# a WeEkLY JOURNAL OF PRACTICAL INFORMATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES. 

$\underset{\text { [NEW SERIES.] }}{\text { Vol. XXX.-No. }} \mathbf{3 .}$
THE NEW STATE CAPITOL AT HARTFORD, CONN.
It is curious to note how the course of architecture in this country has closely followed the changes in the art developed in Europe and more especially in England. The severe Roman classical style of the last century became supplanted in the Greek revival of 1762 , and in both Great Britain and the United States appeared buildings in the main reproductive of ancient Hellenic temples. The British Museum in London, and our own public buildings in Washington, besides numerous custom houses, hotels, and banks, are types of more imposing edifices erected in the Greek style; while cores of wooden country dwellings in almost every village in the Eastern States attest, by their heavy pillars and broad porches, the predilection of architects for its use wherever possible. As the Roman has failed before the Greek, so has the latter in no small measure become less popular than the Gothic, the revival of which style may be fairly dated as of fifty years ago. Fostered by progress in archæological studies and by ecclesiastical patronage, the mediæval in art grew steadily in favor; and as a result, an almost new order of architecture, the modern secular Gothic, sprang into existence, which, emancipating itself from purely religious application has reformed the very principles of the original designs. To Ruskin is ascribed this change, and Eastlake says that it was reserved for him "to strike a chord of human sympathy that vibrated tbrough all hearts, and to advocate, independently of considerations which had hitherto only enlisted the sympa thy of a few, those principles of medieval art whose appli cation should be universal.'

NEW YORK, JANUARY 17, 1874.
\$3 per Annum

With this brief review of the origin of the secular Gothic in architecture, we lay before our readers a fine engraving of an edifice which, when completed, will probably be the most prominent and striking example of the style as treated in the United States. It is the State Capitol of Connecticut, and is located in the City Park, a tract of some 40 acres, in the city of Hartford. The site is on elevated ground, is commanding and appropriate, and admirably suited to display the fine design of the structure. The central feature is the dome, which, springing to a hight of two hundred and ifty feet above the ground, is surmounted by a colossal emale figure, representing Connecticut, holding in her hand the original charter of the State. In common with the entire difice, the dome is of white marble and richly adorned with arcades, columns, galleries, and with thirteen figures placed one at each terminal at angles, each statue supporting a shield bearing the arms of one of the original States. The dome plan is a dodecagon 56 feet in diameter, and is flanked by owers 160 feet in hight.
The extreme length of the main building is 300 feet and ts greatest depth 200 feet. Its construction is of the most substantial description, iron beams and brick arches, and also ground arches in brick filled in, being used throughout. The main entrances are on the north and south fronts, having vesibules, and leading through arcadedopenings. In the tympani of the arches over the grand entrance, are five bas re liefs representing Putnam leaving his plow, and his celebrated horseback ride down the steps, the charter oak, the landing of the pilgrims, and the surrender of Cornwallis. On the
front of the building above the main door are twenty-six niches destined for large statues, and suitable places are p rovided over all the entrances for the reception of busts of dis. tinguished men. These decorations and the bandsome slate roof, together with the general ornate type of the building, will render it,if we may judge from the finished drawings of the elevation, one of the most artistically beautiful structures ever erected. The lower and third floors are devoted to offices and apartments for state and other olticials. The second floor contains the Halls of the Senate and Representatives the Supreme Court, and the Library. The Representatives, Hall is in the central building of the front, is lighted on three sides, and is supported on arcades of polished granite columns, with capitals elegantly carved in marble. The library has two stories of windows, and of alcoves for books.
The main hall, which is approached by all entrances, is tiled and has a stone colonnade, supporting the groined ceiling and floor above. It is well lighted from the doorways and the corridors at each end. There are two grand staircases, entirely of stone and of very massive and beautiful design.
Mr. R. M. Upjohn, of this city, the designer of St. Thomas' Church on Fifth avenue and many other prominent buildings throughout the country, is the architect. He informs us that the ground floor of the structure is now completed and that the entire edifice will require about three years to finish.

GOLD melts at $2,590^{\circ}$ Fah.-a little above the melting point of copper


## Sricutifin Ammana

MUNN \& CO., Editors and Proprietors. published weekly at
NO. 37 PARK ROW, NEW YORK.

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VOLUME XxX, No. 3. [New Series.] Twenty-ninth Year
NEW YORK, SATURDAY, JANUARY 17, 1874.


## THE VIENNA EXHIBITION AND ITS RESULTS

## The Vienna Exhibition closed November 1 last, and that

 wonderful display of industrial products, which had been gathered with so much toil, and at such expense of time and money, from every quarter of the globe, has been broken up and its exhibits are now scattered as widely as before their collection. The greatest of international exhibitions has become a thing of the past, Its influence, however, remain and will long be felt in every part of the world. Even on our side of the Atlantic, thousands of miles from the strange, busy scene in which we, of all civilized natic 1s, took least part, we feel that, in some respects, we have been benefitted by the most important and most creditable of all Austrian nterprises.We felt it our duty to warn the public of the risks which were to be met by those who proposed to take into Austria valuable inventions. We considered the defective patent code of that country no safeguard to inventors, and showed that, despite the promises-still unfulfilled-of liberal changes, any really valuable improvement would be likely to be pirated, unless, as could seldom be the case, the exacions of the law were fully complied with. These facts were o well exhibited that but few of our great inventions were seen at Vienna, and the United States section became conspic-
uous for its small extent; and our own people, visiting the Ausstellung, were struck with the barrenness of the Ameri can department. We were, however, well represented in quality, if not in quantity; and if we may judge from the official record of awards, the jury was very favorably impressed. The proportion borne by the number of awards of Medals of Progress to the number of Medals of Merit granted, as well as the large proportion of awards made to our mall number of exhibitors, are both high, in Group XIII (machinery). The medals are nominally of equal value, but the second class mentioned are given for abstract merit, while the first named were given only where merit was accompanied by evidence of a substantial and meritorious advance, effected since the date of the Paris Exposition, in devices deemed specially meritorious at that time. The United States brought away one third more medals of the first than of the second kind, and is, we believe, the only nation in
The real results of this enterprize are properly gaged however, by a broader view than this. The distribution of medals is but an incidentof the grand work. Comparatively few of the exhibits taken to Vienna by our people will be brought back to the United States. They have found purchasers from all parts of the world, and go among strangers civilized and uncivilized, to spread abroad the fame of Amercan mechanics and Yankee inventions. Our sewing ma chines are distributed from St. Petersburg to Calcutta, and our agricultural implements are found in every grain rais ing district from Great Britain to China, and our wood and metal working tools are alnost as familiar to the Hungarian and the Bohemian as to our own mechanics. In the Chinese and Japanese sections, even, it was noticed very early in the season that nearly every article was marked verkauft (sold) and the unique productions of the Orientals thus also become distributed throughout the world. From the farthest east, from north and south and west, the most intelligent and the most enterprising of every nation have met to see what others have accomplished, and to learn whatever may most aid their own advancement.
It is this universal dissemination of the acquired knowl edge of every department of industry that constitutes the most important work of an international exhibition. Bring ng together, as it does, the products of the labor of every nation, and displaying the natural resources of every country to all who can purchase the one or who can develope or
utilize the other, bringing the nations of every part of the globe into close communion, and presenting to all the best ruits of the labors of each, the most advanced and most thoroughly civilized are stimula ied by competition to great er exertions, and to the accomplishment of still nobler re sults; while those countries which are farthest behind in the great march of human progress are taught what has been done by others, and are awakened and urged to make an earnest effort to overtake those who are now so far in ad vance of them. All wre taught that nations, like individuals may choose between poverty and competence, if not affluence and that intelligence, honesty, industry, and frugality invaiably bring their reward.
Now that the Austrian Exhibition of 1873 has become one of the great bygones, we look forward with renewed zeal to the successful inauguration of our oxn coming Centennia International Exbibition of 1876 . The time for preparation is none too ample, and we anticipate with anxious as wel as hopeful interest the opening of its

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## patent office printing.

A correspondent of the New York World, writing to that paper from Washington, gives some items of public printing done by the Congressional Printer, among which is the sum of $\$ 142,793$ charged for Patent Office printing. On this the writer complains in the following style
I selected the Patent Ofice from the Interior Depart ment for this reason: the work done for that institution is not paid for by taxes, but by the people that take out patents. It is the people's money, not the Administration's, and in ustice the work should be let out to the lowest bidder after dvertisement. In this item 25 per cent, if not more, could be saved. In this connection the Government is running monthly periodical for $\$ 1$ a year, called the Official Gazette, a ost flagrant abuse of public confidence and rather a smal business for a government spending its $\$ 300,000,000$ ear to engage in.
We fail to perceive where the "flagrant abuse of public onfidence" would come in, even if it were true that the afficial Gazette were a monthly periodical run at $\$ 1$ a year. Unfortunately it is not true. The price is $\$ 6$ a year, and it is published weekly. The publication is, however, carried on t a heavy expense to the goverument; but as it has been xpressly ordered by Congress, the Commissioner of Patents only discharges his simple duty in attending to its publicaion, and the manner in which the work is produced is highly creaitabie to him. The Official Gazette takes the place of the former annual volumes, known as the Paten Office Reports, on which Congress was accustomed to spend ar more than the weekly Gazette costs.
The Patent Reports were printed for free distribution by members of Congress, and the same practice is substantially aintained in respect to the Gazette. The public demand or it is far from sufficient to pay its support
Ten thousaud copies of the Gazette are printed every week, f which three thousand copies go to subscribers, who pay 6 a year, and seven thousand copies are given away to members of Congress, other departments of the government, courts, libraries, etc. The total cost of the publication is not ar from sixty-four thousand dollars a year. The annual loss to the government by the publication, is a little under fify thousand dollars a year.
Prior to the establish anent of the Official Gazette, the patent claims were published in the Scientific American, and our publication of them was a matter of great convenience and advantage to the Patent Office. On the basis of the amount now paid out by the government for similar work, or publication of the claims must have saved the Patent Office from twenty to forty thousand dollars a year, during a period of nearly twenty years. But we never received a single centaro from the Patent Office for the service; indeed we could never prevail upon the department to be so liberal as to furnish us with a free copy of the claims for our printers to set up the types. On the contrary, we were compelled to pay the Patent Office from five hundred to a thousand dolars a year to furnish us with the copy. After the issue of our paper, the Patent Office was then accustomed to expend a few cents weekly in purchasing extra copies of the Scien ific American, out of which it scissored the printed claims for use in the various examiners rooms, and in connection
with the drawings, and the preparation of the annual reports.
The weekly publication of the claims is desirable as a mat er of convenience, to the Patent Office, and to a limited number of persons, consisting mostly of patent agents and attorneys. But the public in general have little use therefor We believe it would be a much better plan to enlarge the Gazette so as to give the specifications and drawings in full of all patents issued. This would form an invaluable work of great importance to the public,and, if issued at, say, $\$ 25$ a ear, would doubtless be self-supporting, provided the ree list were wholly suspended, and the best economy prac ticed in the printing.

## SCIENCE RECORD FOR 1874

The new volume of this work is now upon the press, and will be ready for delivery about the 20 th of January. The forthcoming book is one of unusual interest and value. It mbraces a condensed account of the leading discoveries and mprovements in the various branches of science, including Chemistry, Metallurgy, Mechanics, Engineering, Electricity Light, Heat, Sound, Technology, Pisciculture, Botany, Horticulture, Agriculture, Rural and Household Ecэnomy, Materia Medica, Therapeutics, Hygiene, Natural History, Z̈̈ology, Meteorology, Terrestrial Physics, Geography, Geology, M neralogy, Astronomy, Biograpby, etc.
The various departments are illustrated with suitable engravings. In Metallurgy, for $+x a m p l e$, we have illustrations of Siemens' furnace and a dessription of his new and successful method of making iron and steel direct from the ore. This is accomplisbed at a cust of from 20 to 50 p:r cent less than by the present blast furnaces. The subjec' is of importance to iron workers. In Mechanics and Engine +1 ing, we bave accounts of new railway improvements, novel machines, and a great variety of new devices. Tecbnolngy iz full of new information, and there is hardly a worker in any brauch of the applied arts, but will here find some new hint, recipe, or suggestion, of more worth to him than many times the cost of the book. In Agriculture, we bave accounts of new methods for preparing manures with economy, improvements in treating soils, new and useful plants and vegetsbles. Among the latter is illustrated a new and early variety of the potato, from which six hundred pounds are raised for every pound of seed planted, a most valuable a guisition for a 1 who maintain gardens. Natural History, Zöology, Piscicuitare, all are full of interest. Portraits of prominent scientit • men and discoverers are given, among which we notice those o. 「.ieb'g, Draper, Proctor, Lockyer, Baker. The miscellaneous ? epartment will be found er-jecially attractive and useful. Hert we have a series ofi ergravingsillustrating the various devices employed to assist learners in drawing. meang these is a new refi glass, throws down upon the paper the outline of the picture that we have the pentagrapb, the perapeciive rulers, sketching frames, reducing and copying glasses. All are so described as to enable any person of intelligence, to make and use the several instruments. This series of engravings, with the practical instructions given for drawing, will greatly facilitate and ensourage all persons, old or young, who wish to acquire the art of drawing. Not only are the various instruments shown, but their manner of use in actual practice is illustrated. Science Record for 1874 forms a handsome octavo volume of 600 pages, nicely bound, uniform with previous issues. Price $\$ 2.50$. Published ly Munn \& Co., 37 Park Row, N. Y., and by thera sent everywhere on receipt of price. May be ordered through any book or news store.

## THE VALUE OF A KERNEL OF CORN

In considering the curious and interesting chemical nature of corn, we shall use the word as applied to wheat, as well as to maize. The two grains are chemically constituted very nuch alike, and what may be said of one applies with almost equal truth to the other. Both are wade up of starch, dextrin, gum, sugar, gluten, albumen, and plosphates of lime, magnesia, and potassa, with silica and iron. Wheat contains about double the amount of lime and iron, and considerable more phosphoric acid, but less m:agne-ia and soda. The maize seeds are rich in a peculiar oil, which is nourishing and highly conducive to the formation of adipose or fatty matter; hence, the high utility of corn in fattening animals. What a remarkable combinatiou of chemical substances is stored up in a kernel of corn? It may almost be said to be an apothecary's slop in miniature; and the order and arrangement of the mineral elem-nts and vege table compounds, needed to render the comparison mortapt are not wanting. For some reason, Nature places the mist valuable substances in a kernel nearest the air and sunlight, while the little cells of the interior are full of the material used to keep erect and tidy our collars and neck bandsstarch. With a moistened cloth, we can rub off from the kernel about three and a half per cent of woody or strawy material, of not much uutritive value; and then we come to a coating which holds nearly all the iron, potash, sola lime, phosphoric acid and the rich nitrogenous ingredients. This wrapper is the storehouse upon whose shelves are de posited the mineral and vegetable wealth of the berry Whence come these chemical agents? By what superlative cunning are they grouped within the embrace of this cover ing? They come of course from the soil; and by the mys terious and silent power of vital force, they have been raised, atom by atom, from their low estate, and fitted to perform the high offices of nutrition in the animal organisms. And should we not appropriate them to our use as the moit care fully adjusted of all materials designed for human alim.nt Certainly we should; but do we? Unfortunately we canno render an affirmative answer. The sharp teeth of our bur mills drive ruthlessly through the rich wrappers of the ker nel, and then torn fragments pass to the bolt, and frosin that to the barn or stable; the animals obtain the nutritious glu ten, and the starch, in the form of fine flour, is set aside for family use. But it is not designed to enlarge upon this point. Let us look at the chemical offices the substances found in the kernel of corn subserve in the animal ecnomy. Starch is the wood or coal which, under the influence of oxygen, is to be consumed or burned to maintain animal warmth. It passes in as pure fuel, it is oxydized, and the askes rejected through the respiratory organs. The warmth imparted by this combustion is necessary to the proper ful
filment of the functions of the body. Of these functions,
those of digeation and assimilation are the most important. The digestive apparatus receives the athe most the starch of the grain; the latter is pushed forward to be burned, the former enters the circulation; and out of its contained iron, potash, soda, magnesia, lime, nitrogen, etc., are manufactured all the important tissues and organs of the body. All of the irou is retained in the blood, together with much of
the soda and phusphoric acid; the lime goes to the bones, and the maguesia very abruptly leaves the body, as it seem to be very plainly told that it is not wanted. Such, in brief are the uses which the organic and inorganic constituents of kernel of corn subserve in the chemistry of animal life.
The changes which they are made to undergo in the la boratory are almost equally interesting and important. Fe cula, or starch, is a body of greatintereft, and is not found alone in corn. There is scarcely a plant or part of a plant which does not yield more or less of this substance. What a curious vegetable is the potato! Swollen or puffed out by the enormous distention of the cellular tissue in which the starch is contained, it seems almost ugly in its deformity It is little less than a mass of starch when the watery par has been evaporated.
If we separate the starch from the gluten in corn, and boil it a few minutes with weak sulphuric acid, it under goes a remarkalle change, and becomes as fluid and limpid a water; and if we withdraw the acid, and evaporate to dry ness, we have a new body, a kind of gum called dextrin But if we do not interrupt the boiling when it becomes thin and clear, but continue it for several hours, and then with draw the acid by chemica' means, we have remaining a liquid, very sweet to the taste, which will, if aliowed to separate
solidify to a mass of grape sagar. This is the method of changing corn into sirup and sugar. What is most extraor dinary in this process is the fact that the acid undergoes no diminution or ciange. The play of clemical affinities lies betwe-n the amidin: and the elements of water, grape sugar contaiuing more oxygen and hydrogen, compared with the quantity of carbon, than the starch. Nothing can be more triking than these changes. From the kernel of corn we obtain starch. this we change easily into gum, and, by the aid of one of the most powerful and destructive acids, trans form it into sirup and sugar.
We are uow to consider another most extraordinary change which corn is capable of undergoing, that of being trans formed into whiskey or alcohol. If we take the sweet liquid obtain-d by the infusion of malted corn, and subject it to temperature of $60^{\circ}$ or $20^{\circ}$ Fah., it soon becomes turbid and muldy; bubilrs of gas are seen io rise from all parts of the iquid, the temperature rises, and there are signs of chemi cal action groing on in it. Atter a while, it slackens and soon stops altonether. Exa nination shows that it has now com-
ple ely lost its sweet taste, and arquired another quite dis tinct. An intoxicating liquid is found, and if we place it it a $:$ till, we obtain a colorless, intammable liquid, easily re cognized as alcohol. By a peculiar artangement of the con densing apparatus of the still, a portion of the grain, oils, and a large amount of water are allowed to go over witl the alcot,ol. and this constitutes whiskey.

This is an example of the change called vinous fermenta tion. The influence of a ferm-nt or decoraposing azotized bocy upon sugar is strange and quite incomprehensible Through its agency, we may cause the highly organized ker n l of corn to take an力ther step downward towards a dead inorganic condition. We can transform the alcobol over into acetic acid or vinegar, or the sugar may be formed into one of the most curious organic acids, the lactic. As in these proc-sses, we follow the kernel of corn through the various changes, first into gum, then into sugar, then alcohol, then vinegar, and ultimately into carbonic acid and water we oltain an imperfect id $\quad$ a of the marvels of vital chemis ry. The chemistry of a kernel of corn is a comprehensive topic, and to be considered even in its outlines would supply material sulficient for a volume. The aim has been to group together a few of the most interestivg points, and thus a wak en a desire for a more complete and satisfactory investiga tion.
the prime movers and their recent progress,
The prime movers remaining unconsidered in our last is
sue are the heat engines. It was first pointed out by Benja sue are the heat engines. It was first pointed out by Benja abroad at about the time of the war of the Revolution, and who was made Count Rumford in Europe, that heat was not a sub stance, as had been previously sapposed, but that it was a kind of motion. In his paper, published by the Royal Society in 1798, ${ }^{\text {\%he }}$ described experiments which not only proved thi now well known and unirv rsally admitted fact, but also fur
nished data for estimating very closely the value of the nished data for estimating very closely the value of the "meclanical equivalent" of a unit of heat.* Sir Hum
phrey Dary, whose attention may have been called to the phrey Dary, whose attention may have been called to the
subject by Rumford's paper, in the following year made his celebrated corroborative experiment, melting ice, in an at mo:phere below the freezing temperature, by friction, and published his acquiescence in the dynamic theory, becoming one of the earliest disciples of Rumford. Subsequently, the beautiful method of Mayer and the excellent work of Joule determined with precision the fact that the heat energy of a British therrial unit has an equivalent in mechanical power
whose measure is 772 pounds raised one foot high. In heat engines, it is impossible to obtain all of this power from the heat oltainable from any sourse. If coal is burned, the heat feveloped becomes wasted, to a certain extent, in transmis-

ion to the prime mover, and a very large quantity is lost in explained in tself in many ways which have been alread heat obtained from a pound of coal should do work equiva lent to raising a pound weight toa hight of two thousand miles, our engines are so imperfect that our best builders decline to guarantee a tenth of this duty with even very large engines of the most perfect known design. In an ediorial article, published in the Scientific Americin, January $11,18 \tau 3$, we exhibited the reasons for this serious waste of power, and showed how far improvement is possible in heat engines working on knowu principles, and that the range of increased efficiency left to be effected by this improvement amounts to about 15 per cent in the engine and 30 per cent in the boiler of the steam engine, when working bet ween the present limits of temperature. It is impossible to fix a limit to the gain by elevation of temperature and ressure and increased expansion.
We can record no important advance in steam engineering since that date. The use of the compound engine is becom ing more gencral, and progress in the direction of higber steam pressure, and greater expansion is causing gradual modification of old forms of boilers to meet safely the high. er pressures and the so-called "safety" or "sectional" boil ers are coming into use still more extensively in consequence of this change. No great improvement has been recently effected either at home or abroad. In Europe, as was stated in the letters of our Vienna correspondent, the practice in steam engines is passing through the same phase of ex periment and revolution which was witnessed in this country fifteen years ago in the period of the great contests of
Sickles and Corliss for supremacy in the then just opening Sickles and Corliss for supremacy in the then just opening ield.
To-day a pound and a half of coal per horse power per our represents the highest economy of the best classes of arge engines ; and for orlinary sizes, such as drive our mills and our workshop machinery, double that expenditure is not considered estravagant. We can only hope to see these fig res greatly reduced by some now unimagined and com plete revolution in engineering. Such a revolution is by no means impossible or perhapseven improbable, and it would
be unwise to neglect any suggestion which looks promising. be unwise to neglect any suggesion which looks
ly toward such an inestimably important advance.
The immediate and well known directions in which engi neers are seeking to improve the steam engines look to the prevention of external losses of heat by adiation and conduction, and to the reduction of interıal losses due to cool ng of the steam cylinder and to condensation of the prime team, or to liquefaction by expansion and re-evaporation during the exhaust.
The first is accomplished very thoroughly by means of the many sorts of excelleut " felting" now in the market, and
by " lagging." The second is secured by superheating and byixure of steam with air to a slight extent in nou-con densing engines, and by the adoption of the "compourd engine, invented by Wolff a Lalf century or more ago, long before the use of high steam and great expansion gave it it proper field.
Attempts have been frequently made, and a very promis. ng one has been chronicled in our columns during the past year, to save and utilize the exbaust heat of the non con-
densing steam engine, by applying it to the evaporation of densiug steam engine, by applying it to the evaporation of
some very volatile 1 quid, which is then applied to a supplenentary eng ne. The real competition here lies between these "binary vapor" engines and the common condensing engine. The former would seem the more economical, and we are awaiting with interest the report of the performance of the engine which, it has betn stated by the inventor, Mr. Ellis, is to be designed and tested by one of our most dis. inguished engineers. As we have already had occasion to emark, the effort to improve this class of prime movers is required to be eserted rather in removing the objections of the expense of the secondary fluid, the danger of loss by
leakage, and the infinite annoyance, and generally the danger also, which attends its escape. These difficulties removed, a simple, durable, and properly designed machine of this class will find a ready market and will mark a decided advance, if in first cost and expense of maintenance it can compete suc esssfuly with the steam engine. Remembering that the conomical value of a fluid depends simply upon the effect heat, and the advantages which it presents as a receiver and dispenser of that heat, and remembering also that the me chanical effect depends just as much upon the volumeas wel as the density, upon the distance through which its pressure is exerted as well as upon the amount of that pressure, we can see that the value of any fluid as a medium of power ransmission is not measured simply by its pressure at any iven temperature. Up to the present time the vapor o fluid for use in leat engines.
Air has been used very frequently in the production of power in heat engines, but it has not yet become a really successful and satisfactory motor. The convenience of ob-
taining an ample supply of air, its freedom from liability to produce destructive explosions, and the completeness of its expansive action, are important advantages, but they seem o be more than compensated by the difficulty of managing the fluid at the very ligh temperature at which it must be worked, the bulk and cosicic construction and maintenance of the engine, and by difficulties, inherent in all known de igns, of obtaining prompt and complete conveyance of heat into and out of the mass of air employed. Sixty years ago Dr. Robert Stirling proposed to use air in a heat engine, and
his crude design was improved by James Stirling, who worked at the problem tweniy years later. Our distinguished
fellow citizen, Ericsson, still later, and nearly a quarter of century ago, designed a form of engine which was so suc cessful that it still continues in use, as subsequently im proved by its inventor. Shaw's engine and that of Rope have also met with some success; and the very promising en gine of Wilcox, when just seeming most successful, disap peared, for reasons to us unknown. The superheated air en gine of Leavitt is the latest example of this class which has come to our notice, but we now hear nothing more of that At present, we see nothing specially noteworthy in this field of invention. We have indicated the difficulties of the prob lem, and leave the matter in the hands and minds of the in genious and experienced mechanics who read our paper, and hope that we may yet be called upon to record the perform ance of an engine which shall produce the horse power for the expenditure of a pound of coal per hour, as is said al ready to have been done, and without burning itself out af ter a few weeks of good work. A "furnace gas engine," or one which uses in its cylinder the products of combustion, will probably prove the most economical form.
Gas engines are another class of prime movers from which much has been expected, but with which little success has been yet obtained. They offer nearly all the advantages of air engines, with the additional one of readily obtaining high pressure; but possess disadvantages peculiar to themselves which have, as yet, effectually prevented their introduction to any considerable extent. The first engine which came prominently before the public. the Lenoir engine, awakened much interest both among engineers and with the public. Using an explosive mixture, fired by electricity, the pressure was irreguiar, the engine noisy and wasteful of power and the roltaic battery was a troublesome und costly appen dage. The later use of a much smaller battery and the spark of the inductorium reduced but has not eliminated these objections. The Hugon engine nest came into notice, and in this machine, by igniting the charge by means of an ingeniously arranged gas jet, this great objection to the use of exploding gases was done away with. In both these engines, the machine itself was quite similar in its details to the ordinary steam engine. The Otto and Langen engine, re cently introduced abroad and notictd in our Vienna eor respondence last summer, acts much like a Cornish pumping engine. The explosion of the gas drives the heavily ioaded piston rapidly to the top of the cylinder, and, as it descends, its weight exerts a useful power. It is economical, using scarcely half the gas required by the earlier engines, but it is more rattling and irregular in its action than even they were. The most recent gas engine is, we believe, that of Brayton, in which explosion is avoided and of which, it is claimed, the economy equals that last mentioned. It seems a most promising invention, and we hope that time will prove its claims well founded. A good gas engine will find
a large market. Its motion must be steady, its gaces stould be gradually burned instead of exploded, and it should not be injured by the high tempzrature of the products of com bustion, nor should it be subject to rapid deterioration by vear or by any other cause.
We have but superficially glanced over this vast and important field, and have laid before our readers the present situation as respects the progress of the prime movers. Were not our limits so restricted, we should readily find much more to write on this subject, but we hope that we have at least set some active and fruitful brains and some experienced and skillful hands on the right track in a work of the highest importance to mankind.
Ve do not expect soon to see steam superseded, but we do anticipate that other motors will share the field with it to a far greater extent than has been yet the case, and we also are very greatly disinclined to believe that the steam engine itself has even approached the limit of its development.

## obituary.

## Jephtha A. Wilkinson.

The last day of the last year brought to a close the erent ful life of this venerable and vigorous man. Born in Provi dence, R. I., at a very early age he exhibited a singular men go-abery in the form of what is now populat forward some striking enterprise. He served in the war o 1812. Invented a machine for making weaver's reeds, was one of the first inventors of repeating fire arms and cannon also of the planing machine and of the rotary priuting press He was a man of great intelligence and remarkable memory. He passed away in the 83d year of his age.

## Lloyd A. williams.

Lloyd A. Williams, late Chief Engineer in the navy, died recently at his residence on Rood street, Georgetown, D. C., in the forty-second year of his age. Cnief Engineer Williams was a native of Washington, and entered the service of the United States on the 16th of February, 1852. His total sea service was eight years and five montbs. His last cruise was on the Colorado, which arrived at the Ports mouth, N. H., navy yard in June, 1872. During this cruise he contracted rheumatism, while in the Gulf of Mexico, from which disease he suffered greatly, and retired in consequence shortly after, in conformity with the act of August 3, 1861.

## Draper Ruggles.

Draper Ruggles, of the firm of Ruggles, Nourse \& Mason, predecessors of the Ames Plow Company (thirty years ago),
in making agricultural implements at Worcester, died in making agricultural impleme
a few days ago, aged seventy-four.

## improved tramway and vehicle

We illustrate herewith an improved system of tramway, with a vehicle of peculiar construction, adapted for trave thereon. The inventor considers that his plan is applicable wherever the land transportation of heavy freight off of re gular railroads is necessary, and for the running of stage coaches, etc. He believes it absurd to attempt giving a road a hard smooth surface, twenty to thirty feet in width, when but a few inches is required for the tread of the wheels. Moreover, any track reasonably hard and smooth, for the passage of the wheels of laden carriages, is unfit for the travel of horses, since in such case a yielding surface is required.
In the tramway herewith represented a longitudinal timber is simply bedded in the earth, even with the surface, and capped with a hard wood or metal rail. Each length is joined by iron sockets. It is stated that an oak or maple rail, sawn $2 \times 4$ inches, should last many years, but would require to be renewed several times before the bed timbers would be decayed. These, if of cedar, would be sound after 25 to 30 years' use. The arrangement of cars proposed is as shown in Fig. 2. They are provided with two double flanged wheels, which may be constructed of wood sectors, having thin plate iron rims bolted or riveted to their sides. An iron arbor or axle passes through the center of the wheel, and is secured with flanges and nuts on each side, firmly screwed up. The outside courses of plank should be one inch in thickness, and project the same all around. . Then the wheel is placed in a lathe and its periphery turned and trued up, making the edges of the outside courses form the flanges. A wheel thus constructed, of sound well seasoned oak or maple, will be good and durable, and will wear the track but little. Cast iron wheels should be used to run upon iron edged rails.
Each car needs a common carriage axle and wheels, bolted across for preserving its equilibrium. All should be proportioned so that these wheels should be within a few inches of the surface.
The inventor estimates the expense for these tramways, to be laid down on ordinary country roads, where no grading is required, as follows, per mile: 264 cedar logs, 20 feet, at 10 cents each, $\$ 26.40 ; 3,520$ feet maple at $\$ 20$ per M., $\$ 70.40$; $1,700 \mathrm{lbs}$. cast sockets, at 3 cents, $\$ 52.80 ; 200$ lbs. spikes, at 8 cents, $\$ 16$; labor in laying and construction, $\$ 75$. Total, $\$ 240.60$. Such a road, it is stated, could be laid down for about $\$ 180$ per mile by dispensing with iron sockets, etc. Trains of loaded wagons, whether propelled by horses or locomotive or traction engines, could be run over tat a cost for transportation much less, the inventor claims, than by any other style of rail, tram, or common roads.


All ordinary vehicles, stage coaches, lumber wagons, etc., are easily adapted to run upon these tramways, by means of the device shown in Fig. 1. A are the double flanged wheels, which travel upon the central rail, and are supported in hinged frames, B. To the latter are connected shafts, C, which are suitably secured to the rack, D. In the teeth of the latter engages the worm, E , the shaft of which extends to the rear of the vehicle, and terminates in the hand wheel shown. By turning the latter the central wheels, A, may be swung up clear of the ground, or may be let down upon the rail to sustain the main weight, while the outer wheels serve to balance the apparatus. The track for the carriage wheels consists in gutters filled with broken stone, so as to form an even and level surface. For stage coaches and similar vehicles, the shaft and hand wheel for adjusting the central wheels should be carried to the driver's seat for convenience. Patented July 25, 1871, through the Scientific American Patent Agency, by Mr. James F. Cass, of L'Original, Ontario, Canada, to whom inquiries for further particulars may be addressed.

## A Curious Law Suit.

The Philadelphia Ledger gize the following account of a suit $a^{+} \dot{\text { law }}$ recently terminated in that city:
Two mill owners on the Wissahickon creek, above Chesnut Hill, engaged in a curious law suit, which was decided last week at Norristown. The mills are three quarters of a mile apart, and the stream between them has not much fall. In 1823, the owner of the upper mill brought suit against the owner of the lower mill for having backed the water into the race course of the upper mill. Under a decree of the 'ourt, the sheriff put up four dermanent marks to establish
the lawful surface of th- water. At two places holes were drilled in fixed rocks, a warble stone was set in the tail race of the upper dam and properly marked, and a pin was driv en into a buttonwood tree just thirty-one inches above the surface at the breast of the dam. The mills have changed owners since that time, but recently the race of the upper mill has been overflowed by back water, and the owner brought suit for damages. Careful surveys were made, and the water was found to be four inches above the marks in the fixed rocks and on the marble slab, but exactly thirty-one inches from the plug that had been driven into the button wood tree was whether the uppermill and rocks lad suak four inches, or


CASS' TRAMWAY AND VEHICLE.
whether the base of the buttonwood tree had been lifted that much. Notwithstanding ingenious arguments to show that trees only expanded in size and sent out new growths from the extremities of branches, the jury, composed of farmers or those bred in the country, decided that the buttonwood tree had been elongated, by giving a verdict for the plaintiff for $\$ 150$. Counsel for the defence will file reasons for a new trial.

Propagation of Tubercle by Milk.
At the last meeting of the French Association for the Ap vancement for Science, M. Chauveau gave to the section what he termed a demonstration of the transmission of tuberculosis by the digestive organs. He observed that his numerous observations enabled him to state that if the healthy young of animals susceptible of tuberculosis were fed with food with which the matter of tubercle was mixed, they would all exhibit tuberculosis in various organs. In anticipation of this meeting, he had purchased some healthy calves; and, having had them fed as described, on slaughtering them the sixtieth day after the first ingestion, the lymphatic sy stem was found extensively tuberculized, while caseous deposits existed in the lungs. This thesis he demonstrates most conclusively, and he is supported in his inferences by an apparently wholly independent series of experiments carried on by Dr. Klebs, in Germany, which he has recorded in one of the Archiv fur Experim. Pathologie (Heft II, 1873).
Dr. Klebs asserts that the milk of tubercular cows brings on tuberculosisin various animals. The affection generally commences with intestinal catarrh, followed by tuberculization of the mesenteric ganglia, the liver, and spleen, and ending in extensive miliary tuberculosis of the thoracic organs. Infection by means of the milk may be withoat result in vigorous organisms ; and the author has even seen full formed tubercles resorb and disappear through cicatrization. It is likely, adds Dr. Klebs, that the tubercular virus is contained in varying proportions in the milkof cows which are more or less diseased, and the scrofulosis may occur, in children born without tubercle, through the milk of an unhealthy mother or wet nurse. In conclusion, the author expresses theview that the virus is contained in the serum of milk, in a dissolved state, and that it is not destroyed by boiling, which is ordinarily inufficient
If these facts are not overstated, and they do not seem to be so, what a dangerousarticle must be that which is measured out in thousands of gallons daily, in all large cities, the product of phthisical cows, fed on distillery slops, and choked with fou! odors! The milk of one tuberculous cow will contaminate that of the whole dairy when mixed in the cans.
The propagation of typhoid fever by milk has been only too clearly shown in London ihis year; and now have we not to lay to the charge of the same fluid the maintenance of a part of the terrible prevalence of phthisis among us?-Medical and Surgical Reporter.
Lajgh and be Healthy.-The physiological benefit of laughter is explained by Dr. E. Hecker in the Archiv fur Psychiatrie: The comic-like tickling causes a reflex action of the sympathetic nerve, by which the caliber of the vascular portions of the system is diminished, and their nervous power increased. Theaverage pressure of the cerebral vessels on the brain substance is thus decreased, and this is compensated of blood thus called to the lungs. We always feel good when we laugh, but until now we never knew the scientific reason we lau
why.

Comet IV of 1874 , discovered on the $\supseteq 3 d$ of August by M. Prosper Henry, at the Observatory of Paris, presents some remark $\imath \mathrm{ble}$ peculiarities which distinguish it from all other and similar telescopic bodies. Its rapid chavges of form, sudden elongation of tail, and its brilliancy, which became so great as to render it visible to the naked eye for some time previous to its passage to its perihelion, are considered to be phenomena which may th row light upon ou hitherto indefinite knowledge regarding the constitution of comets.
On the day of its disco very, the body appeared as indicated in Fig. 1 in the accompanying illustration, the trlescope showing a spherical nebulous mass, strongly condensed at the center, and exhibiting no traces of a tail. Its ap parent diameter was about $4^{\prime}$, and it resembled a star.of the 7 th magni tude. There was little change in the aspect of the comet until August 26, when, as represented in Fig. 2, a tail began to appear, and the head assumed a slightly elliptical form, its diameter increasing to $6^{\prime}$. Three days later the tail, extending in a direction opposite to that of the sun, attained a length of $20^{\prime}$, and formed with the meridian, passing through the nucleus, an angle of $41^{\circ}$. Fig. 3. On cleus, an angle of 41 thig. 3. On
September 2 (Fig. 4) the tail had grown to $2^{\circ}$ in length aud continued elongating. The nucleus remained nearly constant in size, although its brilliancy augmented until, on Sep. tember 10 (Fig. 5), it became compara ble to a star of the 4th magnitude.
The head of the comet, examined under a magnifying power of 200 , times, appeared composed of three, envelopes and a nucleus the latter being situated near the summit. From the surrounding brilliancy emerged a lami nous and very narrow thread, in which the tail appeared to originate.
From the observations of MM. Andre and Rayct, of the Observatory of Paris, and those of Mr. Plummer, at the Durcomposed of they, the spectrum of the comet is found to be first is in the yellow portion almost between $D$ and $E$; the secoud, in the green, nearly coincides with line $b$; the third is in the blue beyond F. There was no trace of a continuous spectrum in the intervals between these lines. 'The green band was much the most luminous, while the yellow and blue lines were about equal in length and intensity.


On comparing these data with those obtained by Mr. Hug gins from Comet I of 1868 (Wennecke's), it is concluded by Mr. Plummer that the spectra of both bodies are identical, and that the light of M. Henry's comet must be attributed to incandescent carbon, and hence the star must be self-lumi nous. M. Henry, in commenting upon this conclusion in La Nature, from which journal we extract our engraving says that it does not accord with the fact of the variation of brilliancy of comets, which increases in luminosity as the latter approach the sun. It is also difficult to conceive that a body, of a mass so feeble as that generally attributed to comets, could retain for a long time a temperature so high as that required for the volatilization of carbon. It i., per haps, more reasonable to suppose that the comet, inumina ted by the sun, is a cold gaseous body, into the constitution of which carbon enters in the form, for example. of carbonic acid or oxide. This gaseous compound can evidently reflect only those rays which it is able to intercept, and such rays as are intercepted give only a few lines of the spectrum, among which are found those or carbon
The polariscope, M. Henry believes, might furnish some valuable information on this point, and, used in connection with the spectroscope, he considers, must solve positively the question as to whether comets are or are not self-luminous

A Poisonous Anilin Color.-The dye stuff called rosanilin which gives a beautiful carmine color, is, as we have stated an arseniferous production allied to arseniate of lime, and is soluble in lactic acid. It is used in lithograpty and for paint ing wooden vessels, etc. As it is very poisonous, it should never be employed in confectionery, and bright red sugar sticks should not be given to children.

THE WILSON PROCESS FOR MAKING WROUGHT IRON DIRECT FROM THE ORE.

## BY EDWARD $Y$ G GBANT, c.e.

The repeated attempts to manufacture wrought iron direct from the ore are so well known that it is useless to recount the history of past inventions, and, therefore, I will proceed directly to a description of the process which I have investigated.
Tinis furnace wasoinvented and patented by Mr. Joel Wilen, of Dover, N. J., who has spent his whole life in the iron basiness, in England and America, and has been working on this process for nearly twenty years. His last patent was taken out in July, 1872 : and his furnace has been in ope ration a portion of the time during the last twelve months. The stoppages have been caused by changes made at various times in the puddling furnaces, to adapt them to this pro cess; several hundred tuns of iron have been made by this method during that time and sold in the New York market I first heard of his invention in August, 1872, and in December I came north for the purpose of making a thorough.in-vesti-ation of its merits. I brought several tuns of heseveral tuns of hematite from Alabama, for the purpose of testing the working of our native ores by this process. I became 0 much interest. ed in the matter that 1 remained in the vicinity of the works until Scptember 1873 wh wn tember, 1873 ,whin they were closed in consequence of
the panic. Du

went up the annular space, $b b$, thence down through the stand flues, H H, into the circular collecting Hue, I I, which conducts the escape heat to the stack.
In this warthe gases pass entirely around the retorts, heatng them from the outside, while the ore is completely protected from the action of the puddling furnace gases.
After the-ore in the retorts has been reduced by the action of the carbon mixed with it, and thereby freed from its oxygen, the metallic iron, in the shape of red hot particles which flow freely, like fine gravel), is taken out at the bottom of the retorts through the apertures, $d d$ (covered by the slides, $d^{\prime} d^{\prime}$ ), and received into an airtight vessel, of my own design (thus protecting the ore from oxidation from the atmosphere), and is there transferred to a hopper, opening into the puddling furnace, whence it is charged upon the hearth beneath, without losing the heat absorbed in the reducing furnace
This reducing furnace contains sixteen of these retorts,
This reducing furnace contains sixteen of these retorts,
twelve feet high, arranged in a circle about the central cham.
puddling involves less muscular exertion than that required for working pig iron, and only requires one laborer in addition to the usual pudder and helper employed in the ordinary furnace; and the yield from the puddling furnace is fully equal to the production of similar furnaces in using pig metal.
The operations of hammering or squeezing, rolling, etc., are, of course, the same as in the ordinary working of pig iron blooms. A tun of finished iron can be made with two tuns of coal, including that used for reducing purposes. The cost of these reducing furnaces is a small item, and they can be erected in any rolling mill, and the puddling furnaces modified as described, and thus render the mill owners independent of the blast furnaces.
The yield in muck bar from the ore is about the same in amount as that obtained at the blast furnace in the shape of pig iron. The Alabama ore assayed 54 per cent, and I obtained 47 per cent muck bar. Seven tuns of ore sent me from Georgia assayed about 50 per cent (being surface ore) and yielded 45 per cent. Spanish ore from Bilboa, assaying $48 \frac{8}{4}$ per cent, yielded 45 per cent, and many ores from New Jersey and ad. jacent States yielded to within two to five per cent of the assay. Magnetic and hematite ores were worked with were facility, and they were mixed togetherin various propor tions, fully demonstrating th:t mixtures of ores could be worked so as to produceany kind or quality of iron desired. The muck bar showed a uniform fracture both in color the furnace, and $k \in p t$ complete records of the yield in muck twelve inches in hight; all parts of the furnace exposed to bar from each retort, as well as the amount of coal used in puddling, time of heats, etc. I also preserved samples of muck bar from the various charges of ores, to test the uniformity in quality of the iron produced.
The accompanying diagrams will assist an explanation of the appiratus. Theore is crushed to the size of small shot, and mised with the proper percentage of powdered coal and then charged in the retorts, $B$, through the apertures, $a$ a These retorts are built of fire brick or tile, and dove tailed together in ;h a manner as to hold them firmly in position. They c atain from 1,300 to $2,000 \mathrm{lbs}$. of ore, according to the comparative weight and bulk of the mineral. The heat employed is produced from the gases escaping from wo or more puddling furnaces, which are conducted from said furnaces through the flues, F , into a collecting chamber $i$, whence the gases ascend to the level of the base of the retorts at $d d$. Here part of the heat passes under the re torts through the small flues, $h h$, into the annular space, $b b$, thence up to the top of the furnace, where they are con ducted through the conduits, $c c c$, into the intermediate lues, $\mathrm{C}^{\prime} \mathrm{C}^{\prime} \mathrm{C}^{\prime}$, and thencis downward. The major part of the gases rises up through the cintral chamber, $E$, to the cap, ), thence through the conduits, $c c c$, and down through the Hues, C C, uniting therein with the portion of the gases that
the action of the products of combustion are constructed of fire brick or cast iron lined with fire clay. The central cham. ber, E , is seven feet in diameter, and this size of the passage prevents any cutting away of the brickwork by the flame, and also produces an even distribution of the gases through the intermediate flue system, C C C. The heat which escapes from the flue, J, looking to the stack, is sutficient to raise steam for blast and rolling machinery. One of these reducing furnaces will supply three puddling furnaces with reduced ore, so as to keep them in constant operation, and the escape gases from two of these furnaces will furnish lhe heat required to deoxidize the ore.
The construction of the puddling furnaces is based upon the same general principle as that adopted in ordinary bar mills; they are lengthened out, however, so as to form three bottoms, about the ordinary size; the first, next to the flue, is inclined, and upon this bearth the ore is charged; it is thoroughly heated up here, and is then moved forward upon the second hearth, by a tool designed for the purpose, whereit is heated sufficiently to melt the slagproduced by the fusion of the impurities of the ore; from there it is moved o the third bottom and balled up. The operation is coninuous, as a second charge is placed upon the first bottom as soon as the first one is moved to the second hearth. The
ducing a quality of iron equal, if not superior, to any pro duced from the same ores by the old process. The degree of heat employed in the reducing furnace is not sufficient to produce any visible effect upon the bricks, and, therefore, they will endure a long period of service. The furnace is surrounded by a casing of tank iron, with a fire brick lining between the iron and the annular space, $b b$.
Ores containing an excess of impurities may be fluxed in he puddling furnace with perfect facility.
During my investigations, every facility was afforded me by the proprietors of the works; and for a good portion of the time, the operations were practically under my own direction, the inventor following my suggestions so that I might have every point tested in my own way, and to any extent deemed necessary. My conclusions were so favorable that we should have had our works in the South, upon this plan, well under way by this time, but for the unexpected strin gency in the financial world, which has, of course, postponed all new enterprises.-Engineering and Mining Journal.

## NIBUS AND STREET CAR.

A NEW STEAM OMNIBUS AND STREET CAR.
Our engraving illustrates a new style of steam passenger cars, for street railways, the invention of Mr. Grantham, of
London, where the improvement was lately tried. Two small boilers are used, one on each side, fired from the ex-

terior of the car. This novel vehicle has a double set o wheels, one set with flanges, intended for use when the machine runs on the street railway track, the other set being employed when running on common roads. Most railway car and locomotives are useless when at the end of the track but not so with this device. It can then steam off, indepen dent of the track, through streets or roads, as far as may be desired. The axles of the flanged wheels are supplied with cranks and rods, and with a worm wheel and lever, unde the control of the driver, who may, at any moment, raise up the flanged wheels, so that the vehicle will rest on the plain wherls, for running on common roads. The axles of the plain wheels have a screw steering device connected with them, so that the vehicle may be guided in any direction. The car is provided with seats on the top, and, as shown, has capacity for some forty or fifty seats. But the end plat forms, it appears to us, are too long. Taken as a whole, how ever, this device presents some good ideas, and is creditable the inrentor

## $\mathfrak{C a r t e s p}$ madence.

## To the Editor of the Scientific American:

Your reply, in your 18th of October number, to S. W. G.'s inquiry for information as to the best materials to be employed and mode of employing them in the construction of dam for a fish pond, was read by me with very great interest, in connection with the general subject of pisciculture and utilization, especially in this form of enterprise, of smal sheets of water in proximity to large centers of population.
I believe, most firmly, that a larger and cheaper supply of fish than that at present existing would be readily appreciated by every class, and prove most conducive to the more general promotion of health. Meat is good for food, but a vast quantity of meat, seemingly healthy to the utmost microscopic and scientific investigation, is really more or less the reverse, owing to the kind of food used in forcing the process of fattening, and also the habit, in order to accelerate it, of keeping the animal in a state of compulsory inactivity. We are indebted for the comparative immunity we happily enjoy rom the natural, morbid consequences of consimas articles of food, to the benevolence of the vis medicatrix naturce, or vis vitu, to use the language of medicine. But when a man turns the age of 45 or 50 years and his vital power begins to weaken in its resistance to what is injurious, then does he begin (and continue, by an inevitable law of physical life, in accelerated ratio as his years increase) to suffer in one way or many ways, in one organ or many organs, as may be determined by congenital idiosyncrasy or acquired habit. The evil becomes deeper, more irradicable, and therefore more dangerous, by the slowness with which it grows. The remoteness of the effect from the cause throws suspicion into fatal sleep until awakened by the magnitude and seriousness f disease; the physician is called on and in vain invoked to exorcise by a drug the seven spirits which, insinuating themelves into the very citadel of life, refuse to leave until accompanied by that life which they expressly came to take away. But I must not allow myself to be carried away into nordinate length by my subject. I shall not, therefore, anticipate the answer that possibly might be urged-for as sumption growe in extravagance with the extent of ignor-ance-derived from the easily accessible quantity of salt fish Neither shall I touch on the admitted, because admitted, healthfulness of change of food. My object is simply to avail myself of the most potent of all arguments why our attection ought to be more generally directed to the utilization of our lakes for the propagation of fish-the commercial argument. I have been very much astonished by the reports in American papers (I am a Canadian, residing in Canada) of the wonderful financial results of a few private enterprises of this kind, notably on, I think, Long Island. One gentleman digs a pond, and builds a hatching house, at a total expenditure of $\$ 1,500$, and after some two years begins to reap a clear profit of $\$ 3,000$ a year, with a stock of fish on hand (ใ refer here exclusively to trout) valued at more than treble this sum. The reports of others are simply confirmtory of this. It is a crop that sows itself, that needs no plowing, harrowing, drilling or cultivating of the soil. The crop itself does all this. It is therefore nearly all profit. You are already bc ginning, with that intelligence and foresight now indigerous with you, practically to appreciate the enormous pecuniary as well as sanitary value of this industry why should it more especially urge itself on me? Because live within a few miles of a country-the northern bank of the river Ottawa-abounding in lakes, large and small, ome teeming with the finest trout, but nobody cares to atch them ; open to all, or rights may be purchased for a comparative trifle by any person, waiting for some enterprising and intelligent person to come and occupy and enrich himself as well as others. The land is, for the most part, rocky, mountainous, wild, but healthy in the extreme and picturesque. In eager exploration for minerals, the mind cannot, it would seem, appreciate the value of the living minerals which in vain, by their glitter, attract the eye and fearlessly invite attention to their numbers and their beauty.
You have an equal share with ourselves already in our salt water fisheries. It must be because you are ignorant of theextent, perhaps the existence, of our fresh water fish that I suppose you are not already catching and exporting them. You have invaded our forests and are rapidly cutting them down and carrying them off, and profiting by the operation. I think I may safely promise your appearance with rod and
bait a very warm welcome, and a very profitable result. suitable subject for your paper; if so, I shall gladly hail its appearance in the interest of my aim, the extension of a val uable industry and the promotion of our physical well being. These remarks embody the views of our very intelligent Deputy Minister of Fisheries, enunciated some time ago in a conversation with me. The subject is, with him, one of scientific as well as practical interest

Canadian.

## Mannetism and the Nodular Form of Iron.

## To the Editor of the Scientific American

Those much acquainted with magnetism are familiar with the magnetic curves described by iron filings, when shaken about a bar magnet. If we $1 \geqslant y$ on a bar magnet a pane of glass, and shake upon the glass some five iron fil ings, and gently strike the glass, the filings will distribute themselves after a certain uniform manner in obedience to a force operating them from the magnet. If our magnet be a square bar, and we turn it one quarter of the way over, and again try the experiment, a similar distribution of the filings will ensue. Wbat must we conclude from this? Obviously that the force of the magnet does not exert itself simply in the plane in which the filings lie upon the glass, but in an infinite series of planes, extending in every direction about it. • If the magnctism were sutficiently strong to counteract or annul the force of gravitation, or the filings were free to move among themselves, they would arrange themselves, about the poles of the magnet in an elongated globular form. Furthermore: If the atoms of iron of which the bar itself is composed, and which are magnetized, could overcome the force of cohesion, or were alone acted upon by the force of magnetism, they would arrange themselves in accordance with the law governing the magnetic curve. Hence, in all magnets, the atoms of which they are composed are under a strain, which is in proportion to the degree of magnetism by which they are influenced.
I deduce from the foregoing the following corcllary: The best shape for a magnet is that in wbich the circumscribed boundary of any part of its surface will exactly coincide with the exterior maguetic curve, considering the curve to extend in every direction from the center of tither pole. I also find in the a'sove theory an explanation of the fact that iron which has been deposited from solution (as in the clay basins of Missouri) has assumed a globular shape,and is almost universally found in nodules. The atoms of iron have been deposited in obedience to the magnetic force; and being in solution and free to move, the atoms, in aggregating, have ar-
ranged themselves on the magnctic curves. While this was ranged themselves on the magnetic curves. While this was
going forward, the nodules were probably in pairs. Subse quently, violent action has rended them asunder, caus have operated to demagnetize them, and oxidation and at tion have modified their primary form.
C. II. Murray.

## Coal Tar Products.

To the Editor of the Scientific American:
Allow me to add, to your list of the products of coal tar, rhigoline, which is now used in the artificial manufacture of ice. There is also a beautiful black varnish for iron, which dries quickly and produces a gloss almost equal to Japan; this is made by dissolving the pitchy residuum of coal tar in the heavy oil that distils from the same, being the only liquid which will dissolve it. This varnish is known to the trade as paraffin varnish, but this is a misnomer, as that article, although a p oduct of coal tar, does not enter into its composition.
A few years ago I was connected with the coal tar pitch interest in such a manner as to lead to a series of experiments. In the years 1861 and 1862 , I was engaged in the manufacture of a cheap quality of sealing wax for capping fruit cans. Cincinnati at that time enjoyed a monopoly in that trade, supplying dealers at all points. In the years named the price of rosin advanced (owing to the war) from $\$ 1.80$ to $\$ 40.00$ per barrel, and was difficult to obtain at that price: which caused the manufacturers here to look for a substitute, which was found in coal tar pitch. So well did it answer the purpose that at least fifty tuns were cast into
suitable shape and sold for sealing wax, the only objection to it being the odor.
The beautiful gloss of this wax, together with its strength and the facility with which it could be cast into molds, led me to make some experiments as to its value as a material for decoration, picture frames, statuary, etc. This resulted in my securing a patent on the 5th of August, 1865, covering its use for the manufacture of a variety of useful articles From that time until the present, I have endeavored to de velope my invention, being convinced that it will be as useful as vulcanized rubber in time. I send you a blacking box, cast of the material, which please accept as a suriosity, being another link in the long chain of useful products of the unsightly and formerly despised article, coal tar
Cincinnati, 0.
J. T. Peet.

The Curability of Consumption.-This is the attractive itle of a very excellent article in the Deutsclues Archiv fur Klinische Medicin, June, 1873, by Dr. Massini. He shows, frst, that true tubercular consumption is curable, as post it is communicable he also attempts to prove, and hence he disapproves of consumptives marrying. The means of prevention are general and special. His enumeration of them includes nothing novel; but with most of the later German authorities, he is strongly in favor of elevated health resorts -puremountain air.

## ALUMINA, FROM THE CLAY TO THE SAPPHIRE.

before the polytechnic club of the american institute,
december 18, 1873, by Dr. L. feuchtwanger. - conclusion.
It has been stated that alumina is the oxide of the metal aluminum. We will now proceed to describe the process of obtaining this peculiar metal, and its qualities and applica. tions.
It is an earthy metal, like cerium, zirconium, glucinum, er bium, and yttrium, and was first prepared by Wöhler in
1828; it is one of the most important metals on account of 1828: it is one of the most important metals on account of
its usefulness in the arts. Its extraction from its mineral compounds, however, is not very easy, or it would ere this have been the great rival of the pricious metals; in fact it possesses some qualities superior to them. Several metbods have been proposed for its extraction, all of which dep↔nd upon the use of metallic sodium. Common clay, cryolite, and other aluminous minerals may be emploved, but the mineral called bauxite, from France, containing about 60 per cent alumina and 40 per cent silica, is now principally einployєd by the large manufacturers in Europe. The process is as follows: Pulverized bauxite is mixed with powdered soda ash, and fused at considerable heat, during which process the aluminate of soda is formed, and carbonic acid escapes; the fused mass is dissolved in boiling water, and the clear solution evaporated; then the redissolved aluminate is neu tralized with hydrochloric acid, whereby a chloride of sodium is oltained, and the alcimina is converted into a hydrate of alumina, which, being mixed wih charcoal and common salt, is formed into balls and heated in earthen cylinders, dry chlorine gas being passed through the heated mass. Chloride of aluminum and chloride of sodium are thus produced, going over into the retort, the carbon abstracting the oxygen from the alumina. Metallic sodium is now mixed with the two chlorides, and heated in a reverberatory furnace. Metallic aluminum is then found at the bottom of the melted chloride of sodium; this is now separated from the fused mass, and may be remelted, cast in bars, and then rolled out into sheets and wire. The chloride of aluminum is à yet the only vehicle suitable for the extraction of the metal; it may be easily produced by fusing the ammonio alum with char coal and then passing a stream of chlorine gas through the mass; the chloride goes over in the form of vapor which condenses in a receiver as a solid crystaline mass. The metallic aluminum is now largely mauufactured in France and England; the business has been attempted in the United States (from cryolite, by Monier and Parmele), but has not been carried to any extent.
Aluminum possesses the following remarkable properties It is of white color, resembling silver, and is very sonorous more so than any other metal ; i is the lightest metal, hay ing a specific gravity of 25 (while silver has a specific gravity of $10 \cdot 53$ ); this property renders aluminum very valuable in the arts, such as for making small wrights used in chemical analysis, for dentists in the manufacture of plotes for artificial teeth, and many ornamental purposes, particularly as it resists so well the action of a moist atmosphere. It even resists boiling nitric acid; this property puts it on equality with gold and platinum; but hydrochloric acid atacksit. It is, however, not blackened by hydrosulphuric acid. It is infusible in cast iron heat by exclusion of air, but burns in the same with brilliancy, and in oxygen gas the combustion is so fierce that the eye can hardly bear to look on it; it is then formed ints the earth alumina. It dissolves readily in dilute caustic alkali, such as ammonia, and in diute sulphuric acid; it is not attacked by cold sulphuric or nitric acid.
Aluminum bronze is an alloy of 1 part alumiaum and parts metaliic copper. It has the color of gold, but becomes dull after a while, and it is as strong as iron; neither mercury nor lead, both of which generally attack other met. als, has any effect on aluminum.

## UUMNA

It has been remarked that alumina is fouvd in Nature almost pure in the sapphire, corundum, emery, spinelle, opaz, diaspore, in the vast deposits of clay, and in all silicated minerals. In order to obtain the same pure and in a hydrate, the following process is adopted: Commercial alum, free from iron, is precipitsted by a concentrated solution of carbonate of soda in evcess; the precipitate is reaissolved in hydrochloric acid, and again precipitated by ammonia; this precipitate is then calcined, and the result is a pure hydrate of alumina. A more simple method is by igniting the pure ammonio-alum, also by the decomposition of a solution of alum and chloride of barium. The pure alumina is colorless and tasteless, and wholly insoluble in water. If a littie alum is dissolved in warm water, and some ammonia is added to the solution; the latter combiues with the sulphuric acid, while the alumina unites with water so as to form emi-transparent gelatinous mass, which is the hydrate of alumina; this bas a great attinity for many colcring matters, forming the well known lake pigments.

## SULPilate of aldmint

is also called porous alum, concentrated alum or alum cake This very important substauce, of extensive application in the arts, is produced either from common pipe clay, kaolin, shale, ar cryolite. From clay, it is prepared by calcining the same it treating it with half its weight of sulphuric acid, until it becomes a stiff paste, which is then exposed to the air fo washed out with water so as to leave the undissolved s:lica behind ; the clear solution is evaporated to a sirupy consist ence and allowed to cool; it then solidifies into a white mass, and this is the cake or concentrated alum, which is extreme ly soluble. The alum shale is much emplozed for this pur-
pose in Euro by roasting it in heaps and setting fire in several places under them; the iron pyrites (a usual compan ion of all shales) produces a decomposition, and sulphurous acid is evolved. On exposure to the atmosphere, as above stated, the sulphate of alumina is obtained.
In P'ennsylvania, the cryolite from Greenland is altogether used for the manufacture of the alum cake, by the fol lowing simple method: The cryolite is mixed with chalk and calcined, and a double fluoride of aluminum and sodium is productil; while the fluoride of calcium, first formed, gives off its oxygeu to the sodium and aluminum, converting them into sodia aud alumina The soda is now crystalized out of solution with the assistance of carbonic acid gas which is passed iuto it; and after setting the same aside, the soda as the carbonate crystalizes out of it, leaving the pure alumin in the mother liquor to be treated with sulphuric acid.
Sulphate of alumina las a sour taste, but also a sweet and astringent aftertaste; it is soluble in twice its weight of water. It is a powerful antiseptic and arrests animal putri raction, and can be used for preserving bodies. Porous alum or sulphate of aiumina is very extensively used by calico printers and
preierred to alum.

## ALUM.

This, the chief compound of aluminum, employed so ex tensively in the arts, is obtained from the last mentioned substatice, the sulphate of alumina. The solution is mixed
with sulphate of potash, when, on evaporation, beautiful orahedral crystals are obtained. Sulphate of ammonia, as olt:ined from gas liquor, is now generaily substituted for ilu. potish; and instead of a potash alum, ammonia alum i now altogether put in market, although many manufac turers believe they obtain the old fashioned potash alum but the amm snia alum answers as well in dyeing, calico pruting, papermaking, etc., and in the manufacture of colors. In Eugland, the chloride of potassium was formerly used in the manufacture of alum, this being a
from the soapboiler and the saltpeter re.iner.
from the soapboiler and the saltpeter re-iner. called techermigite, which occurs in' fiberous crystals, but not in such sutficient quantities to be of practical use. There are, however, many minerals from which alum can be ex tratted, and the localities may be seen all over the world in Germany, particularly in the neighborhood of Halle in Pruzsia, on the island of Riga in the Baltic, in Bohemia, in Hungary, in England (where the deposits are most exten sivt), and in the United States.
The following sources of alum are mentioned, as the field the mineral used for the production of alum and alum cake, independently of the pure clays or kaolins brought into withet and used most extensively for the manufacture of porcelain, pottery, and Rockinghan ware:
Alum carth, a mineral deposit in the brown cual forma
True alum slate is a dull earthy black slaty mineral, of spe cific gravity $2 \cdot 4$; it contains some bituminous matter and fos il remains, and is found in England, the Netherlands, and Pruspia.
The alum stone, called alunite, of obtuse rhombic form and white color. It has a vitireous and pearly luster, yield ing : ulumina 14 per cent, sulphtric acid 25 per cent, silica 4 per cent, potash 4 per cent, water 2 per cent; total, 100 In 136\%, I found it between the gueiss and granite, in an thorescent state, at First avenue an.ll 51st street, in this city The mineral is found in lava and trachytic rocks at Talfa near liome, in Hungrary, and in Anvergne, France. This naterial was used 1,000 years ago for producing the alum and is called the Roman alum.
The aluminite, found abundantly in Prussia at Halle, and at Epernay in France, is also called websterite, and contains alumina 30 per cent, sulphuric acid $\because 4$ per cent, water 46 pe cent. It is white and opaque; it adheres to the tongue, and has a specitic gravity of 20 . It is rather abundant in the localities named.
The many applications of alum in the arts are due to the alumina having great affinity for many coloring and other vegetable matters, for gelatin, etc.; and in the preparation of laker, it forms an insoluble precipitate of alumina with veretable colors. It is also used in preparing white leather y its action on gelatin, for clarifying water, as an addition on paste used by bookbinders, for preventing the depreda tions of insects, in fireproof safes as a filling, etc. Alum has been described by authors as early as Pliny and Dioscorides. Boerlaaive gives a very extensive description of it, and says Alum is a real fossil, procured either from a hard tlaky otnoue, found deep in the grcund, and to pregnant with sul phur and bitumen as easily to take fire or form a bituminous and combustible earth, which yields a noxious flame and sulphurous stench. If exposed for a month in the cpen air it crumbles into powder, and thus becomes disposed for the srneration of alum, which before it was riot. If dissolved in water, it may be precipitated by adding a fixed or volatile alkali; and it then produces a new salt, which is the alkal and the fossil matter together. In England, Italy, and Flandeis, alum is principally produced." He also says "that rlum bas a sharp, rough, styptic taste. Is crystals are oc tagonal, four of the sides being hexagon $\because l$, and the othe four triangular, suefaces. In is manufactured from the natural substance in summer time.
Lot ine add a few words more about alum and its physica and medicinal properties. Alum is a white, slightly efflor escent salt, it crystalizes easily in octahedrons, but may b made to crystalize in cubes, if an excess of ammonia is add ed to the folution, which must be carefully evaporated; it dismolves in warm water, say in three fourths of its weigh
of boiling water. It is insoluble in alcohol, and has a specific gravity of $1 \cdot 71$; it reddens litmus, and changes the tints of the blue petals of plants to green; it assumes an aqueous fusion when heated to $212^{\circ}$ Fah. Exposed to red heat, ives off oxygen with sulphurous acid. It forms pyrophorus hen calcined with fine charcoal, and then spontaneously forms an inflammable substance. There are several varieties known in c:mmerce, among others, the Roche alum, which riginally came from Rocca in Syria, of a pale rose color; and the Roman alum, which has always been considered as the prest. Five thousand tuns are still annually manufactured. Alum is incompatible with the alkalies and their carbonates, lime and lime water, magnesia and its carbonate, tar trate of potash, and acetate of lead. It is an astringent and antispasmodic; in large doses, it is purgative and emetic. In cases of hœmorrhage, sweats, diabetes, chrcnic dysentery and diarrhoea, it is used as an astringent. It is used as a purgative in the painter's and nervous colics. Alum is also ometimes used for the adulteration of bread, with a view o increase the whiteness, but in very small doses.
It may be stated, in conclusion, that a great many miner als, known by mineralogists as oxygen compounts, the uni silicates, hydrosilicates, and some bisilicates, contain the oxide of aluminum or alumina as one of the component parts. The family known as zeolites, such as laumonite natrolite, analcite, mpsolite, scolecite, thompsonite, gmelinite, phillipsite, harmotume, stilbite and many more of this class contain from 20 to 30 per cent of alumina, pachnolite 25 per cent, and staurulite 50 per cent. Kyanite contains 64 per cent. Several wineral springs in the United States, in Virginia, contain the al:am in solution from 20 to 70 per cent, nd are used in medicire.
I may say that alumina exists in the most common as well as the most precious minerals. White clay or kaolin is ound in many localities in the United States to a very large extent. I have risited many deposits in Vermont, near Bran don, in Massachusetts, in Penosylvania, at Jacksonville, Ala. and in South Carolina. At Bath I saw large deposits of a fine quality, and 10,000 tuns are annually brought to this ity for papermakers' use. At Aiken, S. C., large deposits are yet undeveloped. At Perth Amboy, various qualities have been dug out for the last 50 years from strata 20 fee thick. It is found in the coal, tertiary, metamorphic and older formations. Stourbridge clay, so indispensable for glass pots, is principally brought from England. Alum is a very important branch of commerce. England produces an nually 10,000 tuns, and Germany 10,000 : and in the United States about 5,000 tuns are manufactured

## Death of the Big Rhinoceros in the London

 Zoological GardensThe " Zoo" is in mourning for one of its hugest and oldest nhabitants. The great rhinoceros, which had been from it earliest days a conspicuous object in the elephant house has at last succumbed to the scythe bearer, or whoever the hinoceral typical representative of death may be. For wenty-four years the creature had lived in comfortable quarters, and withstood the rigors of an English climate ; for twenty-four years it had, day after day, partaken of its plain meals of hay and similar food, and day after day for twentyour years it had thrustits snout as far as possible betwee he massive bars of its den, and opened its capacious jaws to eceive the gratuities of its admiring visitors, in the shape f buns and biscuits, oranges and apples, and other titbits The rhinoceros is liable to sudden outbursts of violent temper, and the late lamented individual was no exception to his general failing of its race.
Several years ago, in a furious attack on the rails of its den, it broke its jaw, and was for some time in rather a dangerous condition. It, however, survived the accident and as safely passed through the vicissitudes of English weather, and it may be considered that twenty-four years about the average length of life among this species of pachydermata. The hippopotamus has bred in the gardens, but no success has attended the attempts to breed the rhi noceros in captivity, their violent tempers rendering it dangerous for them to be temporarily housed together. The keleton and skin of the deceased creature are to be preserved and valuable preparations will no dcubt be made.-London Neics.

## Railway Receipts and Expenses.

The proportion of working expenses to receipts is often put forward as evidence of the cheapuess or dearness wit which a line is varked; while in fact it proves nothing at all, either one way $C$ - the other. Recently a statement of the proportion of expens:: $3 n$ the Deaver \& Rio Grande Railway has been widely publis:: d at hcme and abroad as evidence of the cheapness of woninit a narrow gage line, the per entage given in the case b , , re us being 48.5 per cent in August, and 45.4 per cent in September last. The propor ion of expenses depends equally on two things: 1 . The cost f transportation, and, 2, the rates received. Evidently, if it costs me two cents per mile to carry passengers and I get three cents for it, my working expenses will be $66 \frac{2}{3}$ per cent while if I receive 4 cents per mile these same working ex penses will be but 50 per cent. On the Denver \& Rio Grande we understand, ten dollars is charged for carrying a passen ger 76 miles, and at this rate working expenses of 45 pe cent give nearly six cents per mile as the cost of doing the work. This is no argument against the road and its management, for the traffic is light, and heavy charges would be ectssary to support a road of any gage. The Central Pacific whose charges are not balf so high, is worked for 40 per
cent of its earnings, its rates being still higher than those of cent of its earnings, its rates being still higher than those of
most American roads with equal trafic. The Panama Rail

Oad is worked for about 44 per cent, we believe, and one
might think it wonderfully economical; but its charge for carrying a passenger 47 miles is twenty five dollars, so the cost would appear to be something like 23 cents per mile.Railooay Gazette.

## The Hours of Labor

E. W. says: "I regret that A. B. Mullett falls into the very common error of accepting eight hours' labor as costing but twenty per cent more than ten hours, instead of twenty-five per cent more. Let me quote the following letter, written by me in June, 1872: 'If a piece worker asks 20 per cent advance to equalize wages, when the time worker has his hours reduced from 8 to 10 , it does not make them equal in pay, as the former will find on expetiment. The manufacturer, too, will find that, so far as the day hands are concerned, his wages account will be increased 25 per cent. If I have two tands at work, making shirts: to one I pay $\$ 4$ per day, for 10 hours, and he makes 4 shirts per hour, or 40 slirts per day, costing me, of course, 10 cents each for labor ; the other hand works by the piece, at 10 cents each shirt, makes 40 per day, and gets, of course, $\$ 4$ per day. So far, so good; but the day worker now wants to work but 8 hours for $\$ 4$; and he will produce for me , at 4 shirts per hour, 32 shirts, costing me $12 \frac{1}{2}$ cents each; certainly 25 fer cent more. The piece worker then asks for 20 per cent advance over original price of 10 cents, and gets thereby 12 cents each for his 32 , and, consequently, earns but $\$ 3.84$, so that he does not equalize wages.' If, under the 8 hour programme, I have to employ five people to work 40 hours, when four now accomplish that much, am I not paying 25 per cent more wages?

It has been asserted that a mechanic can produce as much work in 8 hours as in 10. If he can do that for his employer, why cannot the piece worker do that for himself, and not ask 20 per cent more to equalize?"

## A New Floral Ornament.

A writer in Les Mondes suggests a new idea for floral de coration, which, it seems, may be readily put in practice. An ordinary earthenware flower pot is filled with water, the hole in the bottom of course being closed, and allowed to tand until its porous sides are completely soaked. The water is then thrown out,and the potis repeatedly dipped until it will absorb no more, and its outside becomes thoroughly wet. On the outer surface fine seed is thickly sprinkled and ailowed to remain sticking thereto. The pot is then refilled with water, and set in the shade under a bell glass. In a short time the seeds will germinate and throw out shoots, so that, to prevent their falling from the sides of the pot, some thread or wires must be repeatedly wound around the exterior of the latter. Eventually the entire vessel will be come a mass of living vegetation, which is nourished by the percolation of the water contained within through the porous sides.
A non-porous receptacle may also be used, but some thick cloth must be wound about its exterior and the seed sprink led thereon. This cloth is kept continually moist by re peated applications of freeh water.

## The wear of Gold Coin.

It appears from experiments made in St. Petersburgh that, ontrary to the opinion generally entertained, gold coin wears away faster than that of silver. Twenty pounds of gold half imperials, and as much of silver copecks-coins of about the same size-were put into new barrels, mounted like churns, which were kept turning for four hours continuously. It was then found, on weighing the coins, that the gold ones had lost sixty-four grammes-the silver ones only thirty four; but as the number of gold pieces was twenty-eight per cent less than those of silver, the proportion is of course greater to that amount in favor of the latter. The silver also contained more alloy than the gold.

A correspondent, " Nick," writes to point out a slip of th3 pen in our issue of December 13, 1872, whertin we stated hat the nickel mi
' In your paper
In your paper of November 30,1872 , you have an articie on American nickel, wherein you mention the mine La Mot e tract, Mo. ;" you also mention elsewhere that the ore is foun' in Pennsylvania and Missouri. The nickel mines of Ming La Motte are now being very extensively worked at the present time, and the owners, the La Motte Lead company, have urned almost their entire attention to raising and reducing the nickel ore to regulus, which is being shipped in large guantities. Recently $7,000 \mathrm{lbs}$. of nickel ore were raised in one day; it assayed 35 per cent metal, and was worth $\$ 1$ per pound at the mine. The work was done by six miners, $\$ 7,000$ being dug out for a cost of less than $\$ 25$.

An Excellent Pen.
Messrs. C. M. Fisher \& Co., of No. 102 Fulton street, in his city, have devised a new form of gold pen, known as the Paragon, in which not only the form but also the char acteristics of the quill are closely imitated. To those who have been accustomed to write with the latter, and have experienced the trouble of mending it, the gold pen, as made by the above firm, will, we think, prove to be a welcome ad dition to the writing table. We have used oue almost constantly for the past month or two, and at the present time it is perfectly flexible, sbows no sign of wear, and is one of the best pens we ever used. The makers adapt each pen to uit the hand; and hence, any peculiarity of holding can be allowed for, and the habits of the individual writer con.

## TESTING THE QUALITY OF IRON, STEEL, AND OTHE METALS, WITHOUT SPECIAL APPARATUS.

 distorting force, at very instant during he experiment up o the point of rup ture.2. Among these de elopments, and not the least important has been the fact hat the quality of any given materia can be determined with some approach to accuracy,by adop ing the method here in use, but without ecessarily going to the expense of pur hasing the power ful machines in ge atral use for de termining tensile strength, or oven paying the two or three hundred dol lars which is charged at the shops of the Stevens Institute of Technology for the recording machine with which these tests were made. A strong long handled wrench, a good pring bulance, and firm but delicate hand, afford all ne cessary means of procuring quite sa isfactory results, as to mere strength of material; while a careful inspection of the fractured pieces, after a little experience, will assist greatly in the deter mination of the general characteristic of the metal
3. The method of
procedure is neatly
illustrated in the large engraving, and would, in general, be as follows: Cut, from the bar or mass to be tested, pieces about three and a half or four inches long, and turn them off in the middle to a diameter of half an inch for iron or brass, and three eighths if of steel; make this neck one inch long. A square head is left at each end. Secure the piece vertically and firmly, by one end, in a strong vise; fit a solid ended wrench to the other end of the test piece; and to the extremity of the handle, which should be, for convenience, about five feet long, attach a spring balance capable of recording with accuracy up to fifty or sirty pounds.
Paint the scale of the balance with white lead or tallow and spring the pointer so as to just touch the painted sur

face. The mark traced by the pointer then indicates the maximum force applied.
4. Commence pulling steadily on the balance, keeping the direction of pull at right angles to the wrench handle
An apparently unyielding resistance will be felt up to a certain point, when the test piece will commence observably to give way. Note the indication of the spring balance at this point, which is the limit of elasticity, and record both that reading and, if possible, the distance through which the piece has twisted, the latter measure being an indication of its stiffness.

## BY PROFESSOR THURSTON.

1. During the research which has occupied a considerable portion of the time of the writer recently, and to which re ference has been made in the earlier numbers of the ScIENTIFIC AMERICAN, some very interesting facts have been observed; and much has been learned respecting the strength, stiffness, elaytiedty, ductility, and resilience of the metals used in engineering, which could only have been accurately obtained by mexms of apparatus capable of recording both he amount of distortion of the test piece and the coincident

Continue twisting the piece until it has gone some distance beyond the limit of its elasticity, then stop and notice how far the arm springs back while gradually taking off the twisting force.
This distance is a measure of the elasticity of the metal and is usually, if not invariably, the same, however great the set, even up to the point of rupture.
Renew the twisting force and break off the piece, noting the maximum angle which the piece has been twisted through and the maximum resistance, as indicated by the spring balance.
5. The stiffness of the metal is measured by the force re
quired to twist it through the first small angle, say five de-


## [MACHINE FOR TESTING THE STRENGTH OF IRON

beautifully finished, has become greatly altered, and has a sumed a curiously roughened and striated appearance. The spirals extend completely around the cylindrical portion, and the fractured end has the appearance peculiarly characteristic of very homogeneous and ductile metal. The record pen cilled by the machine in this test shows it to have been fair ly stiff, to have passed its limit of elasticity under a stress equivalent to about 30,000 pounds per square inch of tension, to have been more homogeneous than many specimens of shear or even than some cast steels, to have had a ductility exceeding that of any other specimen yet found of either iron or low steel, to have had a greater resilience, that is to say, power of resisting shock, than any other metal exam ned, and to hav had an ultimate ten sile strength of about 62,000 pounds per sq uare inch.
This metal wa made of selected scrap from refined charcoal iron, rolle into half inch bars cut and polished,and rolled down to on inch square. Such care must evidently produce a splendid iron. Unfortunate ly, however, it sixteen cents per pound
No. 1 is an iron of vastly differen character. The re cord of the tes shows it to be only a fairly good metal, and the end view exhibits a rough granular characte of fracture, espe cially near the mid dle, and this proves its unreliability
No. 23 is clest iron of a dark foun dery grade, with a perceptible but slight ductility, and about half the strength of fair wrought iron.
The peculiar and almost mathemati cally regular form of the surface of rupture is noticea ble in all irons of this class. No spiy ral markings are perceptible. The metal only yielded aboct ten degree place. Here the color and grain of the iron aid the judg
is should be about fifty pounds on the end of a lever five feet long. For tool steel, it should be about thirty pounds, where the neck has a diameter of three eighths inch.
The limit of elasticity is determined by the force required give it its earliest set.
The degree of elasticity is measured by the distance through which the wrench springs back when the force is removed fter producing set.
The ultimate tensile strength is approximately proportioned the force producing rupture by torsion.
The limit of elasticity for tensile strength is proportional to force producing set by torsion.
The ductility of the metal is measured by the angle through which the piece twists before breaking.
The power of resisting shock, or resilience, as it is called by engineers, is nearly proportional to the product obtained by multiplying the breaking force by the maximum angle of orsion.
The homogeneity of the metal is determined by the regularity with which the resistance of the piece increases when passing its limit of elasticity.
6. By taking samples of well known brands of metal and pursuing this course, a standard is easily obtained, by reference to which a little practice will enable the experimenter to leain readily, and pretty accurately, the relative value of such other metals as he wishes to test
7. Next, taking the fractured pieces, a careful inspection ill assist wonderfully in pronouncing a correct judgment Thus, in our illustrations, No. 16 shows the side and the end of a fractured specimen of wrought iron of excellent quality, but seamy and not well worked
The cracks extending around, in a spiral, through three fourths the circumference, and the appearance of irregular ly distributed flaws on the end, prove the seamy characte of the material, while the record of its test proves it tough, rong, and ductile.
Compare this with No. 22 , which is the best piece of iro which could be found among a hundred tested specimens, and which is of almost wonderful toughness and ductility.
The surface of the neck, which, before being tested, was
ment in forming correct conclusions after inspecting the re cord of test.
No. 30 is a hard white charcoal cast iron, such as is used for making " malleableized cast iron." It is a half stronger than the preceding, but is brittle, and has no ductility, snap ping sharply at the limit of its elasticity.
8. No. 35 is the same white cast iron malleableized. It test indicates undiminished strength, combined with ductili ty exceeding, ly several times, that of the toughest grade of cast iron, and even equaling some kinds of untempered steel. It is far less ductile, however, than wrought iron. The fracture exhibits its incomplete transformation, and the irre gular distribution of the remaining carbon.


No. 35 is also a sample of similar character but much more horoughly malleableized.
The test exhibits a strength equal to that of quite good wrought iron, and a toughness which is not very much less than that of some hard forged iron. The fracture indicates a very regular character, and freedom from defects, while the spiral markings prove its ductility. Such a metal as this is better for many purposes than much of the wrought iron in the market, and the cheapness with which swkward hapes can be made of it, as compared with forginga, giveit special advantages in many cases where the pieces are small.
9. No. 68 is a specimen of low steel, and its peculiarities are those of "homogeneous" metal, or of steel made by either the Bessemer or the Siemens process. The test and an inspection of the fractured piece indicate its strength to be nearly double that of ordinary wrought iron, and prove its great ductility and resilience and its homogeneous character.


No. il is a piece of tool steel, having a strength twice as great as the best of iron, great elasticity, but a ductility only a fraction of that of good iron, excellent, in consequence of its strength and hardness, for tools and for resisting steady strain, but not so well adapted as steel of lower grade, or even as the better grades of iron, to meet shocks. Its jagged fracture and its fine even grain are evidence of the splendid quality of the metal and the perfect homogeneity of struc

ture, which distinguish it from the fiberous wrought irons. The shear steels and the softer grades of tool steel usually exl.ibit an appearance very similar to 68, but are apt to crack alony the side and through the neck, as is illustrated in No. 58.
10. Thus a little practice and careful observation will en able any good mechanic to test his materials even when he cannot afford to purchase a testing machine, and with a fair degree of confidence in the derived resulte, and at almost no expense.


A careful study of the accompanying illustrations, which the artist and engraver of the Scientific American have succeeded in making such perfect representations of the specimens placed before them, will assist greatly in the acquirement of this very valuable accomplishment.

Stevens Institute of Technology, Hoboken, N. J. December, 1873.

## The Vacuum Car Brake.

The vacuum car brake consists of a brass globe or bulb about fourteen inches long and five inches in sectional diameter in the largest part, and in shape very much like a lamp globe. The neck of the globe is about eight inches long. The enlargement is made to allow steam to surround a smaller pipe, which conducts the exhausted air. This pait of the air pipe is about six inches long and two in diameter, reaching nearly to the neck of the bulb, leaving a space all around about one eighth of an inch wide; this tube is fitted tightly into the bottom of the globe so that none of the steam may escape below. To the lowerpart of this globe the air pipe is nicely fitted. In an enlargement of the end of this pipe, there i an air valve arranged to prevent the refilling the vacuum, and just below this is a relief valve to allow the air to tuter. These valves are conical, so that the greater the pressure the more tightly they fit. Beneath each car, and connected with this apparatus by tubes, made so as not to collapse, is a cylinder with solid ends and flexible sides, which are kept from entirely collapsing by iron rings. The ends of this cylinder are connected with the brakes, so that, when the atmospheric pressure forces the ends together, the brakes are put on. The steam, being introduced from the boiler, passes out around the end of the air tube and removes the a tmospheric pressures, producing a vacuum. By enlarging the cylinders beneath the cars, the power may be increased at pleasure. -Polytechnic Bulletin.

## Ramming the Mold.

B. W. says: "In your number of November 22, 1873, you say that "ramming the mold is not a complicated performance, nor does it require the ability of a very skilled artisan." I have for many years been a close observer of losses in founderies, and I have found that about six tenths of the wastrels are on account of imperfect ramming, the latter being either too hard, causing the mold to blow and scale: or too soft, allowing it to strain as long as the metal retains its liquidity and, when turned out, is too largeto fit where it was intended. Hence the casting is condemned, in either case, on account of bad ramming. Any person posted in figures can calculate the pressure of fluids; but it requires the experience of the pressure of fuids; but it requires the experience of
years to know how much ramming is required to resist that years to know how much ramming is required to resist that
pressure. He can only become skillful in the science of rampressure. He can only become skillful in the science of ram-
ming by observing closely the result of every day's work, ming by observing closely the result of every day's work,
not only of his own, but of other molders also, so that he can ascertain the cause of any defect he may see on a casting, and thereby prevent the re-occurrence of the same. Ramming is a most complicated and important process; it amounts to but a very small portion of the cost of other work re quired to complete the job; but too hard, too soft, or irregu lar ramming, will cause all the work done on the job to be ost. The causes of the loss of the other four tenths are numerous, such as: Sand too wet, or too dry, inability of the molder to secure his mold before casting, lack of judgment in venting, lack of judgment in locating his gate to prevent warping and cracking in cooling, lack of judgenent in strip ping the casting so as to allow all parts of the casting to conract together, as that part of the casting that is allowed to contract last puts a great strain on a certain other part of the casting, and is likely to break it as soon as it is put to use. I hope the science of ramming will be further and more ably discussed in your valuable paper, and that you will be the means of getting molders to become more skill ful with the ram, in which most valuable ability too many are lacking.'

## IMPROVED PRUNING SHEARS

It is asserted that, to properly prune a tree, the limbs should be cut from the under side, and the blade should pass through them upon the outer side of the hook, resting upon the stump. In this way, horticulturists say, the end of the stump will not be splintered, and hence will be left in a beter condition for rapid healing over.
Mr. Myron de Groodt, of Eaton, N. Y., his recently devised a pruning shears, acting on the above principle, by which the operator may cut off limbs upon opposite sides of the tree without shifting his position, on simply reversing the instrument.
The handle, A, connected with the blade, is grasped by the right hand, the handle, B , communicating with the anchor like hook with the left. In applying the shears, one of the arms of the hook is brought over the limb, and th handle, B , is held in a vertical position, while the other han dle is elevated to open the jaws to a required distance. The blade then cuts through the limb from the under side and in an upward direction, with the hook bearing against the stump. To operate from the opposite side of the tree, it is only necessary to reverse the shears by simply moving the

handles past each other without changing the hand, when the other edge of the blade acts with the hook precisely as before. In this way, the inventor says, a person may re main in one position and prune a tree nearly all around.

## IMPROVED NUT: LOCK

T'he invention herewith illustrated is a new patent nut locis which, by the suitable combination with it of an elastic substance, is enabled to compensate for the longitudinal ex pansion and contraction of the bolt, thus preventing the nu from working loose under jars or shaking motions.
Our engravings represent two forms of the device as applied to railroad fish plates. In Figs. 1 and 2, which are perspective and sectional views between the two flanges, A A , is provided a chamber containing inside radial projec tions, B, which fitinto corresponding notches in a washer, C. These notches and projections serve to lock together the nut so far as rotary motion is concerned, compelling the different portions to turn together. Into the chamber, between the flanges, A, are inserted a number of rubber balls, D, which are also received in suitable concavities in washer, C, Fig. 2. When the nut and washer are screwed together, it is evident
that the balls are compressed and caused to spread until they fill nearly, if not entirely, the whole hollow space between he flanges, A. If the bolt becomes elongated by expansion, the balls take up the increase, through their own enlarge ment by elasticity, thus preventing the nut from working loose.


In Figs. 3 and 4, small cylinders of rubber are substituted for the balls, $D$, and the washer enters directly between the Hanges. The tubular end of the nut is upset on the hole of the washer, in order to prevent separation of parts. The device appears simple and practical, and doubt'ess will meet with extended application upon railroads.
Patented November 25, 1873, by Casper Dittman. For further particulars address Dittman \& Landis, Leacock P.O., Lancaster county, Pa .

## STARR'S COTTON BALE FASTENER.

We illustrate herewith a very simple and ingenious device designed as a clasp or fastener for the bands which surround cotton bales. The invention is simply a square buckle of iron, A, having at its outer end a rigid tongue, B. Both sides

of the attachment are alike, so that, when the ends of the strap are brought together, the tongue of one buckle slips under that of the other, and interlocking takes place, as shown in Figs. 1 and 2. Figs. 3 and 4 are the same contri vance somewhat differently constructed, the tongue, B , be ing bent to form more of a hook. The device can be stamped or cut out of heavy sheet iron; and, if desired, a projection or stop may be combined with it to prevent the buckles slip ping back after being once locked or hooked. The inventor states, however, that this latter precaution is entirely unne cessary, as a perfect double lock is afforded.
The mode of operating is as follows: After the bale is in the box, duly pressed, etc., the band is put on the top, hanging over in front with one of the buckles attached, hook out The band is then brought under the bale, through the channel made for the purpose, and thence up to meet the attached backle, when it is bent back on the inside. Uver this bent end the second buckle is slipped, hook in. The two buckles are then brought together and locked as before described The strap, it is stated, will not detach itself until the bale is put in the compress, when it can be easily manipulated. For further particulars address theinventor, Mr. Henry D. Starr, Texana, Jackson county, Texas.

Women Dentists in Egypt.-Dr. Edward Warren write from Cairo, in Egypt, to a friend in Baltimore, that there is 'a good opportunity for women dentists in Egypt, as the women are forbidden to consult with men." There are three or four English women practicing dentistry in Cairo already, according to Dr. Warren's letter. In all these east ern countries, there seems to be a wide field of usefulness and profit for woman doctors and dentists.

THE NEW EXPLORATION OF THE AMAZON RIVER,
BY PROFESSOR ORTON. - OVER THE ANDES.

## $\overline{\text { uachapoyas }}$

While most other towns in Northern Peru are but vast pig sties containing human habitations, Chachapoyas is the best built and cleanest city west of Manáos; its grand plaza and paved streets grant no indulgences to the low $\in$ r animals. Perched 7,600 feet above the sea, it possesses a delightful and tquable climate, with the mean temperature of $62^{\circ} \mathrm{Fah}$. Here, for the first time since leaving New York, we saw bread made from native flour. Yet there is very little of that agriculture which requires a preparation of the soil the people (to the number of 5,000 ) depend mainly on the voluntary gifts of Nature, scratching the ground with wood en plows to raise a little wheat, corn, potatoes, and rice. Six crops of rice can be raised without re-sowing. Flour sells for $\$ 10$ a quintal; potatoes, 15 cents a pound; cleaned wool, 18 lb . for $\$ 2$; and cacao from the warmer regions a $\$ 30$ aquintal. Nothing is exported but a little ca: carilla bark. The best Indian tobacco grows at Bagua in the valley of the Utaubamba, and is sold at four reals for three pounds The main woods for construction, cedar, walnut, ishpingu and capuri, being brought a considerable distance, are very high. All boards, from Iquitos to the Pacific, are cut by hand. There are signs of valuable mines of gold, cinnabar lead, limonite, and a gray copper ore contaiuing silver, in the vicinity ; while mountains of salt occur at San Carlos, twenty five miles northwest. Apple trees grow, but do not thrive, at Chachapoyas; the one we saw was covered with moss, tet it presented the singular spectacle of bearing blossom and ripe fruit at the same time. Unfortunately, this city is the head crnter of the garapata, a grublike insect whose bite not unfrequently leads to ulcers. If the road from Chacha poyas to the Marañon by the way of Olleros and the Aichi yaca, recently surveyed by Mr. Wetterman, is ever opened it will bring the city into easy communication with the out side world.
From Chachapoyas to the next great city, Cajamarca, is about seventy miles. On the maps, this intervening country between the coast range and the central cordillera is repre sented as a broad valley; in the reality, it is a jumble o precipitous mountains. The road, for the first two days, is excellent, following the romantic Utcubamba and passing within sio ht of the lofty Cuelap mountain which is crowned with ruins too old to be Incarial.

## a pre-incarial fortress.

These are the ruins of a fortress, containing chambers and tombs, and cossist of a wall of cut stone 560 feet thick, 3,600 long, and 150 high, above which rises another wall 500 feet thick, 600 long, and 150 high . It is estimated that it would take $2 \dot{i}, 000$ men five years to build it. While the an tiquarian is busy with this, the geologist may revel among ammonites and brachiopods; and on the third day, as the road rises above the clouds to the tiptop of Calla-calla,every raveller must be entranced by the magnificent panorama at his feet-a sea of mountains with the still loftier coast range in the bickground, hiding the Pacific. Descending from this frigid zone, by a fearfully inclined zigzag path, we soon reached the other extreme-a deep, narrow valley wedged in
among the mountains, through which the Marañon struggles to reach its northern outlet. In making this descent, we passed over granite and mica schist, the first metamorphic rocks west of the Huallaga, the other rocks east and west being sedimentary. This point, therefore, is the geological Heart of the Andes.
The Marañon is crossed on a raft at the miserable mud village of Balzas, the temperature of which may be compared to that of a furnace. Here the river is from 250 to 500 feet in width according to season, with a six mile current.
Again ascending, and crossing monotonous pajonals and the Again ascending, and crossing monotonous pajonals and the
fertile pampas of Huanco and Polloc, we caught sight of famous Cajumarca, seated on the eastern slope of the western cordillera and fronting the most beautiful plain in all the Andes.
the heart of the andes.
This highland plain or campagnia, sixteen leagues in cir cumference, is almost as level as a billiard table, rich as the Connecticut flats, and well watered by the mint-bordered Chonta and Masscon. The roads crossing it are hedged in with century plants, and here and there rises the "sauci" (salix humboldtiana) the most conspicuous tree in the region The surrounding mountains are barren and brown, but never theless are exceedingly picturesque.
ahinkca and its relics of atahualpa.
Cajamarca, the Caxamalca of Pizarro's day, claims to have 14,000 citizens; certainly it is the largest and finest city on our route from Para to the Pacific. Its altitude is about 9,-
400 feet, and the temperature ranges from $40^{\circ}$ to $72^{\circ}$. The 400 feet, and the temperature ranges from $40^{\circ}$ to $72^{\circ}$. The
houses are generally built of adobe, and tiled; but the churches are of the coarse conglomerate from the sierra, and have elaborately sculptured fronts. The grand plaza is adorned with a fine stone fountain, around which congre gates a motley crowd of Indian women every morning to
vend their little piles of vegetables, fruits, salt, pepper, piles of Spanish towns. The following are some of the prices cur rent: Four, $\$ 16$ for 320 lbs.; corn, $\$ 1$ for 26 lbs.; rice, $\$ 24$ for 260 lbs. ; coffee, $\$ 4.80$ an arroba; cacao, $\$ 24$ a quintal tobacco, 50 cents per mazo of three or four pounds; sugar,
$\$ 4$ an arroba; cotton cloth, 10 to 20 cents per vara; wool, $\$ 4$ an arroba; cotton cloth, 10 to 20 cents per vara; wool,
$\$ 1.20$ to $\$ 2$ an arroba; hides, $\$ 2$ to $\$ 3$ each; horses, $\$ 70$ to $\$ 100$ each; cows, $\$ 25$ each; oxen, $\$ 40$ each; sheep, $\$ 2$ each
tiles, $\$ 16$ a thousand ; a cedar board, $2 \frac{1}{2}$ varas long by $\frac{9}{4}$ vara wide (say 7 by 2 feet), $\$ 5$; land on the plains, $\$ 50$ per "fanigada" of eight acres. Wheat, barley, corn, and potatoes are about the only vegetable productions within sight of the city. The province yields annually over $7,000,000 \mathrm{lbs}$. of city. The province yields annually over
wheat, 160,000 head of sheep, 30,000 head of cattle, and 16 ,wheat, 160,000 head of sheep, 30,000 head of cattle, and $16,-$
000 horses. The manufactures amount to nothing; and the imports greatly exceed the exports in value. A few textile fabrics of wool and cotton are made, and some straw hats, from the "tamsi" instead of the "bombonaje." The celebrated silver mines of Gualgayoc, 18 leagues northwest, a
not yet exhausted, but are not so productive as formerly. not yet exhausted, but are not so productive as formerly.
Cajamarca occupi $\ni$ s an important place in the history of Peru. It was the favorite residence of the Inca when his
empire stretched from the Rio Andasmayo north of Quito to Rio Maula in Chili. The stone walls of his palacestill stand for about 15 feet; and along the eastern edge of the plain a for about 15 feet; and along the eastern edge of the plain a
line of vapor indicates the "Baños del Inca." These hot line of vapor indicates the "Baños del Inca." These hot
springs, even now used for baths, are copious, but not medicinal; we found the temperature as they issue from the ground $162^{\circ} \mathrm{Fah}$. The story goes that, when conquered by the Spaniards, the Peruvians threw the throne of gold of their Inca into a crater, from the sides of which came these thermal waters. The paved "via real" or military road, designed to connect Quito and Cuzco, stopped unfinished a lit te beyond Cajamarca. Its construction was interrupted by the landing of Pizarro or 'Tumbez, who garotted Atahual pa after receiving the ransom of " $\$ 16,000,000$ gold and $\$ 175$, 000 in silver"-one of the many fictions of history.

Again we mounted our mules to scale the last cordillera which separated us from the Pacific. The range, as we crossed it westward, presented three main aspects: the eastern half was of quartzite, and the mountains comparatively mooth and rounded; then succeeded rugged rocks of trachytic porphyry. Here the landscape was purgatorial, presenting the confusion of the "grab box" of a geologist; volcanic piles. marine and river deposits, fiercely contorted granite dykes, tc , are huddled together as if Nature had been in a hurry. Finally, as we neared the ocean, there was a fine exhibition of the ceaseless conflict between sea and land; the barren rocky mountains, upon which even the lichen refused to grow, stubbornly yitlded to the supremacy of the older cean; and as the great Andes died away along the shore, the southerly wind covered them with a winding sheet of | the so |
| :--- |
| sand. |

## an american enterpribe

Two days from Cajamarca, we shouted for joy at the sight and sound of a locomotive. It was the sign of civilization: he signal that our hardships were at an end. The Pacas mayo railwar, now completrd 54 miles from the coast, is a wodel of American esterprise and American skill. It is the
reation of Mr. Meigg', the Vanderbilt of Peru, and will cost $\$ 7,000,000$. The money comes from the sale of guano; the laborers fron China; the ties from Oregon and Chili; the ails from England; and the rolling stock from the United States. The buildings are of corrugated galvanized iron. The track is broad gage, and will have, when finished, a toal length of 78 miles. Starting from an iron pier, which is to reach half a mile into the sea, the road winds over the
pampa, and among the sand drives, and beside the Rio Jequetipeque, and through a region of intensest interest to the rchæologist-crowded with the relics of Incarial cities and cemeteries-and ends near the silver mines of Chilate, at an altitude of 4,000 feet. These mines of Chilate, just opened, 60 to $\$ 200$ a tun
Upon arriving
then at Pacasmayo, weary and worn by our long tramp over the mountains, we were received by the manag ers of the road, Messrs. Faulkner and Maynadier, and by Dr Heath of the Hospital, with such unbounded hospitality that
we are totally unable to "meet our obligations" and accordingly "suspend payment." Thrice happy the American traveler who can fall into such a fraternity at the close of his voyage.

James Orton.

## Heat.

Professor Frederick Guthrie recently delivered a lecture to working men at th
he above subject
The lecturer showed that true gases exmand nearly precise the same fraction of their size for the same increase of heat each cubic foot of gas at the freezing point of water becoming
larger by three tenths and six hundredths when heated to he temperature of boiling water. An appreciable divergence from this rule occurs when we are dealing with a gas near its point of liquefaction.
Returning to the relative expansions of solids, a few prac cical applications were briefly considered, subh as the fusing of glass about platinum on making apparatus for the analysis f gas, or for passing electric sparks through confined gases. Inequality of expansion is also made use of in the gridiron or compensating pendulum. In this a copper bar is placed side
by side with a shorter zinc bar, the lower ends being fastened together; the upper end of the zinc bar carries the bob, and the whole is hung from the upper end of the copperbar The greater expansion of the shorter zinc bar upwards exactly counterbalances the lesser expansion of the longer copper bar downwards, and the center of oscillation remains a constant istance below the point of support, so that the rate of oscil ation does not vary with the temperature. So a little rod of zinc, pointing inwards and fastened at one end to the cir cumference of the balance wheel of a watch, expands inward time of vibration coustant. The watch become a chrono meter. A certain quantity of mercury placed in a cylinder
is also used, instead of the ordinary bob of a pendulum. The
mercury expands more than the metal of which the rod formed for equal columns, and therefore, by taking unequal coluinns, equality of expansion may be obtained. A most sensitive thermometer can be formed by availing oneself of the inequality of expansions of mercury and alcohol. A little platinum diving bell is partly filled with alcohol and placed in mercury, and provided with a slender platinum wire arising above the mercury. The whole floats. When the temperature increases, the alcohol expands more than the mercury. Some of the latter is driven out of the bell, and the latter rises; the motion of the exposed end of the platinum wire exhibits the rise.

As a rule, gases expand more than liquids and liquids, more than solids for the same increase of temperature; and so, according to the well known law of mechanics, we should expect to find the force of expansion of solids greater than that of gases. Accordingly the force exercised by expanding solids is almost irresistible. Iron rods are bent or snapped when their centers are pulled by contracting metals. A semisolid mans, as glasa, suddenly cooled becomes brittle. A drop of hot glass cooled in water becomes solid and rigid on its outide; then the inside cools and shrinks so that the whole, when cool, is in a condition of internal strain or unstable equilibrium. Disturbed in one place, the whole crumbles to pieces in its endeavour to assume the proper size due to itst emperature. The process of annealing depends upon the so gradual cooling of a soft body that the parts get te their proper distance. The bursting of pipes in winter time proves two things: first that the ice is lighter than water; and second, that the ice is almost incompressible. Water frozen in a bomb shell two inches thick will burst it.
The expansion of liquids by heat furnishes us with means in measuring temperature. An ounce of mercury immersed water, it ald water always has a certain size. And at any intermediate temperature, got by mixing together different proportions of freezing and boiling water, the mercury has an intermediate size. According, by measuring the size of any constant weight of mercury, we can tell what its temperature is. Thermometers are made by enclosing bulbs, with very narrow stems, so that, when the liquid gets warm and expands, it may rise a considerable bight in the stems. Plunge such a bulb into freezing water, and the mercury shrinks in the stem to a certain point; plunge it into boiling water, it rises to a higher mark. The lower mark is is sometimes called $0^{\circ}$ and the other $100^{\circ}(\mathrm{C}$.$) , or 80^{\circ}(\mathrm{R}$.$) , or$ the lower is called $32^{\circ}$ and the higher $212^{\circ}$ (Fah.) Water is at its greatest density at $4^{\circ} \mathrm{C}$. If we take a flask full of pure water bearing a narrow stem and cool it from, say, $10^{\circ} \mathrm{C}$., we find it shrink pretty regularly as it cool still it gets to $4^{\circ}$ C. It then expands as it cools so that at $3^{\circ}$ it is of about the same volume (and density) as at $5^{\circ}$, at $2^{\circ}$ as at $6^{\circ}$, at $1^{\circ}$ as at $7^{\circ}$, and at $0^{\circ}$ as at $8^{\circ}$. It then freezes and swells in that act a very great amount, measured by the proportion between the whole volume and submerged volume of a piece of foating ice. When a pond of water is freezing, the surface water is at $0^{\circ}$, the bottom at $4^{\circ}, \mathrm{C}$.
Heat travelsfrom point to point in space in three ways: (1), by conduction; (2), by convection; and (3), by emanation or radiation. It moves by conduction when the body which receives the heat does not move as a whole, but allows the heat to travel through it. Heat moves by convection when a hot body moves. It moves by radiation when a hot body gives off heat into empty space or into some medium which does not intercept it. The gradual heating from end to end of a poker in a fire illustrates the first of these methods, the flight of a red hot cannon ball the second, and the roasting of meat or the solar heat the third.
Metals, as a class, conduct heat better than any other class of bodies. Hence, when both are above blood heat, metals feel hotter than wood. When below, they feel colder. So that paper is scorched when heated in contact with wood, but not so easily when in contact with copper. Hence, also, lead may be melted in paper. Among the metals, silver and copper are pre-eminent. That copper conducts heat better than iron is shown by heating rods of the two at the plane of contact, and noting the melting of fragments of wax arranged along the two. The great conducting power of metals is shown by the cooling effect they have upon the mixed gases of a burning body. The metal withdraws so much heat from the gas in its neighborhood that combus tion is impossible. The miner's lamp is based upon this principle.
Liquids conduct heat as a class worse than solids. The conducting power of liquids is measured by heating the upper surface of a film of liquid, and noting the expansion of the air in a chamber upon whose upper side the liquid film rests. The more complex the composition of a liquid is, the more opposition does it present to the passage of heat by conduction. Chlorine, iodine, and bromine are especially strong in resisting heat conduction. Water is by far the best conductor amongst non-metallic liquids.
Gases are far worse conductors than liquids, and the im perfect conduction of many solids is due to the gases, gener allyair, which they inclose in their pores or between their fibers. Clothing thus protects the body from loss of heat in cold weather and from the scorching heat of the sun in hot weather. A red hot ball may be carried in the hand if a mass of asbestos, which incloses the air, is irterposed. Hydrogen conducts heat far better than other sases, and accordingly cools bodies in contact with it with great rapidity.

Gold may be readily cast; but it contracte so much in cool ing that the process of casting is seldom employed in the arts.

## SCIENTIFIC AND PRACTICAL INFORMATION.

the companion of procyon.
We noticed some time ago that Struve had discovered, by the aid of the maguificent refractor of the Pulkowa Observa tory, a sriall star near Procyon, which he regarded as being the probable cause of the irregularities of the movements of the latter body. Dr. Andrews has since repeated his calcu lations regarding the proper motion of Procyon, which ap pears to be circular, in a period of a little less than forty cars, around some invisible cester. He does not now defin inely conclude that to :'truve's star should be ascribed this peculiar movement, but considers that the question will be decidl-d next spring, if the new star is then visible. In such case, Struve's star thould be at a considerable distance fron the eommon center of gravity of both bodies, and a mas must be attributed to Procyon equal to eighty times that o our sun, and to his companion, a mass equal to six and two thirds of the same body

## tife purification of tallow and lard

Dr. Dotch states that tallow and lird can be kept from get ting rancid by the following process: The tallow or lard is first treated wich carbonate of soda in the proportion of 2 pounds of soda to every 1,000 pounds of lard, and is then subjected to a digestion with alum in the following manner 10 pounds of alum are dissolved in 500 pounds of water, and pound siaktd lime added to the solution and boiled. This so lution is stirred well with 1,000 pounds of lard at a tempera ture of $150^{\circ}$ or $200^{\circ}$ Fal. for about balf an hour. The liquor is then separated ifrom the lard, and the lard is treated with the ame ammunt of pure water again. This lard will keep for an exceedingly long time. The fact is that the alumina in the alum applied acts very readily in a disinfecting manner upon thos $\rightarrow$ compounds which are liable to give rise to rancid ry. The lime is added to the alum in order to render the alumina more active ly its giving up some of the acid to the lim". This treatment las also the advantages of restoring the origina
ness.

Professor Kopp, who has recently made a careful study of the aniliue colors at the Vienna Exposition, says that the manufaccure of these pigments from coal tar products is nilk ing most remarkable progress. Fuchsin, constituted by a
salt of rosanilin, is obtaiued exclusively by the reaction of arsenic acid on commercial aniline. In order to afford an idea of the enormous consumption of this violent poison in the manufacture of fuchsin, it is stated that in Germany lone the same is estimated at $3,300,000$ pounds a year. It is only lately that the residues have been treated to regain
he arsenic in the arsenic in commercial form. M. Kopp mentions as a
novelyy a beautiful rose red coloring matter called saffronin novely a beautiful rose red coloring me
which upon silk is a very brilliant dye.

## new textile plant.

The ordinary wood nettle, as is well known to many of our readers, is found in profusion on the Alleghany mountains often at a level of over 5,000 feet above the sea. A shor time since, M. Rozel succeeded in transporting to Europe number of living specimens of the plant, some of which he di-patched to the Prussian Minister of Agriculture, in order that the value of the weed, if any it bad, might be deter mined. It appears that quite favorable results have been obtained in using the plant for textile purposes, and for such Employment it is now attracting considerable attention in Germany. It is known botanically as the laportea pustulata, and is perennial. As it is, therefore, unnecessary to sow the seed each year, the plant has in this respect an advantage over liemp or Hax, wtile it is stated to necessitate less labor and expense in preparing the fiber. In a wild state, the net tle attains a light of two or three feet, but we learn that such as has been cultivated in Berlin has already exceeded this limit, and it appears possible that, by care and proper soil, even a still greater altitude may be gained. Experiments thus far made point to the fact that the plant wil prove a not unimportant addition to our textile materials.

## decisions of the codrts

United States Circuit Court---District of California.

supreme Court---District of columbla.


## United States Circuit Court--EEastern District of

 ؛ Missouri.trtss bridge patent.-Jayeg v. wegtlake 28 . m. g. \& H. b. Cabtter.

Before Treat, Jnage.-Decided October 11, 1873.


 stuction ;endant claing that the patent is vold for uncertainty, it rests
If hed




 Sunder it he is gillty if nin infingement.
Such evtencone wili be submitted to the jury; the court will not compare


## 

NEW BOOKS AND PUBLICATIONS.
The Overland Monthly for January has, among other interesting orth western Coast," In which the remarkable table lands or mesces, 1 that portion of the country, are described. As an explangtion of the origin
of these pecular formations, the writerthinks we can appeal to the "artion of fice moving slowly but surely as a great planing or moldirg machine. If we accept an icesheet over the continent, or a part thereof, and an ic belt contiguous to the continental shores, we can readily understand tha moved as a great stream, or, more likely, in curr ants, from the north. tion regarding that little known country. The "Japanese Nerchant at Home" and "Summering in the Sierrss" are pleasing descriptions, enter aining and readable. The usual selections of poetry, ellitorial miscellans ... complete a table of quite varled and interesting contents. Publis

## Value of Patents, AND HOW TO OBTAII THEII. Practical Eiils to liraniolos

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        ROBABLY nolnvestment of a small sum of money hrings
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        greater return than the expense incurred it obtaluing a paten
        even whed the invention is but a small one. Larger tiventions
    are found to pay corresponillngly well. The names of Blanchara, are f found to pay correspondlagly well. The names of Blanchart,
Morse, Bigelow, Colt, Ericeson, Howe, McCormick, Hoe, and Morse, Bigelow, Colt, Eric-son, Howe, McCormick, Hoe, an
others, who have amassed immense fortunes from their inven tions, are well known. And there are thousands of others who
haverealized large sums from their patents.

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of the services of Muns \& Co.during the TWENTY-SIX year They stand at the head in this class of bustness; and the ir large corp of assistanis, mostly selected from the ranks of the Patent Cffice: monca
pable of rendering the leat service to the fiventor, frcn the experienc practically ootained white examiuers in the Patent Office: enables MrNs \& Co. to do everything appertaining to patents better and cheaper than

## HOW TAINOPatents, <br> This is the closing inquiry in ome invention which come

 swer can only be had by presenting a complete application for a patent tothe Commissioner of Patents. An application consists of a Model, Draw ng. Pettition, Oath, and full Spectfcation. Varlous cficial rulesand for
nalities must elso be observed. The efforts of the inventor to do all this business himself are generally without success. Aftergreat perplexity and
delay, he is usually glad to seek the atd of persons experifnced in paten
bis delay, he is usually glad to seek the atd of persons experienced in paten
busiuess, and have all the work done over again. The best plan is to solici roper advice at the beginning If the partles consulted are honorable men he fmprovement is probably patentable, and will give himall the directlon

How Can I Best Secure my Invelition
This is an inquiry which one inventor naturally asks another, who has had
ome experience in obtaining patents. His answer generally is as follows and correct
Construct a neat model, not over a foot in any dimension-smaller if po sible-and send by express, prepald, addressed to NitnN \& Co., si Fark lion
New York, together with a description of its operation and merits. On re ceipt thereof, they will examine the Invention carefully, aLd advise you a
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best to have a search made at the Patent Ofice. Such a measure often save

Preliminary Examination.

## tion, In your own words, and a pencil, or pen and lik, sketch. Send thes

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ceptible of one, although sometimes $i$ may be dispened with; or if the tin. vention be a chemtcal production, he must furush samples of the ingredlthe inventor's name marked on them, and sent by express, prepaid siarmodels, from a distance, can often be sent cheaper by mail. The safes way to remit money is by a draft, or pos al order, on New York, pasable to the order of MUNN \& Co. Persons who live in remote parts of the country can usually
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plared on or worted into any article of manufacture.
Design patents are equally as important to citizuns as to foreigners. For

## Foreign Patents.

The population of Great Britain 18 $31,000,000$; of France, $37,000,000$ : Bel :um, $\mathbf{5 , 7 0 0 , 0 0 0}$ : Aust: $1 a, 36,000,000$ : Prussia, $40,00,0,0$ : ; and Russia. $70,000,000$. Patents may be ser,hred by American cltizens in all of these countrice, Nuw is the time, while business is dull at home, to take advantage of these
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## Value of Extended Patents.

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selves of the extension privilege. Patents granted prior to 1861 may be ex tended for seven yeals, for the beneflt of the $i$ iventor, or of his heirsin case
of the decease of the former, by due applicati su to tre Patent Ottice, ninety davs before the termination of the patent. The extended time inures to nghte under the extension, except by special sareement. The Government fee for an extension $1 s ~$
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OFFICE IN WASHINGTON-Coiner of F and 7th streats. opposite
\&xerut Bmerican and foreign eatents.

Frederick Buse, Fergus Falls, Minn.-This invention consists in two wheels arranged in front of the cowcatcher of a locomotive: nd in a plane perpendicular to the direction of the track. By sult able gearing, these are
connected with the forward axle so that the wheels are switly rotated, causing radial wings or shovels attached thereto to throw and blow the even snould it be greatly drifted.

Improved Hoop Lock. rovide a way for fastening or tying the ends of wooden hoops togethe
or barrels, tubs, and other cooper work, and tor other purposes, and it cons'sts in a metalle tie having two sockets connected together, in which ockets the ends of ho hoopsare wedged

Improved Cherry Stoner.
Eli Buck and Edgar W. Kirk, Cincidnati, Iowa.-By suitable construction as punche descend upon the cherries in tapering holes, the stones are
punched out of the fruit and through the holes, and fall into a dish placed eneath the salaholes. As the punches ascend they cariy the frutt wit not the fruit, so that the latter is pushed or stripped from the said punch es. As the punches ascend. the pan moves back so as to pass beneath the anchesand receive the fruit as it falls from the plate. The fruts side down the pan into a dish placed bencath the lower end of sald pan. The
descentof the cherries in the pan is regulated with one hand, while the crank is turued with the other.

[^0]Improved Door Spring.
Henry Cody, New York cty. There is a casing of cast iron which con
 ower end of a shaft turns on at the case and has lower end of a shaft turns on a plvot on the bottom of the case, and has a
roller on the end of an arin. The end of the shaft exteads up above the
top plate top plate, and is ripdly attached to a lever. The jaws are forced to ward

 creasing power, the fulcrum betng the stud and the spring the resisting will be carried to near the outer end of the Jaw, and the arm will be paral will be carried to near the outer end of the Jaw, and the arm win er paral
lel with the door. In this postiton the spring will bear directly against the axtis, and the door will remalin stationary. Should the door be left at any
internediate poltut, t would beclosed by the spring. By meaus of this ap. intermediate poilt, it would be closed by the spring. By means of thls ap
paratus the ordinary butt hinges aredispensed with. The door is held open aratus the ordinary butt hinges are dispensed with. The door is he

## Improved Hand Corn Planter.

ed bot, on the opposite sides of the lower part of the hopper and catch in notech es formed in the sides. The lower part of the cap is formed by two paral part of the pivoted plate is attached a hook which hooks upon a crank
Upon the crank shaft is formed an arm, to the outer end of which is pivot his lower end of a connecting rod. With this arrangement the plates, which are pressed close together by the action of the spring, are forced in
to the soil, and the rear cud of a lever is drawn upward or toward the han le. This movement operates the slide and drops the seed and plaster by spreading the plates apart. As the lever is released the sprit
various parts of the machine hack to their former position.

## Improved Fertilizer Distributer.

Laurinburg, N. C. -This invention is a machiae tor openin furrowand distributing guano in it preparatory to planting cotton or thon. The Invention consists in the shoe provided with a spout held in
piroted suspension bars, so as to allow the shoe to have a backward and forward movement. In the shoe is formed a hole, through which the guano scapes to the ground through the spout, which is designed to guide the guano tnto the furrow, and prevent it from belng blown about by the wind
The rear part of the shoe is supported by a cord, so tlat the inclination of the shoe, and consequently the rapidity of discharge, may be increased and diminished by unwinding the cord from and winding it upon a knob. A whe el is placed directly in the rear of the conduction spout and is made with a deep V -shaped groove in its face, and with a number of rods cross-
ing said grooves near the peitiphery of the wheel. As the wheel revolves, each rod pushes the lower end of a spring forward, which end, as it escapes nsuring the constant and regular discharge of the guano. The amount of uano escaping from the hopper is also regulated by a slide. By suitable construction. by operating a lever, the lower part of the spring is thrown
forward away from the rods of the wheel, to allow the shoe to stand still, forward away from the rods of the wheel, to allow the shoe to stand still,
und thus enable the distribution of guano to be stopped when desired.
Jacod Bader, Olathe, Kansas.-This invention con inter of a pair of legs on the floor or ground, and at the dame time extended from doched down onth directions in which floor or entering the ground they will hold the door or gate from swinging.
In the case of a door, the legs andslide will be arranged in a recess in the dge extending upward a suitable distance from the lower corner, so as to he worked up and down by hand, and will have a set serew to fasten it; but
in a gate the legs, being similarly arranged in a recess on the end post of he gate frame, may be worked by a lever, with whith buttons are arranged
o hold it in the position for keeping the legs in the pround or out of it.

Propelling Caual Boats and Other Vessels. close channels inclined downwardly from bow to stern, and receiving the water from the surface in front of the boat and discharging It at the rear, whereby the surface waves from the front of the boat, that
end to cause the washing of the banks, are prevented.

## Improved Hand Corn Planter Inmers, St. Donatus, Iowa.-The outer

Michael P. Nemmers, St. Donatus, Iowa.-The outer case of the corn
lanter is of oblong shape, and the remainder half prism, base upward. A ertically sllding plunger extends through the full length of case along the rear side of the same. The plunger has at its upper end a handle, and at its
 m movement on the teeth of a horizontal revolving seed cup disk. Above ine latter another cam spring. dagoadally placed in the contrary direction,
ompletes the distributer. The corn chamber is arranged in the upper part of case. A vertical slide plece has an inclined end for the purpose of ad mitting a smaller quantity of corn to the revolving disk, and taking off the weight of the corn from the same, making thereby its motion easter and
unicker. The revolving distributing disk is perforated by a certain number uicker. The revolving distributing disk is perforated by a certain numbe
f holes of such size as to admit freely the seed or corn. A double row of ertical brushes is arranged to allow the seed to tlll the holes to the rim, are approaching to ward them by the revolving of the disk. By sultable adustment the amount of seed passing to the distributer disk may be regulated. The secds pass down as each hole discharges its contents into the
lower part of the planter, dropping on an inclined band spring. The seed lower part of the planter, dropping on an inclined band spring. The seed
is then carried into theground by the descending plunger end. The spring then carried into the ground by the descending plunger end. The spring
ction of the band presses its end tirmly against the plunger, so that no seed can escape. It serves, also,on the upward motion of plunger, asa scraper to and and deposit the seed can be adjusted a the different soils require it

Improved Knite Cleaner and Polisher. rovement of knife cleaners by the introduction of a spring-pressed holder provided with a horizontally slotted top piece, and combined with a leve having a side pivot working in slot. By this improvement, a knife drawn
back and torth a few times not only comes out perfectly clean but beau ifully polished.

Improved Car Axle Lubricator. lubricating the parts of a car axle journal, whereby the surface of the
Hange and the body of journal are automatically provided with a gradua'ed supply of oil or lubricating substance.

Improved Adjustable Bench Vise. Jeremy B. Wardwell, Lawrence, Mass. This invention is a bench jack for
arpenters aud cabinet makers use, for holding boards while being jointed
i bar is sloted to receive the jaw, and has notches to receive the pawl, by which the jaw is supported whea adjusted. The jaw has ratchet teeth
formed upon tts upper side. The shank also passes through the frame, the for ward end of whith is so formed as to fit and slide upon ways formed up-
on the rear side of the ratchet bar. By sultable construction the shank of the jaw holds a plece in place in the frame, which forms a rest and also holds the frame in place upon the rear side of the ratchet bar. To the for-
ward end of the piece is pivoted a pawi, which is so formed that its own elght may hold its lower or engaging end against the notched forwar de of the bar. The paw ing say any position into which they may be adjusted, the said parts all moving
together. There is also other mechanism which allows the jaw to be more ccurately adjusted to the thickness of the board to be held. In using the the vise, and the jaw is adjusted at the proper hight to recelve the board. The board is then arranged in place and the jaw pushed in against the side of the sald board.

## Oren F. Improved Grain Hulling Machine.

 e moving from grain its outer husk or bran, and it consists, tirat, in subje g the grain after the ordinary cleaning to the action of water or steam, o soften the husk, then passing it befaces, one revolving within the other.
Improved Boat Gripe and Crane Keeper and cranes used on board of a vessel for the purpose of handling the boats, and consists in combining a lever having clamp and hook chain with a sin

## Improved Match Box

Morris L. Orum, Philadelpha, Ahe object of this in vention is to pr burner bracket ; and it consists in the match safe combined with the brack et, which was described and illustrated on page 342 of our last volume. Improved Corn Planter.
, Oquawka, ill.- By suitable arr
angement a plate no ony serves as a gulde for the corn, but at the same time the alternating hat it may push out any dirt that may enter the interior of the standard may move back and forth in the hopper above the discharge opening, and thus keep the corn stirred up, so that it cannot clog and will pass out freely
The stirrer moves back and forth close to the upper side of the dropping The stirrer moves back and forth close to the upper side of the dropping roller, so as to operate as a cut off to prevent any more, seed than enoug
to till the dropping recesses from vein ₹ carried out by said roller. Cover ghows or wings, which are attached to the sides of the lower end of the
andard, are formed to guide the s 0 il into the furrow at the rear of ald standard and cover the eed

## Improved Middings Puritier. George Parker, Poughkeepsic, N. Y .-On the top of

ar one end, is a fuunel-shaped receiver, which is to be placed directly ader the floor on which the pile of middlings lies, the floor having a hole as large as the top of the funnel, or thereabout. In the opening of the
funnel is a revolving cone feeder nearly tlling the opening. This cone, which is adjustable vertically to open the passage more or less, is provided witi, grooves in the sides, which facilitate the feeding by scraping off the
mass lying upon the cone regularly, and producing an even stream. It is volved by gearing at the lower end, connected with the main driving haft. Immediately under the cone is a flat shaking sieve hung by hooks at
the upper end to the wall of the case, and at the lower end resting on the
 arse matters escape, to be blown out of the eise on the returning chute ittached to the under side of the sieve, and descending toward the upper
end of the next sieve below, on which it discharges. This sieve is like the ne above, except it is a little tiner. The coarse light matters from the re again separated into two gradesby the plates and a passage which tur, he heavi
beyoud.
Peter Worrall, Sugartown, Pa.-The Redary Engine.
lindere bly for Elinders both fast to the main shaft and in each of which is a piston wheel hen the third one is taking steam. The pistons are of peculiar construc ion, being longitudinal sections of a cyllinder, with a circular head at each hen the pistons reach the abutmenta, they are turned so as to fit into the vities. As they leave the cavity, they are directly turned so that the road and more flattened sides take steam, thus making the steam surface or
rea of the piston greater than the area of the cylinder. The steam is intro duced into the first cylinder from below, the valve beingoperated by means The exhaust aperture opens from the second cylinder. The intermediate valves between cylinders are placed back of the abutments, and are oper-
ated by means of the ribs on the plates of the piston wheels. The ends of ed hy means of the ribs on the plates of the piston wheels. The end alve so that the ports admit and exhaust steam. It will be seen that the
ceam, after doing work, and, consequently, losing a portion of heat and tessure in the first cylinder, is exhausted into the second cylinder, where acts unon the pistons in the same manner, doing more work, and parting

Improved Fire Place
William Hoyland, Newcastle. Pa.-A couple of side plates are set upright a groove in a cast metal bed plate, said plates being curved to corres-
ond with the said groove. They are arranged on opposite sides of the bed ece, to rest at the back uyainst the partition wall, being about as wide as
 ound basket titting the side plates, and mounted on a pivot so as to turn
reely. it has a partition of fire brick dividing it as high as the back plates, of which there is one for each room. The grate, together with its partition
an he turned so that one fire in one part of thegrate will warm both rooms it can be turned half way around, and thus change the tire from one room the other, which may he desirable when only a little heat is required for entilating the rooms, when the tore

$$
\begin{aligned}
& \text { Improved Nut Lock. } \\
& \text { ontlac, Mich.-Four nuts ar }
\end{aligned}
$$

Charles A. Howard, Pontiac, Mich.-Fvur nuts are locked by this inven-
ion. This is the number of bolts usually employed for securing fish plates rall joints. The end of the plate locks the tirst nut. The second nut is aclosed by a square hole in the plate. The third nut is locked by a lock
plate, and the fourth nut by the end of the lock plate, or by both. The end of the spring plate extends sufliciently far to form a spring, and is reduced waising so that it passes through a slot or hole in the locking plate. By
lock plate to a right angle, the third nut is unlocked and the spring plate can be removed without difficulty. The tension of the
Button Hole Stitching Attachment for Sewing Machines. Carl A. Hansen and George Harley, Guelph, Canada. - This invention con-
ists of apparatus mounted on a frame arranged to be attached to the ng machine, and connected to the needle bar to be operated The device is arranged to cause a hook to pass down through the throut
plate, and engage the thread immediately after the shuttle has passed through the loop, draw it up through the button hole, and present it to a
pusher, which, by a portion of said apparatus, is caused to carry the loop rusher, which, by a portion of sald apparatus, is caused to carry the loop
beyond the needle, and hold it until the needle goes down through it and beyond the needle, a
ompletes the stltch

Improved Clothes Wringer.
Jolin Seaman, Groton, N. Y.-The journals of the rolls work in slots in
the standards, and upon the journals of the upper roll are placed half earings, upon which rest the ends of the curved spring, the middle part of Which is attached to the top bar. To one journal of each roll is attacheia
gear wheel, the teeth of which mesh upon a circle of pins or cogs attached gear wheel, the teeth of which mesh upon a circle of pins or cogs attached
to the side of a disk or wheel attached to the other juurnals of the rolls. allows the rolls to work closer together or farther apart without binding or
getting out of gear. Upon the edge of the gear wheel of the lower roll is formed an outwardly projecting tiange upon the inner surface of whicn
are formed gearteeth, into which nesh the teeth of the small pinion wheel, are formed gear teeth, into which inesh the teeth of the small pinion wheel, attached to the crankshaft, which works in a long bearing in a bracket
attached to the standard. This construction is claimed to give a greatly increased power to the wringer.

Improved Bird Cage.
New York city.-This inven
Edward Hutchinson, Ne Y or bird cages, constructed in two parts, which are tongued and grooved
ogether so as to form a very narrow crack along each side, such as insects and vermin, which infest brds, like to hide in, and so that the two parts of the perch can be readily taken apart to destroy the insects, when the perch
Is remored from the cage.

 and an adjustable trangporting wheel. The plow is made double, one end
being made emall and the other large. so thit one or the other end may de bed, according as the work to be done may require. The forked shank of
une rake solted to the standard. The blade of the weed cutter is made the rake is bolted to the standard. The blade of the weed cutter is made
V shaped, and is secured to the ends of the arms of the shank, which is, in V shaped, and is secured to the ends of the arms of the shank, which is,
turn, secured to the standard by the sarne bolt that secures the plow. The clearthe surface of vines, weeds, etc., whose roots or stems may have been severed by the cutter. The roller is used by the weed cutter and rake,
principally for the purpose of preventing the former entering the earth too far or sustaining too much of the weight of the frame of the implement The shovel is detached when the weed cutter is used, or else turned so as
to be crosswise of the standard. Similarly the weed cutter is detached

## Improved Machine for Drawing Wire

Jres in the plates or dies are of successively decreasing didin turesin the plates or dies are of successively decreasing diameters, the last
belng of the proper size for bringing the wire to the intended gage, and the numbers of teeth in the pinions are so proport'oned as to cause the
pulleys and block to rotate at an incrcased surface specd in proportion to the aitenuation of the wire. Motion being now communicated to the main shaft, the wire is drawn by the pulley saccessively through the different
dies, the numbers of teeth in the pinions betng, as explained, in such proportions as th enable the pulleys to take up the increasing length of wire Instead of the pulleys being of the saine diameter, arranged to be driven at
different speeds as regards their revolutions, they might be of diameters moreasing be furnished with equal numbers of teeth; further inged pinans might be furnished with equal numbers of teeth; further, instead of one
pulley being used for each draw plate or die and the wire wound around such pulley, a series of small pulleys (say, threr) might be employed. the surfacessing alternately under and over them, so as to provide succe surface for holding contact with the wire. The surface speeds of the pul
leys and block will be required to be varied in practice for onvious reasous. the said pulleys and bleck, so as to provide a correct surface velocity

## Improved Door Spring.

 tached to the casing and supported by a second bracket passing through恠 in its bottom and secured to the door. In the rear part of the tute is placed a colled spring of sufficient strength to siut the door quickly andWith a slam, if allowed to act frecly. The forward end of tha spring rests against a piston, which is attached to the end of the door baciket, so as to
move back and forth through the tube. The piston is made of such a size as to slide freely through the tube, and to its forward end ls attarned a cup freely through the tube as the piston moves toward the rear end of the sald tube, and which, when the piston moves forward, serves as a valve to push
the air forward, and thus cushion the piston upon cumprossed air, so zo to check the door just before it closes. and thus pratent it from shammeng,
The air escapes through the forward end of the tube, where its escape is regulated by a grooved screw.

Improved sitcam Engine.
Abram Beekman, of New Yurk city.-Part of the boiler constitutes a
wheel case, in which there is a wheel to whici the sti am in delivered to the bofler through a passage on one side of the vertical center of the wheel. to give the steam that difrection a t starting by the lesser wright of the water
on that side, due to the lesser hight of the water column. There is a passage from the boiler to the otherside of the whel into which the st tam
is directed hy a valve. When it is desired to sup the wheel, said valve closes the passage. The steam rises against the wheel, andimpels it with a force governed by the hight of the water colunin, and the amount of steam
generated. In the upper part of water chamber, the steam condenses and Inppoved Road Scraper. place.-This invention is a machine for grading roads. The forward ends of a mold board and land side are securely attached to a cast point
which is made somewhat like a plow. The lower part of the mold board is faced with a steel plate, which projects beneath the lower edge of the said mold board. By suitable construction, by bearing down upon the rear end
of a lever, the forward end of the machine will be raised from the ground for conventence in turning. By lowering the free end of another lever, the
rear end of the macning will we raised and supported upon a rear caster wheel. By means of a sharp rimmed guide wheel, the machine may be
Improved Rotary Engine.
produce a rotary o engines by being built very compactly, having no dead centers, and in an outer steam cylinder with abutments, of a rotating drum onent tonalicd hollow shaft wich steam ports, by which the steam Is alternately applied to vibrating gates placed at right angles in the two sections of the

## Improved Coffee Pot. Peter Knutson, La Crosse,

posed of tinree different sections-the upper or water -The pot is comdle one, in to which the gas, alcohol, or coal oil la mpis placed, and the lower receptacle, for the cotfee or other articles which are intended to be bolled.
The lower part is detachable, and the ceftee, tea, etc., placed therein. The upper re. The ins illed with water, closed tightly, and the lamp then a tube to a glass bulb, and then, through a smaller tube and strainer, to the lower part, extracting the strength of the coffee. The lamp is then extinguished, and the liquid slowly drawn up again into the water receptacle.
The process is repeated, if the coffiee is desired to be very strong. The zlass The process is repeated, if the coffiee is desired to be very strong. The plass
bulo or tube indicates, by the passage of the liquid through it, the different

Improved Heater and Feeder for Boilers.
:. Williams. Catskill. :. Y. Y -To the feed water pipe, and
Williams. Catskill. ... Y.-To the feed water pipe, and a certain and from the middle of the under side or the bo: ter. The water forced
along the fcel pipe past the junctions with the tubes naturally induces along the feed pipe past the junctions with the tubes naturally induces
currentif from the boiler bv the friction of its particles with the particles of the water coming in at the other pipes, which, uniting with the feed
water, re-cuters the boiler again along with it. contrivance similar to the head of a steam stphon or injector is arranged contrivance similar to the head of a steam siphon or injector is arranged
in the feed pipe at the point of entry therelin of each tube. By this plan, it is claimed that the feed water will be heated nearly to the degree of the
water in the boiler, which is much greater than it can be heated by the

## Limproved Steam and Vapor Generator.

Richard Brereton, Easton, Pa., assignor to Benjamin Douglass, Mont rose, N. J.-This invention relates to the instantaneous development of
steam or vapor from fluid substances by application of the substances to highly heated surfaces in expanders. The essential feature of the invenjet bulb to each, so arranged that each receives its due measure of feed in such small quantity that the force or the instantaneous expansion is con-
trolled by the balls, and the vapor produced is sent therefromalong with that from the other balls, to the pipe which conducts it to the engine, in such manncr that there is no accumulation anywhere larger than the con-
ducting passage. By this means, it is claimed, the great pressure attainable by the dircct contact of the fluid with the red hot metal can be conaccumulat could not be in large chambers affording any considerable expansion balls in the furnace so as to be directly surrounded by the fire, to apansion balls in the furnace so as to be directly surrounded by the fre, to
bring the tuid into the most direct contact with the. highest heat of the fire

## Gusimess and extinal.

Temples and Oil Cans. Geo. Draper \& Son Protect your Buildings-Fire and Water to four of any other; it fills up all holes in shingle, felt, tho or iron roofs-iever cracks nor scales off; stops all
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ter,. H.
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all descriptions. W. L. Chase \& Co., 9 g, 95,97 Liberty street, New Yorl
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Machines. Geo. s. Lincoln \& Co., Hartord, Conn.

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Biss $\&$ Willams, cor of Plvm , Hydraulic Presses and Jacks, new and sec-
ond liand. E. Lyon, 470 Grand Street. New York. Damper Regulators and Gage Cocks-For
he best. address Murrul \& Kelzer, Balumore, Md. Steam Fire Engines,R.J.Gould,Newark,N.J. Peck's Patent Drop Press. For circulars,
vdrese Mllo. Peck $\&$ Co.. New Haven. Conn.

## 

We are obliged to $\mathrm{J} . \mathrm{H} . \mathrm{W}$. for his expla-
aatton of the degrees of proof of alconolic splrit, but natton of the degrees of proof of alcoholic spirit, but
the subject is exhausted.- - U. U. Ahould consult a maker by the processes of case hardenting deseribed on p. p . 62.
yol. 25.-T. 0 . . will tind a a ood rectipe for paste on
 T. H. G. asks: When is it winter in Pata-
gonia (Cape Horn) and when 18 it midwiter there? gonia (Cape Horna and when is it midwititer there? A.
Winter commences on the 21st of June, and it is mid
wint in G. M. asks: 1 . If a ressel containing is c.u.
bic feet of compressed air be placed inside of another eessel of 20 cubtic feet capactity, and the compressed air be very graduanly let Into this vessel, with a proper
means of escape to prevent an increase of pressure, means of escape to prevent an increase of pressure,
could a person breathe inside the narae vessel?
how long owo, how long would the eimpresesed iar sapply the neces.
sary amount of air for respiration, the alr being com ressed to 200 lbs. per square tnch? 2. How is gas of am monia made? A. 1. A person making 15 respiration tin
aminute would reaure, under ordinary circumstances $43 \times 15=645$ cubic inches of air. The inner vessel would
 tion for $115,200 \div 645=173^{25}$ minutes. 2 . Put equal
weights of quickilime and sal ammoniac, powdered and welthes olyulxed, in an retort; gently heat it, and an
intimately mix
abundance of pure ammonia gas will be tive off An
An abundance
ounco of a al
of the gas.
C. E. G. asks: How are we to reconcile the
conclusions of sclentific men in regard to the strenzth of ron at extremes of temperature? Common observa-
ton
ton hows ron to be stronger at a temperature of from $109{ }^{\circ}$ Fall. than below wero, in attemptng to drive a mill dop with a mal.
let, I broke the dog in two places. The iron showed clean breaks. The rod was one inch square at one break
and \& fnch round at the other, parting in both places at the log with my hand covered by a bucksklin mitten This dog also broke where it was z inch in diameter.
Thinking it dangerous to try to run the saw, we thought we would try to get some stones and tee from the tal
race that obstructed the water. I Iook a common crow
 Inches from the fulcrum, showing a perfectly clea break of 1 \& Inches square iron. Think ing the laws of
cohesion had suspended for a time, we suspended operattons until a warmer day. Thits and the facts shown by
R. H . Thurston are a paradox. A. The following con. clusions, as stated by profesoror Thurston in his paper on The "Molecular Changes Produced din ron by Variations
of Temperature," will probably make this matter platin.
"10.
 temperature is, in solld bodies, to increase their power
of resistance to rupture, or to cnan eo of form, and their capabillty of fustatinng, d dead' loads. . I1. That the enen
eral effect of change of temperature is to produce chang of ductulity, and consequently, change of resillence and
power of resisting shocks and of carrying live loads. This change is opposite in direction, and usually greate In degree than the variation stimultaneously occurringin
tenacity. The practical result of the whole investigation 1s that iron and copper, and probably other metals
do not lose their power of sustanning $\cdot$ dead' loads a

 pressure of steam should be used, and how $10 n g$ should
they remain in ? Is there anything that. If put in the water, will facilltate the softenning of the wood? 2 . Why
were all the American quarter ond made in the year 1853 stamped with an Imitation sun's rays on the eagle side, and none before or since?
A. 1. The steam chest for bending timber is commoniy made of wood, and connected with the boiler. It is the
exposure to the heat of the steam that softes the and probably nothng put into the water will hasten the ure of steam ts maintained. After the pieces are soft-
ened, they are bent to shape, and then, betng secured in
 at that period.
 Mississppiriver from carro to New orieans
is the enped of the curren per hour between these two
places? 3 . We wish to start from Calro and go to New places? 3. We wish to start from Cairo and go to xew
Orleans in a mamall boat. Do you think this is feasible? If not, why? 4. Would the wind ald us in sailing?
What size and kind of a boat would you advise us bulld? 6. Do you know of any goodbook describing the
Mississippl? A. A. 1,0t miles. 2 . At migh water, the
 water, 2.26 miles per hour. 3, 4 . Yes. 5. Probably yit will
be best to bulld a cat-rigged center board boat. from 18 to 20 feet long. 6. There are numerous guide books the Misisisippl, which doubtless ocotain much that
would be interesting and useful to you on your voyage. C. M. B. asks: 1. What is decalcomania, emedy for that every day annoyance, a bad cold in the throat? A. 1. There are vartous methods of decalco. mania or transferring of pictures. The fnest is to trans.
fer the pictures on wood. Paper pictures for this pur pose are now sold by the stationers. A varnish ts ap
 wood. When dry the paper is dampened and rubbed
off with the tingers, leaving the picture on the wood. 2. off with the tiggers, leaving the pitcure on the wood. 2 .
The way to prevent takigng cold to to beep the feetal.
ways warm and dry the plenty of nourishng food. The remedies that have pent
pean prescribed for ore throat would fill too much
gpach to be tinserted here. Gargling with strong sal
of soreness is perceived. Singed the moment a seold wrap the throat up after exercise when gotng out into the cold air, but a
other times the throat should not be too much covere so as to harden it to the weather. Growing beards said to be $\begin{aligned} & \text { good preventive against colds in the throa } \\ & \text { for those who have them to grow }\end{aligned}$
S. W. asks: How can I run a small bellows
Ithout using my hand? A. You might arrange a mo wrinout using my hand? A. You might arrange a mo
tion to be worked by your foot. R. B. S. asks: 1. How can I make a battery battery, such as is used in telegraph offlces, do? 2. Can you tiform me how to clean and pollsh shello of variou have not succeeded very well. suppose I have two tunk each one holdidng five gallons, what size should the in
side of the tubes connecting them together be? Are al the tules to be the same sizz? What hight should the
 vol. 27 , and use friction for giving a fine polish. 3. In.
side diameter of tubes, babut one quarter of an inch. All the tubers can ees, the eame same except that you
hould contract the opening for the eet. Hight of uppe hholid contract the opening for the jet. Hight of upper
yessel below bottom one is regulated by the hight of je W. P. asks: What is an average analys
 W. S. B. says. 1 . I lave heen told by sev.
eralmechanics that a block cannot be squared on all sides, that 1s, that all the sides of a cube, at right angles to each other, cannot he obtitined hy a conmon try gquare
Can a screw be set up tiguter with 1 long screw drive han a hhort one? What is the theory of this?
of a carpenter's square, frrst dressing one face out of
Vind, nand marklug a squire un it, to serve as a guld In laying off the other faces. 2. The tn creased inefficien cy of long serew driver is due to the greater leverage
afforded by inclining the tool, as already explained on
R. J. T. anks: Can a locomotive start with
ore cars, onc crank beling on the center or dead more cars, one crank betng on the center or dead poitt,
with the other crank below the axle.ora bovethe eame? with the other crank beow the axie, orabo ve the same?
A. There would be no difference e th the two cases, ex-
E. H. B. asks: What is a remedy for biting
he tinger nalls? A. Weep the tingers out of the monting
R. H. D. asks: Will the same amount of
 ell known that more effect can be produced witi
A. D. says: : I have a hollow iron cylinder, the dent up by pouring in melted lead, but I could not
make the lead to adhere to the tron. How can I make he lead stick? A. You can make the lead adhere b
C. D. asks: Why is it that, during rainy
weather, when the alris arometer falls? A. The barometer falls just before densed, thus lightening the column of atr that supports
a. J. V. D. says: You say that for casting shan clay. Willit Itoo do for brass for articles 6 or 8
the
ozs in welbht? Would vent holes be needed tor the es. oza. in welght? Would vent holes be needed for the es-
cane of gas? A. We thnt that plastor of Paris would
answer in the cases mentioned, if proper vent holes were answer in th
provided.
P. G. K. asks. Is it precisely
noon, at any given point when the sun is is due south of noon, at any given potant when he sun is due south o,
that point? Does it vary? If so, what st he variation A. It is precisely noon under these cer Aour times in the year, about December 25, April 16,June 16, and September. At all other times the noon time, as shown by the sun, must be corrected by the equation
of time, which is given in the Nautical Almanac for every day of each year.
sulta a lawyer
J. R. asks: Where should the draw bar of
locomotive be attached? If above the center, she will tip up in front, vertcally. A. As low down as possible.
R. IM. S. asts: 1 . What is gasoline comcoal oll? If so, why? 3. What are naphtha and benzine composed of? A. 1. The term gasoline is a barbarism applited to highty rectited naphtha, one of the liquid
aydrocarbons distilled from petroleum. 2 . It s extreme $y$ dangerous to attempt to burn it in the ordinary maner, on account of its volatillty, the combustinity of its 3. Naphtha and benzine are two names for the same
thing. They are compound of hydrogen and carbon. We do not know the other fulds you mention.
J. F. A. asks: : What proportions of carlon-
ate of soda and sulphurle actd, each in solution of equal quanttile of water, will geuerate the best quallty of lyan of hhe earbonita acid gas will not bee affected by vars-
ing the proportlons or the strength of the solutions em. ing the
L. H. D. asks: 1. How can I make a gold
wash? 2 . How can I mold hard rubber, so that it shall retatn its elastlcitty? A. 1. You can make a gold wash as follows : Dissolve 1 part of gold in 3 parts of nitro
murlatic acid (a mxxture of nitric and murlatic acids) evaporate untl vapors of chlorine cease to be evolved
and then set the solution aside to crystalize. Dissolve the crystals, which are the terchloride of golu, in water.
To the oolution add ether and shake the two together which ls an ethereal solution of gold. When this is ap plled with a camel's halr brush to polished iron or steel,
the ether son the ether soon evaporates and leaves the surface cov
ered with a fllm of pure gold. In this wyy any fancy de. nice or writing may be executed with facillty. 2. 1 old Your best plan is to immerse the rubber in a maxture of bisulphuret of carbon 95 parts, and rectifed alcohol 5 parts, untli it swells into a pasty mass, which may then
be molded into any desired form.
J. A. E. asks: Can you give me any infor
mation reespecting the merits of the Vera Cruz cement used by the Mexicann for builling purposes?
can I construct a cheap home mow is very highly spoten of by engineers who have madeex
periments to determine tits qualtites. 2 . See p. 7 , vol. 30 .
F. T. H. says. In tring to make gun cot-
on, took a namadul of cotion and poured upon to toure ton, Itook a hanaful of oction and poured upon it oute
ounce of ntric and one lial ounce of sulphuric acids,
mixed well, and allowed to cool before pourlug. After

 have any chemical effect on blue litmus paper. I then
dried and ignited tit, but tit burnt only as conmon cotton . A. Youraclas were not in the proper pro-
and probably not strong enough. Treat as fol porws: Mix together equal measures of concent rated
low
nitric acid ( S G. 1 j$)$
aud concentrated sulphuric aclic: S. G. 1.845). When cool, pour into a glass vessel and as possible, for 4 or 5 minutes, promoting the action of the liquide be stirring with a glass rod. Then pour the
acids off and squeeze the cotton as dry as possible, by means of the glass rod, or between plates. Then throw he cotton into clesn soft water, as large a quantity as of water until the article is perfectly free from acid.
Lastly dry by a steam bath at about $180^{\circ}$ Fah. Only mall quantities of cotton should be prepared at a time and the greatest caution observed in handling after man
ufacture. Good gun cotton explodes at $300^{\circ}$ Fah., with
S. A. B. says: I am told that nitrogen may be formed by fabricating coke. Will you explain this?
Does it mean that coking the coill accomplishes it, and can it be done in open air? 2. How much nitrate of potas. a will be sufflcient to put in a tun of fertilizer? A. .
There is no free nitrogen formed in the destructive dis. illation of coal. $\Lambda$ ready means on the small scale of
btaining nitrogen is to burn up the oxygen. In a hell glass filled with atr, over water. by ineans of phosphorus.
. Dr. Jeanmel's fertilizer (see p. \$1, vol. 28) contains Dr. Jeannel's fertilizer
J. M. says: I have a plain cylinder boiler 16
feet long. The fre goes under it and up the smoke stack. Would a check wall buill at the far ead of boiler save
fuel? A. We do not think the proposed arrangement A.K. asks: 1. What lish swims the fastest and where could 1 see a grood drawing of the same?
What is the name of the tluid which removes all dirt rom the works of a wat fish or tunny. You will flud them illustrate in almost any good encyclopedia. 2. See p .98 of our R. T. asks: How can I make a filling for
walnut wood, that will take varnish well? A. Mix with bood whiting such colors as will produce the desired mixture over the work until it is pretty well covered hen rub in well with a soft rag.
Minerals, etc.-Specimens have been re eived irom the fullowing correspondents, and xamined with the results stated
S. S S.-This is a tine specimen of micaceous oxide of iron. is is often round in cofnection with common explored by itself.
N. R.T. Jr.-1. Copper pyrite8, a compound of coppe
iron, aml sulphur. 2. Quartzconglomerate. 3. Iron py ite? $\boldsymbol{\eta}$ quartz. 4. Red exide of zinc and magnetic iron
W. H. H. Thts mineral is a compact prown
E.E.B.-1. Clay with oxide of iron. 2. Clay contain ing brown oxide of tron. : $\because$. Brown quartz. considered a strong indication of coal in the vicinit-y The bituminous varlety, however, is more closely con
nected with coal. The presence of bitumen may be easi in determined by the 8
oxide of iron. Bog iron ore 35 per cent of cast iron; but on account of its containin a small proportion of pnosphoric acld, the bar ir on made
from it is often more or less " cold short." It is advanrom it is often more or less " cold short." It is advan
tageously smelted with the brown oxide and other ore

Josiah M. Hess, 292 East Washington street Indianapolis, Ind., wishes to know who makes the best
horse radish grater. Will some correspondent inform

## communications received.

The Editor of the Scientific Americain acknowledges, with much pleasure, the re eipt of original papers and contributions pon the following subjects :
On Photographs of the Invisible. By J. K. On an Aerial Ship. By W. O.
On What to Do in Hard Times. By G. F nd by J. P. A.
On the Ventilation of the Senate Chamber By R. T.C.
On Small Steamers. Br (i. S. C
On a New Means of Producing Jire. By
On Purifying the Air. By S. B.
On Administrative Reform in the Patent Office. By G. R.
On Some New Inventions. By C. W. P. By T. H.
On the Alignment of the Hoosar Tumel
On a Total Eclipse of the Moon. By J. M. B
Also enquiries from the following:
F.S. L.-D. C.T.-K. A. H.-H. M. P.-G. w. K.

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manufacturers, or where specifled articles are to be had also those having goods for sale, or who want to find partners, should send with their communications an the head of "Business and Personal" which is spectally deroted to such enquiries.
IOFFICIAL.]
Index of Inventions

Letters Patent of the United States rere granted in the week fnding December 16, 1873,
and eaci be.ming that date.
$\frac{\text { Those niarked (r) aee relssued patents }}{\text { Alarm, till, w. Malick ............................. }}$ Amaginating goldand sllver, J. Tinbrid Barrel tap and fancet, G. B. Taslor Barrel tap and faucet, G. B. Taylor Bed-tead, , oota, P., J
Bechive, L. J. Diellı Bulliard table, C. S. Ahil Bit brace, W. E Fereau Boller, agricultural. H.A Mears Boller for warming butidings, C. F. Hitch ngs
Boller, rafety valve, team, H. W. Shepard Boller, rafety valre, rteam, Has, Cuver \& Moseley
Boiler plugs on ferrules, Boot, G. C. Parker...................
Boot heels, breasting, W. C. Butle Boot heels, cuttu..gleather for, M. .I.... II
Boot aud snoe tip, F. w. Ratialander... Boot:, heelug, L. Graf.... .
Boots, baffiug.G. C. Hawkins. Botte $\begin{aligned} & \text { c. S. Lith. } \\ & \text { Bridge, A. Reiling }\end{aligned}$
Bride columin, J. Zelliwe..... Brush holder, C. L. W. B.tker
Bruth woods, 8.aping, J. . mie Building, fireproof, E Vac
Butter worker, s. H. Bush.
 Candustics, 1 II. II. Hilids
Car couphng, J. W. Hees.....
Car couphlug, W. B Mhciell Car couplnges, automntic, g. H. Merriam
Cars, elevatins, etc.. W. T. Bec Cars, elevat, J. O's
Car starter, J.G. Cars, orake bea.n for, D. Wellington Carrase ax es. in anufaccure of, Lone Carliage wheel. H. G rynal ..................
Chainlinks, machine for beidna, C. B. Long.

 Chura dasher, H. B. Robin
Clamp, book, W. A. Miller Clothes pins, making, B. B.
Coffee roas er, w. J. Lane ...
Coppr, welding, E. Leemud Corn, etc., peeserving green, Merrill \& Soule Corn aroiper, I M. \&
Corset, Loomer \& Smit
Cotto Cotton worm destreyer, J. W. Joluson.
Cotton worm destro er, J. W. Johusoun Culiwary vessell, wa. Barlow.
Cultivator, D B. Cultivator, J. E. Sbsson Cultivator, G. slusser Cultivatur, A. C. Smith ........
Curtain Insture, W. W. Wassey
Cutter, straw, T. D. Ande.
 Dovetail mar' ing device, G. Ashby ........ ...
Drills, ctc., die fur forming rock, D. Minthorn Engine, locomo ive, cte., steam, L. Perkin Engine, rotary. C. C. Kietn Engine, rotary, W. P. Maxson
Fan, C. C. Lusty................... Fencet, wash stand, W. S. B
F. W. Duuean Fences, constructing wire, J. W, Rappety File bill and paper, W. H. Foye Fire arm, $t$ reechi-loaul: a , J. Du Fire arm, magazine, A. Ass:nus..
Fire arm, revolving, i . White $(\mathrm{r}$ Foud or sauce, F. A. Friscla. Furnace door, D. Auld. Jr Furnsce, hotair, G. W Day Furuace, hot alr, J. Magee. Furuace, hot alr, J. Magee.......
Gage, recording steam, J. B. Elso Gqu, Illuatuating, E. R. Hophins
 Geue:ator, stemin, H. M. Q

Gralu basket, 1 G.taduy machine.P.D cummings Hammer, drcp, J. Tobin...
Harness trace,

Harvesterdropper. J. S. F
Hatchway, selt-closing, W. P. Cherringto Heater, feed water, G. W. Michardson Hod, masouns, E. C. Monroe Holsting machine, J. Joues Horses, detachug, I. L. Lindis Ins, halinac or buring, J. A. Newell.. Ice creeper, Johuson \& Axford Ingot mold, M. T. Mooney Inhaler, nedical, J. C. Paikinson ..................
Inkstands, toolfur molding, a. W. Brinkerhoff. Irou and s.eel, r. Hiniug, I. M. Phelps..............
Iron, etc., preventing corrosion of, R. A. Fidhe Rultiug macuine regiter, D. A. A. Fioher Kulfe, drawing, M. Brouks
Ladder, step, A. W.O'Jienu
Ladder, step, A. Wrip suip, J. S. \&. T...............

Lamp wick, P. Martin ...... .............

1. amp sl de pendants, J. A. Evarts.
 Iath machiue. T. Bruno Lathes, tool holder for, I. Reder........
Leather perforating machine, L. D. W
Leather metal fastenning. C. Keniston Leathtning rod coupling, J. W. Fritc
Lithouraphic trans er. O. P. Wolff. Lithoyraphtc transfer. O. P. Wo
Lock tumbler. E. W Brettel Lock tumbler. E. W. Brettel............... Nast for vessels, hinged, J. E. Hammont
Mat tre s frame, wire, G. V. \& W. I. Bunke Matiriss spring, 1). N. Sellig.
Medical compound S. Fi .li Medicql compound, S. Fi IJ .
Medical compound, S. Gilber
Meter, dry eas, A. Ilarris .......................
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M,tor. L. II. Dean ust blackboard, Brown \& Care Niil cutting inacl ine, M. Thibau! Vinnachine, cut, E. A. Kimball
:ail plate feeder, J. Poulson ... O-es, etc., flux for, P. X. Mackay Ox shoes, forming, S. Deeble
Ox siloes, making, I. Fre ch
Pans, machine for forming, E. Kuessncr Paper pulp. Brown \& Denison............
Petroleum, distilling, $\Lambda$. W. Wi:kinson Photographic bachgroma,.J. Buchte. Photographic babkgrond, A. R. Costcllo....
Photoraphs, guide for cutting. L. T. Young Placards, etc.. exhibting, Morrell \& Mo Plaung sheet metal edges, G. B. Liundlet
Planter, cotton seed, Z Carter .......... Planter, hand corn, Tracy \& Plat Pianters, droper for seed, II. II. Koelle Plow, C. M. Curk .......
Porttolio, L. F. Rimana Pot i:sa, bitartrat: of, L. Adler ....
Press. cotton and hay, E. S. Collins finter's rules, prepiring, J. B. Bancrof
Priater's s desestch and quoin, F. Kechn. Printing press, copper plat $\cdots$. T. S. Bates.
Propellers, operating screw, F. II. Tobias umb: or blower, rota:y, A. Brear ........ Punching and sicarlur m tehine, C. S wa
Railway rail joi it stiffener, H. Hardug.. Rah way switch, E. Mercter
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Roors, atcachtng shate to. D. Ryan.
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Way, elevated, H. W. Farle
Weather stuip. O. W. Booth
or rattan, sulitting, J. Taggart
Win tmill, J. A. Wheeler
Whindow hini blat adjuster, Beach \& Ber:y
Wiadow screen, W. G. Anderso
Wrench, S. J. Wright..........

APPLICATIONS FOR EXTENSIONS.
$\qquad$ or the extension of the tollowing Letters Patent. Hear the daye hereinafter menti-ned
i,6it.-Cllitivator.-C. M. Hall, D. E. Hall. March t,6.1.-harvester.-F. T. Lomont et al. March r,733.-Boilerfeed.-T. Snowdon. March 18.
8, ct-Car axie.-J. Montgomery. March 8 . 8,263.-BAYonet SCABBARD.-E. Gaylord. April 29

EXTENSIONS GRANTED

 6,477.-SCREW TAPs. -W. and Robert Foster

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27,475.-Breech Loading Fire Arm.-B. Burton. DESIGNS PATENTED.
 7,051 to 7 , c59.-CARPETS.-O. Itinigke, New York city.
 i,063.-Soda Water Apparatis -G. F. Meach ton, Mass.
i,06t.-Fur Tr
7.06t.-Ftr Trimming.-A. Molnar, New York city.
f.06 \& 7,066 .-Carpets.-J. H. Smith, Enfleld, Conn


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1,57a-Berming Flutids, etc.-Netterfleld et al.. Bur
1.576. - Whiskr.,-D. Porter, San Franclsco, Cal.

1,5:7.-Perficmes, ETc.-G. J. Wencb, New York city
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## CANADIAN PATENTS.

December 23 to Decented in Canad 2,50.-W. A. Weldon and J. S. Dennis, Chicago. Ill., U. Improvements on curtain tixturis, called " The Wel
don Curcain Fixture." Dec. 23, 1873. 2,951.-W. A. Lyttle, Grove, Hammersmith, Middlesex county, Eng. Improved process for pr. serving um
:jer, called $\cdots$ Lytule's Process for Preserving Timber. Dec. 23, 18:3
2,952.-I. S. Mussell. New Market, Md., U. S., and H. R.
Russell, Woodibury, N. J., U. S. Improvements in Russen, woodibury, N. J., U. S. Improvements in

## 29, 187

295.-J. G. Tourangeau, Quebec, P. Q. Machine pon
fit ve la pate, called "Le Petrin Tour Dough Mi kin: cllled "Le Methe." Dec 29, Tour
Dis.
2.95-I. Kiuney, London, Mifdicsex county, Ontario
Machine for designtug and cuting scrolls and curve Machine for designtug and cutting scrolls and curve
lines more accurately and expeditiously than has here tofore been done, called "Kinney's Ins rument fo Designtng and Cuttug Scrolls and Curved Lines.' Dec. $\ddagger 9,1873$

English, Ilamilton, Ontario. Improvements in Rotary Stum Eurine , Dec 20, 1873. Rotary Srram Engine " Dec. 29, 1873
ment on skirts, called "The Sanspareil Skirt." Dec 29,1873.
2:57.-C. P. Leavitt, New Tork city. U. S. I Inprovement Dec. 29, 1873.
, in . Stars, Hylifax, Nova Scotia. Improvements. in the art or process of preparing oak
"Stairs' Inproved O*kum." Dec. 99 , 1873 .
,,959-J. F. Stairs, Halifax, Nova Scotia. Improvements in tyrring tow and oakum. cal
Oakum Machtne." Dec. 29,1873 .
2,960-- S. Smyth, Bridgewater, Susquehanna county, Pa U. S. Improvements in grates for stoves and tu
naces, called "Smyth's Stove and Furnace Grate" naces, calle " smith's stove and Furnace Grate.
Dec. 29,1373 . 2,961.-F. J. Bowles, London, Middlesex, Ontario, as
signee of J. II. Thorp, Chicago, Ill. Machine for the detection of burglars, being a portable burglar alarm, cal ed "Bowles' Improved Portable Burglar Alarm.
Dec. 29,1573 .
manufacture of boots and hoes and appara for, called "Lanham's and Last." Dec. 29, 1873
2963.-J. B. Pugh C,
U. S. Improvements on hay presses, called "Pugh U. S. Improvements on hay presses, called "Pugh'
Champion Double Press." Dec. 29, 1873 . 2,96t.-A. D. Crosby, Cuba, Alleghany, Pa., U. S. Im
provements iu buckets tor chain pumps, called "Cros provements in buckets tor chatin pumps, called "Cros
by's Inp roved Bucket for Cain Pumps." Dec. k 9
1873.

Impror ments on snow plows, called "Morton and Smiths. Improved Snow Plow." Dec. 29, 18i3.
gif6.-T R Way, springfied Clark county, 2966.-T R Way, Springferd Clark county, O., U. S.
Improvements on millstone picks, called " Way's Ec improvements on millstone pick
centric Mill Pick." Dec. 29, 1873.

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