

A WEEKLY JOURNAL 0F PRACTICAL INFORNATION, ART, SCIENCE, MECHANICS, CHEMISTRY, AND MANUFACTURES.

IMPROVED FEED WATER HEATER AND PURIFIER. ${ }^{\text {I }}$ and passes into the circular tube, E, Fig. 2. Thence it de- as well as so much of the steam as is necessary, is conducted It is a well known principle of physics that a liquid boils scends through the vertical pipes, $F$, into a second annular to the cistern in order to warm the water therein to such a when the tension of its vapor is equal to the pressure it sup- receptacle, $G$, from which it exits by the conduit, H. The degree as may not interfere with the operation of the pump. ports. Hence, as this pressure increases or diminishes, the steam does not circulate around tubes, E and G, because they From the cistern the water passes to the heater by the pipe,
. ${ }^{2}$ entering asshown tension of the vapor, and therefore the temperature of ebul\#ition, must correspondingly vary. Under a pressure of 1 atmosphere, water boils at $212^{\circ}$ Fah. ; if the former be augmented to 2 atmospheres, ebullition is retarded, and occurs at $250.5^{\circ}$. Similarly, if we continue and increase the pressure to 50 atmospheres, the elastic force of the elastic force of the vapor will not be equal thereto until the liquid be raised to a temperature of
$510 \cdot 6^{\circ}$. It is evident, $510 \cdot 6^{\circ}$. It is evident,
therefore, that to elevate the boiling point of water to a temperature corresponding tho a given pressure of steam, the heat of the liquid at the outset is an important element in determining the quantity of fuel to be quantity of fuel to be consumed an the opeuastrate, if a steam ustrate, if a steam pressure of 5 atmospheres, or 75 lbs., to the square incl, be required, the boiling point of the water in the boiler must be at $320^{\circ}$; if the temperaure of the feed be $212^{\circ}$, then there are 108 degrees to be supplied by the combusplied by the combus-
tion of fuel; if $250^{\circ}$, 70 degrees, and so on. Every apparatus,


## FRANCE'S FEED WATER HEATER AND PURIFIER

 ,entering asshown the apparatus and filling the tubes, C fing in tubes, ace bermate shells, A and B. There, as is evi dent, it becomes heated by bothexhaust and gases, and finally escapes into the boiler by the tube, K .For cleaning the apparatus, a very ingenious and, it is claimed, efficientar rangement is provided The pro vided. The heater with vater, and then the valve on pipe, L, is
opened. Steam directly from the boil er'is thus conducted into a perforated circular tube, $M$ through the orifices of which it escapes breaking up what ever sediment or mud may have ac cumulated at the bottom of the inter bottom of the inter mediate space; and thence it passes hroug a system of pipes beginning at $N$, and leading through all the tubes, C, as shown at $O$ (Figs. 1 and 2). These pipes are closed at the fur ther end of the sys tem, and are also perforated, so the steam, emerging acts upon the impuits object the heating of the feed water of boilers, should, have closed extremities at points respectively opposite those rities packed on the inner surface of tubes, C. The blow-out

 through supplying the feed at the highest possible tempera- $|$| To the elbow of pipe, $H$, is connected a tube, $I$, through | er escapes, and also the sediment driven out by the steam. |
| :--- | :--- | ture; secondly, by effecting this result through the most $/$ which the water due to condensation of the exhaust steam, In filling the apparatus the steam from pipe, L, is shat of thorough utilization of the heat generated lby the fuel that is employed.

The device which we herewith illustrate is clainmed to completely fulfil the requirements of the above propositions. Briefly described, it is a feed water heater and puriffier, in which not only the heat of the exhaust steam, but that given off by the products of combustion in passing through the uptake, is utilized. Our engravings represent: Fig. 1, the application of the invention to a stationary boiler, and, Fig. 4, a somewhat different arrangement of the same principle in connection with a porta. ble engine or locomotive.
Two cylindrical shells, A and B (Fig. 2), are made of boiler iron, and, at their extremities, are provided with flanges, by means of which they are bolted together. When required, by removing the bolts the outer shell can be taken off, thus giving ac"cess to parts inside. In the inner shell, $B$. are perforations in which cross tubes, $C$ are expanded. These are arranged at dif ferent Thights and in a spiral line, as indica ted in the plan view, Fig 2 The appara tuse being placed at He . The appara turs being placed at the end of the boile and secured directly over the receptacle the heated gases from the furnace necessarily pass up within the inner shell and around the cross tubes.
The exhaust steam from tire engine enters through the large pipe, $\mathcal{b}$, at a point about six inches from the tor dithe heater
 and the cock, P , closed. The small jet cock at $Q$, is then opened to allow the air to es cape, and the valve at the bottom of pipe, $K$ raised. The construction of this valve is represented in section in Fig. 3. When th feed water emerges from the heater in th direction of the arrow, it lifts the valve from its seat, but, as is evident. is prevented from flowing back. On raising the valve, how ever by the screw and hand wheel shown the steam pressure within the boiler force he wap through the pipe, $K$, and thence the water up throg whe fill, the valve into the he closed, and the air cock, Q, shut, and the
cleaning process already described repeated cleaning pr
The feed water, entering by the pipe, J, at the bottom, comes in immediate contac with the cooler portion of the contents of the heater, and does not reach the hot meta above until thoroughly mixed. The ex haust, on the other hand, entering at nearly the top, meets at once with the most heated pait; for so long as there is fire under the boiler, the water in the apparatus can be kept warm independently of the steam from the waine This is of especial advantage in engine. in the morning for by the time firing up in the morning, for by the time the engine is ready to start, the contents of the heater will be sufficiently elevated in temperature to prevent the sudden expansio due to the hot exhaust being instantly turned upon the cold metal. Similarly in machines which lay by three or four times daily, in
stead of cold feed being passed through to the boiler, as it might be, were the water dependent for its heat upon ex haust alone, the reverse is the case. Moraover, it is claimed that, from the relative points of entry of steam and water, a uniform temperature of the feed is kept up, which ca maintained through the regular working of the pump.

The inventor lays particular stress upon the point that this device furnishes water to the boiler at a hotter degre than can be attained through using exhaust steam singly Thus, we stated already that the temperature of water or steam, due to a pressure of 75 lbs . to the square inch, is $320^{\circ}$ After this steam has passed through the engine it has proba bly a pressure of not more than 4 lbs . to the square inch which corresponds to $225^{\circ}$, nearly. This communicates its heat to the feed; and were the latter dependent upon this source only, it is evident that the temperature thus reached would be the highest attainable. But, in addition, must be considered the effect of the hot escaping gases, which, if the boiler be properly set, pass through the inner shell at a hea equal to that within the flues or tubes, or of at least $325^{\circ}$, and act on the contents of the apparatus. Clearly, then, by such means the temperature of the feed is still further elevated so that the claim of the inventor, that the present device i superior in this respect to a heater operated by exhaus alone, appears, supposing the latter to be otherwise equally alone, appears, supposing the
The cleaning process is facilitated, as well as a furthe economy of fuel effected, through the purification of the wa ter, which, it is stated, takes place within. The feed, in pass ing out from above, expands as it nears the top, causing separation and precipitation of sediment, so that the latter, instead of entering the boiler, drops to the bottom of the heat er, and is thence removed by the means already described.
In Fig. 4, the same principle is followed in arranging heater in combination with the smoke stack of a portable en gine. A and B are the outer and inner shells, between which feed water is admitted from below by the pipe, C. Thence passing in the direction of the arrow, through two or more pipes, $D$, the water enters an inclosed conical pot, E, where it receives still further heat from the mingled escaping gases and exhaust. From pot, E, the feed is forced down the pipe
F, which may be either inside or outside of the smoke stack, F, which may be either inside or outside of the smoke stack, and thence into the boiler. Cleansing is cffected by steam admitted through the pipe, $G$, and escaping from the circu lar perforated tube shown in Fig. 2. H is the blow-ou valve. The same claims, already explained, regarding free dom from sudden expansion of metal and precipitation of sediment, are made for this application of the device.
Patented August 6, 1872, by Mr. S. W. France. For fur ther information, address Messrs. Heron \& France, 40 Cort Jandt street, New York city ; or the apparatus itself may be Jay street, corner of Plymouth street, Brooklyn, N. Y.

## Srinutifir Ammixam.

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## TIFIRIS

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The POOR MAN'S REPRESENTATIVE.
We note with gratification the projected visit to this country of Mr. Joseph Arch, a man who may be considered as the embodiment of a principle, of which we have frequently ad vised the obbservance. We allude to moderation and a respect for mutual rights in conflicts between employers and employed.

Mr. Arch was an agricultural laborer, a representative of the peasant class of England. Unaided, he taught himself to read and write, and afterwards joined the Methodists, coupling his duties as a workman with those of a preacher to others of his sect. By thrift and energy, he succeeded in amassing sufficient funds to purchase a small freehold property in
Harbury, Warwickshire; and having thus assured fimself a substantial home and certain means of livelihood, he turned
his whole mind to the adva
class to which he belonged.
Mr. Arch is not a demagogue, nor does he aim to maintai the rights of labor by extreme measures. Neither is he al lied to any political creed or faction. He simply strives to ecure, for a disorganized, scattered and down trodden class, a just return for its toil. To this end, he has traveled around England, diffusing information; in some cases leading men in direct opposition to employers, in others counseling co peration or compromise, but in every event enforcing hi views with such reason and moderation as to convince even he most ignorant that his work was for their advancemen nd benefit. The result is that at the present day he is th ecognized leader of $100,000 \mathrm{men}$, organized in a powerfu nd growing movement.
The agricultural labor difficulties in England are perhap the legitimate results of the surplus of population crowded within the narrow limits of that country. There are far more people seeking work than there are places to be filled, so that individual competition is necessarily so strong as seriously to retard efforts to improve the condition of the laboring classes through gaining better wages for them. Following out his precept of demonstrating to the workman the place where he can obtain the best return for his labor, Mr. Arch crosses the ocean in order to investigate the condition of agricultural affairs in the United States, with the view of altimately counseling the emigration hither of large numers of his countrymen. His errand, we believe, will not be fruitless one. He will find a vast and fertile territory waiting only for the labor of the farmer to yield rich returns and will learn that acres by the hundred may be had of the Government for the asking, under no recompense other than the tillage of the soil. The laborer, at home a mere serf wholly reliant for a means of existence upon the wealth and owner, will, under our laws and institutions, becom almost at once a freeholder, drawing a certain support and ustenance from his own farm. The emigration of such men to our shores will be of advantage to both nations; to England, through the dimination of her overgrown popula on, and hence the bettering of the condition of the othe workmen that remain at home; to the United States, for the aluable acquisition of several thousand strong armed, sturd armers in now unsettled and uncultivated districts. T Mr. Arch, the benefits to be derived will be fully pointed out while every facility will be afforded him for a thorough ex mination of the immense agricultural resources of the coun ry. Whether productive of direct result in immigratio or not, his visit will be both timely and welcome, for jus uch sound, practical views and advanced ideas as he ha romulgated across the ocean are sadly needed here
We trust that he may speak publicly, and that both em ployers and workmen will listen to him. His teachings ar broad and general, applying to every trade; and while he counsels justice and the rights of labor to the one class, he as earnestly advises moderation and respect for the rights of property to the other.

## THE BISULPHIDE OF CARBON :AUXILIARY.

The Peters Manufacturing Company, of Newark, N. J., a working derive their power from a pair of steam engines, ders are 20 inches in diameter and 4 feet stroke. Power 300 horses. Consumption of coal, 4 tuns a day
This Company has lately contracted with the Ellis Bisul phide Engine Company, for the use of the Ellis patents as fol ows: One of the cylinders is to be run by steam as at present he exhaust therefrom is to be sent through the Ellis bisul hide of carbon boiler, and employed to convert the liquid int apor, which is to be used in the remaining cylinder. Thu one cylinder will be operated by steam, and the other by th vapor of bisulphide of carbon, heated by the steam exhaust. Mr. Ellis, at his own expense, puts up and attaches the bi sulphide of carbon apparatus, and runs the engines for 60 days, guaranteeing to effect a saving of 50 per cent of the coal at present consumed. If he accomplishes this, he is to receive $\$ 8,000$ dollars in cash, and a royalty equal to on sixth of the value of the coal saved, so long as the company continues the use of his patents. If the bisulphide auxiliar fails to effect the saving specified, Mr. Ellis is to remove th apparatus at his own expense. This seems to be a good ar rangement, and promises to afford a fair test of the value of the Ellis improvement. We shall look for the results with interest. The work is to be completed within sixty days
The Atlantic Works, Boston, Mass., are now putting in he engines for a tugboat of 400 horse power, in which th Ellis bisulphide auxiliary is to be employed.

## WARD OF PRIZES AT THE VIENNA EXPOSITION

The distribution of the premiums awarded at the Vienn Exposition took place on the 18th of August (the Emperor' birthday), in the Imperial Riding School, in Vienna. About three thousand persons were present, but the ceremony i characterized in the dispatches as a rather tame affair. Th ormalities consisted in a brief speech by the Arch Duke Regnier, in reply to which Arch Duke Charles Louis stated ly read the names of exhibitors to whom diplomas, medals etc., had been allotted by the jurors. Baron Schwartz Senborn hen read the list and returned thanks.
The distinctions granted are as follows: 1. The diploma honor, given for eminent merits in science, and its appli ation to the culture of the people and advancement of the intellectual, moral, and social welfare of mankind. 2. The medal for progress, for exhibitors who, by new inventions etc., can show notable improvement over former expositions. 3. The medal for merit for perfection of work and genera
uperiority of produce. 4. The art medal, for contempo, neous fine art produced since the London Exposition of 1862 5. The medal for good taste, for those who distinguish them selves in articles in judging which, form and color are in the first line decisive. 6. The coöperative medal, for man agers of factories, foremen, designers and other assistant who contribute to the excellence of products or extent of consumption. 7. Honorable mention, given to exhibitor who show merit, but not in a sufficient degree to warrant the estowal of a higher award
The medals are in bronze, $2 \frac{8}{9}$ inches in diameter, bearing on he obverse a portrait of the Emperor of Austria with th inscription in German, "Francis Joseph I, Emperor of Aust ia, King of Bohemia, etc., Apostolic King of Hungary." The everse side contains emblems and artistic designs accordin o the respective classes. The medal of merit has, in addi ion, another inscription, of which the following will serv s an example. "Welt-Austellung, 1873. Wien. Fur Vera enste," or "World's Fair, 1873. Vienna. For Meric."
The list of American awards, recently sent per cable and published in the daily journals, has so many inaccuracie ud, in the matter of the names, is susceptible of so much doubt that we defer its publication until the reception of more complete and reliable information. It would seem, however, from the number and wide field covered by th premiums, that it would be rather singular if any exhibitcr ailed to receive some honor; and hence it may perhaps b afely inferred that none of our representatives will retur empty handed, unless, of course, they have voluntarily with drawn from competition.

## THE PATENT CONGRESS AT VIENNA

The delegates to this gathering, from the various State of the continent and from this country, assembled on the 4th of August, in the Jury Pavilion in the exhibition ground at Vienna, and organized by the election of Baron Schwarz Senborn as honorary president, and a council, of which C. William Siemens, of London, was chosen president with several secretaries, of whom Mr. Black, of New York, is one
The object of this Congress, it will be remembered, is t discuss the propriety of establishing a uniform patent law in Europe, and also to suggest, to the several governments he general principles and features which such a law ough to embrace. According to Galignani's Messenger, the follow ing resolutions have been adopted

1. Only the inventor himself or his legal successors shal obtain a patent. The granting of a patent cannot be refused to foreigners. 2. The donation of a patent for an invention to be for fifteen years or for a shorter term with the option
of extending it to that period.
2. The complete publication of extending it to that period. 3. The complete publicatio of the patent to be obligatory. 4. The expense of granting patent to be established on a moderate but progressive scale." duce a graduated tax upon patents according to the conditio of each respective country, was withdrawn after repeate doubtful votes had been taken. " 5 . A specification of all patents in force must be accessible to the public.'
The Congress is to continue the debate upon the sixth res olution, whereby it is made obligatory on the holders of pat ents to place their inventions at the disposal of everybod The first five resolutions appear to be practicable enough and are based upon existing laws, now in vogue in mos of the continental States. The proposed sixth resolution s a novelty in patent legislation and in legal jurispr dence. It is a suggestion from some of the addled head of Great Britain, we believe. It is intended, in that coun try, to involve the appointment of a commission of lords, ukes, or barons, who shall establish the price at which a inventor may sell his device after the grant of a patent Such an enactment would be absurd as well as unjust to the inventor. If it is right and desirable for governmen to fix prices for the inventor, why not in like manner es ablish rates for authors, merchants and dealers in com modities of all sorts?

## LIGHTNING RODS.---A FEW PRACTICAL HINTS

## To the Editor of the Scientific American

On Saturday the 26th of July last, at about a quarter to ne, A. M., in the village of St. Michel, some 15 miles below Quebec, where I have my country residence, the lightning fell during a thunderstorm on the house of one Boulanger with the following effects, which I believe are worthy of ote:
The house is a two story one with a hip roof of ordinar itch. The electric fluid struck the vertex of the triedral angle formed by the plane of the hip and those of the fron and rear slopes of the roof. It there divided into three dis inct and separate parts, one of which went northward or to wards the rear of the house, following the line of rafter along which it traveled, and tearing up the shingles as it passed along. From the foot of the rafter, it jumped to th op of a window situated immediately kelow it, and fol lowed the center of the window along the iron bolts or fast enings, tearing away strips of the woodwork several feet in length, and projecting them to considerab'e distances within the house. From the bottom of the upper window, th lightning leaped to the top of the window below and, fol owing the bolts as before, with the same effects, passed int he earth or foundation
That portion of the electric fluid which went westward down the hip did not follow a rafter, there being none in it icinity, but followed the tongued and grooved joint of th oofing boards, and, as in the other case, tore up the shingle all along from the apex to the eaves, passing down as before long the mullion or center of two windows situated in the end of the building, one below the other, again following
he window bolts and tearing away long strips of the wood work, one of which; four feet long, was pro
interior door to a distance of ful'y 30 feet
The third branch or portion of the divided fluid wen southward along the rafter (but in this case without tearing up the shingles) from the foot of which it jumped to th window bolts of the uppermost of the front windows; and, as the window below is a shop window, with no mullion o bolts, the lightning jumped from the bolt of the upper win dow to the hinge of the blinds, and thence passed down between the frame and architrave of said lower window, which architrave was torn away and projected a distance of 40 feet to the opposite side of the roadway
The man, Boulanger, who had risen during the storm, stood, at the moment the thunder fell, about midway between the fore, aft and end windows above mentioned, or very near ly under the apex of the roof or point where the lightning struck. He was knocked senseless and fell in the doorway where he stood, but soon recovered and is just as well as ever, while his wife and children, who were near him at the time, were unaffected by the shock. A sulphurous odor per vaded the house, so says the man.
Now, Mr. Editor, has it ever happened before that the electric fluid has thus diviled into two or more separate branches, and if so, would it not be advantageous that lightning rods or conductors be bifurcated or trifurcated at the base, the separate branches thereof passing down from the apex of each of the hips of isolated buildings, or down the front and rear roof slopes
One query, Mr. Editor: What is it that projects the large splinters of woodwork to such distances, as in the present case? The ignition and explosion, I suppose, of the gases within the pores of the wood; but how explain the projection of the architrave of the lower front window to some 40 feet,
where the frame itself was not in any way splintered or dewhere the frame itself was not in any way splintered or de-
stroyed, and where the electric fluid appears to have merely passed down between the architrave and the lower frame of the window? Is the action merely mechanical or is it chemical, that is, can the fluid in its passage, and by its immense velocity, so condense the air itself, or the oxygen it contains, as to cause an explosion capable of accomplishing the phenomenon alluded to?
c. Baillairge.

Remarks by the Editor.-It would be hard to find a more beautiful illustration of the principles laid down in the paper on "Lightning Rods," published in our issue of August 16 (page 96 of our current volume), than that furnished in the above communication.
It appears that this. house, with its Mansard roof: with more or less of metal on its exposed angles and edges, and its window bolts standing vertically, no doubt: offered three tracks of nearly $\epsilon$ qual resistance to the electric dischar. e . The one, however, over the shop window, which had no bolt, being the worst track of the three, carried the least quantity of the discharge, and thus the shingles in this line were not disturbed
The mechanical effects of lightning are usually purely physical and due to the expansion of air by the heat, or the development of steam from moisture, where that is present. The present writer bas in his possession an induction coil giving sparks of 21 inches in air, with which many of the actions of lightning may be imitated on a small scale. Thus if the spark is taken across the surface of a piece of pine wood, slightly moist within bu'i well dried on the surface, fine splinters or fibers will be torn off at each flash and projected to the distance of several inches. These are torn out by the explosive force of the heated air and steam, developed by the passage of the spark between the fibers near the surface.
Lightning flashes breaking into numerous forks or "derived circuits" are by no means uncommon, although much less usual than the single "streaks." We have repeatedly seen them, and the phenomenon may also be beautifully imia crumpled sheet of metallic paper, such as is often used in a crumpled sheet of metalic paper, such coffee or spices. The tracks will here be five or six packing coffee or spices. The tracks will here be five or six
feet long and sometimes single, double, triple, or indefinitely feet long and sometimes single, double, triple, or indefinitely
multiple. Multiple lightning conductors are useful because each one helps the others, and if the discharge is too great for one, they will be able to carry it between them, but what is more i nportant is this: The less the total resistance of the conductor to earth, the more certain is it that no other, undesirable line will offer an approximately good path to the earth, and so get a part of the flash. Thus, suppose a single rod whose resistance is 1 , and that a series of bolts, perhaps through the walls of the houpse or the body of its occupant) whose resistance is 2 . Now, under these conditions, a flash would be likely to divide itself, and while $\frac{2}{3}$ tions, a flash would be likely to divide itself, and while $\frac{2}{3}$
would go safely down the rod, $\frac{1}{3}$ passing along the other line might burn the house or kill the man. But if two rods were connected, the resistance in this line would be but half,
hence $\frac{4}{5}$ would take this road and but 1 tend to go by the hence $\frac{4}{5}$ would take this road and but $\frac{1}{5}$ tend to go by the
other. Again, the less the resistance of any line, the higher other. Again, the less the resistance of any line, the higher ti:e opposite charge developed in it by induction, and hence the gieater its attractive influence, leading the discharge to prefer it as a path. This bears upon the importance of connecting all accidental lines of conductors, such as gas and water pipes, with the lightning rods. Insulated, these are opposition lines, soliciting the lightning to come into the house and traverse them; connected, they help the
we have seen, to get and keep the lightning outside.

THE price of quicksilver on the Pacific coast has risen to $\$ 1.10$ per pound.

CAOUTCHOUC---WHERE IT COMES FROM, AND HOW IT IS PREPARED
The extensive and rapidly increasing employment of aoutchouc in the arts has, within the past few years, raised this uniquely useful substance from its humble estate as a mere rubber-out of pencil marks to the front rank among vegetable products. Thousands of tuns are already required to meet the annual consumption, and almost every part of the tropical world has been laid under tribute to upply the demand
The plants which yield caoutchouc are restricted to three natural orders, namely: 1. Euphorbiacece, represented by several species of lofty trees (hcevea or siphonia) inhabiting the hot and humid valleys of the Amazon, and the Rio Grande do Norte. 2. Artocarpacece, comprising several varieties of Ulé trees (castilloa elastica, etc.) ranging from the Gulf of Mexico to Guayaquil; a number of species of fig trees (ficus elastica, etc.) occurring in North Eastern Hindostan, Farther India, Java and Northern Australia. 3. landolphia, in Equatorial Africa; vahea, in Madagascar, and urceola in Malacca and Borneo, all except the first named urceola in Malacca and Borneo, a
being climbing vines and shrubs.
The finest quality of caoutchouc is the Pará, the trade The finest quality of caoutchouc is the $P$
name of the Brazilian products from that port
The collection of Pará caoutchouc begins in August a continues until January or February; in the wet season the milk or sap is too watery for profitable working. When it flows from the trees, the milk has the consistency and color of cream, but it soon curdles by the separation of the caoutchouc from the whey-like liquid in which it is suspended. The trees are usually tapped in the evening, and the milk collected in the morning.
The native method of preparing the caoutchouc for market is to evaporate the milk over molds of wood or clay, by means of artificial heat tempered by the smoke of roasting nuts. The milk is poured over the mold and har dened in successive layers; then, when a sufficient thickness has been obtained, the mass is cut through on one side and the mold removed, leaving a pouch, the parent of the original rubber shoe. By European manufacturers, the milk is coagulated by the use of alum water or ammonia, and the caoutchouc hardened by pressure; a better way, in that it allows the manufacturing to be done a way from the scene of collection, which is always unhealthy.
The export from Pará is now about 5,000 tuns a year half of which comes to this city. It appears in market in several forms: "biscuits" or flat pouches, made by dipping and smoking with round molds; "bottles," made in the same manner over molds of corresponding shape; "nig ger heads" or solid balls, sometimes a foot in diameter made by rolling small pieces together; and lastly, as loose scrap.
Pará caoutchouc,being stronger, purer and more enduring than any other, is ińdispensable for articles requiring great strength and elasticity, such as springs for railway cars and the like.
An article of similar quality, but less pure, is that known commercially as Ceará scrap. It comes in the form of balls or blocks, made up of reddish brown string, like pieces rolled together. Like the Pará, it is the product of havece. The same trees also abound in French Guiana, Venezuela and Eastern Peru, in the dense moist forests along the river valleys.
The second in rank among the producers of caoutchouc is the Ulé tree, which abounds throughout Central America and Western South America as far south as Peru. Two, per haps three, species are tapped. They thrive best in thick damp, warm forests, growing to perfection in the basins of Lakes Nicaragua and Managua. The milk flows at all sea-
scns, but is best in April. A tree eighteen inches in diameter, skillfully tapped, will yield about 20 gallons of milk giving 50 pounds of caoutchouc. The milk is usually coag. ulated by the addition of the juice of certain plants, the caoutchouc separating as a soft brown mass, smelling like new cheese. It is then taken out of the brown liquid in which it was suspended, and pressed into cakes weighing about two pounds each.
Sometimes the caoutchouc is allowed to separate sponta neously, which occurs after the milk has stood half a day or so, and is then left to dry for a fortnight before pressing At other times the milk is simply poured upon prepared ground, when the watery part is absorbed or evaporated. I is sent to market in cakes called tortillas or meros, in balls
or cabezza, and in bolas formed by the natural drying of "the or cabezza, and in bolas formed by the natural drying of the
milk in the cuts made in the tree. The last variety is especially prized.
Six or eight hundred gatherers are employed in the San Juan district (Nicaragua), and as many as two thousand in the neighborhood of Panama, where the trees are cut down to obtain the caoutchouc. The New Granada product, known to the trade as Carthagenia, comes in sheets three fourths of an inch in thickness, and is of good quality, though sometimes tarry from admixture with gum from the wood, the result of unskillful tapping. Guayaquil caoutchouc is very irregular in quality. The best kinds are of a whitish color, and come in large flakes or lumps. The poorer varieties are spongy, and saturated with a disagreeable black liquid, which stains the hands and sickens the workmen who use it. The
best of the Central Americabrands is that known as West India, though not a product of the islands. The finest quality comes in blocks made up of thin sheets, and is of grea purity. Guatamala caoutchouc is the poorest. It is pre pared like the West India, but is spoiled by tarry matter. The remaining caoutchouc region of America comprises
the high plateau of Southern Brazil, between $18^{\circ}$ and $1.2^{\circ}$
south latitude. It affords a good quality known as Pernam trees grow to the size of the apple tree with small leaves and drooping branches, which give them the appearance of the weeping birch. The milk is not much collected, the trees being more valued for their fruit, which is held in high estimation.
The principal caoutchouc tree of Asia is the ficus elastica, which flourishes chiefly in Assam, Farther India, Java, Sumatra and Australia, north of the isotherm of $70^{\circ}$ Fahr. In many parts of the Assam district, the trees have been de stroyed by reckless tapping, and a still more reckless felling of them to render the operation of tapping more convenient. When properly bled in the month of August, an average tree yields about 15 ounces of pure caou tchouc. During the cold season, from October to March, the milk is scantier but richer than during the warmer months. That which flows from the branches is allowed to dry on the tree; that from the trunk and roots is collected in holes in the ground and in large leaves rolled funnel-wise and prepared artificially. The milk is either poured into the boiling water and stirred until it is stiff enough to be handled, or it is mixed with water in a tank and allowed to stand until the caoutchouc water in a tank and allowed to stand until the caoutchouc
separates and floats like cream on the surface. It is then separates and floats like cream on the surface. It is then
boiled over a slow fire until it coagulates, when it is taken boiled over a slow fire until it coagulates, when it is taken
out and pressed, after which it is boiled again, pressed, out and pressed, after which it is boiled again, pressed,
dried in the sun and washed with lime. It is sent to market in baskets of split rattan, holding about three hundred weight. Assam caoutchouc has a peculiar mottled appear ance, the color ranging from cream color to a bright pink. It is seldom pure, the admixture of bark and earthy matter amounting sometimes to a third of its weight.
Singapore caoutchouc, the product of surrounding coun-tries-Java, Sumatra, China, Manilla, the Malay peninsula, and Penang-is chiefly from the ficus elastica. Some bear ing the same name comes from Borneo,Sumatra,and Malacca and is the produce of the vine urceola elastica, a climbing plant of rapid growth and great size, often attaining a length of two hundred paces and the thickness of a man' body. The vine is usually cut into small pieces for the convenient extraction of the milk, the flow being hastened at times by applying heat to one end of the sticks or billets. The caoutchouc is separated by the action of salt, which causes the particles to coalesce. When fresh, the Borneo caoutchouc is white, soft and spongy, the pores are generally filled with salt water and whey. When dry and old, the color changes to a dull pink or red. The quality is inferior. The caoutchouc of Madagascar,also obtained from a vine, is of excellent quality. It is prepared by treatment of salt water, and also by artificial heat. It is largely used in water, and also wy artificial heat. It is
France, and ranks next to the Pará in price.
Equatorial Africa is rich in caoutchouc-yielding vines and Equatorial Africa is rich in caoutchouc-yielding vines and
trees, butits resources are but slightly developed. The col trees, but its resources are but slightly developed. The col
lection and preparation is conducted in the most slovenly lection and preparation is conducted in the most slovenly
manner, the caoutchouc being largely mixed with gum from manner, the caoutchouc being largely
African caoutchoucis received in the form of flakes, round balls and tongues. It is sticky, has a bad odor and but lit tle elasticity. The chief districts whence it is exported are the Gaboon, Congo, Angola, Benguela and Zambesi.
Notwithstanding the wide range of caoutchouc-producing plants, the future supply of this indispensable product is becoming a matter of deep concern. Owing to the reckless habits of the native collectors, all the accessible trees are be ing destroyed with frightful rapidity, large districts being already stripped of them, and no pains taken to secure their renewal. Millions of trees remain, it is true, buried in al most impassable forests, away from means of transportation but the cost of reaching them must ever prevent their being the source of much profit.

## AMERICAN SEWING MACHINE AWARDS AT VIENNA

 The official announcement of the prizes awarded for Amer ican sewing machines at the Vienna show, sent by telegraph, is so vague in detail and the statements of exhibitors are so conflicting that, at the time of going to press, we are unable to determine which machine has gained the highest honor Nearly every one of the manufacturers competing advertise the fact of his having received "a grand medal," and un doubtedly with truth; but it should be remembered that the medals are not the greatest distinctions, and that the diploma of honor is the award which, as we understand the premium system, only one, and that the best, machine can receiveThere is probably no question but that the medals for merit and progress have been bestowed upon all our inven tions of this class, either on the ground of utility, superio workmanship, or adaptability to special employments. Every report relating to the show indicates that our sewing machine have excited universal admiration, and have won the highes praises both from crowned heads and people. They hav stood preëminent over the similar display of any other na tion, and have gained for our general exhibit a degree of credit which otherwise it must have failed to receive.
The honor belongs to the energy, genius, and enterprise of our sewing machine manufacturers, whatever may have been their motive for exhibiting, and to them are justly due the thanks of the mechanics of the country whose skill has been so well represented by their handiwork.

The French Association for the Advancement of Science opened its session at Lyons, on the 21st of August. The city voted $\$ 4,000$ to meet the expenses of the society, and placed the Tuwn Hall and Saint Pierre Palace at its disposal. This is the second meeting of the Association, which now num bers 1,000 members.


THE ARCHITECT AND THE BUILDER OF THE VIENNA EXPOSITION PALACE
The two portraits given herewith represent, respectively, John Scott Russell, the celebrated English engineer, and John Kaspar Harkort, one of the largest Vienna iron masters, two men to whom Austria is indebted for the design and construction of the magnificent edifice which forms, at her capital, the receptacle for the exhibited products of the world.
Mr. Scott Russellis perhaps best known among engineers as the author of the "wave line theory of naval architecture," by which the bows of vessels are made hollow and wedge-shaped, conformably to hollow av of motion in water, while in the wave of motion in water, while, in length, they are proportioned to the ship's run as 3 to 2 . He was not the in ventor of hollow bows, as asserted by some, but he discovered and applied to shipbuilding the principles of Nature
In 1855, at his works at Millwall, London, Mr. Scott Russell began the construc tion of the celebrated Great Eastern, a work confided to him by her engineer, Mr Brunel. The ship was necessarily experimental, and hence no small difficulties were encountered even before she was launched. The hull was completed in 1857 , but through some defects, required 1857, but, through some defects, required a years adme $\$ 400,000$ before she could ture of some $\$ 400,00$ ber be got into the water. Of the eight engines supplying the motive power, Mr, Russell built the four designed to operate the paddle wheels, and also supplied oth er machinery, the failure of some por tions of which afterwards formed the ground of controversy with the owners and elicited adverse comment from the press. The model of the Great Eastern however, is exceedingly beautiful, and she is built on the wave line principle above described. To her fine lines and harmonious proportions her subsequent success, as a seagoing vessel, is douotless due.
The subject of our sketch was called upon, through the agency of Baron Schwartz-Senborn, to undertake the im portant task of designing the building for the Vienna exposition. Mr. Russell' first idea was to construct a dome 800 feet in diameter, but it was impossible to find either room or money for so gigantic a structure; it was eventually arranged that he should prepare designs for a building which should not exceed the width of 400 feet. Only a fortnight's time was given him to complete drawings and estimates; and in this short interval, an outline plan and section of iron work, together with the principal details and specifications, were finished under his direction. With these hastily prepared designs, Mr. red Vien but was with opposition, Russell started for Vienna, but was met with opposition, both secret and public; while many ende
impossibility of carrying out such a gigan impossibility of carrying out such a gigan-
tic cupola-shaped edifice. Aided by the tic cupola-shaped edifice. Aided by the
energy of Baron Senborn, Mr. Russell was triumphant, :and returned to En gland with the opinion of the mechani cal committee 'that Mr. Scott Russell' idea was ingenious, excessively simple, and, moreover, well suited to show how iron could be employed in a new and hith erto untried manner." The successful completion of the work has proved the exactitude of the purely theoretical cal culations upon which the plan was based As in the case with his former colossa labor, the Great Eastern, Mr. Russell re lied upon the accuracy of his designs and the soundness of his principles to over come unforeseen and incomputable diff culties, which might arise in the cours of a construction hitherto unparalleled and unattempted. The raising of the immense iron ring, of enormous weight and over 100 feet in diameter, to a hight of 80 feet, and the placing of the girders joining in a second elevated ring, was an astonishing feat, and, in a technical poin of view, a new and important event in the history of mechanical science
The first plans for the construction of the great edifice involved the use of large quantities of timber, for the supply of which proposals were invited by the ex position committee. The Austrians, how ever, even at that early date, began the system of extortion which they have car ried through the entire enterprise, and ar ranged a "corner" in wood, endeavoring by such means to force the Governmen to pay a most exorbitant price for the large amount required. The "ring operating the transaction were brough to sudden grief by the prompt alteration of the plans, and substitution of iron fo the lighter material Tenders were then


JOHN KASPAR HARKORT

Danube canal bridge, etc. The whole establishment is capa Danube canal bridge, etc. The whole establishment is capa building iron. The rotunda of the Exposition is the greatest work heretofore undertaken by Herr Harkort, and has added work heretofore undertaken by Herr Harkort
celebrity to his name and his establishment.
Regarding the completion of the great structure and its details, we have already given full particulars. We add the two portraits as a part of its written history, for, by the ge nius and enterprise of the men represented Vienna has been enriched with a building which, since it is destined to remain, will ever be regarded as a grand and wonderful achievement of modern engineering.

## the machine room of the great EXPOSITION.

The large engraving upon the 'opposite page, for which we are indebted to the page, for which we are indebted to the
Illustrirte Zeitung, of Leipsic, represents. a iew in the machinery view in the machinery department of the
Great Expossition. This building, it will be remembered, is 2,520 feet, or hal a mile, long, and the clatter of the num berless mechanisms, when all are in mo tion, is something astonishing. Arranged along.in the central part of this great hall are the various stalls or compartments in which the smaller or lighter machines ar run, steam power being conveyed to them from the main shaft by means of belts, as shown. Among these machines are those for weaving and spinning, also pin and needl machines.
The large machine seen at the extrem right of our picture is a double steam engin of a hundred horse power, made by Sigl, o Berlin. It is a beautiful specimen of work manship. A splendid dial indicator, which nows the number of strokes and revolution of the engine, is one of the notable at tractions of this machine. Next beyond the Sigl engine stands the preat sugar re finery apparatus made by Heckmann, of Bor lin. It is a resplendent object, shining like mirror, being made of polished copper and brass. Access to this apparatus is had by means of iron stairways, which lead up to platform that surrounds the machine. Here the stopcocks and siphons are arranged. From this platform, a very interesting and exten sive view of the machine department is ob tained, which the Zeitung characterizes as the submissive kingdom of Vulcan. Beyond tho

JOHN SCOTT RUSSELL sugar refining apparatus, we have German fire engines, tur bines, hydraulic apparatus, paper machinery. Then comes The sign Oesterreich at the left, signifies Austria. that nar the banners, Deutschues Reich signifies Germa Empire.

Octopus or Bevil Fish
For further elucidation of the habits and character of this marine monster, described by us on page 131 of our current volume, we ex ract the following from the pages of Laid and Water. to which it was fur nished by Mr. Henry Lee, of the Brighton aquarium, England:
"A crab was so fastened that the string could be withdrawn, and was lowere near to the great male octopus. He wa sleepy, and required a great deal of tempting, but the sicht of his favorit food overcame his laziness, and he lunged out an arm to seize the precious morsel It was withdrawn from his rearse It was withdrawn from his reach; and so at last, he turned out of bed, rushed a t, and got it under him against the plat glass, just as I desired. In a second the crab was completely pinioned. Not struggle was visible or possible: each leg, each claw, was grasped all over by suck ers-enfolded in them-stretched out to its full extent by them. The back o the carapace was covered all over with the tenacious vacuum disks, while the black tip of the hard, horny beak was seen for a single instant protruding from the circular orifice in the center of the radiation of the arms, and next. ha adunch through the and was crunched throgh deep in the flesh of the miserable vi tim.
The action of an octopus. when seizing its prey for its necessary food is very like that of a cat pouncing on a mouse, and holding it down beneath its paws. The movement is as sudden, the scuffle as brief, and the escape of the prisoner even less probable. The fate of the crab is not really more terrible than that of the mouse, or of a minnow swal lowed by a perch; but there is a repul siveness about the form, color and at titudes of the octopus which invests it with a kind of tragic horror.


T HE GREAT EXPOSITION-LETTER FROM UNITED STATE COMMISSIONER PROFESSOR R. H. THURSTON.

## NUMBER 8.

$\nabla_{\text {ienna, }}$ July, 1873.
Beside the steam engines exhibited in the Machinery an Agricultural Halls of the exhibition, there are a few othe " prime movers."

## aas engines.

The Lenoir gas engine is exhibited in the French section where it drives one of Gramme's magneto-electric machines, the recent invention of which has awakened so much inter est among electricians. The Lenoir engine has now been in use many years, and evidently finds many purchasers. It is an engine in which the gas is first introduced into the cylin
der, where it meets, and mingles with, the required amount of air, and, when the proper quantity has entered, the mixture is fired, impelling the piston by its expansion, which follows the explosion. As the piston must move a consider able distance before the full charge has entered the cylinder that portion of the stroke is made without doing work. The explosion of the gas also gives rise, momentarily, to an ex tremely high pressure, which rapidly diminishes as the pis ton moves forward, and as the products of explosion, steam carbonic acid, and nitrogen, condense and cool down. It fol lows, therefore, that the mean pressure obtained in the working cylnder is comparatively low, while the working parts of the machine must be built to withstand safely an extremely high pressure. The losses of pressure from con densation of steam and from the cooling of the gaseous pro ducts of combustion probably become much smaller at high than at low piston speeds, but are undoubtedly serious at al
ordinary velocities. ordinary velocities.
There are many places, however, in which the gas engine is to be preferred to its more economical but less suitable competitor, the steam engine; and with the generai introduction of illuminating gas in all cities, it has found quite a large market.
The consumption of gas given by these exhibitors for the best performance of their engines, I have been unable to learn, but early experiments made by that well known authority M. Tresca, of the Conservatoire des Arts et Métiers, who is here, by the way, as a member of the International Jury, Group XIII-indicated the consumption, in small machines, of over ninety cubic feet per horse power per hour. Later experiments upon the Hugon gas engine, and with larger sizes, have given something over seventy cubic feet per hour and per horse power. No Hugon engines are exhibited here. The principal difference between the two lies in the manner of igniting the charge, the one using the electric spark obtained from a small battery and the inductorium or Rhumkorff induction coil, while the other uses a gas jet, ingeniously filted to a little slide, which carries it into the cylinder to ignite the charge at the proper moment, and brings it out again to be relighted at a fixed jet after it has been extingrished by the explosion.
The only competitor of the Lenoir engine here is found in the German section. This is the gas engine of Otto and Langen. In this engine, the gas is fired explosively, as in the Lenoir, and the contrivance for igniting it is substantially that of Hugon; but the piston is not secured to a crank through the intervention of a connecting rod, as in ordinary engines, but rises freely under the impulsion of the exploding gases, and, when at its greatest hight, is caught and, falling slowly, its weight turns the shaft. It has the movement, in fact, of the Cornish engine,-the same rapid rise and the same slow descent of its piston, and is, of course, single acting. An engineer would hardly be likely to mills and ordinary machinery. Its inequality of movement, and its large bulk for comparatively small power, would be serious objections, even if the first were not fatal in all cases. Nevertheress, the builders of this gas engine exhibit an engine numbered one thousand, and claim to have manu factured considerably more than that number. Their suc cess in introducing what seems so extremely impracticable,
a method of obtaining, satisfactorily, a motive power from the combustion of gas, is probably due to the exceptional economy of gas consumption which they have attained. They claim to have obtained the dynamometrical horse power upon a consumption of but one cubic meter of gas-
less than forty cubic feet, or about one half less than forty cubic feet, or about one half that reported
for the older gas engines-per hour. On one occasion, the
trial of one of the larger sizes of this engine is reported to have given even a better result, bringing the figure down to about thirty-six cubic feet.
The source of this economy must be found, principally and possibly wholly, in the rapidity with which it makes its upward stroke. The gases have too little time to condense or to fall in temperature seriously. This economy is probaor to fall in temperature seriously. This economy is proba-
bly so marked an advantage as to secure the success of this engine, where competing with those previously invented, in engine, where competing with those previously invented, in
spite of the objections noticed. The first impression produced upon the mind of an experienced engineer by its noisy and irregular movement, and by the odor of gas which surrounds it, is, probatly, almost invariably quite unfavorable; but it is here doing its work well, apparently, and its economy seems well proven, not only by the certified tests, but by its success in the market.
It cannot be doubted, however, that there is still room for important improvements in this class of prime movers, and we may anticipate that they will be effected before the lapse of a great length of time.
The Brayton gas engine is entered upon the catalogue of the United States section, but it has not made its appearance yet. As the juries have now finished their work, this engine will probably not le examined by a body which has
among its members several of the most distinguished engiamong its members several of the most distinguished engi-
neers and mechanicians of Europe, or of the world. It is a neers and mechanician
great opportunity lost.

## the tilghman sand blast

is another American invention which has attracted the attention of all members of the International Jury, and which might, possibly, have secured even higher honor than that accorded it by the American Institute of New York in the presentation of the Grand Medal of Honor. It is not ready however, two months after the opening of the Welt-A $u$, stellung, and those jurors who, of all men, are best capable of appreciating the device, and of giving substantial aid to
the inventor, have been unable to witness its operation. It the inventor, have been unable to witness its operation. It will be considered a remarkably fortunate circumstance if it should be found that the jury have felt themselves justified in making any award at all, when able only to inspect the exhibited samples of work done by the sand blast.

THE JURY OF GROUP XIII (MACHINERY)
has, among its members, some famous men. The President, Ritter von Eugerth, is an Austrian engineer whose knight hood was conferred for distinguished services in connection with railroad work among the neighboring mountains. The elder of the two Vice Presidents is the venerable and distin guished Professor Karmorsh of Hanover, a pioneer in the reat work of introducing, and of rendering truly practical echnical schools of high character, and of systematizing he whole scheme of German technological instruction. Hi ork and his writings have made his name known to every ducated engineer throughout the world. Although seventy two years of age, the noble old man works with the jury
every day, examining every machine with an intelligent in terest, and inspecting the more valuable improvements with an enthusiasm which is quite in contrast with the indiffer ence which less well informed or less experienced member occasionally exhibit. The Professor often returns to his rooms, in the afternoon, with pockets filled with specimens of work done by the machines which have been examined during the day, or even with the shavings which have been thrown out by some tool distinguished by its good work. The regard and the respect which is evidently felt towar him by all his colleagues, without exception, proves that th good work of his lifetime is known and appreciated by al The second Vice President is Mr. Anderson, well known a the enginear who has under his charge all the British Arsen
al and other machinery, and one of the most experienced al and other machinery, and one of the most experienced
mechanical engineers living. His little work on "Strength mechanical engineers living. His little work on "Strength
of Materials" has made him known to many of our own meof Materials" has made him known to many of our own me
chanics, who have found in it-as did those student mechan ics to whom it was given, in England (as a course of lectures) -something which was precisely adapted to their desires and to their mathematical capacity.
Mr. C. W. Siemens, the engineer, metallurgist, and elec trician, who has accomplished so much in each of these de partments, is another member of the group. His regenera tive gas furnace, which is rapidly coming into use in the the age, ranking with that of the Bessemer steel process. He has a large and interesting collection of machines and models in the exhibition, which are placed "ausser Concurs" that he $m$ iy serve on the jury. In the list of his exhibits is an odd kind of steam engine, which should have been men tioned before. The drawing and the machine are equally difficult of interpretation without the assistance of some on familiar with them, although the device is by no means in tricate. The water seems to be driven upward in successive compartments fixed upon the face of a wheel, and by it simple weight to produce revolution. Mr. Siemens has been "decorated" by the sovereigns of Europe, and he has ac quired a more substantial reward for his labors in such an income as seldom rewards an inventor. His highest reward, however, is the enviable reputation which he sustains as practical engineer, and as a man of science.
Professor Reuleaux, the Director of the Gewerbe-Academie or engineering school, of Berlin, a distinguished educator and author, as well as engineer, Professor Hermann, of Aix La-Chapelle, a gentleman of similar position and standing,
M. Henri Schneider, of the great iron works of Creusot in M. Henri Schneider, of the great iron works of Creusot in
France, who has placed hors concours one of the most beautiful exhibits in the Ausstellung, M. Tresca, the learned and distinguished Director of the Conservatoire des Arts et Métier of Paris, and whose papers and experimental work are so
often found useful to the engineer, and numbers of othe hardly less distinguished men, are assigned to this group. It is by such juries that the awards are made. They will prob ably make some mistakes, but, on the whole, their decision will probably have much more weight with the world than those of juries in general at public industrial exhibitions.
Listening to the deliberations of a jury so constituted would undoubtedly be exceedingly interesting to the pullic were they permitted to be present. A proposition, made by a member or by the President, in the German language is of ten met by a rejoinder in French, the discussion is continued by a third member in English, and others join in with a pa tois of one or another of the three languages, in which in terest or excitement infuses strange accents of the native language of the speakers, who may be Russians, Swedes, Tarks, Greeks, or Spaniards, or even Cbinese or Japanese. The discussion also frequently brings out some of the great men present, in most interesting histories of invention or of inventors, or, frequently, in very abstruse discussions of general principles.
We spent an hour, yesterday, in examining the

## MAGNETO ELECTRIC MACHINE

of M. Gramme, already mentioned. Many machines of this class hate been devised, all of which produce an electric current by the motion of one or of many magnets before current by the motion of one or of many magnets before
a coiled wire conductor, or by the reverse arrangement of a coiled wire conductor, or by the reverse arrangement of
movingcoils and stationary magnets. The older machines movingcoils and stationary magnets. The older mache in efficiency of the large or numerous permanent magnets re quired, or the expense and trouble involved in their opera tion. Later, it was discovered that the electricity thus obtained might be employed to excite larger electro-magnets, from which a powerful current could be obtained by the use of a peculiar form of revolving armature invented by Mr. Siemens. Still later, it was found that no permanent magnets were necessary, buit that, the electro-magnets retaining a small quantity of magnetism at all times, the machine could be set in operation and brought up to full power by diverting a portion of 1 ts own current for the excitation of the magnet, while the remainder of the induced electricity was given a useful application. It is to this latter class of machines that this apparatus of M. Gramme belongs. . Its distinguishing peculiarity seems to be that there are several Siemens armatures, instead of but one, all arranged on a single. revolving shaft, and set like the revolving knives of an old fashioned hay cutter, or, as a better illustration, like the teeth of a very broad faced watchmaker's pinion, or a gear wheel of small diameter. They are quite closely set, but are thoroughly insulated from each other. The electro magnets are arranged in a usual form and possess no no ticeable peculiarity.
In this large machine, one horse power is said to develope current equal to that of sixty Bunsen standard elements, rd to be capakle of heating thirteen meters (over forty feet) of iron wire one millimeter in diameter (•004 inch) to a brigh red heat. It weighs six hundred kilogrammes ( 1320 lbs .) and costs about the same, for similar power of current, as the Ladd machine which was, some time ago, described in the Scientific American. Its great and exceedingly impor ant advantage is that its armature revolves but two hun dred and sixty times per minute, but a fraction of the spee of the Ladd or the Wilde, and can thus be worked indef nitely without trouble from heated bearings, and with less consumption of power.
R. H. T.

STEAM BOILERS AT THE GREAT EXPOSITIGN.--
LETTER FROM THE ENGINEER OF THE UNITED STATES DEPARTMENT.
The following letter from Mr. Pickering, engineer of the United States Department at the Vienna Exposition, gives interesting information concerning the steam generators and f the American exhibit in particular. The Pitkin boiler here alluded to, is horizontal, 54 inches in diameter, 16 feet long, with 59 tubes 3 inches in diameter and 15 feet long;

Vienna, July 23, 1873
Messrs. Pitkin Bros. \& Co.,
Gentlemen :-I don't know what you think of me for not writing you long before this time, but if you knew how busy I have been, and the extra work that has devolved on me on account of our commission troubles and changes, you would see how impossible it has been for me to pay prope attention even to those who, like yourself, have so kindly furnished some of the principal apparatus for our depart ment, and without which we should indeed be in a sad plight On arrival here, I found only the foundation for the boile house, and so was in time to see personally to all the boiler setting. The work of boiler setting progressed very slowly indeed, as did all the work connected with the Austrian Gen eral Commission. But with all our drawbacks and delays, we finally got the boiler set and fired up, not the last, as we expected to be, but some two or three days before the French Department; and when all ready for firing, came the boiler testing. Your boiler was subjected to the customary hydro static test, and it was declared by the officer in charge to be the only one of the entire collection at this exposition which stood the cold water test without leaking. And now the boiler has been in constant use nearly two and a half months, and has, to the surprise of every one (including myself), sup plied our department with all the steam we need, and that pith very easy firing and very poor coal. We are running
with with very easy firing and very poor coal. We are running
daily four steam engines: one 30 , two 8 and one 3 horse power: one 650 pounds steam hammer, one steam puddling ma chine engine of 5 horse power, three steam pumps, and live team when wanted for the sand blast exhibit of Tilghman, of Philadelphia. The main steam pipe, furnished by the

Austrian General Commission, is of very thin iron, 6 inches in diameter and 150 feet long. From this pipe all the steam is supplied, except to one 8 horse power engine, which receives its steam through 48 feet of $1 \frac{1}{2}$ inches pipe continued from the end of the 6 inch pipe, making total distance of this last engine from boiler 238 feet, as there are 40 feet of 3 inches pipe connecting boiler to the 6 inches main pipe. This steam piping is not covered, and consequently condenses much steam; so much, in fact, that it was necessary to place a steam trap about the middle of the length of this pipe, to relieve it of the water of condensation. The exhaust pipes of these engines and pumps are so far from the boiler that it was found impracticable to use the exhaust steam for heating the feed water; consequently we feed cold water. I am now, more than ever, impressed with the economy and safety of this style of boiler, and our present and previous commissions, as well as myself, desire to express our thanks for your liberality and promptness in furnishing, for use of the American Department of this Exposition, so good a boiler, and one which is so much in use in the United States.

Very truly yours,
T. R. Pickering,

Engineer U. S. Department, Vienna Exposition.

## Curregpondemte.

Caloric Engine Valves.
To the Editor of the Scientific American:
Those engaged in improving the caloric engine may find the following design worthy of trial. If so, they will con fer a favor by giving the results in the Scientific American.
The device consists of a plain rectangular valve seat, A, having several narrow ports, $a$, opening into one passage way, and key ways, 1 and 2, cut one across each end ; a segment, B, operated.by a shaft, E , extending outside the machine through a stuffing box (not shown); a sheet metal flap valve, $C$, fastened at one end to segment by a key, 4 , the other to the valve seat by a key, 2, and a draw strap, D, put on just the reverse of $C$, fastened by keys, 1 and 3 .


When the shaft rotates with the arrow, Fig. 2, the seg ment moves to the leit, shutting the valve. When it rotates in a direction opposite to the arrow, it moves to the right, opening the valve. In both figures it is shown open. The dotted line, Fig. 2, indicates its position when shut. The shaft is placed near the outside of the segment to reduce its lateral motion to a minimum. The construction being understood, its operation will be apparent without further explanation. Probably the best material for C and D will be soft, thin, sheet steel, and the best results will probably be obiained at a comparatively high temperature perhaps a dull red heat, steel then being very tough. In adapting this valve to an engine, accessibility shouid be studied; for, if accessible, a frequent renewal of $C$ and $D$ when necessary, is inexpensive.
F. H. R.

New Britain. Conn.

## The Hot Air Engine.

To the Editor of the Scientific American:
The criticisms of your correspondent H. S. W. (on page 101 of your current volume), of my modifications of the air engine, are quite proper in view of the partial illustration upon which they were based.
If H. S. W. is a thorough practical machinist, I think that a little patient thought will reveal to him a happy expedient for each of the defects he has named. For instance, he fears that the machine will be top heavy. A machine with an eight inch crank need be but about six feet high to the shaft; then there certainly can be no form so simple and appropriate for a firm base for such an en gine as that of a short cylinder with a massive flange at its
base; the cylinder may be of any desired diameter and base; the cylinder may be of any desired diameter and
weight, the supply pump being placed centrally within this weight, the supply pump being placed centrally within this
in the form of a lining; then four heavy standards or brackets, firmly fixed to the top of this base casting, will form an ample support for the hot air cylinder, in connection with the support afforded by the central supply pipe. As to the matter of getting at the pistons for repacking, the removal of the lower end of the connecting rods from the ends of cross arm (J) will let the pistons out at the bottom of the cylinders; and what can be more handy? The oilers
would be so suspe nded as to be instantly movable to one side.

As to the ash difficulty, whatever ash arises sufficiently to reach the top of the fire box must be extremely fine and open, will be taken off through those' appropriate channels By means of a conduit from the bottom of the ash pan outward and downward to the outside of the hot air chamber, the ashes, etc., may be removed very handily.
As to firing up, a stooping posture is the most tiresome and awkward one for a workman to be placed in; it is far preferable to step up two or three easy steps and then stand upright while putting in the coal.
As to the arrangement of the exhaust valve, this may be placed above and out of any danger from heat, as well as at the side of the engine.
As to supplying coal while the engine is working, this is easily done by means of a receptacle, or hopper, with an in ner and an outer door, each airtight. I have two methods of working these doors; there is probably no better mode of working the outer lid or door than the one now in use on the Roper engine ; and my plans for working the inner door are nearly as simple, and quite as perfect.
I have great confidence in what is termed the " base burn ing" plan, as exemplified in the Littlefield and some other stoves, especially for the small engines; could this plan be applied to hot air engines, sufficient coal could be put in at once for a day's work, and, of course, only an outer doo to the hopper would be needed.
F. G. Woodward.

## The Nebular rheory and Kepler's 1

## To the Editor of the Scientific American:

On page 196 of your last volume I attempted to dipaw atten tion to, and to promote inquiry as to whether there exist any relation between, the nebular theory and Kepler's laws. I will continue the subject by remarking that a close examination of the inclinations and eccentricities of the orbits of all the planets (including the so-called asteroids, which are really planets), together with the consideration of the active and powerful eruptive forces now known to exist in the sun, strengthens our belief that these laws, as set forth by Kepler, are the result of the development of our present solar system from a single and greatly attenuated mass, as
has b $e$ en supposed by La Place and other eminent astronhas bue
omers.
Let us examine some of the data on which such belief is based. Beginning at the outer bounds of our system and approaching toward the center, we recognize Neptune, Uranus, Saturn and Jupiter, all large planets, and all having orbits of small inclination and small eccentricity. Just as might be expected, when we consider their great mass and admit the radial force to be small.
Proceeding further towand the center, we find a large group of small planets, more than 130 in number, revolving between the orbits of Jupiter and Mars, in a space where it would appear to be about the place for the throwing-off of another planet. But just at this point a change, perhips small, seems to have taken place in the eruptive force, seeming to indicate an increase of energy in that force. There here seems to be a throwing-off of smaller masses, at much more frequent intervals and generally with increased radia velocity. And it would also seem as if the equatorial motion of the mass did not so much affect the plane of the pro jection, as in the case of the larger planets.
From the consideration of the above facts, it would appear as if the eccentricities of the planetary orbits were due to the action of the radial or central force; while the inclinations are due to the exertion of that force in a direction forming an angle with the equatorial plane of the revolving solar mass. We may notice also, in passing, that these radial eruptions would not affect the harmony of the orbital motion of these small planets, as the planet-exploding theory would ndicate.
Still proceeding towards the center, we may now assume hat the eruptive force again became comparatively quiet nd the detachment of the masses took place more regularly that the births of Mars, the Earth, Venus and Mercury took place under conditions similar to those of the earlier
and larger planets. Evidence planets.
Evidence in favor of the nebular hypothesis is continually accumulating. That afforded by the spectroscope demonstrates that the planets are composed of the same elements as the sun; while the elements in some of the stars are dif ferent. This evidence is among the latest, and is probably the most conclusive. Admitting the nebular theory to be They are what wor a process of evolution as set forth in that theory.
It is extremely interesting to contemplate the possibility of such changes in the solar system and the evolution of so many beautiful worlde from apparent chaos.
Tamaroa, 111.
E. H. Price, M. D.

Ignition from Steam Pipes.
the Editor of the Scientific American:
The Fire Marshal reports 31 fires for the month ending August 16. Among the causes is " heat from steam pipes setting fire to scraps in drying box 1 ." How do you account for this ignition? It is not probable that any oil was present in a drying box.
New York city. Norman Wiard.
Remaris by the Editor.-Our correspondent has omitted to mention the nature of the establishment, the scraps or the drying box, in which the alleged ignition took place. These particulars are necessary in order to reach a satisfac tory conclusion. We have published examples of ignition used and no oil assisted the combustion.

## To the Editor of the Scientific American

I have read with interest many articles in your journal in regard to the big telescope; but it strikes me there has not been proposed as yet a really efficient and practical instrument, that is, as to form and dimensions.
Why not construct, on a large scale, one of those fine, silvered glass reflecting telescopes, now becoming so popula in England, which, in the hands of both amateurs and ex perts, are so successfully aiding the science of astronomy It is possible to construct such a glass of ten or twelve feet diameter, at but little, if any, more than half the price of such'a glass as described and illustrated in your issue of August 16, by F. H. $\cdot$ R.; while the light-gathering capacity and penetration of the former would be far superior to the latter. Besides, the length of this enormous instrument need not be greater than the five foot glass of the correspondent just mentioned; and its mounting would be as easily ac complished and at as little expense.
The glass, as proposed by your correspondent F. H. R. would be impracticable, though not at all liable to the ob jection he anticipates in regard to the division marks of the field of view by dark bands. But it would fail because sufficient number of piecês of glass, of absolutely the sam density and homogeneity, would be difficult to obtain, and on account of the extreme liability to unequal expansion of the glass, cement, and iron, which are parts of the lons. The latter would render it almost, if not quite, impossible to secure for it good definition, without which such an instru ment would be almost worthless. Opticians and glass man ufacturers know that the present state of the art of glassmaking does not enable them to obtain single disks out of which good refracting lenses can be constructed larger than of 28 or 30 inches diameter; so an excellent instrument of that kind, known as the achromatic, cannot go beyond that limit. But for a silvered glass or reflecting telescope; plate glass of good quality can be manufactured of 10,12 , and ven 15 feet diameter. And it is but reasonable to presume that an application of some of the extremely fine and deli cate methods of producing surfaces on similar smaller instru ments, as practised by some of the English and American opticians, would not fail to secure an exquisite figure and surface on even as large a glass as here contemplated. So large an instrument would, of course, be better adapted to the discovery of the physical constitution of the celestia bodies, by means of its wonderful power to penetrate the unfathomable space, rather than to serve the more exac purposes of mathematical astronomy, this latter being with in the province of, and almost altogether performed at pre sent with, small instruments especially constructed and ar ranged for that purpose. I shall heartily approve the big telescope enterprise if it be put on some sound and practical basis.

Springfield, 0
F. M. B.

## To the Editor of the Scientific American

The existence of an upper southwest current in the tmosphere of the northern hemisphere has been maintained by meteorologists for many years. Espy, Redfield, Maury Butler, and hosts of other scientists, have expressed thei conviction that there is a current of heated air at the equa tor, which rises there and blows off in the upper regions of the atmosphere towards either pole. These currents proceed from a part of the earth where they are moving rapidly with the earth's motion, to a point where the motion is slower. Their momentum being retained, they assume an easterly course; and in the temperate zone, they would range, more and more, to the east and north, the farther they go northward. For the same reason, the wind blowing from the north pole towards the equator acquires an easterly direction, and seems to come from the northeast. Our sur face northeast wind is cold, dry, and heavy. It makes th barometer rise because it is heavier. It chills us with cold from the snow. Its moisture has been frozen out of it. The southwest upper current is warm, moist, and light, and al its effects are the reverse of those of the northeast wind.
The evidence and reasoning satisfy me that there is a southwest upper current. The movements of the cloud show at all times three or four currents; they move in strata, often directly opposed to each other, one above going westward and one below going eastward.
It is manifest that a balloonist can move in a given direction by keeping his balloon in the current, and in that way only To keep in the current, the balloonist must be able to rise or descend at will. This power Professor Wise has not He can go up as high as he wants, and he can come down But having gone up and come down, he cannot go up again This is the trouble in balloon traveling. It is singular that no effort has been made to remedy, this difficulty, except ${ }^{\text {b }}$ by means of ballast and valve ropes. There are several way in which it might be done.
Instead of ballast, sand bags, etc., let the aeronaut take strong vessels, like soda fountain chargers, filled with condensed hydrogen, and an air pump for condensing. If the voir. If balloon has leaked, supply the loss from the reser the air pump, and store it for future use. He can thus be enabled to go up and down several times, and be able to select a particular current on which to sail. With this power at command, there may be some chance for success. He may move up and down till he strikes the right current and may be able to keep in it ill he can reach his destin
Yonkers, N. Y.

## THE IRONCLAD HULLING STONE

The hulling machine, to which the improved stone herewith illustrated is designed to be applied, is composed of a revolving stone contained in a fixed perforated case. The former is dressed on its edges and has grooves in its bottom in order to excite a blast, so as to spread the grain between stone and case and retard its descent to the bed plate. The improvement in the present invention consists in lining the vertical edges of the grooves with metallic plates, in order to prevent the stone, which is generally of soft nature, from being worn away at such edges thro grain getting between the same and the bot tom plate. In Fig. 1, showing the stone cast iron, fitted and secured into a recess in the center, as shown. The spaces between the edge of this flange and the stone are filled with lead or brimstone. Through the filled with lead or brimstone. Through the center opening passes the spindle; on a shoulder upon which the flange rests and is secured by keys. Air is drawn in under the stone through a large aperture cut through the bed plate and platform in the center. The grooves taper in depth from the edge inward, and their vertical sides operate as a fan blower, forcing a strong blast of air toward the circumference, driving the grain the full hight of the periphery of the stone. Slides are arranged under the air orifice to regulate the draft. It is claimed that a four foot stone, fed by charges and revolving at two hundred and fifty revolutions per minute, will drive every kernel out through the ute, will drive every kernel out
discharge slide within three seconds.
The principal advantage claimed for the metal bars or facings, B, consists in the fact that the distance between stone and case need not be over one quarter of an inch. The blast has always to break at a very short angle after enter ing, so that, no matter how strong it maybe,it cannot prevent scattered grain from getting under and wearing away the groove edges. To avoid this difficulty, similar machines are ordinarily made with a clearance of three quarters of an inch or an inch. This, according to the inventor of the present device, renders them incompetent to hull dried oats or tender grain without great. waste, because the material is not spread evenly, and is caused to lie between stone and case in buik. The edges, being guarded as above described, are, in the invention under consideration, not liable to such wear; and hence all grain, it is stated is evenly distributed and hulled
The bars B, are secured by eyebolts C, Figs. 2 and 3, hooked over a recessed portion of the former and then passed through suitable holes and secured by a nut and washer on top of the stone. The bars can thus be readily detached and shortened as the diameter of the stone diminishes by dressing. Patented June 10, 1873. For further particulars address the inventor, Mr. A. Bertelson, West Salem, La Crosse county, Wis.

## IMPROVED WINDOW WEATHER STRIP.

This invention is a combination of both sash holder and weather strip. It serves, therefore, not only to caulk the

edges of windows, preventing the entrance of cold air or dust, but also as a convenient attachment for sashes unproided with cords and pulleys.
Fig. 1 depists the device in position, part of the window casing being broken away to show the india rubber packing. Fig. 2 is a horizontal section of the sash and surroundings, in which A represents one of the vertical battens or guide strips. These are right angled in section, one part fitting in a vertical groove, and the other portion against the inner side of the casing. In each, and on the side facing the sash, is formed a recess corresponding in depth to the thickness of the rubber strip, B. The latter is fastened in an oblique ex-

ension of this recess, by glue, nails, or other suitable means The front end of the strip projects at an angle above th batten, and is pressed back into the straight portion of th eesess, when the sash moves over it. - It therefore acts as pring, holding the sash in any position, allowing the same to be easily and noiselessly opened or closed, while it effec ually packs the interstices between sash and frame.
The advantages of the invention are its simplicity an the fact that it is a substitute for both detachable weather

BER TELSON'S IRONCLAD HULLING STONE.
The patent, obtained through the Scientific American Pa tent Agency; July 8, 1873, is, we understand, for sale, and the model will be exhibited at the coming Fair of the Amer ican Institute in this city. From the inventor, Mr. Giles P Potter, Coventry, Kent county, R. I., further particulars may be obtained.

## IMP OVED FRICTION ATTACHMENT.

The accompanying illustrations represent a new mode of securing pulleys, couplings, etc., to shafts.


Apart from the practical utiiity of this invention, it is claimed to possess the merits of economy and simplicity of construction, which render it much cheaper than any other

fastening now in use for the same purpose. If the castings are turned out properly (which requires no particular skill in molding, and but very little additional labor), no further Fig. 4

work is necessary, as the device merely consists in a pin, cast in the lug, upon which is placed a small cam, which works in a space provided for the same.

Fig. 1 represents a pulley with a fastening of this kind Figs. 2 and 3 represent sectional views of the hub of the ame, through the cam, A, showing the action of the latte upon the shaft. The cam or cams on the pulley or coupling being turned, create the friction or grir, by which the pul ley or coupling is held, and which increases in proportion to the amount of force exerted; consequently the pulleys, etc. are held firmly upon the shafts. When pulleys are required to work in opposite directions (which is not often the case), reverse cams will be used.
This device, applied to shaft couplings, it is claimed, will effect even a greater saving than when ap plied to pulleys, as the couplings will be in one piece, doing away with the labor of fa cing, the expense of bolts, etc.; and as th flanges will be dispensed with, less weigh of metal will be used. Still further, if pro perly cored, the boring also may be saved.
This invention, we are informed, possesse not only the quality of self-tightening (which in itself, is an important consideration, es pecially where access to the means of fasten ing is difficult), but it can also be easily loosened when it is desired to remove a pul ley to another part of theshaft ; it is claimed therefore, that a great deal of labor, whic usually attends such operations, is dis pensed with. It is further claimed that it does not prove injurious to shafts, as is the case with set screws, especially on their giv ing out, an annoyance which is too often experienced by those who use them in case where much power is required to be trans mitted. This quality particularly adapts it application to pulleys on cold rolled shafts as in such cases, key seats, etc., are objec tionable, as breaking the surface causes them to warp. Fig. 4 shows the invention as ap plied to a shaft coupling, two mortices being made, on eithe side of the center.
We are informed that actual trials, by a brake on the sur face of a pulley provided with the device, failed to loosen the latter, and caused a scarcely perceptible indentation on the shaft. The invention is in successful operation in va rious localities in Canada
For information regarding sale of shop rights, etc., ad dress the patentee, Mr. Henry W. Cox, Peterborough, Pe terborough county, Ontario. Patented through the Scien tific American Patent Agency, June 10, 1873.

## IMPROVED WRENCH.

Any one who has ever removed the wheels of a carriage to oil it, will at once appreciate the improvement which the annexed engraving illustrates. An ordinary wagon or car riage wrench is cast with a slot in one side of the square in which a small elastic rubber roller, $A$, is hung, extending into the open space far enough to pinch the nut so that it will remain firmly fixed in the wrench when it is removed from the axle. There is also a handle, B, Fig. 2, projecting from the shank a short distance from the box and at righ angles with it, by which the nut, when loosened, is rapidly turned off with a crank movement. The handle also serves to steady the wrench, keeping it from slipping from the nut while being loosened, when, as is frequently the case, it has become very tightly screwed on. This improvement sup plies a cheap and doubtless, efficient wrench which it i plies a claimed, renders the usually tedious and dirty operation of oiling or g of no rapping of the knuckles, no dropping of the nut and fina
replacing with the fingers, which so exhaust the patience replacing with the fin
and ruffle the temper.

Fiq. 1
Fig. 2


For further information address the manufacturer, N. L. Post, P. O. Box 52,. East Cleveland, Ohio, by whom it was patented February 11, 1873

AT the Patent Office, Washington, every examiner is now favored with the help of a lady clerk, who takes charge of the official correspondence and looks after the odds and ends of the examiner's business. There is one exception, however. The examiner of medical inventions is debarred from feminine assistance, and is compelled to keep a clerk of the masculine gender.

KANSAS CITY, MO., AND ITS COMING EXPOSITION. lar establishments are well represented, it seems that there particularly as they incur little or no expense in forwarding
There are probably few localities which more substantially typify the rapid growth, both in population and material prosperity of Wiar Wa Mo. In the year 1855, its inhabitants numbered but 600 , Mo. In the year 1855, its inhabitants numbered but 600 ,
and this figure, up to the taking of the census in 1860, had and this figure, 4,318 . In the ensuing ten years, the lat tor total augmented over six hundred per cent; while at the present time it is estimated that the population ag population aggregates ove
40,000 souls. , 000 souls. Situated in Jackson coun ty, on the right bank of the Missouri river, Kansas City forms the terminus of nine distinct railways; in addition to which, there are three lines entering on the tracks on others, and of ourners, and in progress of in progress of construction The.completed routes are the Missouri Paci fic, the $S t$ Louis, Kansas City, and Northern, the Hannibal and

MAIN BUILDING OF THE KANSAS CITY, MO., EXPOSITION.


Valley, the Kend Galveston, the Kansas City and Santa Fé, and the Kansas City, Fort Scott, and Gulf. Those upon the tracks of others are the Toledo, Wabash, and Western, the St. Louis, Alton, and Chicago, and the Kansas City and Louisiana. The new lines are the Kansas City, Memphis, and Mobile, the Kansas City and Keokuk, the Kansas City, Wyandotte, and Northwestern, and the Kansas City branch of the Atchison, Topeka, and Santa Fé. A fine railroad and wagon bridge, built at a cost of $\$ 1,000,000$, and the first ever constructed across the Missouri, spans the river and supplies another means of access to the city.
It may readily be imagined that so many concentrating lines of railway-a noticeable fact in connection with which is that not one was in operation at Kansas City before the spring of $1865,-$ attracted as they were to this locality as a point of reshipment and a market for the rich mineral and agricultural resources of the surrounding country, have been largely contributive to its prosperity. This result has been rendered still more beneficial from the fact that a compotition has been engendered between the railways and thetion boats, a circumstance which has led to the cheapening of freights to a degree below those to any other point West, and hence has given to the trades and manufactures of the city a vigor and strength rarely found in new established towns.

As regards the industries of the place, among the most im portant is that of packing cattle and hogs, twice as much live stock, it is said, being there slaughtered as in any other city of the Union. In 1872, 187,221 hogs were packed; and we understand that the business, owing to increased facilities, has been carried on during the present year on a largely in creased scale.
Although founderies, mills, furniture factories, and simi-

The Projected Indo-Russian Railway
The new railroad projected by M. Ferdinand de Lesseps is abundant room for many others. Starch works and dis- their goods to a locality which will doubtless prove an exceltilleries are needed to manufacture the surplus corn. Tanneries, glue, and comb factories are also and even more urgently required; for although Kansas City exports hides, horns, hoofs, and bones, the finished staples of sole leather, is to extend from Orenbourg, Rus sia, on the line of separation between Europe and Asia, and Peshawur on the confines of Af ghanistan, thus forming a direc route, connect ing the center o Asia with the northeastof Europe. Oren bourgis now the terminus of the system of Rus sian railways while Peshawu is the starting point of the An glo-Indian lines The distance be tween the river Ural, on which the first of these towns is situa ted, and the Pass of Khyber, nea the second, mea sures about two thousand thre hundred miles The junction o the Anglo-In dian and Rus sian lines will be at Samar cand, in Bokha lue, bone buttons, etc., are imported in great profusion. ra. When this great road is completed, there will be seven

Smelting works and white lead mills will also find an abundant field for operation. There is a plentiful supply of coal and from the proximity of the town to the mines of Colora do and Utah, and the minerals of the Ozark range, there seems no reason why a large share of the business of smelt ing, which now, at enormous expense, finds its way across the continent, and even to Swansea, to Wales, should not be done here. In fact, there is every pre-requisite at hand for a great manufacturing city and a market of almost unlimited extent.
In order to stimulate local energy and, at the same time to draw the attention of the rest of the country to the rich resources in the neighborhood, the citizens of Kansas City have, for three years past, held an Annual Exposition and gricultural Fair, which has been the means of attracting arge numbers, both of spectators and exhibitors of stock, gricultural machinery, products, etc., from all parts of the United States. A fourth exhibition will take place during he coming fall, and the managers, we understand, have se ured liberal arrangements for transportation of freight to and from the Fair. They offer to handle and display, free f charge, all articles consigned to them, and will repack and return the same to such owners as may be unable to at end in person.
We give herewith an engraving of one of the ample build ings, in the number of which are included power, fine art and agricultural halls. The grounds comprise $97 \frac{3}{4}$ acres, laid out with groves, race tracks, and every attraction and convenience. By addressing Mr. D. L. Hall, the secretary of the expostion, at Kansas City, premium lists and more de tailed particulars may be obtained.
It seems to us that this Fair is well worthy of the atten ion of manufacturers and others, who propose to contribute this year to the various expositions throughout the country
thousand five hundred miles of continuous rail between Ca lais, France, and Calcutta, making the time required to reach the latter city, from New York, about twenty days.

## COUNTERBALANCED LIFTING BRIDGE.

This invention, patented by Mr. Walter Browne, C. E., and described in the Engineer, relates to the class of bridges which are opened by being lifted into an erect position, after the manner of the ancient drawbridges. In order to facili tate the operation of lifting, it is usual to make the jib end and heel end of the bridge balance each other round the shaft or axle. It is in the arrangement of this counterbal ancing that the present invention consists. The counter weight in this case is not attached to the bridge so as to form part of it, but is contained in a separate pit or chamber placed some distance behind the heel of the bridge. This counterweight may consist of a cast iron box filled with sand water, or other convenient material. To each end of this box a chain is attached which passes over a pulley at the top of the pit or chamber, and is thence led to the point of at tachment to the bridge. This point of attachment should be over the axle of the bridge and at a considerable hight above it, so as to give a suitable leverage to the pull of the chain This hight may be obtained by placing the axle below th bottom of the bridge girders, and by using a bracket or standard bolted to the top of the outside girder, to which the chain may ioe attached. It will then be seen that, sup posing the moment round the axle of the weight of the bridge to be equal to that of the pull of the chain when the bridge is down, then, as soon as the bridge is raised, the moment of the pull, acting at a longer arm, will be greate than that of the weight, and will therefore continue the motion of itself. The point of attachment should be so ar ranged that, when the center of gravity of the bridge is ver-

tically over the axle, the line of the chain produced may also pass through the axle or nearly so, so that the two moments may be zero about the same tin:e. From this point the moment of the chain, still acting in a contrary direction to that of the weight of the bridge, will tend to stop the bridge, or to destroy the motion previously given; and as it will again have a preponderance over the moment of the weight, the bridge may be brought to rest in its proper position when fully open. In closing the bridge the same effects will be produced, the counterweight accelerating the motion of the bridge in the first half of its travel and retarding it in the second, so that it may be brought to rest in its origi nal position.
In order to obtain some data for comparison, the bridge has been taken for which the invention was originally de signed, namely, a two leaf bridge, 28 feet wide out to out spanning a 40 feet opening. An estimate has been made o the cost of this bridge on the counterbalanced system, as compared with that of the other types of bridge which might be employed, with the following results: The coun terbalanced bridge costs 15 per cent less than an ordinary lifting bridge or a rolling bridge, and 34 per cent less than a swivel bridge; there would also be considerable economy in working, and the new device would, by its construction be less affected by the wind, when elevated, than the lifting bridge.

## Injuries of the Ear.

"Among the causes of injury to the ear must unfortu nately be reckoned bathing. Not that this most importan and healthful pleasure need, therefore, be in the least discouraged; but it should be wisely regclated. Staying too long in the water certainly tends to produce deafness as well as other evils; and it is a practice against which young per sons of both sexes should be carefully on their guard. But independently of this, swimming and floating are attended with a certain danger from the difficulty of preventing the entrance of water into the ear in those positions. Now, no cold fluid should ever enter the ear; cold water is always more or less irritating, and, if used for syringing, rapidly produces extreme giddiness. In the case of warm water, its entrance into the ear is less objectionable, but even this is not free from disadvantage. Often the water lodges in the ears and produces an uncomfortable sensation till it is re moved; this should always be taken as a sign of danger. That the risk to hearing from unwise bathing is not a fancy is proved by the fact, well known to lovers of dogs, that those animals, if in the habit of jumping or being thrown into the water, so that their heads are covered, frequently become deaf. A knowledge of the danger is a sufficient guard. To be safe it is only necessary to keep the water
from entering the ear. If this cannot be accomplished otherwise, the head may be covered. It should be added, however, that wet hair, whether from bathing or washing, may be a cause of deafness, if it be suffered to dry of itself. Whenever wetted, the hair should be wiped till it is fairly dry. Nor ought the practice of moistening the hair with water, to make it leave wet hair about the ears is to run great risk of injuring
them. In the washing of children, too, care should be taken them. In the washing of children, too, care should be taken
that all the little folds of the outer ear are carefully and gently dried with a soft towel.'
A correspondent sends us the foregoing, clipped from a newspaper, and asks our opinion thereon. He adds: "I am partially deaf (doctors say from cold), and I was told that bathing my ears in cold water was good, being a sort of a stimulant. I can hear very well in a machine shop, or traveling on the cars, the jarring noise causing the drum of the ear to vibrate and allowing sound to enter."
Remaris by the Editor:-The statements contained in the above paragraph are quite correct; and, it might be added, of practical value. The ear is quite as liable to injury from drafts of air as from cold water. The modern style of cutting the hair in men, and of arranging the hair of women, is much to be deprecated; because it was intended by Nature that the hair should fall over the ear, and form thus a protection to it. But as we cannot throw down so great a goddess as fashion, we must use care and artificial means for the preservation of this delicate organ.
If sitting in a draft is unavoidable, the handkerchief should be applied to the ear exposed, or a pledget of cotton inserted within it. The ordinary manner of washing the face does no harm to the ear, because the canal leading to the drum of the ear is partially occluded by wax, and water does not penetrate far; but all swabbing of the ear, whether with dry cloth or lint moistened with hot or cold water or other fluid, is by no means to be advised, as it re
wax, the necerral ea
Our correspondent is suffering probably from a thickening of the epiderm's of the tympanum, caused by chronic in flammation, set up, perhaps, by cold, but it may be by other irritation. He should place himself under the care of some competent aurist, and not attempt to doctor himself.

## The Nature of Infection.

Investigations, says Dr. J. J. Brown, result in establishing these facts: There are low forms of life, some of which can and some of which cannot be seen with the microscope. More than thirty varieties of these infest the human system. They permeate the fluids and solids of the body. They are known to be the cause of some diseases, which makes it pos sible that they are the cause of others. The cause of infectious diseases is obscure. Probably they are caused by species of parasites. This supposition matures into an established fact when supported by the following truths: Under the microscrope of Chaveau, the active principle of
infection is a solid granule. Such remedies as are most estructive of parasites are most efficacious in communicable diseases. The cause dies ; only living things are subject to
death. Lostorfer shows them or their germs actually to exist in the circulating blood

## New Optical Instrument to Exhibit the Mechanical Combination of Colors.

Frederick J. Smith has designed the following instrumen hich he describes in a recent number of Nature
To the center of a
disk, A, which can be caused to revolve by the wheel, G, a plain mirror, B , is fixed at angle of $45^{\circ}$ the surface of the isk. In front of prism, is placed prism, D. At the here are placed different slides, E, for cutting off any par cutting off any par-
ticular rays; also, ticular rays; also,
above the mirror, is small slit cut in a piece of brass, C , to admit the ray under examination.
$x x$ is a ray of light which, passing through the slit, C, is deflected at right angles by the mirror, B , through the prism, $D$, and is
then received in the then received in the form of a spectrum
upon the screen, $S$
 S. As soon as the wheel, G, is set in motion, the spectrum also moves round the conical screen, S S ; and when a certain velocity is arrived at, the colors combine and form the original colored light which is entering at the slit, C. In the same way, by using the slides, $\varepsilon$ ny two or more colors may be combined to form the resultant color.

## A Good Journal Box

A correspondent, Mr. C. W. Crawford, of Brazil, Ind. makes the following suggestion for a journal box, and hopes the mechanical profession will avail themselves of it


He claims the advan tages of simplicity of construction and, conse quently, cheapness. The side brasses are of such shape as to always take
up the wear both horiup the wear both hori-
screwing down the cap, zontally and vertically, by simply screwing down the cap, without the use of liners, wedges, set screws, etc. The journal, being held at three points nearly equidistaint, en may be fitted with bottom brass or lined with Babbitt metal according to circumstances. Mr. Crawford states that thi is the best main journal box now in use for steam engines.

## IMPROVED TESTING MACHINE.

Among modern refinements in the art of construction must be placed in the foremost rank the experimental determination of the cohesive strength of materials under s.rain. The nice adjustment of dimensions and construc tive parts is a corollary of such a knowledge of the ultimate strength of bodies, involving economy of material and


The bearing thereof upon the stability of structures s of essential import; and as a fortress is no stronger than its weakest point, so, whatever be the powers of resistance the constituent elementary parts of any structure, such
union, or vehicle, as painters might call it, should beat least f equivalent strength
Usually, however, the absolute and relative strengths of the cement or mortar, that converts the separate elements into the combined whole, are very much matter of chance and guesswork; hence results a waste of power or an increase of risk. As a factor in construction, however, the strength of cements and mortars has come to be regarded as a fit subject for actual determination, and the machine illustrated in the accompanying engravings aims at placing the means of test in every one's reach. It is the patent of Messrs. Michele and Carrington.
Sample blocks, grooved as shown, are formed from the cementitious material required to be tested, and allowed to set and become dry. After a sufficient interval they are placed in the corresponding and suitably formed jaws of th testing machine, the lower jaw being pivoted to one angle of a toothed quadiant, movable by worm and hand wheel, and pivoted on bearings in a pair of parallel standards. The upper jaw is similarly affixed to the short bent arm of a lever, with fulcrum pin carried in the same standards, and of which the long straight arm carries a heavy counter balance weight; the weighted arm works against a fixed graduated arc carried by the standards, which rest on a be plate. The jaws are also connected and united by bolts and nuts, which are not screwed home, so that a little play is a lowed for the fracture of the cement block to the extent of one sixteenth of an inch or so. Attached to the weighted arm is also an index pointer, capable of being raised, but not depressed, with it
The action of the whole apparatus, for the illustration of which we are indebted to Iron, is very simple and effective the cement block or other material to be tested being placed within the jaws, the hand wheel is turned, which, operating by the toothed quadrant, draws down the block, jaws, and short lever arm, causing the weight to move outwards and upwards, thereby exerting an ever increasing strain upon the block of material undergoing test, and of which the resis tance must eventually be overcome, resulting in fracture whereon the weight, being released, drops back until caught and retained by the bolts and nuts uniting the jaws; but leaving the pointer to indicate the breaking strain upon the graduated arc. The peculiar feature of this apparatus is the gradual application of, and increment in, the strain ap plied, avoiding all jerk or uneven strain, which might exag gerate the breaking effort and yield untrustworthy results

## The Average Migratory Mechanic

"Forfex" sends us the following portrait, evidently taken from life :
The average migratory mechanic, with great self-abase ment, applies to the master mechanic of the shop for work This gentleman, though regarding him distrustfully on general grounds, from press of work in the shop violate his better judgment, employs him conditionally, and sub mits him to the foreman, who conducts him to his station New man scrapes acquaintance with nearest workman by remarking casually: "Work must be looking up in this es tablishment," and adds ostentatiously: "The old man sent for me to New York, and would not take no for an answer so to quiet him, concluded to stay till he can get another man in my place. Vessel's on dry dock any way for two months. 'What vessel?' Why, Blue Warrior ; chief engi neer. Run Uncle Sam's blockade in her during the war; and, winking confidentially to listener, who begins to feel an interest in him, signifying thereby his desire for secrecy on that point, continues: "Two thousand dollars prize money home. Ain't got a spare pair of overalls till trunk comes from city? Thank you. Do's much for you some time. Ever been in Halifax? I built nine locomotives for railroad there Had ninety men. Ever go there I'll give you a line to boss of whole concern. It 'll get you a job on sight. Pretty good lathe this. Always did like to run a double ender. Man ain't liable to get dozy. Lost eight hundred dollars once on contract for building tools for navy yard. Woman, you know! Went to sea. Think I'll recover it, though. Ap plied to old man there. Says show's good. Know in four weeks. Write to him to-night. Tell him to send letters to this place for next two months. Ain't got four dollars in your clothes? Expect package of tools by express, and mate of the vessel's going to send lot of the best tobacco. Smug gled. Thank you. Bet you'll lose nothing by this. You'r like Sam Cunard. Bully fellow. Father's rich. Seconded me once at a little mill. 'Police always around when they're no wanted. Got any tobacco till mine comes? Solace or Cen tury? Both good. When I was in Cuba," etc., etc. New man ingratiates himself into the confidence of all he can borrowing as much as possible from his too credulous shop mates, talking away his employer's time, and sequestering his carelessly done work: until at the expiration of two weeks an envelope, containing his wages to date and dis pensing with his services, is laid on his lathe. Morning discovers to the widow lady with whom he boarded that he has flown in the night; and upon this being understood a the shop, there is, straightway, mental resignation of sums of money, light tools, clothes, and tobacco.'

Borax in California.-Discoveries of borax in Califor nia and Nevada have been made to sush an extent as to warrant the belief that from these sources the markets in the east of the American continent will, at no distant time be able to draw their chief supplies.

A Writer in the Oneida Circular recommends saw dust a each boot will do, keeping the feet dry and warm.

## AMERICAN ASSOCIATION FOR THE ADVANCEMENT

 $0 F$ SCIENCEThe annual meeting took place at Portland, Me., Augu 0, under the presidency of Professor Joseph Lovering. Ex-President Hill, of Harvard, read a paper on a mathe matical subject, and Professors Young and Hough described their different devices for controlling, by an electric current the movement of the chronograph. Hoa. E. B. Elliott, of he Treasury Department, read a paper on the relation of the frequency of auroras to changes in the length of the earth's radius-vector. "The association of the aurora with electrical or magnetic changes or disturbances in the eartin's crust is well understood as invariable. The difficulty of working the telegraph during intense auroras demonstrates this truth. We cannot say that the atmospheric disturbance-the aurora restrial disturbance causes the aurora. Possibly they may both be effects of some cause yet undiscovered. The surface of the sun is subject to vast disturbances, as is manifest'by the spots which appear and disappear so suddenly. Hence the amount of radiated heat, no doubt, varies greatly. In these varying thermal conditions, we have the efficient causes of magnetic disturbances. An investigation of the recorded observations of auroras, published some years ago 'by Professor Lovering, shows that the maximum number were seen in themonth of October, and the ininimum number in March, the number declining from the former date and increasing from the latter. These months mark the extreme points of the earth's orbit; hence, in these varying thermal conditions we have, if not a cause for the aurora, at least a most remarkable coincidence
Professor Wm. A. Rogers, of the Harvard Observatory, detailed the results of many ingenious devices designed to render more delicate and exact the various instruments of astronomical investigation. His special purpose was to obtain a substitute for the "spider lines" of the telescope.
This he finds in a set of lines etched upon glass by hydro. This he finds in a set of lines etched upon glass by hydro. fluoric acid, and rendered opaque by "filling" with plumbago. The process is too intricate for description without the beautiful specimens of etching on glass, which were exhibited. Quite a lively and somewhat dashing discussion followed among the star gazers on the value of certain refinements of modern instruments, Professors Hough, Hilgard and Young taking part.
Professor Putnam, of Salem, presented a statement of his investigations upon a curious fish, the liparis, which has for a long time been a subject of special interest among zoölogists.

Professor T. Sterry Hunt very ably discussed the geology and economic mineralogy of the southern Appalachians. After sketching, in a clear and comprehensive manner, the geological origin of the great Appalachian chain, he pointed out the curious decay to which the micaceous and schistose rocks, which compose the great mass of these mountains, is subject, producing what is' popularly known as rotten rock, which it really is. While the drift somewhat uniformly covers the surface of the Northern States, it does not extend south of the southern line of Pennsylvania; and hence in the Southern States the soil is the direct result of the decom position of the rocks underlying that locality. A great variety of valuable economic suggestions were deduced from these observations.

A debate arose between Colonel Whittlesey and Lewis H. Morgan, Esq., on a paper read by the former on the ratio of increase in the human race, with its bearing on the date of its origin. The special point was as to the probable number of the Indian population at remote periods, the reade claiming a high number, from which Mr. Morgan most ably dissented, his extensive erudition on that subject rendering him, perhaps, the best authority in the country.

FOREIGN APPRECIATION OF AMERICAN INVENTIONS. Mr. Moses G. Wilder, of 121 Chambers street in this city, has, we learn, contracted with the Farrel Foundery and Ma chine Company, of Waterbury and Ansonia, Conn., to man ufacture his machines, he having purchased the patternsand drawings from the New York Steam Engine Company.
Since the illustration of these valuable inventions in the Scientific American, Mr. Wilder states that he has received repeated requests from foreign periodicals for the privilege of presenting the devices in their pages for the instruction and benefit of their readers. The fact of Engineering, of London, publishing a full page engraving and description, abroad making similar offers, free of any expense, indicates the estimation in which improved American inventions are held in other countries, and is a substantial recognition of the merits of these particular machines.

## The Mennonites.

What with the proposed advent of several thousand Eng lish laborers and the contemplated immigration hither of 150,000 of the betier class of Russian peasantry, there is an encouraging prospect for the settlement of our western ter-
ritory, and its rapid development by a very superior class of colonists. The Russians, otherwise known as Mennonites, leave their country on account of religious scruples, the tenets of their sect preventing them from doing military duty. In brief, they are an order somewhat similar to the Quakers. They come from the valley of the Vistula river, which they have thickly settled and cultivated, showing, by their progress both in industries and education, a marked difference from the ordinary type of continental peasants.
A delegation has recently visited colorado, Texas, Minnesota and parts of Illinois, searching for suitable lands upon which to locate the colony. The railroads have of course
held out every inducement; and it is understood that ther will be several settlements along some of the principal lines A second deputation of about 100 lately arrived in this city,
and is composed mostly of young men with their families. It is hoped that a body numbering over five thousand will emigrate by May next.

## Remarkable Railway Disasters

A collision recently took place on the Chicago and Alton railway between a passenger express train running at the rate of 35 miles an hour, and a coal train, of thirty-five cars, running at a speed of 20 miles an hour. Neither of the engineers saw the other's engineuntil it was too late to reverse, fact accounted for by the curve in the road, and partly by the dense fog. The two trains came together with fearful force. Being on the curve,however,both engines left the track and passed each other, that attached to the coal train striking the baggage car a few feet from the end, breaking the coupling between it and the smoking car, which the engine struck square in the end, and with such force as to throw the forward end in the air; so that the engine ran under it, tearing the floor completely out and hurling the fifty or sixty unfortunates who were in the car in a struggling mass to the lower end, where there was no chance for escape, and then ensued a scene of horrors which cannot adequately be described. The smoke stack and dome of the engine were knocked off by the collision, and broken timbers of the smoking car penetrated the boiler, letting loose a dense volume of hot steam, which poured into the car, blinding and scalding the helpless inmates, who with shrieks struggled vainly to extricate themselves. Eleven persons were killed and thir ty-five dreadfully injured.

## another strange disaster.

On August 19 at 340 A. M., on the Great Western Railway, Canada, when the New York express train approached the Welland canal at Thorold, the draw happened to be openThe regulations of the road and the law require the full stoppage of all trains at all draws, but in this instance, to the astonishment of everybody, the ftrain kept on at full speed and plunged inio the canal. The train was drawn by two locomotives, and consisted of several baggage and express cars and an unusual number of passenger coaches. Both engines and all the baggage and express cars plunged into the canal, filling the chasm so that there was not room
enough for the passenger coaches, and thus all the passenenough for the passenger coaches, and thus all the passento the following singular occurrence: Just as the ocomotive reached the bridge, the water gage glass in front of the tire box of the engine burst, instantly filling the cab with steam and boiling water, so alarming the engineer that he jumped before bringing his engine quite to a stand

## A Lightning Freak.

The Pittsburgh Dispatčخ says: "During a recent thunderstorm near Oil City, a large tank owned by Mr. J. S. McCray was struck by the lightning. It is a 10,000 barrel iron tank, and contained 3,000 barrels of oil. The bolt struck the top of the tank at the edge, and ran completely around the periphery of the top, cutting off the head of every bolt that fastened the top to the side. The top was raised about two feet by the concussion, and the oil took fire, sending an immense body of flame high in the air. In an instant the top fell back to its position, instantly smothering the fire inside.
The oil burned off the tank and then went out, and no furThe oil burned off the tank and then went out, and no fur-
ther damage was done. The cover was not two inches out of its original position after its fall."
Remaris by the Editor.-In this case, the lightning simply ignited the explosive mixture of air and vapor contained in the tank, producing an explosion, the sudden force of which was just sufficient to cut the fastening bolts and slightly lift the cover, without projecting the latter into the air. The lightning, we think, did not run around and cut the bolts as above described.

## The Sierra Nadre Tunnel.

The commencement of this enterprise has created less noise than one would expect from such a huge undertaking. Yet if it should be ouly partially successful, not reaching the other side of the range for years to come, the tunnel promises to become of the greatest value in the development of the Gilpin county gold veins.
The mouth of the " great bore" has been located about two miles below Black Hawk, on the north branch of Clear Creek, some 7,000 feet above the sea, 1,800 feet above the plains, and nearly 1,200 feet below the level of Central City. Its course is a few degrees north of west, or in a direction that would intersect the Gregory, Fisk, Hunter and other lodes $15^{\circ}$ to $20^{\circ}$ from a perpendicular. The Bobtail, Mammoth, Winnebago, and other lodes of that system would be cut at a very acute angle.
From the mouth of the tunnel to the Bobtail lode, in a di ect line, is 11,000 feet; and from that point on to the Greg ory, about 800 more. The course being about $30^{\circ}$ north of west, it will run under Central City, almost directly beneath Eureka street, and pass a short distance up that gulch, cut into Gunnell Hill, and pass through it into the main range.
The Bobtail is the first known lode of any prominence that will be intersected. This, as has been said, is 11,000 feet from the mouth, and will be struck about 1,300 feet from the sur face. From this point on, the great bore will strike the Gregory, Bates or Hunter, Gunnel, Prize and Winnebago, in the order named. The three latter lodes are about 16,000 feet from the mouth, and will be opened nearly 2,000 feet from their surface outcroppings. Beyond these, if the tunnel ever reaches so far, it is not improbable that other valuable and
1 arge veins will be met with. The main divide betwee $n$ Cen
tral City and Middle Park is from 11,000 to 12,000 feet high in places rising to nearly 14,000 feet. In passing through
this, the tunnel will reach its greatest depth, namely, from this, the tunnel will reach its greates.
5,000 to 7,000 feet.-Mining Revieu.

## The Porpoise.

At the Brighton (Eng.) aquarium the keeper in charge of hese interesting animals is now in the habit of summoning them to their meals by the call of a whistle ; approaching foot steps, even, cause great excitement in their movements, and re ceut experiments have proved them to be acutely sensitive to the vibrations of sound. By the physiologist a more pleasing spectacle can scarcely be witnessed than the graceful action of these cetacea as they swiftly pursue their course up and down their spacious tank, ascending to the surface of the water at intervals of fifteen or twenty seconds to breathe, each inspiration being accompanied by a spasmodic sob-like sound, produced by the rush of air as a breath is rapidly liberated and inspired through the single central blowhole.
Onward progress is effected in these animals, as in all other cetacea, exclusively by the action of the horizontal caudal fin; the development of muscle at the "wrist "' of the tail on which this action depends being enormous and plainly visible externally; the pectorals are devoted principally to the purpose of steering the creature to the right or left, iding it also in rising to the surface of the water.
The fact alone of the porpoise suckling and evincing much maternal solicitude for the welfare of its young indi cates the superiority of its position, in the zoölogical scale, above that of the other representatives of the finny tribe. A few dog fish, acanthias and mustelus, three or four fee long, placed in the same tank, soon fell victims to their tyr anny, the porpoises seizing them by their tails and swim ming off with and shaking them in a manner scarcely conducive to their comfort or dignified appearance, reminding the spectator of a large dog worrying a rat. The fine sturgeon, six feet long, now sbaring an adjoining tank with the cod, was first placed with these animals, but in a short time was so persecuted that for. safety it had to be removed while to this day the lacerated condition of its tail bear witness to the pertinacious attention of its former comrades Some large skate (raja clavata and maculata), while they maintained their usual habit of lying sluggishly on the floo of the tank, escaped molestation; but no sooner did these fish display any unwonted activity than the porpoises were upon them, and, making a convenient handle of their charac teristic attenuated tails, worried them incessantly. It need scarcely be remarked that the skate were removed before fur ther mischief could be done, leaving the porpoises, with the exception of a few conger (which during the daytime mostly lie hidden in the crevices of therock worls.), turtles, and a huge monk fish (rhina squatina) sole occupants of the colossal tañ.
While far behind the porpoises in display of intellect, the the representatives of the gadida, or cod family, are by no means the least intelligent of fish.-Nature

## Balloonaria.

The preparations for the transatlantic balloon voyage are now far advanced, and our enterprising contemporary, the Daily Graphic, tells us that an extra force of hands, work ing day and night, will hasten them to completion. It is believed that the great fabric will be ready for filling by the 30th of August, when it wili start on the journey as soon a fully inflated. Besides the large boat suspended under the car, a smaller canoe will be carried, to serve as a life boat. This latter craft is fourteen feet long by twenty-eight inche broad, and is made of paper three eighths of an inch thick t is a fine piece of workmanship, and is constructed with ai chambers so as to be practically unsinkable. In event of th leakage from the balloon causing a descent and rendering it necessary to take to the water, Mr. Donaldson will attempt
to reach land in the smaller vessel, while the rest of the to reach land in the smaller vessel, while the rest of the party will navigate che larger boat. The above mentioned gentleman recently sailed the canoe on a trial trip between this city and Long Branch, making good time and arriving The capabilities of the

## ARRIER PIGEONS

are being thoroughly tested, and some of the birds have shown a wonderful speed. The Ariel, a pigeon that wo the $\$ 2,000$ prize in the international contest in Belgium in 1871, accomplished the distance between New York and ratford, Conn., sixty-four miles, in thirty minutes. An quick time. The pigeons made the journey in alm stock, qud some two and a half years ago were imported by Mr. 0 and some two and a half years ago were imported by Mr. O
S. Hubbell. It is related that the flock, some two dozen birds in all, were imported in two detachments, and on thei arrival were carefully confined for a long time in their cotes arrival were carefully confined for a long time in their cotes
After they had been thus mewed up, sufficiently long, a it was supposed, for them to forget all about their transat antic home, the doors of the cages were opened; but to the dismay of their owner, who had invested upwards of a thou sand dollars in them, every pigeon promptly flew away In about four days, however, all returned, apparently very much exh:usted and ravenously hungry, since which time none have ever attempted to leave their present abode. It is conjectured that the birds, on being released, made for the Atlantic coast and flew along its whole length, seeking to recognize some features of their Belgian birthplace They have since maltiplied very rapidly, and at the presen time number about one thousand
A number of these pigeons will be carried in the car of the balloon, and released at intervals with dispatches which they will carry, it is believed, directly to their cote at River
cliff. As it is thrown from the balloon, each bird will probably fly wild until it sights land, to which it will immediately direct its course. The carrier pigeon has no peculiar instinct which directs him homeward, but seems to possess a memory for places, coupled with a very strong attachment for its abode. In its various excursions near the latter, it becomes acquainted with objects, say for a radius of seventy miles, so that, if once it sights any part of the circle, it ca easily find its way home. On being let go, it first flies up ward and perhaps looks over a circumference sufficiently large to include a portion of the circle above referred to,
toward which it immediately travels. But in case it sights no known object, then it will fly in a chance direction for some distance, and then try again, and so on for about three times, when, if disappointed, it returns to its starting point and begins a new flight. A good bird will keep up this repetition until it discovers its home locality, or else it tries so often as to be discouraged; then it seeks a new home. The humorous side of the voyage
seems to form staple exercise for the wits of the daily journals. Puns of various degrees of atrocity have been perpe trated on the name of Professor Wise, and the word "balloonatic" is so frequently used that it bids fair to become a part of the language. One journal suggests sending up an experimental balloon, with a car load of a selected party from the dozen or so emotionally insane murderers now in the Tombs in this city, and then, when at a sufficient elevation, spilling them out. Another exuberates to the effect that Wise's expedition cannot but be fruitful, because he is sure if flaming torpedoes are to be dropped along the course of the balloon, it might be well to provide the passengers of ocean steamers with cast iron umbrellas. Some of the alleged answers of correspondents to invitations, from the managers, to a seat in the car are quite amusing. One remarks that the voyagers are pret ty sure to reach some lo-
cality, but whether in this or the other world is questionacality, but whether in this or the other world is qu
ble; while another, poetically inclined, replies that:

> If I could read my title clear To mansions in the skies, I'd bid farewell to every fear And with your gas arise."

Skillful Navigation in a Fog.
A correspondent to the Boston Advertiser, who writes from London, after completing his voyage across the Atlantic says: The Siberia, of the Cunard for Liverpol, and stris on the new southerly course for Liverpool, and striking into
the fog on the first day out, did not meet with fifteen minutes' clear weather, when an observation could be taken, for almost eight days. But no pains were spared by the officers to make the dead reckoning accurate. The log was thrown every two hours day and night. On the evening of the eighth day, our latitude was estimated to be north $49^{\circ} 36^{\prime}$, but the fog was still dense enough for the fog whistle to be blown. A little later it lifted very suddenly, then the clouds broke, disclosing the pointers of the Dipper, and a moment later the North Star itself was visible. The chief officer hastened for his sextant, carefully took the altitude of the star, and found it to be $49^{\circ} 36^{\prime}$ to a second. And on the tenth day we came in sight of the Skillings, and bore up the coast of Ireland to the Fastnett Light without changing the course a had sailed upon the new course, and during three fourths of had sailed upon the new course, and du
the time she had been enveloped in fog.

## DECISIONS OF THE COURTS

## United States Circuit Court.---District of Massachusetts.

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 Sheplex, J.:






## NEW BOOKS AND PUBLICATIONS

comotive. By Henry Evers, LLLD. Mathor, and " Lo
cond Comotive. By Henry Evers, LL,D. Author of " Navi
gation," " Nautical Astronomy," etc., and Professor of Mathematics and Applied Science at the Charles Science
School, Plymouth, England. Price $\$ 1.50$. New York School, Plymouth, England. Price $\$ 1.50$. New
G. P. Putnam's Sons, Fourth Avenue and 23 d street.
An excellent practical treatise, by an undoubted authority. The work i
made avalable for purposes of instruction by the addition of made avalable for purposes of instruction by the addition of some varied
and exhaustive questions, to be answered by the student. The book is No. 22 in Messrs. Putnam's "Advanced Science Series."
Practical Chemistry: for use in Science Classes and Higher and Middle Class Schools. By J. Howard, Head
Master of the School of Science and Art, Islington, England. Price 75 cents. New York: G. P. Putnam's Sons, land. Price 75 cents. New Yorth Avenue and 23 rd street.
An elementary book of the highest class; lucid in its descript
steadily progressive. The writer is evidently a teacher of abllity.
Steam Boiler Explosions, By Zerah Colburn. No. 2 of Van Nostrand's "Science Series." Price 50 cents. New
York: D. Van Nostrand, 23 Murray and 27 Warren street.
Voluminous as the literature on this subject has become, there is stil room for practical information; and such sound wisdom, drawn from ac
tual experience, as the late Mr. Colburn possessed can never be out of date We commend this little book to all our correspondents who write to ask questions on, or to report, explosions of steam boilers.

## A!GRAND VICTORY OVER EVERY COMPETITOR IN THE

 WORLD.The following Cable Dispatch from Vienna will convey the glad intelli gence to the world that the "World Renowned WiLson Sewing Machine " has not only taken all of the highest Awards at Fairs and Expositions in
the United States, but that it has overwhelmingly defeated every Sewin Machine manufactured in the World, and carried off the first Grand Priz the Vienna Exposition

Vienna, Austria, Aug. 15, 1873.
To W. G. Wreson
land, Ohio:
The Wilson Shuttle Sewing Machine was awarded the Grand Prize a
the Vienna Exposition for being the best Sewing Machine." Raynor.

## frecent gurctican and fureign eatents.

Improved Hopper for Grinding Mills.
Martin Replogle, Moulton, Iowa.- For automatically closing one spout, nd opening the other, of a double or two part stock hopper of grist mills, it is proposed to have a right angled valve arranged between two disks,
and pivoted at the angle under themiddle partition between the two spouts, so that by a quarter of a revolution on the axis one spout will be closed and so that by a quarter of a revolution on the axis one spout will be closed and more pressure by the grain passing through than the one which is closed
by the grain in the hopper above, so that it cannot shift until the hopper by the grain in the hopper above, so that it cannot shift until the hoppe
from which the grain is running is empty, when the weight of the grain in the other hopper will instantly open it by the weight on the side closing
the spout. A bell is attached to the axle of the valve, so as to sound each time the valve shifts and changes the grists to notify the miller of the change.
Robert Simon, Paterson, Improved Reel. N .-This invention consists in a reel, the arms of which are provided with dividing disks for separating the two part
of the skein, so that the silk or thread wound on such reel may be crosse of the skein, so that the silk or thread wound on such reel may be crossed
in opposite directions in the spaces between alternate pairs of arms, in order that at such crossing each separate strand will be above its predecessor.
Improved Apple Parer.
William A.c. Oaks, Reading, Pa.-This invention has for its object to so
improve the apple parer patented to the same inventor on December 10, improve the appleparer patented to the same inventor on December 10 ,
1872, that the knife willmake a positive sticp until the apple has made one 1872, that the knife willmake a positive stcp until the apple has made one
revolution. The invention consists in providing the gear wheel of the knife revolution. The invention consists in providing the gear wheel of the knife
arm, at that point at which the knife takes its position for paring the apple arm, at that point at which the knife takes itsposition for paring the apple,
with two or more recessed cogs and a projecting tooth and lug extension, in connection with the pinion wheel of the crank shaft, having also part of the teeth cut off and provided with a circular fiange, so that thereby a full stop of the pa
the apple.

Improved Shoemaker's Pinchers.
William H. Hanna, Chico, Cal.-This invention consists of a pair of shoe maker's pinchers, having the jaws in the same longitudinal plane and the
teeth abutting against the turning face of the jaws, so as to bring the bite near to the pivot, and thereby not only to secure more leverage in the gripe but thus to enable the upper to be drawn close to the last.

Improved Clothes Pounder.
Edward S. Saxton, Greenfield, Ill.-This invention is an improvement upon the clothes pounder for which letters patent were issued to Ezra Pollard December 28,1858 , and consists in a wooden block provided with a centra a circular communicating groove is formed to allow the air to enter and escape from the inner ro
in the side of the block.
Gustav Blunck, New York city.-This invention consists in a main slide piece, with suitable set screws, moving in a guide frame carrying the adjust able ruler, and acted upon by a band spring applied to a wedge-like thumbpiece, which produces ailed parallel motion of the ruler.
trolling finger the require the con
George W. Eddy, Waterford, N. Y. Sthis invention
George W. Eady, waterf are arranged in a chamber traversing the water way, and work transversely across the water way on the seat or seats, and are pressed thereon to close
the water passage by means of the valve stem; and it consists of lever the water passage by means of the valve stem; and it consists of levers
combined with the disks or gates and an enlargement on the valve stem in such manner that, when, in closing, the gates have returned to their seats, the levers and the enlargement come into play in such manner that they force the gates upon their seats with a powerful lever pressure, which is
produced with the stem by the operator without much effort. Improved Truss Bridge, ttom, middle, and top chords composed of three parallel timed to have ouble posts framed or boxed between the timbers of the bottom and top chords, and passing bet ween the timbers of the middle chord without boxing, and with braces firmly secured to the posts and the bottom chord, all
in a manner calculated to produce very strong frames, capable of sustain-

Improved Pile Driver.
Charles H. Smith, Bloomer, Wis.-This improvement in pile drivers con sists of an endless chain for raising the drop, working over a driving wheel
at the bottom and a drum at the top of the frame, and through contrivances n the drop, with a drum at the top of the frame, and through contrivaig causes the lock to engage the chain when the drop strikes, so that the chai mmediately lifts the drop again, and thus saves the time lost in the ordin in running the hooks down to connect with th. arm coming against any suitable stop in the ascent of the drop. The inve tion also consists of a crane and hoisting rope combined with the drive and the driving mechanism in a simple manner, for raising a pile while an also consists of a guide for controlling the head of the pile while bein driven, contrived so as to be engaged with the rib guides, on which the
dron works, after being attached to the head of the pile before it is ratsed rop works, after being attached to the head of the pile before it is ralsed to be lixed in the
Franklin Chichester, Milwaukee, Wis.-The first invention consists in two art cradle ends, set apart and connccted by intermediate springs. These arings, one at each end, raise the extension and body from the base, whic notion being limited to the width of the openings between the extensio and the base. The same inventor has also patented another cradle in whic there is a central pivot at each end. A fiat spring at each extremity is a ached at its ends to the iron rail of the body.

Improved Treadle for Sewing Machines.
William D. Wood, Mount Sterling, Ohio, assignor to himself and John arridge, of same place.-This invention consists of a pawl and lever an bell crank combined with the treadie mechanismor a sewing machine, in one of the knees, and thus save the labor of starting the wheel by hand The invention also consists of a holding pawl combined with the balance wheel and a double orank, the object being to prevent the machine from be
ing turned back ward, to which a double crank is liable without a holding ing turned
pawl.

## Improved Washing Machine.

Josiah Glines, Postville, Iowa.-A board set on edge is designed to kee e clothes upon the opposite sides of the machine separate from eac Toit is attached the crank by means of which the machine is operated. The lower roller is also fluted and slides up and down in slots in the lowe part of the uprights. To the lower ends of the sliding bearings and to the per edge of the ends of the divisin board are attached pins to whic held up against the upper one so as to apply pressure to the clothes while assing through the machine. Four rollers at the inner corners of the up. ights diminish the friction as the clothes are passing into and out of the machine.
Improved Saw.
Sylvester Cook, Alpena, Mich.-It is proposed to divide the teeth of cross cut saw into groups oi four teeth by a wide blank space of about one
inch between, and in each group to have two teeth fronting one way and nch between, and in each group to have two teeth fronting one way an udinalaxis of the saw. The ends of the teeth are beveled enough for clearance, and the cutting edges and ends shaped like a chisel edge by beveling them on one side only. The beveled sides are alternatelv reversed
At the heel of eachrear tooth of a pair is a cleaner, for scraping out the At the heel of each rear tooth of a pair is a cleaner, for scraping out the
chips cut off by the teeth, said cleanerbeing an extension of the heel of the hips cut off by the teeth,
tooth as low as the point.

Improved Roller Clearer for Spinning Machines.
Charles B. Brown, Lewiston, Maine, assignor to himself and Alvin Wood man, of same place.-This invention pertains to an improvement in the con
struction of clearer rolls of spinning frames ; and it consists in providing covered roll with an enlargement, or, in other words, in reducing its dimeter uniformly at every point except the center. Thus constructed only the enlarged portion will come in actual contact with the rolls of the pinning frames.

Improved Metal Planing Machine
Robert Harper, Glenn Mills, Pa.- This invention has for its object to fur ig said shafts from their bearings. tached to the four corners of the bed. To one end of the screws are a tached bevel gear wheels which engage with similar devices on a cros
haft to which power is suitably applied. The screws also pass throug crew holes in a cross head that slides upon ways which are so formed as to cause the said head to move back and forth squarely, and to sustain the upward pressure of the tool, thus relieving the screws from any strain. To
the crossheadis attached a block, the upper and lower sides of which are the crossheadis attached a block, the upper and lower sides of which ar beveled to form a way for another block. The side edges of the secon ocw which is a T groove formed to receive the tool holder, through a slot in the forward end of which the shank of the tool is passed. By this construc ion, the tool can be adjusted vertically and horizontally, and inclined to ne or the other side, as may be required. Four set screws pass in hori be planed or dressed.

## Improved Propelling Vessel

George W. Dow, Brooklyn, N. Y.-This invention consists in the im oat, drawing the water in from the side and discharging it at stern or bow, coording to whether it is desired to go forward or backward. It consists the peculiar means for enabling the boat to be backed, by means of gat closing the channel through which the water is drawn to th

## Improved Sash Holder

George W. Richardson, Columbus, Ky.-The object of this invention is to furnish means for holding the sashes of windows in any desired position in
the frame or casing; and it consists in the arrangement of a spiral or coil pring, acting upon the sector or wedge-shaped rack. By a slight upwar pressure on the operating lever, the sector is turned and the wedge is moved downward and the sash released.

Improved Kerosene Heater.
Ziba B. Grandy and Cyrus E. Grandy, Stafford Springs, Coxn., assignors to themselves and Winliam D . Heald, of same place.-The obiect of this in iquits by to furnish improved fachities for heating water and other eservoirs arraiged around the lamp chimney. Two different kinds iquids-as water and milk, for instance-may be heated at the same time The heater is made of tin or similar material, and the chimney is riveted oldered with hard solder so as to resist the effects of the heat.

Improved Ladies' Gaiter Shoe.
Henry C.Letsinger, New York city, assignor to Edwin C. Burt, of sam place.-This invention has for its object to improve the construction of la-
dies' gaiters, so that there will be no seam crossing the instep; and it conists in having the vamp made in one piece with one of the half-quarters. and seamed to the oth'er half quarter, the seam commencing at the junc ion of the oo
heel and sole

Improved Car Coupling.
Daniel C. Camerer, Martinsburg, Pa.-This invention consists in the in provement of car couplings by combining the buffer spring with a rigi
buffer bottom, having an upright plate and a sliding box, having part tions, to support the link in a new and convenient manner.
Johnc. Wants, Nashville, Tenn. -This invention aims to protect brake men on railroad cars, and consists in afoot piece and rail raised on a brack et applied to the top of cars, so that the brakesmen can pass from one ca
to another without damage to life or limb.

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alling attention of our Manu facturing readers to E . H . Kellog's a a jertisement in another column, and saying that we believe his claims in regard to fine Engine, Spin-
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## ymucs (burins

R. B. Says: A certain length of railroad
track has asiding which in just long enough to allow a
and train to pass on the main line, when the siding gano on it
eight cars and a ocomotive. Suppose to tring ond contaning gistrteen amoss and a locoomotive, and moving
in opposite directions, meet at the siding; how can the pass each other?
J. C.L. asks: 1 . Will a powerful light of
any kind, 8 feet under water, illuminate an object in the whater so that it can be seen at a 2. What kind of light is best for that purpose and how
can I makeit t 3 . Can that tight be seen from a small
boat or ship 50 or 10 gords aw ? C. L. asks: How can I prepare a wheel for
grinding the carbon diamonds for turning or working grinding the
hard metal?
A. E. G. asks: How can I prepare sizing for H. H. says: : I have a cast iron house fur-
nace that leaks gas.
what is the best recine for cement D. J. W. asks: What is the quickest and
est way to dress a deer skin, so as to make good buckskin?
C. asks. Is there any cheap metal or alloy
that will resist the action of tomato acids? copper plate are acted upon and destroyed in a very R. F. H. asks: Is there a process by which
can combine wax with water?

O. G. will find a review of a book on ex
pression on $n$. 248, vol. 28. - G. B. D. Will find directions
 change of nolor, if any.-J. W. Mecc, . . is in formed that
there are no rel'able statistics published on the subject.
 ol. 24.-R. F. H. will find a recipe for waterproof leath ri cement on p. 119, vol. 28.-H. P. Will find
alculatipg horse power on p. 123 vol. 29.
M. M. B. says: I Iave long known that the
compression of air and other gases is attended with an increase of temperature, but how much, I have been un
able, from the books and papers that t have had access to, to ascertain. Can you give a table of the increase of
temperature by compression? Answer: The followin table of heat developed by compresion of air and fixed
gases is by Professor Thurston, of the Stevens Institute gases is by Professor Thurston, of the Stevens Institut
of
of echnology, Hoboken, , J. J. The volumes are ex-
$\underset{\substack{\text { Pressure in in } \\ \text { ans.above } \\ \text { tomoshere }}}{ } \mid$

C. M. Mfg. Co. ask what phosphor-bronze is ily by the ordinary machinists' tools. Answer: It is
made by adding a very small per centage of phosphorus
 mall sample and try it.
H. F. R. says:
in answer to
B, you state the weight of broken ant ant
and cite coal of almost any size to be 385 cubic feet per tun Have these igures been verified? I find that a coallirm
in whom I have had great confldence, have succeeded in stowing ten tuns of Leenigh furanacee coal in ino a p pacee o
333 cubic feet, or 33 : 3 feet per tun. Also seven tuns of Lenigh stove coal into o space of 247 cubic feet, or 35 ;/ per tun. Answer: The figures. we gave were average
onen, rrom a variey of results Shoonl we weta sufficient
number of comen actual practice, we may be able to give a closer approx
imation.
R. H. M. asks what effect turning has in
the manutacture of ice cream. Dues the centrifugal force, combined with the low temperature, help to freeze
it or it it like the hhurning of cream to bring butrer?
Answer Answer: The object of turning or stirring the cream to
be frozen in the freezer is to bring all the particles on Huid cream successively in contact with the cold sides
of the freezer, in order to make uniformly frozen mixof the freezer, in order to makea uniformly frozen mix-
ture. Centrifugal motion has nothing to do with it. If he cream in the freezer were not stirred, it would free ard only around the sides of the freezer, and as ice is
wery poor conductor of heat, the center of the canfu would remain fluid for a longt time. That frozen around
the isfes, too Che sides, too, would be miserable watery stuff compared
with that in the center, as it is well known that water if undisutrbede, is apt to freeze more or less freefrom for eign mixtures. By constant stirring and agitation, how.
ever, a uniform frozen cream is produced, and the free ing is effected in a shorter time
J. H. B. asks: Is there any ingredient known
hat will prevent sugar sirup from crystalizing? An that wiil prevent sugar sirup from crystalizing? An ${ }^{\circ}$ o prevent sirup from erystallizing. You can attain the object to a certain extent, by heating in open
as high a degree as possible without charring.
T. H. H. asks: What is good to stop a boil-
er from foaming? I inave a 5 horse power one which foams very bady. The boiler is 6 feet high and 2 yif feet
in diameter; it holds about 75 gallons of water
The
 only 15 inches steam room. There are 36 one inch tubes
in the boiler. The water used is clean. Have I too much water and not steam room enough? I blow the water out about once every two weeks. Answer: Prob
ably in your case the steam room is too small. If. yo can safely maintain a higher pressure of steam, you win be able to partially
check the foaming.
W. P. H. says: I would like to have your
mature judgment as to the correctness of two state ments made in your invaluable journal. The first is
under the caption "Hot Air Furnaces," "ated March 15, 1873. The second is contained in your last issue, August 16, 1873, under the caption, " "The Permeability of Cast
and Rolled Iron to Gases." If gases do pass through cast iron, as stated in the first, at what temperaure?
and if not, as stated in the second, will you please give me some light on the matter? Answer : Such action (the passage of hydrogen and carbonic oxide through iron
oees not occur at the temperature to which the metal subjected in ordinary furnaces, but only at tempera ures nearly high enough to melt the metal.
$\underset{\text { ning at i00revolutions perminute, and a boiler } 18 \text { feet } \mathrm{F} 38}{\text { F. }}$ inches, with two 14 inch flues. The feed pump is directly
above the piston and is opened by a connection betw the piston and pump rods, thus running 1000 per minnute. Running at this rate, it will not supply the boilier; but,
by partially closing the throttle valve and allowing the by partially closing the throttle valve and allowing the
engine to run slow 1 , it will fllt the boiler very quickly. pump will work worse Can you tell us the cause, and how to remedy it? The pump cannot be separated fron
hen the engine. Answer: We suppose that the pump runs
away from the water, the supply pipe or suction valve being too.small. Probably the valve is large enough
and the supply pipe too small, in which case you ca easily remedy the trouble. It might be worth your while to consult some good engineer, as, with the data you
have sent, it it impossible to give anything but a hypothetical reply.
W: G. asks: 1. Is there any mode by which commor schorar can inn the heating surface of a a on
r? sow his it done? asmokestack for a boiler? What is the rule for calcu-
ating the area of a number of small flues? .Having ound the area, of you allow the stack the same, or do boiler for a 10,15 or 20 horse power engine, and how
 giving information on one or onal of these points? An
iwers: 1. For fiat rectangular surfaces, multiply the ength in feet by the breadth in feet. For irregula at surfaces, we must refer you to rules given in every
cket book for engineers. For cylindrical surfaces, nultiply the diameter by the length, and by the number
 Makers allow from 12 to t15 suane feet of heating sur.
face per horse power, and half a cubic foot of water evaporated per hour is duite a common allowance for a
orse power. 4 . Calculate the contents of the tank
and horse power. 4. Calculate the contents of the tank in
gallons or cubic feet, also the contents of the barrel. hen divide the first by the second. 5. Haswell's "Men suration," Haswell's "Engineer's Pocket Book,", an
Bilinns "sheet Iron Worker," will be useful books fo you to have. For a single work, containing a very com-
piete collection of rules and formulas, we can recomP. I. says: I live in the neighborhood of would like to fit myself to fll some position of that
wusiness. Can you tell me what is the best course t business. Can you tell me what is the best course to
pursue, and what books 1 should study to learn the same

Furnace."
T. L. B. says: $I$ am building a small oscil
 or one and a half finch fiues, be large enough to supply
he engine with stam? these dimansions be large enough to run a boat 16 feet
in length? What arrangenent could $I$ use to force water into the boiler while under a pressure of steam Snswer: The boliner woild be much too small. Th
boat would de propelled very ylowly by such an engine.
The boiler could be fed by the direct pressure of The boller could be fed by the direct pressure of the
stame, using an arrangement like an equilibrium oil
cun
J. B. D. asks: 1. Can racks be cut in solid Wrough irinn bars, $13 \times$ x $x 12$ inches, by a millung cylinder 15 inches long $x 111$ in ches diameter, so that a plain
smooth margin, $1 /$ an inch wide, may be left on each side of the track? 2 . Do the patent anthorities in forerign
of the countries reject their citizens' applications. if the inven
ions are known to have been patented or described in printed publication? 3 . Why does lightning sometimes trikes dry wood and not ignite it? Answers: 1. W think you could cut the racks by the plan proposed, in the machinery were accurately made. The futes in th milling cylinder should be spiral. 2 . In most foreig
countries, if the pubbication of a patent from abroad had reached that country, the application will be rejected. 3. It is probably impossible to explain the reasons for
E. asks: What proportion of tungster Would it also tend to whiten the German silver? An.
swer: Tungsten, when combined with iron or steel, no only forms a tough alloy, but one that becomes more and more infusible as the proportion of tungsten increases. Other alloys that contain more than 10 per cent, of
 German silver) It would be volatilized before the alloy
could be fused. Copper zinc and nickel onts of German silver, will only unite with tungsten
ent When all the metals are reduced from their oxides to-
Gether. Metallic tungsten is infusible in the strongest M, reguirin 200 pairs of O. G. Says. I I am told that John Fitch was
the inventor of steam, or first applied steam to navigation. If this be so, what had Watt, Fulton and Stevens o do with it? Answer: Watt's improvements were
 wheels.
A. P. asks: 1. What is meant by ebonite?
Is it the same as ebony? 2. Must the upper disk of Is it the same as ebony? ${ }^{2}$. Must the upper disk of
Carre's electrical machine be just one sixteenth of an inch thick? 3. How much would a patent cost for the
improvement of the plow? Answers : 1 . Ebonite is hard vilcanized rubber. 2. Yes. 3. 861 in full, if simple.
T. F. F. H. says, in reply to R. K. K., who asked
now to make tight joints in engine cylinders: Two enstnes, made by different makers and of different patterns,
have been closely observed by the writer. The first was made useless by this eating a way of the iron, as described by R. K., so that it could be cut like plumbago after be. ing used about 5 years. In that time it wore out two
sets of steam chest covers or bonnets, and the studs were pulled out of the cast iron so that larger ones had
to be fited in the with rubber; as soon as the softening of the iron was Observed, the ruiber was replaced with canvas and red
lead, still the eating away grew worse iead, still the eating away grew worse. Tallow was the
lubricator then. After awhile it was found neeessary to have the surfaces of the joints refaced, and the joint
was made with white and red lead alone, and suet, fresh nn sweet, was used as the labricator. still the destruc tion went on; lard ill, parafin, and sperm oil have all
been tried, but there was no help, and the conclusion was that the iron was poor somehow. That engine was
replaced about two years ago by another of a superior replaced about two years ago by another of a superior
make. This one has steam valves on one side of the cylinder, and independent exhaust valves on the other side. There is a cover over each valve, and the joint is
made iron to iron, the surfaces being nicely fitted by scraping. This engine will be used up precisely like the former. There is nothing unusual in the boiliers or their
connections with the engine. The exhaust is conveyed into a cast iron ieater with brass tubes, and several en-
inneers
did exnerts sav that s rom. But if so why what not the exhaust side of the cylinder waste away like the steam side? On the con being hard and sonand. Wुith the former engine, the
boiler used was rather too small for the powerrequired oner used was rather too small for the powerrequir ed Boilers of ample cajacity supplying the driest steam are now in use. Something in the water was thought of ne the water was analyzed by Dr. Vichols, of Boston
the ersult shows that no reasonanabe fault can be found
$\underset{\text { potassium when mixed with pure rain water to form a }}{\text { Y. }}$
 ually grow darker until perfectly opaque, the tempera-
ture being from 80 to 60 ?
The solution is kent in lass stoppered bottle. arments, which is the best form in which to apply chlo
ine? 3 . What is verdigris ; why and how does it form and why does it form most readily where candies are
being burnt? 4 . What is the best way to make solutions nd test papers of lit hus is the best way to make meti, and must they and test papers of lititus and turmeric, and must theybe
boiled with water or not? 5 . Will perchloride of tin trick the protochioride of tin on introducing pieces luar) that tivice the number of its sides minus 4 is equal the number of right angles contained in the sum of
the interior angles of that polygon, whether there be entering angles or not? Answers: 1 . It may be owing o some impurity in the water, or if not, to some decom osition of the cyanide. 2. A solution of bleaching pow der (chloride of lime.) 3. Verdigris is a basic acetate of pressedgrapes on sheets of copper. Itforms by the actio or a afinity of acetic acid on or for copper. The only the materials and hasten the chemical change. 4. Boil our litmus or turmeric in water; and when a strong d coction is made
5. No. 6. Yes.
 were to connect a similar engine to the other end of shaft set 14 revolution ahead, how would it increase the strain
upon the shaft? Is not the strain upon an engine shaf variable from nothing at the dead centers to the max mum when the cross head is at the center of the guides?
Would not, therefore, the addition of another engine merely make this maximum strain continuous and un orm? Answer: Suppose, in the case of one twelv o transmit this power, and would break if more strain were put upon lt . Now, att-ching another engine of nd would evidently break. To those who understan algebra and elementary mechanics, the matter can be
explained in another way. Let $P=$ pressure on crank in, and $a=$ radius of crank. Then for one engine, the ma num moment of strain on the shaft=P×a. Adding an other engine of the same size, with its crank set at an ang $=\mathrm{P} \times \mathrm{a} \times \sqrt{2}=\mathrm{P} \times \mathrm{a} \times 1.8284$, which is 1.8284 times as great
R. V. E. asks: 1. What causes the attrac Whepe is that attraction situated? 3. How great is the
ariation of needle of compass, and (4) in what timewill itreturn to true course? 5 . What is the title of the bes ork on these questionr? Answers: 1 . The earth is meridian. 2. The magnetic meridian of any place is sup posed to depend upon the temperature of the place. is different at different places ; and there is a line o no variation. Needles placed on thls line point to the
rue north. 4. The variation is changing in the Unite states, at a rate varyingfrom 2 to 7 minutes annually, in different localities. 5. You will find a concise statement
in Gillespie's " Land Surveying."

 makes a long detour down the slope leading to a valley;
the gage of the track is a feet; the ralls are about 25
feet long, and weigh some twelve pounds a foot; they are put together in the usual way, with two iron stra steam car has been running for a few days upon the finished portion of the line very successfully, making
hourly and half hourly trips. With a pressure of steam of 125 pounds to the inch, it passes these heavy grades
with forty passengers, without hesitation and with the speed of a brisk trot of a horse. When I first saw an illustrated description of the Baxter steam car in the Scientiric Amprican, I failed to comprehend how the exhauststeam from a small cylinder into a larger one
could add any power to an engine without condensation, andmy logic is still puzzled to make it out. But I suppose it ts one of those things whose merits cannot be got at short of practical test. Here is a steam car with two cylinders, the pistons of which are five and the same crank shaft in the usual locomotive style; and drives the eight inch piston with a force of pe haps 15 pounds to the square inch. Does not this 15
pounds react upon the five inch piston and detract from its effect nearly an equal amount? Is it possible that a partial vacuum is created in the larger cylinder or in the exhaust passage beyond by the momentum of ths
passing steam, after the manner of the Gifford injector? passing steam, after the manner of the Gifford injectorts
Answer: The pressure upon the large piston reacts Answer: The pressure upon the large piston reacts
upon the small one, as you suppose, creating back pressure; but as the ares of the second piston is the
greatest, the effective pressure, which equals total pressure minus back pressure, is available for purposes R. F. asks: How are coiled springs, such as clock springs, tempered? Answer: First hardened
in oil, then ground and polished, and afterwards hammered.
A. P. says: I have a small cylinder boiler
made of five inch steam pipe 15 inchies long, which I use for running a small engine. I have a cast iron
plate that sits upon the stove with a hole large enough to permit one end of the boller to go in the fre about 4 inches. The boiler sits upright upon the stove; there is no flue in the boiler. There is a head screwed in each end. The steam pipe is near the top. The trouble
is that, when I raise steam and go to start the engine, the water rushes out ahead of the steam and it is some the before I can start the engine. I use but very little water, in order to get dry steam. Can you tell me of
any way to prevent this? Answer: Perhaps by placing adry
trouble.
T. H. N. asks: How shall I remove fleas Use what is known as dog soap, which contains a large
quantity of carbolic acid.
C. K. B. asks: 1 . What is the rule for findfor the common two flue boiler? 2. Who is publisher of Auchincloss's "Link and Valve Motions?" Answers :

1. Only an approximate rule can be given. Divide the heating surface in square feet by 15. 2. The book is
published by $D$. Van Nostrand.
A. R. says: 1. I have a small horizontal engine, $11 /$ inches bore $x 3 \frac{3}{3}$ inches stroke: what is its
power? It makes 150 revolutions per minute with 50 lbs. pressure. 2. What pressure would a boiler 8 inches diameter $x 10$ inches high, with flue in center two inches in diameter, made of 14 ounce copper, stand? Answers:
2. About of a horse power. 2. Between 30 and 40 lbs. per 1. About $\frac{1}{6}$ of a
square inch.

Minerals.-Specimens have been received from the following correspondents, and examined with the results stated.
G. W. E.-This ore contains too much sulphur to be
available as an iron ore. vailable as an iron ore
C.P. H.-The stone enclosed is common quartz, of no
value. value.
S. H.-The ore you send is iron pyrites. To determi
the presence and amount of silver in it will cost $\$ 10$.

## COMMUNICATIONS RECEIVED

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects :
On a Small, Fast Steamer. By J. G. X
On Tidal Retardation. By E. F
On Cumberland Gap Cave. By H. B. N.
On Retardation of the Earth. By J. T. H On Gravitation. By S. J. W. On Snake Bites. By J. H. H.
On Catching Rats, etc. By A. F.
On Boiler Explosions. By R. S. H
On Water as Fiel. Ry H. O. I
On Economical Steam Engines. By J.W. H On Jumping from Railway Trains. By J. E. M.

Also enquiries from the following J. J. B.-D. M. S.-W. E.-T. A.-Z.Z. Z.-W.C. L.-
E. K.-C. S.-W. G.D.-G. E. B.- A. T.-F. R. T.-
J. B.-E. J. R.-S. Z.M.

## Correspondents who write toask the eddress of certain manufacturers, or where specified articles are to be had,

 manufacturers, or where specified artcles are to be had,also those naving goods for sale, or who want to find also those having goods for sale, or who want to find
nartners, should send with their communicatoons an amountsufficient to cover the cost of publication under the head of "Busness and Personal," which is specially devoted to such enautries
Correspondents in differ
Where steel bars, used in lieu of church bells, can be obtained? Where can a standard shape for teeth for gears be had? Where can a sewing machine, that
makes stitches alikeon botn sides, be bought? Which makes stitches alike on botn sides, be bought? Which
is the best apple parer, corer and slicer? Where are head blocks for circular saw mills made? Which is the best machine for boring logs lengthwise. for tubing, etc.? Where can I get a carpenter's gage? Who makes machines for turning spindles for wagon backs?
Where can I get a waterwheel tested? Who makes rubber balls and pins for ten pin alleys? Where are toy rubber balloons manufactured? Makers of the by advertising, in reply, in the SoIENTFFIC AMERICAN

## Index of Inventions



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 WERE GRANTED FOR THE WEEK ENDING August 5, 1873,nd each bearing that date
[Those marked (r) are reissued patents.]
Alloy, H. W. Wright
Animal poke J, etc., H. W. Wright
Axles, securing wheels
Bale band stretcher, F. M. Logu
Bale tie, cotton, w. Crone
Bark, mae
Bee hive, D. Latcha
Belt gearing, idler for, Bell \& Hillerick
Belting, making rubber, Gately \& Forsyth Billiard cue, H. Plates, (
Blind slat operator, B. J. Williams Blind stiles, machine for boring, A. B. Carlin.. Boat, life, W.A. Vall. .
Bobbins, machine for winding, J. Goodyear
Boot and shoe ent, wash, E. Davis.
Boot and shoe tree and stretcher, T. R. Evans Box, match, A. Meyersberg...........
Box scraper, C., G. W. \& J.D. Ellis.
Box, spice, J. Sears........
Brick machnne, Irwin \& La
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Buckle, trace, J. Kennedy
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Burner, gas, J. W. Averill.
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Damper and ventilator, J.............
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Seed sower, fertilizer, H. Springer
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Stove grate, coal, S. G. Morrison..
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Water mains, stop gate for, D. C. Cre
Window fastener, Hawthorn \&
Window screen and shutter, B. J. Williams (r)...
Wool on belts, cleaning, J. M. Brown
Wrench, s. W. Wakefield............
APPLICATIO TS FOR EXTENSIONS.
Applications have buen duly filed, and are now pending
for the extension of the foilowing Letters Patent. Hear
ings upon the respective applications are appointed for
the days hereinafter mentioned:
26,028.-GAs.-L.D. Gale. October 22.
$26,030 .-G A S .-L . D . G a l e . ~ O c t o b e r ~$
22.


EXTENSIONS GRANTED.
25,005.-GOVERNOR VALVE.-B. Fitts.
25,014--WOODEN WARE CUTTER.-G. R. Hay.
25,036.-YOSTMARKING STAMP.-M. P. Norton.
25,070.-ROOF FOR RALLWAY CARS.-A. P. Winslow,
$25,235 .-$ MANUFACTURE OF IRON.-B. Lauth.
DESIGNS PA'TENTED
6,791.-Collar Box.-R. W. Betts. New Yo
6,792.-Nubia--H. Boot, Philadelphia, Pa.
6,793\& 6,994.-Boas.-G. H. PrIndle, Philad
6,795.-SIGN.-H. B. Titus, Brooklyn, N. Y.
TRADE MARKS REGISTERED
1,393.- WHISEY.-J. E. Cassiay, Boston, Mass.
1,394.-MEDICINE.-S. De Grath, Jersey City, N. J.
1,395.-GUANo.-B. M. Rhodes \& Co., Baltimore M
1,395.-GUANo.-B. M. Rhodes \& Co., Baltimore, Md.
1,396.-FERTILIzERs.-O. Wittichen, Haymarket, Va.
1,397 to $1,399 .-$ Steam Packing.-Silver I.ake Co., Ne
tonville, Mass.
1,400-BRAIDED Co
1,400 - Bradded Cords.-Silver Lake Co., New
Mass.
SCHEDULE OF PATENT FEEs:



## Practical Hints to Inventors

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 $=4=2$ $=2=5$ well. The names of Blanchard, Morse, Bige-
low, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense for-
tunes from their inventions, are well unes from their inventions, are well known. na there are thousands of others who themselves of the services of MUNN \& Co. during the TWENTY-SIX years they have acted as solicitors and
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Patent Office: men capabe of rendering the best service to the inventor, from the experience placucally obtained Co. to do everything appertaining to patents better
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a complete application for a patent to the Commissione of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various
official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are jenerally without success. After great perplezity and
delay, he is usually glad to seek the aid of persons rienced in patent busmess, and have all the work done
over again. The best plan is to solicit proper advice at over again. The best plan is to solicit proper advice at
the beginning. If the parties consulted are honorabte the beginning. If the parties consulted are honorab1e
men, the inventor may safely confide his ideas to them:
they will advise whether the they will advise whether the improvement is probably
patentable, and will give him all the directions needful
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model, make as good a pen and ink sketch of the im. provement as possible and send by mail. An answer as
to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search
made at the Patent Office; such a measure often saves

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is made with great care, among the models and patents is made with great care, among the models and patenent
at Washington, to ascertain whether the improvement presented is patentabl

## Caveats

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with nse of water. c.D. PAGE. Patentee.Rochester.

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heavy Machinery
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tected by symerous patents Issued to Horace C. Jones
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## TIIITITraswiog <br> THE Union Iron Mills, Pittsburgh, P








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