

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

## EDISON DYNAMO AND MOTOR.

The Scientific American has repeatedly given detailed descriptions of small dynamos and electric motors copiously illustrated with first class engravings. These articles have enabled many mechanics and amateurs to construct machines which have proved more or less satisfactory which have proved more or less satisfactory,
according as the work has been well or poorly accord
It is one thing to make a dynamo or inotor from explicit instructions and quite another thing to design a machine adapted to generate or be operated by a particular current. The former is purely mechanical and within the range of most wachinists and amateurs, while the latter is entirely within the province of the electrical engineer or electrician. When the work of machine building proceeds simultaneously with the study of fundamental principles, real progress is made. For the benefit of those who proceed in this way, For the benefit of those who proceed in this way,
and in answer to many jnquirers, we give a detailed description of an Edison .25 kilowatt machine, designed for use as a dynamo for supplying a current for five Edison standard lamps, or for use on the Edison circuit as a quarter horse power wotor.
Before beginning the description of the machine it is but fair to say that it is thoroughly well made in every particular. The insulation in every part is very perfect, and the whole is so well made that any single machine built by a mechanic or amateur could but suffer by comparison with it; and furthermore, we doubt if any maker of a single machine could even purchase the materials required for the price asked for the machine by the regular manufacturers. Therefore, if the marhine is wanted, we advise a purchase. If experience is wanted, the making of the machine comes first in order, with a probable purchase to follow.
The engravings are one-third the actual size, linear measurement.
The base, which is of brass, is made hollow, as shown. It is 14 in . long, $73 / 8$ in. wide, $13 / 4$ in. deep at the ends, with two $11 / 8$ in. elevations at the middle for receiving the cast iron pole pieces of the field wagnet, which are each secured to the base by two small tap bolts extend. ing upwardly through the base and into the pole pieces.
The upper surfaces of the pole pieces are truly faced for receiving the cylindrical field magnet cores, which are made of Swedish iron, $25 / 8 \mathrm{in}$. in diameter and $41 / 2 \mathrm{in}$. long. These and $41 / 2 \mathrm{in}$. long. These magnet cores are each held in position by a threaded stud screwed into the pole piece and entering magnet core. Each core is provided with a vulcanized fiber collar at each end, which is $1 / 4 \mathrm{in}$. thick and $7 / 8 \mathrm{in}$. wide. Upon each core, and between the fiber collars, is wound $51 / 4 \mathrm{lb}$. of No. 24 silk. wound $1 / 4 \mathrm{lb}$. of No. 24 sikscovered copper wire, with a wrapping of thin varnished paper between the layers. The cores, before winding, are thoroughly insulated with the same material. The fiber collars are each held in place by three conical-headed screws entering the end of screws entering the end of the core, with their heads projecting beyond the
body of the core. To the body of the core. To the
inner and outer ends of the winding of each arm of the wagnet are attached pieces

side view of field magnet, partly in section.
of larger wire to avoid breakage, and the inner ends are led out through grooves in the fiber collars. The yoke, of Swedish iron, is $25 / 8 \mathrm{in}$. wide, $21 / 8 \mathrm{in}$. thick and $71 / 2 \mathrm{in}$. long. It is held in position on the cores by two $1 / 2 \mathrm{in}$. bronze studs, each threaded at the upper and lower ends, and furnished with a collar which fits into the counterbored part of the hole in the yoke. The studs are squared at the upper end to receive a wrench, and a nut is placed on each stud above the yoke for clamping it securely after adjustment. The machine is regulated or adapted to any work requiring less than its full power by raising the yoke more or less. The yoke is provided with an eye, by means of which the machine may be lifted. Front and rear boards of mahogany are arranged on opposite sides of the yoke, and held in place by brass plates at the ends.

The outside ends of the field magnet coils are connected with binding posts on the rear board.

A variable resistance of ten or fifteen ohms is inserted between these posts when the machine is used as a dynamo. In the front board, at the right hand side, is secured a bronze casting known as the right hand motor head field magnet terminal. This is adapted to receive the line wire, also one of the leads, the upper end of which is screwed to the casting. The lower end of the lead is secured to a lead terminal attached to a block of wood secured to the right hand pole piece. At the right hand side of the machine a similar arrangement of the lead is found, but the upper lead terminal is made in two separate parts, one attached to the lead, the other being connected with the line; both being furnished with copper switch tongues. The switch arm turns on a stud projecting from the front board and carries a loose triangular switch plate of copper, having a knife edge which readily enters between the switch tongues. The switch has a T-handle of hard rubber, by means of which it is turned. A stop pin projecting from the front board limits the rearward movement of the switch arm.
The inside end of the right magnet coil is connected with the right hand lead, and the inside end of the left hand magnet coil is connected with the lower half of the left hand lead terminal
At opposite ends of the base there are plane sur faces to which are secured the self-oiling bearings of the armature shaft. Each bearing has a hollow standard furnished with a cap, which, together with a cross piece in the hollow standard, forms a support for the spherical central portion of the bronze sleeve forming the journal box proper.
This sleeve is shorter than the outer portion of the bearing, and is slotted across the top to allow two brass rings to ride upon the armature shaft. These rings dip in the oil These rings dip in the onl
in the hollow standard, in the hollow standard,
and as they revolve carry oil to the shaft in quantities more than sufficient for the purpose of lubrication. The oil is distributed throughout the bearing by means of spiral grooves formed in the inner sur formed in inner sur face of the journal box The surplus oil drops back into the hollow standard A screw plug in the lower portion of the standard (Continued on page 54.)

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ingor Russian patitum IX. MECHANICAL ENGINEERING-IMMroved Helix Forming









## salt packing-a $\$ 4,000$ Prize contest.

The governwent of Netherlands-India has offere the above prize to be a warded in competition as to the best method of packing salt. The salt works, which are run by the government, produce solar salt. This it dries out and loses its hygroscopic slements in great part. It is, however, still inclined to absorb water, to become moist, and to liquefy. The conditions to be filled in packing are : 1st. The package must be proof against the action of the salt, and must not soil it or impart taste or odor. 2d. The package must preserve the salt at least two years. 3d. The package or box must close in a practical and effective manner, and be impossible of opening without certain detection. The salt once packed wust be free from danger of melting. Each box must hold one kilogramme, and it must be possible to fill them accurately with this weight with out weighing. The small boxes are to be packed in larger cases. The packing in 5, 10 and 25 kilogramme larger cases. The packing in
For full particulars of this competition, which i open to all the world, the Consul General of th Netherlands, New York, N. Y., should be addressed. The competition closes at the Hague, September 1 1891.

## THE EDISON ELECTRIC LAMP PATENT SUSTAINED.

On July 14, 1881, Judge Wallace, of the United States Circuit Court, handed down his decision and opinion in the celebrated suit brought by the Edison Electric
Light Company against the United States Electric Light Company against the United States Electric Light Company. The suit was brought to establish the scope of true claims of the Edison patent, No. 223,898, of January 27, 1880. Without going into details, it is enough to say that the object was to establish the va lidity of a basic patent in electric lighting, and one which would include as tributary to its claims all the practical incandescent lamps now in use.
The contention of the plaintiff was that every incandescent lamp for electric lighting consisting essentially of a filamentary carbon burner hermetically sealed in a glass vacuum chamber is within the terms of the patent. The first and second claims are the only ones involved In his opinion Judge Wallace rose very extensively into the merits of the case, reviewing the prior state of the art and endeavoring specifically to state what problem the inventor had addressed himself to solve, and the sufficiency of his description of his in vention for the capacity of those to whow it was ad dressed. At that time the Judge states that Mr. Lane Fox, iu England, and Mr. Edison, of this country, were almost the only ones who believed that the subdivision of electric light might be effected by incandescen lamps of high resistance and small radiating surface, arranged in multiple arc. In those days electricians knew how to make high resistance conductors and how to vary their resistanse, but what was wanting was the knowledge of how to construct a amp
mechanical strength and durability, possessing a small radiating surface and high resistance. The Judge cites the Sawyer Mann lamp and the other old-time burners, but finds that prior to Mr. Edison's French and Eng lish patent, in 1879, no attempt had been made to form the vacuum chamber wholly of glass, with all parts sealed together by fusing. The description of novelty Judge. It includes a carbon filament or wire of high resistance connected to platinum wires and sealed in an exhausted glass bulb. The first claim is for a fila mentary carbon of high resistance secured to metallic wires, as set forth. This the Judge concludes to be re stricted to a connection between platinum and carbon filament by a specific method described in the patent and hence not to be infringed by the defendant's struc ture.
But the second claim was awarded the fullest possible scope. It is for the combination of a carbon filament with a receiver made entirely of glass, and conductors passing through the glass, and from which receiver the air is exhausted. It will be readily seen that this covers the typical incandescent lamp of the present day. The the typical incandescent lamp of the present what was a radically new discovery: that it is possible to make a stable, extremely high resistance wire adapted for use in giving light when sealed up in an exhausted glass globe. In the Judge's words:

He (Edison) was the first to make a carbon of mate rials and by a process which was especially designed to impart high specific resistance to it; the first to make a carbon in the special form for the special purpose of imparting to it high total resistance; and the first to combine such a burner with the necessary adjunct of lamp construction to prevent its disintegration and
give it sufficiently long life. By doing those things he made a lamp which was practically operative and suc cessful, the embryo of the best lamps now in commer cial use, and but for which the subdivision of the electric light by incandescence would still be nothing but the ignis fatuus which it was proclaimed to be in 1879 by some of the learned experts who are now wit not rise to the dignity of an invention."

The Judge's reference to those whom he terms "the earned experts" will be appreciated by the reader.
One good point brought out in the subsequent part of the opinion is that an inventor is entitled to al hat his claim covers, independent of what he or his solicitor may have thought about the meaning of the claim. The Judge says

There are many adjudicated cases in which it appears that the inventor builded better than he knew; where a patent has been sustained for an invention the full significance of which was not appreciated by he inventor when it was made. In the case of the Bell telephone patent there was great room for doubt whether the speaking telephone had been thought of by Mr. Bell when he filed his application for a patent but the Court said: 'It describes apparatus which was an articulating telephone, whether Bell knew it or oot.' 88 Blatch., 532. ."
The nearest approximations to the invention, ac cording to the opinion, were the ribbon-shaped carbon burner of low resistance of Mr. Farmer, never suf ficiently used to constitute public use, and the low re sistance carbon rod burners of Sawyer and Mann The Judge states that it is impossible to resist the conclusion that the invention of the slender thread or carbon as a substitute for the burners previously known opened the path to the practical subdivision of the electric light. This conclusion, cowing near the end of the opinion, emphasizes the Judge's opinion as to the invertion involved in the carbon filament as contrasted with a rod or large conductor of carbon.
The amount of money involved in the suit is very large upon its face. The accounting alone, indepen dent of the future six years' income, would be very large. In one sense the decision and accompanying opinion will be welcome as indicating a liberal and not too technical construction of the claim of a patent.

## An Artificial Railway Valley.

The tracks of the Harlew Railway, where they pass through the city of New York, traverse a dense popu ation. The distance from the northerly boundary o the city to the Grand Central Depot, at Forty-second Street, is something over twelve miles. There are four tracks. These carry the traffic of the Harlem, the New York Central, and the New York, New Haven, and Hartford lines. The increase of population has ren dered it necessary, as a measure of safety at street crossings, to lower the grade of the tracks and raise the grade of the streets at the crossings. This work, which has been in progress for several years past, has lately been completed. The masonry is very massive and substantial. The cost has been very great-some six millions of dollars in all. Going north from Forty second Street, there are tunnels for nearly two miles Beyond these a one mile viaduct and then an open cut or as it might be termed a deep groove, the sides of which are lined with granite walls. Bridges are pro vided at all the street crossings. The approach to New York is not very attractive to the traveler. Looking up ward from the narrow valley in which he is inclosed, he sees the windows in the upper stories of the high buildings that line the railway avenue. The lateral view from the car is simply a solid rampart of stone. Ten miles of this sort of sight seeing is rather monoto nous, although the distance is run in from fifteen to twenty minutes.

## Test for Olive oils and Seed olls.

For the discrimination of olive oils and other oils liable to be used for adulteration, R. Brulle applies nitrate of silver in the following manner : 25 parts of sil ver nitrate are dissolved in 1,000 parts of 95 per cent alcohol, and 5 c . c. of this solution are added to about $12 \mathrm{c} . \mathrm{c}$. of the oil under examination, which should be filtered if not quite clear, then the test tube is heated in boiling water, and the effect observed.

Kind of oil.
Virgin olive oil
gin boiling water
ve oil of second and third pres-
sures, containing some olive
kernel oil............
Darkens slightly, quickly changing

inferior quality, strongSame as previous oil, bat takes | ina |
| :---: |
| Black. |

Cotton seed oill, pure................ Black.
Earth nut oil.............
Brownsh red, greenish as it loses in transparency.
Drk reddish bro

## Se

Rape seed oil Dark reddish brown, not changing to green.
Poppy seed oil........................ Same as preceding.
R. Brulle states that with practice it is possible to determine in many cases thus colorimetrically 5 to 10 per cent of one of these oils in a mixture.
In the same way natural butter, which gives no change, may be distinguished from artificial butter the latter, owing to the presence of margarine, acquir ing a brick red color, and the proportions in a mixture may be approximately determined.-Compt. Rend.
N. W. Afer \& Son, the Philadelphia advertising agents, use the following appropriate line for their motto: "Keeping everlastingly at it brings success."

## Irrigating arid Lands in the west.

The many thousands of square miles of land in the western half of the United States which can be profitably cultivated only with the aid of some system of irrigation are now becoming more and more each year the subject of careful investigation, both by the government and by private parties. So much of the readily available and ordinarily good farm lands of the public domain has already been taken up that prospectors in almost every section are finding their choice limited to making a selection in some place where wore or less irrigation will be a necessity, with the promise of a good reward therefor, or the acceptance of a location where the disadvantages more than outweigh the want of a sufficient amount of water. The wonderfully productive lands of Southern California, where the rich soil is of such depth as to be deemed practically inexhaustible, and the climate is such that two and even three crops can be raised in a year, have been made available almost exclusively by irrigation, and there is no doubt that, over a large portion of the lands now arid, it needs but the efficient conservation and distribution of water flowing from adjacent mountain ranges to create areas of the highest productiveness.
With the view of promoting intelligent work on a general system, this matter has formed the subject of extended investigations by the United States Geological Survey, although it is not proposed that the government shall undertake to carry out irrigation projects at the public expense, further than by the allotwent of lands which may be benefited thereby to the State governments making such improvements. A recent bulletin of the census office also gives details of what has been effected in the way of irrigation in Utah, where the system was first generally applied and has been longest in operation. In that Territorv there was last year in crop an irrigated acreage of 263 ,473, about nine-tenths of the farms in the Territory depending upon irrigation in the cultivation of at least a portion of their land, the remaining tenth being either stock ranches or farms where the climate is less arid.
The average first cost of bringing the water to land in Utah is placed at $\$ 10.55$ per acre, considerably greater than has been the case in most other localities, as the canals and ditches were generally laid out and made by farmers, without the use of surveying instruments, necessitating many subsequent changes. In some cases, however, the cost was below fifty cents an acre. In addition, a certain amount must be expended each year in maintaining the main ditches, cleaning out sediment, and often in renewing the dams and head works, this cost ranging from twenty-five cents up to three dollars an acre, the average being ninety-one cents. The average value of the products on small irrigated farms in 1889 was $\$ 19$ per acre. It is estimated that the cost of preparing wild land for cultivation, including plowing, grubbing, cutting brush, fencing and leveling, averages $\$ 14.85$ per acre; adding to this the Government rate of $\$ 1.25$ per acre, and the first cost of $\$ 10.55$ per acre for the water right, the entire cost to the farmer averages $\$ 26.65$ per acre. In comparison with this, the estimated present value of the farms of the Territory, including buildings, fences and other improvements, is placed at an average of $\$ 84.25$ per acre, showing an apparent profit, less cost of buildings, of $\$ 57.60$ per acre.
From the main canals or large ditches the water is conducted to the farms by small laterals, and is commonly distributed in three ways-by flooding, by furrows, and by markings. Hay and other forage crops are flooded, the water being allowed to enter the field at its highest point, and find its way if possible in a thin sheet over the whole field. This method requires the greatest amount of water, and cannot always be used on ac count of the tendency of some soils to bake and form a hard crust. Potatoes, corn, vegetables, and all plants growing in hills or rows are irrigated by furrows, the water flowing therein gradually moistening the ground on either side. Grain is sometimes watered by flooding, but generally by marking off the ground, after the grain is planted the fields being sometimes rolled with a roller having annular projections, which make small grooves in the surface of the ground in such direction that there is a constant and gradual flow from one end to the other.
The use of flowing wells for the irrigation of gar dens, orchards, and vineyards, and for domestic sup ply and watering stock, is also a feature of some im portance in Utah. There are 2,524 of these wells, of which the census enumerators obtained particular $1451 / 2$ feet, and their cost $\$ 77.60$ each, or 53 cents per $1451 / 2$ feet, and their cost $\$ 77.60$ each, or 53 cents per
foot. Their average diameter was about 2 inches, the foot. Their average diameter was about 2 inche
flow of water averaging 26.37 gallons per minute.
The carrying out of any general scheme of irrigation necessarily involves considerations which have had but little influence thus far in Utah, where there is already more land under cultivation than there is water available to mature the crops in all years. Some large reservoir sites have been examined and segre gated by the Government Geological Survey, with
the view to most efficiently and at'a moderate expense impounding the flow from elevated areas, the water thus collected to be supplied to large sections by a series of canals on different levels. Considerable work of this kind has already been carried out in California, where the returns generally show ample profit on the outlay, but the large areas of the country which invite this method of cultivation, with abundant promise of yielding large results, have hardly as yet been touched. For this task, simple farmers' ditches are totally inadequate, but competent engineering skill must be called upon to collect and distribute a material proportion of the immense supplies of hitherto unused water often coursing in destructive floods from our great Western mountain system.

## The Belgian Firearms Industry.

In the course of a report on the trade of Belgiuin in 1890, Consul-General De Courcy-Perry remarks that the most important industry of Liege is the manufacture of firear:ns. There are over 180 guninakers in the town alone, and in the district the industry gives employment to more than 40,000 workmen. The peculiarity of the Liege gun making is that there are hardly any manufactories, as we understand the term, the various component parts of the firearms being made by the workmen at their own homes and brought in ready-made to the gunmaker, who thus merely requires premises for finishing and storing the arms. It will be at once seen how the economy realized by no extensive plant nor costly workshops being required enables the Liege maker to compete favorably with the manufacturers in, in this respect, less favored countries. The Liege proof house, which is a government iustitu tion, is the oldest and by far the largestin Europe, and probably in the world, and has lately been greatly en larged and improved. Every firearm manufactured in Belgium has to be proved at the Liege proof-house before it is allowed to be sold (with the exception of certain arms that are allowed to be sent to a recognized proof-house, to Birmingham, for instance, to be proved), and the proofmaster, in addition to his ordinary duties, is specially delegated by the government to inspect and control all firearms made in the king dom, with the exception of the military rifles made at the government factories, which do not pass the Liege proof-house. Every double-barreled rifle and shotgun has to be proved three times. First, each barrel separately; secondly, the two barrels when soldered together; and, finally, after the breech-action has been attached; and the charge of powder employed is considerably more powerful than that used at other proofhouses.
One of the great advantages arising from this triple proof is that each class of workmen has a direct incen tive to only turn out, or accept, really reliable material for no one who has worked upon the gun is paid for his labor unless the arm passes the three proofs satisfactorily. Thus, if the barrels burst at the first proof (viz., that of each barrel separately), the barrel maker loses the cost of his labor and material, for he is obliged to replace the burst barrels without any indemnity Should the barrels burst at the second proof, it is not the barrel maker alone who suffers, but the solderer as well, who also loses the price of his labor, because he had not examined the pair of barrels carefully enough before working on them. If the gun bursts at the third proof, all those who have worked upon the gun, from the barrel maker upward, lose the benefit of their labor; and thus, as I have said, each class of workmen has a direct personal incentive to turn out a really reliable gun. Revolvers are only proved once, but each portion of the pistol is subjected to a rigorous exam nation, and any defective arm is at once rejected.
There are in Europe five proof-houses, viz., Birming ham, London; St. Etienne, in France; Fellah, in Aus ria; and Liege; but none of the others can at al compare in importance with the last, which consumes annually from $3,000,000$ to $4,000,000$ cartridges and ove 40 tons of gunpowder.
Liege exported in 1889 firearms to the value of 24,440l., being 233,944l. in excess of the amount of those exported the previous year; and the importance of the Liege gun trade, as compared with that of England and France, will be apparent from the following table of comparison of the arms proved at Liege, Birming ham, and St. Etienne respectively :

FIREARMS PROVED IN 1889.

| Firearms. | Liege. | Birmingham. | St. Etienne. |
| :--- | :---: | :---: | :---: |
|  |  |  |  |

It will thus be seen that the firearms proved at Liege amount to more than douiole those proved at Birm-
ingham, and to nearly double those of Birmingham and St. Etienne together ; and I anticipate, so great has been the increase during the past year, that when the figures are published, the firearms proved at Liege during 1890 will be found to amount to over $2,000,000$.

## PHOTOGRAPHIC NOTES.

Improvements in the Soda Developer.-A number of experiments conducted by the editor of the British Journal of Photography show that the addition of chloride of ammonia to the ordinary carbonate of soda and pyro developer will prevent the yellow staining of the negative, in fact acts as a substitute for sodium sulphite. The strength of the carbonate of soda solution is 15 grains to each ounce of water, even 12 grains to the ounce will do, to which is added 4 grains of chloride of ammonia. In mixing the developer a few minims of this solution, say 20 minims to 2 ounces of a pyro or eikonogen solution, will be suff cient, or more may be added to hasten development if needed. In some cases, it is advisable to add a hialf grain to the ounce of bromide of ammonium.
It is said to work well in connection with hydro quinone, but sulphite of soda should be present to pre vent a slight yellow stain that is liable to occur.
Another modification is the use of caustic soda or potash.
The developer as applied to the plate is prepared as follows:

Caustic soda............................................... 6 "
Caustic potash..
Chloride
Water...

To each ounce of solution one grain of bromide of aminonium should be added.
A Few Improved Developers.-From the British Journal of Photography we take the following formulas The Paramidophenol Developer, recommended as being energetic, keeps well and does not stain the film, introduced by A. \& L. Lumiere.


The latter form is preferred. The developer is on he eikonogen order
Mixed Eikonogen and Hydroquinone Developer.M. Angerer, after numerous experiments, suggests the following proportions as giving excellent results :

Solution A.
Water..
Sodium sulph
Hydroquinone


Solution B.
Water
... ...................................................... 250 parts.

For use mix one part of solution $B$ with five parts of solution A. If over-exposure is suspected, use less of B. Negatives of any desired density can be had with his developer, made on fast plates.
Direct Platinotype Printing Process.-Invented by Herr Wischeropp. The main point is to use a chemically pure solution of an iron salt, and to dry it on the paper so quickly that it cannot penetrate to any appreciable depth. To effect this, the paper is hung up to dry in a box at a temperature of $56^{\circ} \mathrm{C}$. for two minutes. The solutions employed are :

## A.

Sodium ferrous oxalate..
Sodium oxalate three
......................................
B.

Distilled water.
.....
100
0.1

Distilled water. $\qquad$
In A, the solutions which Pizzighelli keeps separate e combined and the useless glycerine omitted. Solution A requires to be renewed frequently, but B will keep for any length of time. To produce a good effect, the paper, after having been dried, should be kept in the dark room for some time. The more quickly the printing is done, the better the tones obtained.

## Danger of Poisoned Fish.

The Lancet contains a warning against the use of iced fish. Ice spoils the freshness, firmness, and flavor iced fish. Ice spoils the freshness, firmmess, and favor
of fish by rendering it, prior to putrefaction, insipid, soft, and flabby. Where fish is preserved on ice, it appears that the ice only favors putrefaction by furnishing a constant supply of moisture, carrying with it the putrefactive bacteria derived from its unclean surroundings, so that this iced fish remains covered with fresh solutions of filth pregnant with putrefactive bacteria. On the other hand, keeping fish dry and cold can in no way favor putrefaction.

A Great Blast.
A great blast was to have taken place at Mr. P. Callanan's quarries, at South Bethlehem, N. Y., on June 16, but it failed, owing to imperfections in the electric wiring, and was a disappointment to thousands of people who had congregated to witness the explosion, and to many who expected to note some important results from the method employed in charging. The failure was due solely to the inefficiency of the electrician who had charge of the wiring, and the greatest sympathy was felt by all with Mr. Callanan, who had spared no pains nor expense to make the occasion successful and impressive.
The quarries are situated at an angle in the great limestone ridge which passes through this section. Previous excavation has given the quarry a very uniform face, crescent shaped, and about 400 feet long, with a perpendicular height of 100 feet. About 60 feet from the base of the cliff is a ledge or offset, so that the top of the cliff is set back some 20 feet. The blast holes were drilled on the ledge and at the top, being at an average distance of 13 feet back of the face. The holes were drilled to a depth of 26 feet, and were charged with from 30 to 60 pounds each of 75 per cent "miner's friend" dynamite. The entire charge amounted to 5,000 pounds of dynamite, divided between 132 holes. The circuit was connected with a dynamo situated in the crushing mill, close to the quarry. At 4 o'clock, in the presence of Governor Hill and his staff and about 5,000 spectators, Mr. Callanan's pretty daughter turned the switch, without result, as the wires were somewhere grounded. Mr. Callanan, however, succeeded in connecting up three sections of his blast, discharging them separately at intervals of 15 or 20 minutes by a hand battery.

At the second discharge the entire cliff, 300 feet long and 75 feet high, was seen to fall over to an angle of 45 degrees, and then drop, completely crumbled.

## The American Petroleum Industry.

Bulletin No. 76, on the production of petroleum, has been prepared by Mr. Jos. D. Weeks, special agent in charge of statistics relating to petroleum and natural gas, under the supervision of Dr. David T. Day, special agent in charge of the Division of Mines and Mining, of the Census Office. The statistics show that petroleum was produced in eleven States in 1889. The total pro duction is shown to be $34,820,306$ barrels, of 42 gallons each, valued at $\$ 26,554,052$, as follows :

|  | Barrels, |
| :---: | :---: |
| Pennsylvania and New York. | 21,486,403 |
| Ohio. | 12,471,965 |
| West Virginia | 358,269 |
| Colorado.. | 316,476 |
| California... ... | 147,027 |
| Indiana.. | 32,758 |
| Kentucky. | 5.400 |
| Illinois. | 1,460 |
| Kansas | 500 |
| Texas. | 48 |
|  | 34,820,306 |

Mr. Robert P. Porter, Superintendent of Census says that the returns show that of the total product of petroleum, 109,891 barrels were disposed of for lubricat ing, $12,330,813$ for fuel, and $22,379,602$ for illuminating purposes. Nearly the entire amount produced in Cali fornia, Indiana, and Ohio was used for fuel, while nearly the entire amount produced in Colorado, New York, Pennsylvania, and West Virginia was used for illuminating purposes.

## AN IMPROVED MORTISING MACHINE.

A portable machine especially adapted for mortis ing wall strings to receive the risers and treads of steps is shown in the accompanying ill ustration, and has been patented by Mr. Paul Swieter, of No. 24 Howard Street, Allegheny, Pa. Fig. 1 is a perspective view of the machine, Fig. 2 representing a vertical section through the carriage, while Fig. 3 shows the cutter detached. The base of the machine consists of two parallel angular sections, the members of which are at a right angle to each other, and each of which has a lower horizontal slotted flange, and also an undercut $T$ shaped recess. Opposite the angle of the outside section a segmental plate is secured by radial arms, the plate having a $T$ shaped undercut recess and a downwardly extending central iug through which a set screw passes. The members of the two sections are united by diagonally located connecting plates, by means of adjustable bolts extending up through the slots of the base flanges, whereby the width of space between the sections may be regulated, and in operation the base is attached to the wall string by bringing one side edge of the connecting plates against a face of the string piece and causing the set screw of the segmental plate to engage the other side edge. The carriage is adapted to travel in the space between the sections, and consists of a box-like casing, through which passes the feed screw, having a downward and outward extremity terminating in a horizontal foot, with a button at one end adapted to enter the undercut recess of the segmental plate. At one end of the casing is a vertical bracket, and in the bracket and an aperture in the end of the casing is the hub of a pin-
ion, the bore of the hub being threaded and the pinion turning upon the feed screw. On a shaft near the top of the casing is journaled a crown wheel meshing with the pinion, the shaft being rotated by a crank arm on each side, the crown wheel also, through connecting gears, operating the cutters, which re volve between the sides of the casing in its lower open face. The cutter head is made in two sections, one of which is nominally fixed and the other held to slide, producing a mortise cut of any desired width, or such adjustment may be made that the mortise will be wider at one end than it is at the other. When one mortise groove or channel has been completed, the position of the carriage is reversed, it being then placed

swieter's mortising machine.
at the other channel of the base, the foot of the feed screw being correspondingly adjusted in the segmental plate.

## IMPROVED MECHANICAL MIXER

In the preparation of many plastic materials, such as wall plaster, cements, paints and the like, nearly or quite as much depends upon the manner in which the materials are put together and mixed as upon the materials themselves. To secure perfect homogeneity in certain kinds of cements, a peculiar handling which


## THE IMPROVED BROUGHTON MIXER.

will insure a thorough mixture of all the ingredients is absolutely necessary
We give an engraving of a machine which is expressly designed for mixing patent wall plaster, but it is equally adapted for mixing other materials. The casing contains two shafts which rotate in opposite directions, and are provided with spirally arranged paddles which lift the material from the bottom of the casing and throw it in opposite, directions from one end of the case to the other, thus insuring a constant motion and obtaining a perfect mixture.
This machine, when set up for use, occupies a posi tion midway between two floors, with the hopper pro-
jecting through the floor above, and discharge spouts held at a convenient height for supporting the bags into which the material is discharged from the machine. The hopper is provided with a pair of iron doors which open downward to let the material into the mixing chamber. These doors are attached to shafts which are provided with worm wheels engaged by a worm which is readily operated by a hand wheel on the floor above at the side of the hopper.
After the material is mixed by the spirally arranged paddles, it is dropped into a receiving chamber below by means of sliding doors, which are furnished with snearing edges adapted to cut off anything of a fibrous nature which may be in the plaster, thus insuring a perfect closing of the doors. The receiving chamber is furnished with valves which control the discharge through the spouts to which the bags are attached.
The machine has a capacity of 200 barrels a day of ten hours, requiring only two men to work it, but its capacity can be increased by providing more laborers. No time is lost in operating the machine, for while one charge is being bagged, another is undergoing the operation of mixing, and at the same time the hopper above is being charged, so that really there are three charges in the machine at one time. The machine is arranged to run at a high speed; its shafts are journaled in boxes outside the casing, and stuffing boxes are provided for preventing the escape of the material around the shafts. 'The high speed and construction of paddles renders it a perfect mixer of hair and fiber with plaster
This machine is manufactured by Mr. W. D. Dunning, Syracuse, New York.

## Extraordinary Increase in the wheat Trade of Bombay

The Bombay papers received by the last mail describe the extraordinary export of wheat from that port during the past few weeks. The Times of India says that every warehouse near the docks and every available piece of open ground were occupied by towering tiers of bags filled with grain, awaiting the arrival of ships to take it away to other ports, where abnormal prices have been paid for it, and where its arrival is eagerly awaited.
In 1874 the total shipments of wheat from Bombay were 33,071 tons, while in 1886 the figures went up to 617,834 tons, this being the largest total shipped oup to the present year. But never since 1874, the year when the wheat trade practically began, have the receipts of wheat in Bombay been so large, or nearly so large, as in the first four months of the current year. They reached during that period the enormous total of 198,097 tons, as compared with 97,420 tons in the corresponding four months of the previous year, and 178,686 tons in the same period of 1886 . Steamers re presenting a total carrying capacity of between 350,000 tons and 400,000 tons were expected to load in Bombay in the course of the present month, and in spite of this large carrying accommodation it will be no easy matter to get the bags, or, at least, those that are not under cover, shipped before the rains. The receipts continue to be so great that as fast as the ground is cleared of one consignment it is occupied by another. The real cause of this unprecedented traffic is the damage sustained by the French wheat crop, which is likely to be about 25 per cent under the average. The traffic over the different railway systems terminating in Bombay has been gigantic during the past few months.
As recently as 1876 wheat was rotting in the Central Provinces, which is now regarded as the granary of India, on account of want of transport, but owing to the railway extensions carried out since that timethe through route to Calcutta being one of the most important-the number of growers has increased materially, and it is now worth their while to produce terially, and it is now worth their while to produce
grain extensively. The lines have been overcrowded with grain, the receipts in Bombay being so vast that the greatest difficulty is experienced in finding ware house accommodation for the hundreds of tons which are daily brought in from up country. Indeed, the competition for accommodation is so great that the rentals have gone up to more than 100 per cent beyond the ordinary charges. The price of labor and cost of carting have also increased.

## Preparation of Lubricants.

The soap formed by treating wool grease with alkaline lye is dissolved in water and filtered. To this a solution of alum or other alumina salt is added, whereby a brown precipitate is formed, which is called "alu-minum-lanolate." With this substance, when dried, lubricating oils of any viscosity may be produced by dissolving it in any fluid mineral oil. If dissolved in a small quantity of mineral oil, a gelatinous substance is obtained which may with advantage be mixed with India rubber or gutta-pereha. Solvents for India rubber are said to be also solvents for " aluminum-lanolate." In textile industries this substance may also be used as a scouring agent.-R. Krause, Wittenberg, be used
Prussia.

A WEIGHT POWER TO DRIVE FANS, ETC. The illustration represents a device of simple construction designed to be utilized in driving fans, sewing machines, small pumps, and other light machinery. It has been patented by Mr. Louis Dedel, of No. 245 Josephine Street, New Orleans, La. In the casing, A, is supported a drum, $C$, on a shaft, $D$, the shaft being connected with the drum by a ratchet mechanism, the ratchet wheel being engaged by a spring-pressed pawl when the drum turns in one direction, while the pawl passes over the teeth of the ratchet when the drum turns in the opposite direction. On the drum is wound a rope, $F$, extend ing up over a series of pulleys, $G$ on the ceiling, $H$, there being hung on the rope between adjacent pul leys a series of weights, I, the last of which, $I^{3}$, is attached to the free end of the rope. The weights slide along suitable guideways, $J^{1}$, ex tending from the ceiling to the floor and increase in size and weight in such manner that the last weight is sufficiently heavy to hold the other

dedel's weight power.
wax are not so white as from paraffin, and are only obtained at a higher temperature $\left(300^{\circ}-320^{\circ}\right)$. The sublimate gives a colored solution with chloroform and a colored and turbid solution with soda. The

1,200 feet long. It is made in sections 30 feet long, o just the length of a rail. Two drilled wells supply the water, which is pumped from water vaults or cistern over the wells into elevated tanks by the side of the rack. The tanks, of 35,000 gallons capacity each, ar fed by two Blake pumps. From the tanks pipesare carried down to the ground and underground to the track trough, entering it as shown in one of the cuts. There are four feeds for each trough. Part of the connections are of leather, to prevent breakage by jarring. Each opening in the bottom of the trough is 3 by 8 inches. The first pipe from the tanks is 12 inches in dia meter. To this two 8 inch pipes are connected, which run both ways for several hundred feet, eventu ally reducing to 4 inches in diame ter. When fully charged, 5 inches depth of water are run into the troughs.
A dipper or movable chute is carried by the locomotive tender. It is arranged so as to be raised o lowered at will by a lever. The general construction is shown in three weights in an uppermost position, the third paraffin on the contrary, gives separate grains in a the cut When lowered, it descends to within about weight in like manner holding up the other two, and clear field
the second weight holding up the first, each, however developing surplus power to actuate the drum. A series of gear wheels, $K$, connected with the drum shaft, actuate shaft, L, extending to the outside of the casing, this shaft carrying a puiley connected by a belt with the mechanism to be driven, in the illustration represented by a fan. On the outer end of the hub of the drum is a crank arm, $\mathrm{C}^{2}$, to wind up the east of Rahway, N. J. An iron trough is laid upon the to an uppermost position the position, the drum shaft then remaining motionless as $t h e$ pawl glides backward over the ratchet teeth. By using an additional set of weights, with proper connections, this powermaybe made to may be me to without interruption, one set of weights being wound up as the other runs down.

## Detection of Par-

 wax.A few grammes of the substance in fine air-dried shavings are gradually heated in a small porcelain capsule until fumes begin to rise. A half-liter wi a mouther bottle is then inbottled verted upon the capsule, and when filled with white vapors is closed and set aside until the fumes have condensed upon its walls. The sublimate is then dissolved in 3 c. c. of chloroform, the chloroform evaporated in a test tube, and the residue boiled with 4 c. c. of soda solution. If paraffin was present, it will, after cooling, be found floating on the clear solution. A drop of the chloroform solution may also be evaporated on a slip of glass and examined microscopically.
Thefumes from pure bees


SUPPLYING MOVING TRAINS WITH WATER
The system of taking water into locomotive tender water tanks without stopping the train has been quite extensively introduced upon some of the leading rail oads of this country. A good example is now in ope ast of Rahway, N.J. An iron trough is laid one mile eepers. It is 6 inches deep, 18 inches wide and about sleepers. It is 6 inches deep, 18 inches wide, and about A ing thrown and out of it
To take in wate the fireman low ers the dipper. As it meets the water in the tank, the latter is forced up in great volumes into the tender tank. From one trough two thou sand $t w o$ hun dred gallons can be taken in on passing. A water ing station is in stalled abou every forty miles Thus an engin can run continu ously as far as the coal can carry it on a road sup plied with these appliances.

Survey of the Pacifie Coast. After nineteen years the United States steamer Hassler has completed the survey of the California and Orego coasts. The Hass ler was built spe cially forthis work in 1871, and on her maiden trip around Cape Horn, Professor Agassiz made a series of deep-sea dredgings along the coast of North and South Ameri ca, with valuable results to science The most interest ing fact developed in the recent sur veys is that the coastline of Southern California is more ab rupt than that of any part of the Atlantic or other portion of the Pacific.

Electricity in Warfare.
Some interesting experiments have been made in the estuary of the Mersey to test the efficacy of submarine mines as defenses of the approaches to the port of Liverpool. For some days the Mersey Volunteer Di vision R.E., Major Montgomery commanding, de voted themselves to laying down "mines" in different spots, and the major, with a large party of officers and others interested, proceeded out in the war office steamer Lady Heathfield to see how these mines could be electrically exploded and note the effects. One wine (an iron box containing 100 pounds of gun cotton had been laid at a depth of 15 feet of water off rocks known as the "Red Noses," and was electrically connected with Perch Rock Battery, as weil as with a buoy 200 yards out in the stream. The steamer struck against this buoy, an electric bell immediately rang in the battery, and the mine was fired. This seemed to be practically instantaneous, and the result was that a rudely constructed raft placed over the mine was hurled up in fraginents to a great height, with a vast volume of water. It was easy to see what would have been the fate of a ship placed in the position of the raft especially if the iron box had contained a full charge of 500 pounds of gun cotton. Lesser mines were laid with relatively equal effects. A hundred mines are laid in the Mersey as port defenses

## The Mammoth Cave of Indiana

by H . c. hover.
Rummaging lately among the rare and curious books in the library of Colonel Durrett, I found proof that while Gen. W. H. Harrison was territorial governor he visited, in 1806, a remarkable excavation which he styled "The Maımoth Cave of Indiana." Later in the same year was discovered its fawous and only rival,
The Mamıoth Cave of Kentucky." But the Hoosier cave has plainly the prior right to the unique title, only it is now too late to make the assertion except as a matter of curious interest. The earliest published account appears in Martin's "Sketches of Louisville and its Environs" (1819), under the heading "The Mammoth Cave of Indiana." In Flint's Geography (1831), it is called the "Epsom Salts Cave," and in legal enactments in 1843 it is designated "The Indiana Salt peter Cave," a name now given to a smaller cave near
by. The name "W yandot Cave" does not seem to have been adopted until about 1848, being taken frow the adjacent Wyandot River, now known as the Blue River. At an early day the ground was pre-empted by Dr. B. Adams, who had saltpeter works here from 1812 to 1819 , whea, by his failure to pay the purchase money, it reverted to the United States. It was bought in 1820 by Mr. Henry P. Rothrock, who at a later date perfected his title, and by whose will it be comes, under certain conditions, the heritage of $\mathrm{Mr}_{\mathrm{r}}$ Frank Rothrock, his favorite grandson.
Frank Rothrock, with a comınendable desire to know as much as possible about his prospective domain, re cently organized an exploring party, including with himself three other sturdy lads named Ben Hains, Henry McClintick and Ira Rainbolt. What they style, in their narration placed at my disposal, " the unexplored regions," are not properly such, having been visited in 1860 by Messrs. Andrew and Washington Rothrock, together with two men named Miller and Langsdale. Miller gave out at a place called for that reason Miller's Reach. Andrew stopped at a spot known as Andrew's Retreat. Washington Rothrock and Mr. Langsdale went as far as Langsdale's Basin. But such are the difficulties and perils of the labyrinth that no one has ventured there since, until now, nor has any previous description of the region been published.
The general plan of the cave resembles a gigantic let ter $K$, including the main cave and the north and sonth arms. Twelve hours are required to traverse the sixteen miles ordinarily on exhibition. The so-called "unexplored regions" cover at least seven miles additional. They are entered from a place called the Ice House, because the gypsum-coated blocks of limestone resemble so many masses of ice. This is near the ter mination of the northern arm. The boys dived under a ledge but two feet above the floor, and burrowed through what resembled a great snow bank, though really a mass of sparkling crystals. In fifteen minutes they came to the Round R ?om, out from which ran several short branches, each ending in a mud bank. But through an orifice eight feet overhead, they entered a sort of second story, or in other words a cross
cave. For it should be understood that Wyandot Cave, instead of being a single excavation, is made up of numerous different caverns connected with each other by large or small openings. Going northward over cliffs, through crevices, and sliding along sharp ridges, the boys halted on the edge of a pit, which they contrived to cross by a kind of natural bridge, and went 300 yards further, finding many oulopholites and other ornate forms of alabaster. In a circular room, 10 feet high and 60 wide, were rewarkably fine helictites, as well as straight stalactites. Their explorations in this direction came to an end at a deep pit,
without appliances with which they were not furnish d at the time
On a subsequent trip they took along a rude ladder made from a cedar tree, the trunk of which was about three inches in diameter, the boughs being cut at a convenient length for climbing. This they dragged in by a rope as far as the Round Room, and used it as an easy means of gaining the "second story," where they left it with one end sticking through the hole in the floor, to play an iwportant part in their subsequent dventures.
Wriggling through an orifice, yet above them, and through narrow crevices in a rocky pile, they emerged into still a third story above the Round Roow, where the floor sloped up to the roof on every side. Thence, pursuing a remarkable wiuding passage, about five feet wide, twenty-five feet high, and a mile long the walls of which were coated with pure white ala section of which would resemble an hour glass. They were now directly under the main cave. Shortly they came to a long, sharp-edged rock, filling entirely the passage for fifty feet, along which they had to stride as if on horseback. This was "Rode Rock, No. 1." Then there was good walking for 200 yards, that took them to a swall orifice opening into yet another cross cave, called the Wild Cat Avenue, a large, low room, with a very muddy floor, on perhaps as low a level a any other spot in the whole cave. Beyond it is Maggie's Grotto, about thirty feet wide. Frow this they nade their way again into the main avenue they had eft for this transverse cave, and which bears the name f the Little Giant Avenue
And now they met with a novel difficulty, for the floor was cut by a series of pits that could be crossed only by bracing themselves against the opposite walls. Coming o a pit too wide to be managed in this way, the boy climbed to the top of the passage, and striding the chasm for half an hour, they finally descended from a rocky shelf to a beautiful stream flowing between nowy banks, called the Marble Rivulet. Along its banks grew many spongoidal forms, with slender necks, but that the explorers found too tough to be broken off by anything at hand. Ascending the Marble Hill they enjoyed a swooth sandy floor for 600 feet, wher they walked between creamy walls, curving in and out
in rounded lines. Then came a tiresome crawl, varied in rounded lines. Then came a tiresome crawl, varied occasionally by the cavern's suddenly folding in u pon itself in such a manner as to compel the poor boys to indeways and drag themselves around the sharpes ing Rode Rock, No. 2, they came to Langsdale's Basin a small pool in a room ten feet in diameter. This poo is very shallow and its bottom covered with a fine yel ow sediment. Imagine their emotions on seeing writ ten there by the finger, and seeming as fresh as if in scribed yesterday, the names of Rothrock and Langs dale, written in 1860, long before those now gazing on the inscriptions were born. What a proof of absolutely unchanged conditions for a whole generation! Of course the boys wrote their own names alongside to wait the advent of future visitors.
By an opening through the left hand wall, and down a steep clay bank, they next entered a spaciou ave, distinct from those they had been exploring Taking its right hand branch, they crawled over foor resembling frozen waves coated with bluish slime while the roof, iastead of rock, was crumbling clay, by which they feared that they might be buried alive unless they were careful. On reaching a cross trench whose slimy walls threatened to allow no escape for those who should get within their grasp, they were disgusted, and turned back, although tempted to search for the locality of an invisible cascade whose mournful music filled the air
By this time it was one o'clock A. M., the stock of candles was getting low, and the boys were weary They had made so many crooks and turns as to over tax their memory, and they decided to go out as ra-
pidly as possible. They made a few mistakes that were easily rectified, and all went smoothly enough until, beyond the Marble Rivulet, they began to work their tedious way through the top of the great hour glass crevice already referred to, supporting them selves by their elbows and knees. They thought themselves near Maggie's Grotto, and spent an hour and a half hunting the opening into it, not aware that they had really passed far above and beyond it. On they went painfully and by a most dangerous path, if a way could be called a path where their feet never touched ground for 400 yards. Presently the passage shrank to a width of six inches, and they could cordingly they tried going downward, with the terri ble certainty, however, that, in their exhausted con dition, they could never climb up again. Plainly they were lost, and that in a part of the cave where no mor tal had ever been before, and where no rescue party would ever find them. The walls closed in so fas around them that in their frantic efforts to descend the rift their coats were torn from their backs. Reach ing at length a hard clay floor, they soon entered a low room, the floor of which was stone. Still impressed
that their way of deliverance lay through some up ward passage, they tested every opening, but in vain At four A. M. the boys had but one candle apiece, and vere many miles from the safe outer world. Round and round they went, examining the walls of their prison house. Finally, in sheer desperation, they tried a pit that led them down to a lower room, from whose floor protruded, to their great surprise, the tip of their cedar ladder. They were in the "second story "of the round room, and two miles nearer the mouth of the ave than they had thought. In five minutes wore they were creeping through to the Ice House, whence husbanding their candles, they hurried down the Northern Arm, and emerged from the cave at $6 \mathrm{~A} . \mathrm{M}$. just in time for an early breakfast, for which their ong fast gave them a keen appetite. Like brave ex plorers they announce their intention of taking the ame trip again, with a better equipment, rope ladders, plenty of food, and a large supply of candles, in hope of reaching regions far beyond those already visited.

## SOME MEASUREMENTS IN THE MAMMOTH CAVE OF INDIANA

## by. c. hovey.

The localities named will all be found on the map as published by the Indiana State Geological Survey enth annual report, but the distances will be found quite different. I a.m indebted for them to wy friend and able assistant, Mr. Ben Hains, of New Albany, Ind., who vouches for their accuracy. The measure

ments as given are all from the entrance to the points named.

| th | ing Rocks.. | 440 | feet. |
| :---: | :---: | :---: | :---: |
| " | Scuttle. | 750 | * |
| * | Cut-off | 1,000 | " |
| * | Wolf's Lair, through the Cut-off. | 1,600 | " |
| 0 | Delta Island. | 1,450 | " |
| * | Foot of the Hill Difficulty. | .2,000 | " |
| 0 | Auger Hole. | 2,400 | " |
| " | Slippery Hill.. | .2,700 | " |
| " | Crawish Spring. | 4 | miles. |
|  | Pillar of the Constitution, aboat | 21/2 |  |

Total combined length of all exhibited portions of the cave, fully nine honest miles-commonly called sixteen miles. This does not include what are styled the unexplozed regions, supposed to be about seven miles more, making a grand total of sixteen actual miles of cavern passageway.

## Asbestos Manufacturers Consolidat

The H. W. Johns Manufacturing Company and the Chalmers-Spence Company, New York; the Asbestos Packing Company and Chas. W. Trainer \& Cowpany, Boston; and the Shields \& Brown Company of Chicago-the five largest asbestos manufacturers in the United States-have formed a corporation under the name of the H. W.Johns Manufacturing Company. They will control most of the output in their line of business. The officers of all the companies and their chief employes will remain with the new concern, which will thus have the advantages of their combined skill and experience. H. W. Johns is the president; R. H. Martin, formerly president of the ChalwersSpence Company, the new vice-president; C. H. Patrick, treasurer, and G. P. Erhard, secretary ; both of the last two named having previously been with the H. W. Johns Manufacturing Company.

The consolidation, which was effected July 1st, was made, it is stated, to reduce the cost of asbestos manufacture and to save other expenses. The company promise to give their customers the benefit of the econowy which will thus be practiced.

## Sorrespondence

## St. Joseph, Missouri. of the Scientific American

To the Editor of the Scientific American:
In your list of cities (see Scientific American of June 13) that are the centers of large populations within a square of fifty miles around them one city was omitted, which must rank next to, if it does not exceed, Pittsburg, and that is St. Joseph, Missouri. Within fifty miles of her is Kansas City, Mo., and•Kansas City, Kansas, and this brings the number considerably over six hundred thousand. South of Kansas City the country is not so populous as that around St. Joseph. Large as is this population around St. Joseph, no part of the country is increasing more rapidly. Oregon, Mo., June 23, $1891 . \quad$ Clarke Irvine

## Bursting of an Emery wheel.

To the Editor of the Scientific American:
There occurred a singular and fatal accident near here recently, in which a prominent and worthy farmer lost his life instantly. Mr. George B. Albertson, of Cook's Valley, was engaged in grinding sickle guards by steam power on an emery stone 12 inches in diameter and 1 inch thick, when the stone burst and a piece in shape like a quadrant, 6 inch radius, buried itself in his head, going down into his neck as far as the collar bone, killing him instantly. It took the combined strength of two men to remove the piece, as it was firmly bedded in his head and neck, nearly out of sight. After the accident the speed at which the stone was running was measured, and it was found to be over
8,000 revolutions per minute.
H. B. J. Wabasha, Minn., June 16, 189

## An Effective wash for Orange scale

To the Editor of the Scientific American:
I see in your paper of June 20 last an article headed "Condensed Information Concerning the Most Valuable Insecticides," from a circular issued by the United States Agricultural Department. The wash there given for San Jose scale (Aspidiotus perniciosus) has long since been abandoned here as not only comparatively worthless, but harmful to the tree, and for fear it might mislead some one I write you.
The horticultural board of this county (Tulare, Cal.) has brought out a wash which is now being used all over the State, and the formula is the following:

Sulphur
Lime...
Boil for two or three hours in 20 gallons of water un til the lime and sulphur have thoroughly united, then add lime enough to wake a thin white wash, adding water enough to make 60 gallons. Apply with spray pump warm, and all the scale will be killed and the tree will be invigorated. N. W. Motheral,

Hanford, Cal., June 25, 1891.
A Pest of Snails.
To the Editor of the Scientific American:
I desire information that will aid me in exterminat ing a species of mammoth snail from my premises. We have been afflicted with them about four years, in a little yard back of our dwelling, $40 \times 60$ feet, used for cultivating quite a variety of roses and other flowering plants, and have two thrifty grapevines trellised against the back walls.
These snails are found measuring from three to nearly six inches in length and half an inch in diameter. Their slimy iridescent tracks are numerous Their peregrinations are nocturnal. When I commenced to hunt them in the evening with a lamp, I used to secure sometimes one hundred at a time. diligently hunted them almost every night during the summers, with hopes of tiring them out. But as time is beginning to tire me out, and the snails hold their own with disgusting pertinacity, I no more waste steps.
Early in the spring they manifest their presence. Our grounds are kept clean and there are no damp or mouldy accumulations on our premises, but adjoining us, over the fence, are rank weeds and, I presume, som careless deposits of rubbish.
What I would particularly desire to know is a method of exterminating the pests-some alkali or astringent that could poison or destroy them on or in the ground. Suggestions and experiments have been utilized to the limit of knowledge, with no relief. If the Scientific American can offer any device to rid us of this afflic tion, we will bless it.

George C. Allis.
Birmingharu, Conn.. June 27, 1891
Reply by Professor C. V. Riley.-The slugs referred to by your correspondent are, from the description without much question, Limax flavus, a well-known pest in European gardens. At least this is the deter mination given me by Professor William H. Dall, our highest authority on these creatures, for a species which has, during the past three years, been repeatedly sent to me with accounts of its abundance and injuries.
They abound most in sheltered, shady, moist situations, and their numbers are easily reduced in our hot summers by avoiding all plank walks and by keeping
from the garden all decaying wood or other moist and shade-giving material. Dry, powdery substances, especially those which are pungent, like wood ashes, salt lime, etc., are antipathetic to and tend to destroy
them. Of these different substances lime is the best because the others are frequently exuviated with the skin. I am not aware just when this species was introduced from Europe, but it has been more than ordinarily cowmon on the Atlantic coast of late years, largely, I think, because of our unusually wet seasons.

## Detecting Forgeries on Paper.

Recently before the Belgian Academy of Medicine, Prof. G. Bruylants gave an account of the researches which, in co-operation with Prof. Leon Gody, he had insticuted with the view of illustrating how fraudsand alterations practiced on business papers can be detected. He said
Although wy experiments were not carried on under the most favorable circumstances, their results wer satisfactory. A piece of paper was handed to me for the purpose of deterwining if part of it had been un equally and greatly wet, and if another part of it had been manipulated for the purpose of erasing marks upon it; in other words, whether this part had been rubbed. The sample I had to work upon had already gone through several experiments. I had rewarked that the tint of paper exposed to the vapor of iodine differs from that which this same paper assumes when it has been wet first and dried atterward. In addition to this I realized that when sized and calendered paper first partially wet and then dried, is subjected to the action of iodine vapor, the parts which had been wet
take on a violet tint, while those which had not been take on a violet tint, while those which had not been intensity of the coloration naturally varied according to the length of time for which the paper was exposed to the iodine.
There is a very striking difference also when water is sprinkled over the paper, and the drops are left to dry off by themselves in order not to alter the surface of the paper, complete desiceation being produced at a temperature of $212^{\circ}$.
Thorough wetting of the paper will cause the sprinkled parts to turn a heavy violet blue color when exposed to the vapor, while the parts which were untouched by the water will become blue.
If, after sprinkling upon a piece of paper and evaporating the drops thereon, this piece of paper is first thoroughly wet, then dried and subjected to the thoroughly wet, then dried and subjected to the
action of iodine, the traces of the first drops will reaction of iodine, the traces of the first drops will re-
uain distinguishable whether the paper is dry or wet. In the latter case the traces of the first sprinkling will hardly be distinguishable so long as the moisture is not entirely got rid of, but as soon a.s complete dryness
is effected their outlines, although very faint, will show is effected their outlines, although very faint, will show
plainly on the darker ground surrounding the space covered by the first drops.
In this reaction water plays virtually the part of a sympathetic fluid, and tracing the characters with water on sized and calendered paper, the writing will water on sized and calendered paper, the writiog will
show perfectly plain when the paper is dried and exposed to the action of iodine vapor. The brownish violet shade on a yellowish ground will evolve to a dark blue on a light blue ground after wetting. These characters disappear immediately under the action of sulphurous acid, but will reappear after the first decoloration, provided the paper has not been wet and
the decoloration has been effected by the action of sulphurous acid gas.
This process, therefore, affords means for tracing characters which become legible and can be caused to disappear, but at will to reappear again, or which can be used for one time only and be canceled foreve afterward.
The usual method of verifying whether paper has been rubbed is to examine it as to its transparency If the erasure has been so great as to remove a considerable portion of the paper, the erased surface is of fected with care, examination close to a light will disclose it, the erased part being duller than the surrounding surface, because of the partial upheaval of the fibers.
If an erasure is effected by means of bread crumbs iustead of India rubber, and care is taken to erase in
one direction, the change escapes notice, and it is generally impossible to detct it, should the paper thus handled be written upon again.
Iodine vapors, however, show all traces of these manipulations very plainly, giving their location with perfect certainty. The erased surfaces assume a yellow brown or brownish tint. If, after being subjected to the action of the iodine, the paper on which an erasure has
been made is wet, it becomes of a blue color, the inbeen made is wet, it becomes of a blue color, the in-
tensity of which is commensurate with the length of time to which it has been under the action of the io dine, and when the paper is again dried the erased por tions are more or less darker than the remainder of the o rough as to take off an important part of the mate rial, exposure to iodine, wetting and drying result in less intensity of coloration on the parts erased, becanse
the erasing, in its mechanical action of carrying off parts of the paper removes also parts of the substances -fecula sizing-which in combination with iodine of the iodine differs according to the extent of the erasure.
When paper is partially erased and wet, as when letters are copied, the sawe result, although not so striking, follows upon exposing it to the iodine vapor after letting it dry thoroughly.
Iodine affords in certain cases the means of detecting the nature of the substances used for erasing. Bread crumbs or India rubber leave yellow or brownish yellow tints after iodination, and these are distiuguished by striæ or more intense coloration, erasure by means of bread crumbs causing the paper to take a violet sbade of great uniformity. These peculiarities are due to the upheaval of the fibers, caused by rubbing, In fact, this upheaval creates a larger absorbing sur ace, and consequently a larger proportion of iodine can cover the rubbed parts than it would if there had been no friction. When paper upon which writing has been traced with a glass rod, the tip of which is perfectly round and smooth, is exposed to iodine vapor, the characters appear brown on yellow ground, which wetting turns to blue. This change also occurs when the paper written upon has been run through a supercalender. If the paper is not wet, these char acters can be made to appear or be blotted out by the successive action of sulphurous acid and iodine Wapor.
Writing done by means of glass tips will show very ittle, especially when traced between the lines written n ink. The reaction, however, is of such sensitiveness that where characters have been traced on a piece of paper under others they appear very plainly, although physical examination would fail to reveal their existnce, but a somewhat lengthy exposure to iodine va pors will suffice to show therm.
If the wrong side of the paper is exposed to the odine vapor, the characters are visible, but of course in their inverted position.
If the erasure has been so great as to take off a part of the substance of the paper, the reconstruction of the writing, so as to make it legible, may be regarded as impossible : but even in this case subjecting the reverse side of the paper to the influence of the iodine will bring out the reverse outlines of the blotted-out characters so plainly that they can be read, especially f the paper is placed before a mirror. In some intances, when pencil writing has been strong enough ts traces can be reproduced in a letter press by wet ting a sheet of sized and calendered paper in the usual way that press copies are taken, placing it on paper saturated with iodine to be reproduced, and putting the two sheets in a letter book under the press, copias being run off as usual in copying letters. The operation, however, must be very rapidly carried out to be suecessful. As a matter of fact, the certainty of these reactions depends entirely upon the class of paper used. Paper lightly sized or poorly calendered will not show them, while manipulations of which I think description would be rather superfluous here can interere very materially with the results mentioned above Another point consists in knowing how long paper will retain these reactive properties. In my own ex periments the fact has been demonstrated that irreguar wetting and rubbing three months old can be plainly shown, as after this lapse of time characters traced with glass rod tips could be made conspicuous. have noticed that imwersing the written paper in a water bath for three to six hours will secure better re actions, but although these reactions are very char acteristic, they are considerably weaker.

An interesting illustration of the antagonistic action of poisons is mentioned in the current number of the Pharmaceutical Journal. Dr. Mueller, of Yackandandah, Victoria, has written a letter in which he states, says our contemporary, that in cases of snake bite he is using a solution of nitrate of stry chnine in 240 parts of water mixed with a little glycerine. Twenty minims of this solution are injected in the usual manner of a hypodermic injection, and the frequency of repetition depends upon the symptoms being wore or less threat ening, say from 10 to 20 minutes. When all symptoms have disappeared, the first independent action of the strychnine is shown by slight muscular spasms, and then the injections must be discontinued unless after a time the snake poison reasserts itself. The quantity of strychnine required in some cases has amounted to a grain or more within a few hours. Both poisons are horoughly antagonistic, and no hesitation need be felt in pushing the use of the drug to quantities that would be fatal in the absence of snake poison. Out of about 100 cases treated by this method, some of them at the point of death, there has been but one failure, and that arose from the injections being discontinued after 1/4 grains of strychnine had been injected. Any part of the body will do for the injections. but Dr. Mueller 18 in the habit of making them in the neighborhood of the bitten part or directly upon it.

EDISON DYNAMO AND MOTOR.
(Continued from first page.)
allows of the renewal of the oil. The bearings at opposite ends of the machine are alike, except that the cast iron support of the bronze journal box, at the commutator end of the armature, is turned on its inner end to receive the brush yoke.
(T'o be continued.)
How to Protect Sun-Dried Brick Walls.
A missionary in Africa writes as follows in Regions Beyond:
"When we came to Lolongo, the first permanent building we attempted was of clay with a palm leaf roof, but before it was finished we found that far more time, trouble, and attention was needed for this kind of house than for one of brick. I am now firmly coninced, from experience, that to put up clay buildings is a great waste of strength and energy. Personally, $I$ have resolved never again to attempt them.
"I am now writing this within comfortable brick walls, but before we could enjoy these we were obliged to exercise patience till a sufficient number of bricks were ready with which to start building. With bricks in readiness, a house like this could be easily erected and made fit for habitation in three months.

Now these bricks are only sun-dried, and, where exposed, would suffer very considerably from the effects of tornadoes, were it not that we have discovered a means by which to protect them from wind and rain. The walls outside are plastered with a preparation of river sand and clay to the height of $41 / 2$ feet, but this would be little better than useless were it not painted with palm oil, which renders the surface impervious to water. Several months of experience have proved that the use of this simple discovery renders the plaster of which I speak almost as hard and as serviceable as English cement."

Stephen Grey, the Founder of Electrical Science. A. D. 1720.-Grey, or Gray (Stephen), a pensioner of the Charter House and Fellow of the Royal Society, makes known through his first paper in the Phil. Trans. the details of the important line of investigation which finally led to the discovery of the principle of electric conduction and its insulation, as well as to the fact, not the principle, of induction (see Æpinus, A. D. 1759). Thus, to Grey is due the credit of having laid the foundation of electricity as a science.

He shows that electricity can be excited by the friction of feathers, hair, silk, paper, linen, etc., all of which attract light bodies even at a distance of eight or ten inches. He next discovers that electricity can be communicated from excited bodies to bodies incapable of excitation. When first suspending a hempen line with pack threads he could not transmit electricity, but when suspending the line with silken threads he transwitted the electrical influence at distances of several hundred feet. The latter he did at the suggestion of his friend Granville Wheeler-Wheler-(not Checler, as Aglave et Boulard have it in Lumiere Electrique, p. 20), thinking that "silk might do better than pack thread on account of its smallness, as less of the virtue would probably pass off by it than by the thickness of the hempen line which had been previously used." They afterward tried experiments with longer lines of pack thread, but failed, as they likewise did after substituting thin brass wire for the thread. This showed them the insulating property of silk and led to the discovery of other insulating substances, like hair, resin, etc. During the months of June, 1729, and August, 1730, Grey and Wheeler succeeded in transmitting electricity through pack thread supported by silken cords a distance of 765 feet, and through wire at a distance of 800-886 feet
Grey demonstrated also that electric attraction is no proportioned to the quantity of matter in bodies, but to the extent of their surface. He likewise discovered the conducting powers of fluids and of the human body. Of the cracklings and flashes of light he re marks: "And although these effects are at present but in minimis, it is probable, in time, there may be found out a way to collect a greater quantity of the
electric fire, and consequently to increase the force of that power, which by several of those experiments, if we are permitted to compare great things with small, seems to be of the same nature with that of thunder and lightning." (Phil. Trans., abridged, vol. viii., p. 401.)

Stephen Grey may be said to have continued his experiments while lying upon his death bed, for, unable to write, he dictated to the last, as best he could, the progress he had made in his studies to Dr. Mortimer, the secretary of the Royal Society. (Phil. Trans., 173j̄-1736, vol. xxxix., page 400 .)
Grey's own description of a new electric planetarium


SWITCH ON THE EDISON DYNAMO OR MOTOR.
deserves reproduction here: "I have lately made several new experiments upon the projectile and pendu lous motions of small bodies by electricity; by which small bodies may be made to move about larger ones, either in circles or ellipses, and those either concentric or eccentric to the center of the large body about which they move, so as to make many revolutions about them. And this motion will constantly be the same way that the planets move around the sun, viz., from the right hand to the left, or from west to east. But these little planets, if I may so call them, move much faster in their apogeon than in the perigeon part of their orbits, which is directly contrary to the motion of the planets around the sun." To this should be added the following description of the manner in which these experiments can be made: "Place a small iron globe, of an inch or an inch and a half in diameter, on the middle of a circular cake of resin, seven or eight inches in diameter, greatly excited; and then a light body, suspended by a very fine thread, five or six inches long, held in the hand over the center of the cake, will, of itself, begin to move in a circle around the iron globe, and constantly from west to east. If the circular cake, it will describe an ellipse, which will have the same eccentricity as the distance of the globe


SIDE SECTIONAL ELEVATION OF DYNAMO. pipes is obvious.
will move as in the circumstance above mentioned, and with the same varieties."-Electrical World.

The Folly High Pressure Pipe coupling.
A patent has recently been granted Mr. Cornelius A. Folly, of No. 699 East 138th Street, this city, for an improved high pressure screw coupling for pipes. It is especially applicable to ammonia ice machines steam, gas and air joints, or to hydraulic systems, and all devices requiring tight joints under high pressures. The joint is similar to an ordinary screw coupling, ex cept that a groove is cut around the inner periphery of the female screw, into which a ring or collar of lead is run. This is formed upon a mandrel of slightly smaller size than the coupling, so that the lead projects a very little beyond the thread of the joint. A small hole, with a thread cut upon it, is made through the exterior of the coupling into the lead-filled groove. A screw plug stops the hole. If now a pipe is screwed into the coupling, it will expand the leaden packing, causing it tightly to fill the screw threads. In case of any sweating or leakage when under pressure, the leak is at once stopped by turning the screw plug. We have seen a number of the Folly joints subjected to the enormous pressure of $5,000 \mathrm{lb}$. to the square inch with out leaking. This was as far as the gauge used would allow. How much higher pressure the joint will stand has yet to be ascertained. On starting a leak purposely when under great pressure, a turn of the sinall com pressing screw at once stopped the leak. The great value, convenience and utility of this simple appliance in the case of ice machine pipes or other high pressure

## Executions by Electricity

The new law of the State of New York, for the exe cution of criminals by the electrical current, instead of by hanging, was enforced for the second time on the 7th of July, upon the bodies of four murderers. The execution took place at the Sing Sing State prison The death in each case was instantaneous and painless. There can be no question of the superiority of this mode of inflicting the death penalty over the rope ystem. The attending surgeons were two eminen doctors, namely, Dr. Carlos F. MacDonald and Dr Samuel B. Ward. In their official report to the warden, they give the following particulars :
"First-All- of the condemned walked into the execution room unrestrained, with firmness and without assistance, seated themeelves in turn in the electric chair without the slightest protest or resistance, and quietly submitted to the ad justment of the retaining straps and the electrodes.
"Second-In each case un consciousness was produced instantaneously by the closure of the circuit, wa complete, and persisted with out interruption until the heart's action had entirely ceased and death had certain ly occurred. In each cas death was manifestly painless. "Third-In compliance with the statute, an autopsy was made in each case, a soon as practicable, by Dr Ira T. Van Giesen, of New York, in \}our presence and under our supervision, with the result of revealing the same gross changes in the blood and tissues previously observed in cases of death by the action of strong electric current.
"In concluding, allow us to congratulate you on the completeness, in all their details, of all your preliminary arrangements, on the uniform good order and decorum which prevailed during the trying ordeal, and on the resulting demonstration of the rapidity and painlessness of this method of inflicting the death penalty. The experience of to-day has proved to our satisfaction that this from the center of the cake. If the cake of resin be of $\mid$ method is superior to any other yet devised." an elliptical form, and the iron globe be placed in the center of it, the light body will describe an elliptical orbit of the same eccentricity with the form of the cake. If the globe be placed in or near one of the foci of the elliptical cake, the light body will move much swifter in the apogee than in the perigee of its orbit. If the iron globe is fixed on a pedestal an inch from the table, and a glass hoop, or a portion of a hollow glass oylinder, excited, be placed around it, the light body

THE earliest Connecticut patent found on record was granted in October, 1717, to Ed ward Hinman, of Stratford, for the exclusive right and liberty of making wolasses from the stalks of Indian corn, in Fairfield Couny, for ten years, which grant ended with the words: "Always provided the said Hinman make as good molasses, and make it as cheap, as comes from the West Indies."

## EDWARD BURGESS AND HIS ACHIEVEMENTS.

 The name of the yacht Volunteer, which proved the victor in the hard-fought contest for the America's cup in the fall of 1887 , will always call up pleasant recollections in the minds of those who take an interest in sailing craft, although just now such memories are tinged with sorrow on account of the recent sudden death of her noted designer, Edward Burgess, which took place in Boston, July 12, of typhoid fever.The fact that American yachtsmen had been so long successful in holding, against all foreign competitors, a cup first won many years ago in a royal regatta, a prize offered by Queen Victoria, attracted general attention to the race between the Thistle and the Volunteer on that occasion, and the lines and sailing qualities of the two vessels were everywhere discussed. The Volunteer, however, was specially built for this race, her measurements not being decided upon until those of the Thistle were known, and she has since proved to be altogether too large for a sloop rig, as was expected would be the case when she was built. It takes too large a crew to handle such a sloop for cruising purposes, the schooner rig being better for vessels of such size. The Mayflower, which won the preceding race with the English yacht Galatea, was afterward
room, and small sails, appeared the outside ballast, shapely hull, and large sail spreads which distinguish the fleet in this country to-day. Mr. Burgess set a pace in the development of the American model which he only could hold until within the last two or three years. He made bold strides in the way of utilizing power in the hull to carry canvas, and always main tained that a roomy boat, wide enough to give comfort, able deck room and sails to drive her, is a much better type of yacht than a narrow, deep vessel with a small spread of canvas. Until convinced two years ago that in the smaller classes a keel boat givesgreater opportunities for speed, he advocated center-board boats on account of the shallow water in American harbors, but as racing has been narrowing down to a contest of science for a margin of seconds, Mr. Burgess has merely tried to embody in his designs the features shown by the experience of himself and others to produce speed. He did not, however, give his yachts the extreme keel characteristic of English cutters, and perhaps the best evidence of his success is found in the partial adoption by many English yacht builders of the ideas developed in the building of the Burgess yachts. It was especially noted that the Thistle, in the famous races four years ago, had a breadth of beam quite unusual for an Eng

Paul and Wyatt, says S. N. D. North, in the Popular Science Monthly, taught the world how to spin a hundred or more threads at one operation; but years elapsed after these early inventions before they came into general use. Paul worked his own machines for many years; but when he died they were broken up and sold, and the world continued to spin on the foot wheel. The tardy realization of the value of these inventions was due primarily to the opposition of the inventions was due primarily to the opposition of the
hand operatives to the introduction of anything in hand operatives to the introduction of anything in
the nature of improved machinery. The guilds were strong, and determined in their refusal to operate or tolerate new devices for dispensing with hand labor. Poor John Kay, after inventing his fly shuttle, was compelled to close his mill at Leeds by the riotous hostility of the hand weavers. Learning that he was also engaged in devising machinery for spinning, a mob broke into his house, destroyed everything it contained, and would have killed the inventor himself had not friends smuggled him away in a wool self had not friends smuggled him away in a wool
sheet. We need not be surprised at the blind brutality sheet. We need not be surprised at the bind brutality
of these ignorant workingmen. They looked upon the inventor as an enemy, planning to take the bread
from their mouths. But what shall we say of the


LENGTHENING THE VOLUNTEER, DESIGNED BY THE LATE EDWARD BURGESS.
changed to a schooner rig; but in her new rig she is by no means as fast a vessel as she formerly was. General Paine, the owner of the Volunteer, decided, therefore upon making a radical innovation in changing the vessel to a.schooner, and is taking the rather unusual plan of adding to her length by building in amidships an additional section of twenty feet, thereby lengthening her hull to this extent. Our illustration represents the manner in which the work was carried on at a Boston yard, the lines of the vessel forward and aft and her nominal draught remaining unchanged. The Volunteer is steel built, and her original measurements were 106.23 feet; length on water line, 85.88 feet; breadth of beam, $23 \cdot 16$ feet ; depth of hold, $10 \cdot 90$ feet; tons meas urement, $209 \cdot 9$. For the photograph from which our engraving is made we are indebted to Mr. N. L. Steb bins, of Boston, Mass.
The designer of the Volunteer, and also of the two previous successful cup defenders in 1885 and 1886, the Puritan and the Mayflower, acquired, through these successive victories, an international reputation, and also introduced a new era in yacht designing. Burgess modified the construction which was formerly the die tinguishing characteristic of American yachts-a great breadth of beam and light draught, with center board, which caused them to be generally designated by foreigners as "skimming dishes"-giving his new designs more keel, thus making more seaworthy craft, while their lines and proportions were such, as the event proved, to combine the greatest number of ad vantages.
lish cutter, and it is now matter of comment that it is not always easy to determine an English from an American built yacht, on account of the modifications which have been made in the construction of the yachts of both nations, largely as the result of the work of Edward Burgess.
Mr. Burgess was born in 1848, and graduated from Harvard in 1871, afterward becoming instructor of entomology in the University and secretary of the Boston Society of Natural History. In 1881 he had to give up work on account of his health and took to yachting, which led to his finally becoming a naval architect and yacht broker. He was a member of the United States Naval Board to award prizes for the designs of cruisers and battle ships in 1887, and in 1888 he was appointed permanent chairman on the Board of Life-Saving Appliances in the United States LifeSaving Service. Mr. Burgess was also the designer of the well-known racers Sachem, Titania, Papoose, Baboon, Nymph, Wraith, Sprite, Saracen, Rosalinda, Chiquita, Marguerite, and many others, over a hundred in all, including the steam yachts Shearwater, Sap phire, Unquewa, and Jothniel, and the well-known flying fishermen Carrie E., Phillips, Nellie, Dixon, and Fredonia.
The whaleback steamer C. W. Wetmore left Mont real on July 4 with 90,000 bushols of wheat bound to a channel port for orders. The grain inspector's cer tificate was granted and her cargo stowed according to the line and rule held where whole cargoes are shipped
manufacturers who stole the patents of Kay, without recognition of the service his genius had done them? And what shall we say of the government which per mitted this man, in his old age, without recompense for inventions which added untold millions to the wealth of his country, to seek refuge from persecution in France, there to die in abject penury?

## Influence of Drugs on the Heart.

The temporary expansion and contraction of the heart under the influence of certain drugs formed the subject of a paper read by Professor Germain See at the last meeting of the Academy of Medicine Paris. The professor, in collaboration with Dr. Pignol, gave the following summary: (1) Sparteine is the ubstance which diminishes most promptly and effec tually the volume of the heart. This drug strengthens the cardiac muscles and augments their vital force (2) Digitalin also contracts the heart, but only when its cavities are already in a state of dilation. (3) Iodide of potassium tends to contract, but to a less degre than sparteine. (4) Antipyrin expands the volume, but without influencing arterial pressure. (5) The action of bromide of potassium may be taken as the opposite of iodide of potassium, but as similar to antipyrin. It dilates the whole organ, the right side being slightly more affected than the left. Certain other drugs have no effective action. Caffeine, say Prof. See, has no influence on the cardiac muscles, in spite of certain assertions to the contrary.

## Licorice. <br> Y nicolas pike.

Theorder of plants Leguminosm contains very many of our best known and most useful ones, and in it the wild weed that gives the licorice of commerce. It other plants of near genera have roots that posses similar qualities. Especially is this the case with the Abrus precatorius Lin., that grows abundantly in the West Indies, notably in Jamaica, and in the islands of the Indian Ocean. It ranks over old hedges and fences with a strong, twisted, rugged stem; bears an insignificant little flower, that gives a rough pod inclosing the little scarlet seeds tipped with black so well known. When not fully ripe they are pierced and strung together to form necklaces, bracelets, rosaries, etc., frequently mixed with the larger silvery seeds of "Job"s tears" (Coix lachryma). I have seen many of the colored nuns, or Sours de charite, count ing their beads while patiently watching the couch of sick and dying sailors. The long rosaries were made of the red and white berries and the prayers marked off with sandalwood beads. The roots of the Abrus are used by all Creoles for chewing and other purposes in various bronchial ailments. They have the taste of
licorice, but do not yield the rich juice of the Glylicorice, but do not yield the rich juice of the Glycyrrhiza.
There are three species of plants, both wild and cultivated, that yield the licorice that is imported by many tons every year into the United States. They are the G. glabra, G. glandulifera and G. echin$a t a$, the latter being considered the best for cultivation. These plants grow wild in all the countries of Europe bordering on the Mediterranean, and their habitat extends through Asia Minor to Central Asia and China. England cultivates it in Surrey and Yorkshire, and the G. lepidata is said to be a native of the plains of 'Missouri and other similar localities in the Southwestern States.
The uses of licorice are varied and numerous. The manufacturers of chewing tobacco consume a great quantity. It serves as a demulcent for coughs and colds, and is an ingredient in many sirups and elixirs, besides having a remarkable effect in masking nauseous medicines. Porter and even ale breweries avail themselves of its saccharine, and the roots are extensively employed by them.
It is imported in different forms; in the roots, also in rolls or sticks of the dried inspissated juice that come packed in sweet bay leaves. The licorice imported into England frow Calabria, Sicily, goes by the name of Solazzi or Corigliano juice; that grown in Yorkshire is made into a confection called Pontefract cakes. The roots of the licorice contain a large amount of sweet, mucilaginous juice, that owes its sweetness to a peculiar principle called glycion or glycyrrhizin, which is present in both roots and leaves. The sugar is said to be not crystallizable, and not susceptible of vinous fermentation.
The cultivation of this plant would have been ardu ous in former years when there was onlv hand labor and money scarce. There is now plenty of the latter article lying idle; agriculture has also made such rapid strides, and the introduction of the wonderful labor saving :machines now in use for plowing, etc., would render the successful growth of the plant almost a certainty. It could then be pat on the market pure, for even licorice has not escaped in this age of adul teration, as starch, rice and wheat flour, and even wood ashes have been used for this purpose. I have carefully collected every available information on the subject, and its growth and cultivation in Europe. I give it for the benefit of those willing and able to introduce fresh objects of commerce to utilize lands good for no other purpose, and to give profitable em ployment in the gathering season to numbers of will ing but often idle hands.
I will first speak of the licorice a native of Southern Europe. The qualities in different countries vary greatly. It is said that the juice from Turkey and Greece is bitter, of Sicily and Spain sweet and rich, but that of Italy the richest, though less is exported thence. I am not a ware of licorice being cultivated in any of these countries, as it is so vigorous and abund ant a wild plant, almost too much so in many places In Spain it grows finest in the rich bottom lands of the great rivers, and the crop depends much on the mild ness or severity of the winters. It is of such vigorous growth that other weeds cannot encroach on it and crowd it out, and no parasite or insect pest is known to infest it. It is so tenacious of life that if only a swall portion of the root is left in the ground after the collecting season, it shoots up again. There are two kinds of licorice, one sending down a tap root from 3 to 6 feet deep and the other runs underground from 6 inches to 2 or 3 feet. The latter is the most highly prized, from the facility with which it is dug up. Only the roots are used, the tops being burned for fuel. It varies in quantity and quality according to soil in different provinces, changes its color to red, yellow or brown, and the proportions of saccharine and starch vary also. The climate best suited to the growth of licorice is that where oranges and all the citrus family
thrive, as it cannot endure severe ground frosts nor cold high altitudes.
In Sicily it grows most luxuriantly in low lands ad jacent to streams of water. The valley of the river Simeto is so rich that, with the rudest tools and cul ture, the peasants have no difficulty in growing cereal and other plants for food. Their principal trouble is keeping down the weeds that spring up so abundantly in the cultivated lands, and the licorice from its per tinacity is most dreaded. A farmer when asked if it grew on his farm replied, "God forbid! for of all wild vegetation, it is most difficult to subdue." A crop can be gathered every three or four years from the same ground, and the digging commences after the autumn rains have set in. Licorice requires the ho sun to perfect its juice, but at the same time it bakes the ground so hard, the task of collecting the deep-set roots would be too laborious and expensive till the earth is well saturated. There are seven manufac tories in Catania alone, and they produce from 700,000 to $800,000 \mathrm{lb}$. annually, and others in various cities of the island. Very little of the root is exported either from Sicily or Italy, only the rolls or sticks made from the inspissated juice. Asia Minor exports largely to the United States, mostly in sailing vessels under the Austrian and Italian flags. A great deal of the trade in this country is in American hands. So long ago as 1885, steam presses were 0 tons were exported at a valu f about $\$ 192,000$
Licorice has been cultivated in England since about the fourteenth century. It is said to have been im ported from Germany (a fact I doubt from its climate), and was cultivated in the gardens of the old monas teries. The monks, I presume, introduced this plant as they did so many other useful ones, as it entered very largely into their medicaments. They were in a mea sure the guardians of the poor in their vicinity in their bodily and dispensed medicines for care for thei souls. Licorice has been so successfully cultivated in England that I give the methods employed, as they would, I should think, serve well for our own country. Mitcham, in Surrey, has been famous for its "herb farms" for over a century, and the air is redolent in summer and autumn with the delicious perfumes of lavender, thyme, rosemary, chamomile, peppermint, and other plants used in medicines or for distillation. The soil is a deep black mould, with some admixture of sand, and considerable licorice has been grown here. The plant is graceful, with feathery pinnate foliage grows about two to three feet high, and bears smal whitish yellow flowers. Since licorice has been im ported into England duty free, the crops
ess attended to, as other plants pay better.
Near Pontefract, Yorkshire, it has been
Near Pontefract, Yorkshire, it has been long success
fully cultivated. The soil is a sandy fully cultivated. The soil is a sandy loam, and has to be of considerable depth to allow the roots to develop well. The beds are prepared by being well trenched, the width of trench and bed averaging three feet, and having the appearance, when finished, of wide celery beds. Commencing early in April or late in March, a top dressing of stable manure is applied and lightly covered over, leaving the trench about six inches below the raised bed. Holes are made with a small spud a few inches apart, and another person follows (often a girl) with a basket of buds and suckers, slips or run ners, and they are inserted about four inches below the surface and covered to that depth. This forms a double crop, that is, the buds grow downward, pro-
ducing the roots, and the suckers form buds for futur ducing the roots, and the suckers form buds for future planting, the width of the beds permitting of cros rows of plants. The buds and suckers are left in the ground for three and a half years, a crop being ob tained in the September following the fourth spring The first manuring is sufficient, the plants being weeded each summer. A hot, dry season is best for
them ; they need no irrigation even in the hottest them; they need no irrigation even in
The trenches are of course idle for two years, as the plant tops do not show much in that time, so potatoe are planted in them the first year. A species called ash potatoes is used, as they have such small tops they do not overshadow the young licorice plants as arger kinds would.
The second year a crop of cabbages is grown, but the third year the trenches must lie fallow, as the the summer the appearance of a shrubbery of young ash trees. The grower plants a fresh crop every spring of each year, and in autumn harvests the one of three and one half years' growth.
The only labor required is that the beds be kept clear of weeds in summer, and in November, when the ap is down, the plant tops must be cut off. If the ered with a light layer of earth
to Gather and prepare the root
The trench, not the bed, must be dug down to a considerable depth, thus exposing without injuring the oots, and the whole plant is very carefully taken out of the ground. The earth from the second trench is then thrown into the first, and so on to the end of th
feld. The roots are then placed in dry cellars after emoving the tops and suckers and of ten covered with sand. The latter serve for the next spring's crop to produce " buds," that is roots in their early stage fo another year. When the stored roots are dry, they form the yellow licorice for producing the juice of commerce. A small portion of the top of the root is ut off as being of less value than the rest, and is ground into powder and sold to chemists for various uses. The tops are only good for burning.
The $31 / 2$ years' sucker, which is gathered with the icorice plant, has now produced "buds," which are reserved with the new suckers for planting. They are ither stored in a cellar and covered with rotten dung or they are made into a mound, outside, and well buried in earth or moist sand, and thus withstand the cold, wet winters of Yorkshire.
There appears to be considerable difficulty in finding out some of the first processes of the manufacture of icorice. Mr. Hilliard, who has the largest factory in Pontefract, courteously shows the place to visitor with the above reservation
In Sicily, when the roots are dug up, they are bound in bundles and stored in the factories for some time to eason them. When sufficiently cured, men and wome cut them into short pieces, and then they are plunged into a vat of water, and thoroughly washed; they are hen crushed in a rude mill, which consists of two cir cular stones of lava, the one horizontal, the other perpendicular over it. Through the center of the upper stone is an axle, to which is attached a mule, which evolves it slowly in a circle. When sufficiently crushed, they are boiled in water for 24 hours, then removed rom the kettles and placed in a screw press, and the uice squeezed out into a cistern beneath. It is passed through a sieve and again boiled, and the sediment again pressed, and the whole again filtered. When boiled to a certain consistency, it is placed in pans ver a fire, and men stir it till dense enough for paste t is placed in wooden moulds for cakes, or made into rolls or sticks, which when dried are packed in bay leaves for exportation. When the roots are required women scrape off the bark, cut it in the desired length, and when dry it is packed in bags, great care being aken they do not mould nor freeze, and they must be ree from the least blemish.
In England now the greater part of the juice manu actured is from roots grown in Spain and Sicily, as the English ones are of smaller size. As the passage is so rapid now over the ocean, a package of roots, buds or suckers could be brought as fresh and easily, perhaps more so than from one of our own Western States, and doubtless from the greater heat here they would improve in size. It would not be difficult to procure fresh wild roots and buds direct from Spain There is direct intercourse with Seville, whence licorice is shipped to England by steamers or by sailing vessel direct to America. An ordinary Wardian case could be sent to Seville and would bring back roots and buds nough to start a licorice farm.
Allowing for the difference of climate in England and the United States, anywhere south of Wasbing ton, D. C., ought to produce licorice of fine quality with careful culture. There are plenty of low-lying ands good for nothing else that could be permanently profitable for it, where ground frosts are light. I say round frosts, because there is no leafage in winter to be injured. The average latitude where licorice flour shes near the Mediterranean is from $36^{\circ}$ to $41^{\circ} \mathrm{N}$. lat., in Mitcham, Surrey, $57^{\circ} 30^{\prime \prime}$, and in Pontefract, $53^{\circ}$

## Chinese Varnish

The British consul at Hankow, writing of the var ish exported from that city, says he is informed that it is the gum of a tree-the Rhus vernicifera. On this ree, before daylight, incisions are made; the gum that uns out is collected in the dark, and strained through a cotton cloth bag, leaving behind a large amount o dirt and refuse. This operation can only be performed in the dark, as light spoils the gum and causes it to cake with all the dirt in it. It cannot be strained in wet weather, as moisture causes it to solidify. When the Chinese use this varnish, they rub it on with a sort of mop, or swab, made of soft waste silk. It should only be used in wet weather, as, if the atmosphere is dry when it is rubbed on, it will al ways be sticky. As sed by the Chinese, the varnish takes about a month o dry and during the time it is drying it is poisonou to the eyes. The consul thinks that this gum may have been one of the ingredients of the celebrated Cremona varnish, and he suggests that it might be worth the while of musical instrument makers to make experiments with it, with a view to producing a var aish that would give a mellow instead of a glassy sound.

Progress of the Manchester Ship Canal
A short section of the Manchester Canal has been so ar completed as to permit the entrance of tide water. This section extends from the river Mersey, at Eastham, to Ellesmere Port. The opening took place June 23 last.

## Locust visitations.

During the past three or four years the French government has been making strenuous exertions to beat down the armies of locusts coming from the south on to the fertile lands of Algeria, and during the present year they are also baving a similar fight with these pests on the southern borders of Tunis. The cheap Arab labor obtainable for this purpose has made it possible to employ in the work a veritable army of men, the government ordering the tribes to form encampments along the line on which it is proposed to fight the oncoming army of locusts, and, in this way, the crops have been in a great measure protected frow the ravages of this plague, although no permanent relief has been obtained. Our illustration, from $L e$ Monde Illustré, Paris, gives a good idea of these destructive insects and also of their carnivorous instincts, always exercised upon the weak when there are no crops to feed upon, as well as the manner in which their eggs are deposited in pockets in the earth, the covering having been removed from the exposed bunches of larvæ.
The manner of fighting the locusts adopted in Algiers and Tunis has been to construct a ditch, or a ditch with a fence at one side, across the line of march of the insects, which come in such vast numbers that the ditch quickly becomes filled up, when the natives jump in and trample them to death at the same time thrashing the living wass with a heavy stick or log of wood. The feuce at the side of the trench consists of long bands of cotton cloth or calico supported on sticks, such fences extending in some places across a mile or more of country, the material at the top having a slippery waxed border about four inches wide, kept moist by daily oiling. The insects cannot keep their hold on this waxed border, and inevitably drop back into the trench beneath, which is from three to four feet deep. When the insects have attained an age where all or a portion of them have wings, they are fought by a line of natives with long palm switches, a method of stopping their progress which, to be effectual, presupposes the simultaneous exertions of grest numbers of the Arab palm wielders.
Prof. C. V. Riley, the entomologist of the Department of Agriculture, at Washington, has made a most thorough study of the locust as it occurs in several different varieties in the United States, with the best means of destroying them, and his widely published researches on the subject $h$ ave undoubtedly been of great advantage to our farmers.
The locust, as is generally known, is of the family of
grasshoppers and crickets, but differs from them in having shorter horns and feelers and a more robust body and limbs. The Rocky Mountain locust, which has been the most destructive pest that has appeared in this country, breeds every year in a large section, embracing most of Montana and Wyoming, western Dakota, and a part of Colorado, Utah, Idaho and Oregon, together with a large region in the British possessions. In a country directly to the east of this section is a considerable region where the locust is liable to breed for some years, multiplying in excessive numbers, but from which it in time disappears. Through a very much larger section, extending almost to the Mississippi and the Gulf on the east and south. and to the Pacific on the west, the locusts migrate in years of excessive abundance, and it is in such migrations that they are most destructive, although in these regions they seldom breed, and generally disappear within a year. The most disastrous invasion of this kind was in 1874, when Colorado, Nebraska and Kansas were overrun, and parts of Wyoming, Dakota, Minnesota, Iowa, Missouri, New Mexico and Texas were ravaged, vast swarms of locusts from Montana and British America sweeping over these sections in that year. In 1875-76-75, considerable damage was done by the locusts, but the boundaries of its depredations were narrowed each year, and they have not since visited any considerable area beyond the limits of their known permanent habitat.

Although the eggs of the locust may be laid in al-
most any kind of soil, they are by preference laid in bare sandy places, especially on high, dry ground which is tolerably compact and not loose. The female forces a hole about an inch below the surface by means of two pairs of horny valves which open and shut at the tip of her ábdowen, until, usually in a few minutes, nearly the whole abdomen is buried, when she commences ovipositing, there exuding from the tip of the body a frothy, mucous matter, which fills up the bottom of the hole, the mucous matter also being ex uded to bind all the eggs in a mass, and when the last is laid, to fill up the neck of the burrow with a com pact and cellulose mass, more or less impervious to water. When the locusts are abundant, they settle so thickly in favorable spots for depositing their eggs that the ground has been frequently seen darkened with them, the eggs deposited by a well developed specimen ranging from 100 to 150 each, while the holes are gen erally so well covered as to afford no evidence of th deposit.

The insects are hatched from the middle of March to the 1st of June, and when they are about half grown and vigorous enough to bare the ground of vegetation the habit of migrating in large bodies is developed those which acquire wings traveling long distances, ac |  |
| :--- | :--- | :--- | :--- |
| cording to the wind, while those which do not seldom | the northern coast of Africa. such quantities as to be cheaply logged.

cheaper and more certain and efficient than theorienta nethods employed in the destruction of these pests in

## Central American Timbe

Colonel E. H. Morrison, who has recently returned from Nicaragua, in an interview, in a Seattle paper, called attention to the fact that when the construction of the big canal got fairly under way, a large amount f lumber would be wanted from the Puget Sound mills. He pointed out that there was no lumber in Central America suitable for the purpose. The hard woods indigenous to that country are not found in

A mistaken impression is abroad in regard to the orests of that section. People have a general idea that great tracts of country are covered with splendid trees, so that one can go into the forests anywhere and cut good logs suitabl? for lumber. The fact is that though the forests are thick, the majority of the tree are too small to be worth cutting. Here and there a arge mahogany tree is found, and a man chops it down. In order to get it out he has to cut a trail hrough a quantity of worthless timbor and run it er. There will probably not be ing for a long distance. It is by the slow collection of logs cut from isolated trees in this way that the shipments ar made. The cost of logging and of holding a stock of log until there is enough to ship make these kinds of lumbe so expensive.
"Many people have been ooled by the expectation o mmense fortunes in lumber ing in Central and South America. A friend of min took a complete sawmill and logging outfit, with a party of skilled men, to one of th South American rivers, ex pecting to do wonders. He found the ground swampy swarming with reptiles, and covered with such a dense jungle that traveling through the Puget Sound woods is a picnic by comparison. He also found that there was only a tree here and there worth cutting, and by the time he had cut a trail to it the beginning of his trail wa so thickly grown up with brush again that he could hardly find it. After on night's rain the brush would grow up to a height of six feet in a day. He was glad to get out of it again.
'There is one tree down there called the snakewood which grows to a great thick ess, but when you come t chop it down, you find tha it is nearly all soft bark When you do finally come to hard wood, it is extremel hard, but there will be only about four inches of it in tree as wany feet in diame
o more than a few wiles from where they hatch The remedies and devices proposed, and to some ex ent adopted, for the destruction of locusts have been ery nuwerous. The protection and encouragement firds, particularly by the paying of a reward for hawks, as is done in Colorado, is a natural agency not o be overlooked, but the destruction of the eggs has ong been looked upon as the most efficient means of averting locust injury. This is effected by harrowing plowing or spading, irrigation, tramping, or collectng. In 1874 and 1876 there were many locations where for hundreds of square miles it is said that scarcely an nch of the soil could be stirred without exposing these ggs, so that, although the task of getting rid of them would vary with the location and the means at hand it was manifestly one of great magnitude. For the per ormance of this work in various ways a great number of novel machines have been introduced and numerous patents therefor have been issued, as also for the de truction of the young or unfledged and the mature or winged insects.
Some of these machines consist of a scraper with converging wings and with a removable canvas bag at the ear end. As the machine is moved over the ground by horses or other power, the locusts are scraped toether and collected in the canvas bag, which may be eadily removed and another put in its place. There is very little delay or loss of time by this method, and it is possible to clear large tracts of land without great
ter It is used mainly for canes, which cost $\$ 3$ or $\$$ in South America and several times as much in this country.
" There are a number of good kinds of lumber down there which would be useful, but have never been brought into use. I suppose they happen never to have become fashionable. Yet they are of fine shades and beautiful, fine grain, and would look well in fur iture and interior decoration. They grow thicke than the better known hard woods, and would be much cheaper."

Frequency of Thunder Storms.
A German periodical gives statistics concerning the requency of thunder storms in various regions of the world. Java has thunder storms on the average 9 lays in the year; Sumatra, 86; Hindostan, 56 ; Bor neo, 54 ; the Gold Coast, 52 ; Rio de Janeiro, 51 ; Italy 38 ; West Indies, 36 ; South Guinea, 32 ; Buenos Ayres Canada, and Austria, 23 ; Baden, Wurtemberg, and Hungary, 22 ; Silesia, Bavaria, and Belgium, 21 ; Hol and 18. Saxony and Brandenburg 17. France, Aus tria, and South Russia, 16 ; Spain and Portugal, 15 ; Sweden and Finland, 8; England and the high Swiss mountains, 7; Norway, 4; Cairo, 3. In East Turke stan, as well as in the extreme north, there are alwos no thunder storms. The northern limits of the thun der storms are Cape Ogle, northern part of North America, Iceland, Novaja, Semelja and the coast of the Siberian ice sea.

## RECENTLY PATENTED INVENTIONS.

 Engineering.Oil Burning Furnace. - Frank B. Meyers, Fort Plain, N. Y. This is a simple and durable hydrocarbon burner, designed to completely atomize
the oil and permit of directing the flame from the the oil and permit of directing the flame from the
center to one side, to distribute the heat uniformly within the furnace. A pipe is held centrally in a casing connected with an air supply, an oil pipe discharging
into the central pipe, on the inner end of which is held an atomizing disk, while a valve formed of two plates having semcicircular openings at their inner edges is fited to side transversely to regulate the admission the central pipe.

## Mechanical Appliances.

Bolt Grip. - Thomas Spriggs, Little River, Kansas. A pair of spring-pressed jaws pivoted tending thumb screws in their upper ends, a wedge shaped chisel sliding in the frame hetween the thumb screws, a yoke being fixed to the chisel and extending
beyond the frame, while a screw mounted in the yoke and frame has a suitable handle. The device is designed to be very useful in removing carriage bolts and tir boten from wheels, or where a nut has become ruste for pulling nails, etc., and for clipping bolts and rivet and holding yas pipe
Pump.-Charles J. McKenzie and David M. Mikesell, Wauseon, Ohio. This is a double-acting force and lift pump of simple and durable construction,
ot liable to get out of order. The pump has a cylin drical barrel with no projections whatever on its out side, permitting of tis being placed in a fixed pipe such as are usaally employed in drill wells, and it pumps of the plunger, the water being lifted or forced to any desired height.
Cooler for Calcined Material. mable B. Bonneville, Allentown, Pa This is a cool ing apparatus more especially designed for use in subjected to a high heat to combine the lime, silicate, and alumina, excluding air as much as possible while the material is highly heated. The material after burning is discharged by a conveyer into a receptact In the shape of clinkere, the receptacle having at it by openings in the wall with the outside, whereby then by openings in the wall with the outside, whereby the
calcined substances are cooled without undue exposure to the atmosphere. It is designed to take about thre days to draw the materia from the top to thereby insuring a slow and gradual curing and cooling

Asbestos Separator. - Henry Powers, Cran bourne, Canada. Rock containing short proved apparatus, be manipulated in a simple manne to extract the fiber contained as a clean and marketable article. The method consists in simultaneously pulVerizing the rock and crushing the asbestos in it, caus ng the dienneerayin of wis asbestos on an agitated body of water having an upward current to float off th
Ore Washer. - James O. Campbell, Colton, Utah. This device is designed more especiall or washing gold sand, to obtain ull the precious meta labor. It is designed to be simple and durable in construction and very effective in operation, consisting of an inclined frame mounted to slide laterally and supporting a series of backets arranged one in front of the
other and one above the other, the higher one discharg ing into the nex
Clearing and Evaporating Saccharine Juices.-Ramon F. Cordero, Rubio, Veneuuela. There are cleaning pans directly over the
furnace of this apparatus, and on the furnace flue rests an evaporating pan having a longitudinal partition forming a return channel, one of the cleaning receptacles discharging into this passage at its end over the furnace outlet. The apparatus has other novel
features and is designed to be economical in fuel for which only cane refuse is ised, while presenting extensive evaporating eurface, the juices being successively cleaned in the several pans and the scum removed before passing to the evaporating pan.
Electric Apparatus for DefecatING SAccearine Juices. - Elias Maigrot and Jose
Sabates, Havana, Cuba. Combined with troughs having longitudinal porous partitions, with pipes connecting the two sets of compartments in two separate series, one
series for the circulation of water and the other for the series for the circulation of water and the other of the the
circulation of saccharine juicee, circulation of saccharine juices, are electrodes suspended in the compartments and connected with an electric generator. The apparatus is designed to give an in-
creased yield of prismatic eugar by subjecting the juices creased yield of prismatic cugar by subjecting the juices
to the action of electric currente, to decompose, alter, transfer and remove fom the juices alkaline salts, acids, albuminous and other deleteriuns substances.

## Agricultural.

Cultivator. - Edward W. Freiburghouse, Sabetha, Kansas. In this implement a number of disk cutters are employed, held in adjustable
hangers, forming a cultivator capable of effective work on level ground, on a hillside, or for cultivating side
ridges, as in listed corn. The cultivator blades are designed to be conveniently and expeditiously adjusted plants and adiusted vertically to stand at any desired plants and adjusted
angle to the ground.

## Miscellaneous.

Sprinkler. - Alpheus J. Bartlett,
branch and a packing located at the top of the body is
a T-shaped sprinkling tube, whose vertical member extends through the packing into the body, and has a exterior collar of less diameter than the body, adapted to turn upon a water cushion or bearing. The device
orms an Improved rotary lawn sprinkler, whose rotar ection revorves rotary lawn sprink ler, whose rotar he friction to a minimum.
Vehicle Step. - Milton Frost, New Bedford, Mass. This step consists of a wheel mounted
oturn on a sleeve secured to the shank supporting the step. the wheel having an open web, and a scraper in he form of a rubber ring being arranged concentric with the rim of the wheel and held in the open web
The construction is simule and durable and ingure safety by preventing the foot from slipping off the step
Toy Mortar.- Edward P. Eastwick, r., New York City. This mortar has an annular
ounding shoulder or swell within its bore in rear of ounding shoulder or swell within its bore in rear or
the muzzele, forming a cup-shaped or flaring seat for the ball, whilie, a frrming a caperackerhaped of flaring seat tor the appenside of the barrel at the breect the ordinary fir racker, without incurring the danger common to to re arms charged with cartridges,
Chiropodist's File. - Charles S . Levy, New York Clty. The body plate of this file is essentially triangular in cross section, while it has a ace, a receesed core being secured within the bod which consists of a strip of metal bent upon itself to he desired shape. It is a simple and compact imple ment, capable of convenient manipulation for removin,

Cooler and Freezer. - Paul L. Dermigny, New York City. This invention is an improvement on a former putented invention of the same nentor, and provides a simple and durable apparatas, wapecially intended for family use, to cool or frees water and other liquids, or to make ice cream, etc.
has an outer and an inner receptacle, with a chamber between them for the reception of the water or othe
iquid to be cooled or frozen, while the freezing miz ure is contained in the inner receptacle, which has Wo sets or beaters or stirrers that are revolved
Filtering Apparatus.-William E Hershberger, Neosho, Mo. Combined with a vessel
aving a series of apertures in its bottom, is used filtering block of porous material, preferably tripoli stone, in cylindrical form, the block having a recess in
its lower face forming a flange resting on the bottom beyond its openings, while a series of passages lead up into the block from the recess. The block is fastenc cleaning and has a sufficient number of passagea adapt it for filtering a large quantity of water for drinking or other purposes.
Lifting Jack. - Joseph S. Locke, Bartonia, Ind. This invention is more particuarly bar is of stepped construction on its upper end, to atd it to varied heights of the axles from the ground. The invention covers a novel construction of parts and
pivoted connection of two levers with the lifting ba and standard of the jack, whereby the lifting bar and standard are hinged together, and kept from shackling, increasing the durability of the jack, while a more
perfect lock is securcd, the lock being the tighter as ater welght is thrown on the jack.
Stove. - William Forbes, Plainwell, Mich. This invention relates to heating stoves in which either coal, coke, or wood are used as fuel, the
construction providing a lurge area of heating surface that has direct contact with the burning fuel and the air surrounding the stove. The fire pot of this stove is revoluble, and is composed of hollow bars or tubes that have communication with the air outside of the
stove, and it can be readily removed from the walls of stove, and it can be re

Revolving Door.-Charles F. Chew, Chiadelphia, Pa. Combined with two oppositely cular flocr, is a main door pivoted at its center in the cap plate and floor, curved wing walls being hinged and braced to the door, forming an improved revolving egress of one or more persons at a time and segs the egress of one or more persons at a time, and seals the
outer opening simultaneously with the opening of the inner one, thus affording a vestibule for the protection of an exposed entrance to a building, while providing a wide and unobstructed passage.
Handle. - George H. Bradshaw, Knoxville, Tenn. This invention provides a simple and convenient handle designed to be readily attached
to or removed from chests, trunks, refrigerators, etc and which when not in use will drop out of the way si as not to be easily broken. The device consists of plate to be secured to the article, and having project ing shoulders near a side and bottom edge, and a handle pivoted
Folding Poultry Crate.-Harry B. ornish, Hampton, Iowa. This is designed to be tiously set up to receive poultry, and readily folded for return transportation. It has an apertured and ribhed top plate and a solid flanged bottom plate, apertured side pieces hinged to the top plate engaging the bottom flanges, and other apertured side pieces hinged to the top plate being connected by strap hinges to the bottom Tobacco Smoker's Device. - Valeriano Gonzalez, Durango, Mexico. This device is in the
form of a cigar holder, and also applicable to the end of a pipe, and has a reservoir to collect the nicotine, back o solution of tannin, while within this chamber is also solution of tannin, while within this chamber is also
secured a medicine cup designed to be filled with a
readily evaporated medicament, possessing properties
beneficial in diseases of the throat and mouth, or any
substance which would impart an agreeable flavor to the smoke. The object of the device is to render obacco smoking alway
particularly beneficial.
Note.-Copies of any of the above patents will be urnished by Munn \& Co., for 25 cents each. Please of this paper.

## NEW BOORS AND PUBLICATIONS.

## Woman and Health. A mother's hy

 gienic hand book. By M. Augus the author. Quincy, Ill. Price $\$ 2.50$ In this volume a wan undertakes to tell women heir needs in matters relating to maternity, also inluding specific directions for the treatment and cur f acute and chronic ailments generally. The book written in dialogue form, and embraces nothing be yond the comprehension of people of ordinary intelligence, dress, dietetics, hygienic cooking, sunshine, exercise, sleep, each forming the subjects of separate chapters.
Steam, its Generation and Use, with catalogue of the manufactures of the Babcock \& Wilcox Co., forms a handsome volume of 150 octavo pages, con-
taining a great variety of valuable information in addiCaining a great variety of valuable information in addstyle of boilers. The volume for 1891 is the twentyhird edition of the work, which was originally pub cessive editions since issued in deference to the appreciation with which its facts and figures have bee received, no less than the striking success which has
attended the introduction and use of the Babcock attended the introduction and use of the Babcock \& Wilcox boilers. The company now has manufactories
in the United States, Scotland, France, Germany, and in the United States, Scotland, France, German
Austria. The book is sent free on application.

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(3166) M. L. S. asks (1) for a cement that could be used to cement glass to metal (brass and iron) and which would not be attacked by bisulphide of caradd a small percentage of glycerine to render it slightly elastic, also a small quantity of bichromate of potash to make it insoluble. 2. Is there an odorless dex of refraction? A. Purified and deodorized bisulphide of carbon costs 70 cents per pound. Its index of refraction is the same as that of the commercial article. 3. Just what kind of a lens is a collimating lens? A. Any lens which will bring light rays into the
line of vision is a collimating lens. 4 . line of vision is a collimating lens. 4. How much heat costs A. In England the difference between the cost of crude petroleum and coal for fuel is as 2 to 1 . In this country, there is a slight difference in favor of coal. There are, however, varieties of crude petroleum which are worthless for the purposes of the refiner. As a fuel, this sort of petroleum is more economical than coal. 5. What substances are transparent to heat and
how can I make a heat lens? A. Glass is transparent how can I make a heat lens? A. Glass is transparent
to heat. You can make a heat lens from glass alone, or you can make a hollow glass lens and fill it with carbon disulphide. 6. How can I detect the presence of car bonic acid gas in the atmosphere when in small quanti ties ? A. By passing the air through clear lime water a very small percentage of carbonic acid absorbed by the solution will produce carbonate of lime, which
renders the water turbid. 7 . What is the chemical renders the water turbid. 7. What is the chemica
nature of impure and injurious air? A. The nature of nature of impure and injurious air? A. The nature o ble to give a general answer to this qnery. Ordinary air contains, besides nitrogen and oxygen, a little car bonic acid, a variable proportion of aqueous vapor, a trace of ammonia, and sometimes a little carbureted
hydrogen. 8. Does throving a hydrogen. 8. Does throwing a picture (as in a camera) upon a plate of glass in any wise affect its transparency
to other light rays while it retains the image ? A. No. 9. Did Professor Herz refract induction and where No I find the particulars of his experiments for the past two years? A. Professor Herz refracted induction by the use of an asphalt prism. 10. I understand that mag netization affects the length of an electro magnet' core. With what rapidity can this change be effected i. .., to how many magnetizations and demagnetiza
tions will the core respond in a second of time? We do not know that any limit has been discovered. 11. How frequently can the power of a discovered changed in a second ? I do not mean how many time a second can it be completely magnetized and demag netized, for $I$ understand there is a residual magnetism, but how many times can the strength of a magnet be varied per second? A. No limit has been discovered 12. How does the resistance of selenium vary from light darkness? A. Exposure to diffused laylight di half of what it was before. 13. Is there any work pub lished giving the cost of experimental materials, suc as selenium, bisulphide of carbon, etc.? Catalogue of course can be had occasionally containing prices of ne or two things required, but bar any one ever pub ished an extended list of approximate prices? A All large dealers in physical apparatus supply cata-
logues of materials and apparatus. Write the dealer in New York, Philadelphia and Boston. 14. Is it tra that light passed through a highly magnetized ring un dergoes refraction as if through a lens? If so, why?
A. Light passing through a magnetized ring is not re-
fracted, but in the case of polarized light, its plane of fracted, but in the case of polarized light, its plane of chanical means of feedıng a wheel forward through successive steps, which steps shall be perfectly gaugeable, and be as desired any portion of the circumference? I desire a positive motion, with stops to preven slipping or the passage of wheel beyond proper points. by a pawl and ratchet, would answer your purpose
(3167) S. M. K. asks: 1. Have you any description of a simple air engine of about one-eighth to one-sixteenth horse power? A. You will find calori 536, 573. 695 and 727. 2 Have you a description of sta horse power? A. Supplement, No. 279, contains a description of such an engine. 3. How can I make boiler to be pnt on a stove for use in connection with small steam engine? A. For small boilers consult Sur Plement, No. 702. 4. Have you directions for making a simple electric motor? A. See Supplement, No
641. 5. How to makea dynamo for 6 or 8 lights ? Consult Supplement, No. 600. 6. How to make a bat tery for running small electric lights? A. See Supple ment, No. 792. 7. What is a goor treatment fo dandruff? A. Wash the head in a weak solution of borax.
(3168) E. J. H. asks: 1. How can a luxuriant growth of beard be permanently removed
from the face without serious injury to the skin ? Will you suggest a course of experiments likely to giv he desired result ? A. In our SUPPLEMENT, Nos. 17 nd 353, you will find the results of the electrolytic $\$ 60,000,000$ in currency was made full legal tende money. How long did it remain in circulation at pa with gold, and at what time, and for what reason was withdrawn from circulation? A. In December, 1861 the banks suspended specie payments, and there wa hereafter a premium on gold until the resumptio of specie payments by the government in 1879. The government was sustained, through 1861, by treasury er act was for the issue of $\$ 150,000$. It passed the House of Representatives February 24, 1862, and passe he Senate and was signed by the President the next ay. The total authorized issues of legal tenders wer 450,00 . Subsequent to the war up to $184, \$ 44,000,00$ of legal tenders were retired, as part payment of an ac nowledged debt by the government, further payments ence as currency when the ability of the goyernme o maintain them at par had been demonstrated. Dur ing the war and up to 1874, $\$ 48,151,000$ of fractio currency were issued, the greater part of which ben red
(3169) C. E. R. asks for the mode used varnish works to bleach shellac, and if chlorine th, inde cheapest form to make it. A. Two pound strained through a cloth. a paste with water, which washed out with two pints of water. For each poun choride of lime add 4 ounces carbonate of potassium dissolved in 1 pint of water. Two pounds of shellac ave meanwhile been digested in 1 gallon of alcohol fo few days. The above fluid is added with constant stirring to the alcoholic solution. After half an hou nough hydrochloric acid is added to show an acid rection. The shellac is precipitated as a white toug ass, which is freed from the acid by rinsing and The shellac is kneaded or worked into strips and ried upon a platform or board in the air. The alcoho can be recovered by distillation. Enough carbonate potash should be added to the original chloride me solution to precipitate all the lime. The quantit siven is approximat
different amount.
(3170) C. I. sends following receipt and hich merits: A patented shoe blacking cg casein in a solution of borax or sode and dissolv esinate of iron, besides the usual boneblack grease and sugar. A brilliant luster is imparted by casein and the resinate of iron gives a deep black color. ${ }^{\text {. }}$. The receipt is suggestive and worth trying. The doubt of iron is made by saponif ying resin with caustic soda. issolving in water and adding to a solution of copperas. The iron salt will be precipitated. Filter, wash, and dry in the Sceentific American.
(3171) S. L. asks : 1. Which is the best bestos. 2. Will air inclosed in a vessel hermetically what force ? temperature of $320^{\circ}$ Fah. will, when heated to $680^{\circ}$ give a pressure of 15 pounds above that of the atmo here. 3. Is a partly vacuum a better non-conductor of heat than air? A. Yes. 4. What causes the explosion from the oil comes in contact with the because the gas ir or with the fiame? A. The explosion of kerosen amps and stoves is caused by the mixture of petroleum vapor driven off by the burner and air. 5. Which is the lightest of all gases ? A. Hydrogen. 6. If a vacuum were created in a vesse!, would it be lighter than if harged with the lightest gas? A. Yes.
(3172) P. C. T. asks: 1 . What is the o-called "bottled electricity" used for headache and rricity. It is simply fill A. The botth sponge, and the sponge is saturated with oll of mustard. 2. Where does the first electrical impulse come from in the dynamo, as there is no magnetism present when the machine is at
rest? A. If there were no magnetism in the cores of the field magnct the machine could not be started. The field maguet of every dynamo retains a little magnetism, which is sufficient to start the inductive process.
(3173) R. E., Jr., says: We want to use
with sulphur, iron, copper, etc. What method can we A. The best chance of purifying the water is to add nough lime water to precipitate its impurities, and to llow it to settle. Or you may let it stand in woode lanks with scrap iron. Either method is imperfect and your boilers will undoubtedly suffer whatever you do ffter standing over scrap iron, the lime treatment mig
(3174) H. McD. asks for any known quid, outside of alcohol, that will not evaporate by Glycerine.
(3175) S. M. B. writes: Can you give me any information of any one who has a process or ethod of removing, salt and alkali from water so tha ing steam? Solt and alkali cannot be or mak water in any practical way for boiler use. Run the biler by the hydrometer, adding new water to keep a constant degree of saturation. Blow off frequently tom to expel deposited matte
(3176) F. A. S asks how many pounds of ire there are on armature and on field magnet of the
nall electric motor described in "Experiment cience," page motor described in "Experimental mount of wire on the motor referred to, but we thin here is about one-third pound on the armature and
(3177) E. V.-To make a mould for orna nents, etc. : Soak 12 ounces of gelatine for a few hours
in water until it has absorbed as much as it can, then apply heat, by which it will liquefy. If the mould is ix well with the gelatine. If a little chrome alum be dded to the gelatine, it loses its property of again bein dissolved in water. A saturated solution of potassium bichromate brushed over the surface of the mould, and llowed to become dry and afterward exposed to sunght for a few minutes renders the surface so hard a te be unaffected by moisture. To prevent the plaste
sticking, brush with olive oil.
(3178) F. H. F.-Since making our former answer as to the heaviest locomotive used on
any railroad in the world, we are informed that the building four locomotives for the Chignecto Ship Rail way, each of which will have a weight of 45,000 pounds on each of four pairs of drivers, or a total of 180,000 pounds, light, for each locomotive. We know of no
(3179) A. D. B. asks (1) for the relative proportion of piston area and length of stroke gasoline engines, considering the expansive force of the gas (not any particular make of engine). A. There is o ixed rule for the proportions of gas engines; som makers think a stroke at least double the diameter meter of the cylinder and the stroke the same. How many volumes should the charge be compressed A. About three. 3. What are the best proportions of asoline gas and air forgreatest force? Also for grea est expansion. A. Eight or nine volumes of air to on of gasoline vapor gives the best results. 4. Would ir (of the proper mixture) in promortion to admit gas and same to be compressed in the same space of a full practic
(3180) C. A. H. asks: In rewinding a small electric motor, say about one-eighth horse power,
toadapt it to Edison 105 volt circuit, what should the reistance be in the fields and armature, and the best wa oo connect up shunt or series? A. The resistance current required for the power needed. An electrica horse power is 746 watts. A watt is one ampere multiplied into a volt. If you require one-eighth hors 110 volts; therefore, if you divide the voltage by the equired, which is 118 will have the current in amperes otal resistance of the machine, you wlll divide the voltage by the amperage, which will give you 92 ohms. of this amount, if the machine is series wound, the hat of the armature, while if it is shunt wound, th esistance of the field magnet should be about four(181) S. R. .
(3181) S. R. S. asks: How can I remove wart? A. Cover the skin around the wart with lard; of strong hydrochloric or nitric acid; then keep the (312) C.
(3182) C. G. C. asks: How can I remove rusl stains from nickel plate? A. Grease the
rust stains with oil, and after a few days rub thoroughly with a cloth moistened with ammonia. If any spots and remain, remove them with dilute hydrochloric acia nd polish with tripoli.
(3183) W. P. S. asks:1. How can I make heblack enamel used on bicycles? A. For ternporary ase to cover places where the enamel has been chipped, se asphaltum dissolved in tarpentine. If the whole it japanned. 2. What cement must I use to cement on the tire? A. Melt together equal parts of pitch and gutta percha; use hot. 3. What cement can be used to mend cuts? A. Use the following: carbon bisulphide oz.; gutta percha, 5 oz.; pure unvulcanized rubber, 1 oz.; fish glue, $2 / 2$ oz. Use no more than necessary,
and bind the tire firmly with string until the cement has set. 4. What oil is used
(3184) E. H. R. asks how to remove ink parts of cream of of tartar and one of powdered alum.
(3185) F. B. D. asks how to make tin foil labels adhere to block tin collapsible tubes. A.
Use a mixture of the best fish glue and gum arabic disolved in water. A little glycerin may be added to ad
(3186) J. C. asks: 1. What kind of waxis used in making wax flowers, and how is it pre
pared? A. Use nothing but the purest virgin whit pared? A. Use nothing but he purest virgin whi edded to render it ductile. It must not be melted in n iron pan; use tin or enamel ware; when stiff leaves a to be made, a little spermaccti may be added. The colors in fine powder are mixed with essence of lavender and this paste is mixed in with the wax. Pour in mould hile sthwar. 2. How is beewas leachedr A. Nen proportion of one ounce to the pound of was; add proportion of one ounce to the pound of wax; add diluted with ten times its weight of water. Keep the wax warm and stir. Let it stand a short time, then fill p the jar with hot water, and allow the whole to cool Afterward wash with water to remove any nitric acid alans that may remain, or finely shred it and expose
(3187) A. M. asks : How can I obtain fine gloss on collars and cuffs? A. Melt $21 / 2 \mathrm{lb}$. of the very best A 1 paramne wax over a slow fire. When itronelle Heve ready some round tin pie ple (pew) place them on a level table coat them slightly with weet oil, and pour about six tablespoonfuls of the namel into each tin. The pan can be fioated on water to cool it. Break up into pieces the size of a lozenge. ause the smoothing iron to impart the finest possible inish, leaving the clothes perfumed. See Supple nat 577
(3188) W. S. B. says : 1. In toning prints bey sometimes assume a deep red color, which cannot or hours. The redness sometimes covers the whole print and is sometimes in spots. I wash my prints in how can it be ror half an hour. Wedieds is due to to acid a toning bath, or insufficient gold in the bath. Sec that the toning bath is alkalne, and test with a piece of red litmus paper, which should turn blue if teneous A Yes,
(3189) T. P. R. asks how to prevent photographs from fading. A. See formula on page
0621, Scientific American Supplement, No. 665. eep the photograph in a dark place.
(3190) J. Z. G. asks why lead castings metimes crack while cooling. A. The cracking of lead castings is due to shrinkage, and generally occurs cracks in the recessed angles, unless filleted.

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