	0.102	0.107	0.112	0.117	0.122	0.127	0.132	0.137	0.142	0.147	0.152	0.157	0.162	0.167	0.172	0.177	0.182	0.187	0.192	0.197	0.202	0.207	0.212
125	0.077	0.081	0.085	0.090	0.095	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170	0.175	0.180	0.185	0.190	0.195	0.200	0.205	0.210	0.215
130	0.080	0.084	0.088	0.093	0.098	0.103	0.108	0.113	0.118	0.123	0.128	0.133	0.138	0.143	0.148	0.153	0.158	0.163	0.168	0.173	0.178	0.183	0.188	0.193	0.198	0.203	0.208	0.213	0.218
135	0.083	0.087	0.091	0.096	0.101	0.106	0.111	0.116	0.121	0.126	0.131	0.136	0.141	0.146	0.151	0.156	0.161	0.166	0.171	0.176	0.181	0.186	0.191	0.196	0.201	0.206	0.211	0.216	0.221
140	0.086	0.090	0.094	0.099	0.104	0.109	0.114	0.119	0.124	0.129	0.134	0.139	0.144	0.149	0.154	0.159	0.164	0.169	0.174	0.179	0.184	0.189	0.194	0.199	0.204	0.209	0.214	0.219	0.224
145	0.089	0.093	0.097	0.102	0.107	0.112	0.117	0.122	0.127	0.132	0.137	0.142	0.147	0.152	0.157	0.162	0.167	0.172	0.177	0.182	0.187	0.192	0.197	0.202	0.207	0.212	0.217	0.222	0.227
150	0.092	0.096	0.100	0.105	0.110	0.115	0.120	0.125	0.130	0.135	0.140	0.145	0.150	0.155	0.160	0.165	0.170	0.175	0.180	0.185	0.190	0.195	0.200	0.205	0.210	0.215	0.220	0.225	0.230

* In boiler, by gage.

THE KEELY MOTOR DECEPTION.

We publish on another page a communication from the counsellor of the Keely Motor Company, Mr. Collier, and his colleagues, in reply to an article on the above subject given in our paper of June 26. We devote this space, first, because the parties interested, feeling personally aggrieved by our remarks, have requested, as a matter of fair play, an opportunity for reply; and second, because we have hopes that some of our readers may be led thereby to study out the probable processes by which these gentlemen have been precipitated into this delusion. Such studies may result in useful suggestions or new knowledge. It is not often that the active participants in delusions like this are willing to come forward and chronicle themselves in the broad and public manner that these persons have done. The mental or psychological phenomena will, we think, be found interesting subjects for investigation.

An example somewhat similar to this Keely motor business occurred in London, in 1871, when Dr. William Crookes, the well known scientist, published his astonishing account of the spirit motor of Home, in which the spring gage was made to move by the simple pointing at it of the operator's finger. The truth of this performance was attested by Dr. Crookes, who himself prepared the apparatus, by Dr. William Huggins, by Edward William Cox, a distinguished lawyer, and by numerous other witnesses of undoubted reliability. Dr. Crookes and others were convinced by this exhibition that a new force, which he termed psychic force, had been discovered; but Dr. Huggins, while attesting that the gage moved (in fact, the movement was made to record itself on paper), declined to express an opinion as to how the movement was produced. An account of these performances, with an engraving of the arrangement of levers and gage used, was published in the SCIENTIFIC AMERICAN, page 99, August 12, 1871.

This motor of Dr. Crookes appears to surpass the Keely device in some respects. The power is workable at a low pressure, involves but little expense for apparatus, requires no blowing of air from the lungs, uses no hydrant pressure, and its success does not depend upon "cold vapor."

No one, we believe, has ever questioned the honesty of Dr. Crookes, or supposed for a moment that he had, personally, any hand in giving motion to the gage. The more reasonable supposition is that somebody, in some manner unobserved by those present, applied the necessary force to the instrument.

The human senses are but weak instruments at best, easily played upon and deceived; and those who have most highly prized themselves upon the possession of superior perceptions, by which they were confident of their ability to detect the unreal from the real, have become lamentable examples of the ease with which the mind of man can be entrapped and led astray by mere appearances.

IMPROVED ENGRAVING MACHINES.

We illustrate herewith two specimens of a series of machines, designed and constructed by Mr. Ferdinand Lotz, of Offenbach, Germany, for the use of engravers, and having a very wide range of application, as they are intended for the production of line engraving, producing enlarged or reduced facsimile copies, and for making copies of reliefs of all kinds. Fig. 1 is a machine employed for engraving reliefs, medallions, etc., either the same size as the original, or enlarged or reduced. With it straight and curved lines in various com-

binations can be produced. The different natures of lines are formed by the use of change wheels, the forms of which vary with the design to be engraved. One of these wheels is shown mounted in place; and it will be seen that bearing upon it on the upper side is a steel point, to which motion is imparted as the wheel revolves, the motion of course varying with the form of the wheel. This movement is then transferred from the arm carrying the steel point, through a set of levers to the bar carrying the diamond point, shown resting on a lithographic stone. For ruling straight lines the upper rack, shown in the engraving, is dropped, throwing out of gear the parallelogram which transmits motion to the carriage. The latter is then moved to the left hand side of the frame. By turning the crank handle, shown in the engraving, motion is imparted through the gearing and rack

and also less powerfully magnetic. It will be seen that the iron has a tendency to rust from the moment it leaves the hammer or rolls, and that the scale above described must come away. One of the plans to preserve the iron has been to coat it with paint when still hot at the mill; and although this answers for a while, it is a very troublesome method which iron masters cannot be persuaded to adopt, and the subsequent cutting processes to which it is submitted leave many parts of the iron bare. Besides, a good deal of the scale remains, and until this has fallen off, or has been removed, any painting over it will be of little value. The only effectual way of preparing wrought iron is to effect a thorough and chemical cleansing of the surface of the metal upon which the paint is to be applied, that is, it is to be immersed for three or four hours in water containing from 1 to

cases, and recourse must be had to scrapers and hard brushes to remove the scale or rust. Having obtained a clean surface, the question arises what paint should be used upon iron? Bituminous paints, as well as those containing variable quantities of lead, were formerly considered as solely available, but their failure was made painfully apparent when the structures to which they were applied happened to be of magnitude, or subjected to great inclemency of weather or to constant vibration. Recourse has, therefore, been had to iron oxide itself, and with very satisfactory results. Iron

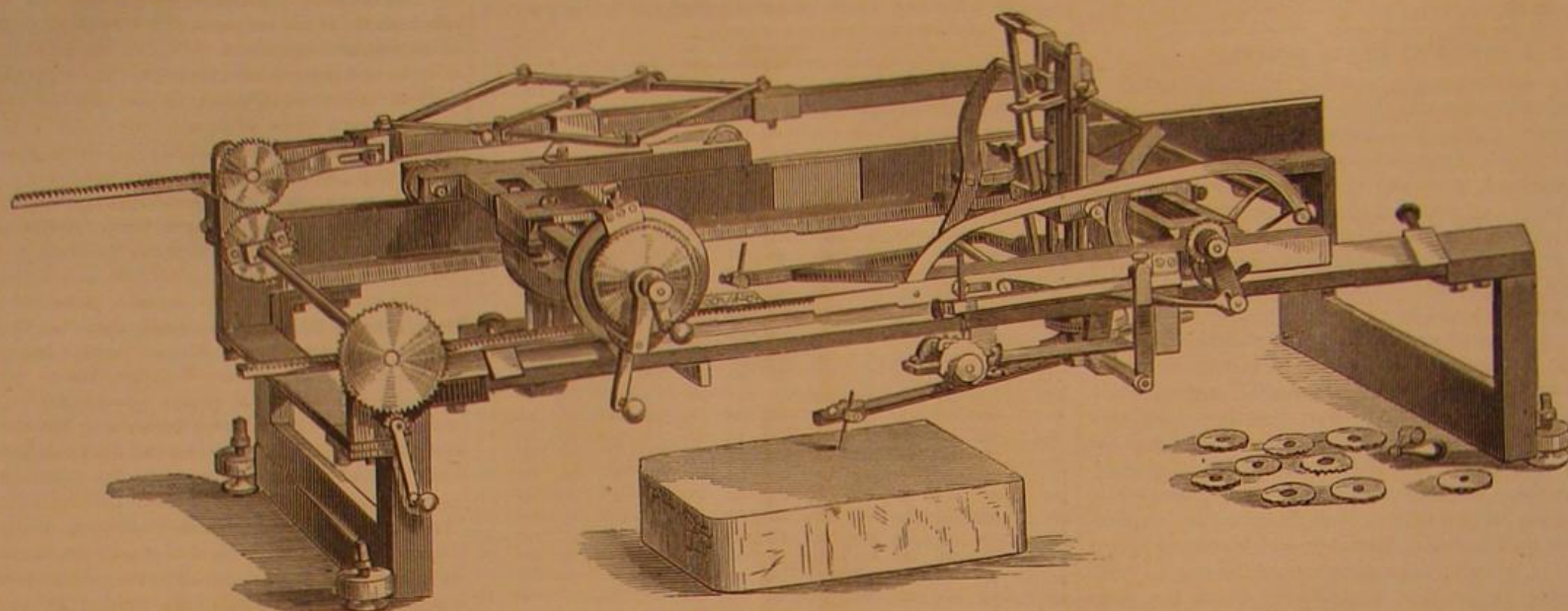


Fig. 1.—LOTZ' ENGRAVING MACHINE.

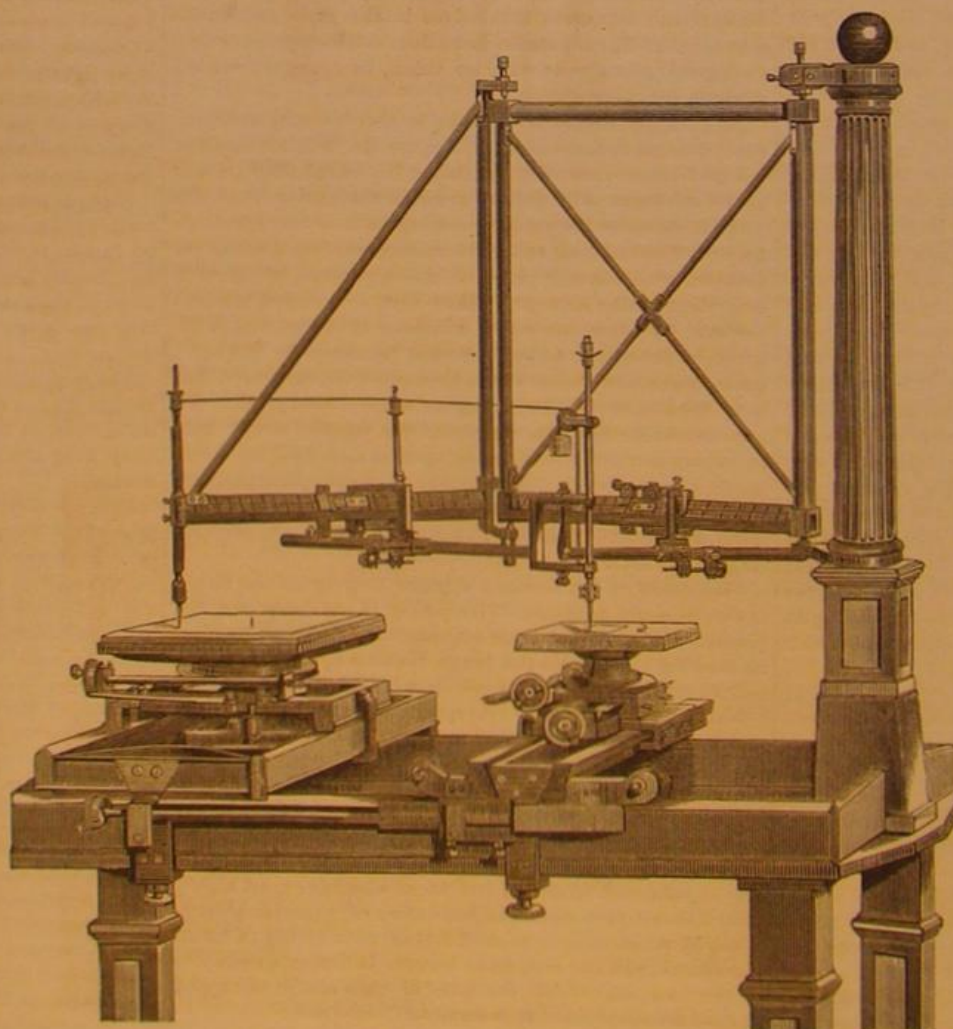


Fig. 2.—LOTZ' ENGRAVING MACHINE.

binations can be produced. The different natures of lines are formed by the use of change wheels, the forms of which vary with the design to be engraved. One of these wheels is shown mounted in place; and it will be seen that bearing upon it on the upper side is a steel point, to which motion is imparted as the wheel revolves, the motion of course varying with the form of the wheel. This movement is then transferred from the arm carrying the steel point, through a set of levers to the bar carrying the diamond point, shown resting on a lithographic stone. For ruling straight lines the upper rack, shown in the engraving, is dropped, throwing out of gear the parallelogram which transmits motion to the carriage. The latter is then moved to the left hand side of the frame. By turning the crank handle, shown in the engraving, motion is imparted through the gearing and rack

and also less powerfully magnetic. It will be seen that the iron has a tendency to rust from the moment it leaves the hammer or rolls, and that the scale above described must come away. One of the plans to preserve the iron has been to coat it with paint when still hot at the mill; and although this answers for a while, it is a very troublesome method which iron masters cannot be persuaded to adopt, and the subsequent cutting processes to which it is submitted leave many parts of the iron bare. Besides, a good deal of the scale remains, and until this has fallen off, or has been removed, any painting over it will be of little value. The only effectual way of preparing wrought iron is to effect a thorough and chemical cleansing of the surface of the metal upon which the paint is to be applied, that is, it is to be immersed for three or four hours in water containing from 1 to

oxide paints are made of two qualities. The first quality is the best adapted for iron work, and is made by purifying the oxides and placing them in retorts, when the various colors are mixed with them. They are altogether submitted to seven distinct processes in the course of manufacture. To insure large surfacing qualities, or the power of covering a large area with a small quantity of paint, the ingredients should be reduced to an impalpable powder before they are mixed with the oil; and after mixture in first quality paint, they are ground for seven or eight hours. The second quality have their colors chemically combined by mixture, and are not so carefully prepared, although they are excellent for common work. A pound of iron oxide paint, when mixed ready for use in the proportions of two thirds oxide to

one third linseed oil, with careful work, should cover twenty-one square yards of sheet iron which is more than is obtained with lead compounds. Oxide of iron paint endures a very great heat without material alteration, and keeps both its color and preservative qualities well. The author is of opinion that, when used under proper supervision, no better protection can be found for iron structures than oxide of iron paints. There is this difference to be noticed between the painting of iron and wood, that, with the former, when a painter comes to spots of rust that cannot be removed, he should endeavor to incorporate them with the paint rather than paint over them. The repainting of iron involves carefully washing down and removing all dust, dirt, and so on from the entire surface, every particle of rust being scraped and chipped off, the work receiving from two to four coats in oil, properly applied. The author would observe, in conclusion, that the real value of any paint depends upon the quality of the linseed oil, the quality and character of the pigment, and the care bestowed on the grinding and mixing; and as all this is entirely a matter of expense, cheap paints are not to be relied upon. He is convinced that the superiority of most esteemed paints is due to the above causes rather than to any unknown process or material employed in the manufacture, and their comparatively high price corroborates this opinion.

Painting of Wrought Iron.

Mr. E. Spon, in a paper read before the Society of English Engineers, says:

In considering the painting of wrought iron, it must be noticed that, when iron is oxidized by heating in contact

2 per cent of sulphuric acid. The metal is afterwards rinsed in cold water, and if necessary scoured with sand, put again into the acid bath or pickle, and then well rinsed. If it is desired to keep iron, already cleansed, for a short time before painting, it is necessary to preserve it in a liquor rendered alkaline by caustic lime, potash, soda, or their carbonates. Treatment with caustic lime water is, however, the cheapest and most easy method, and iron which has remained in it for some hours will not rust by a slight exposure to a damp atmosphere. Although desirable, this method of cleansing the surface is impracticable in the majority of

mounted on a 1 inch steel arbor, and are located three on each end, a cone pulley by which the speed may be regulated being placed in the middle. They are as follows: One wheel of 1 inch square face, one of $\frac{1}{2}$ inch square face, another $\frac{1}{4}$ inch round face, constituting one set of three. The other set includes a wheel of $\frac{1}{2}$ inch square face, and another of $\frac{1}{4}$ inch round face, and a $\frac{1}{2}$ inch saw gummer. An adjustable rest at each end enables the operator to grind a perfectly true bevel of any degree required. The machine is already in use in several establishments, and is proving itself a convenient and useful invention.

A New Six Wheel Emery Grinder.

The Lehigh Valley Emery Wheel Company, of Weissport, Pa., are now making a new six wheel grinder especially designed for the use of plating mills, sash, door, and blind factories, and for molding manufacturers. The wheels are

THE ELECTRIC LIGHT.

A modification of Geissler's tubes has recently been made for the purpose of illumination. It consists of a carbon and vacuum tube, of about one sixteenth of an inch internal diameter, wound in the form of a flattened spiral. The ends of the tube, in which the platinum wires are sealed, are about two inches in length, and half an inch in diameter. They are inclosed in a wooden case, leaving only the spiral exposed. When the discharge from a Ruhmkorff coil is transmitted through the platinum wires, the spiral becomes intensely luminous, exhibiting a brilliant white light. The quantity of the light, however, is small, and it is of no practical value. It is only valuable as an experimental apparatus, or for scientific exhibitions.

Electricity of great tension and power is required for the electric light, and the easiest and least expensive mode of getting it for these experiments is by using a large Ruhmkorff coil, but the current from a battery of 200 cells would answer the same purpose. An electric light, without mechanism at the burner, can be made by placing two carbon points in hollow brass rods which are connected by wires with a galvanic battery. The rods slide in the heads of two glass pillars, so fixed to a stand as to admit of the points being placed at different distances. The wires from the battery poles being properly connected, the points are made to touch, and are then just separated, when the most dazzling light appears, rivaling the light of the sun in purity and splendor. The light is due chiefly to the intense whiteness of the tips of the carbon rods, and partly from an arch of flame extending from the one to the other. The positive pole is the brighter and the hotter, a fact which may be proved by intercepting the current, when the positive pole continues to appear red for some time after the negative pole has become dark. Any kind of carbon is well suited for the points. The more compact forms of charcoal answer very well, but baked carbon answers better. This is made as follows: The fine dust of coke and caking coal is put into a close iron mold, of the shape required for the carbon pencils, and exposed to the heat of a furnace. When taken out, the burnt mass is porous and unfit for use; but by repeatedly soaking it in thick sirup or gas tar, and reheating it, it acquires the necessary solidity and conducting power. The best carbon points, both for brilliancy and durability, are made, however, from the coke that is sublimed inside the retorts in the distillation of coal in gas works. During the maintenance of the light, a visible change takes place in the condition of the poles. The positive pole experiences a loss of matter; particles of carbon pass from it to the negative pole, some of them reaching it, and some being burnt by the oxygen of the air on the way. The same occurs, though to a much less extent, with the negative pole; so that, while the positive pole becomes hollowed out or blunt by its losses, the negative pole is kept pointed by the additional particles.

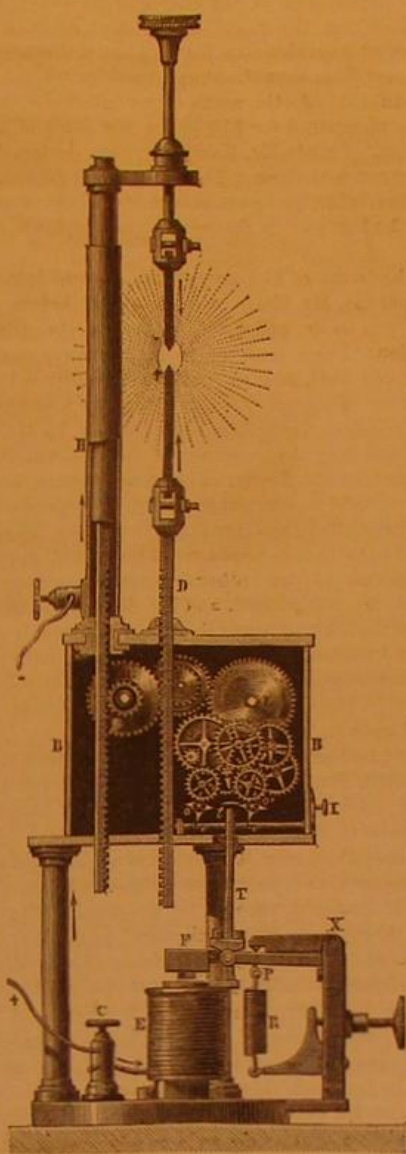
The wasting away, particularly of the positive pole, in a short time renders the distance between the poles too great for the passage of the current, and the light is suddenly extinguished, until again renewed by contact between the carbon points and their separation. If a powerful battery is used, the points may be removed one sixth or even one fifth of an inch before the circuit is broken. The transfer of matter between the poles is considered to account for the existence of the arch of flame, and the passage of the current through the air, as thereby a conducting medium extends between the poles. The light is not caused by the combustion of the carbon, but by its being brought into a state of incandescence. With a battery of fifty Grove or Bunsen cells, a light of very great brilliancy is produced; but when very great power is to be obtained, as well as brilliancy, twice or thrice that number must be employed. Fifty cells give electricity of sufficient tension to produce the light; and if more are used, they should be so arranged as to add to its strength and not its tension. Thus, if 150 cells be used, they should be arranged in three series, the positive poles of all three being joined to form one positive pole, and similarly with the negative poles. With a battery of 50 cells it is not necessary to point the rods, as the action of the electricity will do it. A battery of 50 large-sized Grove or Bunsen cells will produce a light 34 times the power of the lime ball light, or one fifth as great as that of the sun.

Various arrangements have been invented for maintaining the steadiness of the electric light. The aim in all such is to keep the carbon points by some mechanical contrivance within such a distance of each other that the current can pass between them. Duboscq constructed an electric lamp of this description. In it, by aid partly of clockwork, the two points are made to travel towards each other at rates corresponding to those of their consumption, the positive pole in this way traveling faster than the negative.

Foucault's form of regulator, Fig. 1, has two systems of wheel work, one for bringing the carbons nearer together, and the other for moving them further apart. Fig. 1 represents the apparatus, with the omission of a few intermediate wheels. *L'* is a barrel driven by a spring inclosed within it, and driving several intermediate wheels which transmit its motion to the fly, *e*. *L* is the second barrel, driven by a stronger spring, and driving in like manner the fly, *e'*. The racks which carry the carbons work with toothed wheels attached to the barrel, *L'*, the wheel for the positive carbon having double the diameter of the other. The current enters at the binding screw, *C*, tra-

verses the coil of the electro-magnet, *E*, and passes through the wheel work to the rack, *D*, which carries the positive carbon. From the positive carbon, it passes through the voltaic arc to the negative carbon, and thence, through the support, *H*, to the binding screw connected with the negative pole of the battery. When the armature, *F*, descends towards the magnet, the other arm of the lever, *F P*, is raised, and this movement is resisted by the spiral spring, *R*, which, however, is not attached to the lever in question, but to the end of any other lever, pressing on its upper side, and movable about the point, *X*. The lower side of this

FIG. 1.



lever is curved, so that its point of contact with the first lever changes, giving the spring greater or less leverage according to the strength of the current. In virtue of this arrangement, which is due to Robert Houdin, the armature, instead of being placed in one or the other of two positions, as in the ordinary forms of apparatus, has its position accurately regulated according to the strength of the current. The anchor, *T t*, is rigidly connected with the lever, *F P*, and follows its oscillations. If the current becomes too weak, the head, *t*, moves to the right, stops the fly, *e*, and releases *e*, which, accordingly, revolves, and the carbons are moved

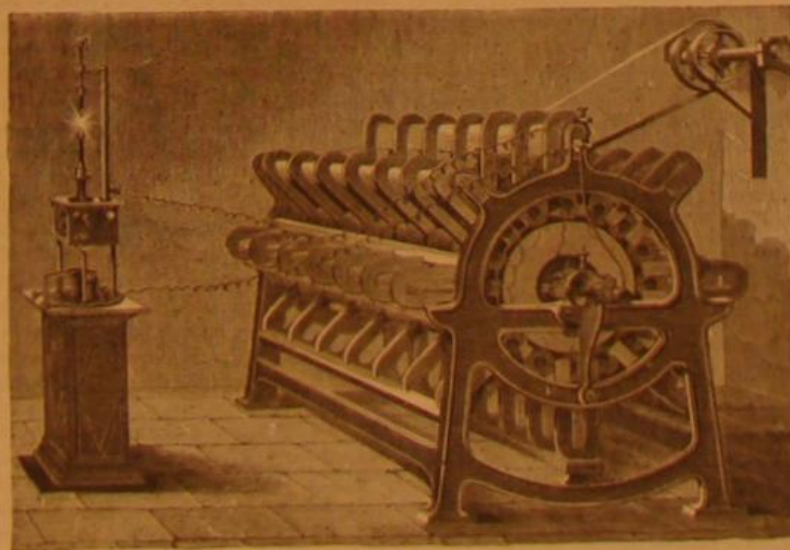


Fig. 2.—MAGNETO-ELECTRIC LIGHT MACHINE.

forward. If the current becomes too strong, *e* is stopped, *e'* is released, and the carbons are drawn back. When the anchor, *T t*, is exactly vertical, both flies are arrested, and the carbons remain stationary. The curvature of the lever on which the spring acts being very slight, the oscillations of the armature and anchor are small, and very slight changes in the strength of the current and brilliancy of the light are immediately corrected.

Mr. Hart, of Edinburgh, Scotland, has invented a simple lamp, in which the weight of the rod, in which the carbon is

fixed, supplies the place of the clockwork in the above described lamp of Foucault, and an electro-magnet lets it descend, or locks it, as the carbons are consumed.

The attempts which have been made to substitute the electric light for coal gas, in lighting up streets and public places, have hitherto proved unsuccessful. One element of imperfect success, in the practical use of the electric light, is due to the uncertainty of the light and the care attending its use. By contrivances like those we have described, the light may be continued for hours; but even then it is by no means steady, and the apparatus cannot be safely left without an attendant. It has, however, been used with excellent effect where a limited space had to be lit up for a few nights, as well as for lighthouse illumination. Its power to penetrate fogs is immensely superior to that of the usual oil light. Lighthouses at Dungeness and elsewhere have been lit with electric lights since 1863, the current being obtained from magneto-electric machines driven by steam engines. Fig. 2 represents the machine. It has eight rows of compound horseshoe magnets fixed symmetrically round a cast iron frame. They are so arranged that opposite poles always succeed each other, both in each row and in each circular set. There are seven of these circular sets, with six intervening spaces. Six bronze wheels, mounted on one central axis, revolve in these intervals, the axis being driven by steam power transmitted by a pulley and belt. The speed of rotation is usually about 350 revolutions of the axis per minute. Each of the six bronze wheels carries, at its circumference, sixteen coils, corresponding to the number of poles in each circular set. The core of each coil is a cleft tube of soft iron, this form having been found peculiarly favorable to rapid demagnetization. Each core has its magnetism reversed sixteen times in each revolution, by the influence of the sixteen successive pairs of poles between which it passes; and the same number of currents, in alternately opposite directions, are generated in the coils. The coils can be connected in different ways, according as great electro-motive force or small resistance is required. The positive ends are connected with the axis of the machine, which thus serves as the positive electrode; and a concentric cylinder, well insulated from it, is employed at the negative electrode. Two of these machines are provided for each light, though only one is used, except in very foggy weather. These are driven by a six horse power steam engine, and all parts of the machinery, including boilers, are kept in duplicate. Coke is used for fuel, and about 56 lbs. are consumed each night. The machines are connected with the lamp by means of underground cables. Each lamp contains two pieces of carbon, about ten inches long by three eighths of an inch square. They are made from coke dust, and are consumed at the rate of thirty four inches per night for each light, at a cost of two cents per inch, exclusive of waste and breakage. They are moved toward each other by means of automatic apparatus; and the only danger of irregularity of the lights arises from the presence of foreign matter in the carbons. This, however, is instantly corrected. The annual cost of the electric light at Dungeness is about \$4,000.

The most powerful light which has yet been constructed is that of the flashing electric light at Soutter Point, England, three miles below the mouth of the Tyne, the condensed beam of which is equal to 800,000 candles.

There are two electric lights situated on the South Foreland, three miles from Dover. These are 1,000 feet apart, one being 372 and the other 275 feet above sea level. The rear light is utilized, by means of totally reflecting prisms, to reinforce the front light, which is required over a range of 180° only. Both lights are fixed. The power of each beam is estimated as equal to 180,000 candles; and when observed from Dover, a distance of three miles, they throw a very distinct shadow from objects on the pier.

In addition to the above mentioned electric lights, there are in France two fixed lights at La Hève, and a revolving light at Cape Gris-nes; in Egypt, a revolving light, at Port Said; and in Russia, a fixed light, at Odessa. The plan in operation at La Hève is very similar to that of the South Foreland. Six-plate magnets, of a power of 145 to 155 lbs., are used, and some three-plate magnets, with a power of 75 lbs. The carbon points are manufactured from the residue contained in gas retorts. They are 10 inches long, and from one third to one half of an inch thick. The optical apparatus is about 1 foot in diameter, and it sends the light tangentially to the surface of the sea. Many accidents, however, have occurred at La Hève; in one instance the lights were extinguished for a space of an hour. Much trouble has been experienced with the machinery, which is now placed in a more satisfactory condition. Of the cost of this light, we have no data later than 1869; but it appears that the average of that and the four previous years was \$3,215.34, the total number of hours of illumination averaging 4,135 annually. The machines are started 10 minutes before the time of illumination, so

that the currents may be well established, and the light is exhibited 15 minutes after sunset, and extinguished 15 minutes before sunrise. Double lights are produced whenever the fog is so dense that the keepers cannot see the beacon lights on the north pier at Havre, and this occurs about eighty hours every year.

The disadvantages attending a general use of electricity are due chiefly to the large amount of space required for the steam engines and the magneto-electric machinery, for storing coal, coke, etc., and for collecting and preserving the

water for the engines. The repairs needed require also special workmen, not usually found in the vicinity of light-houses. Consequently the electric light can at present be made available only in certain localities. It would be disadvantageous in lighthouses at sea, or that are not easily accessible, or those which are distant from centers of population. But where there is plenty of space, and where cities are within easy reach, their substitution for other lights is strongly approved by mariners.

Correspondence.

The Keely Motor.

To the Editor of the Scientific American:

In your paper of June 26 there is an elaborate editorial article entitled "The Keely Motor Deception," in which article you treat the alleged invention of Mr. Keely contemptuously, and speak of him and his "confederates," myself included, as juggling tricksters "whose chief purpose appears to be the wriggling of money out of silly people." I am not willing to believe that journalists professing to conduct a publication devoted to inventions, and advocating, professedly, the rights of inventors, will persist in denouncing an alleged discovery with which personally you are wholly unacquainted, especially when your denunciation involves, necessarily, an assault upon the integrity of reputable gentlemen. I have practised my profession in Cincinnati, O., and in this city uninterruptedly for a period of about eighteen years, for about eight years of which time I have devoted myself exclusively to patent litigation, with probably the average success of professional men: not altogether unknown in my profession, I would be entirely willing now and at all times to leave the vindication of my professional character, when assailed, in the hands of my professional brethren, and to the judges of the courts before whom I have practised. Therefore, if I alone were involved in your article referred to, I should remain silent; but inasmuch as others than myself are also impugned, and inasmuch, further, as the alleged invention of Mr. Keely, for which interest I have been and am counsel, is derided, it is proper that I should publicly notice your article.

The invention of Mr. Keely is controlled by a company organized under the laws of the State of Pennsylvania; and probably I can best vindicate the invention, the inventor, and those connected with him, whom you call his "confederates," by stating in outline my connection with the enterprise up to the present time.

A year ago, several gentlemen of this city, one of New Jersey, and another of New York, held contracts with Mr. Keely whereby they were entitled to certain rights in his invention thereafter to be patented. By mutual consent of the contracting parties, it was agreed to merge their respective rights into a corporate company, thereafter to be organized and now known as the "Keely Motor Company." The writer was asked to act as their counsel. The initial step desired to be attained was the procurement of the requisite amount of money necessary, first, to discharge some indebtedness theretofore contracted by Mr. Keely for materials supplied to him; secondly, to complete his structures then being constructed; and thirdly, to defray the expenses incident to the procurement of letters patent in our own and in foreign countries. At this time, personally I knew but little of Mr. Keely's invention. I had seen in his workshop, a room say ten feet square, a "receiver" charged with a vapor or gas having an elastic energy of 8,000 lbs. to the square inch. I interrogated Mr. Keely critically as to how he had produced this substance; pointing to an inoffensive-looking machine, which stood in close proximity to the receiver, he said to me that he introduced a certain quantity of air into that machine under no greater pressure than was the capacity of his lungs, a certain quantity of water under no greater pressure than was the ordinary hydrant pressure at his residence, and then, by a simple manipulation of the machine, unaided by any chemical substances, heat, electricity, etc., he converted a small portion of the introduced water and air into the cold vapor then contained in his receiver. My credulity, as may be supposed, was taxed to its utmost limit. Before undertaking to enlist a dollar of capital in the enterprise, I instituted the most careful inquiry as to the character of Mr. Keely. Those of whom I inquired endorsed his integrity in unqualified terms; and one gentleman, Mr. Boeckel, for whose mechanical ability and moral integrity I had great respect, and who knew much of the invention, and who spoke without having a fragment of interest in the invention, impressed me greatly by what he communicated to me. So also did Mr. Rutherford, Chief Engineer, U. S. Navy. Thereupon, I had a conversation with Mr. Keely, in effect as follows. I said to him: "Mr. Keely, you profess to be grateful to me for kindnesses received at my hands, the importance of which, indeed, you greatly exaggerate. I am asked to become the exponent of your invention, and to enlist capital for its development. While I may with propriety expend my own money as I please, I cannot, except with greatest caution, enlist the money of others. You, Mr. Keely, know absolutely whether you produce the results which I have seen as you state to have produced them. This, with you, is not matter of opinion, but of absolute knowledge. If, therefore, you do not so produce these results, and I, upon the supposed truth of your statement, am the means of procuring the capital of others to be invested in your enterprise, I will have suffered at your hands as great a wrong as one man can inflict upon another." He reassured that which he had before said in the most solemn language. I reduced his declaration to writing, and he signed it, I at the same time telling him, in the presence of his wife, that,

if I procured a dollar for the enterprise, it would be based upon the truth of his written declaration, which, if false, made him a criminal, and that for my own vindication I would see that he was appropriately punished. With such precautions I visited your city, called together some of your best known and influential citizens—among whom was Charles H. Haswell, Esq., who himself, prior to this time, had visited Mr. Keely's place, seen his receiver when charged with this enormous vaporic pressure, and had reported upon it. I said to these gentlemen that I had not seen Mr. Keely make the power, and therefore had no personal knowledge of how it was done; stating, at the same time, however, the result of my inquiries as to his character as above, and, further, that there was the negative evidence, afforded by the total absence of anything (so far as I could discover) to produce the power other than the simple machine whereby he claimed to produce it. As the result of my interview, the gentlemen present subscribed for \$10,000 of the stock of the proposed company. I made Mr. Keely's written declaration a part of my contract with them. They paid to me \$3,000. I returned to Philadelphia, and gave this to Mr. Keely; and within two hours, he had paid to the constructors of his machine \$2,850 of it.

By the terms of the agreement, entered into by me with these parties, Mr. Keely was obligated, before any further money was to be called for, to explain the principle of his invention. I took with me to his place my engineering assistant, Mr. Bell, and we entered upon the subject, but neither of us—although having before us a sectional drawing of the machine, made from the machine, by Mr. Bell—could understand why the result would follow from its operation, as claimed by Mr. Keely. I so stated to him, and requested that he should repair, put together, and operate the machine (then dismantled), and produce for me the result which he claimed to be able to produce. This he did, giving to me (in the presence of ten other gentlemen, among them Mr. Boeckel, Mr. Rutherford, and Mr. Bell) an exhibition on the night of the 10th of November, 1874, the result of which exhibition I reduced to writing and subsequently to print, for the information of those only who were interested in the enterprise. This report you evidently have seen, as it is commented upon in your article.

After I had written this report, I submitted it to Messrs. Rutherford, Boeckel and Bell, for their careful examination, and for their endorsement of it, if they found it correct. They gave it their unqualified endorsement. Next, I submitted it to Professor B. Howard Rand, of this city, an eminent scientist, as a precautionary measure, in order that he might, if he could, account for the results alleged to be produced, through any known chemical agencies or laws of physical forces. He said that, assuming the truth of my statements of facts—for he had not seen the machine, and of his own knowledge knew nothing of it—he could not account for the results alleged to have been produced upon any known chemical or philosophical principles; and at my request, he reduced this statement to writing. He was not asked, and did not assume, to endorse the Keely motor, and your assertion that he did so is purely gratuitous, and places him in a false position before the public. With this report thus prepared, I proceeded again to New York, submitted it to the parties with whom I had contracted, stated to them that, while I did not understand the ultimate philosophical principle involved in the production of this vapor, I was convinced that it was produced precisely as asserted by the inventor; that I stood ready to return to them their money previously advanced, if they desired to withdraw from the enterprise. They did not so desire, but on the contrary paid to me the balance (\$7,000) of the \$10,000 subscribed, which money was subsequently from time to time disbursed for the construction of apparatus connected with the invention. (1) My original contract with these parties gave to them an option of \$40,000 more of the stock of the company at its par value. Prior to the agreement out of which this company had its origin, the individuals then holding contracts under Mr. Keely had themselves entered into a contract with some parties looking to the disposal of rights in the New England States, which contract became obligatory upon this, the Keely Motor Company. Under and by virtue of the several contracts, the contracting parties were entitled to an exhibition of the production and practical application of this power. This has been given to them, and was witnessed by about 30 gentlemen, among whom were many men of long and extensive experience in the construction and operation of machinery, such as steam engines, air-compressing machinery, electrical apparatus, etc. As the result of such exhibition, the parties respectfully have, un urged, paid to the treasurer of this company an aggregate, with the ten thousand dollars referred to, of one hundred thousand dollars. This company, with the single exception above referred to, has not sold or offered for sale a dollar of its stock; neither has it desired to give any publicity to its business, until it shall be ready to introduce to the public its machine.

Of the money which has thus been paid into its treasury, Mr. Keely was entitled, in his individual right, to the sum of fifty thousand dollars. This, however, he yielded to the company, stating that he did not desire to make a dollar of profit out of his invention until patents had been obtained, and he had established, to the satisfaction of the world, the validity of his assertions. After having long been living in most humble circumstances and working under great disadvantages, a comfortable house and a convenient workshop have, without his solicitation, been purchased for him, and he is now giving his undivided time to the completion of his structures. That he is endeavoring to "wriggle money out of silly people" or out of any one, I believe to be a monstrous calumny. The money which has been paid into the treasury

of the company, it is the declared policy of the company to retain intact for the completion of its various structures now in progress, and for the procurement of letters patent throughout the world. As for myself, I have given to the development of this invention and to the affairs of this company my almost undivided time for a period of several months, having the meanwhile to beg the indulgence of clients for whom I have the charge of important causes, and have not been compensated to the extent of a dollar; my declared policy having been to attest by my actions the confidence that I have professed, in the genuineness and value of Mr. Keely's inventions, resting content to await that moderate degree of fame and of fortune which shall probably be mine, if the correctness of my judgment shall be vindicated in the future. So much, personally, as to Mr. Keely and his "confederates." (2) Now what about the invention?

In my report of November 10, I undertook to narrate as precisely as I could facts which I had observed. I state therein substance, and I now reiterate that I saw:

First: The apparatus, of which I at the time had an accurate sectional drawing made from the machine, subjected to such tests as I believe would have satisfied any intelligent mind, as the tests did satisfy the minds of the eleven persons present, that there was nothing in the apparatus but air at atmospheric pressure.

Second: I saw the inventor blow from his lungs, for the period of, say, 30 seconds, into a nozzle upon the "generator;" then I saw him connect this nozzle by a small rubber tube with the nozzle of his hydrant, and introduce water direct from the hydrant through this rubber tube into the "generator" until say five gallons of water had been thus introduced under a pressure, as indicated by a gage applied to the hydrant, of 26½ pounds, the communication with the hydrant being then cut off.

Third: A connection being then made between the generator and a register of force, by a tube of one tenth inch bore (the register of force consisting of a piston of one square inch area, pressed down in a cylinder by a lever of the third order, and weighted so as, according to the calculations of Mr. Rutherford and Mr. Bell, to require upwards of 1,430 lbs. to the square inch to raise the lever.) I saw Mr. Keely, by a very simple manipulation of his generator, requiring no more force than a child could exert, make an "expulsion," as he terms it, of his vapor, and with it raise this weighted lever; and this he repeatedly did.

Fourth: I saw him, in the same manner, make expulsions filling a chamber of 3½ gallons capacity, with his vapor, at a pressure proved to be a fraction less than 2,000 lbs. to the square inch. This operation I saw repeated several times, and saw the produced vapor conducted through a tube of the dimensions aforesaid upon, not "a dollar toy engine," but one which did not cost less than two hundred and fifty dollars to construct, which was run at a speed of several hundred revolutions a minute, developing no inconsiderable power. (3) These expulsions were made in an inappreciable period of time, unaccompanied by noise or the use of heat, and without appreciable production of heat.

Now, what I assert is stated not as matter of opinion, but of fact. You may deny the fact and assert that I falsify. If so, I retort that you are ruthless traducers of character, and will hold you personally responsible for defamation. Again, you may, with propriety, assert that I am mistaken. To this, I will reply that what I saw was witnessed by ten other gentlemen, who will at any time attest to my accuracy, and three of whom, at least, were of equal ability with yourself. Again, you may accept the truth of the facts and undertake to account for the results upon other hypotheses than as claimed by the inventor, and to disparage their importance. You have in your article of the 26th inst. undertaken to account therefor. While I have not space to review your attempted solution of the matter, I will simply say that, if the writer of your article had seen and examined Keely's generator, and another, not seeing it, had written what appears in your columns, your editor would have said he was a fool. I simply say he is mistaken. Again, I have repeatedly seen, in Mr. Keely's workshop, a receiver with a capacity of twenty-six gallons, containing his vapor at a pressure of 10,000 lbs. to the square inch; I have seen this vapor conducted through a tube of one tenth inch bore to an engine which was propelled by it at a speed of about 1,500 revolutions a minute, developing a power of certainly 10 horses. This fact I can corroborate by the testimony of scores of persons: among them some of your best known and most influential citizens. You think that we confound "pressure with power." We do not. We understand, probably as well as you do, the distinction between "pressure" and *vis viva*. You may say, accepting the fact, that it is condensed air. If so, please enlighten us as to the means whereby it could be so condensed. You may say that it is a gaseous product from chemical action; remarking that this vapor is totally negative in its properties and pure as mountain air, please inform us from what chemical substances it may in your opinion have been produced. I append hereto some communications addressed to me on this subject.

In conclusion, I would repeat that the Company I represent is a private corporation. It does not offer, nor has it offered, its shares in the open market, nor can it be held responsible for the action of individuals who, having acquired, may have again offered its shares, which was, however, their undoubted right. It will not, in "thirty days," though I believe it will before many months have expired, exhibit to the world that which it claims to have. In the meantime, it has not sought nor does it now seek notoriety; but the invention on which it is based having, through newspaper correspondents, been publicly discussed, we must expect, and do not shrink from, fair and legitimate criticism; and if you

Messrs. Editors, can satisfactorily explain or account for indisputable results which are astonishing in their character, and have produced profound impressions upon many excellent and able men, no one will be more grateful to you than

CHAS. B. COLLIER,

Attorney and Counsel, Keely Motor Co.

702 Chestnut street, Philadelphia, Pa. June 28, 1875.

(1) REMARKS.—It appears, from your present evidence, that Professor Rand never saw your machine, nor your cold gas or vapor, and yet you induced this eminent scientist to give you a professional certificate about nothing, which, with other statements, you submitted to the New York capitalists on behalf of the Keely Motor, and they paid you \$7,000.

(2) See our remarks on page 33.

(3) In your report you affirmed that you ran a small beam engine, but did not give its size. We stated that, "Judging from the Barker wheel with 2½ inch arms, this 'beam engine' was probably about the size of a dollar toy engine." You now state that the engine cost not less than \$250; but you are silent as to size. Mr. Gloeker, however, tells us that it had a 3-inch stroke with 3-inch cylinders. You say in your report that you ran this miniature engine at the rate of 400 revolutions per minute, but you do not venture to affirm that you ran it for so long a period as one entire minute. You state, however, that you worked the whirling for that space of time. "At 9:3 P. M. the reaction wheel was again rotated until 9:50 P. M." This is the only complete period of running time cited in your report for either of the little devices. It was on the strength of this contemptible exhibition, made to you by Keely, so you now tell us, coupled with your report thereof backed by Haswell's and Rand's certificates, that you got the New York parties to pay up the balance of their \$10,000 subscription. We accept your confession of facts without denial.

Communication of John W. Keely.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.:

In view of publications in the SCIENTIFIC AMERICAN deriding me and my invention, I feel it to be my duty to depart from my intended policy of making no public declaration relative to my invention. I now publicly assert that I have produced the results which many persons have seen, in the precise manner heretofore stated, to wit, the introduction of atmospheric air into my machine, a limited quantity of natural water direct from the hydrant at no greater than the ordinary hydrant pressure, and the machine itself, which is simply a mechanical structure. With these three agents alone, unaided by any and every chemical compound, heat, electricity, or galvanic action, I have produced, in an inappreciable period of time, by a simple manipulation of the machine, a vaporic substance, at one expulsion of a volume of ten gallons, having an elastic energy of ten thousand pounds to the square inch (4). This I solemnly assert, and am ready to verify by my oath. I only ask of the public their indulgence until a new and perfect machine, now rapidly approaching completion, is finished when I will publicly demonstrate that which I now publicly assert.

Philadelphia, June 25, 1875.

JOHN W. KEELY.

(4) Counsellor Collier gives, on the preceding page, a more detailed statement of the way you produce your "cold vapor," as ascertained by himself and "scores" of intelligent witnesses. He does not agree with you that it is done "in an inappreciable period of time." He affirms that you blow into the "generator" for half a minute, that you then turn in five gallons of water, and then proceed to manipulate the machine, when the "vapor" appears. Juggles more marvelous than yours have been executed by skilled practitioners in less time than you require.

Communication of G. F. Gloeker.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.:

DEAR SIR:—Having constructed for John W. Keely, Esq., the multiplier with which he operated on the 10th of November, 1874, referred to in your report, I desire to state that said multiplier is correctly represented in the sectional drawing made by Mr. J. Snowden Bell, and now in your possession. I further state that, in said multiplier, there are no secret chambers or recesses in which chemicals or compressed air could be contained, and no spaces not fully accessible to a stream of water passed through the apparatus; further that, in said apparatus, there are no pistons or moving parts other than valves.

I have also constructed for Mr. Keely a vertical direct-acting double cylinder engine, having cylinders of 3 inches bore and 3 inches stroke, and a fly wheel 24 inches in diameter and 4 inches face, weighing 200 pounds, which engine I have seen rotated at a speed of not less than 300 revolutions per minute with vapor generated in said multiplier.

A small wrought iron chamber, of a capacity of 1½ gallons, which I made for Mr. Keely, was delivered to him by me on May 13, 1875, about 8 A. M., the chamber being at that time open at one end; and upon the evening of the same day, said chamber, to my knowledge, contained vapor at a pressure of 10,000 lbs. per square inch and upwards, as evidenced by both a gage and a weighted lever.

I am 51 years of age, and have been employed at the Port Richmond Iron Works of Messrs. I. P. Morris & Co., Richmond and York streets, Philadelphia, for nearly 28 years last past. I have for a long time been in charge of their tool room, and in the course of my experience at their works have had knowledge and observation of machinery of various descriptions constructed by them. In view of recent publications respecting the Keely motor, I submit the above statement as an evidence that my experience has been such as to enable me, at least, to form a correct judgment as to the operation of apparatus of my own construction.

Respectfully yours,

G. F. GLOEKER.

Philadelphia, June 25, 1875.

Communication of Wm. Boekel.

PHILADELPHIA, Pa., June 25, 1875.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.

SIR:—In answer to the accusation published in the SCIENTIFIC AMERICAN newspaper, that I have, with others, been engaged in a fraud upon the public, through my connection with the invention of Mr. Keely, I desire to state as follows:

I am now 50 years of age, have lived in Philadelphia since 1848, and have devoted my lifetime to mechanical pursuits, in the practice of which I gain my livelihood. I refer to all who know and deal with me as to my honor and integrity. Had the editor of the SCIENTIFIC AMERICAN instituted inquiry as to my private character and business standing, he might have been fully impressed with the responsibility he incurs in denouncing me as a confederate in fraud of any description, more especially in reference to my connection with a matter of which he knows absolutely nothing.

I have read the communication of John W. Keely, of this date, addressed to you. I have for several years been inti-

mately acquainted with him, and with his inventions. I have seen him produce many "expulsions" from his generator, whereby, to my own personal knowledge, he evolved a cold elastic vapor, in volume of 3½ gallons, at a pressure of about 2,000 pounds to the square inch. I believe that it was impossible for him, if he had so desired, to practise any deception in the matter; and from what I have seen, together with my intimate knowledge of the construction of the machine and its operation, I have no doubt whatever that he produces the results just as he claims to do, and as stated in his said communication.

Respectfully yours, WM. BOEKEL.

Communication of H. C. Sergeant.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.:

DEAR SIR:—My acquaintance with Mr. John W. Keely began about one year ago, and I have been permitted, from time to time, to witness certain exhibitions made by him with his vaporizer or generator, producing a vapor, transmitting it to, and running his engines. I have been permitted to examine the internal construction of his generator, and I am fully satisfied that Mr. Keely has discovered that there exists a power in air and water which, by purely mechanical manipulation, will evolve a cold vapor; and, by peculiar graduations of his machine, he is capable of producing a pressure of 10,000 to 15,000 lbs. per square inch in a receiver of greater volume than that contained in his generator, with great rapidity and certainty.

Yours very respectfully,

HENRY C. SERGEANT.

382 Second Avenue, New York, June 26, 1875.

This gentleman, in another confession of faith in the Keely motor, published in the New York Times of July 3, 1875, says:

"One of the remarkable things about the Keely motor is that it (the new vapor) cannot be transmitted at a lower pressure than 1,000 lbs. (per square inch). It can be used, of course, at a lower pressure, after it is put in action. It can be regulated like steam, but its transmission at less than 1,000 lbs. pressure causes its condensation."

This is a curious statement for an intelligent steam engineer to make. If its transmission at a less pressure than 1,000 lbs. causes its condensation, then it must necessarily condense when moved under any circumstances below that pressure. It cannot be used unless it is "transmitted."

Communication of Chas. H. Haswell.

NEW YORK, June 26, 1875.

CHAS. B. COLLIER, Esq., Philadelphia, Pa.:

DEAR SIR:—Your letters of the 23d and 24th instants, in relation to a brief communication of mine, in reply to an unfounded assertion in one of our city papers, are this day received; and although I am indisposed to make any communication regarding the Keely motor until its elements of operation are made known to me, I cannot refuse to reply to your queries as to the nature and extent of such of its operations as have come under my observation, and my deductions therefrom.

Referring, then, to your several queries, in the progressive order of the operations submitted to and observed by me, I advise:

1st. I have witnessed the development, by Mr. Keely, of a cold vapor, void of pungency or of temperature in excess of the surrounding atmosphere, having an expansive energy of fully 7,800 lbs. per square inch, as tested by my measurements and computations thereon.

2d. I have been present when Mr. Keely has applied a like vapor to an Ashcroft gage, and the index pointed to a pressure of 10,000 lbs. per square inch; and upon writing to Mr. Ashcroft, to advise myself of his capacity to make such a gage, he replied that he had made gages that would indicate such pressure, and that he had delivered some of them at Philadelphia.

3d. I have satisfied myself fully and conclusively that the instrument of Mr. Keely was operated wholly independent of any external attachment, other than that of a chain suspension and a flexible connection with a water service pipe.

4th. I have seen a double cylinder engine, 3 by 3 inches, operated by a like vapor from a reservoir, through a conducting pipe eight feet in length, and having a bore of but one tenth of an inch diameter, although it was resisted by a friction load equal to 2,250 lbs. per square inch, and which engine I individually operated for a period of 15 minutes without any visible reduction in its speed, or indication of the exhaustion of the intensity of the vapor in the reservoir from which the supply was drawn.

5th. I have seen reservoirs which were said to contain vapor at pressures of 5,000 and 10,000 lbs. per square inch, and in volume of 2 and 26 gallons, but my only means of verifying such pressures were in the operation of the engine and the indication of the steam gage referred to.

6th. I am of the conviction that the vapor is not generated by any chemical decompositions or heat, or that it is atmospheric air compressed by an external connection.

7th. I was present upon one occasion only when Mr. Keely essayed an "expulsion," as he terms it, that is, the operation of generating the vapor, and the result was not sufficiently conclusive whereon to base a conviction of its integrity, although the imperfection of the development was very reasonably attributed to the imperfections of the original and rude instrument of generation.

In conclusion, my assertion, in the communication referred to, was that I have never endorsed the integrity of the Keely motor; and my declaration is, I do not now do it, and for the manifest reason that I am wholly ignorant of the manner in which the vapor is generated; and in the consideration of a physical operation, I could not, in the absence of a knowledge of its elements, endorse the declaration of any one.

My position has been confined to reporting that which I have seen. I have said, however, and I now write, that Mr. Keely has submitted to me a cold vapor of an expansive energy of fully 10,000 lbs. per square inch, that in its character and in the instruments of its generation it is wholly novel, and that, if he can generate it with the facility, economy, density, and continuity that he declares, he has arrived at a result hitherto unattained, and one that is as valuable as it is novel; but until I am in the possession of the elements of generation of this vapor, I cannot arrive at any satisfactory conclusions as to its merits.

I am, very respectfully, yours, etc.,

CHAS. H. HASWELL.

Mr. Haswell, it will be observed, strongly asseverates that he does not now and never did endorse the Keely motor, being wholly ignorant of the manner in which "the vapor" is made, or the physical operation, by which it is produced. He further intimates that the attempt to manufacture the vapor in his presence was a failure. At the same time, he affixes his name to a certificate which more strongly supports the deception than any document which the parties immediately connected with the "generator," and who know all about its "physical operation," have ventured to sign. It appears, from Collier's statement, to have been mainly on

Mr. Haswell's report that the New York people were induced to pay their money.

In the fourth paragraph of the above, Mr. Haswell fails to state the speed of the engine or the capacity of the reservoir. But according to the Keely Company's account of the apparatus used during the exhibition at which Mr. Haswell officiated (see SCIENTIFIC AMERICAN, May 2, 1874), the "generator" was of globular form, 3 inches thick and about 15 inches in exterior diameter, connected with an iron cylinder 40 inches long, ¼ inches interior diameter, capacity 3¼ gallons.

Mr. Collier has rated the speed of the engine at 400 revolutions per minute. Mr. Haswell's statement in the fourth paragraph, therefore, purports that, from a generator containing about 3¼ gallons of the vapor, he personally operated a double cylinder engine, having cylinders of 3 inches bore and 3 inches stroke, for a period of 15 minutes, without the least indicated reduction of the pressure contained within the generator. If we are wrong in this estimate, Mr. Haswell will correct us.

Communication of J. Snowden Bell.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.:

DEAR SIR:—Having been cited in an issue of the SCIENTIFIC AMERICAN, dated the 26th inst., as one of the "confederates" of Mr. John W. Keely in a "juggling exhibition," etc., I desire to state:

1. My connection with the operation of the invention of Mr. Keely, which is designated as above, consisted in my attendance upon an exhibition thereof, given by him November 10, 1874, and in my attestation, over my signature, of the correctness of a report, made by yourself, of said exhibition.

2. Such attestation was given after a thorough and critical examination of the working of the apparatus of Mr. Keely, and related solely to matters of fact entirely within my own knowledge. I now publicly and emphatically reiterate and reaffirm my endorsement of said report, and declare further that, if I desired confirmation of the evidence of my own senses, I should find it in the utter inability of the most determined opponents of the invention to furnish any "deception" theory, accounting for the results produced, which is compatible with the conditions of the operation, as witnessed by me.

3. I have examined the patents mentioned in the SCIENTIFIC AMERICAN article above referred to, and find that there is no manner of analogy between them and the invention of Mr. Keely. As to the suggestion of an experiment to be made with "ten communicating water tubes," I have to say that, while I am prepared to admit that the exertion of 620 pounds initial pressure upon air in a close vessel would evolve a corresponding resultant, I am unable to perceive what relation exists between such familiar fact and the evolution of vapor of 2,000 pounds pressure to the square inch from water and air at an initial pressure not greater than 26 pounds to the square inch. I further admit that, if a weight of 1 pound be hung upon the long arm of a lever, the arms of which are to each other as 10,000 to 1, it will balance a weight of 10,000 pounds upon the short arm; but as no such lever was used in the exhibition of November 10, 1874, this explanation must likewise be dismissed as insufficient.

Respectfully yours,

J. SNOWDEN BELL,
Mechanical Engineer.

Communication of Wm. H. Rutherford.

PHILADELPHIA, June 26, 1875.

CHAS. B. COLLIER, Esq., Attorney Keely Motor Co.:

DEAR SIR:—I have read the editorial article which appeared in the SCIENTIFIC AMERICAN advanced issue, dated 26th inst., entitled "The Keely Motor Deception," and presume I am included as one of the "confederates" of Mr. Keely, with yourself and others.

I was present at the exhibition given by Mr. Keely on the night of November 10, 1874, of which you made a report dated November 13, 1874. This report being submitted to me, I carefully examined it, and gave to it, and to the conclusions therein stated, my unqualified endorsement, and I now re-affirm the same.

I have read the communication of Mr. John W. Keely addressed to yourself dated the 25th inst., and of my own knowledge can and do attest to the truth of that which he there-in asserts. Respectfully yours,

W. H. RUTHERFORD,
Chief Engineer, U. S. Navy.

(6) The following is, substantially, the report of the Keely exhibition of November 10, 1874, which Mr. J. Snowden Bell, M. E., desires now to "publicly and emphatically reiterate;" and to which W. H. Rutherford, Chief Engineer U. S. N., now re-affirms and gives his unqualified endorsement:

"Mr. Keely then proceeded to make an 'expulsion,' that is to say, to develop a force or pressure from the multiplier sufficient to exert a pressure of 1,430-36 lbs. This he did by blowing from his lungs, for, say, thirty seconds, into the nozzle upon the multiplier. He then shut the cock and turned on the water from the hydrant. The operation was completed in about two minutes after the attachment to the hydrant was made, by simultaneously opening two cocks upon tubes connected with the first and second drums, when the lever and weight of the force register were raised." The operation of the engines now took place as follows:

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P. M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P. M., the reaction wheel was removed, and connection applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P. M., the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P. M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplier was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus." These remarkable pieces of machinery were, according to this report, run for a minute or two at a time, at various intervals, extending over an entire period of 15 minutes. There was no heat and no noise save that of running water when the car was placed against the multiplier.

"The report, after giving the foregoing facts in regard to actual performances, summarizes the results, which we condense as follows: 1. The invention produced a series of gaseous expulsions of 2,000 lbs. per square inch. 2. The force was almost instantly produced. 3. It moved instantly through a distance of 12 feet. 4. It was attended with no noise. 5. Nothing was or could have been introduced into the apparatus to produce the force. 6. No heat, electricity, or galvanic action was discernible, except that electric sparks were observed in the spur gearing of the engine, caused by friction. 7. Hydrant water, 26 lbs. to the inch, was admitted. 8. The water was drawn off unchanged after the performance. 9. The vapor had no smell or taste, and did not burn. 10. The interior of the apparatus was found to contain no residuum or substance other than air and water. 11. The operations were conducted by gas light. Every facility for the closest investigation was offered to the persons present."

IMPROVED RAILWAY TRACK.

The invention illustrated herewith consists in securing the rail upon an elastic continuous bed, by a simple method of fastening which dispenses with the nuts, bolts, and other means usually employed for that purpose. The principal advantages claimed are that the wear of rail and rolling stock will be lessened, and that there will be less probability of breaking rails owing to the elasticity of the bed.

A, Fig. 1, is a wooden beam which forms the bed upon which the rail rests. The base of the rail and all of the beam are inclosed in the space formed by the inverted T-shaped metal bars, B, one of which is shown detached in Fig. 2. These have inner base flanges which meet beneath the beam. The bars are tied together by metal plates, C, and screw bolts, the nuts of the latter being prevented from working loose by the elasticity of the wooden bar. The vertical part of each of the bars, B, is curved inward at the top, forming ribs which bear on the base of the rail.

The inventor states that the cost of altering the tracks of a road, to conform to the above described plan, will involve only the extra expense of a light steel or iron rail, as the old rails will make the flanged pieces, and the saving of ties, the sleepers. The flanged pieces are put together with alternate splices, and their hold on the rail increases proportionally with the load. They are easily loosened by inserting a bar under the bases and prying upward, this causing their upper portions to spread apart, when the rail and bed may be readily removed.

Patented March 3, 1874. For further particulars address the inventor, Mr. Geo. Potts, Unionport, Jefferson county, Ohio.

Uninflammable Products.

It is well known that certain substances, notably phosphate of ammonia, incorporated in the fibers of tissues render the same incombustible, or, rather, admit of their burning very slowly and carbonizing with the production of flame. M. L'Abbé Mauran, says *La Nature*, has recently discovered that a mixture of borax, sulphate of soda, and boracic acid, in suitable proportions, while rendering cloth uninflamable, will also prevent any alteration of color, flexibility, or lasting qualities through the effect of combustion.

IMPROVED FIRE BOX FOR LOCOMOTIVE FURNACES.

It is a common fault in locomotive furnaces, made in the usual way, that the flanges and rivets of the end sheets, at the points where they are connected to the side sheets, soon become burnt, and thus cracked and leaky. The result is that the end sheets have to be renewed several times before the sides are worn out, involving considerable trouble and expense. To obviate this difficulty, the invention illustrated in the annexed engraving has been devised, and it consists in forming the side sheets to bulge inward throughout the entire width, as shown in Fig. 2, at A; or where the central portion of the sheet is on the same plane as the joints, bulges, B, Fig. 3, may be made adjacent to the flanges to protect said joints. In Fig. 1 is given a view of the interior of the fire box, showing that the device causes but a slight modification of the usual form. By this means, it is claimed, the joints are protected from the intense heat of the fire, and are preserved and rendered as durable as any other portion of the furnace. The cost for the labor of making a locomotive fire box of this design is, we are informed, only three to five dollars in excess of that of constructing the box in the usual way. The iron for the side sheets is required to be from one and a half to two inches longer than when the sheets are made straight.

Patented through the Scientific American Patent Agency, April 27, 1875. For further particulars address the inventors, Messrs. W. Dawson and J. Hughes, Scranton, Pa.

Spirit Photography under a Cloud.

M. Buguet, of Paris, a spirit photographer, came to London early last summer, and, after advertising in this journal for premises, he obtained them, where he received many visitors and sitters. Was not the genuineness, it was asked, of the spiritual origin of the Buguet photographs attested by Mr. W. H. Harrison, a whilom contributor to this journal, and the present editor of the *Spiritualist*? And did not a whole host of *dilettanti*, including the names of some who stand very high in Science, say it was all correct? And were not all the uncles, aunts, grandfathers, grandmothers, and other relatives of several of the sitters recognized in these spirit photographs? All this, we admit, is quite true.

Returning to Paris from this country, and laden with what were the equivalents of testimonials from men of note—fellows of the Royal Society, lecturers in University College, editors, and simple commoners—M. Buguet practised "spirit photography" with renewed zeal in that gay capital. Par-

isian policemen seem to have been materialistic to an unusual extent; they wished to know more about this kind of practice. One fine morning two of the "force"—one of them an inspector, the other a photographer—called upon M. Buguet to have a spirit photograph taken. Waiting till the dark slide with its sensitive plate was about to be inserted in the camera, they produced their warrant, had a developer applied to the as yet *unexposed* plate, and saw a "spirit" developed.

Fig. 1

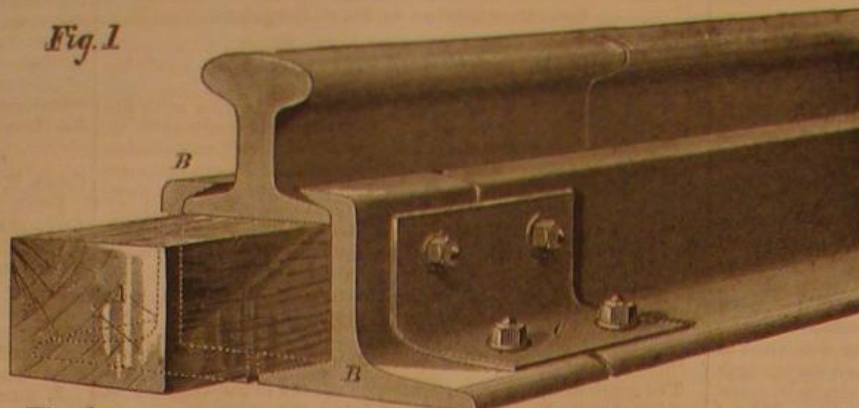


Fig. 2



POTTS' RAILWAY TRACK.

A search was then made, the originals of this and other spirit forms were discovered, and the ingenious photographer was subsequently lodged in "durance vile," from which, after confessing that he was an impostor, he was liberated on bail. In the meantime spirit photography has still many true believers in London; and, although the editor of one of the weekly periodicals devoted to this topic denounces Buguet as a "thorough scoundrel," that of the other looks upon him as a kind of Galileo, who has made a confession he knows to be untrue in order to be released from prison, quite overlooking the fact of the seizure, by the police, of the tools and implements by which the trade in the so-called "spirit photographs" was carried on.

It is said, however, that many of the "spirits" evoked by M. Buguet have been recognized. Far be it from us to say

Remarkable Railroad in Switzerland.

A railroad has recently been opened to the summit of Mount Uetliberg, Switzerland, which overlooks, at a height of about 1,300 feet, Lake Zurich, and is much visited by tourists for the sake of the view. The total length of the road is about 30,000 feet, or more than 5½ miles. The lowest grade is 232 feet per mile, but 59 per cent of the whole length is of grades exceeding 264 feet per mile. The curves are of 500 and 450 feet radius, the latter coinciding with a grade of 327 feet per mile. The track is of the standard gage, and the rails, of iron, weigh 60 lbs. per yard. There are three tank locomotives of the Krauss pattern, with six drivers coupled, each 36 inches in diameter, and with a wheel base of only 6 feet 8 inches. They weigh 41,800 lbs. empty, and in service, from 52,800 to 55,000 lbs. The heating surface is about 770 square feet, the diameter of piston 12½ inches, the stroke 21¼ inches.

The first ascent was made April 24 of this year. The engine pushed up three cars loaded with ballast and workmen, a total gross load of 27½ to 30 tons. This load was moved without difficulty at a speed varying from 8 to 10½ miles per hour, maintaining a steam pressure of 170 lbs.

The descent is made with compressed air, by means of an apparatus used on the engines of the Rigi Railroad. The speed was 15½ to 18½ miles per hour.

At trials made by the professors of the Zurich Polytechnic School, the weight hauled was about 627½ tons, the traction exerted about 7,500 lbs., and the work about 200 net horse power.

A peculiar feature in the working of this road is the use of a jet of water against the rails, in front of the wheels of the locomotive, sufficient to wash the rails completely. It was observed long ago that the influence on adhesion of a slight humidity such as that deposited by a fog, and that of a veritable layer of water deposited by rain, are entirely different. On the Swiss Central Railroad, a jet of water is used on the front wheels of certain engines to facilitate the passage around curves, and the effect on the durability of the tyres has been remarkable; but this jet of water, which was only intended to lubricate the inside part of the rail head, moistens the whole surface in contact with the tyre. No modification of the adhesion has been observed as the result of this; this jet of water does not dispense with the use of sand, while at Uetliberg absolutely no use is made of sand, but water is employed exclusively.

Another Swiss mountain railroad, the Rigi Kulm and Lake of Zug line, is about seven miles long; six miles of it are worked with a peculiar cogged wheel arrangement, or something similar in effect, by which grades of 1,056 feet per mile are surmounted, there being one section more than a mile and a half long with a grade very little less. The radii of the curves, which are uniform, is 600 feet.

Water and its Inhabitants.

The quality of water in relation to its fauna and flora has been the subject of investigation by some of the French Academicians. In substance, the results seem to prove that water in which animals and plants of higher organization will thrive is fit to drink; and on the other hand, water in which only the infusoria and lower cryptogams will grow is unhealthy. If the water become stagnant and impure, aquatic plants of the higher order will languish and disappear, and the half-suffocated fish will rise near the surface and crowd together in parts where there may still be a little of the purer element trickling in, and if driven from these places they soon die. *Physa fontinalis* will only live in very pure water; *valvata piscinalis* in clear water; *limnaea ovata* and *stagnalis* and *planorbis marginatus* in ordinary water; and finally, *cyclops cornua* and *bithynia impura* in water of middling quality; but no mollusk will live in corrupt water. Plants also exercise a reactive influence on the quality of water. The most delicate appears to be the common water cress, the presence of which indicates excellent quality. Veronics and the floating water weeds flourish only in water of good quality. The water plantain, mints, loosestrife, sedges, rushes, water lilies, and many others grow perfectly well in water of moderately good quality. Some of the sedges and arrowheads will thrive in water of very poor quality. The most hardy or least exacting in this respect is the common reed, or *phragmites communis*.

It is said that iron goods treated as below described, acquire a bright surface, having a white glance without undergoing any of the usual polishing operations. When taken from the forge or rolls, the articles are placed in dilute sulphuric acid (1 to 20) for an hour; they are then washed clean in water, dried with sawdust, dipped for a second or so in nitrous acid, washed and dried as before, and finally rubbed clean.

Fig. 1

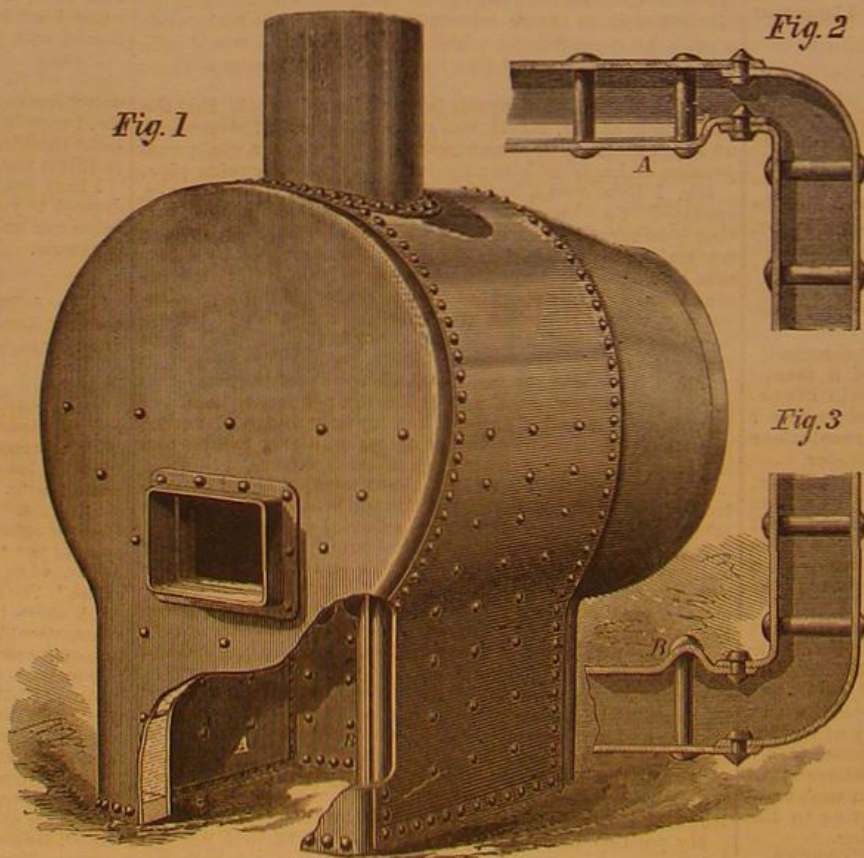


Fig. 2

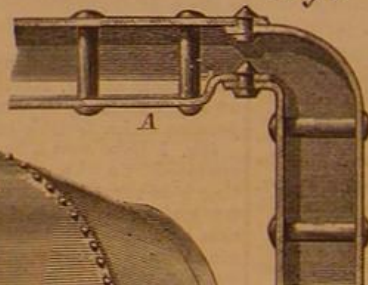
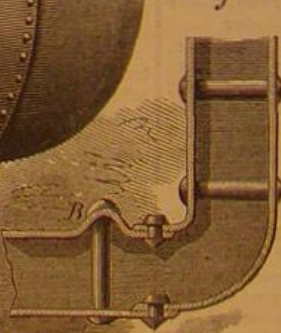


Fig. 3



DAWSON & HUGHES' LOCOMOTIVE FIRE BOX.

that they have not; but we do not travel beyond our own experience in such matters when we assert that a muslin mask, fastened upon the face of a courageous medium, has been recognized, by a person of more than average intellectual powers, as a deceased relative; and that in a deposition of silver on the back of a wet collodion plate, caused by contact with our own fingers, the bearer of a name well known in spiritualistic circles has recognized a visible manifestation fraught with much interest. Surely, one might say, if spirit photography be the incontestible fact some people say it is, there ought not to be much difficulty in convincing the world of the reality of such fact, and this opinion we endorse.—*British Journal of Photography*.

SIR JOHN FRANKLIN'S widow is hopelessly sick

KNEBWORTH PARK, HERTFORDSHIRE, ENGLAND.

To every student of English literature, the name of the late Lord Lytton is familiar. Few there are who have not read the charming productions of his pen; and though he has passed away, he has made for himself an enduring name apart from all inherited or bestowed. But though his works have been read by myriads, yet those who have seen his residence and its gardens may be counted only by hundreds. He was a man of taste, and hence it might be expected he would by no means neglect his garden; and though in size and appliances it has no pretension to rival many of the great establishments, it is, nevertheless, one of the prettiest gardens we know.

Knebworth Park covers about three hundred acres of nearly the highest ground in the county of Hertford. The manor passed into the possession of Sir Robert Lytton in the fifteenth century, and it has continued in the possession of his descendants. The ancient manor house was pulled down in 1811, and the present mansion erected on nearly the same site. Of the west or garden front of this, our first engraving is an accurate representation, and, owing to the elevation of the site, the tower, which forms a prominent feature in the architectural design, commands the view of a wide range of the surrounding country. Extended before it is a flower garden on grass, the beds framed in gravel, plentifully embellished with vases and statuary, and covering altogether about four acres. The design is somewhat complicated, and from its character difficult to plant so as to combine harmony of color with variety, while the number of plants required, some 36,000, is large for the means of producing them. The effect, however, as will be seen from our second engraving, is excellent; and though at the time of our visit the glory of the flower beds had departed, enough of their beauty was left to show what it had been when they were in their pride. The lawn surrounding the beds is beautifully kept, and extends on both sides of the broad central walk to the high laurel hedges which form the boundary of this garden. It is dotted with some fine araucarias, wellingtonias, cryptomerias, and other conifers. Some of the araucarias, after the dry summer of 1866, appeared, to be dying, but Mr. Kipling, the gardener, gave them a good mulching of loam, leaf soil, and a little well decayed manure, and they improved wonderfully. The ivy-covered summer house on the mound on the southwest side, and which forms a conspicuous object in our second view, commands a good view of the flower garden and mansion, and, in a clear day, of the surrounding country.

An old flower garden has been turned into a rosary, in which it is contemplated to carry pillar roses on arches over the surrounding walks. —*Journal of Horticulture.*

Modern Blasting Agents.

In a paper on this subject, recently read by Mr. Noble before the Society of Arts, the author thus explains the reasoning which led to firing slow explosives by local detonation: "When a hammer strikes a very thin layer of nitro-glycerin on an anvil, the blow produces a strong compression of the liquid, which liberates heat and raises its temperature to the point at which it detonates. But only that part which actually receives the blow explodes. If, however, the hammer is very heavy, and the blow strong, the explosion is no longer confined to the part which receives the direct shock, and the whole goes off. A local detonation, owing to the immense tension of its gas, must be very similar in action to a strong blow, and will thus compress the explosive liquid which surrounds it, causing it to detonate at will and to propagate the explosion throughout the whole mass by the same means. Whether that theory be correct or not, it led to a result which affords considerable facilities for the utilization of modern explosives. It enables us, with or without confinement, to turn a

a solid or liquid substance of very harmless appearance instantaneously into gas which occupies the same or nearly the same bulk, but has an expanding tendency which, for nitro-glycerin gas, must come near a pressure of 500 tons per square inch."

Bicycle Riding.

This is a sport confined to a select few in this country; but in England it is extensively practised, with great satisfaction by the riders. Some of them give their experience in the *English Mechanic* as follows: L. Striffler, Secretary of

if wet, as you cannot get any speed, and it is no comfort to yourself, and the incessant jolting has a tendency to loosen your spokes. When going through a country town with macadamized roads, it is glorious to slip through at railway speed and astonish the natives; but whenever I come to a piece of ground which is paved with sets or rubble stones, let me get off and take pity on my good steed."

B. Travis says: "I have been a rider for six years on a wooden machine, and now on a spider-wheeled one. I am only about 5 feet 2 inches, and I ride a 45-inch wheel, with 5 inch cranks. With it I can and do ride up inclines much easier than with my old machine; yet they are each the same weight (50 lbs.) This attribute to the rider being able to apply his power because he sits over the wheel. Every rider who sits much behind his driving wheel knows that in driving up hill his arms have to counteract the push of his feet, whereas push downwards on the treadle requires very little pull on the handles to keep the wheel right. The large wheel machines are worked with the forepart of the foot on the treadle, and not with the hollow of the foot, as the small-wheeled ones were. That is also a great advantage; the leg not having to traverse so great a distance, one is enabled to ride more gracefully, and with greater ease. Some machines are without brakes, the necessity of which depends on the inclines they have to run down. I live in a hilly district, and often on a Saturday afternoon trip I have to go over hills 1,000 feet high. I consider it highly dangerous to attempt a run down some of them, unless you have a brake you can depend on, and then the run down will be splendid and swift; yet with a good brake, you can keep the machine well in hand."

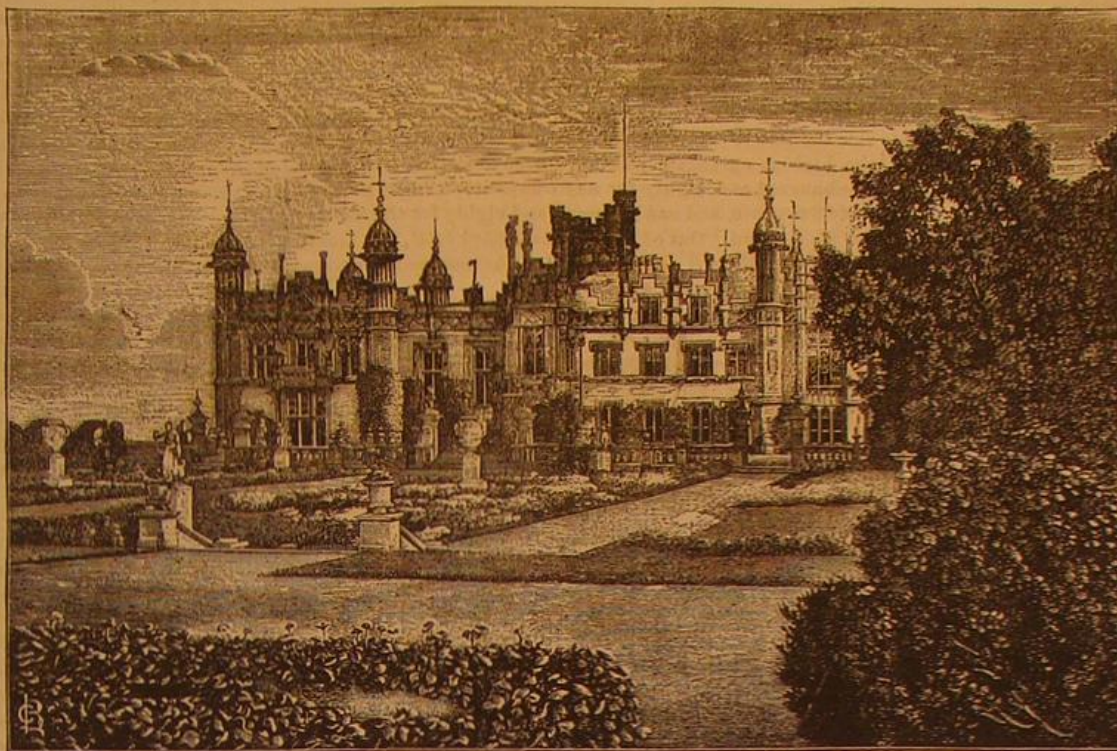
"I have seen in your paper something said about a one-line railway, the running of a bicycle having inspired the remarks. Now, there is no analogy in the matter, for an engine or train would not keep erect on one line of rails only, unless it was perfectly balanced, and remained so. A man could not run a bicycle even under those conditions. It requires a continual side movement of the front wheel to re-

store the balance that is always being lost; for if the wheels were put in a straight line, and fastened, there is no rider could ride it, for he would quickly lose his equilibrium—he could not restore it, and down he must come.

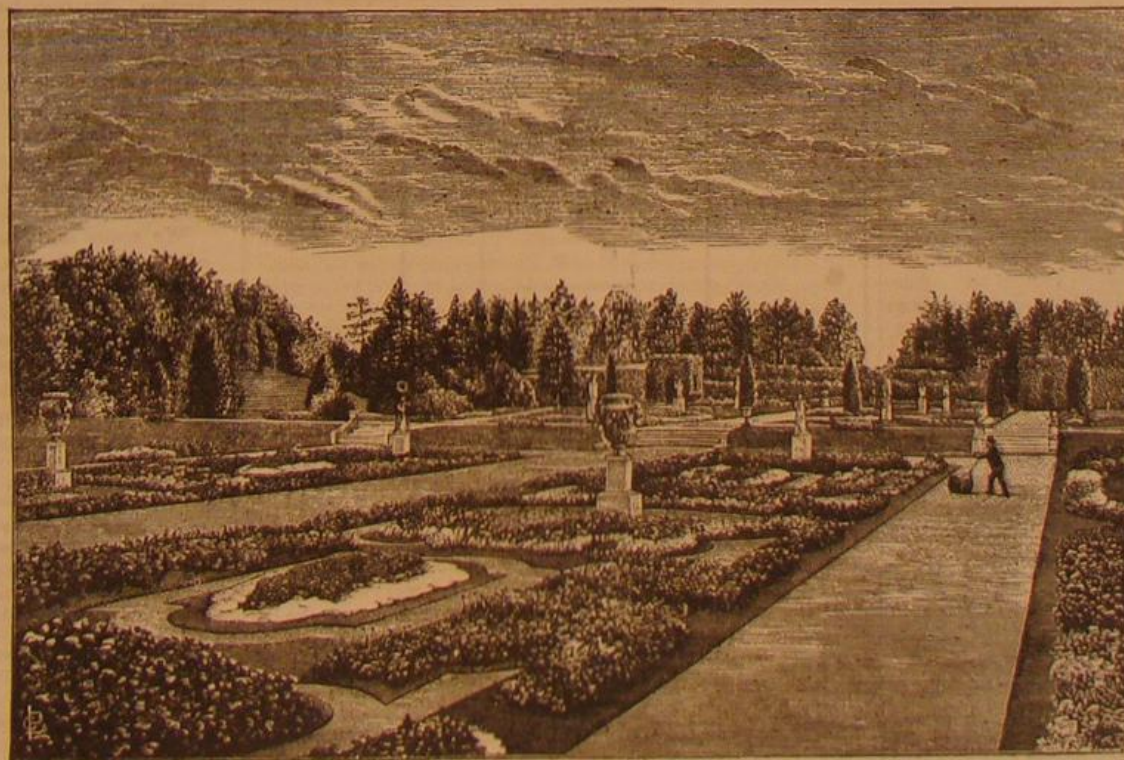
"I have also seen remarks and suggestions about multiplying wheels, so that one turn of the crank will make two turns or more of the wheel. Now, it won't do. The same effect can be got by shortening the crank; but then, who has the strong legs required to drive them? Bicycles as made at present are very good, and very simple also; any addition of gearing will only impair them. Now, I do not expect that any rider will be able to propel himself through the air on any bicycle much over a mile in three minutes—for that is 20 miles an hour—the air itself being the great retarder. I would rather face an incline than a strong wind, it being impossible to go with any speed in the face of a stiff breeze."

A New Cement.

A French chemist is said to have succeeded in preparing a mineral compound, which is said to be superior to hydraulic lime for uniting stone and resisting the action of water. It becomes as hard as stone, is unchangeable by the air, and is proof against the action of acids. It is made by mixing together 10 lbs. sulphur and 42 lbs. pulverized stoneware and glass; this mixture is exposed to a gentle heat, which melts the sulphur, and then the mass is stirred until it becomes thoroughly homogeneous, when it is run into molds and allowed to cool. It melts at about 248° Fah., and may be re-employed without loss of any of its qualities, whenever desirable to change the form of an apparatus, by melting a gentle heat, and operating as with asphalt. At 230° Fah it becomes as hard as stone, and preserves its solidity in boiling water.

**KNEBWORTH HOUSE, ENGLAND.**

Zephyr Bicycle Club, Moston, says: "I have had a roadster made to order, with a 51-inch driver, and it only weighs 30 lbs., and is plenty strong enough. I have discarded the brake as a nuisance, a danger, and extra weight. The best brake is your feet on the pedals, holding back; and if the hill is so steep that it overcomes you, then you may depend it is not safe to ride down, but get off and walk. Always lean well back when descending a hill, and incline forward when ascending, or when riding against a head wind. When

**GARDENS AT KNEBWORTH, ENGLAND.**

riding on a tolerably level road, and especially if going fast, keep upright and firm in your saddle, and you will have no fear of a spill if you happen to come against a stone. Of course, the use of the step is an absolute necessity with our present sized machines, as far as mounting is concerned. I prefer vaulting off from the treadle, as it saves feeling about with your foot for the step, and perhaps catching your toe in the front wheel spoke. If you are riding through a town, if the same be paved and wet, be very careful about turning, as the mud which accumulates in towns seems to acquire a greasy consistence, and seems to completely lubricate the road; and if you turn sharply, your wheel runs away sideways, and you find yourself on the ground. I think it is wise to walk through towns if they are paved, and especial-

John P. McMurray, Oregon, Mo.—The gate rests outside of the gate post, so that it may be readily moved longitudinally about one half its length, and then it may be swung round on a bracket to open the full gateway. It also can be moved on the rolls longitudinally, and may be elevated to swing clear of snow in the winter season.

Improved Fastening for Hats.

Clinton R. Blackwood, New York city.—This spring fastener is made in one piece, and in the form of a bow, the curve of the bow being perforated and fastened to the inside of the hat with thread, leaving the ends to hang down, so as to bear upon the back part of the head.

Improved Water Wheel.

Oliver J. Bollinger, York, Pa.—Secondary guides are arranged in the outer ends of the water passages to divide them into two channels narrower than the throat, so that any objects floating in the water, too large for passing through the throats, will be arrested at the outside of the case, where they can be easily reached for removal. The gates are placed at or near the inner end and narrowest part of the chutes, by which they are subject to the least pressure on account of the smallest area being opposed to the water, so that they offer the least resistance to the moving of them in opening and closing. The gates are attached to a ring, which has radial arms and a hub surrounding the shaft, to strengthen it against lateral strains; and it is connected by the rods which incline toward the shaft with the running block on the shaft, and other mechanism for opening and closing.

Improved Combined Table and Desk.

Thomas W. Moore, Plainfield, N. J.—This invention consists of a table having a suitable inclosed space with pigeon holes, etc., under the top. The top is made of two parts, and hinged at the point where the slope of the desk begins. One side of the frame is lower than the other side, and the ends are sloped from it up to the point where the top is hinged. On this low part a piece is hinged to swing up on the top and hold the table top level when a table is required, and close the space beneath. The table top has a piece at each end, which overlaps the end of the frame, and keeps the space under the top closed when it is adjusted for a table.

Improved Bottle Stopper.

Gustave J. Crikela, Green Bay, Wis.—There is a band around the neck of the bottle, which carries a little clevis. This clevis is pivoted to the band, so that it may work up and down, and a bent lever is attached to the jaws of the clevis by the fulcrum pin. This lever curves up over the top of the bottle, and is attached to the stopper, which has a flange around it, which incloses a packing. A spring is fastened to the lever, the upper end of which bears with a constant pressure against a lug, which is fastened between the jaws of the clevis. When a person takes hold of the bottle, he bears with his thumb on the lower end of the lever, which action raises the stopper, and allows the contents to flow out when the bottle is tipped. A hook is attached to an eye on the under side of the lever, and hooks under the clevis to hold the stopper down.

Improved Child's Carriage.

F. Herman Jury, New York city.—The rim of the wheel is shaped so that, while it widens out at the top to the edges, the bottom will be sufficiently thick to afford the requisite thickness for firmly holding the spokes which screw into it. The hub is cast with an inner annular chamber, to dispense with unnecessary metal, and the ends, which are contracted to the size of the box, are screw-threaded, and the box is screwed in, making a tight hub. The axle is short pieces of round metal screwed into the ends of a hollow middle tubular portion, to make the middle portions stronger for a given quantity of metal by increasing the size. The body is jointed to fold together; and by a spring top for holding up the top, and the braces arranged inside, the top can be raised and lowered easily by the person inside.

Improved Car Coupling.

Benjamin S. Kearney, Franklinton, N. C.—This invention relates to an improved automatic car coupling, that may be readily used for cars of different heights; and it consists of a drawhead with tapering mouth, vertically sliding front socket or gate, and governing rear piece, that couple and control, by suitable levers, the link with ball-shaped heads.

Improved Potato and Seed Planter.

William H. Whitman, Scranton, Pa.—In the slot of a pitman are placed springs, which rest against a crank, and the effect of which is to cause the pitman to stand still for a little time at the end of each movement. The other end of the pitman is pivoted to a frame, which slides upon a block, in which is formed a hole of sufficient size to receive enough seed for a hill, and which is placed directly beneath the hopper. Plates are so arranged that as the frame moves forward one plate will uncover the upper end of the pocket to allow the seed to drop into said pocket. As the frame moves to the rearward, the plate will cover the upper end of said pocket, and another plate will uncover its lower end, allowing the seed to drop to the ground. The plate is made with a short edge, so that, when the machine is used for planting potatoes, it may cut off a piece of potato large enough for a hill. In the case of large potatoes, they will be cut more than once, and small potatoes will not be cut at all. When the machine is used for planting seeds, the upper plate serves simply as a cut-off. The hopper is made in three parts, so that the two upper parts may rock upon each other, and upon the stationary lower part to keep the seed from clogging by the advance of the machine.

Improved Cultivator.

Albert Dart, Rockville, Conn.—A rear wheel gages the cut of two front mold boards. Adjustable bars carry the two rear mold boards. These bars are spread apart by a cam operated by means of a lever. A horizontal guide bar passes through the beam and through the bars, and supports the bars and mold boards as they are spread or expanded by the cams or forced inward by the pressure of the earth thereon. The wheel is supported by the spring, which is attached to the under side of the beam.

Improved Mirror.

Allen Huber, Berlin, Can.—This consists in covering the back of the mirror with varnish or waterproof material, and with a coat of gypsum, plaster of Paris, or equivalent material. The advantages claimed are that the mirror plate and frame will be strengthened, the silver will be protected from injury, and the wooden back board or other back and the wedging of the plate will be dispensed with.

Improved Pneumatic Dispatch Apparatus.

Olney B. Dowd, New York city.—Two pipes join the local stations with the central station, with a circuit of the impelling fluid, preferably compressed hydrogen gas, passing out through one and back through the other, and worked by pressure in a reservoir at the central station. It is designed to make the apparatus useful for hotels, offices, and private houses by a special circuit to each, the outgoing pipe being connected with one of the contrivances for stopping the carrier, so as to discharge into it, and the other connected, so as to allow of the return of the fluid, and having the apparatus for introducing the carrier to be returned to the central office.

Improved Variable Exhaust.

William F. Leseur and Charles Michel, College Point, N. Y.—The invention consists in supporting a cone plug upon a vertical screw stem arranged to project up through the mouth of the exhaust pipe of a locomotive engine. The chief advantage of this arrangement is economy of space and unobstructed passage for escape of steam, it having been the practice heretofore to support and adjust the plugs of exhaust nozzles by means of rods arranged exteriorly thereof.

Improved Farm Fence.

David L. Hoffman and Parker M. Shoemate, Aulville, Mo.—This consists in making the fence in sections, so that each panel may be separated into two longitudinal parts.

Improved Row Gage for Plows.

William Edwin Stanley, Montezuma, Ga.—This is a row gage attachment to plows for marking off rows to guide the plowman straight. A socket for receiving the end of the marking rod is mounted on a support which revolves to shift it from side to side as the plow reverses. Said support has a hollow axle, through which a cord, having a weight attached to it, extends to the end of the socket next to said support, and is secured thereto to return the marker to the normal position after it escapes from obstructions, causing it to swing back on a pivot, as a means of preventing it from breaking. The revolving support for the socket is supported on standards, some of which are attached so as to form guides to keep the suspended weight from swinging about.

Improved Station for Submarine Telegraphs.

Robert F. Bradley, Moffettsville, S. C.—This invention relates to an improved system of telegraph stations in mid-ocean, by which messages can be sent from any point of the ocean, along the line of the cable, to the terminal points, and vice versa, so that communication with vessels and passengers during the voyage may be established. The invention consists of a hollow sectional column with a base plate attached by ball and socket joint, which column is lowered into the water and anchored rigidly to the ground. The branch cable is coupled to the main cable, and carried along the column to the surface of the water, to be there placed in connection with the instruments on board of the vessels.

Improved Letter and Picture Block.

Daniel Birmell, Greenville, N. J.—This invention consists of a different shaped end point or projection to each letter block, so that no letter block will correspond to any other, in combination with picture blocks, having notches corresponding to the letters of the name of the picture, to aid the child in selecting the letters for naming the picture and identifying them therewith.

Improved Life Preserver.

Adolph Traub, New York city.—This life preserver is constructed of a front and rear part, connected together by straps or suspenders, supported by the shoulders, having movable wings or fins attached thereto, the whole being made double or bag-like and filled with roasted cork.

Improved Transom for Doors.

John Berndt, Denver, Col. Ter.—This invention relates to certain improvements in transoms for doors; and it consists in a transom sash that is made to slide into a casing above by means of a branched cord moving over pulleys, one of the branches of which cord is attached to the sash for the purpose of raising it, and the other attached to a suspended detent or locking bar which prevents the raising of the sash except by the cord upon the inside of the house, the cord being fastened below by a self-closing cam lever, and so arranged at its branched ends as to raise the sash and lift the locking bar at the same time.

Improved Hay and Cotton Press.

John L. De Witt, Gardner, Ill.—The invention relates to means whereby the operators on a hay or cotton press may be enabled to work more continuously and with a greater result within a given time. It consists in making the same piece, grooved on both sides, act successively as a follower and platen, and in holding the platen by a hand-operated slide so that it may be pushed out with the tied and pressed bale.

Improved Clothes Wringer.

Leander Becker, York, Pa.—This invention relates to certain improvements in wringers; and it consists in the combination with the body of a washing machine, and the adjustable bearings of one of the wringer rolls of a lever, and an adjustable vertical rod attached to said bearings, so that the weight of the washer is made to supply the pressure for the wringer rolls, the said pressure being regulated at will.

Improved Washing Machine.

Leander Becker, York, Pa.—This invention relates to certain improvements in washing machines; and it consists in two levers pivoted to the outer casing and having notched extensions and pendant segments. To the top of the levers is pivoted an arc-shaped set of rubbers, which are attached at the bottom by a connecting rod with a double crank upon the main shaft. Suspended in the notches of the lever extensions and segments is another adjustable and detachable set of rubbers which correspond to the first in construction, and between which and the first set the clothes are contained.

Improved Paper Machine.

Chas. L. Crum, Winchester, Va.—The object of this invention is to better adapt the Fourdrinier paper machine to making heavy paper or boards out of straw, wood, or other materials; and it consists in the combination with the ordinary belt of wire cloth which carries the pulp, of a second upper endless belt of wire cloth passing around rollers, and an upper suction box resting upon the upper surface of the second belt and just above the web formed from the pulp.

Improved Bale Tie.

H. K. Du Bose and E. W. Charles, Jr., Camden, S. C.—The invention has particular reference to flexible ties by which hay, cotton, and analogous substances are held in a compressed state. It consists in a tongueless buckle and a fastener having two cross slots cut obliquely toward each other.

Improved Spring Seat for Horse Rakes, etc.

Amos W. Coates, Alliance, O.—The object of this invention is to adapt the supporting spring of a chair seat in a horse rake, harvester, or other analogous implement to the different weights of different drivers, and, while preserving its elasticity, render the said spring strong enough to support a heavy driver without bearing down and removing the driver from the most convenient position for operating his hand levers. It consists in the combination with the ordinary inclined band spring, of an auxiliary spring attached to the base frame and connected with the main spring near the seat by means of a stud which is rigidly fixed to the main spring, the said auxiliary spring being slotted at its connection with the stud, so that it does not act at all until the main spring is borne down sufficiently low to cause its stud to rest in the lower part of the slot.

Improved Coffee Pot.

Sumner P. Webber, Charlotte, Mich.—This invention consists of a coffee pot with a cylindrical coarse strainer that is fitted securely into an annular finer strainer, arranged below the spout at the inside of the pot, the detachable strainer being supported at some distance at the bottom of the pot and retained by springs at the top, a ball serving to lift it out of the pot.

Improved Steering Propeller.

Wilhelm F. Zoehle, Brooklyn, N. Y.—This invention consists in the employment of a propelling screw that is driven by hand power applied to actuating lever rods, which rods are pivoted to sliding and guided pieces, transmitting the power alternately, by intermediate gear wheels, to the shaft of the screw. The screw is secured to a supporting frame sliding in vertical direction for yielding to obstructions, and is also employed for steering the boat by connecting the screw frame, by a governing arm and wheel, ropes, and pulleys, with the steering wheel of the boat.

Improved Water Wheel.

Isaac Mallory, Dryden, N. Y.—This wheel has two sets of buckets, arranged one above the other, and a chute curb, having two tiers of chutes. The revolving gate is provided with a series of openings. The water may be admitted to only the lower tier of buckets in the wheel through two or four openings; or by moving the gate farther, two or four chute openings are uncovered for the upper tier of buckets, so that water may be admitted through two, four, six, or eight openings, successively, according to the amount of power required.

Improved Farm Gate.

Wellington H. Pratt, Prattville, Mich.—Devices are provided in connection with this gate, whereby it is supported without sagging. It may be raised from a horizontal position, and swung round over a moderate depth of snow without obstruction, and, when opened, will remain in any position in which it may be placed.

Improved Berry Cup.

Dewitt W. Kniffin, Marlborough, N. Y.—This is a berry cup made of wood veneering, having a bottom of two thicknesses fastened together with the grain of the wood at right angles, one part having tenons which pass through slots and hold the bottom to the body.

Improved Lathe Rest.

James E. F. Leland, Baltimore, Md.—This invention relates to lathes for turning irregular forms, and consists of a spring rest for supporting the article being turned. The spring is given a certain amount of tension to force the rest forward toward the article, while the rest will adjust itself to the irregularities.

Improved Motor.

Jacob G. Peterson, Morganton, N. C.—By this device, a power is applied to one shaft by two springs separately wound when the same could not be used with one spring on account of the difficulty in winding it up.

Improved Corn Sheller.

Frederick H. Hunter, Heltonville, Ind.—This corn sheller has a ribbed surface, over which the ears are drawn by hand to free them of the kernels. The invention relates to a chaff box, which is formed of a sheet metal plate applied beneath the ribs of bars of the sheller.

Improved Felly Plate.

James Y. Sitton, Due West, S. C.—The feature of this invention consists in vertical ears or flanges formed on the sides of the clip, and extending up to embrace the sides of the tyre, thus holding the same in proper position on the felly.

Improved Stone-Extracting Tool.

Nathan R. Cheadle, Delta, Ohio.—This is a method of removing stones in well-boring by first cutting under them, and then dislodging them with a drop.

Improved Fence Post.

Eugene Powell, Delaware, Ohio.—This consists of a post with braced stool seated in the ground, in connection with an additional stool attached at right angles thereto, in the direction of the fence, for increasing the base surface of the post.

Improved Fly Net.

Luther B. Lee and George W. Lee, Ridgewood, N. Y.—The object of this invention is to prevent the ends of the cross bars from untwisting, and at the same time to give to said ends a neat appearance. The cross bars are made of cord, and are quilted or stitched through the longitudinal bars a sufficient number of times to prevent the said cross bars from slipping through the said longitudinal bars. The end parts of the cross bars are stitched upon a sewing machine for a few inches.

Improved Printers' Galley.

Henry H. McWilliams, Sacramento, Cal.—On the bed plate is a raised bar. The same hollow bar is turned in the same manner across the end of the plate. On the inner edge of a slotted movable plate is a square hollow bar, made by turning over the edge, so that this square bar and the triangular bar on the other plate are of the same height, and form a channel in which the type are contained and held. This bar is moved on the plate and the channel increased or diminished in width by means of slides and eccentrics and levers. By means of these eccentrics the movable plate is moved up, and the bar is made to compress the type.

Apparatus for Carbureting and Purifying Gas and Air.

Leander E. Fish, Washington, D. C.—This invention relates to certain improvements in apparatus for carbureting and purifying air and gases. It consists of a vessel having on the bottom thereof a detachable tank for containing oil for carbureting. Communicating with said tank is a pipe for introducing the oil, a gage pipe for regulating the amount of the same, and a perforated inlet pipe through which the air or gas is forced into the oil. Just above the oil tank is a detachable cover with distributing openings for the carbureted gas in its upward passage, and above said cover are located purifying pans with bottoms of perforated sheet metal or wire gauze. The top of the outer vessel is provided with an annular trough of water in which the detachable cover is located with a water-sealed connection, the said cover being provided with a pressure regulator and an outlet pipe for the gas.

Improved Ventilation of Railway Tunnels, etc.

Joseph Dixon, New York city.—This improvement is more particularly designed for underground railways, tunnels, etc., in cities where openings to the external air cannot be had without interference with the surface traffic of the street, or without purchasing adjoining lands and using the same for ventilating shafts. It is proposed to divide the tunnels into sections of a mile, to place midway of these sections a suitable fan blower, connected by suction pipes, extending right and left into the tunnel, and to place partitions, by means of pivoted doors, across the tunnel on either side of said suction pipes, said partitions occupying the entire space crosswise of the tunnel; pending the arrival of a train, said partitions to remain closed. The doors may be opened by an approaching train, and closed again immediately after the train has passed, by the train itself operating suitable mechanism placed alongside the track. By thus dividing the tunnel into sections, and placing the ventilating apparatus midway outside the tunnel, the fan withdraws the foul air from, say, half a mile of tunnel on the left hand side, and at the same time, and by the same operation, it also acts in like manner on the length of tunnel on the right hand side, and discharges the foul air from both sections through a pipe of suitable size on the opposite side of the fan to the surface of the earth, and thence up a suitable height above the surface by an ornamental hollow column.

Improved Steam Engine for Rock Drills.

James Brandon, New York city.—Grooves in the steam chest are so arranged in connection with the grooves in the valve piston that, when the slide valve is just over the steam ports, the small piston will have passed so far that the communication between the groove in the steam chest and the groove in the valve piston will be just closed at the same time the groove of the steam chest passage will be just opening. The steam passing will have full pressure until the piston closes the passage by its own movement. Consequently the valve piston will still have the expansion of the steam to carry it over.

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For Sale, or to Let on Royalty—Canada Patent for Hanging Eave Troughs and Conductor Pipes. Address J. P. Abbott, Cleveland, Ohio.

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Notes & Queries

R. W. J. will find a formula for proportioning safety valves on p. 363, vol. 29.—J. F. can blue steel by the method described on p. 123, vol. 31.—J. S. will find that bronzing on iron is described on p. 283, vol. 31.

(1) J. A. M. asks: Can I magnetize cast iron? A. Yes, temporarily, by enclosing it in a wire helix traversed by an electric current.

(2) S. L. asks: 1. Do you think that a young Irish retriever could be broken of the habit of running away when a gun is discharged? A. Take your dog to a pigeon or shooting match, and gradually approach the shooters with your pet, and encourage him. Most dogs can be broken of gun shyness in this way, but some of them can never be cured. 2. Please give me the name of some handbook on training dogs for the field. A. The best book ever published on the sporting dog is "The Dog," by Mayhew, Dinks, and Hutchinson; it is published by Orange Judd & Co., 245 Broadway, N. Y.

(3) W. C. asks: Is a building, having a lightning rod which is formed of a copper pipe or tube laid flat on the roof and fastened with small strips of zinc to the roof and walls of the building, perfectly safe during a storm? A. The above method of attachment of the rod to the building is correct. But the main thing pertaining to the use of a lightning rod is to have the rod properly connected with the earth. The bottom of the rod, in the earth, must be greatly enlarged, either by having the rod extended underground for a long distance, or by connecting the rod with iron water pipes or iron drain pipes in the ground, or by placing the bottom of the rod in contact with a large mass of charcoal, which may be laid in a trench. No building is safe if the rod is merely stuck down a few feet into the dry earth. This is the common plan, but it is unsafe. Safety can only be secured by having an extensive mass of good conducting material at the bottom of the rod, in the earth.

(4) T. S. and others ask: How is transfer or indelible paper made, for marking clothing? A. The paper is probably saturated with a solution of bichromate of potash, logwood, and a little carbonized strip.

(5) D. G. S. asks: Will a cosmorama lens of 36 inches focus do for the object glass of a telescope which I think of constructing, combined with an eyepiece of 1/2 inch focus? A. A common lens will not do at all for the object glass of a telescope, as it gives too defective an image. You must consider that the image has to be enlarged by the eyepiece, which will enlarge all defects also. For a telescopic objective, it is imperatively necessary to have an achromatic lens made of a crown glass bi-convex lens, and a correcting plano convex lens of flint glass.

How can I obtain sulphuretted hydrogen? A. Pour diluted sulphuric acid on sulphuret of iron or on sulphuret of antimony.

(6) A. B. says: I made a magnetic needle out of a rat-tail file; and while polishing it upon an emery wheel, I thought of testing the action of moving bodies upon it. Having no point ready, I stuck it upon a sharp pointed lead pencil and held it in front of one of the emery wheels. It instantly began to revolve at about 300 to 250 revolutions per minute, running from right to left. I thought it was the current of air striking it, and held the needle on the other side of the wheel. It instantly checked its motion, and started in the opposite direction. In this position, the air would strike it in the reverse of the first position. To further prove it I held it opposite the wheel on the other end of the shaft; and to my surprise it stopped and started revolving in the same direction. It was not produced by air currents. Held between the two wheels, it also revolved. To further prove it, I placed it upon a pin and cork, putting it in an iron pan so that all currents of air would strike the bottom of the pan; and it still revolved, but at reduced speed. I came to this conclusion: Each wheel has a north and south pole, and the north pole of one wheel is opposite to south of the other. It may be that, when in motion, one wheel forms a north pole and the other a south. The wheels have iron arms filled with wood segments, and are covered with leather and

emery. Please explain the cause. A. Probably the wheels contain some residual magnetism, and one side is positively and the other negatively polarized. If the wheels are made of cast iron, this might readily be the case.

(7) C. C. P. asks: 1. Will leather scraps, ground down nearly to a powder, be of value as a fertilizer? A. Yes. 2. Are freshly ground bones in a fit state to be used as a fertilizer? A. Yes.

(8) J. C. asks: I have a piece of genuine moss agate which I would like to cut up in small pieces. How can I do this? A. Agates are cut by means of a small copper disk on a lathe, fed with emery. The surface is then coarsely ground by means of a grindstone of a hard reddish sandstone, and the polish is afterwards given on a wheel of soft wood, moistened and imbued with a fine powder of hard red tripoli.

(9) W. S. & S. say: We wish to make a siphon and draw the water from a well 52 feet deep with 75 feet fall. Can we form a vacuum and start the water running? A. The water could not be induced to rise out of the well without other aid than the mere pressure of the atmosphere.

(10) H. B. B. asks: Is there any cement or paint that would answer for lining a cistern to contain vinegar, that would not be destroyed by the acid nor spoil the vinegar? A. Vats of this character are sometimes coated with melted rosin. Is the refuse of the blacksmith's forge and furnace beneficial to fruit trees? A. It has been recommended for this purpose. Give it a trial.

(11) J. M. T. asks: Can you give me a process for cleansing the dark color from steel blades after cutting fruit? A. Rottenstone is used for this purpose.

(12) F. N. asks: 1. How can I fix colors on caoutchouc or on gutta percha? A. Caoutchouc is probably lettered with rubber solution while it is stretched, the coloring matter immediately dusted over it, and the whole allowed to dry. 2. How can two pieces be made to adhere to each other by the edges? A. By means of a caoutchouc solution in naphtha.

(13) P. B. asks: I have a portrait that is being destroyed by cracking and scaling off of the paint from the canvas. The cause is attributed, by those who profess to know, to the picture's being varnished before the paint was perfectly dry. Is there any remedy for it? A. We do not know of anything except revarnishing.

(14) J. S. asks: Will the residue of sulphuric acid and carbonate of soda, or marble dust, after having been used in the manufacture of soda water, be of value for manure? How should it be prepared? A. The excess of sulphuric acid can be completely neutralized by limestone, and the dried residue used as gypsum. Or calcined bones can be employed, and a mixture of the sulphate and acid phosphate of lime produced.

(15) A. B. G. asks: I want to color glass for lantern slides. How shall I proceed, so as to show any or all the colors of the spectrum in the screen? A. The aniline colors are mostly used for this purpose on a surface prepared with albumen or some similar substance. These colors admit of exquisite shades of fineness and, for this purpose, are remarkably soft and rich in tone. See p. 390, vol. 30.

(16) J. C. G. asks: What is the reason that the second crop of clover yields more seed than the first? A. The crop multiplies itself by scattering its own seed in the fall. This, in the spring, takes root, and soon more than replaces that portion of the last year's growth which has decayed, and which now acts as manure.

What is a good work on mnemonics? A. Consult Appleton's "Cyclopedia."

(17) J. W. K. asks: Can artesian wells be bored here, in Eastern Virginia? A. Yes.

1. How can I mount pictures? A. You do not state whether the pictures were on canvas or paper, also whether they are oil paintings, prints, or photographs. 2. What preparation is used to obviate the necessity of glass? A. Varnish is used for this purpose. 3. What is the origin of the word "remontant," and its meaning? A. It is a French word. Le remontant—the belt strap or belly band of harness.

(18) R. K. says: I have a fine hop vine; but the caterpillars are eating it up. What can I smoke them with so as not to injure the vine? A. Place under the vine a dish containing a small quantity of ignited charcoal: throw upon the coals a quantity of sulphur, and, if necessary, move the dish so that the ascending vapor may temporarily surround each twig and leaf. This is the most effectual remedy known.

(19) M. A. B. asks: What is the rule for calculating the variation in an aneroid barometer, caused by high or low temperature? A. The only correction necessary for an aneroid barometer is a slight one for temperature, detected experimentally thus: Observe carefully its indication at any moment in the external air; remove it immediately before a fire, and heat it until the thermometer on the dial shall reach 100°; then notice the variation of the hand; this variation, divided by the number of degrees through which the thermometer has moved, will give you the correction, whether in defect or excess, to be applied for each degree of change.

(20) W. B. asks: 1. What metal is least liable to tin when coming in contact with a soldering iron? A. Copper or iron. 2. Is there any metal or substance that will not tin, and yet will stand the heat of the iron and be not liable to break? A. We do not know of any such metal.

(21) G. M. G. says: 1. I am making ink composed of nut galls, gum senegal, sulphate of iron, aqua ammonia, alcohol, and rain water. When first applied, it is a pale purple, and slowly turns intensely black. What can I use to make it black when first applied? A. Replace the ammonia and

alcohol by a little alum. This we think would make a decided improvement. The addition of logwood to the ink would have the effect of rendering it black when first used, but such ink is much more liable to fade and corrode the pens. 2. Can you give me a cheaper and a better recipe than the above? A. Take 1 oz. extract of logwood; pour over it 2 quarts boiling water, and, when the extract is dissolved, add 1 drachm yellow chromate of potassa. This is an excellent blue black ink, does not fade, and, as it contains no gum, flows freely from the pen. It can be made for about 25 cents per gallon. If an old inkstand is to contain any of this ink, it must be thoroughly cleansed, as ordinary iron ink decomposes the chrome compound.

(22) D. W. U. says: I wish to know how to keep strawberries in their natural color, to take to the fairs as curiosities. I have strawberries measuring 4 and 5 inches in circumference. A. The fruit may be preserved in many ways. One of the simplest methods is that of immersion in some solution of strong antiseptic properties, such as salicylic acid. To retain the natural color of the fruit for any length of time, however, is something quite difficult. We would advise you to obtain photographs of your mammoth fruit as soon as possible.

(23) C. M. asks: 1. What effect will dissolving blue stone in water, in which iron is to be casehardened, have? A. First polish the metal, and then place it in a sand bath until the desired color is obtained, then plunge into water. The addition of blue vitriol to the quenching bath would only serve to copper plate the metal as soon as immersed in it. 2. What preparation is there that, when put on casehardened work, will give it the fine glossy appearance that the fine English guns have? A. Try the following varnish as a lacquer: Gum sandarac 8 ozs., pounded mastic 2 ozs., clear turpentine 2 1/2 ozs., pounded glass 4 ozs., pure alcohol 32 ozs. Mix and dissolve.

(24) J. H. M. asks: What will absorb the ammonia, generated by the urine, etc., of horses in a stable? A. Sprinkle the floor and stalls with dry clay, which has a powerfully absorbent action upon ammoniacal vapors.

(25) W. H. P. asks: What acid is in rhubarb? Can it be extracted and concentrated, and how? A. The juice of the rhubarb contains oxalic, citric, and malic acids, the latter often in considerable quantity. We hardly think the plant can be utilized for lemonade, because of its characteristic purgative properties. The most objectionable acid of the three may, however, be removed in great part by chloride of calcium.

(26) H. J. E. asks: Do all kinds of iron crystallize under strain? A. No.

How is good mortar made? A. The lime ought to be pure, completely free from carbonic acid, and in the state of a very fine powder; the sand should be free from clay, partly in the state of fine sand and partly gravel; the water should be pure, and, if previously saturated with lime, so much the better. The best proportions are three parts of fine sand, four parts of coarse sand, one part of quicklime recently slaked, and as little water as possible. There should always be enough water added at first; if water is added after slaking has begun, it will be chilled and the mortar lumpy. The addition of burnt bones improves mortar by giving it tenacity, and renders it less apt to crack in drying.

Is the casting of small brass or iron articles smooth and without flaws considered as one of the lost arts? A. It is not; at present it is by no means impossible to make a perfect casting.

What is civilization? A. Civilization mainly consists in intellectual development, culture, and refinement.

(27) J. C. H. asks: How can I make the hardest alloy that melts below a red heat? A. Melt together 2 lbs. copper and 1 lb. tin.

(28) W. H. Jr. says: I have separated iodine from iodide of potassium by passing chlorine gas through a solution of it. The chlorine gas was made by the action of sulphuric acid upon calcium chloride. I now find that the solution of iodine contains some of the calcium chloride. How can the iodine be separated from it? A. It may be separated by distillation over a slow fire; but the temperature should not be allowed to rise above 350°.

(29) C. S. R. asks: What composition can be molded, either under pressure or otherwise, have a hard, smooth surface, and not be brittle nor liable to warp? A. Many metallic alloys, we think, would answer your purpose. See p. 11, vol. 31.

(30) S. E. M. asks: 1. Will the common gold fish spawn in a tank that holds 30 gallons water? A. Yes, if the tank be otherwise properly arranged. See pp. 33, 102, vol. 30, and p. 29, vol. 32. 2. What kind of plants will grow best on the bottom of the tank? A. Any of those indigenous to fresh water lakes and streams.

(31) R. B. R. asks: Suppose a suitable turbine wheel to be driven by a certain fixed quantity of hot water, forced through by high pressure steam, the apparatus being so arranged as to use the same water over and over again, such a quantity of water to be supplied only as will make good the loss by evaporation, and the steam used expansively: would such a motor be economical? A. It would be much more economical to use the steam in a well designed steam engine.

(32) F. H. B. asks: 1. Will good plumbago used in the cylinder of a new engine, be of service to prevent cutting? A. A true bore of cylinder and well fitted rings are the best preventives. It ought not to be necessary to use plumbago in a new cylinder. 2. Is there anything in the mixture of metal of which the cylinder and rings are cast, that makes some more liable to cut than others? A. Care is necessary in mixing the iron, to produce a quality that is tough and of uniform texture.

(33) W. asks: If I have a steam yacht for my own pleasure on the Mississippi river, would I have to get a license for her, and would I need a licensed engineer and pilot? A. Yes.

(34) T. S. W. says: A firm recently ordered a machine for making ice, and secured one of the following dimensions: Boiler 4 feet 6 inches x 2 feet diameter, with 8 two inch iron flues; cylinder 4x12 inches. Directions for use: Raise steam to 50 lbs., and run the machine at 130 revolutions. Good wood was first used, and afterward coal and rosin; but after a few revolutions steam would run down to 30 lbs., which was not sufficient to drive the machine. Reporting that the boiler was not large enough, or there was not sufficient heating surface, they received two iron blocks to be put, one in each end of cylinder, so as to reduce the stroke to 8 inches, and a new crank to suit this stroke, with a coil of lead pipe to be placed in water tank through which to exhaust. The exhaust had previously been into the smoke stack. The makers of the machine claimed that the boiler was large enough, yet sent the extra pieces, the putting in of which would make everything work all right. Please to give your opinion. A. The boiler was too small.

(35) W. M. J. says: J. R. W. (vol. 32, No. 21, June 12) must have something wrong in the setting of his boiler or with his engine. I think it is in the valve; for it is certain that he should run his 8x16 engine and do all it could possibly do on from $\frac{3}{4}$ to 1 cord of wood. It is certain that a good return tubular boiler will save at least half the fuel used by a two flue boiler. A. We would be glad to receive some facts in corroboration of your views.

(36) J. C. G. says: I am 19 years of age. My occupation is that of a stationary engine driver. I have a good English education, and am considered very good in mathematics. Mechanical engineering is the only business I care for or think about. I have tried to get a situation in a machine shop to learn the trade; but owing to depression in business, I have not succeeded. Would it be best for me to enter a shop or a scientific school? Will I be prepared to superintend the construction and designing of engines by such knowledge as I could gain in such a school? A. It is very desirable to get such advantages as are afforded by the course of a good school of mechanical engineering, such as the Stevens Institute, Hoboken, N. J., the Massachusetts Institute of Technology, Boston, Mass., or Cornell University, Ithaca, N. Y. When one graduates from such a school, he has learned how to study, and has also acquired a great deal of practical experience, in addition to a knowledge of the fundamental principles and methods of the engineering profession.

(37) D. L. B. asks: 1. Would a solid iron bar sink in the ocean in the deepest part, or would it float at a depth where the amount of water, displaced by the bar, would be equal in weight with the bar? A. It would float under the conditions stated. 2. At what depth would the water be of such a density? A. We cannot tell you, as experiments have not been sufficiently extended.

(38) E. F. M. asks: Can rubber belts be renewed? A. No. Which is the front end of a planer, where the boards go in, or where they come out? A. Where they go in.

What glue is best for cementing leather belt ends together? A. Use marine glue, or gutta percha dissolved in bisulphide of carbon. Can brass in small quantities be melted in an iron ladle in a common blacksmith's forge? A. It will be better to use a crucible made of clay or plumbago.

How are plaster of Paris molds made? A. They are cast over the pattern.

(39) Z. W. B. says: 1. I have a small steam engine 5x6 inches, that cuts off at half stroke. How can I change it to make it cut off at $\frac{3}{4}$ stroke? The valve is a plain slide valve. A. You must lengthen it and increase the travel. 2. Is a $\frac{3}{4}$ circular safety valve large enough for a return tubular boiler 24x36 inches with fifteen 2 $\frac{1}{2}$ inch tubes $\frac{3}{8}$ inches long, and a heating surface of 45 feet? A. Yes.

(40) H. D. & Co. say: 1. We are running a 400 horse power engine at 75 lbs. pressure. City water is very expensive, and artesian is very hard. Is it feasible for us to condense our steam, or a large part of it, by currents of air? Has any contrivance of that sort ever been perfected? A. There have been a number of plans proposed for condensing steam without the use of water, but we do not know of any that are in practical operation. There is, of course, no difficulty in arranging such a device, if it is made large enough. 2. Is it of any use to try to clear hard water by raising its temperature under pressure above 212° before entering the boiler, thus reducing the boiler scale? A. This treatment removes some of the impurities, and is generally found to be of great advantage.

(41) W. H. H. asks: I do the street sprinkling in our city, and force salt water 1,200 feet through a 4 inch pipe up a rise of 75 feet. I use a 10 inch steam pump, and 6 inch water cylinder with 12 inches stroke. I require 60 gallons a minute; my pipe has 5 elbows. I hire steam and take it 20 feet through a well protected pipe. A dispute has arisen as to the required horse power to do the above work, and it is agreed to leave the question to you? A. It would be necessary to make a test, in order to settle this question. From the data sent, we could only make a guess.

(42) L. S. asks: Who was the first inventor of the locomotive? A. The first locomotive was built by a Frenchman named Cugnot.

How long a piece is used in testing rope? A. Generally a piece not more than one or two feet long.

I have been firing a Baldwin locomotive, which has a mud drum, by blowing out at drum; the

mud would not all come out unless I took the drum head off. Much mud has also settled between the bottom flues, around the drum. We have inserted rods through the drum, and also through plugs in smoke box, but could not do much good. We have also tried a strong stream of water, but to no effect. Can you give some good advice? A. Try the plan of hauling the fire at night, and letting the water remain in the boiler until it is quite cool. That may soften the mud, so that it can be washed out.

(43) H. A. A. says: I am using an engine which throws out much fire. What is the best cap to prevent this? A. You can purchase a spark arrester similar to those used on locomotives. Frequently a piece of wire cloth, placed over the top of the smoke stack, will remedy the trouble.

(44) C. E. B. says: In a boiler (say a rectangular one) filled partly with water and partly with steam, is the same pressure exerted on the bottom as at the top? If not, is the pressure greater on the top or on the bottom? What is the proportional difference, and would the proportion vary with the temperature, and in what proportion, if any, would the pressures vary as the volume of the steam and water might be respectively changed? A. At the top of the boiler you have the pressure of the steam; at the bottom the pressure of the steam, increased by the weight of the water and the steam. Suppose, for example, the weight of water in a boiler is such as to bring a pressure of 1 lb. on each square inch of the bottom of the boiler. If, now, steam is raised in the boiler until its pressure is 40 lbs. per square inch, the pressure per square inch at the top of the boiler is 40 lbs., and at the bottom 41 lbs.

(45) T. G. W. asks: What is superheating steam? What temperature and other conditions will produce superheated steam? A. Superheated steam is steam having a higher temperature than is due to the pressure. To superheat it, it is only necessary to let it pass through heated pipes or vessels having a high temperature, and in this manner it can be heated to any desired degree.

(46) C. C. says: I enclose you some facts in regard to our engine: Cylinder is 14x20, steam pressure 55 lbs., revolutions 120, cut off at $\frac{3}{4}$ stroke, indicator shows 23 lbs. mean pressure, exhausts into a feed heater. Power is 45 $\frac{1}{2}$ horse. Running at 60 lbs. boiler pressure (vacuum gage showing 24 lbs.), revolutions 120, cut off at $\frac{3}{4}$ stroke, showing 9 lbs. mean pressure, and 9 lbs. mean vacuum, she shows steam 35 horse power, and vacuum 17, total 52 horse power. The engine (high pressure) has been changed to a condensing, and the indicator cards and other particulars were taken before the alteration and after, respectively. Coal bill was reduced 33,000 lbs. a month by the change. The work was about the same; if there were any difference, it was more in the last case. Coal used was slack or fine soft coal in both cases. A. This is a very good illustration of the gain from condensers, and will, doubtless, be interesting to all steam users. We would be obliged to our correspondent if he would send us the amount of coal burned before the change, the original cost of the engine, and the cost of attaching the condenser.

(47) O. C. M. asks: How can I make a mold for zinc castings, so as not to have airholes in them? I want to make a small engine, 2 $\frac{1}{2}$ x4 inches stroke, of zinc. A. Use a brass mold made warm.

(48) C. W. S. says: We have a railroad locomotive that we are using to run a sawmill with; her dimensions are: Two cylinders 16x16, running at 120 revolutions per minute. Boiler has 120 copper tubes 8 feet long x $\frac{1}{2}$ inches diameter; fire box is 3 feet deep, 3 feet wide, 28 inches long, open on bottom. Wishing to burn sawdust, we constructed a firebrick fireplace underneath and opening up into the firebox of boiler. The fireplace is built of firebrick something after the form of tanners' ovens. It is 7 feet long, 51 inches wide, and 3 feet deep. We have not draft enough to take the heat through the flues; our stack is 50 feet high and 18 inches in diameter. The fireplace makes a quantity of smoke which is very black and seems to clog in the firebox. We cannot make enough steam, but we can make heat enough in the fireplace, if we could draw it through the flues. Do you think a blower would answer? A. A blower or steam jet would probably be of some service. For dimensions, it would be best for you to address a manufacturer.

(49) M. A. O. says: I wish to make a vessel for household use, and in its construction I will have to use a piece of brass or copper, 2 inches square, in a vessel to hold 1 quart. Would there be any fear from corrosion if the vessel was not cleaned properly every time it was in use? It is to be used for milk, vinegar, etc. Would copper be better than brass? A. Both copper and brass would be dangerous.

(50) C. P. V. asks: What size of lens is required for a camera obscura, to take a picture 8 inches square at a distance of $\frac{1}{4}$ of a mile? A. The distance at which a picture is to be taken and its size do not depend on the size of the lens, but on its focal length, which is determined by its curvature. To take a good picture of 8 inches square, the focal length of lens must be at least 12 inches. If the scene is so far off that there are too many objects in the picture of 8 inches square, and the details are too small, you must take a lens of longer focus, which will make the details larger in proportion to its focal length; it will also make a large picture if needed, but a small one just as well. As a larger lens admits more light, it will require less time to make the picture than a small lens, which of course admits less light. In any case it is well to use a diaphragm placed about 2 inches in front of the lens; this makes the picture sharper, but protracts the time necessary for taking it. It will not reduce the size, even if you make the opening as small as a pinhole.

(51) W. D. M. asks: Is there any one man who can turn 80, 100, or 140 feet of 2 or 2 $\frac{1}{2}$ inch shafting on any machine in one day of 10 hours? A. Yes, with a special tool.

(52) J. B. P. asks: What are the objections to the following plan for running street cars? Use all the available space in the bottom, sides, and top of car as a reservoir for compressed air, which is to be supplied to the cars at street crossings from a pipe or air main, laid along the tank and beneath the surface. The pipe is to connect with a large tank centrally located, and the pressure kept up with air pumps run by stationary steam engines or other power. The car driver could connect and receive his supply while passengers were changing at street crossings. With a sufficient capacity and pressure to start with, the car would run several squares without being replenished, and might draw another car. The air main should be of a sufficient capacity to avoid friction in the flow of air, and to supply the cars quickly. A. We could hardly form an opinion without having more data. We believe the difficulties of this form of motive power have been with the arrangements for compressing the air, and its cooling effect when used in the engine. A great many inventors have turned their attention to this subject, but so far we have not heard of any system which is a complete success.

(53) C. P. L. asks: Please give me a recipe for a cement to fasten oiled wood together. A. Melt together in an iron vessel equal parts of common pitch and gutta percha.

(54) C. G. asks: How can I make large lumps out of small bits of sal ammoniac? A. Dissolve in water, and allow to crystallize slowly by evaporation.

How can I make cheap liquid manure for young plants on poor ground? A. Fill a large barrel with old rotten manure, fill with water, allow to stand one week, and draw off as required.

How can I magnetize knife blades on a Tom Thumb telegraph apparatus? A. While the current is passing, place the middle of the knife on one of the poles of the magnet (taking care not to let it touch the other pole) and gradually move the blade along from the middle towards one end. Repeat this several times, taking care always to move the same pole in the same direction.

(55) E. E. says: I have a cistern which leaks badly. The water penetrates through the cement and brickwork. Can I put on new cement over the old, and make the cistern tight, or must I remove the old before putting on the new? How would it do to cement on the outside of the cistern? Would it stop the water from coming through? A. Remove all water from it and get it as dry as possible; then put on a good coat of Portland cement in clean sharp sand, and give it time to set before you put water into it. After it becomes hard, let the water into it, and you ought then to have a tight cistern.

(56) C. W. S. asks: Is it practicable to make and use a light carriage on common roads, propelled by other than horse power? Can a 2 or 3 horse power engine and boiler be made (of iron, steel, or other metal) sufficiently strong, light, durable, and cheap, to be economically to use to propel a light carriage to carry one or two persons on common roads? A. We believe there are no serious difficulties in the way of designing such a machine. Steam road rollers, traction engines, and steam plows are in successful operation, doing the work more economically than it can be accomplished by animal power.

(57) E. N. B. asks: Will you tell me how fast to run a $\frac{1}{4}$ inch twist drill to drill iron? A. At 250 revolutions per minute.

(58) C. S. F. says: During the late spring we planted some tomato and radish seed. The seeds were placed in two cups with a solution of chloride of lime. The water in the tomato cup froze solid, while the radish seed did not freeze at all. Both were set side by side in the open air. Why did not the radish freeze? A. It was due to a difference in the amount of cooling in the two vessels, dependent upon some undetected difference in the surroundings of the two vessels, the thickness of the glasses, or some similar cause.

What is the address of the Stevens Institute of Technology, and is it a free university? A. Hoboken, N. J. It is free only to poor students who have distinguished themselves for great merit.

1. What can I use to gum pressed leaves and flowers into an herbarium, so as not to curl and stain the pages, or discolor the flowers or leaves? A. Try pure gum arabic. 2. What can I put on leaves or flowers to make them retain their color when pressed? A. Copal varnish.

(59) M. T. J. asks: What is the best compost for celery in a sandy soil? A. Well rotted pig manure.

(60) N. F. B. says: We have recently heard it asserted by one of our manufacturers that it was more profitable, or fully as much so, to pump fresh water into boilers for the purpose of making steam as it is to allow the hot condensation water to be returned to the boilers. He contends that water once made into steam loses in a measure its life and vitality to be re-used for that purpose, and that fully as much or more fuel is required than if allowed to run off and fresh water is used. We would like to know if this is really the case. We have our pipes so arranged that the steam, which is used for heating purposes, passes from the boilers, and the condensation water returns directly back again without contact with the air, at nearly a boiling point. Would the value and vitality of the water (if lost) be restored by pumping air in with it, or allowing the water to be exposed to the air before going again into the boiler? A. We think that your present arrangement will answer as well as any other. It is true that water which contains no air acts differently when heated from the water ordinarily used in boilers, but we do not think that it has been proved that the spe-

cific heat is much different. Besides, it is exceedingly doubtful whether your condensed water is entirely free from air. The United States Commission on steam boiler explosions intend to make some experiments on airless water, if they do not take up the time till cold weather in getting ready as they did last season.

(61) C. L. K. asks: Water in shallow vessels put into a cellar will prevent vegetables from freezing. I have seen ice freeze to two inches thick in one night, and potatoes remain unfrozen by the side of the vessel in which the water was. A. It is true that water in melting gives out a large amount of latent heat; but the question is whether, under the circumstances mentioned, the potatoes might still have remained unfrozen, the water being absent.

(62) D. H. S. asks: How can I cleanse a well which has become foul, the water being impregnated with water from a drain? A. Pump it dry if possible, and have it cleaned out. Then pump as much water from it as you can every day for a week. Let the water settle and then test it; if not yet good, keep exhausting the water until thoroughly washed out, and the water becomes pure.

(63) B. & G. H. ask: How can we make a frost-proof house? A. The outside wall may be 8 inches thick and the inside wall 4 inches, the walls tied together with iron anchors or with brick with. Sawdust is sometimes used for filling; and sometimes the air alone, when unventilated, is considered a sufficient non-conductor of caloric without filling.

(64) K. K. K. says: I have a number of fish globes and aquaria. I use well water drawn with an iron pump. Occasionally I notice that the water in some particular aquarium or globe has a peculiar crystal-like brilliancy, different from that in others treated in the same way. What is the cause, and how can this beautiful effect be with certainty obtained? A. The clear water is free from suspended animal matter and dirt. 2. Would filtered well water be suitable to replenish aquaria? A. No. 3. What is a good cement for aquaria? A. Put an egg-cup-ful of oil and 4 ozs. tar to 1 lb. rosin; melt over a gentle fire. Pour the cement in a heated state, but not boiling hot, into the angles. The cement will be firm in a few minutes.

How is terra cotta made? A. It is made from a pure clay and a fine-grained clear sand or calcined flints, mixed with crushed pottery, made into a paste, in which state it is molded, dried slowly in the air, and then in a kiln until of the hardness of stone.

(65) S. A. S. asks: What will make a good flux for brass? I am melting up a good deal of old scrap and sometimes use glass for a flux, but it makes the brass too hard. A. Glass is a good flux. Do not overheat your brass.

(66) J. W. asks: Can a small achromatic lens one inch in diameter be used to correct a large one of crown glass, say from 6 to 8 inches diameter? A. A small concave flint lens may be used to correct one more than twice as large of crown glass by placing it half way in the tube, and then you have what is called a dialytic telescope.

(67) R. L. asks: 1. I have good lenses for a 3 inch achromatic astronomical telescope. The 3 inch object lens is of 4 $\frac{1}{2}$ inches focus, and the Huyghenian eyepieces are of $\frac{3}{4}$ to $\frac{1}{2}$ inch focus. How long should the main 3 inch tube be, and how long should the sliding focus tube be? A. The main tube should be 40 inches, and the sliding focus tube 8 or 10 inches long. 2. What is the best and cheapest metal to make it of? A. Brass or German silver is the best material for the sliding tube, and wood for the large tube. Paper, well varnished, is also good. 3. Where should the diaphragm, if any, be placed? A. One diaphragm should be placed, of course, in the Huyghenian eye piece, between the lenses. Another diaphragm should be placed in front (outside) of the 3 inch lens, in case the image is not sharp; and it is well to have several of them, and use them according to the necessities of the case.

(68) J. S. asks: 1. How are chilled iron rolls used for rolling in paper mills, made? A. They are chilled in the mold. 2. How are they turned, and what is the shape of the tool? A. We have heard that a wrought iron tool is made, of ordinary diamond-pointed form, and iron cast around it in a chill.

(69) H. L. A. C. asks: How is it that the moons of Jupiter can be so plainly distinguished with the aid of an ordinary looking glass, when they are invisible to the naked eye? A. You do not see in an ordinary looking glass the moons of Jupiter, but the planet itself is made visible several times by the repeated reflection of the upper and under surfaces of the glass. For proof: First shift the position of the mirror so as to give a more oblique reflection, and the supposed moons will go further apart. Secondly, let the mirror be nearly vertical, and then lay it horizontally, and the position of the apparent moons will always be in the plane of reflection. Thirdly, watch the movements of the moons in the mirror every night; and if you place it in the same position, they will never change their positions as the real moons do. Fourthly, compare the position of the supposed moons seen in the mirror with those of the real moons seen in the telescope, and you will find them very different. Fifthly, look at Venus or Mars, or even a bright button, in the same way, by help of the mirror, and it will show in the mirror the same moons as you suppose Jupiter does, and in exactly the same position. Sixthly, take mirrors of different kinds of glass, and each mirror will show different positions and different numbers of moons; with some mirrors, you may see six and even more moons near to Venus.

(70) J. B. N. and others.—The potato is a native of America, and was not seen in Europe till Sir Walter Raleigh introduced it there, after his return from this continent.

(71) W. & R. ask: What is a good and cheap elatment or varnish to prevent rust on polished iron and steel exposed to dampness, or to a sea voyage? A. Tallow and white lead. A. Is there known a process which facilitates the union of steel to iron cast around it, that obviates the necessity of pouring the iron very hot and in large quantities, as now generally done, to the frequent injury of the steel? A. Dry the mold and cast endways.

(72) J. H. W. says: A drop of turpentine in a grain of chloride of potash, with the addition of a drop of strong sulphuric acid, produces immediate combustion. Can I obtain similar results by the mixture of any solids? A. Sugar may be made to replace the turpentine in this experiment; but there is nothing that will replace the oil of vitriol, unless it be the anhydrous sulphuric acid, and this is not a pleasant substance to handle.

1. Ganot's "Physics" states: "For physiological or chemical effects, the wires on the bobbins (of a magneto-electrical machine) should be fine, and each from 500 to 600 yards long. For physical effects, on the contrary, they should be thick, and only from 25 to 35 yards in length." I want to produce the longest spark; which arrangement, other portions of the machine being similar, will accomplish my object? A. The fine wire will produce a current of the highest tension, and consequently the longest spark. 2. Can I increase the spark by passing the induced current of one of the above machines (constructed for medicinal purposes) through an induction coil, or would such an arrangement only add to the resistance? A. It is requisite that the inducing current in a Ruhmkorff coil should be one of quantity; and as the current referred to in the preceding question does not possess this essential attribute, it is useless for this purpose.

1. Does mercury evaporate? A. Yes. 2. Which would be more durable as a valve seal, subject only to climatic changes of temperature, mercury or glycerin, the seal being in a position difficult of access for adjustment or inspection? A. Although both have objectionable features, the mercury would probably answer your purpose best.

I wish to construct a small but powerful battery, to be placed in a position difficult of access, but arranged with cord and pulley in such a way that I can lift the electrodes out of solution when not in use, and produce strong electric action immediately on replacing them. Under such conditions, I wish to employ such materials as will be most constant. The battery will not be used more than five or six times in a day, and then for only a few seconds. What form would best answer the purpose? A. Arrange a number of large plates of zinc and carbon alternately, and connect for quantity, that is, all the zincs together to form one pole, and all the carbons to form the other. Place in a lead-lined wooden trough, containing a cooled solution consisting of one part by weight of bichromate of potash in ten parts of hot water and five parts of oil of vitriol. The plates are readily arranged so as to be lifted together out of the solution.

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

E. B.—It is clay with yellow ochre; it contains oxide of iron, but only in small quantity.—A. L. H.—All the specimens are oxide of iron, except No. 2, which is asphalt.—P. D.—They are cubical crystals of iron pyrites.—J. T. W.—Silver was not detected in the sample forwarded. It would be necessary to take a larger sample to subject it to careful assay.—F. H. D.—Quartz.—J. M. R.—It is slate, with a small percentage of bituminous matter. Not valuable.—F. H. F.—It is wulfenite or molybdate of lead, and contains 51 per cent lead and 39 per cent molybdate.—D. L.—No. 1 is a rock containing sand, clay, and oxide of iron. No. 2 and 3 are dolomite, No. 2 containing some clay.—C. H. W. Jr.—No. 1 is quartz with carbonate of copper. No. 2 is galena.—E. F. R.—The water holds a considerable amount of oxide of iron in solution, which on contact with the air is separated, and gives the iron stains shown on your paper. It is probable that the water is impregnated with matter from a cesspool, as it contains a large amount of organic matter.

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 Use of Superphosphates. By T. B. S.
On the Altitude of Thunderclouds. By —.
On the Grasshopper Plague. By J. S.
On Astronomy. By J. R.
On the Potato Bug. By J. C. B.
On a Cold Water Engine. By R. J. W.

Also inquiries and answers from the following:
A. F. K.—N. H. W.—J. C. T.—B. J.—N. F. R.—A. S.—J. T. B.—R. H. S.—J. F. W.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells sundials? Where can salicylic acid be obtained? Where are small printing presses sold? Whose is the best paint for ship's bottoms?" 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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8,389.—KNIFE HANDLE.—L. J. March, Deerfield, Mass.	
8,390.—MEGS, ETC.—T. C. Pears, Pittsburgh, Pa.	
8,391.—HEAD LIGHT.—T. S. Ray et al., Buffalo, N.Y. city.	
8,392.—DRINKING FOUNTAIN.—W. Tweeddale, Brooklyn, N. Y.	
8,393.—RANGE PLATE.—N. S. Vedder et al., Troy, N. Y.	
8,394.—RANGE.—H. A. Wood, Bangor, Me.	
8,395.—COFFIN HANDLES.—M. H. Crane, Cincinnati, O.	
8,396 & 8,397.—CHAIN PUMP CURB.—H. L. Fry, Cinn., O.	
8,398.—GAME BOARD.—C. G. Harger, Jr., Watertown, N.Y.	
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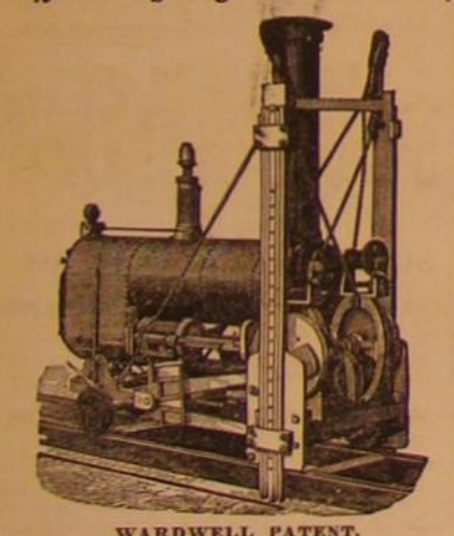
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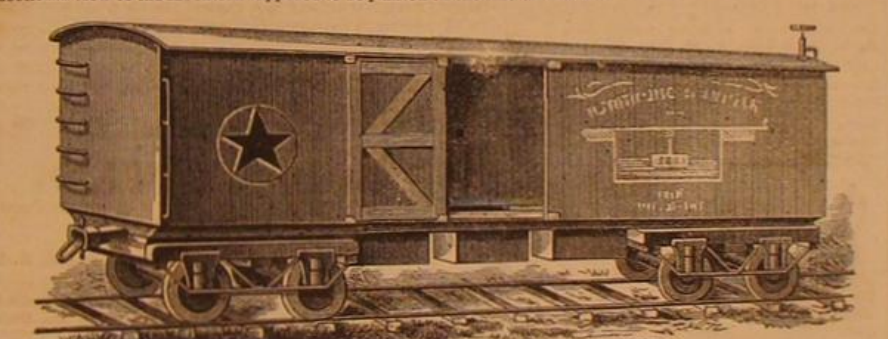
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The Engraving given herewith will render clear the arrangements of a novel automatic churn, the particulars
relative to the disposal of the patent for which will be found in the following lines. The idea of the invention is
to utilize the jarring and oscillating motion of the cars to agitate dashers in cream receptacles placed below the
flooring of the vehicles and between the sets of trucks, as represented in the engraving, in which three boxes are
shown on the car. The dasher is merely suspended by springs in a way that will be readily understood from the
sectional view of the invention supposed to be painted on the side of the car.



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The above invention was patented through the Scientific American Patent Agency, May 18th, 1875. The churn
is intended in its use for a railway car. Butcher can be made in any country. The value of the inven-
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a spring. It is intended that three or four churns can be used on a single car-wagon. The description of how the
churn can be applied will be found in the copies of letters patent No. 163,365, for which remit \$1 to Messrs. MUNN
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Personal in this paper, giving their names or initials, with address. It is the object of the patentee to have the
offer appear in this paper in place of written communications, in order that parties making later offers than the
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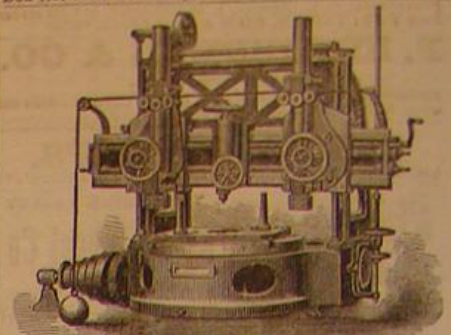
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Vol. XXXIII.—No. 4.
(NEW SERIES.)

NEW YORK, JULY 24, 1875.

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RIVETING BY HYDRAULIC POWER.

We illustrate herewith an hydraulic riveting machine, which is a representative specimen of the system which is now coming into extensive use abroad. It is clearly delineated in our engraving, which is selected from *The Engineer*, and requires but little description. It can deal with a row of rivets about 6 feet 6 inches long, and the compressing strain is about 80 tons per rivet when the machine is doing its maximum, which can be reduced to 20 tons by taking weights off the accumulator. This is by far the most powerful riveting machine ever made. One at Jarrow, England, can take in a seam 11 feet long; but the strain per rivet is only 30 tons. The great range, however, of the Jarrow machine enables a marine boiler shell to be riveted straight off, without stopping to turn it end for end.

In the machine we illustrate, pressure is supplied by a two-throw 1½ inch pump, which forces water into the accumulator, which is of the differential type, and loaded to 1,500 lbs. per square inch; when the accumulator is filled, a rod is caught by a tappet, stopping the suction pipe to the pumps. The water is led from the accumulator to the machine, and by a suitable valve the ram is worked. Only one valve is required for the whole plant, everything is above board and get-at-able, although, owing to the extreme neatness of the arrangement and the high pressure used, the head of the riveting standard is very small and out of the way of everything. The speed of these machines can be regulated from 25 to 2 rivets per minute. They require little or no foundation, the exhaust water returns to a small cistern, as shown, and from that it again goes to the pumps. It is needless to expatiate further on these machines, which are now in use at every large works, and in the dockyards of every European power.

The machine illustrated is one of several ordered for use in France, and is the invention and design of Mr. R. H. Tweddell, Delahay street, London, England.

Sword Fish Exploits.

A few days ago, a couple of men, who were out in a boat, fishing in Lower New York Bay, observed a commotion among a shoal of small fish, and, rowing to the spot, found what they at first supposed, by its single fin above the water, to be a shark. They attacked the monster with a view to capture, and were astonished by the sudden piercing through of their boat bottom by the sword, 4½ feet long, of a large sword fish. They succeeded in noosing his tail, securing and killing the fish, after which he was towed ashore, and subsequently brought up to the city, to a restaurant in Park Row, a few doors from the SCIENTIFIC AMERICAN office. The *New York Express* states that the fish weighed 390 lbs., and measured 19 feet 8 inches in extreme length. It was certainly one of the finest specimens we ever saw.

The *Liverpool Mercury* has a report from Captain Harwood, of the brigantine *Fortunate*, lately from Rio Grande, to the effect that the vessel, while at sea, was struck and shaken by a sword fish. After discharging the cargo at Liverpool, the hull was examined and the sword of the fish found, broken off even with the outside planking. The fish

had driven his sword completely through the four inch planking, leaving eight inches of the blade projecting within the vessel.

The sword fish is allied to the mackerel, which it resembles in form, and is a swift swimmer. The sword is a most formidable blade, consisting of a strong straight bone, sharp and flat, projecting horizontally from the nose, of which it is a prolongation.

ing reduced to 0.001 second. With this last metal, therefore, the highest possible rapidity in the transmission of signals may be attained. This is due, according to M. Deprez, to the molecular structure of the metal and not the proportion of carbon contained.

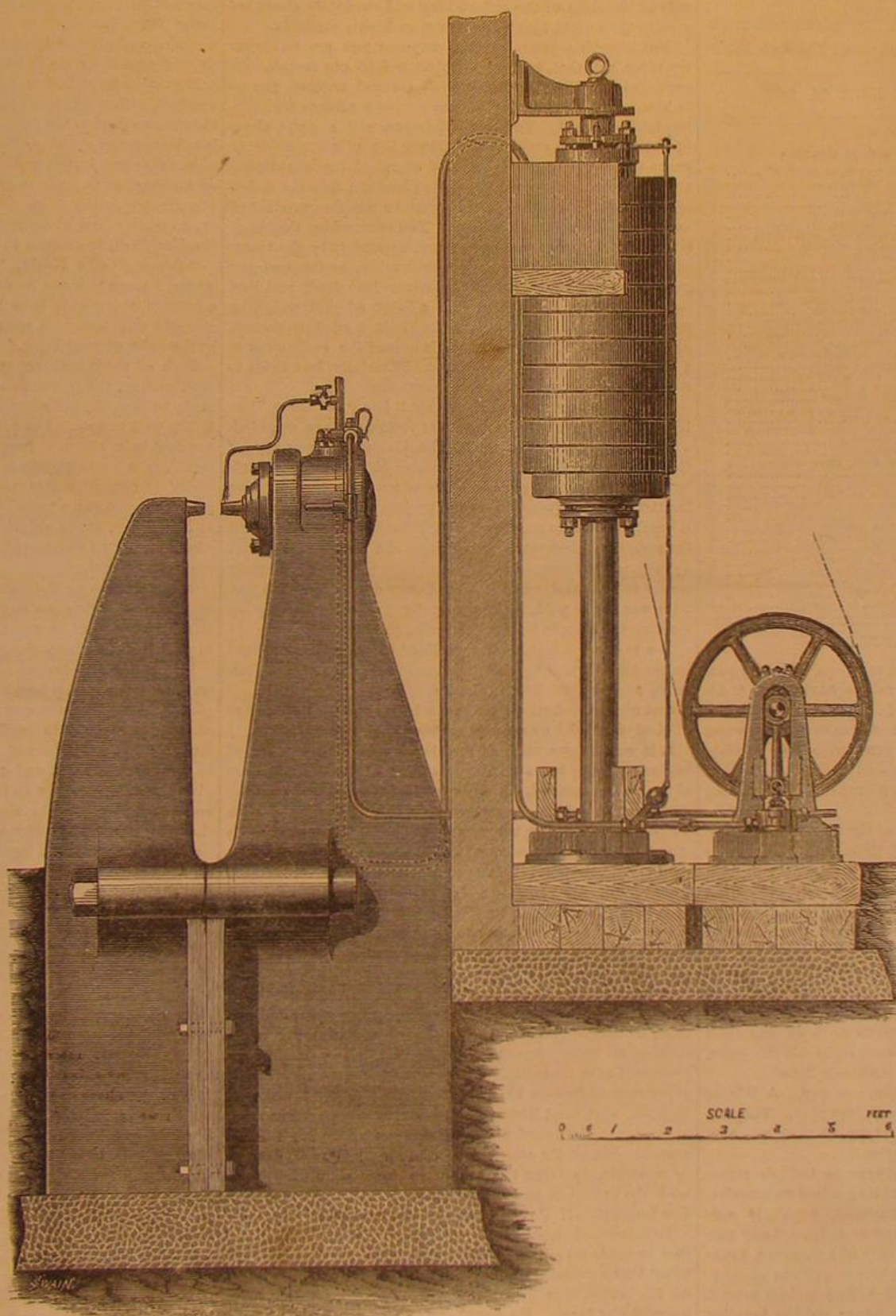
The Intensity of Different Colored Lights.

An experiment recently made at Trieste, to test the intensity of various colored lights, is worth recording in these columns, as it is naturally a matter of some interest to photographers. The experiment was a practical one, and designed for the purpose of discovering how far lights of different colors penetrate darkness, and whether they would be of any value for the lanterns of lighthouses. Of course a white light is seen at a much greater distance than any colored illumination, and it is singular, too, as many of our readers have, no doubt, remarked, when viewing a fountain illuminated by various colors, that when the white light is thrown upon the drops these appear at their best. At first we may admire the violet; then a ruby light is thrown upon the falling water, and we pronounce in favor of that; then, perhaps, green, orange, and blue illumination follow, all securing our admiration in turn, until, at last, the white light is again turned on, and its brilliancy and intensity give at once finer effects than the others. In the experiment at Trieste, half a dozen lanterns, with carefully selected glass, and all furnished with oil and wicks of a like character, were set burning on the beach, and then observations were taken by a party of sailors in a boat. At half a league distant the dark blue lantern was invisible, and the deep blue one almost so, so that there could be no doubt as to their unserviceableness for lighthouses or beacons. Of all the colors, the green was visible for the longest distance, with the exception of the red, which ranked next to the white in brilliancy. It is only the green and the red—such, indeed, as our railways make use of—that are capable of employment, and the green light the Trieste authorities only recommend in the vicinity of white and red lights, as from a short distance an isolated green light begins to look like a white one.—*The Photographic News*.

Vanadium in Rocks.

Dr. A. A. Hayes, in a paper read before the American Academy of Science, Boston, in January last, states that he had detected vanadium in many rocks associated usually with compounds of phosphorus and of manganese. His mode of examination for the detection of vanadium is described in detail, but no complete analyses of any rocks are presented. The author proposes in a future paper to give a tabulated list of the rocks. He also states the occurrence of vanadium in the well water of Brookline, near Boston.

A THICK solution of marine glue in wood naphtha is a good cement for fixing glass letters. The glass must be chemically clean and must be previously scrubbed with soda, then with whitening and water, followed by thorough rubbing.



TWEDDLE'S HYDRAULIC RIVETING MACHINE.

The sword fish is found in considerable numbers off the island of Martha's Vineyard, coast of Massachusetts, at this season of the year. Its flesh is considered excellent food by many persons, and the annual catch is quite large. The ordinary length of the body of the fish at full growth is 14 feet, and its sword 6 feet, or 20 feet in all.

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VOLUME XXXIII, No. 4. [NEW SERIES.] Thirtieth Year.

NEW YORK, SATURDAY, JULY 24, 1875.

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TAKING A CHANCE.

David said in his haste: "All men are liars." With equal truth and greater deliberation he might have said: "All men are gamblers." There is a fascination in taking a chance that is quite irresistible to most men, especially when the cost of the chance is small compared with the possible outcome; and the greater the promised prize, the less apt men are to think of the overwhelming probability of drawing a blank.

Just now the adventurous spirits of the country are feverish with a desire to get to the Black Hills. They know, or ought to know, that the hills that await the pioneer in that disputed region are blacker and more numerous than the hills; but report says gold is there, and multitudes are bound to have a chance for it, in spite of Uncle Sam, the Sioux, or any other hindrance.

The probabilities are a hundred to one against success in any individual case, even if the precious metal should be found in paying quantity; they are as strongly in favor of sickness, suffering, and violent death to such as win their way there. Yet the possible prize outweighs all the risks, and so dazzles the imagination that it alone is seen.

But these are reckless adventurers, you say. A life of privation and danger is what they specially enjoy. They are constitutional gamblers, and no fair type or illustration of the prudent average man of civilization.

True as to their character, but not true as to their representative character. Judging from their conduct on occasion, we must say that prudent men of business, popularly supposed to calculate the probable success or failure of any new enterprise with the passionless accuracy of a machine, are as likely to take a wild chance for a big prize—quite as likely to overlook the enormous probability that the promised prize is a fiction—as the most adventurous miner on the frontier. The one stakes health, strength, comfort, life, against a fabulous "pile;" the other stakes what is just as dear to him—his cash. Hence we have the familiar saying that the average capitalist can more easily be persuaded to go out of his regular line of business to take hold of a downright swindle (take hold honestly, we mean) than of a legitimate enterprise of reasonable promise. To the latter, he applies his customary business maxims, criticises percentages, and is the more cautious the less he knows of the nature of the proposed undertaking. In the other case, his credulity is in direct proportion to the extravagance of the promise and the depth of his ignorance.

For example, we will suppose that you, courteous reader, are a scientific metallurgist, and that you have wrought out and patented a process for the better separation of the silver from argentiferous galenas. You are in want of capital to

carry out your project, so you go to the Hon. Mr. Mortgage Bond, the well known millionaire, and lay the matter before him. You show him that by the usual processes a considerable percentage of the silver remains in the lead, much to its detriment. You show him that, by your process, which is less costly than those in use, the silver is more completely separated from the lead, giving you a threefold profit, in the cheaper process, in the gain in silver, and in the superior softness of the lead.

"That is all very plausible," he will reply; "but I'm a banker. I don't know anything about metal working. But I do know that schemes like yours never turn out so well as the projectors imagine. Then the risks are very great. You will have to compete with all the wealthy firms already in the business, and they control the markets and the mines. You will have this other difficulty to contend with, and that, and that, and that."

In vain you try to convince him that you will have the inside track: that with a cheaper process and a purer product, you need fear no competition. You can afford to pay more for the ore and so command it, while the demand for pure soft lead is such that you need have no fear of the rivalry of those who supply an inferior quality. Your breath is wasted. The cautious capitalist is shy of patent processes. He looks only at the risks of the undertaking, and resolutely shuts his eyes to the merits which make success highly probable.

But (begging your pardon) suppose you are an arrant swindler, and that, instead of laying before our incredulous capitalist a legitimate enterprise of assured success, you go to him with a cleverly devised fraud: say a scheme for turning lead into gold. You talk glibly and with a great show of learning. You quote from a long list of authorities to prove that the growing opinion of chemical investigators is that all matter is substantially one at bottom: that the different qualities of the so-called elements are the product of varying molecular arrangement. You assure him that such is actually the case; you have demonstrated it by the transmutation of different metals into each other, as for instance gold into iron, iron into silver, silver into lead, and lead into gold. You present him with a brick of gold weighing a pound, and tell him that it is the product of three pounds of lead. Theoretically two pounds of lead are equivalent to a pound of gold, you tell him confidentially, but there is some waste in the process of transmutation.

It needs no argument to show that it is a "big thing," too big for any one man to handle. So you propose to establish a stock company to develop it, the Universal Company of Gold Refiners, of which the Honorable Mortgage Bond shall be president, with the lion's share of profit, in consideration for the capital required to set the project on foot. Of course it would not do to publish the fact that the gold is made on the premises; that would bring down the price of gold with a rush, and disorganize all established values. Secrecy would be essential. But if he had any doubt that the product was really gold, he could easily prove its quality by sending the sample brick to the mint to be tested.

Ten to one, the Hon. Mortgage Bond would bite. It would be too great a prize to miss. He could afford to risk a little on it, and would take the chance.

One more illustration: perhaps a better one for these days of Keelys and the like, not to mention their dupes.

It is well known that, as coal is now burned, the best of engines develop but a small percentage of the actual power of the fuel consumed. Suppose a clever inventor should devise a boiler capable of evaporating a third more water with a ton of coal than any boiler now in use. The supposition is not an extravagant one, and the increase of power could be easily demonstrated. The economy of such an improvement would ensure its ultimate adoption, subject only to the risk of some one's inventing something better; yet the maker of it would find it no easy task to induce men of means to furnish the capital required to put the improvement before the manufacturing public.

But suppose the same man were to get up a perpetual motion of the modern type, call it the Schwindler motor or something of that sort, and have it certified as something transcending all known principles and powers by two or three engineers of easy credulity. There would be no end of newspaper correspondents to write it up in the most eloquent English, with head lines to match. The greatest invention of the age! Unlimited power at nominal cost! No fuel required! Simplicity and safety combined! Power derived by catalysis, evolving the expansive force of nitroglycerin with the precision and gentleness of a jack screw! Explosion impossible! Power of engine inexhaustible!!!

To interested enquirers, Mr. Schwindler could frankly say that he made no secret of his sublime invention, being confident that a grateful public would see him suitably rewarded for the stupendous benefaction he was about to confer on humanity at large. He would call the motive power of his miraculous engine expansive glycerin, not nitroglycerin, but something still more powerful, yet absolutely controllable. Its power would be developed by the passage of the glycerin over a certain compound of metals known only to himself, by which the bland liquid would be converted by catalytic action into cold vapor of enormous tension: the vapor, having done its work, to be discharged into a receiver enclosing another combination of metals whose opposite catalytic power would reconvert it into liquid glycerin without loss of substance. Once charged—and a gallon of commercial glycerin would suffice for a thousand horse power engine—the generation of power would be perpetual, without additional expense. Combining superior economy with absolute safety, the Schwindler motor could not fail to supersede all others, the Keely motor not excepted.

And there would be no lack of men eager to take a chance

in a scheme so promising. What if it does fly in the face of all experience? Haven't we railways, telegraphs, steam navigation, and a score of brilliant achievements that were once as incredible to the conceited professors of Science who thought they knew everything?

It is the gambler's delusion in another form. The magnitude of the promised prize hides the multitudes of blanks.

It is useless to tell those infatuated with the dream of impossible riches that the marvelous projects which achieved success were the legitimate outcome of scientific investigations, and always in harmony with the previously discovered laws of Nature. The swindler's victims will know nothing of such things. They are not amenable to sober reason. There's a big prize in view, and they are determined to "go" for it.

THE KEELY MOTOR DECEPTION.

We continue to receive hundreds of newspapers from all parts of the country, containing the most fulsome endorsements of this most puerile deception. Nothing more lamentably exhibits the general lack, in this country, of elementary scientific education, than the editorial comments upon this subject by many of the papers. With very few exceptions, the writers are unable to perceive why the Keely chimera may not be true, the general line of argument and thought being that, inasmuch as modern discovery has heretofore revealed and produced inventions quite as startling as anything assumed by Keely and his abettors, therefore it may be that what he claims is well founded; and it is unwise, imprudent, to throw doubts upon his statements, especially when they are so thoroughly supported by other persons of reputed intelligence and veracity. To all of which it is a sufficient reply to say that any inventor who pretends to get something out of nothing, or to produce more force or more substance out of a given quantity of materials than they possess, is a deceiver, no matter how many respectable people join hands, like the Keelyites, to support the deception.

"People," says Keely, "have no idea of the power in water, I mean that can be drawn out of it. I purpose to run a train of thirty cars from Philadelphia to New York at the rate of a mile a minute, out of as much water as you can hold in the palm of your hand."

Both of these statements are incorrect. Estimating approximately, the power in water, or the power that it can be made to furnish, whether in liquid or vaporic form, is perfectly well known. Four thousand gallons of water, falling one foot in a minute, furnish one horse power. One sixteenth of a horse power is furnished by one cubic inch of water, if converted into vapor at the ordinary atmospheric pressure. To run a train of thirty cars from Philadelphia to New York, at the velocity of sixty miles per hour, would require not far from two hundred barrels of water and over two tons of coal.

These are among the elementary facts pertaining to motive engineering, which no Keelyite can set aside; and which, if they were kept in mind by editors, would enable them to perceive at a glance the grossness of the present deception.

In further illustration of the need of better educational training among our business men, as a protection against stock-jobbing deceptions wrought and maintained in the name of Science, we give in another column a few gems from the most recent declarations of Keely. These were lately made to the correspondent and reporter of *Inter-Ocean*. We also give extracts from the statements of some of Keely's chief assistants, showing the rise, progress, and management of the deception. The price of the Keely stock, which at one time was very high, is beginning to ebb, and in a short time all the beautifully engraved stock certificates will doubtless find their way into the cellars of the rag and paper dealers.

THE NEW PHYLOXERA REMEDY.

We took occasion recently to announce the discovery, by M. Dumas, of an efficient phylloxera remedy, in the alkaline sulpho-carbonates, a class of salts which hitherto have been more objects of scientific curiosity than available for any beneficial employments. As the vine growers in this country are directly interested in the result of M. Dumas' very important investigation, we propose briefly to review the nature of the above chemicals, in giving below a few facts, for which we are indebted to *La Nature*, relative to the researches of the well known French chemist.

Everybody is familiar with the potashes, sodas, and the lime of commerce. If in these substances the oxygen contained be replaced by sulphur, the sulpho-carbonates of potassium, of sodium, of calcium, and its analogue, the sulpho-carbonate of barium, are obtained. Of these, the salt most utilized at present is the sulpho-carbonate of potassium, made by calcining sulphate of potassium with carbon, forming by reduction a monosulphide of potassium. A saturated solution of the latter is made in water, and sulphide of carbon added, when, after prolonged agitation, a reddish orange liquid, marking 37° to 40° on the Baumé areometer, is obtained.

While the sulphide of carbon is by itself an efficient insecticide, it offers disadvantages through its volatility, injurious vapors, etc., which neutralize its benefits. The sulpho-carbonates on the other hand have no disagreeable odor, are not dangerous to handle, are not inflammable, and are unalterable in the soil. When in contact with acids, however, even if these be the weakest, and especially when acted upon by the moist carbonic acid which arable earth imbibes, the salts are transformed into carbonates, and disengage sulphide of carbon and hydrosulphuric acid in vapors, both of which, and especially the first, are highly poisonous. To combat the phylloxera, such gases, as experiment has proved, are the only effectual means. It is necessary not merely to poison the insects upon the vines and roots, but to render

the earth in the vicinity uninhabitable by them. Besides some such substance as the salts alluded to must be employed, on account of the slow reaction of the acid, keeping up a supply of deleterious gas for several days, or longer than the insect can defy its influence by shutting its respiratory orifices.

It is found that 1442 grains of sulpho-carbonate of potassium will poison from 111 to 132 cubic feet of air, and will drive insects from 198 to 284 cubic feet of earth, killing not merely the comparatively delicate vine louse, but the larvae of crickets and other large insects. The mode of application is to make a hole at the root of the vine, about 1 foot deep and 16 inches broad. Into this pour five or six quarts of water mixed with from six to eight quarts of the sulpho-carbonate solution at 40° Baumé. When the liquid is well absorbed, the hole is filled up, and the operator passes to another vine. The solution is thicker than water, and, when mingled therewith, percolates slowly through the ground, reaching the deepest roots.

In order to render the sulpho-carbonate of potassium or of sodium, which salts closely resemble each other in their toxic properties, easily portable, M. Dumas suggests mixing them with twice their weight of slaked lime. The powder thus obtained is very easily sprinkled over the surface of the soil.

RATE AND CAUSE OF GLACIAL MOTION.

The movement of a glacier has many resemblances to that of a river. It follows the windings of the valley; is more rapid in the center than at the sides, at the surface than at the bottom, because the center of the surface is subject to the least friction; the part having greatest motion changes to the right and to the left of the center as the glacier changes its direction; it moves more rapidly when the descent is steepest, and where there are least obstructions; it becomes broken up and uneven when the bed is rough; and a large stream is often made up of smaller ones joining one another. The distance to which the ice river flows depends upon temperature and the amount of precipitation. In cold and wet years, it may extend fifty feet further than ordinarily; while under opposite conditions, the lower edge of it may melt away more rapidly than it advances down the valley, and hence seem to recede. It always descends in summer beyond the region of snow and ice, and flowers and other summer vegetation are not uncommon in close proximity to the ice mass. The force with which a glacier advances is so great that trees and forests, houses and villages, offer no more apparent resistance than a straw in its way.

Many students of glaciers have made investigations more or less carefully, respecting the rate of glacial movement. But there are so many modifying circumstances—as position and formation of the valleys; inclination, size, and thickness of the glacier; influences of the seasons and the weather—that even in the same glacier the rate is so variable that no universal law can be established. Some move most rapidly at the upper part, least at the lower, and just the average in the middle, while others move with greatest rapidity at their lower extremity. Eight inches per day may be considered a fair average of all glaciers and all parts of each. In the earlier investigations on this subject, only rough and inaccurate means were used for making the measurements, such as building a hut on the ice, or leaving some object, as De Saussure's ladder, on the surface, and noting how far it had descended each year, or after an interval of several years.

The works of James D. Forbes on glacial phenomena rank among the classics of physical science. He was a precocious Scotch youth, whose mother, by the way, came very near being the wife of Sir Walter Scott when she was young; the only thing that prevented was the simple fact that she said "no" when Sir Walter wanted her to say "yes." Young Forbes was studying Science, and entreating his father to buy him a telescope when a mere child. At eight, he composed sermons. Before ten, he was reading Phædrus with his father, having previously read Caesar. At seventeen he was contributor to the Philosophical Journal, then edited by Sir David Brewster. At twenty four he was elected to the chair of Natural Philosophy at Cambridge. He was then a member of the Royal Societies of Edinburgh and London, and writer in the Edinburgh Review. This savior, better known as Principal Forbes, made the first accurate determinations concerning the rate of glacial movement. He used the theodolite which his father gave him, in place of a telescope. By mounting this upon the glacier in various positions, and taking an exact point of observation on the wall rock, he made correct measurements at fixed intervals of time. He also set up rows of pegs in exact line across the glacier, and, by noticing their later deviations from a straight line, determined the rate of motion in different parts.

From these exhaustive and delicate observations, he arrived at the following conclusions: (1) Glacial motion is approximately regular; (2) it is nearly as great during the night as during the day; (3) a marked increase of motion is due to heat of the weather; (4) the center of the glacier moves more rapidly than the sides.

The cause of this motion has been subject to much discussion, and, cold as the subject is, it has occasioned frequent heated contests and many warm words. Beds of tough clay will rest on a considerable slope without sliding; loose stones and debris will rest on a hillside with an inclination of 80°; and at this embankment formed by the material shot out from Mount Cenot tunnel, the inclination is much steeper than this. But ice, more rigid than the hardest clay, will move on a slope inappreciable to the eye. And the question stated is: "What property does ice possess which enables it to creep upon slopes down which only fluids and semi-fluids can

move?" De Saussure ascribed the motion of ice to a mere gliding or sliding upon an inclined plane, like that of a piece of slate detached from the roof. But this could not take place over a very rough bed or in presence of an immovable obstruction. De Charpentier—and, in his earlier writings, Agassiz—explained the movement by an expansion of the mass due to freezing, in the crevices, during the night, of water which melted during the day. But this would necessitate an alternation of rate between day and night which the best observations do not detect.

In review of Principal Forbes' results, it is not strange that he looked upon the glacier as a river of ice, and attributed its motion to the viscous or plastic nature of the mass, in consequence of which it is urged downwards by its own weight, like tar or treacle. An infinite number of minute rents occur when the ice is subject to violent strain, and the bruised surfaces are forced to slide over one another, producing a quasi fluid character in the motion of the whole. This is quite consistent with the rapidity of motion in different portions, due to friction, inclination, and bulk of the glacier, and its compression on entering a narrow passage, and expansion as the channel widens. But we can hardly conceive that ice, with its known unyielding and brittle nature, could thus be changed merely by its own weight. Tyndall also ascribed the motion to fracture and regelation, due to the pressure of its own weight, and extending to every minute particle. Faraday had previously noticed that two moist pieces of ice freeze together when in contact. Canon Mosely opposed the last two theories with the idea that there is a constant displacement of ice particles over and alongside one another, to which is opposed that force of resistance known in mechanics as shearing force, which force weight alone is not able to overcome. He claims that, considering ice a solid body throughout, there must be some other force besides gravity to drive it forward, as even clay, so much more yielding than ice, does not descend by mere weight.

Another theory held by Professor James Thomson and his brother, Sir William, and advanced by two or three others about the same time, is based on the idea that the freezing point of water is lowered by pressure. Condensation as the result of pressure diminishes the capacity for heat, and hence some latent heat becomes sensible. This free heat, instead of remaining free, expends its force in melting contiguous molecules of ice. As water occupies less space than ice, the melted ice makes more room for the unmelted particles; these then have space to yield to pressure, and move in the direction in which it is exerted. The water, subject to less pressure, moves in the direction of gravity, and, coming in contact with ice colder than itself, freezes. The ice again resists pressure and is melted, and in this way there is a constant change in the position of molecules, which has the effect of giving ductility and movability to the mass. Ice has been subjected to great force in Bramah's hydrostatic press, by which it can be made to assume any desired shape by the use of suitable molds. This is explained by supposing that the pressure liquifies the ice, which, in the melted state, conforms to the shape of the mold and then consolidates when the pressure is removed. This theory seems quite plausible and is accepted by many. The only apparent objection is in the question as to whether the weight of the superincumbent mass is capable of producing pressure sufficient to liquefy the ice below; and we are not aware that this question has yet been conclusively answered.

Croll's theory, which is considered the only tenable one by another class of physicists, ascribes the motion to heat rather than to pressure. The heat of the sun melts the surface of the ice, and if it were constant would in time melt the solid mass; but when the sun's rays are removed from any molecule, it congeals and, by its condensation, gives off heat which melts another molecule. The molecule, during the instant it remains water, is acted upon by gravity and assumes a lower position in the ice mass; this on freezing gives off its heat to a lower molecule, which in its turn seeks a lower place. The heat of the sun is thus transmitted through ice by the melting and freezing process, from molecule to molecule, and every melted molecule sinks lower in the mass. Thus the sun's heat causes the ice gradually to work down hill. The sun is aided, in heating the interior, by warm winds and rains which are admitted by cracks and fissures (always abundant), by the internal heat of the earth, and by heat caused by friction of the moving mass on the bottom. Experiments made by Professor Agassiz, by means of a hole in the ice 200 feet deep, lead to the conclusion that the internal part of a glacier has a comparatively high temperature, and in winter this is greater than the surrounding atmosphere. But his results were somewhat contradictory, and the real state of temperature in the center is mainly a matter of conjecture. The objection to this theory appears in Forbes' results, that motion is approximately regular—nearly as great during the night as during the day.

All the investigations thus far noticed on the rate and cause of glacial motion have been confined to local glaciers, like those of the Alps. In our own age there is manifestly but little opportunity to study phenomena connected with any existing continental ice sheet. We may some day obtain information in this line from a study of a sheet glacier of Greenland, and would doubtless have been able before now, if arctic explorers had succeeded in reaching points sufficiently far north. Agassiz said, at Penikese: "Since we have no positive data, we can form some idea of their motion by the number of icebergs which they send forth annually; for these icebergs could not exist but for the advance of the glaciers into Baffin's Bay, where their ends are lifted up by the water, broken off, and floated south. We do not know what these icebergs amount to, though it would not be difficult for an observer at the south end of Baffin's Bay to as-

certain approximately by counting the number of icebergs that pass a given point annually." He assumes that the continental glaciers moved at least as fast as 100 feet per year. At this rate it would take over 50 years for a boulder of Lake Superior copper to travel one mile south; and as some are found 500 miles south of their home, it would have required 25,000 years to reach this distance. This affords us one of the many indications of the vast antiquity of our globe.

In the Boston Society of Natural Science a few weeks ago, Professor Shaler, while accepting Croll's theory in the main for the movement of local glaciers, advanced the belief that the cause of sheet glacial movement was the melting of ice at the bottom by the pressure of the superincumbent mass, and that this water, in its effort to escape in the direction of least resistance—or towards the edge,—would push forward boulders, gravel, etc., and thus cause the southerly movement of erratics. He thinks the ice sheet itself did not move, and attributes the cause of scratchings on the boulders and bed rock to local movement at the edge of the ice sheet when it was melting, which movement Mr. Croll's theory may explain. The continental glacier, on account of the unevenness of the earth's surface, must often have moved up hill for miles, and sometimes for hundreds of miles, if it moved at all, and for this he thinks there is no adequate explanation.

SCIENTIFIC AND PRACTICAL INFORMATION. GROWING ROSES.

"An Old Rosarian" says: "Roses require a strong soil, highly enriched with good rotten manure; an open situation and loamy soil for the strong growing, hardy kinds, and a protected aspect and light soil for the teas and other tender varieties. The hybrid perpetuals in my judgment are the most desirable among the hardy roses, as they are the best for all the various purposes to which they are applied in garden and lawn decoration. The teas, however, are the diamonds *par excellence* of the race, although needing great care in their culture. I advise that they be grown in pots, and sunk in the ground during the summer, and removed to a cold frame or greenhouse during the winter. If left remaining in the open ground, they should stand on the south side of a wall, fence, or hedge, and on the approach of cold weather, receive a covering in the form of a shed open to the south, and the plants have a liberal supply of manure over the surface of the ground, and plenty of leaves over the whole plant. If roses are set out in autumn, perform the operation very early in November, so as to allow the roots to obtain a hold in the soil before cold weather. Give them a thorough dressing of manure to protect against sudden changes. Choose a dry day for planting, the drier the better. Be careful to tread the soil firmly around the plants; this is very important. A cloudy day is the most desirable for removal; and moisten the roots first, to be followed by a thin coat of dry earth over the fibers."

CHEAP COOKERY.

We noticed, while visiting a large steel-making establishment recently, that the workmen at noon ingeniously utilized the ingots of steel, which lay cooling in the yard, as cooking stoves, and seemingly prepared their dinners over the heated metal as easily as over a fire. The idea is a good one, and might be adopted with advantage by the men in all metal-working concerns. We believe that the custom is not common among the workmen in this country, nor in the ironworks in England, though it owes its origin to and has long been practised in the tin melting establishments of Cornwall. It is considered quite a civility there to offer a visitor a chop nicely broiled over a recently run ingot of tin. The big hammer block, we were told as an especial wrinkle, is the best place to fry things, as it is smooth and usually just hot enough. Ingots are ordinarily rough and generally somewhat too warm. In winter time, a workman can economize considerably, and at the same time get a hot dinner, by thus utilizing the wasted heat of the metal.

PORTLAND CEMENT.

Three tests are used:—1. Resistance to tensile force. 2. Specific gravity. 3. Water test. The first is by making a specimen briquette in a mold with a transverse section of 2.25 square inches, the specimen being held vertically in clips, which is placed under the short arm of a steel yard balance, and broken. Mr. Bazalgette used a test of 500 lbs. on an area of 2.25 square inches after 7 days immersion in water. The second method is by finding the weight in pounds of the struck bushel. The water test is useful when the others cannot be applied. It consists of gaging a small quantity of the dry powder with water, and immediately immersing it in water. If the sharper edges crack or break away after a short time, the cement is too hot or fresh, or is inferior in quality. The weight of good Portland cement ranges from 100 lbs. to 130 lbs. per bushel, equal to from 80 lbs. to 102 lbs. per cubic foot. The lighter kinds set more rapidly than the heavier, but are weaker. Mr. Bazalgette specified a specific gravity of 110 lbs. to a bushel.

THE VORACITY OF PICKEREL.

According to M. Peupion, who has been practically investigating the subject, a pickerel will eat 47 pounds and 4 ounces of fish per pound of its own weight per year.

The following is one way to cut a bottle in two: Turn the bottle as evenly as possible over a low gaslight flame for about ten minutes. Then dip steadily in water; and the sudden cooling will cause a regular crack to encircle the side at the heated place, allowing the portions to be easily separated.

IMPROVED HORSE YOKE.

The horse yoke illustrated in the annexed engraving is intended to enable horses to be attached to plows and other implements without using traces or whiffletrees, enabling the horse to perform his labor with ease, especially among trees and in other situations where the whiffletrees obstruct the work. The hames, A, are placed on the horse collar, as usual, and are made in two parts, hinged together on a pivot at the bottom, and fastened at the top by a screw. B B are the two sections of the yoke, which are joined by the horizontal bars, C. The hames, A, are made with projecting ears, which are slotted horizontally to receive the ends of the yoke, which are jointed by pins or screws in the top and bottom of the hames. The bars, C, are joined by the draft pin, shown in the engraving, and can play up and down to accommodate the position of the horses. It will be seen that the yoke is self-adjusting, the hames turning freely on the pins by which they are jointed to the yoke. Breeching and cruppers may be used when considered necessary, but harness in general can be dispensed with by using this arrangement.

Patented April 13, 1875, through the Scientific American Patent Agency, to Rufus Stratton and George Olmsted. For further particulars address the inventors at Hazardville, Conn.



STRATTON AND OLMSTED'S HORSE YOKE.

A NEW PYROMETER.

M. J. Salleron is the inventor of a novel form of pyrometer, an engraving of which, herewith given, we extract from *La Nature*. The instrument consists of a cylindrical vessel, C, Fig. 2, of copper contained in an outer brass jacket, E. *d* is a disk of wood supporting the inner vessel, the radiation and conduction of heat from which is farther diminished by the air space intervening between it and the enveloping cylinder.

The vase, C, is first filled with about half a pint of water measured in the flask, V, and the initial temperature of the liquid, *t*, is noted from the thermometer, T. A cylinder of copper, M, weighing 1,530 grains, is then placed in the furnace, the temperature of which it is desired to measure, and is held in a recess in the end of an iron tube, L. As soon as the cylinder is heated to the same degree as that of the furnace it is quickly removed, and, by reversing the tube, L, dropped upon a stand inside the vessel, C, which stand is then agitated by means of the rod, *a*. The mercury in the thermometer will rise rapidly, and finally remain standing before beginning to descend. While stationary its indication, *t'*, is noted. The temperature can then be calculated by the formula: Temperature = $50(t - t') + t'$. For example: Suppose before the immersion of the copper the temperature of the water is $15^\circ \text{C} = t$; after the experiment it is $25^\circ \text{C} = t'$; then the temperature of the locality measured, $T = 50(25 - 15) + 25 = 525^\circ \text{C}$.

Copper cannot be employed for determining temperatures exceeding $1,832^\circ \text{Fah.} = 1,000^\circ \text{C}$, since its point of fusion is too nearly approached. In such case a platinum cylinder, M, weighing 2,355 grains may be used, and the coefficient 50 in the above formula is replaced by 100.

It will be seen that this plan offers a simple instrument for determining high temperatures, which any mechanic can easily make, or which, in case of necessity, may be extemporized with always available materials.

Reducing Force.

It is the practice of many manufacturers, on the approach of the dull business season, usually beginning about the present time, to seek to economize by discharging a number of their workmen, giving the latter to understand that they will again be employed when trade becomes brisk in the fall. This course, naturally the first to suggest itself under the circumstances, does not appear to us to be the wisest that can be adopted. It certainly does not enure to the benefit of the discharged workmen, who find themselves out of a situation at the very time when work is hardest to get, nor are the employers likely to gain much in the long run, when they sever their connection with hands thoroughly familiar with all details of their particular business, and run the risk of having to instruct a new gang in the fall, should the old workmen prefer to remain in places obtained during the summer. We have always advocated the view that, if both employers and employed would treat each other more as men and manifest a reciprocal interest in each other's welfare, there would be less feeling on the part of one class that workmen are but machines to exact the greatest amount of labor from at the least cost, and less of the efforts on the part of the workmen to extort the greater amount of wages from their employers in return for the least and poorest labor.

The *Carriage Monthly* takes a very sensible view of this

custom of reducing force in the summer time, and suggests a method whereby the same may be avoided, which, at the same time, is just as economical and much better calculated to meet the favor of the workmen. "If it became necessary to reduce our force, were we engaged in manufacturing,"

ture far below its boiling point and even far below its melting point. If the vapor from a boiling aqueous solution of salicylic acid be condensed, it readily gives the reaction of this acid; and if salicylic acid is exposed to a current of air heated to 212°Fah. , it rapidly loses weight.

I made use of this phenomenon in the process here described for the preparation of pure salicylic acid, and found, after many unsuccessful experiments, that superheated steam was best adapted to the distillation of salicylic acid. For this purpose I had made a little double-walled copper boiler, by placing two copper tubes of unequal diameter one within the other, and closing the ends with plates of copper soldered with hard solder. The space between the two tubes was filled through a suitable opening with melted paraffin, and in this opening was placed a thermometer so that I could continually observe the temperature. The interior of this double boiler held the crude salicylic acid, and to the highest part was attached two tubes. One tube served to introduce the superheated steam; through the other the boiler was filled with crude salicylic acid, and it afterwards served as exit for the steam laden with acid. This tube should have a diameter of at least 0.6 inch, because otherwise it is easily stopped up by the escaping salicylic acid. The double walled boiler used in my experiments was so large that

says the editor, "we would assemble the whole number and address them in this wise:

"Gentlemen, the present standing of trade will not permit our continuing a full force. Neither do we wish to, nor will we, discharge any competent employee. Such work as we have we will give you. So many will work each week in each department, and alternate, so that the amount will be equally distributed. This will allow all engaged in our employ to earn at least part if not full wages. If there are any who may feel aggrieved, and prefer accepting other situations, we shall place no obstructions in their way, and shall gladly receive them into our employ on a full resumption of business."

To those who have never tried this method, we would suggest that they give it a fair trial, and compare notes of this

Fig. 1.



SALLERON'S PYROMETER.

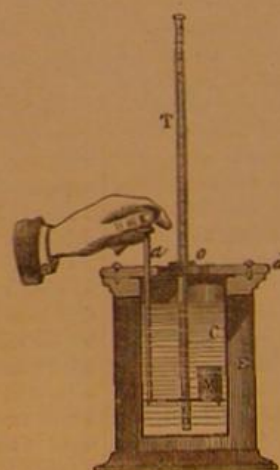
plan with notes of the old one of a wholesale discharge. Unless it be most needy operatives, there is hardly a man in the whole force but would gladly accept a few weeks' recreation after many months of arduous toiling.

Snow-White Salicylic Acid.

It is well known that the salicylic acid prepared by Kolbe's process does not possess a pure white color, but is more or less yellow. The salicylic acid manufactured and furnished to the trade by Dr. F. von Heyden in Dresden, according to the above patent, is a whitish powder with a strongly yellow hue, from which by recrystallization tolerably colored crystals are obtained. Kolbe himself says that, in order to obtain snow-white salicylic acid, the crude acid should be converted into an ether by the usual method, and this again decomposed by caustic soda, and so on. However, the boiling point of the ethylic as well as the methylic ether is so high that at this temperature a portion of the salicylic acid begins to decompose. For my part, I have never succeeded in obtaining in this way more than one fourth of the quantity of salicylic acid originally employed, in the form of a chemically pure product.

As the use of salicylic acid for medicinal and surgical purposes is continually increasing, a method of purification, whereby the yield is much larger and almost the entire quantity of salicylic acid present can be separated from its colored impurities with little trouble and at a small expense, will be welcome. Salicylic acid, we know, cannot be sublimed without decomposition. It splits up into carbonic and carbolic acids. On the other hand, salicylic acid volatilizes in a space filled with any gas or vapor at a tempera-

Fig. 2.



the carbolic acid. By recrystallization from distilled water (well water, or a filter which has not been washed with hydrochloric acid, contains enough iron to impart to it a reddish color), it can be obtained in beautiful, absolutely white crystals. One must not neglect to carefully clean the tin tube with ether before beginning the operation, to remove the grease that always accompanies the manufacture.

In the manufacture on a large scale, high pressure steam could be substituted for the paraffin baths. In high pressure steam itself, employed directly, the salicylic acid scarcely distills at all. I tried, among other things, to distill the acid by the direct action of steam at a pressure of 5 atmospheres, at which pressure the temperature is 320°Fah. , but did not succeed; the steam scarcely carried a trace of acid with it. Evidently the boiling point of the acid was correspondingly raised by the increased pressure. I conjecture that the distillation of salicylic acid under diminished pressure, say half an atmosphere, would take place still more readily.

I would farther recommend a stirrer for the salicylic acid boiler, so as to give it more opportunity for contact with the vapor passing through it.—Dr. Aug. Rautert, in *Polytechnisches Notizblatt*.

A LONDON architect has submitted to the municipal authorities of that city a plan for a gigantic pyramidal necropolis, which is to cover five acres of ground, and yet be capable of holding in its vaults 625,000 corpses.

To EBONIZE wood, collect lamp black from a lamp or candle on a piece of slate. Scrape off the deposit, mix with French polish, and apply to the object in the ordinary way

THE NEW ARCTIC SLEDGE.

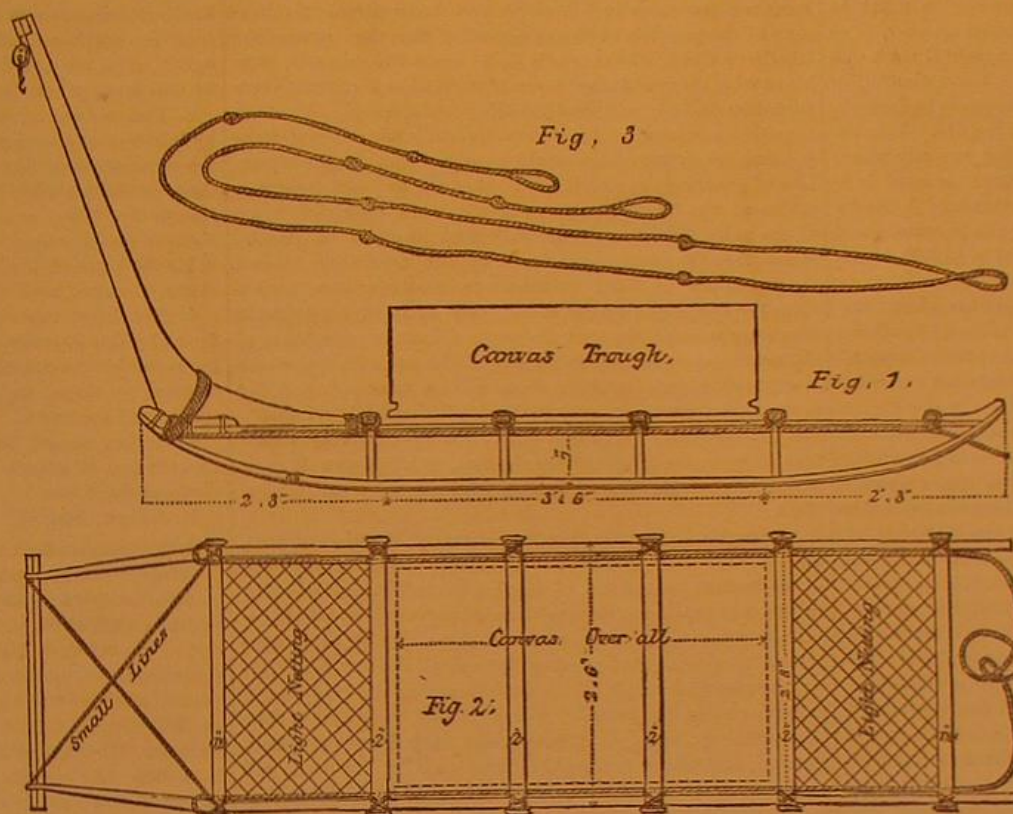
Among the many elaborate arrangements for securing success to the British Arctic expedition, a new form of sleigh (or sledge, as the English call it) is to be employed, and *Engineering* gives the following account of the vehicle and its use:

After passing through Davis' Strait and up Baffin's Bay, the vessels will push on at once northward through Smith Sound, which has of late years been explored by the Americans as far as the 83d parallel. One of the advantages of this route is that, it having been determined that Smith Sound, as far as it had yet been explored, is bounded by a continuous line of coast, stations could be fixed all along it, where provisions might be left, so that in case of any accident happening to the ships so as to necessitate their abandonment, there would be a safe journey back to Baffin's Bay insured, on the banks of which, at Upernivik and other places, Danish settlements exist. There is a hope, too, that this coast line stretches still further northward, and this route thus affords additional advantages to the sledge exploring parties, as they would not be tied so much to time their return home before the breaking up of the ice as would otherwise be the case. This return home, when it has to be accomplished over the frozen sea, is sometimes a matter of considerable danger; and as it would be impossible for a single sledge to go by itself further away from the ships than the distance which could be traversed while half its provisions lasted, the following system of combined movement is adopted. A number of sledges start together, each with its proper complement of men under an officer, and all provided with sufficient provisions to last for fifty days. After traveling together for six days one sledge is dropped with only six days' provisions to take it back to the ships, the remainder of its provisions being divided up among the other sledges. The dropped sledge immediately returns to the ships, re-provisions, and proceeds to the original point where it was dropped, where it forms a depot. The remaining sledges, in the mean time proceeding onwards, continue to drop a sledge at the end of every six days, making up their fifty days' store of provisions from each one before leaving it. Each sledge as it is dropped forms a depot, and returns to re-provision from the one already established behind it. In this way a constant communication can be kept up with the ships as a base of operations, and the last sledge allowed to proceed forward fully provisioned for a journey of 50 days. The sledges which have been provided for the expedition are of three sorts, namely, 5, 7, and 12 man sledges respectively.

The accompanying engravings show a 5 man sledge, which consist of two runners made of English ash, straight for a length of 3 feet 6 inches amidships and turned up for a distance of 2 feet 3 inches at each end, and fitted with a steel shoe plate $\frac{1}{8}$ inch thick and two and a quarter inches broad. The bearers, on which the platform of the sledge is laid, are made either of English ash or Canadian elm, secured to the runners at each end by an elm chock, and supported by ash poppets tenoned into both the runners and bearers, and riveted through with brass rivets $\frac{1}{4}$ inch in diameter. The cross-pieces, which are also of ash, are 2 feet 8 inches long, 2 inches wide, and 1 inch thick, slightly rounded on the top, and are lashed to the bearers with straps of hide which has been previously rendered soft and pliable by being soaked in warm water. When these lashings get cold, they shrink exceedingly tight and hard. The drag rope span, which is fitted after the cross-pieces have been lashed, is made of 1 inch rope with an eye at each end to fit over the horns of the rear end of the sledge. It passes through two small grummets on each of the cross bars, and a hide strap which is formed round the forepart of the runners. The bight is about 3 feet in front of the sledge and is provided with an eye and thumb toggle to fasten the drag ropes to. The latter (Fig. 3) are made of 1 inch rope middled, and have their bight toggled to the span on the sledge. Three Turk's heads are made on each leg of the drag rope at equal distances

apart to fasten the drag belts to. These drag belts are made of light horse girth 3 inches wide and 5 feet long, with an eyelet hole worked in each end, into which a piece of 1 inch rope 12 inches long is spliced, having at its other end a copper toggle $\frac{1}{4}$ inch thick and $\frac{1}{4}$ inch in diameter. This is attached to the drag ropes below a Turk's head with a Black-wall hitch, so that in case of necessity it can be instantaneously detached by loosening the strain upon it.

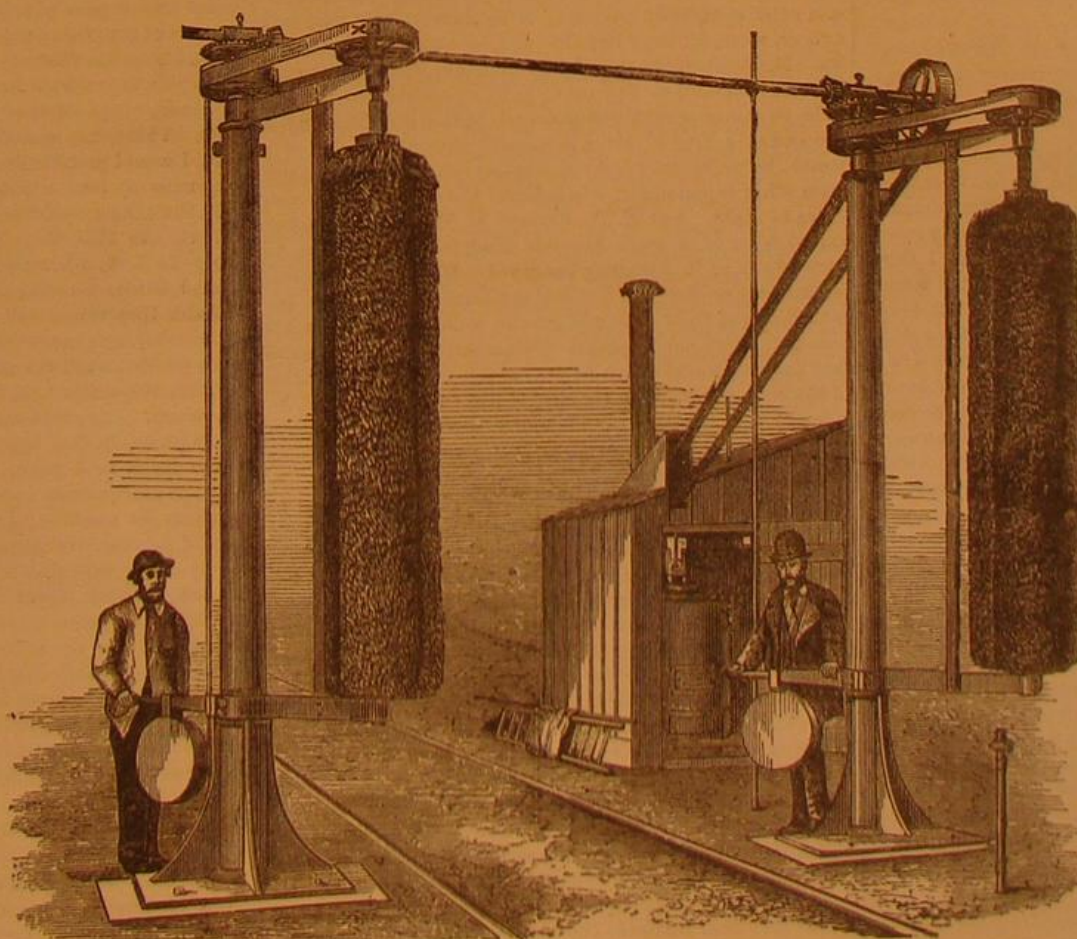
To assist the crosspieces in forming a platform on which to fix the sledge bottom, two fore and aft lines are clove-hitched round the end crosspieces and stretched as taut as possible,



SLEDGE FOR THE ARCTIC EXPEDITION.

being placed about 9 inches apart, and 9 inches from the side of the sledge.

The sledge bottom itself is formed of stout canvas, stretched down to the bottom of the sledge and laced to the two end crosspieces, and is intended to aid the sledge trough in supporting the load and to keep it from being chafed by the working of the sledge. The trough is also made of canvas, and has a tatling worked round its bottom edge (not, however, projecting beyond it), into which are let eyelet holes 6 inches apart, by which it is laced to the bearers and end cross pieces in order to keep it in its place. To its ends and sides, flaps of unbleached linen are sewn, in order to cover



THE EARL OF CAITHNESS' CAR-WASHING MACHINE.

the lading and to keep out the snowdrift and cold. At each end a network is stretched to take the cooking utensils, which are the last things put on and the first taken off. The lashings for fastening down the lading on the sledge consist of 12 fathoms of 1 inch untarred hemp or manilla rope. The sledge back forms no unimportant item in the construction, as on it can be hoisted a sail, which, in case of a fair wind, is of great assistance in relieving the men from drag-

ging. This back is shown fitted in the diagram, and is attached to the sledge by hide lashings.

IMPROVED RAILWAY CAR-WASHING MACHINE.

We publish herewith an engraving of an apparatus for washing the sides of railway cars, recently invented by the Earl of Caithness. It consists essentially of two large vertical brushes driven by a steam engine; a number of dirty carriages, making up a train of any length, is passed slowly between these revolving brushes; water is thrown upon the side of each railway carriage, 2 feet in advance of the brush, from a vertical iron pipe pierced with small holes, placed at an average distance of 8 inches from each other. A second water pipe, pierced with similar holes, directs another series of small jets of water directly upon the brushes. The whole arrangement is not very dissimilar in principle to that of hair brushing by machinery.

This invention was made and patented towards the end of last year. Lord Caithness recently visited this country, and, says *The Engineer*, "a week or two since returned, bringing with him an exceedingly efficient and well made stationary engine of 4 horse power, manufactured by the Barter Steam Engine Company, at Colt's firearms manufactory. This little engine, which is very popular in America, is used to drive the brushes at King's Cross station, London, where the apparatus is in use.

In a recent experiment a train of twelve dirty carriages, of different sizes, was passed between the brushes. The time occupied in so doing was $4\frac{1}{2}$ minutes, and, although this was the first experiment tried with the completed apparatus, the results were gratifying. During these four minutes it became evident to the observers that three conditions at least affected the results. The chief of these was the velocity with which

each carriage was drawn between the brushes by the locomotive, those which were passed most rapidly being less perfectly cleansed than those drawn more slowly. Another condition was the amount of pressure of the brushes against the sides of the carriage, which pressure was completely under the control of the man who used the apparatus. A third condition was the distance between the holes in the vertical pipes, which projected the water upon the sides of the carriages. The motion of the train, as the small jets of water played upon it, caused the jets to describe parallel lines upon the sides of the carriages; and when the motion was too swift, and the brushes themselves not quite saturated with water, small portions of the carriages were liable to pass without being wetted. These and other little points were noted before the train had passed half way through the brushes on its first trial; the speed of the train and the pressure of the brushes were then so regulated that the last half of the train passed as perfectly washed as could be desired. Before the train passed between the brushes it was palpably dirty, and after it came out it was palpably well cleaned, windows and all.

In using apparatus of this kind in practice, the trains will probably have to be pushed back wards and forwards on sidings, so that they will run between the brushes once in one direction and once in the other; but in order to brush them on each of these occasions, it will be necessary to use reversing gear to drive the brushes, so that they can be turned in one direction while the train is entering the siding, and in the other direction while it is leaving. The brushes are made of horsehair.

THE repeated applications, to copper or brass, of alternate washes of dilute acetic acid and exposure to the fumes of ammonia will give a very antique-looking green bronze; but a quick mode of producing a similar appearance is of ten desirable. To this end the articles may be immersed in a solution of 1 part perchloride of iron in 2 parts water. The tone assumed darkens with the length of immersion. Or the articles may be boiled in a strong solution of nitrate of copper. Or, lastly, they may be immersed in a solution of 2 ozs. nitrate of iron and 2 ozs. hyposulphite of soda in 1 pint water. Washing, drying, and burnishing complete the process.

Correspondence.

The Iron Horse.

To the Editor of the Scientific American:

In your issue of June 12, you refer to the \$5,000 prize, offered by the president of a horse railroad company in Philadelphia, for a substitute for the horse for working street railroad cars. The conditions required are that the device shall be acceptable to the company, that is to say, it must be satisfactory to at least two thirds of the members of the company; and that the company shall have exclusive control of it. To reach the first condition, an engine must be constructed in the most simple and substantial manner, at an expense of at least \$3,000, exclusive of the mental work and the plans of the inventor; this would be a low estimate for the first machine, provided such could afterwards be furnished at \$2,000 as a standard article of manufacture. The engine must then be placed upon the track and run any where from six months to a year, two years perhaps, or until it is found possible or impossible to satisfy two thirds of the members of the company, all at the expense of the inventor; and the cost will probably amount to from \$800 to \$1,500, in addition to the \$3,000 for the engine.

If the invention proves to be more economical and satisfactory to the company, and less objectionable to the city authorities and the general public than the present horse system, the inventor receives \$5,000, provided he deeds his entire interest in the invention to this company.

Doubtless the president and directors of this road are men of good sense and generous impulses, and would be willing to furnish the successful inventor with a free ticket home in addition to the \$5,000 prize, and would also pass his name along to posterity. I think, however, that the \$5,000 is offered as a reward for the use of an invention on their line only; if so, it is a very fair offer, and would enable the inventor to get a tolerable recompense for his invention eventually.

Were it not for an unaccountable prejudice against the use of steam cars on public thoroughfares, horse railroad companies would have a successful substitute for their horses in the shape of an improved steam car or light locomotive. A steam car has already been constructed and tried which is competent to answer fully every reasonable condition as a substitute for horses on street railroads; all that is need to ensure its success is that the manufacturers on their part shall proportion the machinery a little better, and employ more thorough workmanship, and that the city authorities and the public on their part shall remove their prejudices and give a lively countenance and support to the enterprise, and the thing is done. Steam cars and light locomotives will soon become a more economical, successful, and satisfactory institution in our cities than the present system of horse cars.

The products of combustion from the improved furnaces of these light machines will prove to be far less annoying and deleterious to health than the products of combustion from the mass of diseased horse flesh now required to do this work. With horses, the process of consumption and contamination goes on continuously night and day, work or no work, until death; with engines it ceases with the hours of work.

Worcester, Mass.

F. G. WOODWARD.

The Iron Horse.

To the Editor of the Scientific American:

As one of many inventors and patentees to whom you allude as engaged upon this problem, I did not fail to note the proposition of Mr. Flower on page 340, or your comments on page 389, vol. XXXII. You have therein very fairly stated the problem in most of its bearings, but one point I think was omitted. The problem, as I understand it, is not merely to obtain the power of one, two, or three horses, but to obtain that power with the condition of endurance throughout many consecutive hours. For instance, I am informed that it requires twelve horses to draw a street car sixteen hours. Hence, in one sense, the requirements of a street car come within the limits of "ten, fifteen, or twenty horse power," within which you give the opinion of the SCIENTIFIC AMERICAN that the locomotive is preferable. Again, while as you say the horse is easier to raise than to build a locomotive, the cost of twelve horses is considerably more, at present prices; and the stokers will agree that coal for the engine is cheaper than oats for the horses. And to whatever evils the iron horse is subject, including priming, running away, and premature dissolution by explosion, he is not, thus far, subject to the epizootic; yet his introduction will not lessen, but rather increase, the usefulness of the most universally useful animal in the world, as the locomotive has already done.

When analyzed, this problem is but a form of an old contention, or rather emulation, as to which can work best and most effectively, cheap labor or expensive skill; and however doubtful the result may now seem, the conditions of the problem are rapidly changing.

F. H. RICHARDS.

New Britain, Conn.

A Handy Life Preserver.

To the Editor of the Scientific American:

Nearly every man has his own life preserver. It is not generally known that, when a person falls into the water, a common felt hat can be made use of as a life preserver. By placing the hat upon the water, rim down, with the arm around it pressing it slightly to the breast, it will bear a man up for hours. Any one doubting the above can take an old hat, and try it in a bucket of water, or when bathing, and he will soon be convinced.

Charlotte, Mich.

H. J.

The Mechanical Force of Light.

To the Editor of the Scientific American:

Has it occurred to you that the remarkable discovery of Dr. Crookes, the mechanical or repulsive force of light, may offer a satisfactory solution of a great cosmic problem? I am one of those who believe that matter never had a beginning and can never have an end, any more than time ever had beginning or can have end, or than space has a beginning and an end; nor do I believe that, when a planetary system has passed through its incalculable cycles of formation, and through the decadence of its central source of light and heat, and becomes barren and desolate, it will for ever remain a dead system. I think you have struck the keynote of the problem in your suggestion that the tremendous repulsive force, of the sun's light upon the planets, combines with the centrifugal force of revolution to prevent them from approaching and finally falling into the sun. No other hypothesis is tenable, for we are certainly not receding from the sun, as we assuredly would be were it not for the attraction of gravitation; and the fact that we are not receding, while at the same time the incalculable repulsive force of the sun's light must inevitably tend to make us recede, shows that the centrifugal force of our revolution around the sun is not of itself sufficient to continue our distance from the sun, but that the added force of light repulsion is necessary to maintain that distance. Now by decadence of the source of light, the dying out of the sun's forces (which is inevitable), this repulsive force will be removed, and the desolate planets of our system must with equal inevitability fall into the sun; for as this light force is assuredly necessary to keep the planets from the sun, so to remove it must precipitate them, in due course of time, into the central mass.

The forces that would thus be generated, of light and heat, have already been estimated; and it seems clear to me that, in the instant conversion of these solid bodies into the disintegrated, vaporous, expansive substances which would result from these collisions, is found the material for a new system, beginning and passing through all the cycles of time and formation through which astronomy has shown that our present system has passed. There may be other forces than the centrifugal and light forces which keep the planets from the sun, and whose removal, by decadence of the sun, will precipitate "the eternal smash;" but as neither force nor matter can be lost, and as it is childish to assume that the cosmic system was destined to begin and end with a single formation of suns and planets, so it is inevitable that, from some such cause as that which I have inadequately foreshadowed, the operations of the Universe which we now witness will continue for ever; in ever changing forms, it is true, but absolutely without end.

Washington, D. C.

W. E. SAWYER.

The Mechanical Force of Light.

To the Editor of the Scientific American:

In a recent number of your paper, Mr. R. L. Taylor showed that the motive power of light was known 30 years ago. In Rees' "Cyclopaedia," a work published at least 70 years ago, I find the following: "Some writers have attempted to prove the materiality of light, by determining the momentum of its component particles, or by showing that they had a force, so as, by their impulse, to give motion to light bodies. M. Hombert imagined that he could not only disperse pieces of amianthus and other light substances by the impulse of the solar rays, but also that, by throwing them upon the end of a kind of lever, connected with the spring of a watch, he could make it move sensibly quicker; whence, and from other experiments, was inferred the weight of the particles of light. But M. Du Fay and M. Mairan made other experiments of a more accurate kind, which exhibited no such effects as M. Hombert imagined. However, Dr. Priestley informs us that Mr. Mitchell endeavored to ascertain the momentum of light with still greater accuracy, and that his endeavors were not altogether unsuccessful. Having found that the instrument which he used acquired, from the impulse of the rays of light, the velocity of one inch in a second, he inferred that the quantity of matter, contained in the rays falling upon the instrument at that time, amounted to no more than the twelve hundred millionth part of a grain. In the experiment, the light was collected from a surface of about three square feet; and as this surface reflected only about half what falls upon it, the quantity of matter contained in the rays of the sun, incident upon a square foot and a half of surface, in one second of time, ought to be no more than the twelve hundred millionth part of a grain, or, upon one square foot only, the eighteen hundred millionth part of a grain. But the density of the rays of light at the surface of the sun is greater than at the earth in proportion of 45,000 to 1: there ought, therefore, to issue from one square foot of the sun's surface, in one second of time, in order to supply the waste by light, one forty thousandth part of a grain of matter, that is a little more than two grains a day, or about four millions seven hundred and fifty-two thousand grains, which is about six hundred and seventy pounds, avoirdupois, in six thousand years; a quantity which would have shortened the sun's semi-diameter no more than about ten feet, if it was formed of matter of the density of water only. Priestley, *ubi supra*, page 389."

C. M. BRADBURY.

24 Bollingbrook street, Petersburg, Va.

Grasshoppers in the West.

To the Editor of the Scientific American:

In No. 24, of your volume XXXII, page 369, I find, in an article regarding grasshoppers, this remarkable statement: "The size of the locust is from that of a flea to that of a house fly." As this statement does injustice to the great and growing States of Missouri, Kansas, and Nebraska, States

which are as fertile as the valley of the Nile, I submit the following for your consideration:

1. I send you a box of grasshoppers by express, to give you visual proof of their size, varying in length from 1 to 2½ inches. This will convince you that your fleas and house flies must be very large. The statement you published in regard to the size of our grasshoppers is nothing less than a libel on the fair fame of this part of the Great West, and you must retract or suffer the consequences of your calumnious reports. Even our grasshoppers are indignant to learn that they are as small as fleas and house flies.

2. The section of country now completely devastated by these grasshoppers is about 100 miles square, with this city near the northeast corner of the square. Fields of wheat, barley, corn, etc., of 160 acres are laid waste in a single day by this hungry and devouring plague.

3. The number of the grasshoppers can be expressed only by infinity, with one million as the unit; no arithmetician can compute their number. Some farmers have been killing them by the bushel and by the wagon load, before they were able to fly. They are now beginning to fly, and the whole air is as full of these insects at mid-day, say from 9 o'clock A.M. till 5 o'clock P.M., as with snow flakes during a snow storm in winter, and having a similar appearance.

4. Not the farmers only, but all classes of people are sufferers by this grasshopper scourge. Even railroading is much hindered by the grasshoppers, and trains of cars are often stopped by them, as they are so numerous. In sorrow, I speak only the truth.

5. Having regard for the truth, I send you the above and also the box of grasshoppers. If you doubt my statements, then come and see.

R. R. C.

St. Joseph, Mo.

[Our correspondent errs in declaring us in error, as our previous remarks were based on the ocular proof of specimens of hoppers forwarded to us, and the statements of the journals published in the immediate vicinity of the insect raid. We referred, however, to the young locusts, as, is obvious from the means mentioned for their extinction, as of course, after their wings had grown, the insects would find no difficulty in clearing such obstacles as ditches and streams. The box of hoppers, which we have duly received, furnishes very excellent evidence that the insects in our correspondent's neighborhood are fully of the size stated by him, but certainly do not disprove the fact that there was a period in their history when their dimensions did not exceed those of the flea or the house fly.—Eds.]

The Colorado Potato Beetle.

To the Editor of the Scientific American:

From various articles in yours and other papers, I gather that the Colorado potato bug has so far proved rather more than a match for the proverbial Yankee ingenuity. Will you allow me to suggest a plan by which I think it probable this destructive insect may be got rid of?

I take it for granted that the bug preys upon the plant in one year, deposits its eggs in the ground during the autumn, and that they are hatched next year, and, in their turn, feed upon the plants, and so on. Further, I have read that this insect travels over new land at about 60 miles per annum; but this of course is over land well stocked with the potato plant, its special food.

My plan is to divide the territory of the United States into imaginary strips of land, north and south, each fifty miles wide. These may be numbered for reference. In the year 1876, I would propose to confine the growth of the potato to the strips of land numbered 1, 5, 9, 13. In the next year, 1877, the potato would be grown only on the strips numbered 3, 7, 11. In 1877, therefore, the insects in the strips of territory 1, 5, 9, 13, will have to travel over fifty miles of ground before meeting with any food; and this I think it probable they would fail to do, and would therefore perish. If, however, the insects should be able to traverse this distance without food, the strips would have to be made wider. In 1878, the strips 1, 5, 9, 13 would again be planted with the potato. The cultivators of the strips 2, 4, 6, 8, etc., would probably feel aggrieved by the inability to grow the potato for 2 or 3 years; but some arrangement might be made, of an equitable nature, to meet their case. It is evident that the adoption of this plan would necessitate the carriage of potatoes over a maximum distance of 25 miles for the supply of the inhabitants of the non-potato-growing strips; but the question appears to be either the extinction of the bug or of the potato plant. The plan, if attempted, would no doubt require the management of a geographical department of the United States, who would easily arrange and advertise a list of places for 1876, 1877, and 1878, in which the potato should be grown, and in which it should not; and I doubt not the agriculturists of the United States would be willing to give the plan a fair trial.

THOMAS A. COTCHETT.

2 Craig's Court, London, England.

Possible Recovery of the Lost Elgin Marbles.

Out of seventeen cases of marble sculptures taken by Lord Elgin from the Acropolis in Athens in 1802, twelve reached the British Museum, and the remainder were lost, with the ship in which they were stored, by the foundering of the vessel during a severe storm off the Island of Cerigo. M. Makoukas, a resident of that island, has recently informed the Archaeological Society of Athens that the marbles are now plainly visible, lying on the bottom of the sea at a depth of about 96 feet, and it is stated that prompt measures will be taken for the recovery of the valuable relics.

It is interesting to observe that the appliances by which these archaeological treasures will be regained have sprung

into existence since the marbles have reposed in the depths of the sea. Seventy-three years ago, the diver's dress and the vulcanized rubber of which it is made were unknown, and the works of ancient art have had to remain in their watery prison until, in the progress of inventive skill, means have developed themselves, by which their liberation, once presenting insurmountable difficulties, is now rendered a comparatively easy proceeding. Lord Elgin gained possession of the marbles through a firman of Sultan Selim III. Greece was then but a province of Turkey; the battle of Navarino had not been fought; and before achieving its independence, the country for many years after remained under the rule of the Turk, who at his pleasure bestowed upon foreigners the relics, which, by modern Athenian archaeologists, are deemed of priceless value.

Mineral Wool.

The utilization of blast furnace slag recently discovered bids fair to be of some importance. It is stated that if a jet of steam be injected into a current of fluid scoriae, fine, supple, and elastic filaments are obtained. With certain slags these are of a brilliant white and resemble cotton thread. The material is remarkable for its non-conductibility of heat, and hence may be profitably used for covering boilers and for other purposes in which it is desirable to prevent radiation.

PRACTICAL MECHANISM.

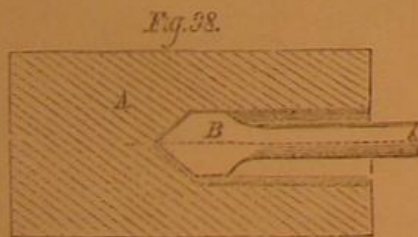
BY JOSHUA ROSE.

NUMBER XXVII.

DRILLS AND DRILLING.—FLAT DRILLS.

A drill is, all things considered, the most effective tool employed by the machinist; for while its cutting edges are necessarily of decidedly undesirable angles and form, it sustains the very roughest of usage, and yet will bear more strain in proportion to its strength than any other cutting tool. The reason of this is that it is supported by the metal upon which it is operating, and is thus prevented from springing away from its duty. This support may be of two kinds, first, that due to the wedge shape of the main cutting edges, one to the other, and second, that to be derived from making the diameter of the drill parallel for some little distance behind the cutting edges, so that the sides of the drill, by contact with the sides of the hole, serve to guide and support the drill. The latter, however, only comes into operation at and after such time as the drill has entered the metal sufficiently deep to drill a recess of the full diameter of the drill.

The support given to the drill, in the first instance cited, arises from the tendency of either of the cutting edges to spring away from the cut, which is, of course, counterbalanced by the opposite cutting edge having the same tendency, but in an opposite direction, so that between the two the drill is held to a central position; and also from the tendency of the drill point to force itself forward (by reason of the pressure behind it) as far into the cone formed by the end of the hole as possible, as the end of the hole and the cutting end of the drill are two cones, one being forced into the other. In a drill properly ground (that is, having its cutting edges at an equal angle to the center line of the length of the drill, and the cutting edges of an equal length from the center or point of junction of the cutting edges) both the cutting edges and the sides of the drill act as supports and guides, tending to sustain it under the strain and keep it true. If, however, the drill is not ground true, the strain upon it becomes very great, because the whole force of the cut is then placed upon one cutting edge only, and is continuously tending to thrust the point of the drill outwards from the center of the hole being drilled, hence cutting a hole larger in diameter than the cutting part of the drill, that is to say, a hole whose diameter will be twice that of the radius of the longest cutting edge of the drill, measured from the center line of the length of the drill. If, under such conditions, one side of the drill bears against the sides of the hole, as shown in Fig. 98, A being the metal and B the drill, there will be

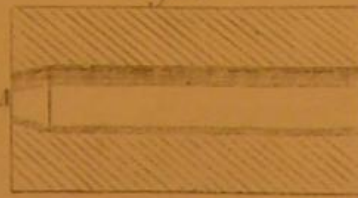


created two opposing forces, independent of the strain necessary to sever the metal, one being the endeavor of the point of the drill to keep to the center of the hole, because of the conical shape of the end of the hole and point of the drill, and the other being the endeavor of the cutting edge to force the drill to one side and the point of the drill out of the center of the hole. And as the pressure of the side of the drill against the side of the hole will tend to force the drill to revolve true with that side of the drill so that the point of the drill will revolve in a circle and not upon its own axis the result will be a hole, neither round, straight, nor of any definite diameter, as compared to the diameter of the drill.

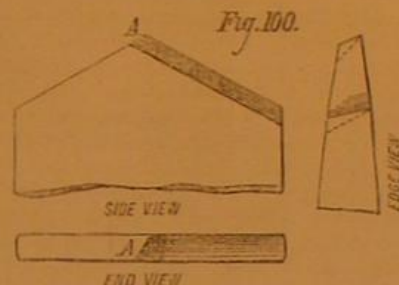
Drills that are a trifle too small for the required size are sometimes purposely ground a little out of true so as to cause the hole to be larger than the drill, but the action of such drills is distorted, and it is impossible to estimate exactly how much deviation is necessary to the required increase of diameter of the hole. Part of the power driving the drill is

lost, the loss being due to the creation of the above opposing forces, and the drilling operation is slow by reason of only one edge of the drill performing any cutting. Hence, the feed of the drill being only half as rapid as it should be, it is an unmechanical expedient and a loss of time, especially if the hole is to be drilled clear through the metal: for in that case, as soon as the point of the drill emerges through the metal and the drill is therefore released from its influence, the cutting edges will gradually adjust themselves to the hole, and drill the remainder of the hole to the size of the diameter of the drill, the hole when finished appearing as in Fig. 99. Thus the end, A, of the hole will require to be filed out, entailing in all more loss of time than would be required to make a drill of the proper diameter.

Fig. 99.



The importance, then, of taking especial pains to grind a drill true being apparent, we may next consider how thick the point of the drill should be. It is here that the main defect of the drill as a cutting tool lies, for it is impossible to make the cutting edge across the center of the drill (that is, the cutting edge across the thickness of the drill, connecting the cutting edge on one side of the drill to the cutting edge of the other side, as shown at A in Fig. 100) sufficiently keen



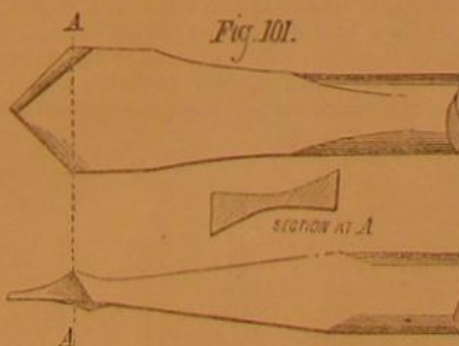
to enable it to enter the metal easily, without grinding the angles of the two cutting edges very acute, as shown, in the edge view of Fig. 100, by the dotted lines, which would so weaken the cutting edges as to cause them to break from the pressure of even the lightest feeding. The only alternative, then, is to make the point of the drill as thin as is compatible with sufficient strength; and this will be found to be of about the following proportion:

Diameter of drill	Thickness at point
1-8 inch	1-64 inch
1-4 "	1-32 "
3-8 "	3-64 "
1-2 "	1-16 "
5-8 "	1-16 "
3-4 "	1-16 "
7-8 "	1-16 "
1 "	3-32 "

The flat face must be made gradually thicker as the full diameter of the drill is reached.

The angle at which to grind the end of the drill is governed to a large extent by the kind and degree of hardness of the metal to be drilled, the angle shown in Fig. 100 being suitable for wrought iron, steel, or unusually hard cast iron; while, for common cast iron or brass, a little more angle may be given. But no definite angle can be given for any metal, because of the varying conditions under which a drill performs its duty. From these considerations we find that the effectiveness of a drill arises from the support rendered to it by the work, which more than compensates for the want of keenness inherent to its form of cutting edge.

Thus far, however, we have been considering the ordinary flat drill in its most simple form. For use on steel, wrought iron, and cast iron, we may improve the cutting qualifications of the drill by bending each side of the cutting bevel edges forward, thus forming what is termed a lip drill, as shown in Fig. 101. Such a drill will cut with much greater ease and rapidity, because the angle, of the two faces whose



junction forms a cutting edge, is much more acute, while the cutting edge is, at the same time, well supported by the metal behind it, which advantages are to be obtained in no other way. The cutting edges of this drill are similar to those on the twist drill.

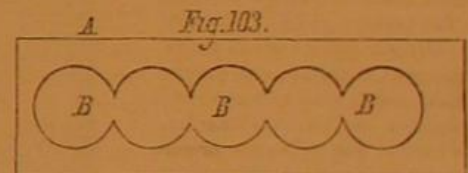
TWIST DRILLS.

Twist drills are not, as is usually supposed, of the same diameter from end to end of the twist, but are slightly taper, diminishing towards the shank end. The taper is usually,

however, so slight as to be of little consequence in actual practice. Neither are twist drills round, the diameter being eased away from a short distance behind the advance or cutting edge of the flute backward to the next flute, so that, were we to grind the cutting end square or level, instead of conical, it would appear as in Fig. 102.



The object of this is to give the sides of the drill as much clearance as possible. The part of the diameter from A to B, on each side, is left of a full circle, which maintains the diameter of the drill and steadies it in the hole. If, from excessive duty, that part from A to B should wear away at the cutting end of the drill, leaving the corner of the drill rounded, the drill must be ground sufficiently to cut away entirely the worn part, otherwise it will totally impair the value of the drill, causing it to grind against the metal, and no amount of pressure will cause it to cut. The advantage, over other drills, possessed by twist drills lies first in that the cuttings can find free egress, which effects a great saving of time, for plain drills have to be frequently withdrawn from the hole to extract the cuttings, which would jam between the sides of the hole and the sides of the drill, and the pressure will frequently become so great as to twist or break the shank of the drill, especially in small holes. In point of fact, the advent of twist drills has rendered the employment of any other form for use in small holes (that is to say, from $\frac{1}{8}$ inch downwards) totally inexcusable, except it be for metal so hard as to require a drill tempered to suit the work. The other advantages of the twist drill are that it always runs true, requires no reworking or tempering, and, by reason of its shape, fits closely to the hole, and hence drills a very straight and smooth hole. It is also not liable to be influenced so much by an air or other hole or soft spot which may exist in the metal being drilled. These qualifications render the twist drill a very superior tool for the finer classes of work, and for such purposes as drilling metal away to form a key way or slot; for in the latter case, the holes may be drilled so closely together that they will run one into the other, as shown in Fig. 103, A being the piece of metal, and B B, the holes. A com-



mon flat drill is incapable of performing such work. The twist drill will not, however (in holes of a moderate depth, that is to say, holes whose depth is not more than four times their diameter), do so much duty in a given time as a common drill, especially if, in iron or steel, the latter be slightly lipped: the reason being that the latter, stronger in proportion to its diameter, will stand more strain, and may therefore be fed much more rapidly in all cases wherein the depth is not too great to permit the cuttings from finding egress before becoming jammed in the hole.

FEEDING DRILLS.

Much more duty may be obtained from a drill by feeding it by hand than by permitting the gearing of the machine to feed it, because, in hand feeding, the sense of feeling indicates to the operator how much cut the drill is capable of standing, and he can therefore vary the rate of feed, keeping it up to the maximum obtainable on the degree of hardness of the metal being drilled. Dullness of the cutting edges, hard or soft spots in the metal, or any other variation in the condition of the drill or in the metal being drilled, is at once perceived by hand feeding. Drilling machines have, it is true, several degrees of feed, but the fact is that the human hand can feed the drill at any rate that can be obtained by means of machine gearing; and having behind it the human mind, it is enabled to accommodate itself to the numerous and variable conditions against which no provision can be made in automatic feed gearing. No positive rate of feed, either for any particular size of drill, or for any definite kind of metal, can be given, because of the always present variations in the degree of hardness of the metal to be cut, and furthermore because, in the case of iron and steel, the facility of supplying the cutting edges with oil seriously affects the attainable rate of feed to the drill. If, for instance, the hole is being drilled horizontally, as in a lathe, and is very deep, so that it is difficult to freely supply the cutting end of the drill with oil, the feeding must proceed slowly or the cutting edges of the drill will soon become destroyed. Here, also, it may be well to state that, if oil be supplied to a drill cutting cast iron or brass, it will cause the cuttings to jam between the sides of the drill and the sides of the hole, until the pressure becomes so great as to either stop the drilling machine or lathe, or else twist or break the drill. The rate of feed, and the speed at which the drill should revolve, depend upon the hardness of the metal under operation, although not to a very great extent, except in the event of the metal being unusually hard, in which case the drill should revolve very slowly; for not much latitude in the degree of hardness of the drill is permissible, for fear of impairing the strength of the drill.

To fix labels on tin, use French polish or a solution of shellac in naphtha or alcohol.

ARTESIAN WELLS.

There are three conditions essential to the successful boring of an artesian well: 1, a fountain head more elevated than the locality where the boring is to be undertaken; 2, a moderate downward dip of the strata, toward the site of the well, as a steep angle is unfavorable and permits the water to flow away beyond the reach of the boring, which must needs pass at an acute angle through few layers of rock; 3, alternation of porous and impervious strata beneath the surface soil. It is sometimes the case that the head of water is at so high an elevation that the column bursts forth from the ground as a fountain, throwing up a continual jet. By raising the water above the surface in a pipe, and letting it flow over, convenient water power is obtained. Artesian wells are applied to this purpose at many localities in France, the water they supply being found sufficient to run heavy machinery. From the great depth at which the currents of water are reached, the supplies may be regarded as permanent. A well at Aire, in Artois (from which name the word "artesian" is derived), France, has flowed steadily for a century, the water rising above the surface at the rate of 300 gallons a minute; and at Lillers, in the same country, one well has given a constant yield since the year 1126.

The large engraving (Fig. 1) given herewith represents the artesian well of Grenelle, a suburb of Paris. Seven years and two months of constant labor were devoted to the boring, the rock being extremely difficult to pierce. The water-bearing stratum was reached at a depth of 1,802 feet, when the water was discharged at the rate of upwards of 880,000 gallons in 24 hours. The force is such that the water ascends to a height of 120 feet above the surface, in the pipes in the elegant structure which has been erected over the bore. The present yield of the well is about 500,000 gallons per 24 hours. The water is at a uniform temperature of 83° Fah., and is used to warm some large hospitals in the vicinity. During the boring, and when at a depth of 1,254 feet, it is related that a drill broke and fell, with 270 feet of rods, to the bottom, necessitating fifteen months of constant labor to remove the pieces.

In the United States the deepest artesian well is that bored for the insane asylum in St. Louis, Mo. This has reached the enormous depth of 3,843 feet, or, in that locality, 3,000 feet below the sea level. This would give a water pressure at the bottom of 1,293 lbs. to the square inch. The deepest bore in the world is one, begun as a rock salt mine and yet uncompleted, at the village of Sprenburg, some twenty miles from Berlin. Its present depth is 4,194 feet. In the Desert of Sahara some seventy-five shafts have been sunk, which yield an aggregate of 600,000 gallons per hour. The effect of this supply is said to be plainly apparent upon the once barren soil of the desert. Two new villages have been built, and 150,000 palm trees have been planted in more than 1,000 new gardens.

In the engravings accompanying this article, from Mr. E. H. Knight's American "Mechanical Dictionary" (published by Messrs. J. B. Ford & Co., New York city), will be

found represented a number of the tools used in the operation of boring rock. A common mode of performing this labor is shown in Fig. 2. Two men walk around and turn the handle of the boring tool, which is screwed into an iron rod. In moderately soft ground the weight of the men and the rotation of the handle will cause the boring chisel to penetrate, but in rock it requires to be hammered down. The

expands to a distance regulated by the screw and swivel connecting the two spring cutters, the cutting edges of which are placed reversely.

Figs. 5 and 6 exhibit different kinds of tools for penetrating earth and rock. The rods frequently break in boring; and for raising the portion broken off below, various devices have been contrived, one of the most simple of which is represented in Fig. 7. It consists merely of a worm, which screws around the rod, which is retained only by friction when lifting. This is available only when the weight of the broken part is insufficient to overcome the friction.

In Fig. 8 the shaft has a point, cutting lips, and a floor on which the earth is received. It is forced into the ground by the screw on the shank, which rotates in a nut at the junction of the legs of the tripod, which is raised above the spot where the auger enters. The end of the screw staff is keyed to a stirrup, in which it turns. Above the stirrup is a coupling piece, having inclined projections fitting in corresponding recesses in the upper part of the stirrup, in such a manner that the shaft is made to operate the screw when boring, while a reverse motion will raise the screw out of the ground without turning it. In Fig. 9 the shaft has a screw point and angular rings, above which is the floor of the dirt chamber. The soil is scooped up by the usual flange, and is elevated in the chamber by the spiral which is braced by the axial rod.

Numerous artesian wells are being sunk along the line of the Union Pacific Railroad, in order to obtain water for the locomotives and for the workmen laboring in the coal mines along the route. The first well is at Separation, 724 miles from Omaha, and the last one is at Rock Spring, 832 miles. It is believed that for agricultural purposes the mineral salts could be washed out of the water obtained from wells in the above vicinity, so that soil irrigated therewith would probably prove remarkably productive. A flowing well, furnishing 1,000 gallons per hour, will water a section of 640 acres. If bored 1,000 feet in depth, the cost would be about \$10,000. Out on the plains this outlay would make a most productive farm, which might be made the nucleus of a stock range of thousands of acres, having besides an ample supply for human consumption.



ARTESIAN WELL.
GRENNELLE, PARIS, FRANCE.

operation is greatly facilitated by suspending the boring rods from a beam, fixed at one end and worked by a man at the other, assisting, by its elasticity, the efforts of those below in alternately raising and depressing the tool to give it the necessary pounding motion. The hole being thus opened, a valved cylindrical auger, Fig. 3, is introduced. When this is turned, the valve is opened by the pressure of the comminuted rock or earth below, the latter enters the cylinder, and is thus removed.

In Fig. 4, a is a plan and elevation of an auger used for boring in clay or loam; b is an S chisel for hard rock; c exhibits a hollow valved auger, for boring through sand or bringing up rock previously pulverized by the chisel; d is a spring reamer for enlarging a hole previously bored: this is passed down through the pipe, and, on reaching its bottom,



Fig. 2.

Well-Digging.

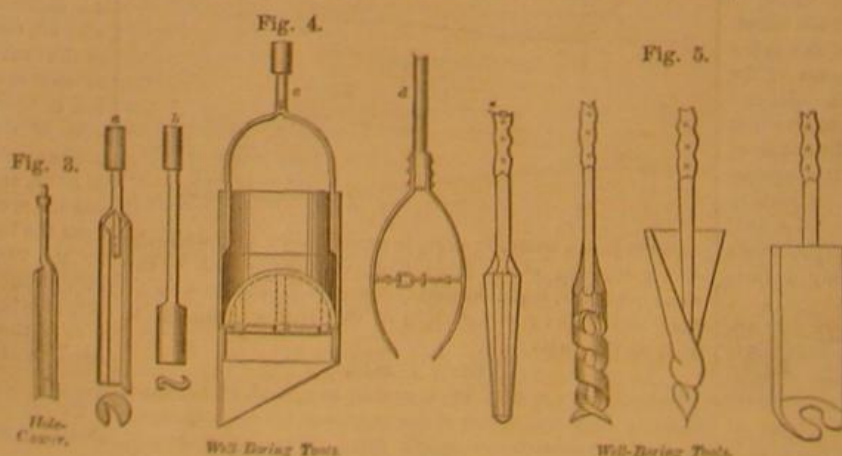


Fig. 3.

Fig. 4.

Fig. 5.

Fig. 7.

Fig. 8.

Drill-boring Auger.

McMahon's
Earth-boring
Auger.

Well-Digging Tools.

Well-Digging Tools.

Well-Digging Tools.

The Electric Light for Locomotives.

Experiments with the electric light as a head light for locomotives have recently been made in Russia on the railroad from Moscow to Kursk, with successful results. The apparatus consisted in a battery of 48 couples, which produced sufficient illumination to light up the track for a distance of from fifteen to eighteen hundred feet ahead.

A correspondent of *Les Mondes* suggests that a small electric machine would serve the purpose much better than a galvanic battery, liable to injury by agitation. It is proposed to connect the mechanism directly with the front axle, the revolution of which will set the former in operation. The chances of danger usually augment with the speed; but arranged as above described, the intensity of the light would increase in like ratio, up to certain limits. In running slowly, the illumination would be comparatively feeble; but in such case the bell, whistle, and other signals would afford warning in ample time.

THE FINCHES.

One of the most interesting of the numerous families of birds consists of the various species of finch, of which the canary is the best known in this country. In our engraving the chaffinch, the yellowhammer, the goldfinch, the linnet, and the crossbill are shown, and there are many others, the bulfinch, the greenfinch, etc. The goldfinch and the yellowhammer have very brilliant plumage, and, with the linnet, are excellent songsters. The linnet's note is not so powerful as that of the canary, but it is sweet; and the bird, when brought up near a good singing canary, becomes a very accomplished vocalist. The goldfinch and the chaffinch build nests of exquisite workmanship, the latter's domicile being nearly globular in shape, with an entrance at the side.

Most of the finches are very docile, the bulfinch and goldfinch being susceptible to an advanced education. Mr. Syme, an eminent British naturalist, describes some trained birds of this species, one of which appeared dead, and was held up by tail or claw without moving; a second would stand on its head; a third would walk about with little pails at his side, like a milkmaid; a fourth imitated a girl looking from her casement; a fifth acted as a soldier with his firelock; a sixth would fire a cannon, and go through the motions of an artilleryman. It has been known to live twenty-three years in confinement.

The crossbill has a singular conformation of the beak, the mandibles crossing each other like a pair of scissors; and the facility with which it opens the pine cones, for the sake of the seed, on which it principally feeds, is surprising. It is not found much in the south of England, except in captivity, but it frequents the pine woods of Scotland and the north of Europe. As a cage bird it is very amusing, and from its movements might be called the European parrot. The pen-

sants of Germany have a tradition that its bill was twisted in an attempt to extract the nails from our Saviour's cross—a legend which Longfellow has embalmed in an exquisite poem. The bird being very shy, not much is known of its habits in a wild state.

NESSLE'S STREET RAILWAY RAIL.

In the invention herewith illustrated, the rail is divided horizontally, about through its center. The lower half is first bolted on the stringers, and the upper half is laid on it, so as to break joints with the lower half, the bolt holes being slotted sufficiently to allow for contraction and expansion, making substantially a continuous rail, thereby avoiding the bending and battering which is found to be so destructive to the rails and the rolling stock. The greatest advantage is that, when the upper half is worn out, it can be removed, and thus only these top halves need be renewed.

Fig. 1

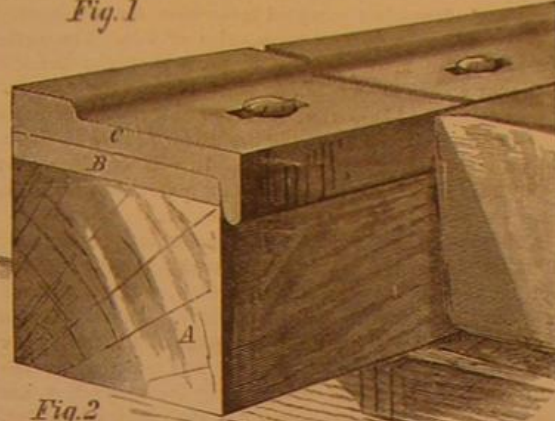


Fig. 2



A, in the engraving, is the timber ordinarily laid down to form the base for the track. On this is secured the lower half rail, B; and on it the upper half, C, is bolted so as to break joints with the under halves, as before explained.

Patented May 4, 1875. For further particulars address the inventor, Mr. John P. Nessle, 23 Frelinghuysen avenue, Newark, N. J.

The Duplexed Telegraph Printers.

The experiment of working the combination printing telegraph apparatus in duplex, between this city and Boston, has proved to be a complete success, and will probably result in the extensive use of printers on the Western Union line.

The quadruplex arrangement of circuits is used, although only two circuits are worked by the printers, the other side, which, with the Morse instruments, is used for operating circuits, being utilized for breaking the sending circuit when required. By this arrangement neither circuit interferes with or interrupts the other, as is the case with the quadruplex Morse.

The operators are delighted with the new arrangement, and say they can work faster and more easily than with the old arrangement or single circuits. In one day recently, one thousand messages were transmitted over a single wire between this city and Boston, employing four operators only, and doing as much business as could have been accomplished by quadruplex Morse circuits and eight Morse operators, on the same wire in the same time.

This improvement is likely to open up a new and successful future for printing telegraph instruments, which had been somewhat out of favor of late years, and have heretofore been used only to a limited extent.—*The Telegrapher*.

Singular Explosion.

At the works of Hewes & Phillips, Newark, N. J., a few days since, it became necessary to remove the rings from a steamboat piston, which was hollow, with two sets of packing rings. The rings were found to be rusted and corroded fast, and the piston was placed on a fire in the blacksmith shop to loosen them by heat. In a few minutes an explosion occurred, and the piston was blown to pieces, injuring one man so that he died in a few minutes, and hurting another badly about the face. On a close examination of the pieces, it was believed that marks of an old crack were found. It is thought that, when hot and under pressure, some steam may have leaked through into the piston and subsequently condensed, and the crack may then have been rusted tight. When the piston was heated, this water inside became converted into steam and caused the explosion.

THE following is a good recipe for raspberry vinegar: Pour over 1 pound of bruised berries 1 quart of the best cider vinegar; next day, strain the liquor on 1 pound of fresh ripe raspberries, bruise them also, and on the following day do the same. Do not squeeze the fruit, only drain the liquor thoroughly. Put the juice into a stone jar and add sugar in proportion of one pound to a pint. When the sugar is melted, place the jars in a saucepan of water, which heat; skim the liquor, and, after it has simmered for a few minutes, remove from the fire, cover, and bottle.

PROFESSOR WILLIAM HAGEN, of the Academy of Civil Engineers, Berlin, predicts the failure of the jetty system, now being constructed at the mouth of the Mississippi, and declares that the large amount of money, appropriated by Congress for that work, will be a total loss.



MEMBERS OF THE FINCH FAMILY.

MEDICAL NOTES.

(New York Medical Journal.)

New Remedy for Burns.

There has been in hospital for many months a case of extensive burn, in which different applications have been tried. Every new dressing succeeded well for a time, but soon it ceased to prove of advantage. The last agent that has been used, and is used at present, is salicylic acid. The effect is more beneficial than that obtained by any of the former remedies. The method of using it is to form an emulsion with olive oil, one part of the salicylic acid to sixteen parts of oil. This mixture is painted over the ulcerated surface once or twice a day. It gives rise to a slight smarting sensation when first applied, but that soon passes off.

Compressed Sponge for Abscess.

A patient had been suffering from mammary abscess for three weeks, but without any special benefit from treatment in checking the discharge of pus. It was decided to try the effect of compressed sponge, and for this purpose a sponge about ten inches in diameter was subjected to pressure and then applied by means of a bandage over the breast. After it had been in use forty-eight hours, the abscess was completely cured. No pain was experienced by the patient, and in this case the opening in the breast was three inches above the dependant part of the abscess. In applying a sponge to the breast in this class of cases, it is found of advantage to compress it when dry. After it is applied to the breast and firmly secured in position, a little water is poured upon it to cause expansion and the necessary pressure.

Apparatus for Cure of Fracture of Patella.

There has been recently a patient in hospital who had received a fracture of the patella, which did not unite. As a result of this unpleasant state of affairs, she was unable to extend the leg in walking, and found great difficulty in getting up and down stairs. She has, however, been so benefited recently by an appliance designed by Dr. Carney, of the hospital staff, that when she has it on she is enabled to walk with facility. The principle consists in using rubber as the extending power. The mode of application was to place a plaster bandage below the knee, having incorporated in its folds a loop of strong iron wire, of which the loop is projected above. A similar dressing was placed on the thigh, above the knee, with the loop of wire projecting downward. Folds of rubber were then attached to the two iron loops sufficiently strong to keep the leg extended when in a passive state. With this apparatus the patient was enabled to walk up and down stairs without inconvenience.

Wood Sorrel in Epithelioma.

The dried extract of wood sorrel has been used as a dressing epithelioma, and found to be more serviceable than any thing else in relieving the pain.

Treatment of Fistula in Ano by the Elastic Ligature.

The use of the elastic ligature in fistula in ano proves of more service than the knife in the few cases in which it has been employed. The method of applying it is to introduce the ligature by means of an eye probe, and allow it to cut its way out, which it does in from five days to a week. It leaves behind it a granulating surface which soon heals over. In one case the knife was used, and it was two months before the cure was complete.

Salicylic Acid.

In chronic cystitis, the bladder has been washed out with a solution containing one part in five hundred of water. The method of washing out the bladder has been to make four injections of one ounce each every morning and every evening. The acid not only removed the disagreeable odor of the urine, but in a short space of time freed it from pus. In empyema, a solution of the same strength has been employed with valuable results. It is used under the same circumstances as carbolic acid was formerly. In dressing suppurating surfaces, it appears to have a stimulant effect on the granulations, somewhat similar to that of carbolic acid.

Melanosis.

There is at present in Roosevelt hospital quite a rare case of melanosis. The patient is covered over the entire body with a discoloration of a dark slaty hue. There are also tumors beneath the skin, situated on the face, body, and extremities. The disease first appeared about a year ago, and advanced rapidly to the state that it has now reached. Occasionally the melanotic tumors break down and suppurate. There is no history of hereditary cancer, or of syphilis.

Sciatica.

The treatment of sciatica is based on the view that it is usually due to malaria or syphilis, and for this purpose quinia is first given to the extent of sixty grains in twenty-four hours, followed the succeeding day by thirty or forty grains. If this fails to benefit, anti-syphilitic treatment usually proves effectual.

The Birds and the Insect Pests.

The western journals are beginning to wake up to the fact that the idea which we broached some time ago, relative to the wholesale slaughter of the prairie chickens and other feathered game having its result in an increase of the grasshopper infection, is founded on substantial truth. It is admitted that the destruction of the birds has been enormous, and that they have been trapped by thousands and fed to the hogs, on the theory that pork can be salted and sold while birds cannot. Now, let the journals suggest to their readers the necessity of game laws, rigorous ones, which will impose heavy penalties not merely for killing the chickens, but for exposing them for sale, and let local authorities see that such enactments are enforced to the letter. If this be done, and if the western inventors will give more attention to devising

exterminating machinery, by next year the hoppers, between the scorching from the machines and the hungry crops of the birds, will find life utterly devoid of pleasure, and perhaps may be induced to migrate out of the United States territory, say to Canada or Mexico.

There is another reason why the birds should be spared, and that is the potato bug. Prairie chickens and quail, it is said, will eat the insects, and other birds are said to feed upon them greedily.

Our Debt to Patents.

Ohio politicians and other individuals who believe that our patent system is of no advantage to the country, but rather a burden, and hence advocate its abolition, will find suggestive food for thought in Mr. Howson's essay on our country's debt to patents. We recently made a brief extract from this treatise, and now add another, in which the writer, in several happily selected instances, demonstrates how completely we are dependent upon patented inventions for not merely the comforts but the actual necessities of life. The same facts tend even more cogently to prove that the benefits which may accrue to an inventor from his holding a temporary monopoly on his device, no matter how much his gains may be, are infinitesimal beside the advantages which subsequently are secured by the public. It will be clear that scarcely any price is too high to pay for a valuable invention during the years it is protected by a patent.

Mr. Howson chooses the simplest articles, in everyday use, to illustrate his assertions. "Let us turn," he says, "to the paper on the wall, a paper of neat design, with ribbed and glazed surface studded with gilt sprigs. This is a home manufacture; for wall paper to the value of \$1,000,000 per year is produced in this city alone. The patents for the manufacture of paper, and economizing its production, are innumerable. Patent after patent has been granted for drying, glazing, printing, and other operations connected with wall paper; and the result of all this has been the permanent establishment of six large manufacturing in this city.

Then look at the stove. Compare this stove with the open fireplaces in which our fathers burnt cords of wood, or tuns of coal, without obtaining a tithe of the heat which that ornamental structure generates. Compare it with the old anthracite stove of but thirty-five years ago. I saw one of these obsolete heat generators the other day, a hideous structure, with metal enough in its composition to make a cannon of small caliber—metal enough to make four modern stoves of equal capacity. There are, perhaps, more patents for stoves than for any other class of inventions.

There is a picture on the wall, a steel engraving—an art of which one of the greatest of American inventors and patentees, Jacob Perkins, was the father. In hanging the picture to the wall, I objected to the driving of nails, even if they were brass-headed, through the handsome wall paper; and I objected to the ridiculous and disfiguring inclined cords, and to the clumsy knot which is usually employed to conceal the nail. I discovered a patent molding which would serve the twofold purpose of a finish for the wall paper at its junction with the ceiling, and of a ledge to which could be adapted a gilt hook; and I found patent plated wire cord, almost invisible, with which to suspend the picture from the hook. By these appliances, I am enabled to slide my picture laterally to any position desired, and I dispense with wall-mutilating nails and clumsy cords. But I have not done with the picture yet. It has a gilt frame, consisting of a wooden molding, to which the composition for receiving the gold is applied by a well known process, forming the subject of an expired patent, and which has reduced the cost of ordinary gilt frames to such an extent that they are now to be found in the dwellings of the comparatively poor: whereas twenty years ago, handmade gilt frames were within the reach of the well-to-do only. It is only within a comparatively few years that sheets of glass, sufficiently large and clear for a picture frame of moderate size, have been produced in this country; and this production may in a great measure be attributed to patented glass furnaces, and hosts of patented appliances connected with glass manufacture.

Immediately in front of me is an ordinary paneled and molded door for a closet. A door like this, if made by hand, would cost just double the money for which a door of the same size and character, but of more accurate workmanship, can now be purchased at a large sash and door manufactory. This economy is attributable, in a great measure, and in the first instance, to Woodworth's patent wood-planing machine, which was succeeded by many valuable improvements in the same class of machinery; but there are many other patented machines which have contributed to this economy of manufacture—sawing machines, tonguing and grooving machines, molding machines, etc., for which patent after patent has been and continues to be granted. Patents for woodworking machinery may, in fact, be counted by the thousand.

There are two very important things, without which the door could not be completed; and these are glue and sandpaper. It may surprise many to know that Philadelphia can boast of the most extensive glue and sand paper factory in the world. It is a factory in which one thousand hands are employed. The foundation of this gigantic establishment was based on a series of valuable patents. It is but a comparatively few years since all the glue and sand paper used in this country were imported; now they are made, owing to patented facilities, so economically that much of the product of the factory in question is exported, while the home market is supplied at a cost less than half that which the imported materials cost a few years ago.

Compare the old costly hand-forged nails with the cut nails of the present day, which cost but little more than the metal

plates from which they are made. As immense sums of money have been expended in perfecting nail machines in this country, and hundreds of patents have been granted for improvements, we must conclude that the incentive to the outlay and expenditure of ingenuity is to be found in the protection which patents afford; and hence we may justly reason that these cheap nails of to-day are due to our patent system.

Then, again, the door is furnished with a lock such as is made in the large manufactories in New England and Pittsburgh—a lock that can be purchased at any hardware store at less than one third the price of one of the old handmade locks of equal quality. The art of lock-making has made rapid advances in this country, superiority and economy of construction being the characteristics of our homemade locks. When we take into account the many hundreds of patents which have been granted for locks, it will be evident that the progress of the manufacture is largely due to our patent system. The same remarks will apply to the hinges of the door.

Lastly, we have the screws by which the hinges are secured. The patented machines for producing these screws are numerous, and their production is rapid and economical. Take the patent gimlet-pointed screw: what facilities it affords for the carpenter's operations! What tedious manipulation it dispenses with!

The houses of our artisans and laborers, the comfortable homes of our struggling western farmers, are a source of admiration and astonishment to inquiring foreigners who visit our country. The cheap woodwork and cheap building hardware, which enter into the composition of these dwellings, owe their existence to the thousands of patents which have been granted for the articles themselves, and for the machines for the cheap production of the articles."

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

The following are freeing powders, which may prove useful in hot weather when ice is not attainable: 1. 4 pounds sulphate of soda, 2½ pounds each of muriate of ammonia and nitrate of potash; when about, to use add double the weight of all the ingredients in water. 2. Equal parts of nitrate of potash and muriate of ammonia; when required for use, add more than double the weight of water. 3. Nitrate of ammonia and water in equal proportions. 4. Carbonate of soda and nitrate of ammonia equal parts, and one equivalent of water.

The absolute strength of a well glued joint is given as follows in pounds per square inch:

	Across the grain.	With the grain
Beech,	2,133	1,095
Elm,	1,436	1,124
Oak,	1,735	568
White wood,	1,493	841
Maple,	1,422	896

It is customary to use from $\frac{1}{2}$ to $\frac{1}{3}$ of the above values to calculate the resistance which surfaces joined with glue can permanently be submitted to with safety.

The following is a good method of purifying lubricating oil: A tub holding 63 quarts has a tap inserted close to the bottom and another about 4 inches higher. In this receptacle are placed 7 quarts boiling water, 3½ ounces carbonate of soda, 3½ ounces chloride of calcium, and 9 ounces common salt. When all these are in solution, 45 quarts of the oil to be purified are let in and well stirred for five or ten minutes; the whole is then left for a week in a warm place, at the expiration of which time the clear pure oil can be drawn off through the upper tap without disturbing the bottom.

To remove rust from steel, immerse the article to be cleaned (for a few minutes, until all dirt and rust is taken off,) in a strong solution of cyanide of potassium, say about $\frac{1}{2}$ ounce in a wineglassful of water; take out and clean with a tooth brush, with a paste composed of cyanide of potassium, Castile soap, whitening, and water.

To convert a wooden tray into a useful sink for photographic purposes, coat with shellac varnish. The latter can be purchased prepared; but, for the first coat only, it should be thinned with alcohol.

Microscopists collecting in the fields, who have not a glass slide at hand, will find the glasses of their watches an efficient substitute. If the watch be partially opened, the face forms a "white cloud reflector," and throws a good light through the object on the glass.

To test lubricating oil for acid, dissolve a crystallized piece of carbonate of soda about as large as a walnut in an equal bulk of water, and place the solution in a flask with some of the oil. If, on settling after thorough agitation, a large quantity of precipitate forms, the oil should be rejected as impure.

A varnish has been prepared from mica, which promises to become a useful article in the workshop, though at present it has been applied only to plaster casts and similar articles. Mica, calcined by fire or cleaned by boiling in hydrochloric acid, is reduced to as fine a powder as possible and mixed with collodion, when it can be laid on in successive coats like paint, giving the articles a silvery appearance. It may be colored by carefully grinding in the required pigment. The varnish adheres well to porcelain, glass, metal, wood, and plaster, and may be washed without injury.

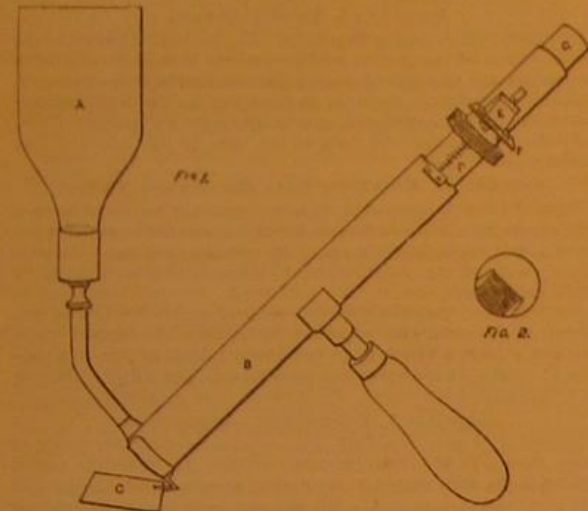
To waterproof fishing lines, apply a mixture of two parts boiled linseed oil and one part good size; expose to the air, and dry.

Artificial grindstones have been made at Worms, Germany, of grit, soluble glass, and petroleum. The proportions are not given. It is said that they will bear a very high speed without becoming soft.

TESTING THE COLOR OF WATER.

Dr. Bowditch has recently devised an apparatus for testing the depth of color of different specimens of water, which is described in a report upon the purity of the different rivers around Boston, etc. (City Document No. 142).

The instrument consists of two tubes, B and D, sliding, watertight, one within the other, the lower end of each tube being closed with a disk of plate glass. Into the large tube, B, just above the plate glass disk, is inserted a piece of small tubing, which terminates in a funnel-shaped receiver, A. Water poured into this receiver will, therefore, pass into the space between the two glass disks, entirely filling the outer tube when the inner tube is withdrawn, and again returning to the receiver when the inner tube is passed down, so that



the glass disks come in contact with each other. Through an opening, near the upper end of the smaller tube, is inserted one end of a rhombic prism, E, in which total internal reflection takes place twice. This prism extends halfway across the inner tube, so that an eye, looking through the eyepiece, sees the field of vision nearly half filled by the surface of the prism (see Fig. 2).

The eyepiece, G, contains a single lens, which is focussed upon the upper surface of the prism. The position and angles of the prism are such that a ray of light, outside of and parallel to the tube, B, is reflected first directly into the tube, D, and then parallel to its axis, thus emerging from the prism and entering the eyepiece alongside of the rays of light which have passed through the two plate glass disks. I will thus be seen that the conditions for comparing the color and intensity of these two sources of light are as favorable as possible.

A piece of white card, C, fastened at the lower end of the larger tube, throws a uniform white light through both tubes, and also along the outside of the instrument into the prism.

In using the instrument, a piece of brownish yellow glass is placed in front of the prism, and the water whose color is to be determined is poured into the receiver.

The inner tube is then withdrawn until the column of water between the two glass disks is sufficiently long to give to the light passing through it a color equal to that imparted by the colored glass to the light passing through the prism. The length of this column of water, which will, of course, vary inversely with the depth of the color, can be determined by means of the scale on the inner tube. By this means the relative intensity of color of various specimens of water may be determined with considerable accuracy. Dr. Bowditch thinks that this instrument might also be of service in connection with chemical color tests.

Gems from the Keely Motor.

"An ordinary steamship can be run so fast with it that it would be split in two."

"With these three agents alone (air, water, and machine), unaided by any and every compound, heat, electricity, or galvanic action, I have produced, in an inappreciable time, by a simple manipulation of the machine, a vaporic substance, at one expulsion, of a volume of ten gallons, having an elastic energy of ten thousand pounds to the square inch."

"It is a vapor of so fine an order that it will penetrate metal. It is lighter than hydrogen and more powerful than steam or any explosives known."

"I found this vapor capable of exerting power infinitely."

"I once drove an engine 800 revolutions a minute, of forty horse power, with less than a thimbleful of water, and kept it running fifteen days, with the same water."

"I produced a pressure of about 28,000 lbs. to the square inch in a shell of a gallon and a half capacity and three and a half inches thick."

"I experimented with a gun. The target was a 4 inch plank placed against a steel plate. My vapor threw the ball with such tremendous force that it went through plank and steel, tearing the bullet in shreds."

"I propose, in about six months, to run a train of thirty cars from Philadelphia to New York, at the rate of a mile a minute, with one small engine, and I will draw the power all out of as much water as you can hold in the palm of your hand. Why, people have no idea of the power in water. A bucket of water has enough of this vapor to produce a power sufficient to move the world out of its course."—John W. Keely, in *Inter-Ocean*.

"You treat the alleged invention of Mr. Keely," says Charles B. Collier, "contemptuously, and speak of him and his confederates as juggling tricksters whose chief purpose appears to be the wriggling of money out of silly people."

"I have given to the development of this invention my almost undivided time, having meanwhile to beg the indulgence of clients for whom I have charge of important causes; my declared policy having been to attest by my actions the confidence I have professed in the genuineness and value of Mr. Keely's inventions, resting content to wait that moderate degree of fame and fortune which shall probably be mine, if the correctness of my judgment shall be vindicated in the future."

HOW THE MONEY WAS OBTAINED.

"The initial step was the procurement of the requisite amount of money."

"I visited your city, called together some of your best known and influential citizens, among whom was Charles H. Haswell, Esq., who himself had visited Mr. Keely's place, seen his receiver charged with this enormous vaporic pressure, and had reported upon it."

"As a result of my interview, the gentlemen present subscribed for \$10,000 of the stock. They paid me \$3,000. I returned to Philadelphia and gave this to Mr. Keely."

"Mr. Keely was obligated, before any further money was to be called for, to explain the principles of his invention. This he did, giving to me (in the presence of ten other gentlemen) an exhibition on the night of the 10th of November, 1874, the result of which I reduced to writing. This report you have evidently seen."

"Mr. Keely," says the report, "proceeded to make an 'expulsion,' that is to say, to develop a force or pressure from the multiplier sufficient to exert a pressure of 1,430-36 lbs. This he did by blowing from his lungs, for, say, thirty seconds, into the nozzle upon the multiplier. He then shut the cock and turned on the water from the hydrant. The operation was completed in about two minutes after the attachment to the hydrant was made, by simultaneously opening two cocks upon tubes connected with the first and second drums, when the lever and weight of the force register were raised. The operation of the engines now took place as follows:

"A short tube, carrying upon its end a reaction wheel or 'Barker's mill,' having two arms of about two and a half inches long each, was screwed upon the reservoir, and, at 9:03 P. M., was put into rotation at a very high velocity, by the manipulation of two cocks. At 9:05 P. M., the reaction wheel was removed, and connections applied to a small beam engine, which was rotated at 400 revolutions. At 9:08 P. M. the reaction wheel was again rotated until 9:09 P. M." The machinery was then stopped, and the gaseous fluid allowed to escape against a candle flame and blow it out. At 9:15, the engine was run again for a few turns. "At 9:17 P. M., the reaction wheel was run again, and at 9:20, the experiments being concluded, the multiplier was taken apart and inspected by those present. There was no heat perceptible in any part of the apparatus."

"After I had written the report," continues Mr. Collier, "I submitted it to Messrs. Rutherford, Boekel, and Bell. They gave it their unqualified endorsement."

J. Snowden Bell says: "I now publicly and emphatically reiterate and reaffirm my endorsement of said report."

W. H. Rutherford says: "This report being submitted to me, I carefully examined it, and gave to it, and to the conclusions therein stated, my unqualified endorsement, and I now re-affirm the same."

"With this report," continues Mr. Collier, "I proceeded again to New York, and submitted it to the parties with whom I had contracted. They paid me the balance (\$7,000) of the \$10,000 subscribed."

"Under and by virtue of the several contracts, the parties were entitled to an exhibition of this power. This has been given to them, and was witnessed by about 30 gentlemen. As the result of such exhibition, the parties have paid an aggregate of one hundred thousand dollars."

Charles H. Haswell, civil engineer of this city, says:

"I have witnessed the development, by Mr. Keely, of a cold vapor, void of pungency or of temperature in excess of the surrounding atmosphere, having an expansive energy of fully 7,800 lbs. per square inch, as tested by my measurements and computations thereon."

"I have been present when Mr. Keely has applied a like vapor to an Ashcroft gage, and the index pointed to a pressure of 10,000 lbs. per square inch."

"I have satisfied myself fully and conclusively that the instrument of Mr. Keely was operated wholly independent of any external attachment, other than that of a chain suspension and a flexible connection with a water service pipe."

"I have seen a double cylinder engine, 3 by 3 inches, operated by a like vapor from a reservoir, through a conducting pipe eight feet in length, and having a bore of but one tenth of an inch diameter, although it was resisted by a friction load equal to 2,250 lbs. per square inch, and which engine I individually operated for a period of 15 minutes without any visible reduction in its speed, or indication of the exhaustion of the intensity of the vapor in the reservoir from which the supply was drawn."

[Capacity of the above reservoir not stated by Mr. Haswell, but fixed by Mr. Collier at 3½ gallons.]

H. C. Sergeant says: "One of the remarkable things about the Keely motor is that it (the new vapor) cannot be transmitted at a lower pressure than 1,000 lbs. (per square inch). It can be used, of course, at a lower pressure, after it is put in action. It can be regulated like steam, but its transmission at less than 1,000 lbs. pressure causes its condensation."

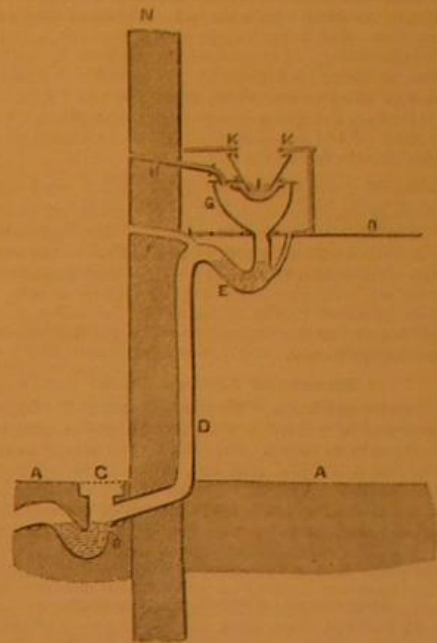
The capital stock of the Keely Motor Company is \$1,000,000. Among the New York gentlemen, believers in Keely, largely interested in the stock, and who are at pre-

sent resident directors of the concern, are J. W. Shuckers, Charles Lamson, Frank G. Green.

"An ordinary steamship can be run so fast with it that it would be split in two."

HOW TO PUT UP A WATER CLOSET.

Our engraving represents sectional views of the water closet in the upper floor of a two story house. A A is the level of the surface of the ground at the back court and of the kitchen floor. B is a 6 inch vitrified fire clay siphon trap,



with an open iron grating, C, at its top, which grating may be hinged. D is a 4 inch soil pipe from the water closet; it is here shown coming down inside the wall; in other cases it may be carried down the outside. One advantage of such pipes being carried down the inside is that they are more likely to be protected from frost. F is an ½ inch or 2 inch lead pipe for ventilating the soil pipe. In this case it is carried through the wall, in other cases it may be carried up through the roof. G is the water closet trunk, made of iron, it being a pan water closet, which is here shown. H is a ½ inch lead pipe carried through the wall and put in to ventilate the trunk, or that space between the water in the pan, I, or basin, J, and the water in the siphon trap, E. This ½ inch ventilating pipe, H, is a very important one, and its use ought to be the rule in place of the exception, as is at present the case. It works as follows: When the handle of the water closet is lifted, then any foul air lying in the trunk, in place of coming out into the apartment, is sent outside with a rush through this pipe, H; besides, being open to the air, it tends to prevent the accumulation of such foul air in the trunk.

In order to keep the outer orifices of the pipes, F and H, always open, it is a good plan to solder on one or two pieces of copper wire across them. J is the water closet basin, and the two small circles shown, underneath K K, are the india rubber pipes. L is a 3 inch zinc ventilating pipe carried up through the roof to ventilate the space or inclosure in which the water closet is situated. M is the gas bracket right below it, helping, when lighted, to cause an upward current. The empty space at N is supposed to be the water closet window. O is the surface of the floor of the upper flat. No gas can accumulate in the soil pipe, for the pressure of the atmosphere on the surface of the open grating, C, tends to send a current of fresh air through the soil pipe and out at the ventilating pipe, F.—W. P. Buchan.

Recent American and Foreign Patents.

Improved Fire Escape.

Franklin P. Berney, San Quentin, Cal., assignor to Lee B. Matthews, of same place.—A box is built upon the roof of the building, and so placed that its front door may open at the wall of the said building. The box is also provided with doors at its inner side. Within the box is a reel on which a rope or wire ladder is wound. The ladder is made of such a length that its lower end may reach to the ground, where it may be secured to hooks attached to the pavement. When the doors are swung open, an arm pushes a ball from a pin, so that the ball may fall into the street and carry down with it the end of the cord or chain, by which the ladder may be drawn from the reel. The doors are swung open when unfurnished by springs. The doors are fastened, when closed, by a sliding catch bolt. The bolt is operated by a rod or chain, which passes down along the wall of the building through a guard pipe attached to said wall.

Improved Running Gear.

Henry Dacker, Union Hill, N. J.—By this invention the connection between the head block and the forward axle is made firm and secure without the use of a fifth wheel. The end parts of the axle between the ends of a strengthening bar and the axle arms are strengthened by bars, placed upon them, and secured by suitable fastenings.

Improved Blacksmith's Forging Hammer.

Andrew J. Judson, Hillville, assignor of three fourths his right to Jacob Truly, Catfish, Pa.—This consists of a sledge hammer for blacksmith's use, contrived with a foot treadle for forcing it down and a spring for raising it. It will strike quite light blows, or slower heavy ones, at the will of the operator. The helve of the hammer is pivoted in a yoke of a vertical standard, which is free to turn, and has a lever for the purpose of swinging the hammer laterally along the anvil, whereby the blacksmith may cause the hammer to strike on any part of the anvil at will, and as the work requires. The springs for raising the hammer are also contrived to turn with the helve, so as not to interfere with its turning, and the helve is extensible to lengthen and shorten its range.

Improved Clamp for Grinding Watch Crystals.

Arthur C. Norton, Monona, Iowa.—This invention consists of a pair of rubber-faced clamping disks, arranged in a pair of jointed clamping jaws, having a clamping screw for fastening them to receive and hold between them a watch crystal, and revolve with it. The edge of a crystal is presented to the face of a grindstone, so as to be ground suitably for fitting in the rim of a watch case.

Improved Planing Attachment for Metal-Turning Lathes.

Axel Hoffman, New York city.—The bed plate of the attachment is made to slide on the ways of the lathe. There is an adjustable clamp, by means of which the attachment is applied to the lathe, and a lever, by means of which the slide and tool of the attachment is put in motion. The fulcrum pin passes through a slotted arm made fast in the clamp. The feed screw works in the slide of the tool holder. A spring is attached to the base which bears against the shank end of the tool, which, when the tool leaves the piece which it is cutting, the spring throws back into position for another cut. The feed of the attachment is given by means of another spring, which is attached to the bed.

Improved Combined Baby Tender and Crib.

Mrs. Ariette Baird, Riverhead, N. Y.—This invention consists of a frame work in the nature of a crib, supported detachably on corner posts, and provided with a bottom carpet, applied to the lower part of the frame, and with a stretching part attached at suitable height above the carpet, to be alternately used as a tender or crib. A canvas sheet is stretched to the upper end of the lower connecting boards, and transforms the tender into a crib, the mattress and bedding being placed thereon.

Improved Lifting Jack.

John B. Fayette and Lorenzo Meeker, Oswego, N. Y.—In using the jack, the free end of a lever is raised, and a step is adjusted to fit under the object to be raised. The jack is then placed beneath the object to be raised, and the free end of the lever is drawn down, which raises the object. When the free end of the lever has been lowered so far as to carry the pivot in the end of the said lever past the straight line connecting the fulcrum of the lever and the pivot in the end of a lifting bar, the said lever strikes a stop attached to the brace bar, and the jack is locked, holding the object raised.

Improved Furniture Casters.

Ceredra B. Sheldon, New York city.—The object of the first of these two inventions is to contrive a stamped spindle socket, so as to bear the weight of the load on the top of the spindle by the bottom of the socket, which, as ordinarily arranged, it is incapable of, because the metal is so soft, to facilitate the stamping, that it will not stand the wear. A bush or washer is secured in the socket, by the spindle end passing through and riveted above it, and a shoulder for the washer or bush is formed in the socket by a contraction of the upper end thereof, the spindle passing through and being riveted above. The second invention consists in the construction of the horn of a single piece of sheet metal with a rolled eye. The horn is much stronger and more durable than when made of cast metal, while its cost is trifling when compared with the cast articles.

Improved Brake for Hay Wagons.

William Harper, Seneca, Ohio.—This improvement in wagon brakes relates to the construction and arrangement of the operating lever, whereby it operates automatically to hold the brake bar away from the wheel, except when applied thereto by manual force.

Improved Ship's Furniture to Prevent Seasickness.

Joseph Wertheim, Frankfurt-on-the-Main, Prussia.—This invention consists of a chair with supporting legs, carrying a universal joint, to which the supporting rod of the seat is connected, to retain the level position of the same during the movements of the vessel. The said parts are so constructed and arranged that the legs may be folded for storage.

Improved Machine for Turning Bobbins.

Luther Bean and James M. Butters, Stratford Hollow, N. H.—This invention consists of a revolving cutter head on a hollow mandrel, having a sliding center, in combination with another sliding center, and a sliding table, all being worked automatically, and so arranged that the blanks, being supplied to the table by hand, will be automatically introduced between the centers, and turned, and discharged rapidly and efficiently.

Improved Throttle Valve.

Reinhard Scheidler and John H. McNamar, Newark, Ohio.—This consists of a valve which is controlled by the sawyer by means of a sector lever and rack placed in the steam pipe, either in combination with or separate from a throttle valve.

Improved Sewing Machine.

George S. Darling and Augustus L. Darling, Watertown, N. Y.—This invention consists of improvements in the construction of the Davis vertical feed sewing machine. The thread tube is made by novel arrangements to serve for the pivot pin of the link, as well as for its own legitimate purpose, being firmly screwed in the top of the needle bar. The cam at the lower end of the tumbler is so shaped that, at the same time that it swings to lift the presser, it will work the take-up as it is required to operate, and there leave it at rest, to be afterward returned by the spring, which is arranged in a volute coil around the stud to which it is attached as being a better and more durable arrangement than the angular form in which it has been heretofore arranged in these machines. To take up the edge wear of the cam bar, an adjusting bar alongside of it is introduced, with adjusting screws, by which it can be shifted along against the cam bar from time to time, as may be needed.

Improved Boot and Shoe Last.

Chas. F. Hill, Baltimore, Md.—This invention relates to certain improvements in lasts for boots and shoes, and it consists in attaching, to the metallic plate upon the bottom of the last, points which receive and hold the lasting sole while the upper is being attached to the same. Said points have a sharp knife edge upon the side next the heel, so that, when the shoe is finished and the last is to be withdrawn, the said point cuts a slight gash in the sole and allows the last to be withdrawn.

Heating Stove.

Alexander Bettes, Warrensburg, Mo.—This invention is an improvement in the class of heating stoves which are circular or oval in cross section, provided with return flues on the sides, and have a damper so arranged that the products of combustion may be, at will, diverted from a direct course and caused to take the circuitous one. The patentee aims to secure a maximum exterior heating surface with a cheap, compact form of stove, and to insulate the combustion chamber, at will, by means of a dead air space on the sides, bottom, and rear end of the stove.

Improved Furnace for Manufacturing Iron.

George J. and Samuel J. Skinner, Milton, Pa.—This invention consists in reducing iron ore to wrought iron in one continuous operation, consisting first in subjecting the ore in a liquid or molten condition to the deoxygenizing influence of hydrogen and carburized hydrogen gases; and secondly, in smelting the ore by the subsequent action of the same blast admitted with atmospheric air. The invention also includes the apparatus for carrying out the process.

Improved Press.

Edward Van Gosen, Forest, Ohio.—This invention consists of a press for cheese, wine, cider, and the like, in which there is a hand lever connected with the follower, and another lever carrying an eccentric lever for operating the first mentioned lever when the resistance becomes too great for the direct application of hand power.

Improved Feed Water Heater and Filter.

George F. Jasper, Freeburg, Ill.—This invention relates to improvements in the feed water heater and filter for which a patent was granted to the same inventor under date of December 1, 1874. It consists of a water box in the heating tank, from which the water is conveyed to a double filter receptacle, and back by a return pipe to the sediment pan, from which it is fed to the pump.

Improved Hog Boots for Animals.

Wilhelm Jacobs, Charleston, S. C.—This invention consists of a hog boot for horses and mules, to wear on soft boggy ground to prevent miring. The upper is made in two side and one front pieces, and a back stiffener, together with straps for buckling the boot fast on to the foot. Loop straps keep the fastening straps in place. The said side pieces are to open the top to admit the foot. The side pieces meet together behind, and are cut down on the top to fit the fetlock.

Improved Pump.

William H. Conner, Agnew's Mills, Pa.—This improved pump consists of two cog wheels, running together in a case, to pass the water between them. Leather packing diaphragms are confined against the ends of the wheels, and also leather packings are provided for the faces of the wheels, also held by springs in a manner calculated to afford efficient packings with but little friction.

Improved Picture Exhibitor.

Julius Buechner, St. Paul, Minn.—This invention consists of a picture case with hinged back, having folding side, top, and bottom flaps, that may be closed at the front or back, for inclosing or exhibiting the picture. It is a convenient device for carrying photographs or other pictures in a safe and compact manner, and for exhibiting them at any time by changing the inclosing parts to form a stand or a picture frame.

Improved Paper Bag.

Emil Langgesser, Atlanta, Ga., assignor to Elias, May & Co., same place.—This consists in so folding paper as to form a bag from one piece. The bag has a seamless or satchel bottom, and, when filled, will stand erect, and will not be liable to draw apart at its seams.

Improved Nut Lock.

Joseph C. Wright, Monocacy Station, Pa.—This invention consists of a notched block sliding in a washer against the nut, to hold it by the corners or broad side. The block is held against the nut by a spring, which is contrived to release the block readily to free the nut when it is to be screwed on or off. The block is fitted in a notch in the washer for operating in this manner by rabbit joints, which are stamped out cheaply, and the spring is a kind of yoke or bow strained against the outside of the locking block.

Improved Insect-Destroying Composition.

Joseph B. Douglass and Elijah S. Green, Columbia, Mo.—This is an improved compound for protecting trees from boring insects, consisting of sugar of lead, alcohol, spirits of turpentine, aqua ammonia, gum arabic, and camphor.

Improved Car Mover.

Milton Woodworth and Jerome B. Fredricks, Conneaut, Ohio.—This consists in a lever so constructed as to adapt it to be applied to the rim of a car wheel, for rotating the same, and thus moving the car on the track.

Improved Scraper.

Elbridge Dickinson, Marshall, Mo.—This is an improved scraper for grading roads and other purposes, so constructed as to take up the dirt without its being previously plowed or loosened. The scraper plate is slightly concave, and its ends are turned up to act as cutters. It is strengthened and secured by bars, and has attached a grating upon which the dirt slides when the scraper is full.

Improved Former for Bending Sled Frames.

Jacob W. & Eugene W. Karu, Seneca Falls, N. Y.—This invention relates to a device for forming or bending the iron in the construction of sleds, in which a single piece of metal is so bent as to form both the runner and side frame of the sled. It consists of a base plate upon which are mounted segmental plates having dowel pins and handles, whereby the said plates are detachably fixed to the base. The segmental plates are shaped to suit the open spaces between the frame to be constructed, and, when placed upon the base, leave a space between them which constitutes a pattern around which and between which the iron is bent to the required shape.

Improved Bottle Stopper.

Michael W. Shaw, Galveston, Tex.—This invention is an improvement in the bottle stopper of Westel E. Hawkins, patented under date of August 4, 1874, so that the same may be used with greater ease, and without being liable to wash off the dust and fly dirt from the outer cap piece by the liquor running over the same. It consists in providing the sliding cap piece with a circumferential flange or rim to prevent the running of the liquor from the perforated extension over the outside of the cap piece.

Improved Ironing Apparatus.

J. Wright Gardner, Troy, N. Y.—This invention relates to machines for ironing collars and other special articles by power with a cylindrical iron, which is made to roll or slide on the goods and then slide back. It consists of the carriage for the roll or other contrivance by which it is connected to the working mechanism made to slide on ways parallel to the table, the object being to dispense with the overhead device heretofore employed for suspending the roller frame.

Improved Lamp Chimney.

Robert Norris, Anna, Ill.—This invention consists in side glasses tapered to slide in vertical grooves and be removable at the top, and in making an air flue between the outer shell and inner flue.

Improved Saw Gage.

O. T. Gronner, Baltimore, Md.—This invention consists in novel means for gaging the division lengths of lumber on the sawing machine, and in securing the table on which the lumber is fed, so as to take up its own wear and prevent the possibility of tilting. For this purpose, the table is provided with beveled ways, the gage made reversible by tenon and groove on each side, and the guide combined with a sliding gage.

Improved Measuring Instrument.

E. C. Roberts, Broadford, Va.—This invention consists of a pivoted plate, two notched arc plates, two direction bars, and two pointers, one of the direction bars turning in a horizontal plane, while one of the arc plates turns in a vertical plane.

Improved Nozzle for Smoke Stacks.

Wm. Stamp, Susquehanna Depot, Pa.—The invention consists in means whereby exhaust steam may be more effectually utilized in augmenting the up draft of a smoke stack.

Improved Eaves Trough.

Robert Tyhurst, Dresden, O.—The invention consists in making the eaves trough for buildings out of burnt clay, the sections being coupled by tongue and groove.

Improved Fire Escape, and Improved Combined Fireman's Ladder and Fire Escape.

David Sanford, Ashton, Ill.—The first invention is a vertical extension ladder, provided with a coiled spring arranged in connection with the windlass of one of the movable sections. The spring winds up when the section descends, and serves to counteract the weight of the moving parts, and assist in raising and lowering them. The movable sections may be swung out against the building, and are provided with a sliding extension. The ladder is in the form of a hollow square. The second invention is an improvement on the above. The ladder is pivoted to the frame of a carriage, and may be raised by a chain connected with a spur wheel. The chain is prevented from slipping off said wheel by suitable devices, no matter in what position the ladder may be placed. The ladder may be adjusted laterally; suitable braces are added for steadying the machine. Finally, the ladder may be turned down and conveniently stowed for transportation.

Improved Smoke Stack.

W. Stamp, Susquehanna Depot, Pa.—The invention relates to the smoke stacks of locomotive engines wherein means are employed to prevent the emission of sparks and cinders; and it consists in utilizing the exhaust steam in augmenting the up draft without materially impairing its force, so as to discharge the sparks and cinders through a spiral conveyor to one side of the outlet of the smoke pipe.

Process of Treating Jute for Paper Pulp.

Edward Conley, Cincinnati, O.—The patentee produces a pure white pulp from jute by a process which depends for its novelty, not upon a new combination of chemical elements, but upon the relative strength of the caustic alkali solution, the degree of pressure while boiling, and certain other conditions. The patentee seems to have discovered the proper relative proportions of chemical agents, degree of pressure, etc., necessary to produce the desired white product, although others have previously subjected jute to a process or treatment analogous in a general way, but without arriving at a like satisfactory result. The process is an economical one.

Improved Exercising Apparatus.

George W. Wood, New York city, assignor to Hetty W. Wood, of same place.—In the ends of a rubber tube are inserted conical blocks, made with rounded outer ends, around which the ends of the tube contract, so that, when the said ends are grasped by the hands, it will be impossible for the said conical plugs or handles to be drawn out. The plugs are perforated longitudinally, and through them, and through the rubber tube, is passed a cord, which has knots formed upon its ends of such a size as to prevent said ends from being drawn through the said handles. The cord is of such a length as to allow the tube to be stretched to any desired extent. With this construction, should the rubber tube break, the cord will prevent the ends of said broken tube from springing around and striking the person using the implement, or those standing near.

Improved Corn Marker.

Miles A. Throckmorton, Andersonville, O.—The side frames may be turned up over the middle frame, for convenience in passing from place to place, and to enable the machine to pass through narrow places. The standards of the plows are slotted longitudinally to receive bolts, by which they are secured to adjustable bars, so that they may be conveniently raised and lowered, to make shallower or deeper marks. To the rear parts of the bars are pivoted wheels to support and carry the machine. The faces of the wheels are made V-shaped, so that, as they follow the marking plows, they may pack the soil in the bottom and sides of the marks, and make said marks distinct, so that they can be easily seen, and permanent, so that they cannot be obliterated by storms that may occur between the marking and planting. Another device makes a small mark parallel with the marks made by the plows and wheels, to serve as a guide to the driver when using the machine, and may be extended and contracted to correspond with the adjustment of the plows and wheels.

Improved Wood Grinder for Paper Pulp.

Anna M. Zimmer, Elkhart, Ind.—The invention consists essentially of a grindstone arranged to run in an oblique plane of about 45° to the horizon, with two grinding faces and two sets of feed boxes and feed pressers, both arranged obliquely to the horizon, so that the gravity of the wood will assist in feeding it, and the water for lubricating the stone will apply to both faces better than it will to one if the stone is arranged horizontally. The invention also consists of certain details of the apparatus for working the feed pressers, and in the contrivances of the feed boxes and their supports.

Improved Wood Grinder for Paper Pulp.

Joseph O. Gregg, Elkhart, Ind.—The invention consists in the combination, with a double elbow lever fulcrumed on different frame posts, of a single central hollow weight, attached to all the levers to prevent jarring, shaking, or quivering of the lever. The fulcrumed double levers swing only in vertical direction, and prevent play in any other direction, while the central weight causes every piston to grind alike, as the pressure is shifted from one to the other in case the wood in one box is softer and easier cut than in the other.

Improved Blind Slat Adjuster and Improved Shutter Worker.

William M. Lanphere, Waterloo, Iowa.—The first invention consists of tubular shafts arranged on the shaft of the blind opener, to open and close the slats by wheels at the outer end gearing with racks on the blind, which operate the slats by levers and connecting rods. A set of the devices is employed for each section of slats, to work them independently of each other. The second invention consists in the provision of a hinged angle plate, which is carried by a push rod, employed for starting or dislodging the shutter when bound by frost or any slight obstruction, said plate serving to fasten the shutter, when closed, by engaging with its lower edge.

Improved Hopper.

John Shive, Center Hill, Ark.—The invention consists of a hopple formed by one unjointed arc piece with a shoulder and three links, so arranged that all liability to unfasten is removed, while facility of manipulation is still retained.

Improved Grain Drill.

James C. Daman, Elk Point, Dakota Terr.—The machine embodies an improvement in the class of grain drills having a reciprocating or shaking hopper; and the invention relates particularly to an arrangement for simultaneously elevating the seed coverers and throwing the seed box or hopper out of action.

Improved Folding and Sliding Ten-Foot Pole.

Stephen W. Blatchly, Dickson City, Pa.—This rod is made of four sections of wood. The two middle sections are hinged together. To keep this hinge rigid when the rod is opened, there is a slide, which is slotted and held in place by two screws. A bar plate receives the slide when the rod is opened. When the rod is closed or folded the slide is pushed back. The outer sections are confined each by bands, and slide up to shoulders, in which condition the rod is readily carried from place to place. The rod is marked off into feet and inches in any convenient manner.

Improved Corn Shelter.

Frelinghuysen H. Hunter, Heltonville, Ind.—The invention relates particularly to a chaff box, which is formed of a sheet metal plate applied beneath the ribs or bars of the shelter.

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Notes & Queries

A. J. C. and B. B. L. should consult a physician.—R. F. will find a good recipe for burnishing liquid for the heels of boots and shoes on p. 317, vol. 31.—F. K. will find a recipe for cement for china on p. 345, vol. 24.—J. C. T. should consult an engineer.—A. K. will find a recipe for root beer on p. 135, vol. 31.

(1) H. J. R. asks: How do you suspend the sheet of zinc in the galvanic battery, mentioned in a recent issue? A. Suspend it upon any insulator. Wood will do.

(2) G. F. H. asks: 1. Is there any better insulator than gutta percha or glass for the key of a telegraph instrument? A. Yes. Bone or rubber. 2. Do operators ever lose the use of their arms, by electricity passing through gutta percha insulators? A. No. 3. Is there anything that will counteract the effect of electricity on the nerve? A. No.

(3) E. L. G. asks: What is the best battery for making an electric light? A. Fifty cells of Bunsen.

(4) P. Q. S. asks: 1. In the following battery, what is the least number of cells that will give a perceptible shock? It consists of a glass jar 5x4 inches, covered by a piece of wood, suspended from which are two pieces of coke 5 inches long by 2 wide; between these is a piece of zinc of the same size. The liquid is bichromate of potash, 2 parts, dissolved in 20 parts hot water and 1 part sulphuric acid. A. One hundred cells would give a slight shock. 2. Should the zinc plate be amalgamated? A. Yes. 3. How many cells would be necessary to nickel plate buttons, etc.? A. One cell. 4. Which is the positive plate? A. The zinc. 5. In a recent issue of your journal, you published a recipe for amalgamating zincs. I tried it, but it was a total failure. I could not dissolve the mercury. What is the trouble? A. You need not dissolve the mercury. Clean your zincs with muriatic acid, and the mercury will adhere.

(5) J. S. F. asks: 1. If a plate electric machine is arranged with metallic disks and points on both sides of the plate, for conducting the electricity to the prime conductor, would it conduct more of the fluid with the same friction of the plate than it would if there were disks on one side only? A. Yes. 2. If the points are a quarter of an inch apart instead of half an inch, would it catch more of the electric fluid with the same friction of the plate? A. Yes.

(6) R. S. says: I have constructed a line of telegraph to connect my store and house, distance half a mile, and have found it impossible to make any circuit by the ground. I commenced with 4 cells of Daniell's battery; then I increased to 7 cells, and carried ground wire at each end into the cellars; these I connected with a piece of gas pipe 8 feet long, driven the whole length into the ground and surrounded with a quantity of scrap metal of different kinds, yet it does not work, and I had to put up a return wire. It works splendidly with the second wire, but I wish to make it work with the single wire. Can you inform me how it can be accomplished? A. Bury two copper plates, six feet square—one at each end of the line—in earth which is always saturated with water, and solder the ends of the wire to the plates.

(7) W. S. H. asks: What should be the members of a saline battery for constant action, the solution to be similar to sea water? A. Zinc and copper.

(8) B. P. D. says: In a recent issue you say that the resistance in the pencil of charcoal develops heat, producing incandescence. Is any effect produced by this intense heat where the carbon comes in contact with the glass cylinder? Or, more to the point: Is heat generated at all in this partial vacuum, I mean of course to any considerable extent? A. Machine electricity is not sufficient in quantity for the production of light with carbon pencils.

(9) A. asks: 1. How can I make a Leclanché battery? A. See p. 73, vol. 31. 2. How many Leclanché cups are required to make an electric light? A. Seventy-five, of large size.

(10) C. S. W. asks: Am I correct in claiming that light travels faster than galvanic electricity? A. Yes, as a general statement of fact. Galvanic electricity could travel as fast as light if it had a conductor without resistance, but that is difficult to secure.

(11) M. M. asks: Has there been in this country any practical application, to the artificial lighting of buildings, of the electric system of the Russian inventor, M. Ladigun, described on p. 373, vol. 32? A. No.

(12) R. H. S. asks: 1. What does the following mean, in relation to lenses: "½ inch, angular aperture 175°," and "½ inch, angular aperture less than 90°," without adjustment? A. These questions relate to compound microscope objective lenses; ½ inch means that the magnifying

power of the combination is equal to a single lens of ½ inch focus, or ½ x 8 = 160 linear, when it would be used alone without an eyepiece. Angular aperture 175° means that the extreme rays which can converge in the axis of the lens from the edge of any object, and reach the eye, make in that axis an angle of 175°. Four tenths of an inch means that the magnifying power is equivalent to that of a single lens of ¼ inch focus, or ¼ x 8 = 20 times linear. Angular aperture less than 90° means that the lens does not admit rays more oblique than those which make ½ x 90 or 45° with the axis. Without adjustment means that the lens has not the adjustment required for high power, by which the relative distance of the achromatic lenses, of which the lens is composed, can be shifted so as to adapt the lens to different thicknesses of glass crossing the object. 2. What are an immersion lens and a dry lens? An immersion lens is one of which the curves are calculated in such a way as to be only adapted to be used with a drop of water between the lens and the object. Dry lenses are the ordinary lenses.

(13) S. M. says: I have run my lightning rod into my well as a ground connection. As water is a good conductor, I supposed this would be the best possible way. Is this correct? A. Yes.

(14) W. M. Q. asks: 1. Is there a telegraph insulator in use that the wire simply passes through? A. Yes. 2. Would a glass tube passing through the cross bar be as good as the common insulator? A. No.

(15) W. O. C. asks: 1. Will a battery consisting of two 1 quart cells (copper and zinc) be of sufficient power to silver plate small articles? A. Yes. 2. How can I construct such a battery? A. See p. 26, vol. 32. 3. Can electricity be felt by taking hold of wet sponges attached to the wires? A. No. 4. What is the least number of cells required to plate small articles, coins, etc.? A. One cell. 5. How much and what kinds of wire should I use to make an induction coil two inches long with? A. Use 500 feet No. 40 and 50 feet No. 16 wire.

(16) O. C. says: 1. I have had an electro-magnet made of ¼ inch iron, U-shaped (the arms 4 inches long), wound with 650 feet No. 23 cotton-covered copper wire; with two cells of Leclanché battery it attracts the armature (¼ of an inch from the poles) with a force of about 4 ozs. Is that as much as I ought to expect of it? A. The Leclanché battery is not well adapted for power. You would get much more power from a single cell of Bunsen than from a dozen of Leclanché. 2. How shall I connect the cells together to get the greatest attractive power of the magnet, carbon of one cell to zinc of the next, or all the carbons together and all the zincs together? A. Connect all carbons together and all zincs together.

(17) E. C. says: I have made two Morse sounders, ¼ inch cores, 2x1½ inches spools, with 500 feet No. 26 wire. How many cells Callaud battery shall I want for 600 feet No. 12 iron wire? A. Six.

(18) C. H. W. says: 1. In a recent article on electro-metallurgy, you stated that lead articles should be electro-coppered before silver would deposit. Is the solution for this purpose the same as that for electrotyping? A. Yes. 2. You also gave the proportion of ingredients for silver bath, using cyanide of silver. What would be the proportion in using nitrate of silver? A. Nitrate of silver will not answer. 3. How many Minotti cells with 2½ inch disks should I use for plating in a ½ gallon bath? A. One.

(19) G. A. C. says: I tried to make a battery by taking a glass jar and putting sulphate of copper in the bottom, and water on top, with a piece of copper in the bottom, and a copper wire leading from it, and zinc above with copper wire leading from it also. I cannot feel any electricity going through the wires. Is the battery too weak? A. A single cell would not have force enough for you to feel the electricity.

(20) J. W. W. asks: Is there a method of creating a vacuum, however small, by means of an electric current? A. We do not know of any.

(21) E. F. M. asks: What effect will heat lightning have on a balloon if the air is hot? A. We have no positive data to guide us upon this point, but should think the heat lightning would not affect the gas.

(22) S. E. P. says: In melting ore in a small crucible, can I put in anything to make silver flow freely and separate from the other matter? A. Melt your silver with a small quantity of lead in an ordinary cupel.

(23) C. W. H. says: If a piece of glass is placed between the heat of a fire and the hand, the heat will not be felt. But if you place the glass between the hand and the sun, the heat will be felt as if the glass were not there. Why is this? A. Heat radiations are classified under two heads, luminous and obscure. A plate of glass, while it freely transmits all the higher heat vibrations or luminous heat rays, wholly arrests the obscure ones. The rays from the stove are possibly all obscure, or of slower vibration, and are therefore completely arrested by the glass plate, while the sun's heat radiations are mostly of the luminous kind (the obscure rays having been sifted out in their passage through the aqueous vapor in our atmosphere), and pass with little loss through the glass.

(24) K. H. asks: How can I color the hair on a buffalo robe, so as to make it a dark brown, nearly black? A. It will be necessary to first thoroughly cleanse the hair of all dirt, etc., as it is impossible to get any satisfactory results until this has been done. For the above purpose, the following has been used with advantage: Sufficient aqua ammonia is added to a pint of water to make the whole pungent. Afterwards wash with clean water. Then use the following dye: To a saturated solution of sulphate of copper, add ammonia

until the precipitate which falls is wholly redissolved. For a mordant, to be first applied, use a saturated solution of ferrocyanide of potassium.

(25) J. F. W. says: A Jeweller recently had several watches in his front window, and at a flash of lightning he felt the glass in his window move. On taking down a watch, on the face of which was a small compass, and laying the watch down face upwards, he noticed the compass out of order. It would first start and turn rapidly to the right for a good many revolutions, then pause for a second, and then revolve rapidly to the left, which it continued to do for two days, when the owner took it out. Was the watch electrified by the lightning? A. You should have stated whether the working parts were in motion or not. If in motion, the phenomenon is easily explained; some of the movable steel parts of the mechanism have, from some cause or other, become magnetized (possibly from the cause mentioned), and at every change of position they alternately attract and repel the opposite poles of the compass needle.

(26) A. S. says: I have about 300 bottles of Burgundy which has turned slightly sour. Can you tell me how to cure it? A. Try the old German method of putting into the wine a small quantity of charcoal, shaking it, and, after allowing it to stand 48 hours, decanting from the sediment.

(27) H. S. F. says: 1. On my barn there is a metallic vane. The vane is higher than anything else in the vicinity, though there are plenty of trees about. The soil is very dry. Knowing that lightning rods are seldom put up properly, is the barn safer without or with them? A. If you follow the advice given on p. 145, vol. 31, on constructing and placing the rod, there will be no doubt of its efficient protection over your property. 2. Why do trees tend to protect a building from lightning? A. Tall oaks and elm trees some times offer some protection to low buildings; but in most cases this protection is rather uncertain.

(28) O. C. L. asks: How many revolutions of Robinson's cups are equivalent to one mile traveled over by the wind? A. Dr. Robinson concluded himself warranted in laying down, as a general law, that the cups on a horizontal windmill of this description move with one third the wind's velocity, except so far as they are retarded by friction.

1. What is the simplest method of determining when it is exactly noon at New York, so as to regulate time pieces? A. The methods of determining true local time by observation are several. (1) By equal altitudes of a star or opposite sides of the meridian. Observe the time when the star has equal altitudes before and after passing the meridian; the middle point between these times is the time of the star's passing the meridian. By comparing this time with the known place of the star, we may obtain the error of the clock. (2) By equal altitudes of the sun. Since the declination of the sun changes from morning to evening, the time of the sun's arriving at a given altitude is affected by this motion, and we must compute the correction to be applied to the mean of the times observed. (3) By means of the transit instrument. The instant of the sun's passing the meridian is the time of apparent noon; and hence, if we compare the sun's passage over the meridian with a chronometer, we shall obtain the deviation of the chronometer from apparent solar time. If to this we apply the equation of time with its proper sign, we shall obtain the error of the chronometer in mean time. 2. Will a sun dial serve this purpose, and if so, how can I make one? A. Sun dials are not very accurate chronometers.

How can I make a self-registering rain gage? A. A graduated bottle with a small funnel placed in its mouth is the simplest of the various pluviometers in use, and is, perhaps, as accurate as any of them. We do not know that any self-recording instruments of this kind have yet been constructed.

(29) A. L. F. B. says, in reply to S. L. G., who asks if violin tops and bottoms are sawn thin and then bent, and also if there is a block or anything of the kind inside the violin, to glue the neck to, or is the neck simply glued to the outside: I give some extracts from the "Practical School for the Violin," by U. C. Hill: "Wood for the belly or sound board should be split so as to have a full inch thickness toward the bark or outer side, and a quarter of an inch towards the heart of the tree. Sycamore, for the back, must be cut in the same manner, with this exception: It should be split, in pieces not less than 6 inches wide, and 2 inches in thickness, at the back edge. It is then sawn in two, breadthways, or sliced into two pieces. These two pieces are then glued firmly together, with the edges nearest to the bark of the tree inwards. The under side is planed flat, and the upper or outside is, in the first instance, planed down, somewhat in the form of the roof of a house, that is, higher in the center, and sloping down gradually towards the edge. The form or model is then scooped or worked out according to the taste of the artist. It should be observed that the end blocks, which are placed one at the extremity of the neck, and the other at the bottom of the instrument, immediately under the tail-piece, are never omitted even in the commonest violins. It may not be amiss to remark that, in the oldest instruments, the upper end block is not a detached piece, but, in fact, a continuation of the neck, the ribs being let in on each side; but this system is now exploded. The neck is merely glued, and not fastened on with either a nail or a screw."

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

H. J.—It is tint.—H. S.—It is a poor quality of hematite.—J. R.—Nos. 1 and 2 are mica schist. No. 3 is quartz rock, containing iron pyrites. No. 4 is

quartz rock, containing arsenopyrite.—E. N. L.—It is not plaster, as you suppose, but calcite or carbonate of lime—Ca CO₃. Several small crystals were found in the calcite, but there were not enough of them for us to determine what they were.—J. O. B.—The dark red material, No. 1, is shale. No. 2 is a limestone containing marmolite.—J. A. H.—It is hematite.—I. L.—It is the cocoon of the *attacus cecropia*. "The cocoon is fastened longitudinally to the side of a twig. It is, on an average, three inches long, and one inch in diameter at the widest part. Its shape is an oblong oval, pointed at the upper end. It is double, the outer coat being wrinkled, and resembling strong brown paper in color and thickness; when this tough outer coat is cut open, the inside will be seen to be lined with a quantity of loose, yellow brown, strong silk, surrounding an inner oval cocoon, composed of some kind of silk, and closely woven like that of the silkworm. The insect remains in the chrysalis form through the winter. The moth, which comes forth in the following summer, would not be able to pierce the inner cocoon, were it not for the fluid provided for the purpose of softening the threads; but it easily forces its way through the outer cocoon at the small end, which is more loosely woven than elsewhere, and the threads converge again, by their own elasticity, so as almost entirely to close the opening after the insect has escaped."—Harris.

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 Keely Motor. By T. P. W., and by O.
On the Weight of the Earth. By J. F.

Also inquiries and answers from the following:

A. E. L.—N. J. W.—F. C. S.—N. R. S.—K. B.—
F. W. T.—N. H. N.—A. B. F.—R. L.—W. F.—G. F.—
A. G.—J. W. D.—C. H. S.—P. S.—G. D.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who sells lenses for telescopes? Is there a good and cheap microscope for student's use to be found in the market? Who sells the best bookbinders' boards? Whose is the best gear wheel cutter?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

FOR WHICH

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

June 22, 1875.

AND EACH BEARING THAT DATE.

(Those marked (r) are reissued patents.)

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DESIGNS PATENTED.

8,406 to 8,408.—BREAKFASTING.—L. S. Beals, Astoria, N. Y.	
8,409.—SCARF RING.—L. S. Beals, Astoria, N. Y.	
8,410.—PICTURE FRAME.—E. Beck et al., Lockport, N. Y.	
8,411 & 8,412.—EMBROIDERY.—E. Crisand, New Haven, Ct.	
8,413.—COMB.—G. G. Miller, Philadelphia, Pa.	
8,414.—BORDER.—C. Osborne, North Attleboro, Mass.	
8,415.—VASE.—C. F. Pike, Philadelphia, Pa.	
8,416.—DRESS.—C. Richter, Dedham, Mass.	
8,417.—BOTTLES.—J. F. Truxal, Mt. Union, Pa.	
8,418.—CASKET.—E. C. Clark, Rockville, Ct.	
8,419.—PRINTING TYPE.—J. M. Conner, Greenville, N. J.	
8,420.—TYPE.—P. A. Jordan, Philadelphia, Pa.	
8,421.—THERMOMETERS.—C. Kitchell, New York city.	
8,422 to 8,425.—OIL CLOTHS.—C. T. Meyers, Bergen, N. J.	
8,426.—STOVE DOORS.—J. Wormer et al., Albany, N. Y.	
8,427.—BIRD HOUSES.—J. White, Philadelphia, Pa.	

SCHEDULE OF PATENT FEES.

On each caveat	\$10
On each Trade mark	\$25
On filing each application for a Patent (27 years)	\$15
On issuing each original Patent	\$20
On appeal to Examiners-in-Chief	\$10
On appeal to Commissioner of Patents	\$20
On application for Reissue	\$30
On filing a Disclaimer	\$10
On an application for Design (3 1/2 years)	\$10
On application for Design (7 years)	\$15
On application for Design (14 years)	\$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA,
June 15 to June 18, 1875.

4,964.—D. J. Topley, Brooklyn, N. Y., U. S. Fire extinguisher. June 17, 1875.	
4,965.—J. H. Morrell, New York city, U. S. Floodway for warehouses, etc. June 17, 1875.	

4,866.—G. H. Longmore, Portland, Me., U. S. Matting roller. June 17, 1875.	
4,867.—E. B. Dodge, Peterboro, N. H., U. S. Spring bed. June 17, 1875.	
4,868.—G. H. Greenough, Brooklyn, N. Y., U. S. Producing artificial light. June 17, 1875.	
4,869.—A. Crabtree, Bacup, England. Middlings separator. June 17, 1875.	
4,870.—A. Bedford, Boston, Mass., U. S. Bell target. June 17, 1875.	
4,871.—J. P. Sharp, Birmingham, England. Steel process. June 17, 1875.	
4,872.—A. Cummings, New York city, U. S. Pouring lip for sheet metal measures. June 17, 1875.	
4,873.—R. S. Van Zandt, Williamsburgh, N. Y., U. S. Extension step ladder. June 17, 1875.	
4,874.—A. S. Walbridge, Mystic, P. Q. Horse hay rake. June 17, 1875.	
4,875.—G. M. Mowbray, North Adams, Mass., U. S. Frictional electric machine. June 17, 1875.	
4,876.—G. R. Prouse, Montreal, P. Q. Steam mangle. June 17, 1875.	
4,877.—A. L. Davis <i>et al.</i> , Port Crane, N. Y., U. S. Vehicle spring. June 18, 1875.	
4,878.—F. Van Patten <i>et al.</i> , Auburn, N. Y., U. S. Fifth wheel for carriage. June 18, 1875.	
4,879.—S. Duck, Victoria, British Columbia. Hub and bevel mortising machine. June 18, 1875.	
4,880.—F. Van Patten <i>et al.</i> , Auburn, N. Y., U. S. Fifth wheel for carriage. June 18, 1875.	
4,881.—F. H. Date, Niagara, Ont., <i>et al.</i> Combined gas retort. June 18, 1875.	
4,882.—E. A. Beers, De Kalb Center, Ill., U. S. Gang plow. June 18, 1875.	
4,883.—N. E. Smith, Richford, Vt., U. S. Milk cooler. June 18, 1875.	
4,884.—H. Ragot, Pittsburg, Pa., U. S. Glass furnace. June 18, 1875.	
4,885.—C. W. Hunt, West New Brighton, N. Y., U. S. Automatic railway. June 18, 1875.	

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We would take this opportunity to return our thanks to

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Construct a neat model, not over a foot in any di-

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together with a description of its operation and

merits. On receipt thereof, they will examine the

invention carefully, and advise you as to its patent-

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or the means at hand, to construct a model, make

as good a pen and ink sketch of the improvement

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prospect of a patent will be received, usually by

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search made at the Patent Office; such a measure

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