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THE BALLOON AND THE AERONAUTS.

We have already laid before our readers a detailed description of the great ship to be employed in the coming

JOHN WISE.

transatlantic voyage. We now present an illustration which will convey a general idea of the appearance of the main balloon accompanied in its flight by the two smaller attendants with which, at first, it was proposed to provide it. This idea has, however, recently been abandoned, and it is now intended, if any additional balloons at all are taken, to carry but one, and that only of some ten or twelve feet in diameter. This will be used as a pilot, that is, connected to a long rope and let fly upwards, in order to indicate the different currents above the main balloon, so that, if at a higher elevation it be found that a quicker speed can be gained or a more favorable direction assumed, ballast will be thrown out and the ascent at once made. The project of having three balloons was to utilize all in jointly supporting the car and boats until a considerable quantity of gas from the largest one had exuded. Then the smaller vessels were to be hauled down below the neck of the main balloon and connected with the latter by hose provided for the purpose, so that the gas would rise therein.

We add portraits of Messrs. Wise and Donaldson, the aeronauts, to whom the important enterprise is confided. Mr. Wise is a veteran balloonist of some thirty-five years' experience, and has probably made as many, if not more, ascents than any man living. He is a firm believer in the theory of an eastward current, and, in making the present voyage, carries out a desire which has been the cardinal object of his life. Mr. Wise is an able writer and the author of a work on aeronautics, which has gained for him considerable reputation. In conversation with us quite recently, he unfolded his various plans, giving us many details to which we shall hereafter allude; and he also mentioned the important part which aerial navigation might play in making geological, geographical, or archæological researches. As an instance of the latter, he stated that, in an ascent over Chillicothe, he was astonished to notice, on the fields before him, ridges which appeared to be fortifications, clearly marked, and which were entirely invisible to persons on the ground. Further and closer examination proved the elevations to be mounds made in queer shapes, some being built in bastions and others to represent the upper portion of a gigantic human body stretched out, proving that they were the work of prehistoric races. At another time, in passing over the Eastern States, Mr. Wise recognized a depression strongly resembling the crater of an extinct volcano. On mentioning the fact to local geologists, he found that the rocks in the neighborhood added their evidence to the fact, and that his observation proved a means of reconciling otherwise problematical appearances.

Mr. Washington H. Donaldson, the coadjutor of Mr. Wise, is the practical man of the enterprise, and to his ingenuity are due the many novel arrangements comprising the apparatus. He is comparatively young, and has been in the profession for about two years, during which period he has made forty-one ascents.

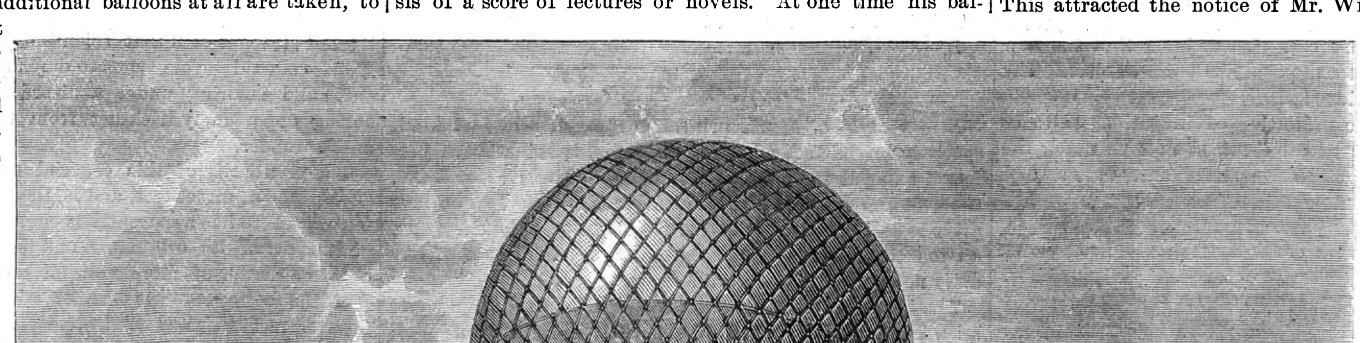
Mr. Donaldson is an intrepid and fearless aeronaut, and the hero of innumerable romantic aerial adventures. Recently, he tells us, he has been doing "trapeze business," because ordinary ascents of a balloon, with the operator standing in a basket, failed to afford a sufficiently startling sensation. Trapeze business is executing gymnastics of appalling description on a slender bar, suspended several feet below the bottom of a car, while the balloon is several thousand feet in the air. Mr. Donaldson has a fund of anecdote of his hairbreadth escapes, which might form the basis of a score of lectures or novels. At one time his balloon burst while he was 3,000 feet high, and down he came. Luckily the empty sack formed a parachute, so that his descent, although rapid, was sufficiently broken to land him in

WASHINGTON H. DONALDSON.

a tree with only a few bruises. Another exploit was to ascend and travel for ten miles in a paper balloon.

To Mr. Donaldson the organization of the present enterprise is mainly due. He started the idea, and communicated his views in correspondence to a daily journal in this city. This attracted the notice of Mr. Wise, and the two aeronauts joined forces. The unsuccessful effort to raise sufficient funds ($10,000) from the city of Boston is well known; but, nothing daunted, attempts were made to enlist other parties in favor of the scheme. Application was made to the New York *Herald*, but that journal declined and, finally, the *Graphic* took up the matter, but not until Mr. Donaldson had begun arrangements, which bade fair to be successful, with the town of Allentown, Pa. Mr. Donaldson is, in event of the balloon descending for want of sufficient gas to sustain all the party, to remain by her until the life boat and every available weight is removed. Then, with his ship thus lightened, he will attempt to complete the voyage alone. The ingenious devices for disconnecting the life boat, and how the separation of the party will be effected, will be explained and illustrated in our following number.

The Graphic company offer to forward letters by their balloon on this experimental trip, at a charge of $1 per half ounce above the regular postage. The proceeds are to be divided between the two aeronauts, who will attach to each letter a certificate stating how it was carried.



THE GREAT TRANSATLANTIC BALLOON

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NEW YORK, SATURDAY, SEPTEMBER 13, 1873.

Contents.

(Illustrated articles are marked with an asterisk.)

END OF THE VIENNA PATENT CONGRESS.

The labors of this body were brought to a close on the 5th ult., after debate on the resolution mentioned in our last issue. The recommendations given below were adopted by a vote of 74 to 6. It will be noticed that the resolutions cover little more than is contained in the existing patent laws of the European States. The conservative, narrow-minded policy appears to have predominated among the members, who were evidently unable to appreciate the wants of inventors, or give expression to liberal and progressive sentiments concerning the value of inventive labors. Some of the reasons given in support of the adopted resolutions are peculiar, if not erroneous. The last and best thing done by the Congress was to appoint a committee to choose members and convoke a second Congress. Let us hope that the new body will be more competent to deal with the subject. The following are the resolutions in full.

"RESOLUTION I.—The protection of inventions is to be guaranteed by the laws of all civilized nations under the condition of a complete publication of the same, because:

a. The sense of right of civilized nations demands the legal protection of intellectual work.

b. This protection affords the only practical and effective means of introducing new technical ideas, without loss of time and in a reliable manner, to the general knowledge of the public.

c. The protection of invention renders the labor of the inventor remunerative, and induces thereby competent men to devote time and means to the introduction and practical application of new and useful technical methods and improvements, or to attract capital from abroad, which, in the absence of patent protection, will find means of secure investment elsewhere.

d. By the obligatory complete publication of the patented invention, the great sacrifices in time and of money, which the technical application would otherwise impose upon the industry of all countries, will be considerably lessened.

e. By the protection of invention the secrecy of manufacture, which is one of the greatest enemies of industrial progress, will lose its chief support.

f. Great injury will be inflicted upon the countries which have no rational patent laws by the native inventive talent emigrating to more congenial countries, where their labor is legally protected.

g. Experience shows that the holder of a patent will himself make t e most effectual exertions for a speedy introduction of his invention.

RESOLUTION II.—An effective and useful patent must have the following principles:

a. The inventor or his legal heir only can obtain a patent. A patent cannot be refused to a foreigner.

b. In order to carry out the principle stated above (*a*), the introduction of the system of a preliminary examination is recommended.

c. A patent for an invention should be granted for fifteen years, or the option should be to extend it to that period.

d. The granting of a patent must be accompanied by a detailed and complete publication, which renders the practical application of the invention possible.

e. The cost for the granting of a patent should be moderate; but in the interest of the inventor, an increasing scale of fees should be fixed, so as to cancel a useless patent as soon as possible.

f. It should be easy to obtain, through a well organized patent office, the specifications of any patent, as well as to ascertain which patents are still in force.

g. Laws should be passed by means of which a patentee may be compelled, in cases of public interest, to allow the use of is invention for a suitable remuneration to all *bona fide* applicants.

For the rest, and especially with respect to the proceedings in the granting of patents, the Congress refers to the English, American, and Belgian patent laws, and to the proposition made by the union of German engineers for a patent law of the German empire.

RESOLUTION III.—In consideration of the great difference between the existing patent laws, and in consideration of the altered state of international communication, the necessity of reform becomes evident, and it is to be strongly recommended that the different governments should endeavor to arrange, as soon as possible, an international understanding on the patent laws.

The not executing of a patent in a country is no reason for its becoming void in that country, as long as the invention has been carried out once, and the possibility is there that the right of using the invention can be obtained by any inhabitant of this country."

Resolution I (f).—This, we suppose, is a hit at Holland and Switzerland, where there are no patent laws. The Hollanders will laugh at the idea of injury to their country by the departure of their inventors. There are almost none to depart. The object of a patent law is not to prevent emigration, but to bring forth an abundant supply of new and original improvements, the working of which shall promote industry and happiness among the people, thereby increasing the national wealth and strength.

Resolution II (b).—The best patent law is that which supplies the inhabitants of a country with the greatest number of new and useful discoveries. The less the costs to which the inventor is subjected in maintaining a patent, and the more simple the process of obtaining it, the more will he be encouraged to invent.

The system of preliminary examination here proposed is intended to be something like that now in vogue at our Patent Office at Washington, which is believed by many to be productive of more mischief than benefit. It consists in the maintenance, at the expense of the inventor, of an army of paid officials, whose prime duty it is to find objections to the grant of petitions to patents, and it compels applicants to support another corps of lawyers and agents to combat the points raised by the examiners.

The inventor himself is the best examiner. All the government needs to do is to supply him with copies of previously granted patents at a cheap rate. He can then decide for himself, without official assistance, whether or not he ought to apply for a patent.

(*e*)—The increasing scale of patent fees here recommended exists in nearly all European countries, and, instead of being advantageous to the inventor, works practically to his disadvantage. Take England, for example. The second patent fee is $250, the third, $500. We have in mind now the actual case of an inventor of a valuable improvement. He is a poor man. With great difficulty he was enabled to meet the second fee of $250 which made his patent valid for three and a half years longer. That term is now about to expire, and he is called upon for $500 more which he will be unable to pay; and for want of the money, will lose his patent just as he was in prospect of making an advantageous arrangement for introducing the invention in England.

The interest of the inventor demands that only one fee, and that a very small one, should be charged for a patent. The practical effect of this increasing scale of fees is to subject meritorious inventors to serious pecuniary losses.

(*g*)—Why should laws be passed to fix the prices of commodities that inventors sell any more than the goods sold by ordinary merchants or traders? The Congress fails to give us any reason for its recommendation of this outlandish proposition. Its practical effect would be the appointment of a board of officials, to be paid and supported by the inventor, charged with the duty of depriving him of all voice in the sale of his own inventions.

Resolution III.—In Austria and some other countries the inventor is required to put and maintain his invention in use within a specified period—a year, or two years—after the grant of the patent. Failing so to do, the patent becomes null. By this resolution a change is recommended, to the effect that it shall suffice if the inventor only once begins the manufacture, he not being required to continue the work.

This is the most novel and liberal suggestion contained in any of the resolutions.

HOE'S NEW PRINTING PRESS.

A new style of steam printing press, of the fast kind, specially intended for daily newspapers, has just been perfected and put in operation in London, by Messrs. Hoe & Co., the well known press makers of New York city. The new press is designed for the use of the London *Daily Telegraph*, a two cent paper, said to have the largest circulation of any daily newspaper in the world.

The improved machine, on a recent trial at Lloyd's paper mill, Bow, actually printed and delivered, in even piles, twenty-two thousand copies of Lloyd's *Weekly*,—a large sheet—in sixty minutes, with the attendance of two men and a boy. The sheets are delivered printed on both sides, and the number of newspaper impressions when the sheet is cut apart by the machine is forty-four thousand per hour. The machine is built on the rotary plan like the Bullock, Walter, and other presses, and is said to yield superior printing.

The cost of each press is $17,500. The *Telegraph* is to be supplied with ten of them, and thus have the means of printing 220,000 copies of the paper in sixty minutes.

THE BALLOON VOYAGE TO EUROPE.

It is now definitely announced that the *Graphic* balloon will start on its transatlantic voyage between September 1 and 10. We understand from Mr. Donaldson, one of the aeronauts, that the last mentioned day will in all probability be the day of departure. The principal part of the labor of construction of the great air ship is done, and nothing remains but the completion of a few details and the joining of three or four seams. The rainy weather during the past few weeks has retarded the work and prevented the rapid drying of the varnish, thus causing inevitable delay.

The entire apparatus, when finished, will be transported to the Capitoline grounds in Brooklyn, N. Y., and there a preliminary inflation with air will take place in order to test the gas-holding power of the fabric. The balloon will then be emptied, and, if the prognostications of the Weather Bureau prove favorable, will be inflated to its full capacity of 450,000 cubic feet of illuminating gas. The ascent will be made at about six o'clock in the evening, that time being chosen from the fact that the gas will be rapidly condensing, and hence a greater sustaining power can be gained than if the balloon were filled during the heat of the day, when its contents would be subject to increased expansion.

We notice that a petition, signed by several prominent members of the community, requesting that the public be admitted to witness the ascent of the balloon, has been sent to the managers of the *Graphic* company. In perusing this document, we are somewhat at a loss to determine which amuses the most, the verdancy of its signers in gravely beseeching the *Graphic* people to perform precisely what the latter could not possibly be induced to forego doing, or the delightful coquetry with which our enterprising contemporary dallies with the request through some three sticksful of double leaded editorial, after the fashion of "whispering she would ne'er consent, consented." Really, for any one to suppose that the originators of this very laudable scheme have, or ever had, the remotest intention of letting that balloon go without parading the circumstance with just as sonorous a flourish of trumpets and before as big a multitude as can possibly be assembled, indicates an ignorance of modern journalistic enterprise which is refreshing in its utter simplicity.

In a succeeding number, we shall publish some interesting details regarding the construction of the balloon, together with illustrations of ingenious and novel devices to be used during the voyage.

MODERN MIRACLES.

However much believers in the progress of reason and consequent decline of superstition may argue that the age of miracles has passed, and that such supernatural phenomena would be speedily stripped of their mystery by the scientific rationalism of the day, it is nevertheless an undeniable fact that a tangible confutation of their views now exists, and that a so-called miracle has taken a firm hold, not merely upon the masses, but has carried conviction to many learned and distinguished savants and men of eminence in a nation, one of the foremost in the ranks of modern civilization.

Since the Franco-Prussian war, a religious revival of unprecedented fervor has taken place in France, and a series of remarkable pilgrimages are now being made to the locality where the above referred-to miracle took place. This celestial manifestation is based on so frail a foundation that it adds further proof to the well known saying that a people desirous of believing will always find foundation on which to ground their belief. The story goes that Bernadette Soubirons, a weak and sickly peasant child residing with her parents at Lourdes, France, while gathering wood with her companions, reached a grotto, near the town, in which was a shrine to the Virgin. Kneeling to repeat her prayers, the girl felt an "invisible" wind, saw a glorious radiance, and beheld a woman, who, her instinct told her, was the Virgin, standing on the rock. Returning home she told her vision and described the garments of her celestial visitor, even to a string of white beads on her head. On again repairing to the grotto, Bernadette received other visitations; finally the story spread, a sign was asked for, and a spring of water, to which wonderful healing powers are ascribed, gushed from the rock.

If there be any miracle in the circumstance, it seems to us to lie in the fact that people, not by tens and twenties but by hundreds of thousands, constantly attest their belief in it; and stranger still that scientific journals as able as *Les Mondes* should devote pages to defending its authenticity. A sick child laboring under a disordered constitution, and a spring opportunely trickling from the stone, sum up the entire wonder.

The peculiarity of this especial mystery is that it is not susceptible of direct test, and is, therefore, a mere matter of faith. There has apparently been no attempt at deception on the part of its originator, and hence the credence placed in it is a matter of mere volition on the part of believers.

If the editor of *Les Mondes* will visit any negro camp meeting in the United States, he will remark innumerable repetitions of fits of religious ecstacy, such as that of Bernadette. He will find both young and old of both sexes shouting, singing, and launching off into descriptions of golden cities and celestial inhabitants, which they sincerely believe they see, which will throw the peasant girl story far into the shade.

THEORIES OF THE SUN SPOTS.

The question of the solar constitution, and more especially that of the nature and cause of sun spots, has ever since the first discovery of the latter phenomena, by Galileo, Fabricius and Scheiner, been a constant subject of difference between students of astronomical physics. Totally opposite theories have been enunciated, and have found able and learned supporters, only, however, to be abandoned for new views formed by the light of more recent investigation; and thus up to the present time, no solution of the problem, to the entire satisfaction of the scientific world, has as yet been adduced.

In here referring to the subject we allude briefly to the principal ideas held by some eminent astronomers and physicists, but more especially we lay before the reader the two theories which are now attracting considerable attention through the extended public discussion by their learned originators. Early observers (Galileo and afterwards Hevelius) attributed the spots to dark *scoriæ* floating on solar seas. In 1769, Dr. Wilson determined them to be cavities or depressions below the sun's surface, a view confirmed by the researches of Sir William Herschel. The latter astronomer's theory suggested the enclosure of the sun by two strata of clouds, the outer one self-luminous and the other opaque, though partially illuminated by the outer layer. When a opening was formed through both strata, the dark body of the sun appeared surrounded by a penumbra, due to the less luminous under layer. Kirchoff advanced the idea that the spots were clouds, floating in the sun's atmosphere and obscuring portions of the glowing surface. Subsequently a protracted controversy arose between the French and English astronomers, the former maintaining that the absence of light was due to a defective radiation of a gas in the sun, the latter to absorption. De la Rue, Stewart and Loewy held the last mentioned view; and in 1866, their ideas were in substance confirmed by the spectroscope observations of Lockyer and subsequently of Huggins. The spots were proved to be owing to general absorption, to "something over the bright portions of the sun that eats away the light." Proctor has suggested volcanic action, intensified by the proximity of some planet as a cause; and in a paper read before the Astronomical Society, he considers that the closeness of the moon to the earth stimulates terrestrial volcanoes to renewed activity, and adds that in 1860 the belts of Jupiter were strongly disturbed during changes in the solar envelope.

The opposing theories, the discussion of which is now filling the columns of European scientific periodicals, are respectively those of Faye and Father Secchi. The latter has by far the strongest support, and appears to be sustained in his views by Lockyer, Huggins, Young, Zöllner, Spoerer, and Tacchini, besides many others of eminence. M. Faye's theories are briefly as follows: He supposes a nebulous or chaotic fluid mass, formed of gas and mixed vapors, raised to a very high temperature, animated with a movement of rotation and cooling by way of superficial radiation into space. Through the condensation of vapors of the external layer, the photosphere is formed and the chromosphere separated, the latter being composed of hydrogen, relatively cold but at a temperature superior to the point of dissociation of nearly all its compounds. By the peculiar mode of superficial rotation, the angular velocity of which decreases rapidly from equator to poles, the interior movements are reduced to simple ascending and descending vertical currents. These, by their play, maintain the photosphere at all points of the surface. The variation of velocity of rotation of these streams gives rise to their eddying movements, so that whirling phenomena or cyclones are produced. Viewed from above, from a point at some distance from the earth, ordinary waterspouts would scarcely appear except as simple points; but terrestrial cyclones, the diameter of which is sometimes hundreds of miles, would have the effect of circular cloudy spots in the form of funnels, variously lit by the sun and roving slowly over the earth. Evidently the special rotation observed in the sun would produce similar phenomena, giving rise to the appearance of pores and spots. An analogy is traced between solar and earthly storms, the latter of which are not formed in the polar or temperate regions, but in the torrid zone. The only difference lies in the fact that the solar cyclones remain in the regions where they are generated, between parallels 40° north and south, and have hardly any movement of translation but those of currents parallel to the equator. Under the action of these storms, M. Faye adds, there is a circulation of the exterior hydrogen which penetrates into the superficial red layers, to return immediately to the surface.

Father Secchi states that, in the interior of the spots, a peculiar spectrum is met with, disturbing the harmony of ordinary intensities and presenting enlarged and dilating lines in the position of those of the metals sodium, iron, magnesium, and calcium. In brief, he considers that the spots produced by eruptions abound in metallic substances, and especially in those just mentioned. The dark masses may accumulate at the orifice of the eruption and there unite in a single mass, condensed under the influences of currents from various neighboring orifices. The size, the duration, and the intensity of the spot depend on the quantity of eruptive matter; and an agglomerated mass may continue a long time after termination of the eruption, being fed by a slow successive eruption of the same substances. The mass sinks by gravity into the photosphere, cutting off a portion of the light of the sun, and appears black, although, according to Zöllner, the dark *umbra* emits four thousand times as much light as that derived from a equal area of the moon. Both Faye and Secchi agree in the view that the sun is mainly gaseous, as it is only by such a hypothesis that the smallness of its density can be explained.

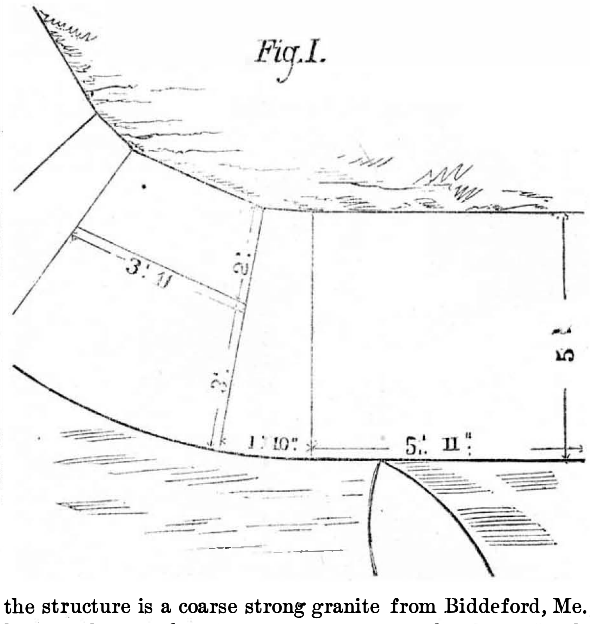
Professor Young, since the opening of the present session of the American Association at Portland, has presented some new suggestions on this subject, in which he considers that the phenomena of eruption indicate the existence of a crust which restrains the gases and through which they break their way. This crust may consist of a more or less continuous sheet of rain, formed of the materials shown, by the spectroscope, to exist in the solar atmosphere. As this tremendous rain descends, the velocity of the falling drops is retarded by the resistance of the denser gases underneath; and these drops coalesce until a continuous sheet is formed; the sheets uniting form a sort of bottomless ocean, resting upon the compressed vapors beneath and pierced by innumerable ascending jets and bubbles. In other words, the sun, according to this view, is a gigantic bubble, the walls of which are constantly thickening, while its diameter is decreasing at a rate determined by its loss of heat. Unlike other bubbles, however, its skin is continually penetrated by blasts from within.

We may add that the eruptive theory is that now generally accepted by the majority of eminent astronomers. As Professor Young says, however, "we do know what sun spots are: we do know what they are not;" so that, as is the case with all theoretical speculation, even this widely received view may be sooner or later abandoned, when, in the progress of science, other revelations are made.

J. H. H. writes to say that stramonium, known also as Jamestown (corrupted into jimson) weed, is an effective remedy for snake bites, and will cure them even some days after they are inflicted. The weed should be applied in the form of a poultice. In the absence of any other remedy, cauterizing the part with a live coal is good, especially for horses and cattle.

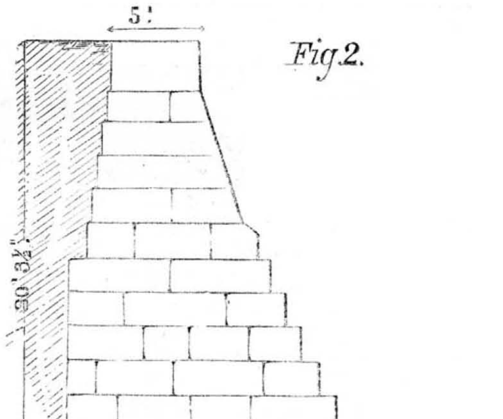
ACCIDENT TO THE NEW DOCKS.

The City of Limerick, one of the smaller steamers of the Inman line, through faulty navigation, recently rammed the bulkhead of pier No. 1, North River, with her bow, striking the stone near the angle and in the direction indicated by the prow in Fig. 1. The rate of speed of the ship at the time, we are informed, was fully four knots per hour. The material of



the structure is a coarse strong granite from Biddeford, Me., hewn in heavy blocks of various sizes. The effect of the blow was to wedge the stones apart. Little crushing was done, though an angular fragment from one block was split or torn cleanly off. The stones were shoved helterskelter in every direction, so that the damage consists in the displacement of the masonry not only at the point of contact but for a distance of 75 feet one way and 25 feet the other. The entire adjacent portion of the bulkhead, therefore, including the boat landing, will have to be rebuilt at an expense, it is estimated, of about $25,000.

The failure of the structure to withstand the blow is due, manifestly, to its insufficient backing. The uninjured masonry seems to be well set together with Portland cement, and, as shown in cross section in Fig. 2, is 4 feet 3 inches through at the top, 19 feet 6 inches at the bottom, and rests



on a bed of concrete and riprap. The hight is 30 feet 3½ inches. Behind this wall, however, is merely earth thrown in and not packed or rammed down,—a precaution, in fact, not as yet taken, because no craft larger than a ship's launch was expected to come near the work. The consequence was that the loose soil yielded, while the ship escaped with no other injury than some scratches and a lump of granite imbedded in her bow.

The impetus of a vessel such as the City of Limerick, displacing in the neighborhood of 4,000 tons, and moving at the rate of three knots per hour, or five feet per second, is stated to be nearly 3,000,000 foot pounds. This tremendous force concentrated in the stem of the vessel—a solid mass backed by the heavy iron skin and only some six inches in width—necessarily would produce no small effect on almost any masonry, however strong. It is well known that a large vessel can strike head on with hardly any injury to herself; and on this fact the use of rams in naval operations is based. In the present instance there is little doubt but that, had the wall been stronger, although it would have been badly damaged, the ship would have suffered the most. In such case the force would have been expended in crushing stem and stone, neither yielding instantly to the impact. As it was, the blocks of granite gave way, and the comparatively small amount of splintering which they suffered shows that they were easily driven backwards into the loose earth. Considering the degree of injury, it seems to us that the crushing and ruining of a number of stones in a solidly backed wall would have been less expensive to repair than the dislodging, which necessitates the replacement of about a hundred feet of finished wall.

The accident, we think, has demonstrated the necessity of a solid brickwork or other equally strong re-inforcement to the masonry; particularly, as it appears quite probable, judging from the extent and circumstances of the present damage as far as known, that even a tug striking the pier at ordinary speed might have inflicted a serious though less injury.

On the same pier at which the above described accident took place, we noticed, out of range of the effects of the shock, stones displaced and open cracks between them; while parts of the concrete flooring have broken joints and sunk below the level. The difficulty was explained by the fact that the stone had settled on its riprap foundation.

HAY FEVER.

At this season of the year, there are many suffering from this tormenting trouble; and to them it would no doubt be a gratification to learn of a sure cure. But unfortunately there is none yet known, except that which, to the majority of sufferers, is impossible from want of time or means, namely, a temporary change of residence. There are, however, palliative remedies which often bring great relief. One of the best is a tea made of poppy heads.

The poppy is so generally cultivated as a garden plant that it is quite easily obtained; if not in our own, it may be in our neighbor's garden. The tea should be made to boil in an ordinary tea kettle, and the steam, issuing from the nozzle, breathed deep into the lungs; and this should be continued until relief is obtained. If the poppy heads cannot be had, half a teaspoonful of laudanum may be added to a pint of water, and the steam from this mixture inhaled. At the same time attention should be given to the general health; only digestive and nutritive food should be eaten, because an attack is much aggravated by overloaded stomach or bowels.

In conclusion, let us add, for the benefit of those who are subject to yearly attacks, that much good is done by preparing the lungs for the coming hay season. If a teaspoonful of alum be dissolved in a pint of water, and the spray from this mixture be breathed into the lungs for several minutes every day for a month before the expected onset, it will brace up the lungs and make them less susceptible to the irritation of hay dust.

S. H. C., M. D.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW ANILINE BROWN.

A new dye, called cannelle, produces upon silk, wool, and cotton a lively brown color, and, by admixture with blue, red, or yellow aniline dyes, is capable of assuming every possible shade and variation of brown. For silks and woolens, no mordant is required; but, like all other aniline colors, it refuses to attach itself to cotton without a mordant. Silk is dyed in a lukewarm bath to which is added a sufficient quantity of the dye, which has first been dissolved in hot water, and, when cold, filtered through flannel. The dye bath is made slightly acid by the addition of tartaric acid. Wool is dyed in a boiling solution of the dye, to which is added half a pound of Glauber salt and 2 ounces sulphuric acid to 10 lbs. of wool. Cotton is mordanted with tannin by placing in a solution of 3 lbs. sumach or ¼ lb. good tannin to 10 lbs. of cotton. After being mordanted, the goods are unrolled and put in a cold bath of pure cannelle.

Cannelle is prepared from one of the products used in making fuchsin, and is essentially the double acid salt of chrysotoluidine. This latter base is formed from toluidine by the removal of hydrogen, just as the base of fuchsin is prepared from a mixture of aniline and toluidine, and its composition is represented by the formula $C_{21}H_{21}N_3$. Its formation from toluidine is thus represented: 3 C_7H_9N (toluidine)— 6 H = $(C_7H_7)_3 N_3$ (chrysotoluidine).

This dye is also very similar to fuchsin in its nature. The free base is insoluble in water, and therefore may be thrown down as a bright yellow precipitate by the addition of an alkali to an aqueous solution of its salts. Chrysotoluidine is very soluble in alcohol, and can be used in this form for dyeing, while rosaniline and its derivatives are colorless, except as neutral salts. The neutral salts of chrysotoluidine dissolve with difficulty even in boiling water, and are decomposed thereby into insoluble basic salts and soluble acid salts. The solutions of the soluble acid salts have a pale yellow color with a brownish tinge, while free chrysotoluidine gives pure yellow shades. The same pure colors are obtained by dyeing with the acid salts, provided some alkali is added to the dye bath. Cannelle is at present manufactured, so far as we know, only in Stuttgart, Germany.

MUSCULAR FORCE OF INSECTS.

M. l'Abbé Plessis, in an article in *Les Mondes* on the above subject, says that, by way of experiment, he placed a large horned beetle, weighing some fifty grains, on a smooth plank; and then in a light box, adjusted on the carapace of the insect, added weights up to 2·2 pounds. In spite of the comparatively enormous burden, being 315 times its own weight, the beetle managed to lift it and move it along. A man of ordinary muscular power is fully a hundred times feebler in proportion; and had an elephant such comparative strength, it could run away with the Obelisk of Luxor, a load of 5,060,000 pounds. Similarly, the flea, scarcely ·03 of an inch in hight, manages to leap without difficulty over a barrier fully 500 times its own altitude. For a man six feet is an unusually high leap; imagine his jumping 3,000 feet in the air, over three fifths of a mile!

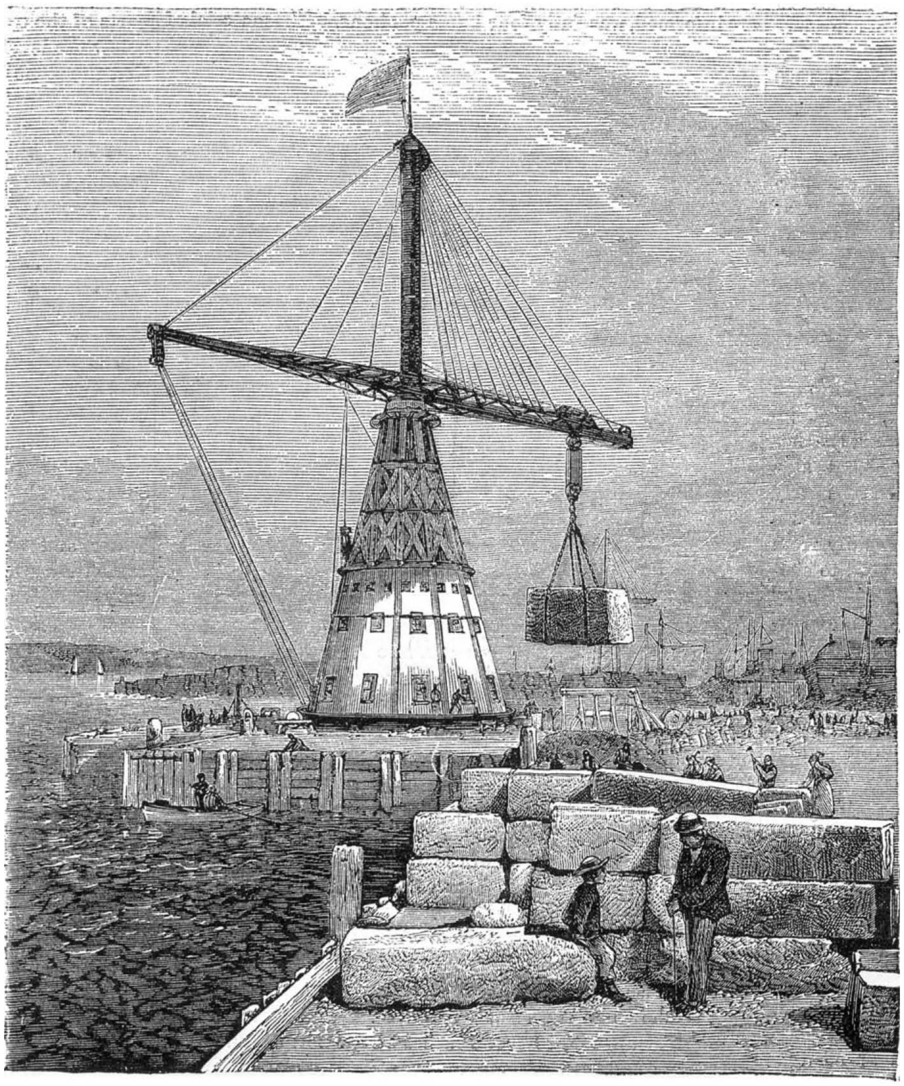
NEW PROCESS OF PRINTING WITH INDIGO.

M. Lalande reduces indigo by means of hydrosulphite of sodium; and to the white indigo thus obtained, he adds an excess of the salt, to produce a suitable consistence. With this preparation, he prints fabrics, and afterwards exposes them to the air. The excess of hydrosulphite causes the rapid oxidation of the indigo.

THE LARGE FLOATING DERRICK.

In constructing the solid walls of the new water fronts of New York city, already described and illustrated in our pages, a derrick, capable of lifting a block of *béton* weighing 100 tuns, is used by the workmen. This powerful machine has been described and commented upon by many foreign journals, *Engineering* having given its readers full descriptions and illustrations. This form of derrick was designed and patented by Mr. Bishop, many years ago, and was used in the building of High Bridge aqueduct; some valuable details, however, have been added by Mr. G. H. Reynolds, of the Delamater Iron Works, where the specimen under consideration, of which Fig. 1 is a perspective view, was built.

The float is of rectangular form, one side being 65 feet, the other 70 feet; its depth is 13 feet. It is built chiefly of Georgia or hard pine timber, put together in a very substantial manner. In order to prevent any twisting or change of form, the float is stiffened by sixteen trusses, made similar to the well known Howe truss. The tower, which carries the ring post and booms, is made of twelve pieces of selected Georgia pine, 14 by 14 inches at the lower ends, 63 feet 3 inches in length, and 12 by 12 inches at the upper end; these legs are stiffened by struts and braces. The lower ends of these legs are fastened into a heavy cast iron circle. At their upper extremities, these legs are brought close together and are held by a casting of circular form, to which they are bolted. This casting is made with a recess which is filled with spherical rollers; these rest against a casting fitted to the ring post, so that its lateral pressure, where it passes into the tower, causes but little friction.



THE NEW YORK FLOATING DERRICK. Fig. 1.

The front or hoisting boom of the derrick consists of two plate iron box girders 22 inches deep by 9¾ inches wide; the upper and lower members of these girders are of channel iron three quarter inch thick; the side plates, which are riveted to them, are three eighths inch in thickness. All the rivet holes are drilled. These girders are spaced 24 inches asunder, and are held in position at the ring post ends by being inserted in deep sockets formed in a heavy casting which encircles the post. The boom is supported by eighteen diagonal rods two inches and a half in diameter, made of iron warranted to stand 75,000 lbs. per square inch tensile strain; these rods converge near the top of the ring post and are secured to it. (See Fig. 2.)

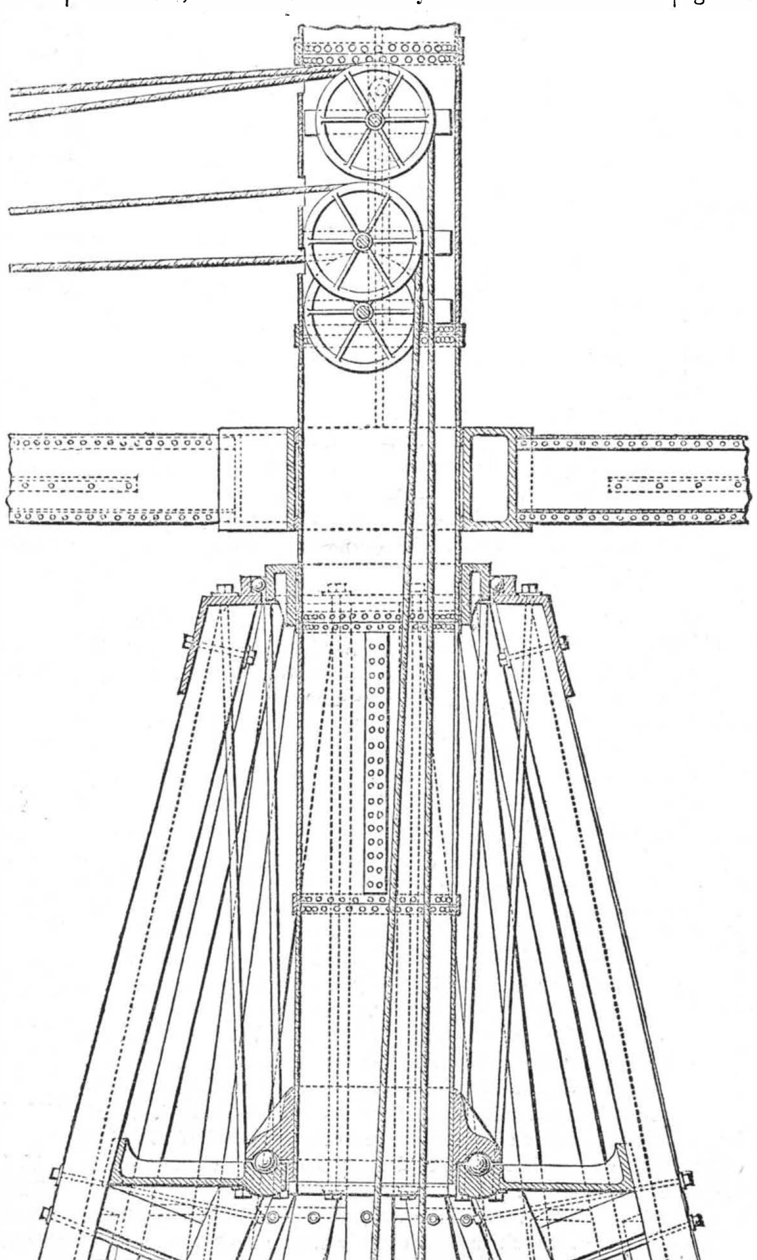


Fig. 2.

All the machinery is placed on the float within the tower, and the levers which control the various movements mentioned are brought conveniently together on a stage 35 feet above the deck.

The following are the chief dimensions of this structure:

	feet.	in.
Length of float	71	
Breadth of float	66	
Depth of float	13	
Length of hoisting boom	60	3
Length of back boom	50	3½
Length from end to end of boom	110	6½
Hight of tower	62	3
Hight of ring post above tower	49	8
Total length of ring post	62	
Hight from bottom of float to top of ring post	127	3

The derrick, says *Engineering*, has been skillfully planned; it has many novelties and mechanical refinements to which are due the marked success with which it works under very heavy loads. We may mention, for instance, the ingenious arrangement of the wire rope guys of the back boom, equally distributing, as they do, the heavy strain over a large sector of the traversing circle.

Working in Hot Atmospheres.

In relation to the subject of how high a temperature men can endure and work in, a writer in the *British Journal of Science* notes the following interesting cases: During the re-heating of furnaces in an iron works in England, the men worked when the thermometer, placed so as not to be influenced by the radiation of heat from the open doors marked 120°. In the Bessemer pits, 140° was reached, and yet the men continued a kind of labor requiring great muscular effort. In some of the operations of glass making, the ordinary summer working temperature is considerably over 100°; and the radiant heat to which the workmen are subjected far exceeds 212°. In a Turkish bath, the shampooers continue four or five hours at a time in a moist atmosphere at temperatures ranging from 105° to 110°. A case is mentioned of a person in the same establishment working for half an hour in a heat of 185°. In enamel factories, men work daily in a heat of over 300°. On the Red Sea steamers, the temperature of the stoke hole is 145°, and some men will labor there for half an hour without a drop of perspiration, while others are carried out fainting.

These examples of continuous work at 110, 120, 140 and 145 degrees correspond to depths in mines of 3,650, 4,250, 5,450 and 5,750 feet. The author thinks, therefore, that the limit of 4,000 feet, fixed by the English commissioners as the extreme workable depths of mines, is too small, and he considers 8,000 feet a safe boundary.

Reward Offered for Self-Acting Railway Couplings.

The confederation of the administration of German railways has determined to award prizes—one of 3,000 thalers ($2,250) another of 1,000 thalers ($750)—for the invention of a contrivance by means of which the coupling of railway carriages can be effected without the necessity of any one stepping between the carriages. The inventions submitted for competition must have been tried practically by one of the railways belonging to the confederation previous to the sending in of the papers, and the proposition for the award of the prize must emanate and be supported by one of the said railways. The premium does not debar the inventor from patenting the invention and enjoying the benefit of the patent. The papers must so explain the invention by illustrations, drawings, models, etc., that an opinion can be easily formed of its quality, practicability and working; and must be sent in, carriage paid, to the head office of the confederation, Berlin, Prussia, before the 1st of July, 1874. The examination of the competing plans as well as the decision, whether general or in the form of an award of prizes, will be undertaken and decided by an examining committee, consisting of twelve members, appointed by the confederation.

Cinder Fuel.

M. Chary has recently made experiments with the view of utilizing cinders which have dropped through the grate. He suggests passing condensed air over red hot cinders, whereby carbonic oxide is formed, which gives a flame of several feet in length, well adapted for boiler heating. The greatest difficulty lay in the ultimate removal of the refuse cinder. From his short experience in this direction, he calculates that 2 lbs. of cinders, sorted by hand, give a heating effect equal to that obtained by 1 lb. of coal. It has been argued that the mode of separation was of the greatest practical importance. The wet process was not to be recommended, on account of the extensive drying grounds required, and the fact that after all the pieces had to be used in a damp state. A current of air has been suggested as an agent for separating, or, as it were, winnowing the bits. Another authority on the subject states that the amount of incombustible matter in the cinder amounts to 10·5 per cent by volume, or 26·7 per cent by weight.

Cutaneous Exudation of the Water Newt.

E. A. Ormerod gives the following observations in the *Journal of the Linnean Society*: The common *Triton cristatus* of our ponds and ditches appears, in its natural state and when undisturbed, to be scentless, but when alarmed or irritated it emits an odor strongly resembling that of bruised poppy heads, which is clearly perceptible in the open air. If the animal be exposed to the vapor of chloroform a viscid fluid exudes from the pores of the skin, collecting over the wet surface after death in a kind of slime which, when touched by an abraded portion of the hand, causes momentarily acute pain; this acrid fluid can be made to exude from the tuberculated parts of the skin by gentle pressure with the finger. This fluid, moreover, has an acrid taste, produces a feeling of numbness in the tongue, and causes a sensible degree of inflammation in the mucous membrane of the lips and mouth, which lasts for some hours and is accompanied by a sense of dizziness and stupor. An analysis of the slime showed it to be similar in composition to serum as regards its chief constituents; the exact nature of the acrid principle was not ascertained, but it appears to have no alkaloid character and to be highly volatile, corresponding in these particulars with the exudation from the skin of the common toad described by Dr. John Davy. The effect of the exudation when discharged direct from the skin of the triton upon the subject of experiment seems usually to be far more powerful than when applied artificially, and fully to justify the popular prejudice against these creatures. On the tritons themselves the effect appeared to be painful and stupefying. On a healthy cat there was copious discharge of saliva and foam, and violent and audible action of the jaws. When placed on a human tongue the first effect was a bitter astringent feeling in the mouth, with irritation of the upper part of the throat, numbness about the teeth in contact with the fluid, and a strong flow of clear saliva, followed by foaming and violent action of the muscles of the mouth; these symptoms were followed by headache, general discomfort, and, in half an hour, slight rigor.

THE MAGIC LANTERN AS A MEANS OF DEMONSTRATION.

BY HENRY MORTON, PH.D.

Any expert in the general use of the magic lantern, or, as we say now-a days, in "methods of projection," who attended Professor Tyndall's lectures last winter must have been struck by several things; in the first place, by the admirable management and efficiency of the electric light. This was largely due to the form of the galvanic battery employed, not to neglect, of course, the Foucault regulators and the still more important control of Mr. Cottrell and the Professor. This battery is made by Mr. Ladd, of London, and is remarkable in the first place for its compactness, which not only adapts it for transportation but greatly facilitates its handling when it is to be set up and dismounted. It involves nothing new in principle, being made up of the simple Grove elements of zinc and platinum; but to secure compactness, the cells are of a rectangular and flat shape, by which, not only are they made to pack well but, the elements being brought near each other, the internal resistance is reduced, and the efficiency thus increased. Forty of these cells will produce an excellent electric light, and Professor Tyndall never used more than fifty in one circuit. He sometimes had one hundred in use, but then one set of fifty produced one light (as, for example, in some of the dark heat experiments), while another set illuminated the galvanometer.

In justice to our readers, we must not neglect a warning. If they purchase any of these cells from Mr. Ladd, we would advise them to employ some one else to pack them. Many hundreds have been imported already, and have invariably been so packed as to secure the destruction of a large part. Out of sixty, the present writer received but forty sound ones, and the experience of Professor Wright, at Yale, and Professor Farrar, at Vassar, is identical. The method of packing is, in fact, such as to suggest the idea that the destruction of the articles was intended, the only other solution we can suggest being mental aberration on the part of the packer.

The second notable point in connection with Professor Tyndall's projections was the great beauty of those involving the use of small pencils of parallel rays, such as the production of Lissajous' figures with tuning forks, some experiments in diffraction, and the like.

Lastly, came a surprise that, with such unusual success in these difficult directions, those projections, which resembled in character the ordinary work of a magic lantern when throwing a picture, were decidedly inferior to what is generally accomplished with a lime light. The reason of all this will be at once clear, if we understand something about the action of a magic lantern, which does not seem as yet to have found its way into published accounts of that instrument.

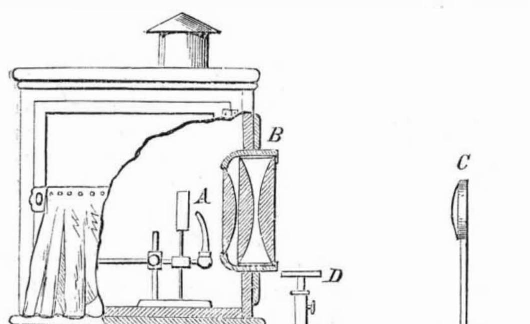


FIG. 1.

A magic lantern consists essentially of a box to inclose the source of light, say a lime light, as at A, a series of lenses called the condenser, whose office is first to collect the scattering rays, from A, that fall upon it and bring them into a common direction, and, secondly, to so converge or condense them as to make them all enter the object glass or objective, C.

In order that each of these conditions should be fulfilled in turn, it is evident that it would be desirable, in the first place, that some part of the condenser, B, say the first two lenses, should throw out, in parallel lines towards C, all the rays which fall on them from A. If the light all came from a single point, and the lenses were theoretically perfect, it would only be necessary to bring that point to a certain place, called the principal focus of the lens or lenses, to secure this object. For a single lens this point is found as follows: If the lens be plane on one side, the principal focus is at the extremity of a diameter of the curved surface drawn through the center of the lens. Thus, in Fig. 2, A B being a lens of ordinary glass, D would be its principal focus. If both surfaces are curved, we find the distance of the principal focus from the optical center of the lens by dividing twice the product of the radii of the curves by the sum of these radii minus the thickness of the lens. We give these simple examples merely as illustrations, and would refer our readers for full and exact statements to such works as Brewster's "Optics," Monkhoven's "Photographic Optics," Daguin's "*Traité de Physique*," Young's "Natural Philosophy," and other similar books.

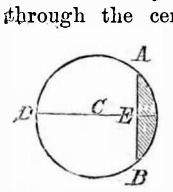


FIG. 2.

This all assumes a theoretical perfection or uniformity in the action of the various parts of the lens. In fact, however, the necessities of workmanship compel the use of spherical curves in lenses; and these occasion a greater relative action on the rays passing through the edges than on those traversing the center of the lens. As a result of this, it follows that, if the source of light were placed at the true focus for the central rays, those which passed from it through the margin of the lens would not only be bent enough to bring them parallel, but would also be converged so as to cross at some distant point, and thence proceed in a continually expanding circle of diffusion. Omitting the detailed discussion of this action, we may say that, as the result of calculation and experiment, with a certain combination (to be presently described) in which the difference of the central and marginal foci is about 0·1 of an inch, this circle of diffusion would be about 1 foot in diameter at the distance of 25 feet. Such, then, would be the error due to the spherical aberration of the lens alone, if the light came from a single point. In practice, however, the light comes from a surface of considerable magnitude which, in the lime light, for example, is not generally less than half an inch in diameter. Now we have already seen that a luminous point, located at E, Fig. 3, in the center line or axis of the lens, would produce a parallel beam, B H, A I, whose direction would be the same as that of the axis, or C F. But a further considera-

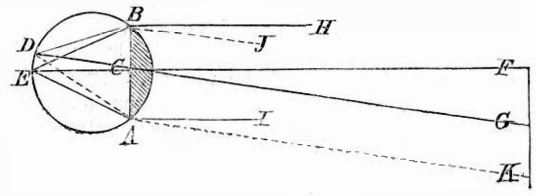


FIG. 3.

tion of the general action of lenses teaches us that any luminous point, D, not in the axis of the lens, would produce a beam whose direction would coincide with that of the secondary axis (such as D C G), drawn from the said point through the optical center of the lens. Now, from the similar triangles, D E C and C F G, we see that EC : CF :: DE : FG; or, considering E C the focus of the lens or combination, to be 3 inches, C F, the distance to a screen, to be 25 feet, and D E, the radius of the luminous surface, to be $\frac{1}{4}$ inch, we have 3 inches, or $\frac{1}{4}$ foot : 25 feet or $\frac{100}{4}$ feet :: $\frac{1}{4}$ inch : $\frac{100}{4}$ inches, or 25 inches = FG. Now, it is evident that, to this, we must add the distance, G K, which is half the diameter of the lens. Let this be 2·5 inches, 5 inches being the usual diameter of condensers, then FK = $27\frac{1}{2}$ inches. But F K, evidently, represents only the radius of the circle of light on the screen, and its diameter, or 2FK = 55 inches = 4 feet 7 inches.

It thus appears that, with this form of condenser, the scattering of light due to the magnitude of the luminous source is more than four times as great as that caused by the aberration of the lenses, and that a lens with very much greater spherical error would work as well, practically, with such a source of light as an absolutely correct one, since the scattering produced by the magnitude of the source of light would outreach any which the lens would occasion.

This teaches us the value of such a source as the electric light, in all experiments where a parallel beam is needed, and the uselessness of any special correction of error in lenses to be used with a source of light of larger size. It may, however, naturally be asked if corrected condensers (corrected for spherical aberration) would not be of great value with an electric light. In certain cases they undoubtedly would, but in all the experiments to which allusion has been made so far, as requiring parallel rays, very small pencils of light only are used; and these being obtained by covering the condenser by a plate of brass pierced with a small hole (called technically a diaphragm or stop), the error of the lens, as affecting the small transmitted pencil, is reduced to that of a lens equal in size to the opening. This renders it quite insignificant. In fact the apparatus for projection used by Professor Tyndall, which was simply that made by Duboscq, of Paris, for the last fifty years, and a complete set of which was purchased by the Stevens Institute of Technology (in the Bancker collection) and may be seen in their optical cabinet, consists of the simplest possible combination of lenses, with no attempt at correction in this relation. Indeed, the spherical error in this apparatus is so great that, when the entire lens is used, it becomes, in its turn, a more serious element than the magnitude of the source of light.

Though what we have so far stated is far from covering the entire ground, or alluding to all the points involved, it will suffice to show, in some measure, what are the real advantages of the electric light, to what class of experiments it is essential, and in what direction it is worth while to work in improving the instrument which we are considering.

Were the electric light as convenient, economical, and regular in its action as the lime light, our methods of projection would be largely modified, for we would then adapt every thing to its essential conditions: but, notwithstanding all the improvements in batteries and regulators which have been recently made, the electric light is a costly, troublesome, and irregular source of illumination for such purposes as we are considering; and it should therefore be confined to those experiments only in which its defects are least apparent, and for which it possesses some special advantage. In all others the lime or oxyhydrogen light is greatly to be preferred, and for this our instruments should, as a rule, be adapted. It is in this light we shall consider the subject.

THE SOURCE OF LIGHT.

This we know is a piece of lime intensely heated by a jet of burning hydrogen mingled or supplied with oxygen. In place of hydrogen, it is very common to use the ordinary illuminating gas or mixture of light and heavy carbureted hydrogen. As regards the production of light, we do not think that there is any choice between hydrogen and illuminating gas, but would be guided in all cases simply by the question of convenience. The jet from which the gases are burned is a matter of some importance.

THE JET.

The simplest form to which this can be reduced we believe to be the best. This is what has been described as the diaphragm jet, and consists of a tube of copper, straight or slightly tapered, decidedly larger than the outlet in its end by which the gases escape. This outlet should be simply a smooth hole in a diaphragm or wall, and is easily made by hammering in the end of a soft copper tube and then boring a hole through it (Fig. 4). Into the lower part of this tube the two gases should enter freely, by different openings, as shown in Fig. 4, and no wire gauze or other so-called protection should be admitted above this point. Such a jet gives the most light with the least gas, and is less likely to retreat or snap than any other. Having used this for years I have almost forgotten what snapping is. The concentric jet, in which the gases mix only as they burn, is very inferior in economy to this, and on the other hand all mixing chambers and the like are simply useless.

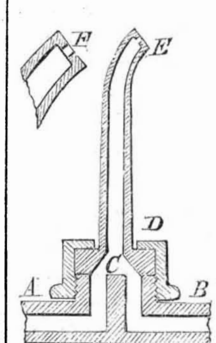


FIG. 4.

THE CONDENSER.

As we have already remarked, this portion of the apparatus may be theoretically divided into two parts, one collecting the rays and rendering them parallel, the other concentrating or condensing them so that they shall enter the object glass. This division is, however, not only convenient for the theoretical discussion of the subject, but, as we shall see, is of great convenience if practically realized.

A very excellent combination was developed and used many years since by Dr. Charles Cresson, of Philadelphia. Its collecting portion consisted of three lenses (see the engraving, Fig. 5), of which the first was a plano-convex, the second a meniscus, and the third a bi-convex lens. The surfaces of these were as follows: 1st, plane; 2d, 4·5 inches radius; 3d, 30 inches radius; 4th, 6 inches radius; 5th, 52 inches radius; 6th, 8·75 inches radius. The first lens is 4 inches, and the others are 4·5 inches in diameter. To complete this combination a lens of 12 or 15 inches focus was added at G H, according to the work to be done. The error of this combination is very small; in fact, the three first lenses do not show a difference in focus, for rays near the center and near the margin, of more than one tenth of an inch. It will be seen, from what has been already stated, that the correction of this combination has been carried far beyond what is available with a source of light half an inch in diameter. But where, as in a class room, a small jet and, consequently, a small ignited surface of lime can be used, and well concentrated or parallel rays are required, as in experiments in polarized light, this is a most satisfactory instrument.

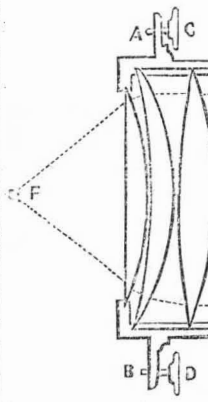


FIG. 5.

After a dozen years' constant experience with this and others, and with five other lanterns of the best forms at my command, I always experience a sense of satisfaction in the use of this instrument. The focus, F, is about three inches from the rear of the first lens, and thus the rays entering it are those included in a cone of about 65°. It is evident that, if the focus were nearer, a larger cone of rays would be received and rendered available by the lens, and thus a brighter illumination of the screen would be secured. To meet this requirement, I made, many years since, the following combination, which has proved in practice very efficient. All the lenses here used are plano-convex, and have for their curved surfaces the following radii: First, 18 inches; second, 14 inches; third, 16 inches. The first lens is $4\frac{1}{2}$ inches in diameter, and the other two are 5 inches. The focus is about 2 inches from the rear surface of the first lens, and thus the light which it receives is that included in a cone of 95°, or about twice as great as that entering the former combination. Its correction for spherical aberration is, however, far less perfect, but is quite good enough for a powerful lime light, that is, one in which the jet is large, and therefore the ignited surface of lime considerable in area.

I have experimented with condensers of even shorter focus, and having the light, therefore, yet nearer to the lens. Thus, one in which three plano-convex lenses were used as before, with their curved surfaces of the following radii gave very excellent effects for ordinary picture projections: Radius of first lens, $3\frac{1}{4}$ inches; of second lens, $3\frac{3}{4}$ inches, and of third, $4\frac{1}{2}$ inches. The focus here was only about one and one half inches from the first lens; and, as a result, it was impossible to protect this lens from the intense heat. A glass plate could, of course, be interposed, but then this was, in its turn, constantly breaking, to the interruption of the experiment and the annoyance of the operator. After a faithful trial, I have abandoned this combination in favor of the one previously mentioned.

In both of these last combinations, the first two lenses had their plane surfaces turned towards the light and were permanently attached to the box of the lantern. The third had its curved side towards the light, and was so attached as to be easily removed. The first two lenses, acting alone, gave an approximately parallel bundle of rays, the third serving to converge these at its focus, which was, of course, 8 or 9 inches in front. The question is often asked: Could we not, by using very large condensers, obtain such an increase of light that an ordinary lamp or the like would serve in place of the intenser forms of illuminator? The reply to this involves several points. In the first place, unless the glass is specially ordered, it cannot be obtained much more than one and a quarter inches thick; from this, if we make large lenses, they will be of proportionally long focus, and so the light will be further off. To take an example, I have a set of condensers, 8 inches in diameter, consisting of three lenses made as thick and, consequently, of as short focus as the ordinary glass would allow. The curves are as follows, all the lenses being bi-convex:

1st surface	10 inches radius	7 inches diameter.
2d "	7 " "	
3d "	50 " "	8 inches diameter.
4th "	10 " "	
5th "	10 " "	
6th "	50 " "	

The focus is here about 4 inches from the first lens; and thus the amount of light transmitted is no greater than with the 5 inch combination whose focus was 2 inches from the first lens. Such a set of condensers is of great value in certain cases from its enabling us to employ large objects; but it requires as powerful a source of light as the smaller one to obtain with it an equal effect.

In the next place, however, let us suppose that, without regard to cost, we obtained a large lens of short focus. Then all the errors would be greatly increased, and a heavy loss of light would be experienced, by reflection at the surfaces on which the light would fall at angles unfavorable for transmission. Another yet more serious difficulty arises from the fact that all these less brilliant sources of light have a very large area, and this, with the error of the lenses, causes such a scattering of the light that much is lost before it can reach the objective. There are other drawbacks to the use of large condensers which will be noticed further on, and on the whole we find that such a plan as that above suggested is quite impracticable.

Correspondence.

Property in Inventions.

To the Editor of the Scientific American:

In giving your views, suggested by the inquiries of Secretary Fish, in answer to his first interrogatory, you say: "A patent is a private monopoly, an infringement of equal rights, and therefore untenable on the ground of justice;" and again: "Every man in every community is bound by the strongest natural obligations freely to contribute his best powers of mind and body to promote the common welfare." As an abstract view, of rights and duties, this is possibly correct; as a practical view, of society as it is, it is rank heresy. For the inventor has no more obligation to give the public the fruit of his labors, invention, than the capitalist has to give the public the fruit of his labor, money.

A and B start in life, each with about the same amount of education, with correct habits, and each with $1,000 capital. A devotes himself to some useful and honorable calling, and by industry and economy, has at the end of five years increased his capital to $10,000. B devotes himself to the invention of some new and useful machine; at the end of five years, he has perfected his invention and procured a patent therefor; but he has expended his $1,000, and all he has found time to earn besides. You can from your observation in life continue the comparison, between A, respected, honored, courted, and B, out at elbows, out of friends, and very likely condemned by his frugal, industrious neighbors. Now, read this, and then tell us that the law protecting the inventor in the fruit of his labors is tyranny and an infringement of equal rights.

There may be a case where a man has blundered on an invention worth $100,000; there may also be a case where a man has blundered on an oil well, which he sells for $100,000; yet the latter is protected in his find for all time, or until he uses it up; while the former has, as a favor, the protection of the Government for a few years, if he pays a special fee for it.

Prescott, Kan. L. G. JEFFERS.

Deep Sea Soundings.

To the Editor of the Scientific American:

I am a constant reader of the SCIENTIFIC AMERICAN, and have been very much interested during the past three or four months with the articles written on the above subject. The following objections appeared to me to belong to all the methods proposed:

1. Sinking a vessel filled with air of atmospheric pressure, thereby requiring a vessel of great strength and lightness, as well as great weights of iron or sand, which would make the whole thing clumsy, and cause it to require too much space in the ship.

2. The whole contrivance for sinking is lost at each observation.

3. The difficulty of ascertaining where the apparatus is floating after it has reached the surface. A flag, smoke or flame, might answer, provided that there was no drift and the sea was without a ripple. The stick leaping out of the water would be something like the

"Borealis rays,
Which flit ere you can mark the place."

In order to overcome these objections, I propose constructing a small vessel with two empty gas bags attached, one of them only being required, when inflated, to support the apparatus in the water and the other arranged so that, by the expansion of the hydrogen with which it would be filled, it would disengage itself from the vessel until it reached the length of a cord, say, twenty or thirty feet long; this bag would be constructed of light material so that, when it reached the surface, it would continue to ascend in the atmosphere; thus one bag would float the apparatus, and the other would be a balloon floating twenty or thirty feet directly over the spot where the whole could be found. I would arrange the vessel so that gas would be generated directly it touched the bottom, and, of course, at the pressure to be found at that depth.

I would accomplish this by either of the two following methods: 1. By an arrangement of cells to form a battery sufficiently powerful to decompose water, so that acidulated water with platinum terminals could go down in the vessel, which, upon contact with the bottom, could be made to connect with the battery, and so we should have oxygen in one bag and hydrogen in the other. 2. By filling the vessel with dilute sulphuric acid and granules of zinc, so arranged that, upon contact with the bottom, they could be let fall into the fluid, when hydrogen would be formed, to inflate both bags alike. The heat generated by this process might also be economized by using it to raise the temperature of the gas.

You will see that I have only described the vehicle which would convey the apparatus to the bottom and back; of course a registering apparatus would have to be attached. I will not trespass further upon your space by describing that part of the subject; but taking advantage of hints thrown out, time after time, in your valuable paper, I do not doubt accomplishing the following results: 1. Registering the temperature of the ocean at specified depths. 2. Registering the depth and dredging the ocean bottom.

Before venturing so far as to rush into print on this subject, I decided upon asking the opinion of my esteemed friend, Professor John Tyndall, and the following is a copy of his reply:

MY DEAR SIR:—Your idea appears to me to be a very ingenious one. I can say no more, as my thoughts have never been turned to this subject. Faithfully yours,

July 27. JOHN TYNDALL.

I trust that something will be found effective in this important matter. W. WALTON,

late of the Science and Art Department, South Kensington, England.

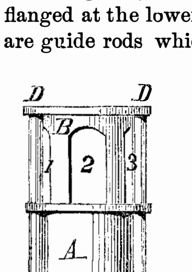
Williamsburgh, N. Y.

Balloon Valves.

To the Editor of the Scientific American:

Now that Professor Wise is going to demonstrate the practicability of the theory I have long cherished, I wish to propose an improvement in the construction of the safety valve of a balloon, nothing of the kind having ever been devised that would give me satisfaction. The engraving will, I think, represent my idea.

A flanged cylindrical tube, B, is placed within A, and is flanged at the lower end to keep it from blowing out; D, D, are guide rods which may pass through the flanges, to prevent the upper cylinder head from settling towards one side and to insure a perfectly airtight joint. B is represented as being forced up by the gas; and 1, 2, and 3 show the openings by which the excess of gas will escape. The lower flange, C, will be inside of balloon, the end being open to admit the gas; E, E, and F, are a device for holding down the valve with a force equal to the amount of buoyant pressure of the gas; and the device must be regulated by a weight, as are all other valves. The upper face of A, and the under face of the head of B must be ground to a perfect joint, and may be supplied with a flexible gasket to prevent all leakage. As C passes freely back and forth through A, the valve can never get foul or fast in it, as has so often been the case, causing many disasters. The dotted lines represent the apex of the balloon. A glance will show any scientist how the valve can be secured in position. The whole apparatus may be made of any suitable metal or of vulcanized rubber.



If made of brass or other metal, would it be likely to attract electricity from the clouds and set fire to the gas?

Elsah, Ill. S. W. GREER.

Mordants for Aniline Colors.

To the Editor of the Scientific American:

After perusing, on page 17 of your current volume, the article "Mordants for Aniline Colors," I am induced to make a few remarks on the subject. I have frequently used hot soap liquor as a mordant for aniline pinks, light and dark and found it to answer well. It is an easy, quick, and economical mode. For a deep, brilliant rose, I have generally found an annatto base, in combination with alum as a mordant, to be the best; it produces the most beautiful color. The sumach process is good for either light pinks or deep crimson shades, using it as a base for either double muriate of tin or tin crystals. In the hands of a skillful dyer, this process is very economical, for, by adding aniline in proportion to his shade, he can exhaust his dye bath. Tannin or sumach is the best known mordant yet for the aniline green. There is a mode of mordanting which has been much practiced in England and Scotland. It is the white liquor process, similar to the Turkey red, but not so complicated; it is, however, too tedious. It is claimed that it animalizes the cotton. Now this is the desideratum, namely, a cheap and quick mode of animalizing cotton, so that it would have as strong an affinity and absorb the aniline dyes, of all colors, as simply, quickly and easily as either silk or wool.

I have no doubt the Austerlitz mode is a very good one as to economy, but I scarcely think it will answer for all classes of fine yarns, as I am afraid it will stiffen or size the yarns too much. J. N.

Frankfort, Ky.

A New Explanation of the Origin of Nerve Force.

Those who are unacquainted with the principles of the modern doctrines of thermo-dynamics will readily perceive that a difference of temperature in two bodies is a source of power, when they consider that a low pressure steam engine depends, for its power of doing work, on the difference of temperature between its boiler and condenser; and that a current may be maintained through a copper wire, if it is connected with a thermo electric battery of which the two ends are kept at different temperatures. In what are termed hot blooded animals, that is, in mammals and birds, the difference of temperature between the surface and the interior is considerable under all natural circumstances, and in them there is a regulating action of the skin, by which they maintain a uniform internal temperature, always hotter than the surface, whatever that of the external medium may be. In the sluggish so-called cold blooded animals, the temperature of the interior of the body is but slightly different from that of the air or water in which they live; that it must be higher is evident from the fact that destruction of tissue is continually going on in their bodies, which is always necessarily attended with the evolution of heat.

Such being the case, it is evident that, in the difference of temperature between the surface and the interior of the living body, there is an available source of energy, which is almost certainly employed advantageously throughout the whole animal kingdom; and what is more, it may reasonably be supposed to be that which gives rise to the electrical nerve current, as only one assumption is involved, and that not an improbable one, it being that a thermo-electric current is capable of being generated between soft tissues of different composition or structure. Physicists will be able to decide this question experimentally, and if they do so, they will do a service to physiology.

For the distribution of a current so generated, the construction of the nervous system is perfectly suited. Two sets of conductors are necessary, the one to carry the currents from the skin to the central organ, which arranges the direction that they must take, and the other to send them on to their destination: these are to be found in the afferent and efferent nerves. As in the telegraph system, no return conductor is necessary; for as the ends of the wires are put into connection with the earth, by which they are able to communicate, so the terminations of the nerves in the skin, muscle-corpuscles and otherwise where they lose their insulated coverings, place the extremities of the afferent and efferent nerves in communication through the intervention of the mass of body tissue. The brain and minor ganglia would then act like greater and lesser offices for the reception and transmission of currents in the required directions, being in fact the commutators of the system.

There are several of the most important phenomena exhibited by the nervous system which are very satisfactorily explained on the above hypothesis. For instance, in cold weather the impulse to action is much more powerfully felt than in summer when the air is hot, and therefore the temperature of the surface is higher. It is well known that it is impossible to remain for more than a very short time in a hot water bath, of which the temperature is as high as, or a little higher than, that of the body, on account of the faintness which is sure to come on, and this may be reasonably supposed to be the result of the cessation of the nerve current, which is consequent on the temperature of the surface of the body becoming the same as that of the interior. This faintness is immediately recovered from by the application of a cold douche. When great muscular exertion has to be sustained, as in running or rowing, it is always necessary to have the clothes very thin, and it is felt, during the time that it is necessary for the continuance of the effort, that the surface of the body must be kept cool.

As the termination of the nerves in the skin must correspond, on this hypothesis, with the cooled end of a thermo-electric battery, therefore the brain, which is very abundantly supplied with blood, and is the part of the body to which most of the nerves are directed, must be compared with the heated end; and as it is by the conversion of heat into electric current that the nerve force is developed, it is evident that heat must, to a certain extent, disappear as such in the brain, and that that organ must consequently be colder than the blood which enters it. This is exactly what Dr. John Davy observed in the case of the rabbits he experimented on, and his results have not been shown to be incorrect.—*A. H. Garrod, in Nature.*

NEW STYLE OF PAPER.—The English display at the Vienna Exposition an original manufacture, which is very strong and tough, and yet perfectly soft and pliable, like cloth. This is embossed and printed on, and is prepared for the purpose of hangings, curtains, etc., for which it seems very well adapted; some of the rooms of the British Commission are furnished with this. It is simply tacked to the walls, so that it can easily be removed at any time. In this case the curtains were of the same pattern as the walls, but lined with another style in light colors. It is handsome, cheap and durable.

THE GREAT EXPOSITION—LETTER FROM UNITED STATES COMMISSIONER PROFESSOR R. H. THURSTON.

NUMBER 9.

VIENNA, August, 1873.

The labors of the international jury are occasionally intermitted for a day, and its members are given an excursion to some peculiarly interesting district in the environs of Vienna. Evening receptions by the Emperor, or by the nobility of the Austrian capital, or even the excellent dinners given by the Arch Dukes, can hardly be considered as very greatly relieving the fatigue of a long day's work, although they are exceedingly pleasant. But an excursion into the country for a day is wonderfully rest-giving.

One of the pleasantest of these excursions was that to which the whole jury were invited, with a few gentlemen of the press and others, by the management of the exhibition. The party were taken over the

SÖMMERING PASS

to Murzzuschlag, returning to Vienna after dining at that station.

Starting at about eleven o'clock, on one of the hottest days of the season, the train ran, at what was considered in Austria very high speed, through the level country in the immediate neighborhood of Vienna, but soon slowed down, as moderately heavy grades were met after reaching the base of the mountains. Sixteen miles from Vienna, Vöslau was passed, a lovely spot, noted for its beautiful scenery, its excellent baths and its fine wines; and from this point the grades became heavier, and the engineering skill which had been exhibited in the construction of the road over this mountain range became more and more strikingly exhibited. The greatest amount of skill and labor has been expended upon that portion which lies between Gloggnitz and Sömmering, a distance of about twenty-five miles. The average gradient on this section is something over sixty feet to the mile. There are fifteen tunnels and sixteen bridges, some of which are of large size. The last tunnel is situated about three thousand feet above the sea level, and is more than four thousand five hundred feet long. Many of these tunnels are ventilated, and in some degree lighted, by lateral galleries opening out on the steep face of the mountain. The bridges are of stone, and are well designed and solidly constructed. The size and the solidity of the culvert arches, which have been constructed to afford passage for the floods of water which, after severe storms, rush down the mountain sides and across the line of the road, were particularly noticeable. The care taken, at all exposed points, to protect the road against washing would appear in the United States somewhat extraordinary when compared with our own average practice in even such localities. The whole road is, from beginning to end, thoroughly well built. The cost of this section was 14,000,000 florins, or about seven millions of dollars. A similar piece of work in the United States, in consequence of the difference in cost of labor, would have cost nearly as many dollars as this has cost florins. This railroad over the Sömmering Pass is probably one of the finest examples of engineering to be seen in Europe.

The scenery along the line is exceedingly beautiful. The road follows the sides of the valley, sometimes crossing it and apparently reversing its direction; and at every projecting point, the traveler looks far up the valley where green hill sides rise one above another and, far in the distance, are themselves overshadowed by the highest peaks of the mountain range. Or he has a more beautiful and a wider, though less picturesque, landscape spread before him as he looks down into the valley and traces the stream in its meanderings toward the greater valley of the Danube, among many villages, and through fertile fields, yellow with ripening grain or green with vineyards.

At one point the road crosses the valley on a long high bridge; and the view on the one side extends even to the snow-covered top of the well named "Schneeberg," which glistens still, even under the fierce rays of this midsummer sun, and contrasts strikingly with the lower peaks about it, covered, as they are, with vegetation. On the other side the view from the same point reminds one somewhat of that beautiful spot nearer home, the valley of Wyoming, as seen from the hights above Wilkesbarre, and is pleasing beyond description. Sömmering is the highest point of the pass, and is about three thousand feet above the sea.

Passing through the long tunnel piercing the mountain, which still rises far above, the traveller finds himself, on emerging, in the midst of a landscape completely in contrast with that which he has just left behind. The scenery has a quiet beauty which he could hardly have believed it possible to find so near while he was admiring the rugged and picturesque last view above Sömmering. There seems here a different climate also, for on the one side the farmers are just cutting their hay, while on the other they are completing the work of harvesting their grain. From the next station,

MURZZUSCHLAG,

down to Trieste or to Venice, the scenery is very beautiful in many places, but probably nowhere equal to that on the Sömmering side of the pass. At the place just named, the party of excursionists found a good dinner and excellent concomitants awaiting them, not the least of which was the music, both vocal and instrumental, which was furnished by a large body of musicians.

While this important railroad interests the stranger by the solidity of its construction and by the skill and energy which have their monuments in every section, there is but little to be said of its rolling stock. It is usually of what may be said to be the standard European type, and the locomotives are such as are generally in use elsewhere for heavy work. They are well designed and apparently well made.

The exhibition contains a large number of

GERMAN AND AUSTRIAN LOCOMOTIVES.

They are of many types, most, if not all, of which are well known at home. They are now usually fitted with the American cab, a detail which the continental builders have been more prompt in adopting than have the British. The frames, instead of being made of forged bars of rectangular section, as is customary in the United States, are cut out from rolled plate, which, for heavy engines, is at least thirty millimeters (one and two tenths inches) thick. The cylinders are usually outside, and the valves are frequently driven by eccentrics placed outside the crank pin, and without the intervention of rock shafts. The boiler is now generally made with that portion surrounding the firebox considerably enlarged, in order to obtain a wider grate and a higher steam space over the crown sheet. Instead, however, of making the top of this portion semi-cylindrical, as is the practice in the United States, the top and sides are made flat, the outside of the boiler being thus made like a rectangular box with rounded corners. The cylindrical part of the shell surrounding the tubes is connected with the enlarged part just described, frequently by a single sheet which is cut out and flanged on the one side to take the former, and is flanged around the edges on the other side to meet the shell surrounding the fire box. This makes a very perfect and strong connection between the two portions of the shell, and, at the same time, forms an expansion joint. It is evidently a favorite method of construction here; but whether better than our American method of accomplishing the same result, it is difficult to say. These flanged sheets, such as have just been described, make rather a neat piece of flanging, and seem to be favorite *pièces de résistance* with the principal exhibitors. A number are exhibited in steel, and among these are some of the best specimens of such work to be found in the exhibition. One of the very best is shown in the Creusot exhibit, where also is the most beautifully finished locomotive engine to be found in the building. As such finish can only be given to the very best of material, this engine probably stands unequaled in material and finish by anything here. Steel is employed for nearly all parts which were formerly made in wrought iron. The favorite grade for the locomotive builder's purpose seems generally to have so small a proportion of carbon as to be properly iron. This proportion frequently falls to one quarter of one per cent. This metal, when made from good pig iron and with proper care, is much stronger than merchant iron, except, possibly, in rare instances and with the very best and highest priced brands; it is perfectly uniform in strength and quality, and takes a magnificent finish. This metal has a tensile strength of from sixty to seventy thousand pounds and upward, and stretches more than one fourth before finally breaking off, and can be relied upon to do this invariably, say those who are using it. Each piece is also uniform in structure and in strength throughout.

The section assigned to

GREAT BRITAIN

contains only two or three small machines, for use in making up trains about stations. Neither Great Britain nor the United States illustrate their present practice in building heavy engines.

RUSSIA

exhibits two locomotives of good design, of apparently good materials, and of exceedingly creditable finish.

ITALY

exhibits one of the engines used at Mont Cenis. It is of the usual continental type for such work, with four coupled drivers, and of the following principal dimensions, as given by the exhibitors, in meters: Cylinders, diameter, 0·43, stroke, 0·62; grate, 2·25 × 0·98; surface, 2·205; number of tubes, 91; diameter, 0·045; heating surface, 103·49. Steam pressure, 9 atmospheres. The machine would look a little rough by comparison with an ordinarily well finished American engine.

On the whole, it would appear that the changes now going on in European practice, in construction of locomotives, are principally in the introduction of a better material, and that such slight changes in design as are noticeable are usually in that direction in which the builders of the United States have preceded them

There are quite a number of road locomotives, or

TRACTION ENGINES

exhibited in the British section. Messrs. Fowler, the well known manufacturers of steam plows, exhibit their road locomotive. It is of good form, well made and neatly finished, and looks serviceable. Messrs. Aveling and Porter exhibit examples of their several designs, among which is one of the size of the machine which did such good work at South Orange, N. J., last autumn. This engine is fitted with a small crane, and is frequently seen about the lower end of the enclosure, transporting heavy stones or huge boxes from place to place, with far greater celerity and handiness than could any team of horses. Another engine is attached to a train of great wagons heavily loaded with stone.

A French traction engine is exhibited, which is fitted with the Thompson india rubber tyres, and which is often trundled across the grounds regardless of obstacles or of pedestrians, at a speed and with a facility in manœuvering which are as admirable as intimidating. The action of the flexible tyre, as it continually maintains its broad area of contact with the rough ground as the wheel turns, is very interesting; and if, as the exhibitor maintains, success has been attained in securing great endurance and comparatively low first cost, there must be, as he also asserts, many situations in which they will find profitable use, and where the usual form of tyre is inadmissable.

The introduction of road steamers to take the place of horses for heavy work seems one of those phases of progress which are only noticed by a few. Messrs. Aveling & Porter are doing an immense business in building their machines; other firms, English and French, are also doing something in the same direction; and in the United States, where some of the most skillful pioneers in this direction have labored, there are strong symptoms of ultimate success in the use of steam for, at least, all heavy transportation. Such success will probably secure the advantages of great convenience as well as of cheapness, and the removal of the multitudes of horses which now crowd our streets will be productive of sanitary advantage also.

The pressure of steam carried on locomotives, and on some of these traction engines, is usually eight or nine atmospheres, as it is reckoned here. The boilers are usually rather stronger than those built in the United States for the same pressure. The riveting is generally snap-headed, and is very usually done by the steam riveting machine. Where done by hand, the large rivets are headed up by the blows of heavy hammers upon a forming tool. The plates, along the edges of the laps and around the rivets, exhibit, too frequently, that scoring which is to be regarded as a sign of carelessness on the part of the workmen.

Probably the very best

BOILER WORK

exhibited is that of Adamson, of England. His boilers are of steel plate, with the exception of the heads, which are of one piece of heavy iron. Every lap is planed and every rivet hole drilled. One of his most beautiful pieces of work is a boiler having large flues, across which are carried the Galloway tubes. These tubes, however, are welded in instead of being riveted, and so neatly is the work done that it is impossible, in some examples, to find the weld. Such conscientious work is seldom seen on steam boilers, and deserves full credit when found. R. H. T.

Improved Whips.

We visited not long ago, at New Haven, Conn., the works of the New Haven Whip Company; and although the general process of manufacture is substantially the same as in other whip works, still we observed certain peculiarities that are worthy of note. In this establishment they are not afraid to permit visitors to inspect every branch of their operations, the reason being that only the very best of materials are used in the manufacture. In some concerns, visitors are excluded for fear of disagreeable revelations, it being common in such establishments to introduce shoddy stuff into the interior of the whip, covering it over with the usual braiding, the whip thus made having an appearance upon its exterior as good as the best, although in reality it is an unworthy production.

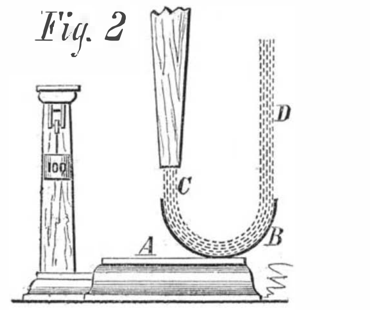
At the New Haven whip works, the specialty manufactured is the patent whip tip. The old plan was to make the long slender tip in one piece with the handle; and when the tip was worn out, the handle and all was rendered worthless. The handle if properly made will out last many tips; and the New Haven Whip Company make the tips separate from the handle, but attached thereto by a screw connection; so that when one tip is worn, another tip may be quickly substituted. Thus a few cents expended in tips will keep one supplied with a good whip for years. Tips of different colors, lengths, or qualities may be used on the same handle.

The manufacture of the patent whip tips has become quite extensive. The company above mentioned holds the exclusive right to this description of goods, and supplies only first class articles. The body of the ordinary handles consists of a central core of whalebone, stiffened and filled with rattan. This is now enclosed in rubber cloth and covered with rubber cement, so as to be impervious to water. The next operation is to braid upon the exterior a finishing covering, composed of some thirty strands of cotton, silk, or gut, according to the quality desired. The braiding is done by machinery, by girls, and is a curious and rapid operation. After braiding, the whips are repeatedly varnished, dried, and packed for market. The finer varieties of handles made by the New Haven Whip Company are composed of holly wood, imported from England, and Molucca wood, also imported. The company is entitled to much credit for the excellent and thorough manner in which their goods are prepared, which have a high reputation in the market.

IMPROVED TURBINE WATER WHEEL.

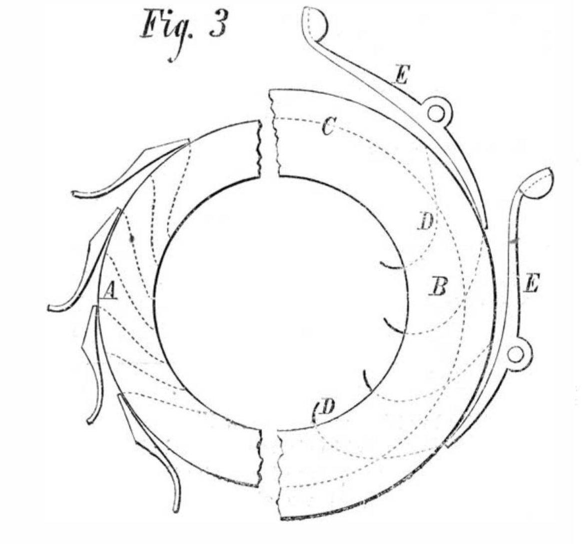
The principal point of improvement, in the turbine wheel represented in the accompanying engravings, consists in the peculiar shaping of the buckets, through which, it is claimed, the maximum power of the water supply is utilized. The idea of this construction, the inventor (Mr. James Craik, of Chateaugay, N. Y.) states, was developed by first causing a column of water to descend perpendicularly upon a horizontal scale platform, and balancing its effect by weights. For the level plate, a curved one was then substituted, of such a shape that the descending column, entering at one end, was deflected around the bottom and returned upward at the opposite side. It was then found that, in order to balance the direct impulse of the falling column, together with the reactive force of the ascending stream, double the weight previously employed was required, and that the curve was a semicircle. This will be rendered clearer by Fig. 2, in which A is the horizontal

Fig. 2



platform, B the curved plate, and C and D the falling and rising columns of water. The conditions, however, thus determined are modified through the motion of the point to which the power is applied. Thus, if a wheel could remain stationary and still transmit the impulse, the semicircle would be the proper curve for its buckets; but such not being the case, the wheel rotating, it is evident that centrifugal force affects the water, so that the bucket must be set to counteract the tendency of the fluid to flow toward the circumference.

Fig. 3



The inventor proceeds further to state that, in some well known turbines, the direction of the water must be deflected inward against this centrifugal tendency, a force augmented by the motion of the wheel. This deflection increases the action of the water against the point of the chute, but diminishes that in the inward direction, through the bucket by which the wheel is driven. The force due to deflecting and returning the column of water is thus thrown against the point of the chute, instead of being applied within and against the bucket; and as the action of the column is more intense at this point of reversion than in any other part of its revolution, it is considered evident that a portion of its power is not communicated to the wheel.

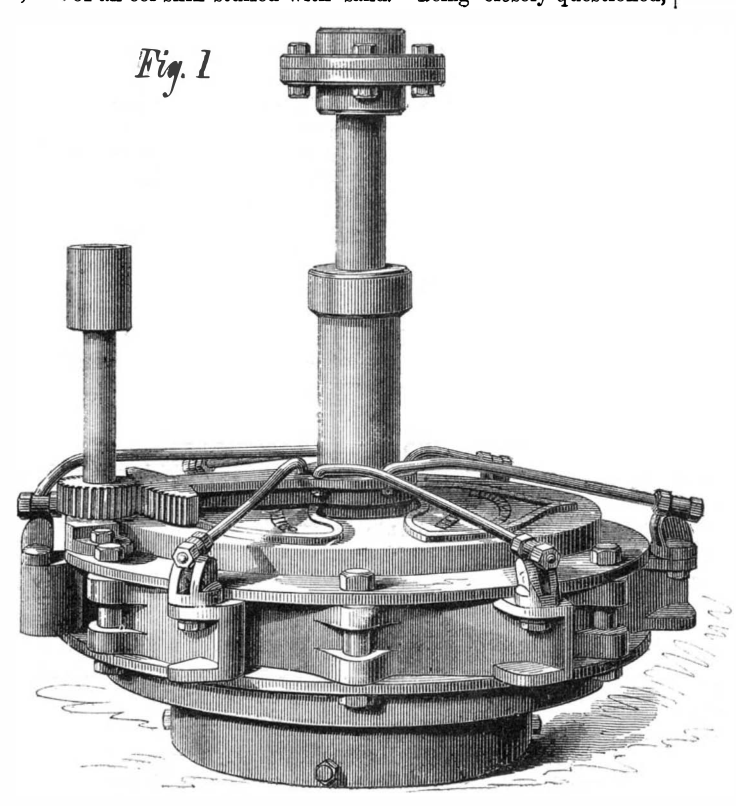
In the sectional plan, Fig. 3, are shown diagrams of the ordinary turbine and the Craik wheel, the side, A, representing the former, and B the latter. C is the line of rotation, D the buckets, and E the chutes. From this illustration, the difference in construction will be at once noted; while the amount of loss in the starting power of the wheel can be theoretically computed. In practice, however, the element of centrifugal force complicates the problem; so that from the reports of public trials, perhaps, the best judgment of the efficiency of the device can be formed. Fig. 1 gives a general perspective view, from which other points in the construction of the invention will be understood.

For further particulars regarding sale of wheels, etc., address Whittlesey, Meigs, and Co., Malone, N. Y.

The Sand Club.

This is a weapon used by rowdies and criminals in San Francisco, resembling in principle the sand bag used by the same sort of scoundrels in New York. The sand club is formed by filling an eel skin with sand. When this instrument was first brought into use, the authorities were greatly puzzled by deaths, apparently from violence, yet no marks could be found on the outside of the body. A burglar was finally captured with a sand club in his possession, made out of an eel skin stuffed with sand. Being closely questioned, he explained its use. When the victim is struck, for instance, on the head, he drops insensible, and soon dies from congestion of the brain. Often the skull suffers no injury from the stroke; and if the person struck recovers sensibility, he gradually relapses into a condition of idiocy. Sometimes a man struck in the body will be knocked down by the peculiar force of the blow, and feel no immediate results from it. In a few weeks, however, the flesh will begin to mortify under the line of the blow, and rot down to the bone.

Fig. 1



CRAIK'S IMPROVED TURBINE WATER WHEEL.

THE HYDRAULIC PROPELLER.—A NOVEL MODE OF MARINE PROPULSION.

Some years ago a gun boat in the English navy, the Water Witch, was fitted with machinery which propelled the vessel by drawing in water and then forcibly ejecting it through tubes arranged in her sides. The experiment was, in a measure, successful, although we have heard nothing concerning the ship for some time past. The present invention is based on a somewhat similar idea, in so far as it drives the craft by the reaction of water ejected from the hull; but instead of employing mechanism to obtain the supply, it relies on the rolling of the ship, or dash of the waves, to fill the tanks, and thus produce a sufficient head to generate a forcible discharge.

As the plan, in its entirety, is quite novel, and, in the opinion of the inventor, practicable, we leave that gentleman to explain his idea in his own words, premising, however, that, in our engravings, Fig. 1 shows the general application of the device to a vessel, and Fig. 2 a section of the ship with the arrangements represented in detail.

"For a vessel of 36 feet beam, 30 feet depth of hold, and 400 feet long," says the inventor, "I make tanks or penstocks (A, Fig. 2) on each side, for the whole length of the ship, these tanks to be 16 feet high, 8 feet above and 8 feet below the water line when loaded, to be 5 feet wide fore and aft, and 3 feet wide from the vessel outwards or across beam. In the top of these tanks are holes 6 inches in diameter, and as close as they can be conveniently made, to admit water (whenever, through rolling, or pitching, or high seas, the outside water may be over the tanks). Valves, B, one foot square, are arranged near the water line, opening inwards, for the purpose of admitting water whenever the outside water is above that inside; and there is an opening, C, at the bottom of each tank, shaped so as to discharge aft, and 6 by 12 inches in the opening.

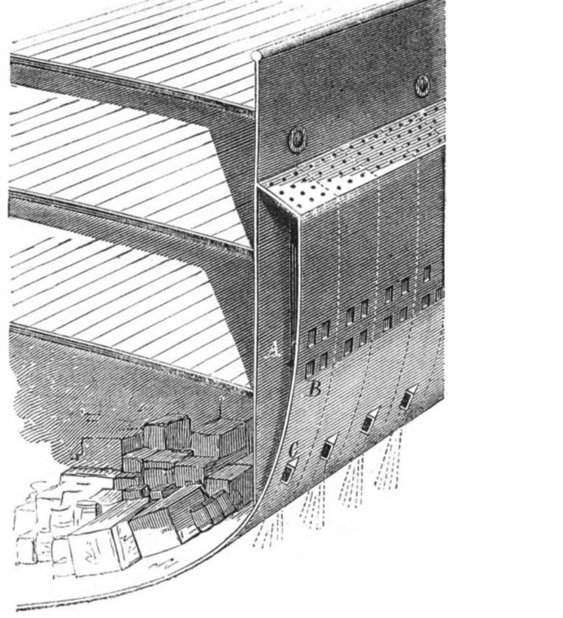
"A ship so fitted will, from the rolling or pitching, or from the dash of the waves, receive water into the tanks when submerged, or whenever (from any of the causes previously mentioned) the water within the tanks is lower than the water outside. And whenever the hollow of the waves is being passed, or the roll or pitch is upward, and the water in the tanks is above the water outside, then the re-action, consequent upon the discharge from the outlets at the bottom of the tanks, will propel the vessel forward.

"The discharge outlet may be made to close by pressure from without, or it may be drawn up by rods attached and leading to the deck, or made to reverse the action; the valves also may be manipulated by rods, if necessary; but it is thought that fixed outlets and plain valves will answer best."

The inventor also suggests a plan for similarly utilizing the pitching of a ship, by arranging two tanks, one at either end: "Valves in the bottom admit water into either tank when down; and when the tank is up, valves will let it discharge into a tube on the bottom of the vessel; said tube discharges both tanks at the stern or each at its own extremity of the ship, or, for the sake of the greater head of water, each at its opposite end."

We are informed that it is especially desired to explain the principle of this device (which, it is believed, is suscep-

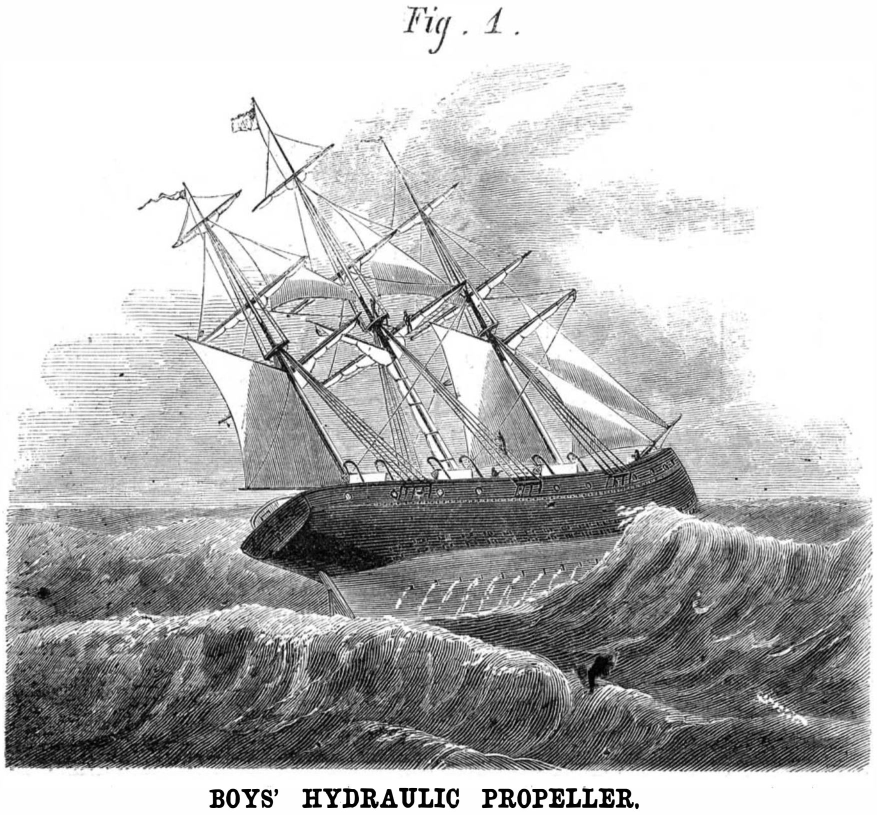
Fig. 2



tible of more improved application than the especial arrangement above alluded to), although the inventor is of opinion that the latter would fulfil the necessary requirements.

An application for a patent is pending by Mr. Henry R. A Boys, of Barrie, Ontario Canada, by addressing whom further particulars may be obtained.

Fig. 1.



BOYS' HYDRAULIC PROPELLER.

Sir Francis Ronalds, F.R.S.

Sir Francis Ronalds, formerly Director of the Observatory at Kew, died recently in England, aged 85 years. To him has been ascribed the invention of the electric telegraph, as it remains on record that, nearly sixty years ago, he devised an efficient instrument of that kind, which he described in a pamphlet published in 1823. The *Philosophical Magazine* thus describes his first success:

"In the summer of 1816 he undertook to prove the practicability of telegraphic communication, at great distances, by transmitting a certain number of electric shocks, for an arranged signal, through insulated wires of considerable length. He laid his wire in glass tubes surrounded by wooden troughs lined with pitch, which were placed in a covered ditch, 525 feet long and 4 feet deep, dug in his garden at Hammersmith. He also suspended eight miles of wire, by silk cords, from two wooden frames erected on his lawn, so that the wire passed to and fro many hundred times, well insulated at each point of attachment, and forming one continuous line, kept separate from contact with other parts. Both these kinds of apparatus served equally to show the instantaneous transmission of the electric shock. In order to provide the means of conveying intelligence along the underground line, he placed at each end of it a clock, with a dial bearing twenty letters inscribed. In front of the dial was a disk, revolving with the second hand, forming a screen with a small opening cut in it, so that as the disk revolved only one letter could be seen at a time, and this only for a second. The two clocks were made to go isochronously, the one always presenting the same letter as the other at any given second of time; and the moment chosen at one end was indicated at the other by the sudden collapse of a pair of pith ball electrometers, suspended at each station close to the clock dial and connected with the telegraph wire."

Attempts to enlist government aid in proving the value of his invention being unsucessful, Mr. Ronald turned his attention to other subjects, and devised several valuable self-registering instruments now in use at the Greenwich and other English observatories. He was knighted in 1870 as a reward for his public services.

Short's Patent Loom.

That very ingenious and useful improvement in the loom, for weaving fabrics of any width, invented by Mr. James Short, of New Brunswick, N. J., which, it will be remembered, was described and illustrated in our columns some time ago, has been made the object of a corporation known as the Short's Patent Loom Company, which, with a capital of one million dollars, has been recently formed under the presidency of Mr, Christopher Meyers.

There is little that we can say, in the present connection, which will tend to augment the praise which we unhesitatingly bestowed upon this invention on our first inspection of its merits; unless it be the fact that others have added the weight of their favorable opinions, and that the device has excited a widespread interest and elicited repeated commendation in the mechanical circles of both this country and Europe.

Under the management of the well known gentlemen who comprise the officers of the new company, the Short loom will not be long in making its way into our manufacturing towns.

THE PERSIAN PAVILION AT VIENNA.

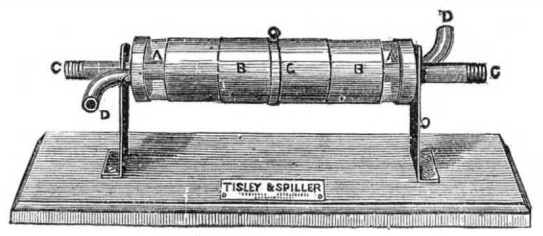
The grounds occupied by the Vienna Exposition comprise five hundred and seventy acres in extent.

In addition to the main building, which occupies a space half a mile long and five hundred feet wide, there are no less than one hundred and forty detached buildings scattered through the grounds, which are devoted to represent special exhibits, some of them illustrating the architecture of various nations. One of these structures, the "Persian Pavilion," is represented in our engraving. It shows in general the modern buildings of the Persian nobility. In its exterior it represents the best forms of domestic Persian architecture of to-day, while its interior contains a large amount of products which illustrate Persian industry.

New Ozone Generator.

Mr. Tisley, of the firm of Tisley and Spiller, has designed a new ozone generator presenting considerable improvements.

A A is a piece of glass tube, of a little more than an inch in diameter, and of as uniform a bore as can be obtained. On each end of this tube is placed a brass cap, bored with two holes, and coated internally with shellac: in the interior of this glass tube, and of a diameter scarcely less than that of the tube itself, but not quite so long, is placed a thin hollow brass box, B B, with its surface made as true as possible by turning in a lathe: this brass box is placed concentrically with the outer tube, and is completely coated on its exterior surface with tin, the tin being acted upon to the smallest extent



by the ozone. This hollow box communicates with the exterior of the apparatus by means of the tubes, C C, passing through the center of the caps. It is intended that a current of water shall be kept circulating through the interior of this box, the water being brought into direct contact with its sides by means of a small spiral placed within it, the box being of a slightly less diameter than the glass tube; a small annular space will remain between the two, and through this space the gas to be ozonised is passed by means of the tubes, D D; the box itself is made one of the electrified surfaces, and a strip of tin foil, G, fixed to the outside of the glass tube, forms the other; two binding screws, E and F, serve to make the necessary connections with an induction coil. The water may be kept cool by means of ice.

This instrument is adapted to the purposes of the lecture table, while it is at the same time easily worked. Abundance of ozone can be generated with an induction coil giving a half inch spark only.

We shall be glad to hear of the construction of larger forms of this instrument, which physicists will find very useful in their study of the properties of ozone.—*Telegraphic Journal.*

A Railroad Fire Engine.

The Virginia (Nev.) *Enterprise* gives an account of a new fire engine which the Virginia and Truckee railroad company have had constructed and fitted upon one of their locomotives, in view of the frequent occurrences of fires in wood piles, tunnels, buildings and other property along the line of their road. It stands upon the boiler of the locomotive between the steam chest and the bell, and not a little resembles an iron monkey riding the iron horse. The locomotive, with the little fire fighter mounted upon its back, was recently brought up to the depot, and a trial of its squirting capacity made, which proved highly satisfactory. In case of a fire anywhere on the line of the road, the locomotive and engine, with cars fitted with water tanks, will at once be dispatched to the scene of the conflagration. Meanwhile the locomotive will not remain idle, as it can do switch duty and other work just as well as though it had not the queer little fire monkey riding about on its back.

The Mental Atmosphere.

The probabillity of the existence of a mental atmosphere, as recently discussed by a writer for the *Reporter*, is a question which has attracted considerable attention, and which in time will probably throw much light on the nature and action of mental phenomena.

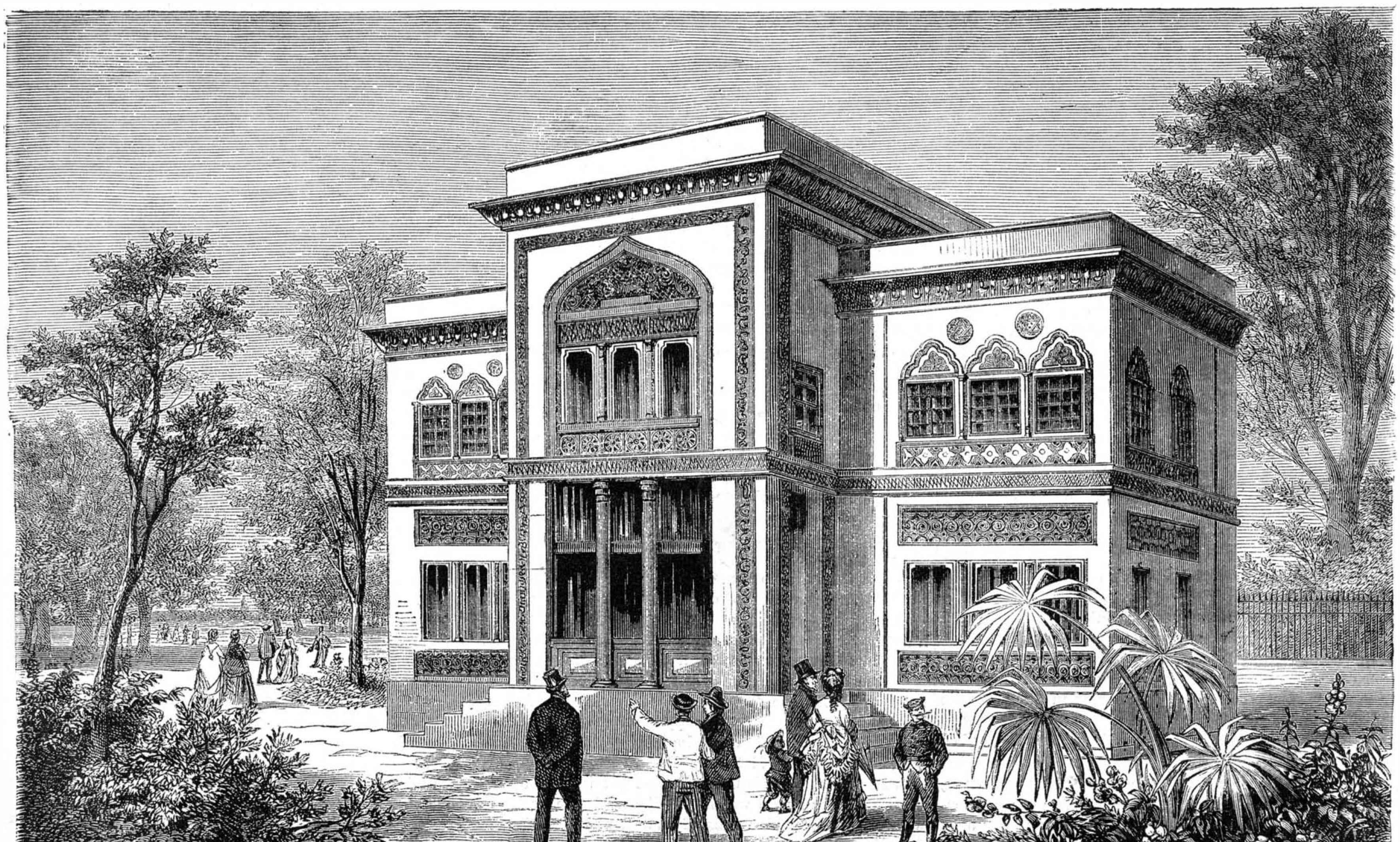
We all know that any mental action results directly in molecular change; it is performed at the expense of certain constituents of the nervous system, notably phosphorus. It transmits a definite wave of motion, at a rate which has been accurately measured, to the distal extremity of the appropriate nerves; how much further, we do not know. Many instances also illustrate the high quality of mental force. It can produce the most important changes, even ulceration or gangrene, in the remotest parts of the body, and aid with equal power in processes of restoration and growth.

That the superficies of the body does not bound its activity numerous facts demonstrate. To pass by the less remarkable and more familiar ones, there is the most positive evidence that those gifted with " second sight," as it was once called, do possess an undefined power of knowledge which transcends the senses. The presence of danger is often felt before any warning reaches us through the senses. Men who live lives of peril know this perfectly well, and are the last to underrate such feeling.

Another form of this external mental power is that by which a strong emotion or a fixed attention on an object will excite a similar emotion or the picture of a similar object in another person without any communication. A certain natural analogy and a special training is required to bring this about. The French " magician" Houdin has established such a mental relation with his son, so that the latter, though blindfold, would at once name an object shown to his father, though the width of a large room intervened.

Undoubtedly as emotional influences are clearly epidemic and contagious, there is nothing incredible in the belief that ideas should also possess equal powers beyond the superficies of the body or the limits of expression.—*Medical and Surgical Reporter.*

J. C. S. says: "I believe John Chinaman strikes the heaviest blow at you newspaper men, as he crowds out other citizens and never buys a paper himself."



THE PERSIAN PAVILION AT THE VIENNA EXPOSITION

THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

The meeting proves to be one of the most interesting yet held, both from the number of eminent scientists present and the variety of the subjects discussed. We notice that Mrs. Elizabeth Thompson, of New York city, has donated to the Association the sum of $1,000 for the purpose of advancing original scientific research. The gift was presented by Dr. Van der Weyde, and its reception suitably acknowledged by the President, after which the thanks of the society were transmitted to the donor.

The Metamorphism of Rocks.

Professor T. Sterry Hunt said that when, early in this century, the crystalline rocks of the Alps were shown to rest upon uncrystalline fossiliferous strata, it was suggested that the overlying crystallines were newer rocks, which had undergone a metamorphism from which those directly beneath had been exempted. This notion spread until the great crystalline center of the Alps was considered to be in part of secondary and even of tertiary age. The speaker questioned this view, and had satisfied himself that the crystalline rocks of the Green Mountains and the White Mountains, and their representatives alike in Quebec, New Brunswick, and in the Blue Ridge were more ancient than the oldest Cambrian or primordial fossiliferous strata. He showed how folding, inversion, and faults had alike, in the Alps and in Scotland, led to the notion that these crystalline rocks were in many cases newer than the adjacent fossiliferous strata. In another paper, on the "Geology of New Brunswick," the same subject was further illustrated.

Professor Pierce, on

The Rotation of the Planets as a Result of the Nebular Theory,

set forth an explanation of the actual rotation of the planets on the supposition of their being formed, according to the nebular hypothesis, from rings thrown off from the rotating main body in the process of condensation. He instanced more particularly the planets Jupiter and Saturn. The inner portions of such a ring having a less velocity than the outer ones, axial rotation in the same direction as that of the primary would be determined in the breaking up and running together of the ring into a planetary body. He showed by a mathematical analysis, of the movements of the particles composing the ring, that the velocity of the resulting rotation must be such as is actually observed in the case of the planets referred to, whose mass represents nine tenths of the whole planetary system.

This theory was applied to the absence of rotation in the case of our satellite. He showed the probability that the original nebular ring from which the planets were formed may have been of twice the size of their present orbits.

In the discussion which followed, he stated that we have never seen anything of Jupiter or Saturn but the clouds which cover them. He thought that those planets were yet at a white heat, and we simply saw the clouds that are raining down upon them.

The Growth of the Brachiopod

was the subject of a paper by Professor E. S. Morse, in which he showed that the brachiopods were the only class of animals of which the developmental history has been hitherto unknown. The reason for the peculiar interest attached by naturalists to this animal is that the very earliest fossiliferous remains—those deposited in the most ancient rocks—are of members of this class. They are moreover found in rocks of all subsequent ages, and are still living in the seas of the present day. Singularly enough, while all other groups of animals have changed in their distinctive features, and many have been extinct, there are brachiopods of the present day that can scarcely be distinguished from their most ancient representatives. The brachiopod is a small animal, enclosed in a bivalve shell and adhering by a posterior appendage to the ocean floor. The possession of this bivalve shell has led all naturalists to include brachiopods among the mollusks. Three years ago Professor Morse, after a long and patient study of the living forms, startled the world of naturalists by announcing his conviction that the animals were not mollusks, and that they had no relations with shell fish whatever, but were true worms. Professor Morse has succeeded in raising the brachiopod from the egg and has studied its external and internal structure in every stage of growth. Briefly, the embryo commences life as a little worm of four segments; and after enjoying itself in swimming freely in the water for a while, attaches itself to sea bottom by its posterior segment and settles permanently. The middle segment then protrudes on each side of the head segment and gradually incloses it, thus producing the dorsal and ventral shell so characteristic of the entire class.

Mr. Hilgard read a paper on the meridional arcs measured in the progress of the coast survey, in which the length of the quadrant is considered as 2000 meters greater than the 10,000,000 which the base of the metric system was supposed to represent. This corresponds to an error in the theoretic value of the meter of $\frac{1}{200}$ of an inch.

Professor Hough, of the Dudley Observatory, described a new

Automatic Registering and Printing Thermometer,

which consists of a glass tube bent in the form of a siphon, the closed leg of which is filled with alcohol and the open one with mercury. On the surface of the mercury in the open end, there rests an ivory float suspended from a delicate balance, having platinum wire attached to each end of the lever. When the column of mercury in the thermometer tube rises or falls from the effect of temperature, the platinum wires dip in small mercury cups underneath them, thereby causing a current of electricity to pass through one of two electro-magnets operating mechanism for giving motion to a fine micrometer screw. The motion of this screw elevates or lowers the balance, thereby breaking the circuit. Whenever a change of temperature equal to one tenth of a degree Fahrenheit occurs, the magnetic circuit is completed, and the screw is moved a space equivalent to the change in the hight of the mercury in the thermometer. At the same time the clockwork moves the type wheels indicating the temperature, which is printed at the end of each hour on a slip of paper moving in front of them. A pencil held against a revolving drum also records a continuous curve, exhibiting at a glance the hight of the thermometer.

Professor Feuchtwanger referred to the

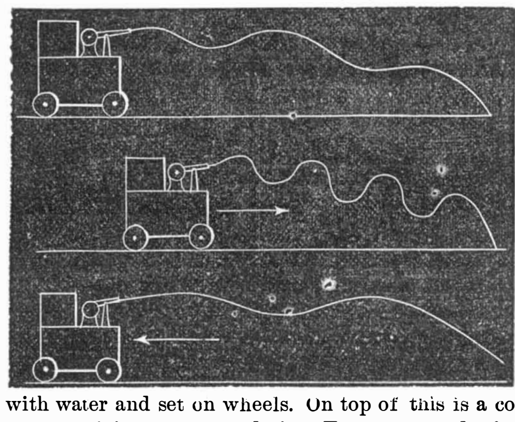
Existence of Live Mammoths,

and stated that the discovery of the mammoths in Siberia, in the deep gorges of the mountains near the Lena Viner, which was lately published as having been made by a scientific Russian convict, who saw five living animals, 12 feet in hight and 18 feet in length, with projecting tusks four feet long, excites some discussion in Europe. It is worthy of inquiry whether the mammoth of the past tertiary period, discovered during this century in Siberia, near the same river, can have any relation to the convict's discovery. Thousands of these animals have been found buried in the ice, with their well preserved skins, and thousands of tusks are brought to England to this day for the use of the turner. These are of nearly the same dimensions of those seen by the Russian. The convict has received an unconditional pardon on the recommendation of scientific men who have investigated his statements and believe them to be true.

Professor E. S. Morse read a paper on the subject of

Variations in Wave Lengths,

in which he first alluded to the discoveries of Proctor, Huggins, and others in accounting for the displacement of lines in the spectrum in observations of celestial objects. It is well known that when a star is approaching the observer the luminiferous waves emitted by it are crowded together, and on the contrary are separated when the star is receding. To illustrate this phenomenon, the speaker exhibited the instrument represented in our engraving. It consists of a tank



filled with water and set on wheels. On top of this is a compartment containing compressed air. From one end of the tank a pipe protrudes, which is moved up and down at a fixed rate by simple clockwork. When the cock is opened, allowing the water to escape from the pipe, the stream assumes a sinuous line, which may be shown, if brilliantly lighted, across a large audience hall. This undulatory stream, when the tank is at rest (Fig. 1), illustrates a luminiferous wave from a stationary source. To exhibit the shortening or lengthening of the waves of light by the approach or recession of the luminiferous body, Mr. Morse simply moves the apparatus rapidly back and forth on the table. As the apparatus moves with the direction of the stream its undulations are crowded together, and the waves are consequently shortened (Fig. 2). On the other hand, when the motion of the apparatus is in an opposite direction (Fig. 3) the waves are proportionably lengthened. The advantage of this illustration is that it exhibits precisely what takes place in the luminiferous waves approaching or receding from the observer of celestial bodies, producing the displacement of spectrum lines.

There was further

Discussion of the Darwinian Theory

between Dr. Dawson and Professor Morse. The former gentleman argued that the making of monkey and of man is explicable quite as readily, to say the least, on the theory of plan as on that of evolution. The egg grows into the animal and that organism produces the egg again. This is revolution, not evolution. The speaker went on to state that, after its appearance in geological history, every species has a plastic tendency to spread to its utmost limits of form. Then ensues a period of decadence until it may become extinct. He believed that a similar process is true of the human race, that the most ancient form of man is beyond the standard of modern humanity, and that, if the man of Cro magno or Mentone had been sent to Harvard, he would have graduated with the full honors of an average American student. Professor Morse, in support of the evolution theory, replied that, if the high development of the ancient skulls found was such as stated by Dr. Dawson, it only carries man further back. Similarly, in the light thrown upon the history of man by the wonderful discoveries in archæology where we meet with traces of an ancient civilization, with complicated language and manners, we can surely believe in savage hordes, pre-existing, from which this ancient civilization has been evolved. The evolution theory, as compared with that of special creation, presented similar features of the undulatory theory of light as compared with the emission theory. Newton's theory required a new modification with every discovery in optics, so that it became a web of hypotheses. The theory of Young explained all that was difficult, and gave physicists the power of prevision. So with evolution: it not only accounts for existing phenomena, from the modification of a flower or the spot on a butterfly's wing to the genesis of the solar system, but it has endowed naturalists with the gift of prophecy, and enabled them to predict the intermediate forms, afterwards discovered in the records of the rocks.

Professor Washburn, of Hobart College, Constantinople, presented a paper on the supposed relics of man found in the miocene of the Dardanelles, in which he concludes that Mr. Calvert and Sir John Lubbock are mistaken, and that the split bones and marks on the fossils are the work of beasts, and no evidence in reference to the antiquity of man.

It is supposed that the resistance of the etherial medium, shown to exist by the undulatory theory of light, will gradually cause the satellites to fall into the planets, planets into suns, and suns into a common center, after which darkness, silence and death will reign. Mr. H. F. Walling, in a paper on the Dissipation of Energy, suggested the maintenance of motion might be from two reasons. First, a series of chemical evolutions or combustion, similar to what are now going on in the sun under its conditions of enormous pressure, etc., by which undecomposable elements are produced, and from which inconceivably enormous quantities of heat are developed; and the other that the infinite magnitude of the universe would prevent a never ending concentration of masses. It was also suggested that the concentration might be so gradual that catastrophic effects might be avoided, either by tidal influences or by final collisions

A New Method of Measuring the Velocity of Ligh

suggested by Professor Dolbear, consists in observing one of the planets, as Venus, both when approaching and receding from the earth, with the spectroscope. Two lines on opposite ends of the spectrum are measured with regard to their displacement, both in approach and recession. If the lines of red and violet rays move with the same velocity, the displacements would be the same. When they move with varying velocities, the difference gives an approximating measure of the velocity of the light.

Coal Mining by Compressed Air.

At the colliery known as Marie, at Seraing, Belgium, the Cockerill Society has an admirable arrangement for working the underground machinery. Standing in the engine house, with the shaft in front, we have the boiler house behind, and to the right of the boilers the forge for repairs, and to the left the air-compressing machine; while in front is the building over the pit mouth enclosing the winding gear, adapted to secure continuous winding day and night and during all weathers. Attached to the engine is a large fly wheel, 5½ yards diameter and weighing 6½ tuns. By means of cranks, this fly wheel shaft moves two pistons, which work each one in a cylinder. Each of these cylinders communicates with upright boxes, placed at each end, having valves attached at the top, opening inwards, and a discharge pipe with valve, opening outwards, which leads to the reservoir of compressed air. The cylinders and boxes are partially filled with water; and when the pistons are moved by the steam engine, the water is first forced into the upright vessel at one end of the cylinder, correspondingly lowering the level of water in the other vessel. A partial vacuum is thus produced, which the outer air rushes through the valve to fill up. On the return stroke, the water is forced back into this vessel, thereby compressing the air and forcing a portion of it through the discharge pipe into the reservoirs. The same action is carried on alternately at the other end of the cylinder, and precisely the same at the cylinder on the opposite side of the machine, with its two upright vessels. The principle is that of the common double action air pump. The disks of the pistons are brass, and the piston rods are coated with that alloy. Each cylinder is 18 inches diameter, and 4 feet 10 inches long. A stopcock or valve is fixed between the compressors and the reservoirs, to cut off communication with the machine during the period of stopping. The air reservoirs are two boilers, each 13 yards long and 5 feet diameter. The air thus propelled into these reservoirs carries with it a portion of water, which settles in the first boiler and is thence, by means of an ½ inch pipe, returned to the compressors. Each stroke of piston compresses about 12 gallons of air to a pressure of three atmospheres. The machine at the Marie Colliery is generally worked at a pressure of four atmospheres (60 lbs). From the reservoirs the air is led by iron tubing of 3 inches diameter and each portion 16 feet in length, is furnished with accurately turned ends. The pipe descends the pit, and runs along the main gate road. From this, branch pipes, 2 inches diameter, lead to the various and numerous works. The joints are fitted with india rubber rings and tightly screwed. The pipes are made from best iron, and admit of being turned in the cold, to suit the various windings of the roads, without fear of fracture. In this pit a total length of nearly a mile of piping is fitted up, and so perfectly that there is not the slightest sensible loss to be observed.

The application of this motive power—or, rather, transmission of power—to the various mining operations, to tunnelling, sinking, driving, coal-hewing, etc. has necessarily induced various forms of apparatus. Some act, as for coal, by means of a revolving cutter working horizontally, others with a percussive action, cutting a groove, in imitation of the ordinary manual operations. Others, again, act solely by percussion to form shot holes. The nature of the material also modifies the form of drill or punch. The form which appears to receive the most favor for hard rocks is of the shape of a

Z, and, in the best arranged apparatus, is made to revolve in such manner that consecutive strokes do not fall in the same place.—*Mining Journal.*

The Largest Engine in the World.

W. L. C. states that, some time since, the New York *Times* mentioned the pumping engine of the Lehigh zinc mines, at Friedensville, as "the largest stationary engine in the world." A writer in a Pittsburgh paper assails the above statement, and endeavors to show that the engine above mentioned has not even an approximate claim to that distinction, and he states that the great Haarlem engine has a 12 feet cylinder with a 10 feet stroke, and he makes its capacity to be 10,000,000,000 gallons raised 1 foot high in 24 hours. "Now, 10,000,000,000 gallons is 83,388,000,000 foot pounds per day, or 57,908,333 foot pounds per minute, equivalent to 1,755 horse power. But the designers themselves only claim 500 horse power for their engine, and must feel flattered by the Pittsburgh estimate. The Lehigh engine was originally designed and rated at 3,000 horse power, and, if called upon, could increase even that figure. Where, then, is the comparison?

The famous engine of Haarlem is nothing but a familiar single acting Cornish engine, having an 84 inch cylinder, with the attachment of Simms' combined cylinder, which is also single acting. Its normal speed is 6 strokes per minute, and who can make more than 500 horse power out of that at any reasonable pressure? But the Lehigh engine is a beam engine with a plain cylinder 110 inches in diameter, 10 feet stroke and double acting. It is now working at 11 strokes per minute, or a piston speed of 220 feet. What is there, then, in the Haarlem engine to entitle it to rank above the engine at the Friedensville mines?

I suspect, however, that my Pittsburgh friend would care little for the reputation of the Haarlem engine, if his own could be shown to be the veritable leviathan. But he describes his engines as having two 64 inch cylinders of 14 feet stroke geared to one shaft and fly wheel, each actuating two pumps, and each capable of working independently. Two 64 inch cylinders give an aggregate piston area of 6,434 square inches, while the piston area of the Lehigh engine is 9,504 square inches, or nearly one half greater. In fact, we have half a dozen blowing engines in the Lehigh valley which show a greater volume of cylinder than that at Pittsburgh. The Lehigh engine was designed by Mr. John West, the company's engineer, to bear a pressure of 60 lbs. with a factor of safety of 8, or a pressure of 80 lbs. with a factor of 6.

Finally, the justice of comparing, at all, the work of the Pittsburgh engines, which are practically two distinct engines, with the single engine of the Lehigh zinc mine is not to me apparent."

Cumberland Gap Cave.

H. B. N., a member of the 42d regiment O. V. I., writes as follows:

In the summer of 1862, while the Federal forces were occupying the Gap, a cave was discovered by our men, while felling timber on the south side of the mountain. Start from the point where all the roads converge to pass the Gap, and follow the Virginia road along the side of the mountain in an easterly direction, until you pass the spring or rather creek which gushes out of the mountain; leave the road at the curve just beyond this spring, and take a diagonal course up the mountain until you reach an altitude of about two hundred feet above, and five hundred feet east of, the spring, and you will find the place.

We were encamped at the foot of the mountain; and although we were not generally much given to ecstacies over holes in the ground, the discovery had sufficient force to rouse a few of us, who soon came to a small depression in the mountain side, as if a large tree had been uprooted, leaving a hollow some six or eight feet in depth. At the bottom of this pit was a small rectangular opening in the rocks, leading in a horizontal direction, and just large enough to admit one person at a time, on all fours. This did not quite meet our expectations, as we thought it not much of "an opening for young men." Lighting my candle, I made a venture, and found, after creeping a few feet, that the passage suddenly widened in all directions. Rising to my feet, and taking a few steps forward, I held the light above my head; but nought could be seen. Beyond the few feet of rocky floor I stood upon, all was impenetrable darkness and profound silence. From the upper ceiling or outer wall not a ray of light returned. A shout brought back a long succession of echoes, and died away in a murmur, bringing evidence that we stood in the entrance of a large cavern with irregular walls. Getting our party together, we followed along one side of the cavern until we came to a kind of rostrum, rising abruptly from the floor to the hight of eight or ten feet. At the front edge, and near one corner, stood an irregular column of alabaster, by which means we were enabled to mount the daïs, which proved to be a horizontal platform extending backward at a slight inclination, and joining the ceiling at a sharp angle some distance back. This grotto was filled with stalactites of dazzling whiteness, so thickly set as to bar our entrance. Instead of the counter parts, the stalagmites, growing up like cypress trees from the ground beneath as usual, the material had been evenly distributed by the inclination of the rock, thus making a floor of glittering crystal, and fringing the front of the rostrum with a pendant veil of silver whiteness and dazzling brilliancy.

Holding our lights above our heads and looking towards the interior of the cavern, we discovered the ceiling, as far as our lights could reach, to be much more brilliant in scenic effect than anything we had yet seen. It seemed as if we were looking up into an immense dome hung with tapestry. So perfect was the imitation of heavy folds of drapery that no repetition of the view could dispel the illusion. The column that had helped us to our position was now seen to be an irregular cluster, some six feet in diameter and extending from the floor to the ceiling.

Among other features of interest was a small stalactite in the form of a quarter circle, with its base attached to the under side of a horizontal rock; it turned on a radius of about five inches, and terminated in a sharp point at right angles to the base line. The drops of water forming this had evidently followed the line of some insect's web.

When we left the chamber, everything was intact, not a stalactite broken or a crystal displaced, save a few specimens we brought away. But when I saw it the next time, "the hand of the spoiler had been there." During the "unpleasantness," I was the witness of much vandalism, but nothing ever seemed less excusable, or furnished a stronger proof of the irredeemable destructiveness of some natures, than the wanton spoliation of these beautiful specimens of the Creator's handiwork. I visited the cave several times before we broke camp, each time finding new chambers; and I left it with a feeling that I had only walked along a corridor, and had not entered the palace proper. If the cave has not been entered since then, these eleven years will afford some evidence as to how fast Nature repairs her desecrated shrines. I write this in the hope that some one may have made or will make further exploration, and report the same."

The Enormous Waste of Fuel in Stoves.

The scientist tells us that fully fifty per cent of our fuel is wasted; that is to say that, as each kind of fuel will, by proper combustion, evolve a given amount of heat to each one pound of such fuel, and as our machines for the conversion of fuel into heat, as now constructed, do not operate without a loss of one half of the heat evolved, the waste is as above stated. Our country has a population of about 50,000,000. It can be put down as a low estimate for each individual, a consumption of fuel, either wood or mineral, equal to at least one tun of coal, with a value of $6 per tun, equaling in the aggregate $300,000,000, one half of which ($150,000,000) is lost. If this be true, this enormous waste should be seriously considered by the inventor, improver, and manufacturer of the stove, in view of its improvement, and a saving of at least a portion of this enormous waste, which, if reduced to twenty or even five per cent, would be of great value to our country.

Science has already done her part of the work, and it remains for the inventor and improver of stoves to do his part. Science tells us the amount of heat each pound of fuel will produce; the conditions required for perfect combustion; the laws governing the operations of heat; the nature of the materials used, and surfaces favorable for operating with heat. Science will go no farther. The practical man must take up the facts science has given, and work on her suggestions to embody, in operating devices, those principles of construction and operation which will result in the effects desired to be secured and attainable.

The usual custom, demanded by the construction of the stove, of adapting its use for service, either for warming in all weathers or in all kinds of cooking, is by the regulation of the draft dampers, by which the combustion of the fuel is increased or diminished; or in other words, the same amount of fuel is used, in the fuel chamber, in a January thaw, or the early spring months when but little heat is required as when the outside temperature is below zero; or when a pan of biscuit or a custard is to be baked, as when a loaf of bread or a custard pie; and to diminish the amount of heat for our use, we check the supply of air to support combustion, and thus prevent perfect combustion, and evolve carbonic oxide, which, by reason of a sluggish current, is more liable to escape into the room to impair the health of our families; while on the other hand we are permitting a good portion of our fuel to escape unconsumed.

What is desired on the part of the people, and is required to effect a saving of fuel, is a stove, for both warming and cooking purposes, which will be capable of dispersing a larger portion of the heat evolved from the fuel in combustion, by all the ways in which heat is made to effect the warming or heating of bodies or substances, which should be made to embrace not only heating by radiation and convection, but also heating by transmission and reflection; and the control of the degree of heat should be obtained by the quantity of fuel in perfect combustion, used or necessary to give the amount of heat required, which quantity of fuel should be so regulated as to adapt its mass to the operations to be performed.

Some may say this is impracticable, and that these operations cannot be secured in stoves. In this we differ; and further, we believe that these operations will eventually be secured in modes both simple and practical. Science has given to us facts and figures, and the inventor and improver of stoves must use these, and adopt the proper means to accomplish the ends desired to be secured; and he who succeeds will do a greater work for the people than has been done by any one man for many years, and will rank with Watt, Fulton, Henry, Morse, as benefactors of our race.—*Stove Trade Gazette.*

A. M. E. states that he once saw, in Boston, the lever of a safety valve fastened down by a ¾ inch iron, driven into a brick wall so that it was impossible to raise it with any amount of steam; and this was directly under a room where some twenty-five men were at work. And still people wonder why some boilers explode!

A GRAND MEDAL FOR CLEVELAND.

THE WILSON SEWING MACHINE TAKES THE GRAND PRIZE AT VIENNA.

THREE separate dispatches from Vienna combine to dispel all doubt as to what sewing machine has won the first honors of the Great Exposition. The first was a special to the New York press on Monday, and was as follows:

VIENNA, August 15, 1873.

The Wilson shuttle sewing machine was awarded the grand prize at the Vienna Exposition for being the best sewing machine.

The second was the regular Asssociated Press report, compiled from a long special to the New York *Herald*, in which the "Wilson Sewing Machine of Cleveland, Ohio," was named as among the exhibitors which received "medals for merit," the highest class of premiums awarded at the Exposition. *All other sewing machines will receive simply an award for progress.*

The third was a private cable telegram received yesterday from Vienna by Mr. Wilson himself, which was as follows:

VIENNA, August 19.

You have received five medals—two for merit and three co-operative.

The meaning of this is that the Wilson machine has received the grand medal *as the best sewing machine*, and a second medal as the machine best manufactured—that is, embodying the best mechanical workmanship. Besides these, Mr. George W. Baker, Assistant Superintendent of the Wilson Sewing Machine Company, receives a special medal for excellence of workmanship on the machine; Mr. Williams of this city receives a medal for best sewing on leather, done by the Wilson; and Miss Brock and Miss De Lussey receive still another medal for best samples of family sewing and embroidery, done on the Wilson machine. This sweeps the entire board. Not only has the Wilson sewing machine been pronounced the most capable and efficient sewing machine in the world, but its work, on both dry goods and leather, is pronounced superior to that of all other machines. This verdict at a World's Fair, where all the leading sewing machines of both continents have competed, before a thoroughly competent committee for more than three months, is the most complete triumph ever won by a sewing machine. We congratulate Mr. Wilson, we congratulate Cleveland on this admirable result. The people of the United States can henceforth be assured that in buying the Wilson machine for $20 less than any other first class sewing machine is offered, they are purchasing the best sewing machine ever offered to the public. It is the people's own machine, made to do the people's work, and offered at a price which every one can afford to pay. It is the people's machine which has won this triumph; the judgment of the Vienna Committee only confirms the verdict that the masses had long ago reached by actual experience.—*Cleveland Daily Leader, August* 20.

The National Lifeboat Service.

Although, in the perfection of its lighthouse system, our country is unsurpassed, there are many improvements in progress in the lifeboat service. The beacon serves to warn vessels from dangerous points, but, as in the case of the ill fated Atlantic, its warning does not always serve to avert the calamity it is designed to prevent. Hence a system of coast guards, comprising staunch lifeboats and thoroughly drilled men, ready to put off to a stranded ship at an instant's warning, has been, for a long time past in England and more lately in the United States, recognized as a necessity. In 1848, an appropriation was made by Congress for the establishment of life-saving stations on the volunteer principle, but experience proved that concerted action and full efficiency were only to be attained by proper training, and therefore the service has been placed under regular naval supervision. Lifeboats have been placed along various points on the Atlantic coast; and we learn from *Inter-Ocean* that two stations are now being established at Evanston and Calumet, on the lakes. The report of the operation of the system during the season of 1871-72 shows that the number of wrecks on our eastern coast was 22. The value of the vessels lost was $227,300, and of their cargoes, $281,800. The amount of property saved aggregated $299,756, and lost, $208,344, 206 persons being also rescued.

The Highest Land East of the Mississippi River.

Professor T. Sterry Hunt, in a paper on the mountains of North Carolina and Virginia, recently communicated to the *Tribune*, says that the region bounded between the Blue Ridge and the branch known as Iron Mountain, Smoky Mountain and the Unaka range, is the most elevated range east of the Mississippi. The summits of the Blue Ridge in North Carolina rise to nearly 6,000 feet above the sea, while the highest points of the Unaka range, in the same State, reach about 6,700, or more than 400 feet higher than Mount Washington, the culminating point of the White Hills of New Hampshire. This region, though abundantly wooded, watered and arable, besides possessing a delightful climate, is in the condition of primeval forest, from the fact that it is cut off, by its position, from the markets, and hence offers little advantage in remuneration of labor to the agriculturist.

The August Meteors.

G. C. T. says: "On the night of August 10, one hour before the moon arose, I kept my eye in the direction of *Perseus*, whence emanated eight meteors, two of which were of unusual brilliancy. The first traveled eastward, parallel with the horizon for 90°, with a uniform trail of 20°. The other ascended to the zenith; it also had a trail of 20°, with brilliant lateral scintillations, increasing in width."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From August 2, to August 14, 1873, inclusive.

ANCHOR.—C. A. Chamberlin, Pittsburgh, Pa.
ARTICLE OF DRESS.—E. La P. Daniels (of New York city), London, Eng.
BALE TIE.—E. P. Jones (of Shell Mound, Miss.), London, England.
BOOT STRETCHER.—D. Harris, St. Louis, Mo.
CAR PLATFORM.—E. Miller, New York city.
DOVETAIL JOINT.—T. Hall, Northampton, Mass.
ELECTROMAGNETIC ENGINE.—C. Gaume, New York city.
FURNITURE CASTER.—J. B. Sargent, New Haven, Conn.
JOURNAL BEARING.—J. Eccles, Philadelphia, Pa., *et al.*
MATTRESS AND LIFE PRESERVER.—J. F. Peck, Springfield, Mass.
PILE DRIVER.—P. S. Justice, Philadelphia, Pa.
PROPELLER.—N. A. Patterson, Cleveland, Tenn.
RAILROAD RAIL.—J. B. Johnston, New York city
RAILWAY SIGNAL.—F. L. Pope, Elizabeth, N. J.
SEWING MACHINE.—D. Shedd, New York city.
STEAM PUMP.—D. Douds *et al.*, New Castle, Pa.
THEATER SEAT.—P. W. Nolan, New York city.
TOY.—A. H. Cramp, New York city.
WOOD PAVEMENT.—B. B. Hotchkiss, New York city.

Recent American and Foreign Patents.

Improved Pen Holder.

John S. Orndorff, Virginia City, Nev.—The object of this invention is to furnish an improved pen holder, which softens the scratches and jars of steel pens, producing an easy hold without cramping or tiring the fingers. The invention consists in attaching a hollow elastic sleeve to the stem of a pen holder, so as to confine a quantity of air and form a cushion.

Improved Farm Fence.

Winfield S. McKenzie, Rockwall, Texas.—This invention consists in the posts and pivoted or tilting bars for supporting a fence formed of wires or other material; in the combination of the loops and bars with the bars or posts that support the fence; and in the portable brace for strengthening an inclined fence against pressure. By this construction the weight of the panels forces the bars downward upon the loops, clasping the panels firmly between the bars with a greater or less force, according to the weight of said panels. The bars and loops may be used for connecting the panels to vertical posts, if desired.

Improved Rotary Engine.

George W. Cummings, Conneaut, O., assignor of one half his right to Daniel W. Hazeltine, of same place.—The object of this invention is improvement in the class of rotary engines and pumps having a piston box placed eccentrically within the steam cylinder and controlling the piston arms. The piston arms are arranged concentrically with the steam cylinder and tightly fitted to it by means of springs and packing.

Improved Signs.

William B. Lambert, Geneseo, Ill.—This invention consists in applying, to the backs of detachable letters, pivoted spring jaws or arms, which are adapted to be sprung under or into notches in a rod supporting the letters, said springs serving, in connection with hooked plates or clips attached to the letters and fitted on the rod, as a medium for firmly retaining the letters in position while not preventing their easy removal when desired.

Improvement in the Manufacture of Beer and Yeast.

Louis Pasteur, Paris, France.—The object of this invention is to eliminate and prevent the multiplication of microscopic organisms by the following means, namely: First, obtain pure yeast by separating the organic germs foreign to brewers' yeast; second, treating the wort while cooling from the time it leaves the copper, in which all the germs of disease are destroyed, until it reaches the vats, tuns, or fermenting apparatus, and even after fermentation in such manner that it shall not again receive, either by unlimited contact with the open air or with the vessels employed, any pernicious germs capable of multiplying and of subsequently changing the condition of the product; third, cooling in closed vessels in the presence of a limited supply of filtered air or carbonic gas.

Improved Dovetail Machine.

Alfred C. Van Alstine, New York city.—This invention consists in the improvement of tenoning and sash dovetailing machines. This machine is mainly arranged like an ordinary tenoning machine. Next to a tenoning head is a cope head; next to cope head is a dovetailer, which is set as close to cope head as it can be and run clear; it is mounted on a bar, which is pivoted to the machine in such a manner that it can be set perpendicularly, or inclined by swinging the bar on its pivot. Another dovetailer is set far enough to allow the check holder to tip over while passing between. The dovetailers are driven by belts from an upright shaft. There is also other improved mechanism of which a clear idea cannot be imparted without the aid of a drawing. To operate this machine for dovetailing sash stiles, the carriage is raised by means of inclines and screw, so that the sash stile, when laid on the carriage, will be above and clear of the head and cope; the upper head is then set so as to cut the stile to the required thickness; the dovetailer is then set so as to give the dovetail or diagonal cut, and another dovetailer is set so as to cut the last part of the dovetail mortise; then the stop is adjusted to give the depth of cut required; the stile is then put on the carriage against the gage bar, and passed through, and is finished at each end by one operation. The stiles for the bottom sash are run with the face of the stuff down, and the stiles for the upper sash are run with the face up. The inventor's address is 236 East 42d Street, and the machine may be seen in operation at 124th Street, East river, both in New York city.

Improved Ice Cream Freezer.

Antonio Lucetti, New York city.—To the tub of the freezer is connected the ice receptacle, which is made with a spout leading into the tub, through which the pieces of ice enter. The spout of the receptacle is provided with a gate to enable the outflow of ice to be regulated as required. A tube extending up allows the cold air from the ice to pass into the middle part of the receiver, so as to freeze the middle part of the cream as quickly as the outer parts. To bars crossing the open lower end of the tube and secured to the bottom of the receiver is attached a pivot, which works in a socket in the bottom of the tub. With the upper end of the tube is connected a vertical shaft which by suitable mechanism communicates with the crank for operating the machine. In using the freezer, the receiver is revolved by turning the crank with the right hand, and a spatula is controlled and guided with the left hand. The apparatus should be so arranged that the operator, while turning the crank with his right hand, can open the gate with his left hand to admit ice to the tub as required.

Improved Machine for Dressing Millstones.

Joel W. Parish, McFarland's, Va.—A small rectangular frame is arranged so that a platform, sliding forward and backward on a long frame, will carry the picks parallel with the furrows; that the shifting of the frames will adjust them from line to line for fine or coarse cracking; that by turning the pickstock the picks can be adjusted for cracking or furrowing; and that by shifting the socket piece on the pickstock the picks can be adjusted to the angle of the furrows, and by the fast and slow feeds the picks can be moved along the stone radially at the requisite speeds for the different kinds of work.

Improved Water Wheel.

Elyanus Hackett, Ulysses, Pa.—This invention relates to modes of utilizing the reactionary power of water, and consists in buckets having peculiarly shaped curves; in a novel mode of applying adjustable gates; and in combining with the ordinary wheel a subjacent second one which receives the reactionary impact of the water from the first and utilizes it in a very effective manner.

Improved Tilting Gate.

John Bartholf, Hillsborough, Wis.—This invention consists in the combination with double main posts of two folding half gates, which fold up into a vertical or inclined position, as may be required.

Improved Splice Joint for Railroad Rails.

William D. Lindsley, Wathena, Kan.—This invention consists in a fish plate having a solid flanged base that fits an excised part of the inside base flanges of rail, and rests, with an offset, upon a shoulder of the same to give strength to the rail ends and cause them to last as well as other parts of the rail, and at the same time to take the strain off the bolts.

Improved Pruning Knife.

Abraham C. Hulse, Palmyra, Ill.—This invention relates to pruning knives, and consists in a novel mode of combining the parts to form a pruning knife which shall be simple, effective and durable. It also consists in a peculiar mode of adjusting the relative position of the blades to take up the gradual wear upon them.

Improved Grindstone.

James F. Green and Sidney H. Green, Haverstraw, N. Y.—The object of this invention is to produce a perfectly true and central fastening for the cranks of grindstones, for the purpose of permitting their placing on and detaching at pleasure, economizing thereby in space and freight in shipping. The method provides a bushing cemented centrally to the grindstone, with a detachable crank. The different pieces may be separately packed, resulting in less damage to the goods and reduced expenses for freight.

Improved Hose Coupling.

Simon Ingersoll, Stamford, Conn.—This invention consists of a couple of short sections of metal tube, which couple together by a screw collar swiveled to one of them, and in connection therewith each section is provided with a clamp composed of two semi-circular parts connected together by flanges and bolts for clamping the hose on the metal tubes. The clamps are attached to the metal tubes by stud pins, which prevent the hose from slipping off the tubes endwise, as when clamped thereto by the ordinary two part metal clamps not connected to the tubes.

Improved Car Coupling.

Gebhard Koeb, Springfield, O., assignor to himself and Jacob B. Korn of same place.—The mouth of the bumper is made hopper-shaped, and with a horizontal opening between the inner edges of the upper and lower inclined sides of said mouth. The upper and lower inclined sides of a wedge-shaped cavity meet the upper and lower inclined sides of the mouth of the bumper head, just in front of the hole for the coupling pin, so as to form ribs, which angles serve as fulcrums to the coupling link, to allow its outer end to be raised to enter the bumper head of the adjacent car by lowering its inner end. The coupling pin passes down through a hole in the bumper, and upon its rear side is formed rack teeth connecting with a small gear wheel, attached to a rod. The rod passes through and works in holes in the flanges formed upon the upper side of the bumper, and which rise sufficiently high to protect the gear wheel. The ends of the rod extend out to the side of the car and terminate in a crank, or hand wheel. The lower end of the rack forms a shoulder, which rests upon the link, so that by turning the rod and gear wheel in the direction to force the pin downward, the inner end of the link will be lowered, raising the outer end of the said link to adjust it to enter the bumper head of the adjacent car. As the pin is raised, the outer end of the link will drop by its own weight. To the rod is attached a spring to hold the pin in any position.

Improvement in Attaching Knobs to Spindles.

Franklin M. Merriam and Joseph B. Merriam, West Meriden, Conn.—The spindle is made square, and has one, two, or more transverse notches or grooves formed upon the side of one end to receive the screw that fastens the neck of the knob. Upon the outer end of the spindle is cut a screw thread to receive the nut, the outer middle part of which is recessed to adapt it to serve as a cap to receive the neck of the other knob, which is secured to the spindle by a screw which passes in through a hole in the side of the socket nut, so as to lock the said nut as well as to secure the knob. A sleeve is slipped upon the socket nut to keep the screw from working out. The cavity of the rose is so formed as to receive within it the socket nut and sleeve, and its outer end projects inward so as to cover the ends of the said nut and sleeve, and fit upon the neck of the knob. The inner side of the plate of the rose is recessed to fit upon a washer, interposed between the said rose and the side of the door to prevent the door from being chafed by the said rose.

Improved Wrench.

Michael Bubser, Jersey City, N. J.—This invention is an improved wrench for turning the nuts of fish plate bolts, and other nuts and bolts that require great power to turn them. The base of the improved wrench is of such a length as to rest upon three ties at the same time. To the middle part is attached a wide bearing in which a shaft revolves and slides. One of the projecting ends of the shaft is enlarged, and in its outer end is formed a square hole of sufficient size to receive the nut to be operated upon. To the other projecting end of the shaft is attached a chain wheel, which is so small that its rim will not come in contact with the tie or ground. An endless chain, passes around the chain wheel and also around another chain wheel attached to a second shaft. By turning suitable screws the bearings may be raised to tighten the endless chain. Locking nuts are placed upon these screws so that the two halves of the bearings will be held close together. To the second chain wheel is attached an arm, to the outer end of which is attached a bolt, which passes through a longitudinal slot in a bar, and is provided with a hand nut. The other end of the bar passes over the projecting end of the wrench shaft, and is secured in place. Upon the end of the bar is formed a handle for operating. The arm and slotted bar thus form an extendible crank, which may be conveniently extended and contracted to give a greater or less leverage as more or less power may be required. The machine may be inclined in one or the other direction, as may be convenient in operating it. By this construction, as the machine is operated to turn the nut in one or the other direction, the movement of the nut upon its bolt will move the machine out or in.

Treating Cotton Seed Oil to Render it Drying.

Henry Goldmann, New York city.—This invention consists of a chemical treatment of cotton seed oil, to prepare it so that it can be used in the arts as a substitute for linseed oil. The inventor dissolves bichromate of potassa in water, heats to boiling point, carries into this clear cotton seed oil, agitating and mixing strongly for two hours; after twenty-four hours the oil is drawn off into another vessel, where it is again added gradually, under constant strong agitation, *aqua regia*, freshly prepared, diluted with water. After settling the oil is again drawn off into another vessel, where it is mixed with oil of vitriol, diluted with water under agitation. It is then allowed to stand till clear enough for use.

Improved Harvester Cutter.

Frederick R. Sutton and William O. Sutton, Wellington, Ill.—This invention consists of independent ledger plates for the cutters of mowers and reapers, secured to the fingers by a lip at each rear corner turned down on the edge of the finger, and a bar above extending along the whole series, and secured detachably to the front edge of the finger bar, so as to be readily taken off to remove the plates for sharpening them. At the other ends the plates are secured by a notch in the end, and a notch or slot in the finger, as in other cases

Improved Wagon Seat Fasteners.

George Ruston, Freeport, Ill.—The object of this invention is to provide a fastener or latch, which is applied to both sides of a wagon seat, to connect the same firmly to the body of the wagon, so that the displacing or detaching of the seat is prevented, and a secure seat obtained. The invention consists of a hinge fastener combined with a latch applied to the sides of a wagon seat, the hinge fastener with bent end closing over the guide strip of the wagon body in connection with a pin locking into a hole of the same.

Improved Water Regulator for Boilers.

Calvin J. Weld, Brattleborough, Vt.—This invention consists, mainly, of the employment of a small tube or cistern by the side of the principal receiving cistern or vessel, into which small cistern the water is received and flows from it into the boiler, and in which is arranged a float having such connection with the cock for shutting the water off from the boiler that, when the water rises to the required level in the boiler, it will close the passage, and open it again when the water falls.

Improved Leg for Furniture.

James C. Orr and James M. Baird, Wheeling, W. Va.—This invention consists in constructing the legs of tables, desks, chairs, etc., in two parts, made and applied separately at right or other angles to each other, at the corners, and fastened separately to the table or other article, and fastened together at the bottom by a kind of lock-joint, secured by a button at the top on the table.

Improved Disinfectant Compound.

Jonathan Hilton, New York, N. Y.—This improved deodorizing and disinfecting compound is nitric acid mixed with oil of tar. This mixture is agitated with carbonate of lime. Sulphurous acid is caused to pass through, when, after settling, the fluid is separated from the solid parts. The solids are then dried, and, when reduced to powder, are fit for use. The fluid product is also very useful for pouring into sinks and other conduits requiring disinfection.

Improved Musical Railway Signal.

Reed A. Filkins, Cheshire, assignor to himself and Augustus R. Tyrrell, Savoy, Mass.—The object of this invention is to avoid the disagreeable and monotonous whistling of locomotive engines, and substitute therefor a more satisfactory method of signaling, and at the same time to indicate different signals, by the combination of harmonious sounds, or by various successions of sounds. This object is accomplished by providing a series of whistles in connection with the steam boiler of a locomotive engine so that one or more of said whistles may be brought into action by the engineer

Improved Hoe.

James M. Baird, Wheeling, W. Va., assignor to himself and Richard Stanley, same place.—This invention consists in an acute angled socket for attaching hoe blades to handles, the part or arm of the same which is to be secured to and cover the end of the handle being of semi tubular form, and provided with an inner projection or lug, and the other part being flat, or nearly so, to adapt it to be applied to the back of the hoe blade, to which it is secured by means of rivets.

Improved Hoisting and Conveying Apparatus.

Charles B. Stough, Monticello, Ill.—This invention consists of a portable apparatus, having a crank frame and roller frames, over which an endless chain is stretched, which is provided with adjustable links and hook carriages at suitable distances for hoisting and conveying the receptacles for the materials. Two of the roller frames are placed on the ground; two others are combined with the crank frame at any required hight above the lower frames and connected by guides which convey the boxes to the place of work. The chain is so constructed that it can pass over the rollers, which have separate shafts and are placed at some distance from each other, to allow the passage of the hooks between them.

Improved Combined Brake and Propelling Mechanism for Cars.

Jacob W. Hill, Jefferson, Iowa.—This invention is an improvement in the class of apparatus for propelling and braking railway trains, in which air is forced into suitable receivers when the train is checked, and its expansive power utilized into subsequently starting or propelling the train. The operation is as follows: When the train is running on a level, or when it is to be stopped or impeded by the brakes on down grades, so that all the steam is not required for driving it, the throttle valves will be closed, and air inlet valves will be allowed to act, thus converting the engines into pumps, which, being actuated by the running gear of the car, will force the air through passages into the receivers, which are connected together by a pipe, so that all may be filled to the extent of their capacity to retain it—say two hundred and fifty pounds to the inch; then valves will be fastened open to stop the pumping. At any time when more power is required than the steam is capable of exerting, the valves will be released so they can close, and the throttle valves will be opened, thus converting the apparatus into a motive power, which, being impelled by the compressed air, will largely aid the overburdened engine in its work.

Improved Churn.

Esau Archer, Davisville, W. Va.—In this invention the body of the churn is hung between standards so as to have a universal movement to adapt it to the dasher, which, worked by a crank, is provided with gearing so that it has both a rotary and an up and down motion.

Improved Smoke and Steam Burner.

John W. Kingman and Adolphus Eurgens, Laramie City, Wyoming Terr.—A box or trough, open at its top, is supported upon pivots attached to its ends, which work in bearings attached to the front and rear walls of the fire box. The coal to replenish the fire is first placed in the box, where it is exposed to the full heat of the fire. This heat expels the more volatile gases, which, with the smoke, are at once ignited and consumed. At the proper time the box is tilted, and the coke is dumped into the fire, so as to replenish without checking it. A steam pipe leads from the exhaust of the boiler, or from the boiler, and passes through the fire upon the grate. The pipe is connected, by a hollow pivot or other convenient means, with a pipe which extends along the bottom of the box, and has numerous holes formed in it. By this means the steam is superheated while passing through the pipe, and is discharged among the coal in the box, where it is decomposed, mingles with the smoke and volatile carbon from said coal, and is consumed.

Improved Shutter Worker.

Seth R. Foster, St. John, Canada.—This invention consists of an improved device for connecting all the window shutters upon each row, or upon each side of a storehouse or other building, so that they may be all closed or opened at the same time, and from any floor of the building upon which the operator may happen to be.

Improved Chair Seat.

James P. Sinclair, Elbridge, N. Y.—This invention relates to an improved mode of forming seats, backs for chairs, settees, etc. Strips of wood are placed edge to edge, and the ends enter grooves in the inner edges of the side bars of the frame. The forward edge of the forward strip and the rear edge of the rear strip enter grooves in the inner edges of the front and rear bars of the frame. The adjacent ends of the bars of the frame are framed and secured to each other in the ordinary manner. A strip of galvanized iron, flat or a wire, is passed through holes in the strips and its ends enter and are secured in holes in the front and rear bars. One or more of the metal strips may be used as may be required.

Improved Fireproof Floor and Ceiling.

William T. Butler, Chicago, Ill.—The joists are made of wood and form abutments for brick arches at the top or for the floor, and so as to support inverted arches for the ceiling or bottom. Braces of iron may be used for tying the joists together, the design being to keep the joists rigid and at a uniform distance from each other. A succession of arches forms the entire support of the floor. These arches are sprung from one joist to another, with bricks made for the purpose, supported by the beveled surfaces or abutments of the joists. The floor may be of any description. The lower part of the joist has beveled surfaces, which support the arches The bricks which form the arches come in contact with each other and form a continuous incombustible surface beneath the joists. The plaster or ceiling surface is laid directly upon the arches, thus dispensing with laths

Business and Personal.

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

Notes & Queries

L. S. asks: Photographs can be taken on paper which has been dipped in a solution of bichromate of potash, but the shades are not dark enough. How can I make them darker?

J. H. C. says: I have an eye stone (as described by Mr. J. Stauffer on page 131, current volume), 3½ inches in circumference. Where could it have come from?

J. H. P. asks how small brass castings, such as keys, are made, and is it possible to cast more than one key in the same mold? If so, how is it best done?

J. C. P. asks: How is gold leaf put on books, leather, etc.?

D. U. B. says: I have varnished (copal varnish) and polished some tiles made from Portland cement. About 20 days after finishing, there came out on the surface a great many small blisters. Can any one suggest the cause and the remedy?

A. G. S. asks: How can an oval cylinder be bored on a lathe, if the shaft be in the center of the cylinder?

Answers to Correspondents

O. B. will find a recipe for a cement for mending leather shoes on p. 129, vol. 28.—E. E. T. can cast brass by following the directions on p. 231, vol. 26. —N. D. can weld iron and steel by the method described on p. 381, vol. 26.—T. G. S. should follow the directions on p. 41, vol. 28, for gilding names on china.—F. H. B. will find a system of filtering described on p. 241, vol. 27.

L. S. asks: 1. Will a bar of iron, suspended by the middle, sustain less or more weight if we groove it the whole length, so as to make the sectional area of a ∩ shape? 2. If it is made of cast iron, and malleableized, will it sustain as much weight as when made of wrought iron? Answers: 1. Less. 2. No.

W. P. asks: Which is the preferable way to heat a medium sized greenhouse (where coal averages from five to six dollars a ton), steam, hot water or simply by carrying the smoke along the floor in a brick flue? I care more for the good of the flowers than the first cost, although that is also an object. Answer: The best plan is to heat by means of hot water pipes. The cheapest method is to conduct the fire through a flue, along the floor. The portion of the flue nearest the fire, say for 30 feet, should be of fire brick; the remainder may be made of drain pipe.

J. W. says: I am told that a pipe ½ inch in diameter and 20 feet long, the end of which is inserted in the bung hole of a barrel, if filled with water will burst the barrel. Suppose that the pipe were 2 inches diameter, and 10 feet long, if filled with water; would it have the same effect? Answer: The pressure on the barrel would be only half as much, in the second case.

W. S. C. says: I am running a 12 horse power threshing machine, in which the power is connected to the drum by means of the ordinary coupling rods. Can I gain any power by applying a belt in the place of the coupling rods, allowing the power the same distance from drum and giving the drum the same speed? Answer: We think not, but would be pleased to hear from any of our readers who have tried the experiment.

H. S. H. says: An oscillating engine has two cylinders one inch in diameter x two inches stroke. How large and how thick should a boiler be to carry a working pressure of 100 lbs. and run at 350 per minute? Answer: Allow from 10 to 12 square feet of heating surface; and if the boiler is cylindrical, with riveted joints, and made of copper, the thickness in inches may be found by multiplying the diameter in inches by 0·002917. If the boiler be made of wrought iron, multiply the diameter in inches by 0·001786.

J. A. H. asks: In the exhibition of Pepper's "ghost," do the rays of light forming the ghost's image come from the front surface of the glass plate (according to the laws governing all rays having an incidence of 50 degrees or less) or do they come from the back surface of the glass according to the laws of total reflection or refraction? Answer: The rays come from the front of the glass, in reality, but apparently from behind.

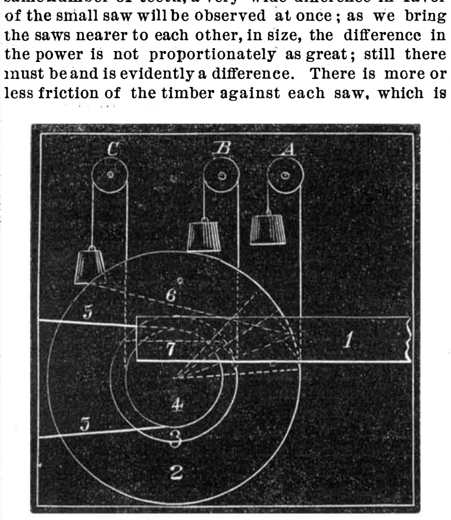
W. K. asks: What is the cause of tubes in a boiler blistering? I am running two tubular boilers they became red hot last summer and scaled off to a depth of ⅛ inch. I used an anti-incrustation powder, and now the old scale is coming off and the tubes show blister. Is it on account of overheating? Answer: The tubes were in all probability blistered from overheat, the scale preventing contact with the water.

D. C. asks: 1. What is the most intense heat that can be got from a blacksmith's fire, fitted with a blower, in degrees Fahrenheit? Which is the most powerful mechanical power? Answers: 1. About 3,200°. 2. In practice, you can probably increase pressure to the greatest extent with the screw.

J. W. S. says: On page 66 current volume, in speaking of the lecture of Dr. Thomas before the Nautical School in New York, he is reported as having said as follows: "The Lapland, which sailed from England one day after the City of Washington, carried such an instrument (the palinurus), which showed that, during the appearance of the aurora borealis, her compass deviated 1½°. This deviation, occurring, as it must have done on the City of Washington, at the beginning of her voyage, would cause her to diverge 20 miles from her course in every hundred," etc. Is there not a mistake in the Doctor's statement concerning the deviation and divergence? Would not the divergence at 1½° deviation of compass be but about 2·62 miles in 100 instead of 20 in 100; or would it not require about 11°28′ of deviation of compass to cause 20 miles of divergence in 100? Answer: On the principle of plane sailing: Departure=distance×sine of course, which will make your calculations about correct.

J. B. asks: Why does gas in a stove explode, making a report like a musket and blowing the dust over the room and filling the house with gas? Sometimes a flame will flash out, two or three feet from the bottom door, and people are sometimes badly burnt. These explosions take place when the fire is first built or immediately after fresh coal has been put on. They are more common when red ash or Franklin coal is used, but will take place with the hardest coal. Answers: The cause of the explosions alluded to is the combustion of carbonic oxide, a compound of carbon and oxygen. The blue flame over the surface of newly made coal fires is due to the combustion of this gas, which is always formed when hard coal burns with a limited supply of oxygen, or when carbonic acid, formed by the combustion of the red hot coal below, comes in contact with the hot coal above in an ordinary close stove. Reversing the draft, that is, carrying it from above down through the feed coal and out at the bottom of the grate, would probably prevent any explosion.

J. E. E., of Pa., says: As A. W. I. differs with me in my reply to H. B. as to the relative power required to drive two circular saws, one just large enough to cut through the timber and one larger, I give the following explanation, admitting that certain conditions may favor his theory. The accompanying diagram shows two saws, respectively 30 and 60 inches diameter. The teeth in the 30 inch saw will be only half the distance from point to point of those in the large saw; and the teeth in each saw being of the same size, pitch, and length, the small saw will have only one half of the space between the teeth that the large saw has. In case the feed is very heavy, so that, in the small saw, there is not space between the teeth sufficient to contain the sawdust without clogging, then the large saw would have a decided advantage, as the dust room would be twice as large. The track cut by the small saw is greater than that cut by the large one, and more cutting points are in the timber at the same time, cutting more lengthwise of the grain than the large saw; while the teeth of the large saw are running at greater velocity at the expense of power. If, for example, we run a 12 inch saw 1,000 revolutions per minute, by a 6 inch pulley, and saw through a 4 inch cut, and we put a saw 5 feet in diameter on to the same mandrel at the same speed, and with the same number of teeth, a very wide difference in favor of the small saw will be observed at once; as we bring the saws nearer to each other, in size, the difference in the power is not proportionately as great; still there must be and is evidently a difference. There is more or less friction of the timber against each saw, which is



Scale 1¼ inch to the foot. 1, stick of timber 12 inches through. 2, circular saw 60 inches in diameter. 3, circular saw 30 inches in diameter. 4, 24 inch pulley. 5, 5, driving belt. 6, pitch line drawn to ¼ the diameter of saw. 7, pitch line drawn to ¼ the diameter of saw.

evidently in favor of the smaller one. It will be observed on reference to the above diagram, that with the same pitch of teeth (and I have drawn each to a one fourth pitch) the teeth of the two saws are presented to the wood quite differently. The large saw presents the teeth with more hook than the small one. A represents a weight, attached by a cord to the edge of the large saw, B a weight attached to the edge of the small saw, C a weight attached to the pulley face, or one foot from the center of rotation. Now supposing the weight C to weigh 1,000 lbs., a 500 lbs. weight at A would raise it, while it would require about 800 lbs. at B. Now detach the weight A and B and apply the teeth of each saw one inch into a 12 inch stick at one turn; which saw will require the most weight, provided in each case that the points of the teeth only come in contact with the timber? I hold that the smaller saw will require the lighter weight. There may also be conditions when a larger number of teeth will require less power than a less number; on very heavy feed, where each tooth would be overloaded so that it would require a great amount of power to crowd it through the timber, if each tooth in a circular saw cuts one twelfth of an inch of timber (which is an average for a board circular saw) it certainly will require more power to cut each chip. A saw may be too coarse or too fine toothed for the work required. Practice directs the carpenter how to set the cutting tool of his plow or jack plane in order to accomplish the most with his muscle; and it will do so with the saw.

R. F. H. asks: How can I make Javelle water? Answer: Put 4 lbs. bicarbonate of soda in a kettle, add 1 gallon water, and boil for 15 minutes; then stir in 1 lb. chloride of lime, free from lumps. Use cold.

W. E. asks: With small turbines running under a head of 30 feet or more, do the buckets ever become heated by the action of the water upon them? If so, why? Answer: It will depend upon the construction of the wheel, whether the water has a free exit or not. A simple experiment (taking the temperature of water before and after discharging) would settle the matter for any particular case.

C. H. M. asks: If I multiply the number of square inches in a boiler by the pressure, shall I get the aggregate pressure in same? To illustrate: A boiler is 40 inches diameter x 10 feet long inside, and the pressure is 70 lbs. shown by steam gage. What would the total pressure be? Answer: If you mean the pressure tending to produce rupture, it may be calculated in the following manner: Area on which pressure acts $=40\times10\times12=4{,}800$ square inches. Total rupturing pressure$=4{,}800\times70=296{,}000$ pounds.

G. B. M. asks: 1. Why is it that with all the iron and coal that there is in this country that so much of our railroad iron and machinery comes from England? Is it because it is cheaper there, or are they better workmen than we are? 2. Please name some of the works on electricity and electrical apparatus. Answers: 1. Because it is cheaper. Wages are much less in Europe than in this country, but we do not think that the workmen abroad are any better than our own. 2. We can recommend Noad's "Text Book of Electricity."

S. D. P. Jr. asks: 1. I would ask your opinion in regard to a boiler which I am using, making steam for boiling stock and drying paper. Said boiler is about 25 years old, never has been patched, is 52 inches by 10 feet, with 70 (I think), 3 inch copper flues. I usually carry about 25 pounds to the inch, it blows off at that A short time ago, I tested it by the force pump, pumping in warm water until the gage showed 42 pounds. Now although this boiler has been long in use, and, it is to be presumed, has become worn thin in places, would it be advisable to substitute a new one? It is perfectly tight and makes steam freely. On account of the copper flues, I think I get more steam from the fuel than I would from an iron flue boiler. 2. I have heard experienced engineers and boiler makers contend that, when a boiler gives out simply from the natural pressure of the steam on some weak spot, there will be no general destruction of the boiler but merely a "blowing out" at that particular place, and that destructive boiler explosions occur from low water or some other unknown cause, and that, under such circumstances, the stronger the boiler the more destructive the explosion. Is this so? Answer: 1. If you have a careful engineer, we would advise you to continue the use of the boiler since from your statements, it would seem to be unusually well constructed. 2. We believe that all boiler explosions occur from what you call the natural pressure of steam. As to the destructive effects of such ruptures, witness the explosion of the boiler of the steamer Westfield, under what is considered a very low pressure of steam. On page 193 of volume XXVIII of SCIENTIFIC AMERICAN, you will find an article giving our views on explosions from low water.

J. T. M. says: In Dick's "Practical Astronomer" there is a description of a new achromatic telescope, in which a small compound lens is made to correct the chromatic aberration of a large crown lens, by which the necessity for a large flint lens is done away with. The inventor, I believe, was a Mr. Rogers. The compound lens was to be made of crown and flint, so as to lengthen the focus for violet rays and shorten that for red. Now the large object lens would bring the violet to a shorter focus than the red, but, melting the compound glass, the first is lengthened and the second shortened so as to come to a focus together. The proper adjustment of the compound lens for this correction is effected, not by regulating its radii, but by placing it nearer or farther from the object glass. I would like to know: What is the defect in this combination, that it has not been adopted in the construction of achromatic telescopes, since it is far less expensive than the common arrangement? 2. How high a power would a three inch crown object glass, with a 1½ inch compound lens, bear? 3. Would a small achromatic lens do for the compound lens; and if not, how is this lens to be constructed? 4. Would you advise me to attempt the manufacture of such a telescope for my private use? Would it be worth the trouble? Answers: 1. Large flint disks for lenses are now sold at the same price as those of crown glass. The contrivance you mention does not properly correct the spherical aberration; the small lens being one quarter the size of the crown objective, must be four times as accurately figured. 2. About 200. 3. No The late Mr. Fitz made thorough trial of the Barlow fluid lens, of bisulphide of carbon between meniscus cheeks of glass. 4. No. A glass reflector, silvered, then nickel plated and polished, costs little and is the only telescope which can be cheaply made by an amateur See our remarks to C. M. P. on page 43.

L. S. asks if landscape painters do not use a mirror which reduces the object to the size required Answer: They sometimes do use a mirror. A sheet of glass blackened on one side makes a good reflector for this purpose. But a still better device is a *camera oscura*, which consists of a lens set in a box, something like a photo camera. In this instrument a reduced image of the landscape is thrown upon ground glass or upon tracing paper, and a drawing of the view may be readily made.

W. J. W. asks: What is the process of bleaching india rubber? Answer: One process consists in heating the rubber with ammonia and phosphate of lime. Another consists in treating the rubber with chlorine and washing it with hot water, then hardening by means of phosphate of lime.

W. H. T. asks: 1. When a locomotive is rounding a curve, which rail sustains the greatest weight, the outside or inside? 2. Which of the wheels slips, or how is the difference in length of rail overcome? Answers: 1. If the outer rail is elevated, the inner sustains the greatest weight. 2. If the wheels are coned, neither may slip; but if not, the one that describes the longer curve will slip.

M. W. asks: 1. What causes type metal to be porous, or to have small holes on the face? 2. At what heat will antimony fuse? Answers: 1. The cause of your type metal having a porous face is probably imperfect casting. 2. Antimony melts at 842° Fahr.

C. S. asks: Is there any ingredient that can be mixed with pine tar so as to give it a yellow color when tarring any dark fiberous material? Answer: You can try yellow ocher.

C. D. S. asks: What is the philosophy of the gyroscope, and what is that instrument used for? What keeps it in a horizontal position? Answer: The weight is sustained by reason of its inertia, or by virtue of the principle that rotating bodies tend to preserve their planes of rotation. This is the best explanation that can be given without the aid of a mathematical investigation. The gyroscope is a philosophical toy, and its principal use is to illustrate astronomical phenomena

J. P. G. says: I wish to know to what uses soapstone can be applied. I understand that it is used (1) as a lining for furnaces, stoves, etc.; (2) when ground to powder, as a facing for molds for fine castings; (3) as a fertilizer. Answers: Steatite or soapstone is used for a variety of purposes, chiefly (as far as we know at present) those that you have mentioned, except as a fertilizer. A line or two in our "Business and Personal column will introduce you to the buyers of it.

J. H. S. says: There are in this place several engines that are mysteries to me. The trouble is a creaking noise in the feed pipe, in some between the pump and boiler, in others just back of the pump. The clicking noise is so bad at times as to cause fears of the pipe breaking. Can you tell me the cause of the noise? Our pump is connected to the cross head and runs at 110 strokes per minute. I stopped the noise on one pipe by putting in a piece of rubber hose. Answer: Without seeing the pumps and pipes, we can only give a general reply. This creaking noise is frequently caused by leaks in the pipes, and engineers know very well that noises around machinery generally originate in very different places than those from which they seem to proceed. It is easy to see how putting in a piece of rubber hose would prevent the noise, since you have replaced a good conductor of sound by a bad one.

W. W. H. asks: Is it strictly proper to speak of dew as falling? One party contends that dew never forms in the atmosphere and falls to the ground, but is only produced by the moist warm atmosphere coming in contact with the surface of cooler bodies, when the condensed moisture is deposited in the shape of drops of water. Is he philosophically correct? And if so, can you inform me why dew forms on the upper surface of objects only? Answer: It is not philosophically correct to speak of the dew falling, as one would speak of rain. Dew is the condensed moisture of the atmosphere which collects gradually on terrestrial objects when they become cooler than the surrounding air, and it forms most readily and abundantly on those objects which soonest and most perfectly radiate their heat. On this account, a rough surface is more favorable for the deposition of dew than a bright or polished one, and the rough moist blades of grass in the morning are more abundantly covered with dew than dry, dead stalks or a wooden fence. Dew collects on the upper surface of objects because they are more favorably situated for radiating their heat to the upper air, and its formation retarded in objects more or less covered by the heat which they radiate being reflected and again radiated back upon them. A cloudy night is unfavorable to the formation of dew, for the same reason.

E. J. asks: How can I detect lead in water by the use of hydrosulfuric acid? Answer: Reduce by boiling about 5 gallons of the suspected water to a gill or less, and pour into the concentrated liquid a strong clear solution of hydrosulphuric acid, or pass a stream of hydrosulphuric acid gas through the water. If lead be present, the solution will turn dark from the formation of sulphide of lead. It may be necessary to filter the concentrated water, as it must be perfectly clear, and the solution of acid as well, otherwise any discoloration may escape notice.

J. M. H. asks: 1. What keeps a hoop or wheel in an upright position while in motion? 2. Is space a created thing or a necessary nonentity? 3. At what temperature does water boil in a vacuum? 4. Is steam condensed at 210° or 211° Fahr. as effectually as when a lower temperature is used? Answers: 1. Its own motion, which it tends to preserve in the same plane in which it was imparted. 2. We would refer you to a good work on metaphysics. 3. In a good well maintained vacuum, water could be made to boil until almost the freezing temperature, 32° Fahr. was reached. 4. No, because the tension of water vapor at 211° Fahr. is nearly as great as that of steam at 212° Fahr. The lower the temperature of the condensing water, the more quickly and effectually is the steam condensed.

S. B. B.—All papers sent through the mails must be paid. Much obliged for the copy sent.

J. B. says, in reply to G., who asked how to get red ants out of sugar: Get some gum camphor in lumps and secure the separate lumps in small cotton sacks, and attach them to the top of the bins, very near the sugar. If the bins are large, fix a piece of board on the surface of the sugar and place the camphor on it. Use the camphor plentifully. My experience has been that, in a few days, the ants would leave and not return while the aroma of the camphor lasted.

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

G. W. K.—A kind of clay resembling fuller's earth.

G. W. C.—The enclosed mineral strongly resembles antimony; and if found in sufficient quantity, is well worth a chemical analysis.

J. G. S.—Nos. 1, 2 and 3 are iron pyrites. No. 4 is zinc blende. No. 5 is iron ore. No. 6, is galena in calcite. No. 7 is rhomb spar (calcite).

W. A.—The stone sent is carbonate of lime. It seems hardly compact enough for lithographic stone.

B. D. J.—We tasted one bottle of the water sent, and detected iron, but could not perceive sulphur or sulphuretted hydrogen. It might be worth a chemical analysis.

G. W. B.—Nos. 1, 2 and 3 are claystones. No. 4 is conglomerate. The other is quartz geode.

COMMUNICATIONS RECEIVED.

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

On Jumping from Railway Trains. By A. F.

On Spontaneous Generation. By J. C. W. and by D. S. G.

On the Devil Fish. By C. R. B.

On the Last Railroad Horror. By A. T.

On a Canal through Syria. By T. L. F.

On the Locomotive. By W. T. H.

On the Patent Right Question. By C. S. and by J. E. S.

On Meteors. By G. C. T.

On Bisulphide Engines. By J. A. H. E.

On Car Ventilation. By E. M. G., Jr.

On Boiler Management. By A. M. E.

On Electricity. By O. H. T.

On the Great Telescope. By F. M. B.

On Flying Machines. By T. B.

On Steam Fire Engines. By J. A. W.

Also enquiries from the following:

W. M. B.—P. P.—S. H.—W. T.—C. H. J.—W. H. T.—W. A. M.—S. W. G.—M. M.—J. N. H.—N. T. P.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

Two correspondents ask what barytes is worth, and who will buy it? Others wish to know where magnetic iron sand can be obtained? Who are makers of the New Jersey apple gatherer? Who makes heating apparatus using low pressure steam? Which is the best portable gas apparatus? Who makes electric clocks? Who make or deal in mechanical tools? How can we find out how to mix colors for pottery? Who makes hard rubber, silvered glass reflectors for lamps, and grain separators? What is used for "stuffing" calf skins? Where can a file-cutting machine be purchased? Makers of the above articles will probably promote their interests by advertising, in reply, in the SCIENTIFIC AMERICAN.

[OFFICIAL.]

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August 12, 1873,

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APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

26,090.—FOLDING MACHINE.—C. Chambers, Jr. Oct. 29.
26,097.—ELECTRIC TELEGRAPH.—M. G. Farmer. Oct. 29.
26,128.—BILLIARD CUSHION.—G. D. Sharp. Oct. 29.
26,136.—ADVERTISING.—E. Wiebe. Oct. 29.
26,139.—PUMP.—W. Wright. Oct. 29.
26,147.—BUNDLING WOOD.—W. L. Williams. Oct. 29.
26,177.—RUBBER BELTING.—D. C. Gately. Nov. 5.
26,178.—RUBBER BELTING.—D. C. Gately. Nov. 5.
26,276.—MAKING RUBBER HOSE.—T. J. MAYALL. Nov. 12.
26,321.—CASTING MOLD.—J. P. Broadmeadow. Nov. 12.

EXTENSIONS GRANTED.

25,115.—SELF-ACTING WAGON BRAKE.—B. S. Healey.
25,148.—WEIGHING SCALES.—F. M. Strong, T. Ross.
25,149.—BLANKS FOR SHOE PEGS.—B. F. Sturtevant.
25,167.—LIGHTING GAS BY ELECTRICITY.—A. Wilson.

DESIGNS PATENTED.

6,798.—STAMP PAD AND RACK.—G. K. Cook, New York city.
6,799.—CAKE HOLDERS.—G. Gill, Taunton, Mass.
6,800.—CLOCK CASE.—J. F. & H. Mann, Brooklyn, N. Y.
6,801.—ADVERTISING DESK.—C. W. Armstrong, Detroit, Mich.
6,802.—TEA SERVICE.—G. Gill, Taunton, Mass.

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1,405.—ALPACAS, ETC.—Moore & Co., New York city.
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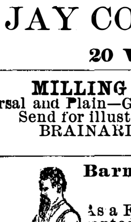

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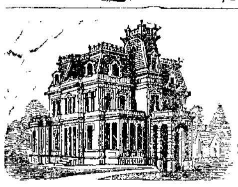

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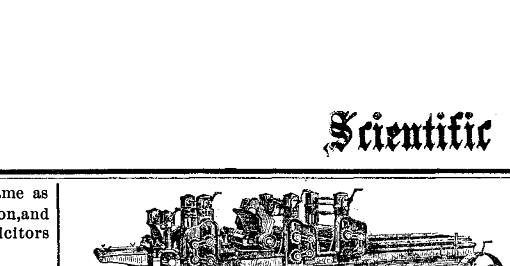

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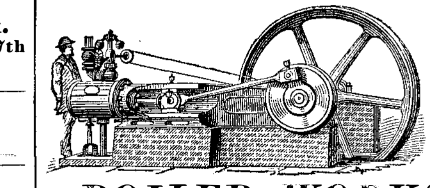

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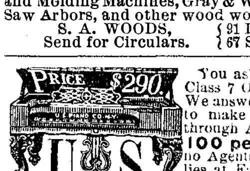

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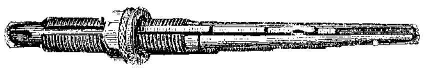

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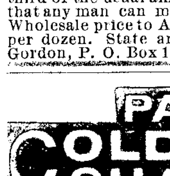

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