



## FOURTEEN TON LOCOMOTIVE CRANE

The crane hereillustrated is representative of a class of portable steam cranes specially designed and constructed in various sizes for use in steel works. The work to be performed is constant and heavy, night and day, such as ordinary cranes could not cope with. Every part is extra strong, and easily accessible for inspection, while compactness is a prominent feature. In order to be universally available through the works, they travel on the standard railway gauge, and have sufficient stability to 1 ft , with their full load suspended in any posit graving is from the Engineer, and made from a photograpb of the makers' No. 6 standard size, which lifts 14 tons at 12 feet radius, or 12 tons at 14 feet radius. It is the fifth crane supplied to Messrs. Beardmore, of Parkhead Steel Works, Glasgow, but it is the largest yet made capable of slewing aud traveling with its full load on ordinary gauge. These


#### Abstract

cranes are now in use in the principal steel works in England. and several have gone also to America and the Continent. The carriage is a massive casting of 10 tons, with a fore and aft wheel base of 8 feet center to center. The wheels with steel tires are for a gauge of 4 feet $81 / 2$ inches. The axles are of steel, 6 inches diameter, in brass bearings. The traveling gear, wheels, and pinions are of cast steel, and all outside. On each side of the carriage is a strong wing bracket, giving a width over all of about 7 feet, so that a guide rail or bar could be laid parallel to the rails on which the crane travels on each side, in special positions, when the maximum weights may require to be lifted. Tbis is an exmaximum weights may require to be lifted. This is an ex- tra precaution to provide for any jerk or abnormal strain tending to overcome the stability of the machine. These side rails or bars being half an inch under the brackets, would only come in contact when too great strain was put on the crane, and in case of a jerk the crafe diately settle back on the traveling rails. "多 One of the special features of this crane is the con tion of the central post and its connections. The post with its bearings is the most important detail in such cranes Messrs. Russell bave abandoned the use of the roller path o universally adopted in cranes by other makers; holding bat when such crines are exposed to dust and grit the wear is excessive. If the crane is used so that only a part of a evolution in slewing is performed, that portion of the ath wears the remaining portion below the level, so tha hrough time the crane ceases to be able to make a complete evolution. If the roller path and sole plate are cast to gether, the casting requires occasional returning and even ewal, which is inconvenient. The small engraving shows an improved arrangement of (Continued on page 132.)




IMPROVED FOURTEEN TON LOCOMOTIVE CBANE.

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## balancing wheels and cylinders.

For wheels of large diameters and wheels and cylinders o great velocity, accurate balancing is required. It is not yet determined that a standing balance aud a running balance can be made identical, especially when a belt is used, as on the flywheel of an engine, or the momentum of a crank is to be overcome. But for many purposes the standing balanc is near enough to accuracy to prevent tremor and injurious jar in running. When the wheel can be turned inside a well as outside, the rim balancing is not always necessary if the arms approach uniformity in size; but there are cases where inside turning is impossible, and balancing becomes a necessity.
There are three methods of balancing in use, the mos common being the suspension of the cylinder or wheel on the centers of an arbor or slaft. This is not always accurate, as, if the wheel is very heavy, the centers must be set up too hard to allow the wheel or cylinder to turn easily.
A better way is to suspend the wheel by the journals on which it is to run; but of these are seated in boxes, the same objection will exist. To obviate this, the journals are some times mounted on friction rollers; but a much more accurate method is to mount them on two parallel bars, planed and filed to exactness and rixed perfectly level. These ar long enought to allow the journals to travel far enough to make a complete revolution of the wheel or cylinder shaft, 3 inches diameter requiring bars something over 9 inclie long. By this method the degree of accuracy obtained is very great, as the journals bear on the bar at only one point and the mass rolls at a touch
There is still another method, especially applicable to large turned wheels, as the fly wheels of steam engiues. In this the wheel, after being bored and turned, is suspended by the central hole so that the wheel hangs horizontally. The wheel is held by an eye bolt accurately turned, having mounted on it two disks with shoulders turned to fit the bore of the wheel; thus the eye of the bolt is in the mathematical center of the wheel. The wheel is then suspended by a crane, and a spirit level laid on the turned edge of the rim. If the wheel hangs true, the level will show no declination; but the slightest variation of weight will deflect the rim. Pieces of iron are hand clamped on the opposite side, and when accuracy is attained the clamp and weight are weighed, and a pattern for a casting to goinside the rim is made accordingly.

## Coforing of Bnass.

We translate the following from Industrie Zeitung
If brass he covered with moistened sand for some time a beautiful brown coloration is developed upon the surface, which remains bright when polished with a dry brush. In order to render the color more light or green, it is covered with a film of verdigris obtained by evaporation of dilute acid applied to the surface. The antique appearance of the article thus treated is quite beautiful and more or less lasting. An objectionable feature of the process is the extent of time necessary for its execution, and it bas for this reason been substituted by another process.
The brass being beated is immersed in old or dilute nitric acid, and left therein till the surface is covered with scales; it is then cleansed with sand, washed, and bronzed. The term bronze comprehends in commerce all possible colorations.
Brown is obtained by immersion in a solution of nitrateor chloride of iron; the intensity of the color being dependent on the strength of the liquid-for violet colors antimony chloride being used; while a chocolate color is obtained when the surface is covered with a layer of humid iron oxide and highly heated, and polished with graphite. By moistening the brass with a solution containing iron and arsenic chloride, an olive-green is imparted to it. The liquid is prepared by dissolving the respective metals in muriatic acid. The surface is polished with a graphite brush and coated with a lacquer composed of 1 part varnish, 4 parts turmeric, and 1 part gummi gutta
A steel color is developed by using a boiling solution of arsenic chloride, while a careful application of a concentrated solution of sodium sulphide causes a blue coloration.
Black, being generally used for optical instruments, is obtained from a solution of gold or platinum chloride, to each of which tin nitrate has been added. In Japan the brass is bronzed by using a boiling solution of copper sulphate, alum, and verdigris.

The success in the art of bronzing depends in a chie measure upon the temperature of the alloy and solution, the quality and proportion of the metals used in preparing the alloy, length of time of immersion, drying, and many other particularities-as regards care of the manipulations-which demand a dexterity only acquired by practice.
When it is not the object to impart to the surface an artificial color, but to protect it against the formation of rust or oxidation, a coating of the surface with a varnish called "lacquer" will then suffice. The metal is heated as above, steeped in acid, and washed with water; it is again immersed in pure nitric acid, washed, and diried in sawdust. Or the brass is placed in dilute nitric acid-1 part of acid to 1 part of water-until the surface appears quite white, being then washed and dried as before. The first method produces a bright, the latter a dull surface; by polishing the projecting
parts this imperfection is partly overcome. The articles are parts this imperfection is partly overcome. The articles are
again immersed in acid, washed with water, containing some crude potassium bitartrate, and dried in hot sawdust. The
varnished. The varnish used is prepared by dissolving 1 ounce shellac in 1 pint alcohol. Pigments, sandalwood dragon's blood, and annatto are introduced to increase the color and gloss; also turmeric, saffron, gummi gutta, etc. The former produce a yellow, these a red, and a mixture of both a beautiful orange colored varnish.
An excellent light colored lacquer consists of 3 parts aloes, 1 part turmeric, and 1 part plain varnish. A yellow lacquer is composed of 1 part turmeric, 4 paris dragon's blood, and 1 part of the spirit varnish. A red lacquer can be made by mixing 32 parts of annatto, 8 parts dragon's blood, and 1 art varnish.
Lacquers fade and are chemically altered by the rombined action of light and heat, and should be kept in vessels of glass or earthen ware; they are also affected by metals.

## The Microscope in Analysis

The recent gift by Andrew Carnegie of $\$ 50,000$ to Belle vue Hospital, New York city, to be devoted to the further ance of microscopic study and microscopic investigation, is a step which must go far toward adding to the value of the microscope as an aid to the chemist as well as to the physician and surgeon.
With every improvement in that noble instrument, the telescope, new worlds are revealed to the astronomer, and the science of astronomy owes as much to the skill of Alvan Clark, the instrument maker of Cambridge, as to the patience and learning of Secchi or of Proctor or Langley. patience and learning of Secchi or of Proctor or Langley.
So it is in respect to the microscope, and the skillful and So it is in respect to the microscope, and the skillful and
ingenious men who are continually improving and perfecting these invaluable instruments. The modern analytical cbemist finds a microscope almost asindispensable in his researches, especially in organic analysis, as are bis retorts and acids and tubes.
The intricate relation which botany bears to medicine presents a field in which intelligent use of the microscope must produce excellent results. The student of medicine is to-day enabled to unravel, before the potent glance of the perfected microscope, the deepest mysteries of the medicinal plant, flower, berb, or root. The nature, virtues, attributes, etc., of these can be studied at leisure, and gazed upon with an eye that magnifies from a few hundred to thousands of diameters.
The brilliant discoveries by Pasteur and by Koch are as much due to the perfected microscope as to any one cause. The nature and habits of the tubercular bacillus bave only been capable of study since the microscope was so improved that organisms heretofore unrecognizable stand revealed. Disease has been traced to its source, the presence of bacteria and germs, by the use of the finest microscopic appliances; and in fact a thorough course study in the art of intelligently using this instrument is becoming yearly a greater necessity, not only to the medical student but the pharmacist who wishes to keep abreast of the age we live in. The relation of the microscope to cholera is at present an interesting and close one. And when another potent servant of man, electricity, is summoned to aid the microscope, the power of the latter is increased to an astonishing degree. Recently in London such an apparatus threw upon a screen the image of a cholera germ, magnified two million times, and in which these long hidden and minute organisms appeared the size of the huntan hand.
The motto of the modern microscopist seems to be: There is nothing bidden that shall not be revealed." And the determination of the modern student of medicine and of drugs and their effect and nature should lead bim to expend less upon cigars and divers luxuries and aim to be the possessor of an instrument without which three-fourths of the realm he proposes to enter will remain invisible. Fortunately, the growing perfection of the instrument does not imply increased cost. And it is now possible to secure a microscope of marvelous power for a sum which a decade ago would by no means have secured a much less perfect instrument.
We are satisfied, concludes the Independent Record, of this ofy, that in the next few years the microscope, in the hands forainy and quick witted American students, must pave he way for discoveries in the realm of medicine that will be worthy of a place beside those of Pasteur or of Koch.

## A New Revenue Cutter

The Commodore Perry, a United States revenue cutter, just completed by the Inion Dry Dock Co., of Buffalo, for service on the great lakes, is an iron steamer of 451 tons displacement. Her length over all is 161 feet, on the water ine 145 feet, beam 25 feet, depth 11 feet 2 inches, draught of water 9 feet. Her rig is that of a topsail schooner. Her engines and boiler were constructed by the Hartford Engineering Co. The boiler is a returu tubular, 15 feetlong and 11 feet 6 inches diameter of shell. She has a single direct acting engine, cylinder 38 inches diameter and 40 inch troke, single screw propeller 10 feet in diameter and of 4 blades. Her decks and spars are of white pine. All bands rom the captain down are quartered below the main deck; he captain's cabin is in the extreme stern next the ward room. The engine and boiler are amidships, and the men orward.
The woods used for finishing are white pine, black walnut, mahogany, cherry, and ash. She is a neat, handsome little builer, inside and out, in every way creditable to the by Mr. Frank R Rosseel, of Buffalo.

## aspects of the planets in september.

 saturnis morning star, and wins the first place on the planetary record, for his beautiful appearance in the eastern sky, and elso beeause he reaches one of the great time marks in his course.

On the 16th, at 10 o'clock in the morning, he is in quadrature with the sun on his western side. He then passes the balf-way bouse between conjunction and opposition, and is in favorable position for observation, both with the naked eye and the telescope. He is at the same time conveniently situated for the star gazer, rising now at half after 11 o'clock in the evening, and, at the close of the month, making his appearance at half past 9 o'clock. For a time after his advent Saturn is the brightest star in the myriad host that sparkles in the star depths, but his supremacy lasts but a few short hours, when his fair rival, Venus, appears upon the scene and robs him of the proud distinction.
A peculiar interest is felt in the approach of the ringgirdied planet to tbe earth at the present time, for knotty problems are to be investigated-with little expectation of their being solved-connected with the complicated Saturnian system. The most magnificent member of the planetary brotherhood is drawing near the terrestrial domain under conditions that will not be exactly repeated until the present generation of astronomers has given place to the one that will succeed it. For though the members of this profession are distinguished for longevity, 25 years spans the length of the highest power of observation in an astronomer's life, while $29 \frac{1}{2}$ years must pass before Saturn presents the same advantageous position he now holds.
During this year and the succeeding year the finest telescopic views of Saturn and his rings may be obtained in northern latitudes. For in this time he passes his peribelion, reaches his greatest northern declination, and his rings are open to their widest extent; these events all occurring before the year 1885 closes.

The composition of Saturn's rings is a question of profound interest to men of science. When the rings were first discovered astronomers saw nothing wonderful in the fact that two rings sur rounded a planet, and accompanied it in its revolution aronnd the sun, any more than a child wonders at the creations of fairy-land. But as a knowledge of the science and the principles of gravitation advanced, it was found that if such a body were solid it could not be supported, but would soon be precipitated upon the planet. There are those who still believe that the rings are approaching the planet. According to Struve's figures, the fall will take place about the year 2150. The theory next advanced was that the rings were fluid. This was shown to be equally untenable. The next and last important step was a great advance upon the preceding, for the distinguished astronomer to whom it is due proved that there were unanswerable objections against both the solid and fluid constitution of the rings; he also suggested or revived a third theory. This is that the ring is formed of myriads of satellites, too small to be separated in the most powerful telescopes, and too close together to allow the intervals that separate them to be visible. The rings look solid and the surface unbroken on account of the immense distance at which they are observed, something on the same principle that the little drops of moisture, of which cloud and fog are composed, appear like solid masses as we look upon them.
The rings, as is well known, consist of two rings separated by an opening, while the inner ring is joined at its inner circumference to a third or dusky ring, considered partially transparent. There is also a line that looks like a division in the outer ring. A broad field here opens to investigators, and observers will carefully study the golden circlet in order to find if the comparative darkness of some portions of the
rings is not caused by the sky showing through the openings where the satellites are more sparsely congregated, instead of being breaks in the rings, and whether the dusky ring is not partially transparent.
No effort will be spared, no human aid will be unused, no favorable night will be lost, in the attempt to discover the weighty secrets our brilliant brother has hitherto kept hidden from mortal vision. If a few extra satellites chance to be picked up, while his faee and rings are being scanned, immortal fame will redound to the fortunate discoverers. This year, then, and the year to come are to be specially devoted to Saturnian investigation, a study of exceeding delicacy, requiring exceptional visual power and the long practice that makes perfect. For objects viewed at a distance of $900,000,000$ miles demand the higbest exercise of the highest powers with which humanity is endowed.
We have proof that the present favorable conditions for observing Saturn are being diligently improved. The Messrs. Henry, of the Paris Observatory, have recently made observations on the mysterious rings under atmospheric conditions that were exceptionally favorable. They make the startling announcement that, outside of the known rings, there exists a small bright ring on the outer border of the outer ring, the width being nearly equal to the division in the ring. Now if this new ring is a reality, other astronomers will not fail to see it, and the opinion will not fail to be coufirmed that important changes are taking place in the rings, especially in the outer one. There is a curious analogy between the solar system and the Saturnian system. The sun has eight planets and a ring of asteroids revolving around him. Saturn in like manner is surrounded by eight moons and a ring of minute bodies corresponding to
the asteroids. Some time in the future the reason for the correspondence may be discovered.
The right ascension of Saturn on the 1 st is 5 h .30 m. ; his declination is $21^{\circ} 51^{\prime}$ north; and his diameter is $16.8^{\prime \prime}$. Saturn rises on the 1st not far from balf past 11 o'clock in the evening; on the 30 th he rises at half past 9 o'clock.

## venus

is morning star, and seems as yet to show no symptoms of the falling off in brilliancy and size to which she must as surely succumb as the less glorious members of the family. She continues to travel westward, lengthening out the invisible chain that binds her to the sun until the 21st, when a change comes. On that day, at 70 o'clock in the morning she reaches her greatest western elongation, being then $46^{\circ}$ $6^{\prime}$ west of the sun. Here she reverses her course, approach ing the sun with slower step than she receded from him, ing the sun with slower step than she receded from him,
and gradually growing less brilliant as she draws near the central fire that will quench her lesser light.
One cannot belp regretting that the bright planet must ose her luster, especially after the superb aspect she took on during the month of August, when she seemed to illumine the eastern heavens like a young moon as she hung tremulous on the rosy waves of light that proclaimed the near approach of the sun.
The right ascension of Venus on the 1st is 7 h .45 m . wer declination is $17^{\circ} 11^{\prime}$ north; and her diameter is $30^{\circ} 4^{\prime \prime}$.
Venus rises on the 1st about 2 o'clock in the morning; on he 30 th she rises about a quarter after 2 o'clock.

## JUPITER

is morning star. Though the latest comer among the planets that usher in the day, he is far enough from the sun to be easily visible, rising now an hour and a half before the great luminary, and two hours after Venus, who looms
above the eastern horizon at 2 o'clock. One of the delightabove the eastern horizon at 2 o'clock. One of the delight-
ful observations of the month will be to watch the approach of the king and queen of the stars as they draw near each other on the celestiol road. On the 19th Jupiter is only an hour behind Venus, and, at the end of the month, he fol lows so closely in ber steps that only the short time of 15 minutes separates them. Observers who command the eastern horizon, and will take the trouble to rouse from their slumber in the small hours of the morning, will behold one of the finest exbibitions our brother planets can get up.

The brightest gem of the sun's family appears suddenly above the eastern bills, shining with dazzling brilliancy on the dark background of the sky, the prince of planets follows in quick pursuit, and the tirst magnitude star Regulus in near proximity completes the starry picture.

The right ascension of Jupiter on the 1st is 9 h .34 m . his declination is $15^{\circ} 10$ north; and his diameter is $30^{\prime \prime}$.
Jupiter rises on the 1st about 4 o'clock in the morning; on the 30 th he rises about half past $20^{\prime}$ clock.

## uranus

is evening star until the 20th, when he becomes morning star. On the 20th, at 10 o'clock in the evening, he is in conjunction with the sun. The four great planets are then on the sun's western side, and are all shining as morning stars. Neptune and Saturn have passed quadrature, and are more than half way advanced toward opposition. Jupiter is on the way to quadrature, and Uranus is just commencing his course for the same goal.
The right ascension of Uranus on the 1st is 1.1 h .51 m .; his declination is $1^{\circ} 40^{\prime}$ north; and his diameter is $35^{\prime \prime}$.
Uranus sets on the 1st about a quarter after 7 o'clock in the vening; on the 30 th he rises about a quarter after 5 o'clock in the morning.

## mercury

is evening star until the 19th, when he joins the ranks of the morning stars. On the 19th, at 10 o'clock in the morning, he is in inferior conjunction with the sun, passing to his western side, and increasing the number of morning stars to five in the following order of distance from the sun: Neptune heads the list and is succeeded by Saturn, Venus, Jupiter, and Mercury.
The right ascension of Mercury on the 1st is 12 h .11 m . his declination is $5^{\circ}$ south; and his diameter is $8 \cdot 6^{\prime \prime}$.
Mercury sets on the 1 st soon after 7 o'clock in the evening; on the 30 th he rises about half past 4 o'clock in the morn ing.

## neptune

is morning star and the leader of the shining brotherhood. He is of little importance now in his distant quarters, but we have faith that some time in the future be will point the way to a world or worlds lying beyond his sphere. Meantime his ethereal path must be closely watched, lest any unusual perturbations escape detection.

The right ascension of Neptune on the 1st is 3 h .25 m . his declination is $16^{\circ} 54^{\prime}$ north; and his diameter is $2.6^{\prime \prime}$.
Neptune rises on the 1st. about half past 9 o'clock in the evening; on the 30th he rises at a quarter before 8 o'clock.

## MARS

is evening star, the sole representative of that role through the whole month. He is moving slowly toward conjunc tion, but we must wait till 1886 for another opposition, when he ruddy planet will take on a more imposing aspect.
The right ascension of Mars on the 1st is 13 h .23 m. ; his declination is $8^{\circ} 46^{\prime}$ south; and his diameter is $48^{\prime \prime}$.
Mars sets on the 1st soon after 8 o'clock in the evening; on the 30th he sets at 7 o'clock.
the moon.
The September moon fulls on the 5th at 4 minutes before

6 o'clock in the morning, standard time. On the 10 th , the moon is in conjunction with Neptune; on the 12th, with Saturv; on the 15th, with Venus; on the 16th, with Jupi ter; on the 19th, with Mercury and Uranus; and on the 22d, with Mars. No planet is occulted by the moon in Septem ber in any part of the globe, but some favored mortals may see her pass over the star Aldebaran on the 10th, and we shall see her in his vicinity

## the harvest moon

An interesting lunar pheuomenon will occur when, after the full, the moon rises for four consecutive evenings with an average interval of 35 minutes between the time of rising. We may not think with the agriculturists of old that, by a merciful interposition of Providence, the day is thus apparently prolonged to help the husbandman in his labor. But we may be equally grateful for the charm of the landscape when floods of silvery moonlight quickly succeed the short September twilight, and show the artistic touch of our satellite in producing effects of light and shade that wo hu man pencil can reproduce in its perfection of stillness, soft ess, and serenity, so deliciously harmonizing with nature's great harvest festival.

## Krakatoa.

At the meeting of the Meteorological Society of Mauritius on May 22, several interesting communications were made with regard to this eruption; among others, a letter from a M. Lecompte, dated at Diego Garcia (latitude $7^{\circ} 20^{\prime}$ south, longitude $72^{\circ} 35^{\prime}$ east of Green wich) on April 24, describing how at breakfast, on the morning of August 27, they had heard detonations, low but violent, and, attributing them to a vessel in distress, had run, and had sent men, to different ponts of the shore of the island, who were unable to seeany thing to cause such sounds; also how the captain and mate of the Eva Joshua, just leaving Pointe de l'Est to anchor at Pointe Marianne (these places are supposed from the accoun to be near Diego Garcia), had heard the same detonations, and sent men to the mastheads, without seeing anytbing. These, with the previous reports from Rodriguez, showed hat in three distinct cases the sounds of the Krakatoa ex plosions were plainly heard at distances of at least twentytwo hundred miles, and, in the case of Rodriguez, of nearly hree thousand.
In Nature, May 1, it was stated by Herr R. D. M. Verbeek that these sounds were heard in Ceylon, Burmah, Manila, New Guinea, and at Perth, on the west coast of Australia, and, in fact, at all places within a radius of ahout $30^{\circ}$, or two thousand miles. But these later reports from Rodriguez and Diego Garcia show that across the waters of the Indian Ocean, with no land intervening, they were carried distinctly to much greater distances.
The still more remarkable atmospheric gravity waves which traveled round and round the globe in all direction from the Straits of Sunda, and which were fortunately reg istered on the self-recording pressure gauge of the large gasometer at Batavia, close by Krakatoa, were also registered on the barograms at Mauritius; and here there were distinctly recorded four successive transits of the waves from east to west, and three from west to east, the same as shown by Gen. Strachey to have occurred at some of the European stations. But, what is still more remarkable, there is a faint trace of a fifth transit of the waves from east to west on the morning of September 2, $i$. e., more than six days after the explosions, and when the waves had traveled more han four times round the earth, or about a hundred and two thousand miles.

## Overwork in German Schools.

After forty-two years' experience it is now virtually conceded in Germany that physical exercise is not a sufficien antidote to brain pressure, but that where the evil exists, the remedy must be sought in the removal of the cause.
Official action with reference to over-pressure has been taken in Prussia, Saxony, Würtemberg, Baden, Hesse, and Alsace-Lorraine.
The commission appointed by the stadtholder of AlsaceLorraine recommended that the number of study-hours should be restricted to twenty-six a week for the lowest classes of the gymnasia, and to twenty-eight and thirty-two for the higher; that the hours of home study should be eight, twelve, and eighteeu a week, progressing from the lowest class to the higkest; and thatsix bours a week should be devoted to general physical excrcise, including swimming, open air sports, skating, and excursions. While the existing conditions will be somewhat ameliorated by these decrees, they do not seem to have brought about a final solu tion of the difficulty. Last year a petition upon the subject, signed by eminent teachers, physicians, and other citizens, was addressed to the Prussian Chamber of Deputies. After setting forth the deplorable effects of the excessive strain upon the nervous system of scholars, it appealed to the patriotism of the deputies to put an end to the abuse, which, the petition aserts, "threatens little by little to reduce the cultivated classes of society to a state of moral weakness that shall render them incapable of great and manly resolution."

An inventory of the estate of the late Cyrus McCormick, the inventor of the harvester, bas been filed in the Probate Court of Cook County, III. The total is not far from twenty million dollars. The executors of this colossal trust furnished a bond for thirty millions.

A Forty Thousand Dollar Horse.
Mr. Wm. H. Vanderbilt bas lately sold the famous trotting horse Maud S. to Mr. Robert Bonner, editor of the N. Y. Ledger, for the sum of forty thousand dollars. An offer of one hundred thousand dollars from professional turfmen was previously refused by Mr. Vanderbilt, as he preferred to have the animal go into the hands of a privat ndividual.
Maud S. is believed to be the fastest trotter in the world Her best mile record is $2 \mathrm{~min} .93 / 4 \mathrm{sec}$. At 4 years of age she trotted a mile in $2: 17 \frac{1}{2}$, and Mr . Vauderbilt then bough er for $\$ 21,000$. She is a beautiful chestnut colored mare long neck, satin skin, brown eyes.

## COTTON BALING PRESS.

In the annexed engraving Fig. 1 is a sectional elevation of the hydraulic apparatus, and Fig. 2 is a perspective view of a cotton baling press recently patented by Mr. C. Baumgarten, of Schulenburg, Texas. The manner of constructing the press proper is clearly shown in the cut. In the bydraulic portion of the press is a tube of suitable size and length, which is hermetically closed at its lower end by a cap, screwed on, and upon whose upper end is screwed a strong collar having an annular recess in the upper side around the hole, into which the upper end of the tube screws. This collar is formed with holes to receive stud bolts by which the gland is held down on a ring of elastic packing. In this tube is fitted a second tube, for a piston, which is
tal for 1881 was $\$ 6,278,565,052$; the amount per mile, $\$ 60$ 645. The total for 1880 was $\$ 5,402,038,257$; per mile, $\$ 58,62$ The total for 1879 was $\$ 4,872,017,517$; per mile, $\$ 57,730$ It is to be observed that although, since 1879, the actua cost of construction per mile bas steadily diminished, very few expensive lines having been built, and during the las half of that period the cost of all construction material be ing unusually low, the apparent cost as represented by share capital and debt has steadily increased. The increase o cost in the four years since 1879, as represented by sbare capital and debt, equals $\$ 4,446$ per mile, and for the whole number of miles, 120,552 , constructed a total of $\$ 535,974,192$
The gross earnings of all the roads for their several fisca cars of 1883 were $\$ 823,772,924$, an increase from the previous year of $\$ 53,563,02$ ธ
Of the gross receipts $\$ 215,287,824$ were received from pas sengers, $\$ 549,756,695$ from freight, and $\$ 58,728405$ from miscellaneous sources. The net earnings for the year were $\$ 336,911,884$, an increase of $\$ 21,461,082$ from the previous year. The amount of interest paid was $\$ 173,139,064$, an ncrease of $\$ 18,843,684$ from the previous year. The amount of dividends paid was $\$ 102,052,548$, an increase of $\$ 21,114$ rom the previous year. The percentage in 1883 of gross arnings to investment was 10.99 per cent; in 1882, 11.74 in 1881, 1118 ; in 1880, $11 \cdot 36$; in 1879, 10•80. The percent ge of net earnings to investment in 1883 was $4 \cdot 49$ per cent n 1882, 4.81 ; in 1881, $4.56 ; 1880,5 \cdot 04$; and in $1879,4 \cdot 40$ per cent. The earnings per mile of all the railroads ope rated for 1883 were, gross, $\$ 7,461$; net, $\$ 3,051$


BAUMGARTEN'S COTTON BALING PRESS.
closed at the ends by plugs welded in, and on the head i seated a metal cup having a socket to connect with the pis ton by simply resting on it, aud the follower is attached to the cap by bolts. To check the piston and prevent damage in case it should accidentally fall too rapidy, and to pre vent the piston falling below and closing the water pipe, there is a strong coiled spring arranged beneath it. At the lower end of the outer tube is connected a pipe through which water is forced in to raise the piston. This pipe is provided with a conveniently located check valve, and is connectèd with a pump for forcing in the iiquid. The cylinder may be placed in a pit with the collar at the surface of the ground, so that the follower and case may be arranged low down on the ground floor when it is desirable to do so.

## The Railways of the United States

The introduction to the 17 th annual number of Poor's Manual, just published, comprises the following interesting and valuable review for 1883 :
The accompanying statements show a mileage at the close of the calendar year 1883 of 121,592 miles, 6,753 having been constructed within the year. The total length of completed oad at the close of the com panies fiscal years was 120,552 miles. The average mileage operated during the year was 110,414 . The amount of share capital issued by the several companies up to the close of their respective fiscal years was $\$ 3,708,060,583$, an increase from the previous year of $\$ 207$, 024,759 . The funded debts of the several companie amounted to $\$ 3,455.040,383$, an increase from the previous year of $\$ 219,497,060$. Their floating or unfunded debts amounted to $\$ 332,370,345$, an increase of $\$ 61,199,383$ from the previous year. The total increase of share capital and of funded and floating debts from the previous year equaled $\$ 477,721,202$. The total amount of all liabilities at the close of 1883 was $\$ 7,495,471,311$. The total per mile for completed mileage was $\$ 62,176$. The total of stock and liabili ties for 1882 was $\$ 7,016,750,109$; per mile, $\$ 61,303$. Th 47,548; $\$ 3,318$; in 1879 , gross, $\$ 6,652$; net, $\$ 2,761$.

Grand Canon of the Colorado.
At the last meeting of the Academy of Sciences, San Francisco, Prof. Davidson spoke of his re cent visit to the Grand Canou of the Colorado at a point 160 miles east of the Needles, on the Atlantic and Pacific Railroad, which required only $211 / 2$ hours' time, and an expense of $\$ 10$ for horses and guide and 75 cents a meal. He saw vertical walls 2,700 feet high, 6,200 fee above sea level, where the Colorado River was 190 feet deep, and cannot imagine anything grander than the effect of sunset shining on these walls, only $10^{\circ}$ from vertical, composed of different colored rocks, red sandstone, and the black overhanging rocks. The temperature wa $136^{\circ}$ Fahrenheit.

## PAPER AND CARD CUTTER

The top plate on which the paper is placea is supported at the ends by two-leg, braced frames Held longitudinally above the plate is a clamp ing bar that is beld in position by screws which pass through fixed nuts on the ends of the top plate, and which are provided at their lower ends with crank handles. Formed in each side edge of the bar is a groove, in which slide tongues formed on a cutter head resting on the upper surface of the bar. Mounted in upwardly projecting lugs on the cutter head is a shaft on each end of which is a bandle. Projecting downward from the shaft is an arm carrying a cutter blade, the inner edge of which rest against the side edge of a projection on the clamping har. As soon as the handles are released, the cutter is wung upward by a spiral spring mounted upon the shaft between the ugs, as clearly shown in the sectional view, Fig. 2. Part of the top of the table is divided into small squares by which to gauge the paper to be cut
The material to be cut is beld firmly by the clamp bar, which is pressed on the paper by the screws. The operator seizes the handles of the shaft, and turns them so as to bring the blade down when the cutter is pushed from him; the blade, sliding along the guide edge, cuts off that part of the paper projecting beyond the edge.
This invention has been patented by Mr. J. E. Tylee, and additional pariculars may be obtained from Messrs. Tylee \& Clarke, of Ashland, Neb.

## American and English Colonies in

 Russia.It is not generally known that there is an American town in the realms of be Czar, yet such is a fact, it being near Moreton Bay, Kamtschatka. The colony has been formed, gradually, by mmigrants attracted by the establish-
mert of important lumbering operations, including saw milis, by an American company, and the town itself, according to Z Zacht, has so far been practically ignored. It is not down pon any known map, does not appear in the cadastral nhabitants thereof pay no kind of tax, and, until recently at least, have remained independent of local authorities.

Another colony, of Englisu origin, of later establishment but analogous origin, exists near Archangel, on the White Sea, where are important saw mills managed by capitalists of North Britain.

## AN AERIAL PROPELLER

The accompanying engraving represents an aerial propeler recently patented by Mr. M. H. Depue, of Homer, Ill. The propeller, Fig. 2, has a rim and bub in which are jouraled radial blades; each journal of each biade being pro vided with two transverse arms in the same plane. The main


DEPUE'S AERIAL PROPELLER.
udder for guiding and controlling the machine is shown in he right side of the perspective view. Upon each side, at he other end of the balloon, is a rimular rudder used to aise and lower the machine when balanced in the air, there by avoiding the necessity of throwing out ballast or let ing out gas. The under part of the balloou, next to the car, is made straight, thereby giving the propeller more power, and the car a better sbape for the other attachments. When the car descends, it alights upon small wheels, which revent scraping and slidiny on the ground. Figs 3 and how the hub of the wheel and the frame and a single paddle or blade in different positions.

## Real Disinfectants.

Professor De Cbaumont, in a lecture at the Health Exbibi tion on cholera and its prevention, exposed the untrust worthiness of many so-called disinfectants. The belief in a ew of these disinfectants has come to be almost a superstition, and it has been too much played upon by some saniary authorities, and even medical officers of health, who in times of smallpox have covered all available hoardings in the parish with posters vaunting the epidemic virtues of disinfectants. Professor De Cbaumont said: "Iu regard to


## tylee's paper and card cutter

disinfectants, there is but one true disinfectant, viz., fire. The majority of so-called disinfectants are simply deodorants The idea that tobacco smoke or the odor of camphor is de tructive of contagion is still extensively held, though it is imply absurd. A true disinfectant is a substance tbat will kill the germ or living particle in which the contagious principle resides, or through which it is conveyed."

## Rabies Inoculation.

It is now about four years since Pasteur commenced his experiments and researches into the nature of hydrophobia the results of which have been recently given to the public. Although the profession and scientists generally may not be very sanguine as to the grand results which this distinguish ed savant claims, yet enough has been advanced to warran the French Government in appointing a commission of sci entific men of indisputable authority to investigate the mat ter and to test the value of the interesting experiments in stituted by Pasteur. The names of Vulpian, Villemin, Bert, and Bouley are a sufficient guarantee of the character and reliability of the proposed inquiry. Pasteur in the course of his experiments hil upon the expedient of inocuating the brain of the animal with the virus of rabies. The sull is trephined with a small instrument, aud the virus introduced.
By this method the action of the virus is much basten ed, the effects being manifest in a few days, instead of from twelve to fourteen days. In fact, Pasteur thinks he has in this way demonstrated that rabies is a malady of the brain. In the course of his experiments he found that the virus, after baving passed through three monkeys in succession, becomes so attenuated that its introduction into a dog is barmless. But when the virus is passed through the rabbit and Guinea pig in like manner, it increases in viru lence, becoming more virulent than the virus of the rabid dog. The plan proposed is to take the virus from a rabbit dying after inoculation, and inoculate this successively in other rabbits, and finally in the dog, which is thus rendered refractory to the rabies.
The test experiments proposed by Pasteur consist, first, in causing twenty unprotected dogs and twenty " vaccinated" dogs (presumably protected thereby from poison) to be bitten by dogs in a rabid state; and, second, in artificially inoculating with the virus of rabies two other sets of twenty dogs, respectively vaccinated and unvaccinated. "The twenty vaccinated dogs," says Pasteur, "will resist the poison, and the other twenty will all die of madness."
The importance of this discovery, if true, cannot be over estimated, but we must not be too ready, the Canada Lancet says, to express unqualified approval and indorsement of Pasteur's views. It will be observed that he uses, contrary to what one would have supposed, the virus from rabbits, and not the attenuated virus from monkeys. Furthermore, he does not propose to apply the virus for the protection o human beings, although we have read in the press that per sons applied to him for inoculation. The experiments so far do not seem to us convincing, and we wait with considerable curiosity, mingled witil not a little anxiety, the report of the commission. The result of these trials can hardly fail to be largely decisive of the question one way or the other and will be an unequivocal illustration of the value of experimental pathology. Meantime, we agree with the man who said that the best way to prevent bydropbobia was "to shoot the dog before he went mad."

## PAPER OR LETTER BOX

A flat bos baving an open side and one of the longitudinal edges open is secured to the door in such a manner tha when the door is closed the open edge of the box will rest against the side of the casing, which thus covers the opening. In the lower end of the box is a slot, the side edges of which are turned inward to form upwardly projecting flanges. When the door is closed the paper is pushed up into the box through the buttom slot, and as the edges of the paper distend after it has been pushed in, they rest ove the flanges, thus making it impossible to pull the paper out of the box through the slot. The patper is thus secured un-


STOCKS' PAPER OR LETTER BOX.
til the door is opened, when it can be easily removed from the box through the side opening. The paper is thus protected from thieves and from the weather, and the box is simple in construction and cheap.
This invention has been patented by Mr. Harry Stocks, and particulars may be obtained from Messrs. Campbell \& Han scom, of Lowell, Mass,

## BAG AND TWINE HOLDER.

The bags are strung upon wires carried upon posts de pending from a horizontal flange formed on the inner fac of the octagonal ring. The wires are held to the parts by hinge connection at one end of the wires, the hinges being formed by bending down the ends of the wires and passing these portions through holes in the lower ends of the posts, the pins being headed below the posts to hold them in place. The slots in the lower ends of the posts not only fford a means of connecting the hinge pins, but serve as guards to the pointed ends of the pins, which spring into the upper parts of the slots and lodge in the lower parts. The wine holder is made in the slape of an acorn and is at ached to the ring by arms.
The cover is held in place by lugs on the lower portion


## GILLILAND'S BAG AND TWINE HOLDER

which engage the inner edge of the cover when the slots in he cover-which pass over the lugs when the cover is put n-are turned around either way to carry the slots out of ine with the lugs. Chains connect the octagonal ring to a collar which is fitted with a swivel hook, in the efe of which a chain is placed to suspend the bag and twine holder at a convenient height above the counter. Figures are cas or painted at the center of each plane face of the ring, to ndicate the sizes of the bags held by the wires. In at taching the bags, the points of the wires are lifted from the slots and the bags strung on. The upper edges of the wires are made angular, to facilitate tearing the bags from hem.
Further particulars relating to this invention may be ob ained from the patentee, Mr. E. I. Gilliland, of Salt Lick Pa .

## Inventions Wanted.

Under this or similar headings the editor of the Scientific american has frequently called attention to inventions needed or to special manufactures for which there was present demand.
There is hardly any field of invention which has been so little cultivated as the American house. For instance, what a disgrace it is to the mechanic arts in this country that every stick of timber in every house is not fireproofed by a cheap, practical process, the plant for which should become the second thing after a sawmill to be rected in every new settlement! For want of a cheap, prac tical process for fireproofing wood, one hundred million dollars' worth of property are destroyed ever year in the United States. The carpenters have hitherto opposed such processes because the mineralized wood is less easily finish ed with the common tools. But a large part of all the wood in a house is used in the rough, and this objection need no apply to it. For the finished wood let the nireproofing and steam seasoning be done together, after all the finishing bas been completed except the final fitting. For the fina smoothing, if edge tools will not work, let us have new tools, carrying pumicestone or other abrading and polishing material.
We are entering on anew and more complex system of domestic architecture-the family club house or social palace-which will require a host of uew inventions. It is not looking very far ahead to see whole towns built in this way. These buildings must bave their internal railways and elevators of all sizes. They must be tunneled for ho and cold air flues, ventilating flues, with artificial draught steam, gas, water, and sewerage pipes, and speaking tubes. They must be equipped with an electric generator and electric wires for light, power, and telephony, with arti-
ficial refrigerating as well as heating apparatus, with gas generators, and the most perfect rooking and washing machinery. All of this machinery must be made on a large scale with a capacity of subdivision.
There is, at the present moment, one desideratum in th modern house for which no sufficient provisiou exists, and
which would insure a number of fortunes to the parties who would introduce the wished-for article in a cheap and prac tical form. This is a small elevator, run by the water in our city pipes, of no greater power than fifty pounds raised ten or twelve feet, applied to running the common dumb waiter. This little simple invention would be a very import ant labor saving machine in the average house with a base ment kitchen. It would save its own cost in broken crock ery and servants' wages, not to speak of the temper of mpioyers and employed
There is room for a dozen manufacturers to advertis cheap, practical little elevators for this purpose in the Scr entific American. Once introduced into our city houses, no house with a basement kitchen could go without it. The automatic dumb-waiter would have an enormous distribu tion.

Wm. F. Channing.

## Taking Down a Chimney.

From a paper entitled "Cbimney Construction," by Messrs. R. M. and J. F. Bancroft, we take the following in teresting account of an ingenious arrangement employed fo aking down a chimney shaft in Middlesboro', England, the method followed being necessary, as the chimney stood in crowded position, and therefore could not be thrown down. The bricks had to be lowered with as little damage as possi ble, so that they might be used again for building purposes Owing to the position of the chimney the bricks could no be thrown down outside, and if thrown down inside they be thrown down outside, and if thrown down inside they
would have been smashed, or if lowered by mechanical would have been smashed, or if lowered by mechanical
means the process would have been very tedious, and was means the process would have been very tedious, and was
impracticable. Under these circumstances it was considered whether the bricks could not be allowed to fall by their ow gravity, and at the same time be cushioned sufficiently to break their fall and prevent damage. In order to do this an airtight iron box was placed at the bottom of the chimney this box was fitted with an airtight door mounted on hinges, and closing on an India rubber face, against which it wa tightened by a wedge.
A wooden spout was then fixed to the top of the box and carried up the chimney; it was $31^{\prime \prime} \times 5^{\prime \prime}$ inside, and wa made of planks $11 / 8^{\prime \prime}$ thick, well nailed together, with a littl white lead on the edges, thus making it airtight. The spout was made in about twelve foot lengths, and these wer joined together by cast iron sockets or shoes, and corked round with tarred yarn, the whole apparatus costing abou $\$ 30$. A few stays were putinside the chimney to keep the pout steady, and steps were nailed upon it, by which the men ascended. It will be seen that the whole of the spout ing being airtight, if a brick filled the spout it would not descend; but as the section of a brick is $3^{\prime \prime} \times 41 / 2^{\prime \prime}$, and the pout was $31 / 2^{\prime \prime} \times 5^{\prime \prime}$, there was a quarter inch space each way through which the air could pass the brick freely, the space further allowing for any irregularity in the sizes of the bricks. The result was that the bricks, being cushioned in their fall, arrived at the bottom without any damage. As soon as the box was full the man at the bottom rapped on the spout as a signal to stop, and then opened the airtight oor and removed the bricks inside. This being done be shut the door and signaled same to the man at the top. The man on the top lowered his own scaffold, and as the spou became too high be cut a piece of with a saw. If there was much mortar adhering to the bricks, it was knocked off before putting the latter into the spout, and such mortar, etc. was allowed to fall inside the chimney, and was afterward wheeled out.

## STAMP AND ENVELOPE MOISTENER

The engraving shows an apparatus for moistening stamp and adhesive envelopes that was recently patented by $\mathbf{M r}$ D. G. Beaumont, of Laredo, Texas. A box made of any desirable material and of convenient form may be adapted to contain water, or may be provided with a removable ater reservoir. The cover is formed with an oblong

beaumont's stamp and envelope moistener.
aperture to receive a wheel upon whose periphery is a cover ing of cloth or other suitable material which dips in the water in the reservoir. After revolving the wheel so as to saturate the covering with water, the stamps are moistened by pressing them lightly against the covering; this plan avoid the inconvenience of moistening them with the tongue, and the incon venience of moistening the
also removes verylittle of the gum,

The Excavation of a Great Cut in France.
The railroad from Saumur to Chateau-du-Loir, after leaving the valley of Loire, crosses an elevated plateau by a cut 1,640 feet long and with a maximum depth of $621 / 3$ feet; the cubic contents equaled 274,500 cubic yards.
The material belongs to the Tertiary period, the Eocene; it is made up of a bed of clay inclosing large bowlders of a pudding stone formation, lying in distinct strata, about 17 feet thick; under this is a bed of white clay, $291 / 2$ feet thick, traversed by small veins of sand; beneath this again is sand.

The method of removal adopted was as follows: A gal lery or tunnel was driven into the cut at its base, and this tunnel was connected at intervals with the surface of the cut by vertical shafts located on the axis of the cut. These wells were then enlarged from the top by giving them a funuel shape, and the material thrown directly into the cars placed beneath, at the bottom of the shaft. The tunne was driven from both sides.
The tunnel was timbered as in a mine; two posts and a cap of oak $10 \times 10$ inches, spaced about 5 feet apart, with lagging of poplar planks $10 \times 11 / 2$ inches and $61 / 4$ feet long. The gallery was $7 \frac{8}{10}$ feet high and $111 / 2$ feet wide in the clear.

While the tunnels were being driven, the wells were also sunk. At the bottom of the wells the caps of the tunneltimbering were tied together longitudinally by braces spaced $31 / 3$ feet apart, thus forming a kind of box and strengtheuing the upper part of the gallery; four of the covering planks covered this space.

As soon as the wells were finished and the tunnel driven, the removal of the material commenced. The workmen began by breaking away the earth at the top of the shaft by bars and throwing it into the opening. As soon as the slope of the cone thus formed became too flat to permit the free motion of the debris, the cone was deepened so as to present a steeper pitch. One man in the gallery was all that was required to regulate the fall of the earth into the cars. At this cut only two wells were worked at a time; this was sufficient to furnish a cube of 600 cubic yards daily. By this method timber was saved, and the tunnel admanced reusing that from the portion of the cut innished.
The train of empty wagons was drawn in by three horses, and the horses and their driver were prisoners in the tunnel heading while the filling was going on, but as no relays of horses were thus required, an interval of rest was afforded. The loaded cars descended by gravity to the dump by reason of the grade of the road.
In this method of excavating, it is advantageous to have car's as large as possible so that they may be less frequently moved; at the cut in question the cars contained $43 / 4$ cubic yards and ran upon a track of 5 feet gauge. As each movement of a car corresponds to a stoppage in the excavation, as soon as the bed of sand was reached the engineer, to avoid the loss of time from this cause, put a stop valve at the bottom of the well.
The valve was made by placing upon a timber framework a sheet iron cylinder 2 feet in diameter, closed at the bottom by an iron door, like that used on a beton mixer. This door moved horizontally in guides, and was pivoted at one side.
When the successive funnels met at the top, a series of cone-like excavations of great width were presented, and it only remained then to cut down and remove the walls of earth lying between the cones.
The cost of the timber for 1,200 feet of tunnel, including the timbering of the shafts, was $\$ 782$,
The manual labor and expense of driving the tunnel amounted to $\$ 1.83$ per lin. foot. The total expense was as follows:

Dividing the total cost by the contents of the cut, 274,500 cubic yards, we have as the cost per cubic yard about $1 \cdot 1$ cents ( 0.074 fr . per cubic meter).-Genie Civil; Engineering News.

## Painting Shingled Roofs.

More shingle roofs are paiuted now than ever before in the history of building in this country. It is mostly seen in cities and suburban towns, although in the country it is by no means rare. Considerable inquiry has led to the conclusion that many have their roofs painted to add to their appearance, which in many cases it certainly does, while others labor under the impression that the paint acts as a preservative to the shingles. The latter are probably right, provided the paint is renewed as often as it needs to be. If the roof is allowed to remain with the paint partly worn off the shingles will retain more moisture, and conse quently decay sooner then they would were they not painted at all. On the score of durability, however, little can be gained in cost by painting. A good shingle roof unpainted will last a great many years, and the expense of painting it a few times would replace it. One painter, who had painted the roof of his own house, when questioned by a representative of the Lumberman, used good logic from his standpoint. He thought that painting a roof would add somewhat io its length of life. "You see," he said, "that I have painted mine. I do for myself what I desire to do for others. If I did not, the influence would be bad."

## FOURTEEN TON LOCOMOTIVE CRANE

(Continued from first page.)
post and bearings. The post is a wrought iron forging, A, fixed in the carriage, with a bearing at top and bottom, on which the crane revolves. The weight is carried on a steel plate fixed on top and the steel bush, B. This bush is screwed into a jacket or case, C, which is continued down to the bottom bearing. The post is thus entirely inclosed, and no dust or grit can find access to the bearings. There is a square head on the bush, to which is titted a large cap, E , fixed by four bolts to the cross girder, D , which is a wrought iron plate. The bush can be adjusted by screwing it in the case to maintain the crane at a constant level above the carriage, taking up any wear. It can also be removed and replaced for inspection or cleaning in a few minutes. On unscrewing the bush the crane settles down about a quarter of an inch lower than the working level, and rests on the carriage till the bush is replaced. The side frames are of massive proportions, with brass bushes and covers for the various bearings of the shafts. There is a large balance weight of 8 tons under the boiler, with ash space and self-discharging arrangement. The boiler has two cross tubes in the fire box, and is double riveted in the vertical landings. A capacious tank is carried on the opposite side to the platform. The engines have a pair of 8 incb cylinders, with link reversing motion of steel. The crank shaft is bal anced by weights to prevent vibration. T.he disengaging

clutch for hoisting is in the view of the driver on the plat form, and there is a powerful foot brake for lowering.

The jib is 22 feet 6 inches long, of wrought iron, with lattice stays, and is adjustable by worm and wheel motion The haudles are all convenient to the driver, who has easy control of all motions, viz., hoisting, lowering, slewing, traveling, and adjusting radius. The weight of the crane i 41 tons, exclusive of water in the boiler or tank; the center of gravity of the whole is as even as possible to obtain maximum stability. The greatest radial projection at the back is 7 feet 9 inches.

Saccharification of Different Starches.
In spite of all that has been written and said concerning the saccharification of the different starches siuce brewers have been allowed to use unmalted grain in their mash tuns, there is still, says the Brewers' Guardian, much difference of opinion, and the practical applications of theoreti cal opinions have not always been attended with success. In dealing with the couversion of starch into sugar, the fact has frequently been overlooked that starches vary very considerably; the starch of barley is in many respects different from the starch of maize, and the starch of rice differs from both; this difference is not in the chemical composition, for all the starches are identicul in this respect, but in their physical properties; the size and aggregation of the different starch cells have a most important bearing on the problem which has engr red so much of the attention of brewers of late. From the following table it will be seen how greatly the cells of the starches vary in size; the dimensions are given in decimals of an inch.

| Potato. | .0.00270 to | $0 \cdot 00148$ |
| :---: | :---: | :---: |
| Maize.. | about | $0 \cdot 00074$ |
| Dari | . ${ }^{\text {c }}$ | 0.00074 |
| Wheat. | . $0 \cdot 00185$ to | $0 \cdot 00009$ |
| Barley. | about | $0 \cdot 00073$ |
| Oat. | " | $0 \cdot 00037$ |
| Rice. | .0.00020 to | 0.00002 |

It will thus be seen that the sizes of starch cells vary between very wide limits, and it has been established by some experiments of Symous and others that the smaller sized starches resist the action of moist heat much more than the larger ones; the cells of potato starch, for instance, tumefy and burst at a temperature several degrees below those of
a very important bearing on their saccharification, and scarcely sufficient attention has yet been paid to the subject. The larger the starch cells, the more compact and dense ar their cell walls, and thus the greater is the resistance to the disintegrating influence of heat; diastase, also, has com paratively little action on the outside of the starch cells the cells must be burst or broken, so that the diastase can penetrate into the interior for this agent to exert its full saccharifying action. If this view be correct, the difficulty of conversion of the starches must be in direct proportion to the sizes of the cells, aud the experience of practical men will probably confirm this, for although rice is a brewing material which presents many advantages as regards price and purity, it is not saccharified with the same ease as maize or potato starch, unless previously submitted to some treat ment by which its starch cells are ruptured. Before the so lution of this problem can be satisfactorily effected, the phy sical as well as the chemical propertics of starch must be taken into consideration, and it is in this direction that further investigation is needed.

## Gerome Cheese.

The following is a description of the manufacture of a very popular cheese, known in France under the name of Gerome. It is largely consumed in Paris just as it is ripe and it would be difficult to mention any cheese which is more delicious at this particular period. It is a soft round cheese, varying in weigbt from 4 pounds te 8 pounds, and is some times made with the addition of aniseseed. It is made with milk at the temperature at which it comes from the cow this being placed in a deep copper vat holding some forty five quarts, when it is covered with a wooden lid, in the cen ter of which is inserted a wooden funnel resembling in form a cup. To the bottom of this is attached a cloth for strain ing. When this is not used, a small disk is drawn over the hole. The rennet is immediately added, in quantity accord ing to the weather and its strength.
In half an hour the whey is divided from the curd with a ladle, and the vat recovered. In another half hour the separation is continued, with the aid of a copper strainer, 12 inches by 4 inches. When the curd is divided into pieces about the size of a small nut, it is taken out and placed in wooden cylindrical moulds, from 5 inches to 9 inches in diameter. Two moulds are used for each cbeese, the one being fixed into the other, which is somewhat larger in di ameter, and has a number of holes pierced in the bottom The total height of the two when fixed is from 14 inches to 16 inches. The curd entirely draius in this mould, and a the end of about twelve hours it will have sunk to about the height of the bottom and larger part of it, so that the top part can be taken off. The cheese is then placed in anothe mould of the same diameter as the bottom one, and put upon a shelf upside down. After six hours it is again turned, and this turning is continued twice daily for the two following days.
In draining the whey the moulds are placed upon sloping shelves, which are furnished with a rim at the edge, as in the Camembert cheese rooms in Normandy. The whey run off, and is collected in a receptacle placed at the side of the table for the purpose. The temperature of the room in which this operation takes place should be from $59^{\circ}$ to $64^{\circ}$ Fab The next thing to be done is to salt the cheeses, which for this purpose are placed upon small boards made of beech, and upon which layers of fine salt are sprinkled. The surface of the cheese must be well salted, and the operation repeated every three or four days, care being taken that it is turned each time. This turning is continued twice daily for three days after salting, and the surfaces of the cheeses each tim are gently moistened with tepid water. When sufficiently dry on the crust they are removed to the drying room, 30 grammes of salt having been used in the salting process. In this sechoir, or drying room, the cheese shelves are built on above the other, so that large nuinbers of cheeses can be kep in a small space and well cured, provided the temperature and aeration are complete. In summer the process of ripen ing is frequently conducted in the open air, the cheeses be ing protected with cloths to keep off flies and the sun; but during the other parts of the year a specially prepared room is invariably used.
When thoroughly dry they are removed to the cave or cellar for the completion of the process, and here they ar very carefully managed. This cave must be in good con dition, with a draught of air passing through it; but if the temperature is too low, the cheeses crack and lose quality The time they remain here is determined by the season and the size of the cheese, the maker judging this for himself The largest, however, are usually kept from three to fou months. While in this compartment they are often turned and washed with tepid water slightly salted, and daily ex amined to see whether they are ripening too rapidly. When they are brick-red in appearance and the surface sufficiently firm to yield to the pressure of the inger, they are ready for market. A good Gerome is firm on the exterior, rich, and oily, and has a few small bolesin the interior; while inferio makes, like inferior Gruyere, have numbers of large holes, are fragile, easily crumble, and sometimes become soft and pulpy when the whey has not been properly extracted from them.--London Grocer.

## Platinized Magnesium

M. Ballo.-Magnesium, which has no action upon pure water, decomposes it instantly in presence of a trace of platinum chloride,-Zeit. f. Anal. Chem

## Correfyaudemte.

## Lightning for Diamond Making.

To the Editor of the Scientific American.
I notice in your issue of July 26 that a correspondent of English Mechanic proposes to utilize lightoing for the purpose of nanufacturing diamonds, but has failed thus far on account of the scarcity of lightaing strokes in the locality in which his apparatus has been erected.
Will you please inform the gentleman through your paper that I can show him a place where lightning strikes on an average once a year; at least it has done so for the last four years, keeping within a radius of two hundred yards from my house.
An aunual yield of balf a bushel or so of diamonds will amply repay all expenses of moving and resetting the apparatus. No charges made for this information; a donation for the rebuilding of my school, destroyed by lightning a couple of weeks ago, will, however, be thankfully received

Peter J. Desmedt,
Pastor of St. Mary's.

## Cbeboygan, Mich., July 28, 1884

## Work of a Small Engine.

I'o the Editor of the Scientific American:
We have in our mill a direct-acting engine, $10^{\prime \prime} \times 12^{\prime \prime}$ cylinder, which was fed last season from a small boiler $40^{\prime \prime} \times 10^{\prime}$, thirty-two $3^{\prime \prime}$ flues, with a steam dome, $24^{\prime \prime} \times 3^{\prime}$ This engine runs a 60 inch saw, with 80 to 90 pounds pressure, 450 to 600 revolutions per minute, cutting 20,000 feet of elm per day; size of steam pipe, $21 / 2^{\prime \prime}$; size of exbaust, $8^{\prime \prime}$. The exhaust from this engine wasfed into steam boxes, making an estimated back pressure against it of 50 pounds. The same engine is fed this season with the same sized pipe from a larger boiler, aud is doing even better. It is com monly run up to 600 revolutions per minute, as tested by the speed indicator. The reason of our putting in a larger boiler was to get additional steam for another engine, not because we found the other boiler at all inadequate. The manner of fitting a saw bas a great deal to do with the power of an engine; poor filting will choke an engine down as quick as auytbing.

Trenton, Mich., August 4.
[The statement of F. H. S. seems rather extravagant-600 revolutions per minute with 80 or 90 pounds steam, with 50 pounds back pressure, leaving 30 to 40 pounds only as util zed, cutting 20,000 feet of elm per day. Who will add their experience to this?-ED.]

## The Registration of Labels.

To the Editor of the Scientific American
An intelligent discussion of any controverted point in the statutes which the Patent Office is requir ed to administer is always of interest and value to us who are employed in the office, as well as to the public, to whom presumably such discussions in the columns of the Scientific American are addressed. I have therefore read with interest two articles which you have recently published criticising the action of the Commissioner of Patents in refusing to admit to registration, under the act of June 18, 1874, labels which in bis judgment constitute trade marks. It is none of my business to defend one so well able to take care of himself as the present Commissioner, and yet for the information of the public there are some things not yet stated in your valuable columns which in fairness ought to be exhibited as elements in the determination of the question whether he is right or not in the position he takes.
I therefore venture to ask you to print the full text of the section of the law whose interpretation is in question, and which is as follows:

- sec. 3. That in the construction of this act the words 'engraviog, cut, and print' shall be applied ouly to pictorial illustrations or works connected with the fice arts, and no prints or labels designed to be used for any other articles of manufacture shall be entered under the copyright law, but may be registered in the Patent Office. And the Commissioner of Patents is hereby charged with the supervision and control of the entry or registry of such prints or labels, in conformity with the regulations provided by law as to copyright aud prints, except that there shall be paid for recording the title of any priut or label, not a trade mark, six dollars, which shall cover the expense of furnishing a copy of the record, under the seal of the Commissioner of Patents, to the party entering the same.'
I agree with you that there is room for doubt as to the constitutionality of this law; but with that the Commissioner has nothing to do. As long as no court having authoity has prouounced upon the question, and the statute stands unrepealed, he must administer it in the interest of the public, interpreting it in accordance with his best judgment.

He may employ such means as he finds best to guide his judgment, may seek the aid of counsel, may endeavor to procure the determination of courts, but no law can be so tramed as to take away from the executive officer to whom it is committed to administer, all exercise of discretion.
Now I think no one can read carefully the above section without observing that some discretionary power is conferred upon the Commissioner.
He is charged with "the entry of such prints and labels in conformity with the regulations provided by law as to in conformity with the regulations provided by law as to
copyright and prints," but the statute goes on to particular
ize, that prints and labels such as are not trade marks are the only ones provided for under it.
Now, as you say, " a trade mark is defined by law, a label is not." That readers may not be misled, it is as well to say here, that when you say defined "by law" you do not mean by statute, at least in the United States. What constitutes a trade mark is determined by a thousand decisions and ruliugs of the courts; and, unfortunately perbaps, there is not a single decision or ruling of United States courts, so far as $I$ am aware, out of which a legal definition of a labe an be derived.
Still, a trade mark being well defined, it can be easily apparent to the Commissioner, when a case is presented to him, whether it is a trade mark or not. No legal definjtion of a label is needed to guide him in this question, and being, as he interprets the statute, inbibited from register ing any labels but such as are not trade marks-trade marks within the well known definitions-it appears to me that when he refuses to register any label because in his judgment it amounts to a trade mark, he is simply exercising the discretion which the statute intends he shall ex ercise
The Willcox \& Gibbs case, which you cite in your article of Aug. 9, was a suit for mandamus. Legally it settled the status of the particular case, and no other. The Commis sioner has never been legally bound by it.
The late Commissioner thought best to be guided by it; the present Commissioner does not. I think I may venture to say that he will be perfectly satisfied to have a case carried up to the Supreme Court of the District of Columbia, where it will be properly argued by counsel on his behal (as the Willcox \& Gibbs case was not), and even to the Su reme Court of the United States, for a final determination of the meaning of what has already been the most obscure statute with which the office has bad to deal.
The public can hardly be aware of the confusion and conflict of rights resulting from the practice upon which you insist, but the office is painfully aware of them, and under constant embarrassment in consequence of them. The position taken by the Commissioner is the only one now seen by which this ennfusion can be prevented; and unless it is desired that the office shall be kept in hot water by the issue of papers which, whatever their actual value, are en ployed as conflicting evidence of title, be should be sus tained in the interest of honest trade and fair dealing.

Very truly yours,
F. A. Seely,

Examiner of Trade Marks.
U. S. Patent Office, Aug. 9, 1884.

The Label Registry Statute, as we may term it (Sec. 3, 4 and 5 , Act of June 18, 1874, referribg to patents, trade marks, and copyrights), is characterized by our learned correspond ent as obscure. Such being admitted, it would seem proper to use in its interpretation any light afforded by the courts In the decision in the case we cited-the Willcox \& Gibbs Sewing Mach. Co. vs. E. M. Marble, Com.-the statutes are so clearly explained and defined that to our miods it seems that further light is not needed. This case treats the question in the broadest possible way. Of course, all the decision did "legally" was to determine the issuing of the final mandamus. The three judges then sitting discussed the question iu so full a form, and yet so concisely, that it is an iujustice to quote fragments of the decision. We will quote enough, however, to show that it "practically" should
settle, as far as the office is concerned, the status of all this settle, as far as
class of cases.

Of course, then, when this control over the registry of the same prints now called ' labels which are not trade marks' was transferred to the Commissioner of Patents, it had only the same limited application, and did not include any discretion to determine whether a particular label should be classed as a trade mark or as only a label. If Congress bad
intended to take away from the owner of a label his former right to determine what use he should make of it and how be would have it entered, that intention would have been plainly expressed. The actual intention was merely to change the place of registry. When an applicant for registry complies with all the requirements of the law and the lawful regulations, as the relator appears to have do
If the Willcox \& Gibbs case was not argued properly by counsel, it woult make little difference before such a tribu nal as the District of Columbia Supreme Court. The three judges were well able, sua sponte, to investigate all the law relating to the case. In admitting trade marks to registration an examination is required to see that they comply with the law, scattered through many decisions, as our corre. spondent observes. This examination is a source of expense to the office, and is provided for in the fee ( $\$ 25$ ) charged for registration as trade mark. In registering labels no examination is authorized, and this seems indicated by the much lower fee $(\$ 6)$ charged for label registration.
The courts have been prolific in decisions on trade marks he common sense interpretation of tie statutes makes such definition of labels uncalled for. The Willcox \& Gibbs decision gives an abler and more concise statement of the matter than we could pretend to, so we do not feel called on to argue the case at length. At present the Hon. Commissioner of Patents simply refuses to accept the opinion of the Supreme Court, deliberately expressed, as of weight in affecting his action. Finally, we beg leave to tender our thanks to our correspondent for the courteous manner in which he has criticised the two articles.

Conductivity of Metals and Alloys.
M. Lazare Weiller has conclucted a new and independent investigation into the electrical conductivity of certain metals and alloys, the results of which he lately presented to the Society Internationale des Electriciens. For the pur poses of his experiments he caused small bars of metal to be cast of a diameter of about 13 mm . ( 0.51 in.$)$. These were divided in such a way as to shew the grain of the fracture, and one part was drawn iuto wire to be used in the trials Those alloys which can neither be drawn nor rolled easily, such as silicides and phosphides, were tested directly on the cast bars after the method of Sir William Thomson. In the trials the bars, fitted with binding screws at each end, rested upon knife edges at an invariable distance apart. These knife edges were respectively in communication with two resistances composed of two parts, of which the one was a thousandth part of the other. The extremity of one was connected to the fixed terminal of a Wheatstone bridge with a sliding contact, and the other to the slider itself. The two points which separated the resistances communicated with the galvanometer. Finally the extremities of the bridge were connected to the binding screws by means of a circuit, which included a battery of four elements and a contact key.
The resistance sought was then equal to the resistance measured upon the wire of the bridge, divided by 1,000 . The measurements, which were very carefully and accurateiy conducted, and were effected on a great number of specimens, were made in part by M. Weiller bimself, and in part by M. Duflon, in the laboratory of Messrs. Breguet The results are given in the following table:


The resistances are not given in ohms, but as proporiions to a given body. They may be reduced to the conventional standard on the assumption that a wire of pure silver, one millimeter in diameter, has, at a temperature of zero Cent. a resistance of $19 \cdot 37$ ohms per kilometer.

## A New Domestic Machine Wanted.

We are all of us too apt to forget past annoyances in protracted but temporary exemption from them, and yet what has been will be again, with many incouveniences at least, especially those which are peculiar to the different seasons. The severity of last winter, however, must be fresh in the memories of most of us. The frequency of snow falls, and the necessity and expense of clearing off the sidewalks in front of our domiciles, made many a good housewife's heart ache, and the numerous annoyances, dangers, and accidents to pedestrians, consequent upon the accumu lation of snow and ice on our street pavements, were too forcibly brought to our notice or experience to be very easily forgotten.

Here then, we think, is a field for new and profitabie invention, and the man who can devise a good and cheap machine for removing the snow and ice from in front of our dwellings and stores would be a public benefactor. All previous attempts employing heat bave been failures. What is needed is a good hand machine that can be manipulated much in the same manner as a carpet sweeper or a hand lawn mower, and which can be readily used by any ordinary domestic. Something more than a mere brush or scraper would be requisite, but such a machine need not necessarily be very complicated. We are tired and ashamed of those clumsy expedients now in use, the shovel and the crowbar, and have often wondered why more efficient and economical means could not be discovered.
If a cheap and serviceable macbine, such as we have here indicated, can be invented, there is money in it; but whoever would try to bring out an implement of the kind should not leave it till the winter is on us again, but at once pro ceed to make the effort and have his invention patented and bis machines, in sufficient quantities, in the hands of the dealers in time to meet the coming winter's demand; and this would not be confined to a single place, but would apply to every city afflicted with snow and ice during no inconsiderable portion of the year.

## delta metal.

Mr. T. A. Crompton, chief engineer of the steamer Assy rian Monarch, has recently shown us some specimens of this new alloy, which is stated to possess a number of val uable qualities. In color it resembles gold. Thefollowing are some of its qualities as claimed by its inventor and manu facturer (Mr. Dick).
Delta metal can be forged and rolled hot, and when so treated is 50 per cent stronger than wrought iron. In its molten state it runs freely, and sound, close-grained cast ings can be produced from it. When cold it may be rolled into the thinnest of sheets, or drawn into the finest wire, its tensile strength in the latter form being nearly three times that of the best wrought iron. It is adapted for all kinds of cylinders, cocks, valves, and other steam fittings; being grainless, it is easily manipulated by any cutting tool, will take a high polish, and does not tarnish or corrode.
Its quality of non-corrosion renders it specially suitable for air, circulating, feed, and bilge pump rods, linings, buckets, valves, rams, condenser tube plates, studs, and bolts, or anything exposed to the action of salt or fresh water. For screw propellers, its great tensile strength and non-liability to flaw or hreakage in cases of fouling wreck age, or such like, will render it invaluable, its nature being that of bending to a blow long before fracture can take place; and by its great superiority in hardness, toughness, and ductility over cast iron, gun metal, or brass, propellers may be made much lighter in weight, and their blades much thinner at their extremities, and shaped to finer and quicke curves and bends, in "Delta meta" than in any Other now in use.

A great future is open to this metal, its qualities before enumerated making it less liable to damage by indenting than other metals; and its power of resisting corrosive action, combined with its lesser required thickness for the same strength, points to its special adaptation for purnoses where the transmission of either heat or cold-as in stills, refrigerators, fresh water or surface condensers, land and marine boilers, etc.-is a desideratum.
Outside the more direct uses to which this metal may be put by the mechanical, marine, hot water, gas, or electric engineer, or shipbuilder, its possible applications are truly "legion" in number, as there is hardly anything made of metal, either inside or outside our factories, shops, offices, or houses, or in our streets, which may not be fashioned out of $i$.

From the results of experiments made to ascertain the comparative teusile strengths of Delta metal, brass, and gun metal:
eita metal, cast in sand (green), showed
breaking strain of................. $21 \cdot 6$ tons per sq. in.
Ditto, rolled hard ( $11 / 2$ in. diameter bar)...... 33.6 " " "
Among recent applications of the new metal is its use for small vessels, such as steam launches. We give an engraving of such a boat constructed entirely of the Delta metal by Messrs. Yarrow \& Co., of Poplar. The length of the launch, which is named the Delta, and is at present at the Crystal Palace International Exhibition, is 36 feet over all, with a breadth of beam of 5 feet 6 inches, and a depth from gunwale to keel of 3 feet, and she will conveniently seat twenty-five persons.

Delta metal is an alloy of copper, zinc, and iron; having repeatedly been proved of equal strength, ductility, and toughness to mild steel, the plates and angle pieces were made of the same thickness as if steel had been used, viz., tbree thirty-secouds of an inch. The stem, keel, and stern post are of forged Delta metal, and are scarfed together in the usual manner gether in the usual manner The angle fram, of the same material, are placed longitu-
dinally instead of transversely, so as to obtain greater longitudinal strength. The four bladed screw propeller is cast in Delta metal, and has a diameter of 2 feet 4 inches, with a pitch of 3 feet. The engine, of the usual direct-acting inverted type, is of sufficient power to give a speed of eight knots per hour.

Terrors of Lightning.
Nathan Miller, of Maryville, Kan., lost his four daughters, aged respectively $18,17,9$, and 7 years, by a single stroke of lightning.
Lightning struck the house of John Queen, of Jacob's Creek, Pa., knocked from the wall his loaded gun, and at the same instant his daughter Nancy dropped dead. The gun was discharged, and the contents struck her in the breast. Whether she met her death by the lightning or the shot will never be known.

ONE hundred and five miles in 119 minutes, or almost 52 miles per hour-deducting stops, 55 miles per hour-was the time lately made by a special passenger train on the Illinois Central Railway, being from New Orleans to McComb nois

## A New Saltpeter Bed.

Near the outer end of the draw head is formed a vertical hole, for receiving the coupling pin, D , which is passed through a hole in the plate, E , on top of the drawhead. Behind this hole is a second one for receiving a downwardly projecting bar, G, having an enlargement at its lower end Behind these is a third aperture extending from top to bottom and containing a hollow slide, J, projecting downward from the plate to which it is fastened. Pivoted on a transverse pin that passes through vertical slots in the sides of the slide is the latch, K , formed with an outwardly project ing tongue, $L$. A vertical sliding rod is held by clips on the end of the car and is connected by a chain with the plate, E. This rod is operated by two levers pivoted to the end of the car and passed through a vertícal slot in the rod.
When the car is to be coupled the plate of that draw head which is to receive the link is raised by pulling up the rod,

hoover's car coupling.
either from the top of the car or by means of one of the levers. When the plate is moved the latch swings outward the tongue passing into a slot connecting the holes and holding up the plate, the hollow slide, the bar, and the pin. When the link enters it pushes the latch inward, thereby permitting the parts to drop, the coupling pin passing through the link. The bar, G, rests on the inner end of the link, and is of sufficient weight to hold the outer end of the link raised so that it will be in a horizontal position. To uncouple the cars the plate is raised by pulling up the vertical bar or by operating one of the levers.
This invention has been patented by Mr. G. W. Hoover, of Keithsburg, Ill.

## Efficiency of Lightning Rods.

Prof. Mohn, of Christiania, Norway, having been em ployed by the government to investigate the efficiency of the protection afforded to buildings by lightning rods, seems to have substantially settled the much debated question, at least for that region of country. His report shows that lighthouse, telegraph station, and other exposed buildings, which were provided with conductors, did not by far suffer as much as churches, which in most cases were unprotected.


STEAM LAUNCH BUILT OF DELTA METAL
It appears, in fact, that of about 100 churches reported to have been struck by lightning, only three were provided tor in good order, and the building was uninjured; the second had a conductor of zinc wire, which melted, and, of course, left the structure without protection; the third had a wire which was rusty where it joined the earth, and the church was burned. More than one-half the number of churches struck were totally destroyed. Mr. Preece, the English government electrician, states that no damage has occurred to telegraph poles since the practice was adopted of providing them with lightning rods or earth wires.
appears, in fact, that of about 100 churches reported brick, running on the top into a peaked arch. olden times, pierces the moun tain Kastri, which was formerly crowued by the fort Samos, and ends a few hundred yards from the old town of Samos, about ten feet below the surface. From the mountain slope to the city this subterranean aqueduct is protected by a massive stone structure, ending within the walls of the present convent of St. John. The preservation of this work -which is truly wonderful considering the imperfect mechanical resources at the disposal of the builders-for nearly three thousand years is probably due to the care taken by Eupalinos, who in all places where the rock did not seem of sifficient firmness lined the tunnel with several layers of

## COUVREUX'S EXCAVATOR WITH PIVOTING BUCKET

 FRAME.Ever since the epoch at which Mr. A. Couvreux constructed his first type of excavator, which rendered so great services in excavating the Suez Canal, the use of the apparatus bas been extending, and, at the present time, any work must be of small importance that does not employ it. Mr. Couvreux, who bas made use of it in all his undertaking on public works, bas successively introduced numerous improvements into it which we have already described.
For making large cuttings the most ad vantageous excavator is the one that is capable of moving over a roadway parallel with the axis thereof, and it is by means of succes sive diggings that the trench is enlarged to the desired dimensions. In this case the chute is on the side opposite to the chain and buckets, the car track is parallel with that of the excavator, and the loading is effected by causing all the cars to pass in succession un der the spout.
This mode of operating is extremely simple, and is known to all those who have had oc casion to see an excavator work. In works of less importance, such as ditching on single rail railways, a heading is made in which an advance is made right straight ahead. As the type of excavator under consideration is not adapted for working according to this method, Mr. Couvreux has studied out a new apparatus, which appears to us to be fitted to satisfy al the needs of practice
We must, in the first place, observe that on account of the mode of working it is more difficult to remove the excavated material where the excavator is moving forward in a trench than where it is working laterally; so it becomes necessary than where it is working laterally
to study out arrangements for cheaply maneuvering the cars designed to receive the excavated material. Moreover, as this materia. Moreove, as this new engine was to be applicable to works of small importance, it became necessary to make it of
small dimensions and of great simplicity, in order that it should be light and cheap.
In principle the bucket chain of this excavator attacks the ground, not by a forward motion of the whole, but by means of a revolution around a pivot. The forward motion occurs only at the moment when the apparatus is moved in advance over the excavated portion.
It is not without interest to remark that the similar apparatus that have already been built are got up after the type of steam cranes, where engine, boiler, and jib revolve upon a frame mounted upon rails; while the new pivoting excavator has a stationary engine and boiler that actuate a bucket chain which alone moves around a rotary axis. The excavated material falls into a chute of sufficient width to receive the earth, whatever be the angle at which the work is being done, and to carry it to the rear where the cars are to be loaded with it. Upon referring to the accom-


Fig. 2.-PLAN.
generator is elevated above the smoke box, in order to re ceive a boiler iron disk that forms a seat for the pillow blocks of the engine and the pivot of the revolving portion. The motor consists of two single cylinder vertical engines, fixed here and there to the boiler. They are reversible, but the eccentrics are keyed in such a way as to revolve in contrary directions. At one of the extremities of each driving shaft there is a bevel pinion that gears with a wheel which
bearing that we bave mentioned, and below by horizontal rollers, and which rests, through the intermedium of rollers with vertical axes against a strong circular projection n a piece with the bed plate
The vertical rollers are fixed in a casting in which there is a crown wheel that serves to move the apparatus right and left. This motion comes from the engine through the inter medium of two straight pinions, $p$, which gear with the
loose wheels, $r$, of an intermediate axle. These pinions and the transmitting sbaft are rendered interde pendent by means of coupling boxes. Consequently, this shaft revolves to the right or left, according to the pinion which actuates it. Moreover, this shaft is provided at the center with an endless screw, which, through a helicoidal wheel, revolves the vertical shaft, D. This latter carries a pinion, $g$, which drives the large crown wheel above men tioned. Finally, it is through the elongation of this axle that the mechanism, $t$, which gives the forward motion is actuated. Both the motions that we have mentioned are started or stopped by means of a lever within reach of the engineman
At the moment of their passage over the upper tumbler the buckets empty their contents into a hopper, whence they run into a chute placed over the roof of the engineman's cab. This chute is sufficiently wide to receive the earth when the apparatus, with its hopper, is pivoting around its axis, provided,
Fig. 1.-ELEVATION.-EXCAVATOR WORKING IN A TRENCH.

As a consequence of this arrangement the two engines are coupled; and, moreover, as the cranks make an angle of $90^{\circ}$ with each other, there is no dead center.
This arrangement has been adopted with the object of simplifying the control of the various motions. As a single simplifying the control of the various motions. As a single
motor has, in fact, to actuate all the parts, it will be seen mplifying the control of the various motors. As a sing in the ears
that it was necessary, during a revolution always in the same direction, to be able to turn the mechanism that actu ates the upper part either to the rigbt or left. Now as the two engines revolve in opposite directions, it is only necessary to throw the turning mechanism into gear with one or the other of the crank shafts, according to the direction in
which the bucket chain is to be pivoted.
The various motions are obtained by means of a very simple mechanism that presents some analogy with the system adopted for controlling radial drills. Upon an inspection of Fig. 3 it will be seen that the vertical sbaft, A , rests at its lower part upon a step bearing between the two driving pinions, and that it carries at its otber extremity the pinion, $B$ of a wheel, $C$, that is keyed to a horizontal shaft. This intermediate axle is supported by a cast iron piece mounted on a second step and connected
 ith the bucket frame. It always remains parallel with the bucket chain wheel, and actuates the latter by means of two pinions, over which runs a pitch chain that passes over two corresponding wheels on the chain wheel axle. Owing to this mechanism the bucket chain, no matter what the angle be, is capable of receiving the action of the motor.
This chain is constructed in the ordinary way, and is provided with different kinds of buckets, according to the kind of work to be done. The bucket frame, which is provided with rollers and kept at the proper height by a jib and windlass, carries a chain wheel at its extremity. It passes into a boiler plate frame, which is supported above by the step

In our engravings we give two applications of this appa-
ratus-one of them relating to trench cutting and the other to trench cutting and the other
to excavation or widening; the cars, in the latter case being upon a track parallel with that of the excavator. Fig. 4 shows, on a larger scale, the motion of the bucket on the up per tumbler, which actuates the endless chain through six flat surfaces, three of which are pro vided with teeth. The chain consists of a series of four ele ments each, these latter being made up of a male link which carries the bucket and three fe male ones. It is with the middle one of these two latter that the teeth of the tumbler engage Finally, upon the second ele ment of each series is fixed the movable bottom of the bucket. While the apparatus is in operation, the movable bottom remains fixed against the bucket at the points where the chain is taut, but, at the moment the bucket is passing over the surfaces of the
panying engravings our read ers will readily understand the construction of this apparatus, the detailed study of which was made by Mr. C. Bourdon according to directions from Mr. Couvreux. As may be seen, the entire affair is fixed upon an iron frame supported by two strong axles, with the interposition of suspension springs behiud only. Upon this frame there rests a large cast iron plate which receives in its center a very strong vertical boiler that serves as a frame and pivot for a great portion of the mechanism. The cylindrical shell of this
tumbler, the two forward links of each series form an angl with each other that brings about the opening of the bucket and allows the material that it contains to drop into the hopper.
Loading the Cars.-When a pivoting excavator is employed in cases of trench cutting where the malerial has to


Fig. 4.-DETAlLS OF UPPER TUMBLER AND BUCKET CHAIN.
be emptied to the rear, it is very difficult to dispose of the material. The majority of the methods that have been em ployed up to the present for substituting empty cars for full ones cause great loss of time, and necessitate long maneu vers that result from the complication of the tracks.
In order to render his work complete, Mr. Couvreux has devised an accessory which, it seems to us, is called upon to render genuine services. In principle the carriage ought to be performed upon two parallel tracks, one of them for the empty and the other for the full cars. During the ope ration of loading, the engine that has hauled the empty
train runs to a switch at a sufficient distance away to allow it to run on the otber track and place itself at the head of the loaded train. As for the excavator, it must evidently advance in the axis of the trench. The width of the track upon which it runs may, at a minimum, be 1.44 m ., while cars are frequently found that require a 1 meter track.
Iu order, then, to satisfy the two conditions of the problem without involving considerable expense in laying the tracks, the ingenious idea has struck Mr. Couvreux to utilize the center track for the excavator and to thus empty the material in the axis of the trench. It now becomes a question as to how the loaded cars shall pass. This is effected as follows: At the rear of the excavator there is a stiff bar, which is connected with a turn table carried by wheels that run on the car tracks. The top of this table is about 0.15 m . above the rails, and these two levels are connected by means of in clined planes that converge toward the center of the table. The maneuver is easily understood: An empty car is shoved up on to table, and when it is full is pushed down on to the other track, and so on, care being taken at each change of cars to close the chute so that the operation of the bucket chain need not be interrupted. It is proper to remark that in causing the car to pivot upon the table it is made to present its two extremities in succession under the spoul, thus permitting of its being loaded uniformly. The stress necessary to push the empty car on to the table may be perceptibly reduced by a very simple means. To the rear of the excavator there is fixed a pulley, $\mathbf{E}$ (Fig. 1), over which passes a cord, F, that is attached at one of its ex tremities to the empty car, and at the other to the full one. Upon descending the inclined plane the full car bauls up the other, and the stress that it bas to undergo moderates it speed.

In the apparatus that we have here described, the diamete of the cylinder is 0.12 m .; strokes of piston, 0.2 m .; number of revolutions, 150 ; register of boiler, 150 kilos.; heating surface, $7 \cdot 6$ square meters; capacity of water tank, 1 cubic meter; number of buckets, 15 ; capacity of buckets, 50 liters. -Revue Industrielle.

## Experience with a Water Tank of Tinned Copper. by theodore deecke, special pathologitt, new york atate unatic asylum.

On the first of July, 1875, a water tank seventeen feet in length and eight feet in width, holding about five thousand gations of water, was completed and taken into use in the New York State Lunatic Asylum, at Utica, N. Y. In August, the same year, its use had to be discontinued on account of leakage, and on examination it was found that at a number of places the tin lining in more or less large flakes was peeling off. The copper was not affected, and the leaks were discovered ouly where the plates had been soldered. Upon consultation with the writer, and from experiments made with the plates used, it was concluded that the trouble was due to a defective tinning. On direction of the Superintendent, Dr. John P. Gray, a number of samples of tinned copper were procured and subjected to suitable tests, and one selected of which a new tank was built. This stood well, and was in permanent use until May, 1884, when, in cleaning and brushing out the tank, it was found that the copper plates at the bottom were covered with small circular or oblong perforations. On closer inspection peculiar tracings in the metal were discovered in connection with these perforations, irregularly ritdiating in all directious from a center commonly formed by the bole. They presented an appearance as if they were excavated by a graving tool. The holes and furrows were filled out with an earthy and, when dry, quite bard material, consisting mostly of carbonate of copper. The weight of the copper was twenty ounces to the square foot; the amount of tin used could not be exactly ascertained.
The water in the tank bad been in constant motion and replacement. It contained in the average, according to a number of analyses made by the writer, of inorganic salts: 16.9 grains of carbonate of lime, and 0.20 alumina, silica, etc., and 072 of nitrate of potassa per imperial gallon, and only traces of organic matter. Besides, rain water flowed inlo the tank whenever it rained.

The question arose, what produced the corrosion of the copper? Similar tanks bad been in use for over twenty years wilbout having shown evidences of similar injury.

On all inquiry by Mr. Joseph Grabam, the chief engineer of tric A Mur plates, the following answer was received: "Galvanic action is brought about by the influence of the water on the copper treated hy the tinning process, and it would be only a question of time when the entire mass of metal would be eaten away. Munn \& Co."
The writer had entertained originally the same view, yet for the following reasons regarded the explanation as un-
satisfactory. First, the water constituting a slightly alkaline liquid, from the amount of carbonate of lime in it, cer tainly did not favor the production of galvanic action between the two metals. Secondly, the effect of the galvanic action can be but proportionate to the quantity of the metals present, and it cannot be seen why and how the compara tively small amount of tin should have led to the compara tively large consumption of copper. Besides, the corrosion of the latter is not uniformly spread over the whole surface, but confined to certain spots. Thirdly, experience had shown, for a time covering some twenty years, that the cor
rosion of the metal was neither of constant nor of necessary
occurrence, which it would be if it was due to galvanic ction.
The phenomenon, therefore invited further investigations Upon microscopic examination of the earthy materia which filled out the furrows I found the following:
When a small piece of this substance, still moist, wa placed in the center of a drop of water on a so-called lif slide provided with a circular air space, and covered with cover glass, the clear water surrounding the opaque mas was filled out in a short time with a protozoon belonging to the class of prot-amœbæ. It was not difficult to see them, in all possible shapes and sizes, creep out from the dark mass and wander slowly toward the margin of the drop bordering the air space, and the more numerous they There the more the air contained in the water was consumed
This is very convenient method, to which I have often esorted, of bringing micro organisms, which live in hiding places, into view. It is air that they, like all living beings need for their existence, and the scarcer this becomes in the isolated drop of water the more they approach from the center of the drop to its margin, which remains in contac with the air. The prot-amœbæ here observed differ from the ordinary species not so much in the peculiar shapes hey assume as in the dark color of their contents, or rather the presence of a dark, finely divided substance embedded in the otherwise transparent and colorless gelatinous litlle mass. By the action of diluted hydrochloric acid, under the development of a gaseous product (carhonic acid), the dark contents are dissolved into a colorless fluid, while the bodies of the prot-amœbæ mostly assume more or less spherical forms, resembling drops of oil.
Considering the great numbers in which these micro-or ganisms are present, their peculiar mode of life by adhering to, and of locomotion by slowly creeping over a surface their feeding by the simple extension of their sarcode body
over any material on their way, a process very likely associover any material on their way, a process very likely associ-
ated with some secretory function, it seems quite probable that they exert an observable influence wherever they happen to locate. This influence is probably of a mechanical as well as of a chemical nature. When the material which fills out the furrows is removed, the perfectly pure metallic surface of the copper is brought to view, as if acted upon by the use of an acid. Thus, at first, as it seems, the copper is dissolved in minute quantities, which afterward, by the intercbange of the acid with the carbonic acid of the lime salt contained in the water, form a soluble organic lime compound and carbonate of copper, the latter of which is deposited in the furrows. That a portion of this as a comparatively indifferent material is taken up by the prot-amœ$\mathfrak{\infty}$ is not surprising. They certainly do not feed on the copper. Its presence is merely accidental, and the whole phenomena, as I believe, should be looked upon from thi point of view.
The species, even if brought into existence only by this peculiar combination of circumstances, may be regarded as distinct, since it bas developed peculiar qualities and a mode of life of its 0 wn . The origin of the protozoon is easily ex plained, and must be sought in the rain water which occa sionally flows into the tank, carrying down from the roof of the buildings microscopic forms of life, of which, in most places on the top of all buildings, innumerable species can be observed, and among which the prot-amœbæ are of quite common occurrence.
It is not improbable that, in perhaps many other instauces where simple experiences hitherto bave been ascribed to eitber galvanic action or the combined and successive action of air and water, processes associated with micro-organic life are of greater importance than is known at the present
time. The phenomena unquestionably invite to further rearches in that direction.
Utica, June, 1884.

## The Finland Polar Expedition.

M. Lemstrom has published the chief results of the Finland Polar expedition of 1883-84. The scientific observa ions were made at Sodankyla (latitude 67 deg. 24.6 min north; longitude 27 deg .17 .3 min . east of Greenwich) and at Kultala (latitude 63 deg. 295 min . north; longitude 26 deg. $39 \cdot 4 \mathrm{~min}$. east). The earth currents were studied from September, 1882, to September, 1883, at the same time as
the magnetic variations. Two conductors of copper wire running from north to south and east to west for about 5 kilometers, terminated in platinum plates buried to a depth of 1.3 meters. The wires ${ }^{*}$ were insulated on telegraph poles, and a sensitive galvanometer was interposed in the circuit of each. Wires of iron were also used with plates about 2.5 kilometers apart
At Kultala the earth plates were plunged in the river Fralo and its tributaries. With a Mascart electrometer giving 18 divisions for a vol', and with the galvanometer, the perturb-
ing forces due to the polarization could be eliminated. From ing forces due to the polarization could be eliminated. From wires were very slight, M. Lemstrom is inclined to believe that there is a belt of earth currents round the pole. The magnetic variations were found to be intimately associated with those of the earth currents. 'The atmospheric currents were observed with the wire network, which we have al ready referred to in a former note. At Kultala four of these nettings of wire, with brass discharging points and zinc earth connections, were erected at different heights on a
mountain side. With these it was fuund if two discharging mountain side. With these it was found if two discharging nected together through a galvanometer, no current was
observed. With one net higher than the other, and both connected, a current was sent from the higher to the lower. The electromotive force of the currents observed did not rise above 0.326 volt (on March 20).
Near the surface of the earth there is a layer of air which has a much greater electric density than layers bigher up. The minimum density was formed at a beight of 3 to $9 \mathrm{me}-$ ters. During the aurora the atmospheric current was al ways positive, that is to say, going from the atmosphere to the earth; at some other times it was negative. With regard to the artificial aurora sometimes seen crowning the discharging networks, M. Lemstrom states that they showed eithe diffused light or visible rays. They were observed by the aked eye and by the spectroscope, which showed the lines of the polar aurora. A Holtz machine working in connec tion with the wires could re-enforce the effect under favora ble circumstances. If the monn was high, the phenomenon was never seen with the naked eye.

## Tides and Tidal Currents.

W. O. Ayres, M.D., in the Manufacturers' Gazeite, says: At Rio Janeiro the tide rises four feet only. On the northest side of South America, being at the narrowest part, the rise and fall are four feet or a little over. All through the Windward Islands, the Lesser Antilles, as they are marked on many maps, the range is four to five feet. Along the coast of South Carolina the rise is about 4.6 and at the Ber mudas four feet; at the Delaware breakwater $4 \cdot 5$, and a Sandy Hook 5.6. Passing, therefore, through all the narrowing and then the subsequent widening, we have found but small change and uone at latitude $40^{\circ}$; being at about the same width as our line of origination we have a tide equal to that of the Southern Ocean, from which it is separated by an interval of 5,000 miles.
But here, without apparently any change in the correlated surroundings, anything which can develoy new vigor, strong change commences, and preseutly it has become a mighty change; and it is quite apparent that this change cannot have anything to do with the shape of the land, for its potentiality is displayed on both sides of the Atlantic, the European as well as the American. We will look firs to our own waters. Passing Montauk and Block Island, and striking the sandy shore of Massachusetts, we find no five foot tide, such as we had at Sandy Hook, for at Provincetown the rise is 10.8 and at Boston Light 10.9 . Reaching the coast of Maine and passing on northeastward we find a tide of $20 \cdot 6$, and still further at St. John, N. B., o twenty-three feet. Nor is the European side to be outdone, for at Cape Finisterre, which is in the same latitude as Bos ton, the regular rise and fall is fifteen feet; at Brest it is nineteen, and across the chanuel at the Scilly Isles it is sixteen. On the west coast of lreland it is fourteen; in Gal way, though for local reasons, at Cape Clear it is only nine Up the English Cbannel at Dover, the one side it is eighteen while across in France, at Havre, it is twenty-two, and at St Malo thirty-five, though this latter is somewhat infuenced locally.
Now neren is much that is remarkable. We are passing further and further away from our originating impulse, and the tides, instead of losing power, are growing stronger and stronger as we get into increasing height of latitude. The fury with which their currents sweep through the contracted passages north of Scotland, separating the small island which make the Orkney and Shetland groups, is something fearful. Even the Pentland Firth itself with all its breadth is nearly impassable except when the tide is favorable, and whoever has read Sir Walter Scotl's "Pirate" needs no re minding of the dreadful rush of the current through th Roost of Sumburgh, and then over toward Norway as far up as the Arctic Circle. The world renowned Malstrom (Maelstrom we used to spell it), whici is a wonderful repre sentation of power and fury even when stripped of all its former romance of ignorance, is barely a necessary resul of the dash and tear of the Lofoden tide around the south end of the little rocky island of Moskenaes between that and Mosken.

Returning now for a moment to the coast of Great Britain we notice two migbty examples of tidal exaltation, where the great normal rise is picked up by a local configuration and made to display its points to great advantage. On the west side of the island are two funnels, so to speak, the Bristol Channel and the Firth of the Solway. The curren of flood tide entering at the wide end of the funnel finds itself so restricted by the approaching sides that it has $n$ way to expand its energy but by dashing straight forward and away it goes, and in the head waters of each a normal daily rise and fall takes place which is immense. At Bristol it is reported at forty-four feet, and at the bead of the Sol way as much as fifty or more.
But in this matter of local results the whole world knows here is unbounded opportunity for "Yankee boasting, though the precise glory is rather over our line, and New Brunswick leads. The Bay of Fundy has not its equal in the world for the might of its tides. Of course they are due to the peculiar sbape of :the bay shores, and having greater sweep than even in the Solway they mount up most astonishingly, and while claiming only sixty feet as a common oc currence, it is asserted that when driven in by the coinci dence of a favoring storm with the date of a spring tide they have been known to reach an elevation of 120 feet. Thi seems incredible, but I see nothing impossible in it, judging merely from the ratio of addition to a uormal high tide which we often see at any of the points along our shores.

The "Separation" Method for Sugar.
The "separation" method of sugar extraction from the beet, we are informed, has been adopted in several German factories with satisfactory results. The present method is composed of three operations: First, the preparation of the caustic lime; second, formation of the sucrate by precipitation; third, purification of the saccharate.
1st.-The caustic lime should be pulverized as soon as possible after leaving the lime kiln. The powdered product is thrown on a magnetized surface, where any particles of iron in the lime are separated. Every precaution is taken to prevent the absorption of moisture from the air, and for this reason the various pulverizing operations take place in hermetically sealed vessels. The thoroughly pulverized caustic lime is received in a weighing apparatus-in this latter is placed a revolving device emptying a given quantity for one operation into the saccharine solution.
2d.-The precipitation of the saccharate is effected in an apparatus called the cooling macerator. By suitable pipes there is circulated a cooling liquor by which the saccharine solution is kept at a very low temperature. Above the cooler is located the pulverized caustic lime measurer and two reservoirs-one for molasses to be worked, and the other for water to dilute both the molasses and the subsequent washings of the saccharate press. A certain quantity of molasses is diluted until 25 hectoliters contain 7 per cent of sugar. When the solution reaches a very low temperature in the cooling apparatus, the caustic lime is added, 5 kilos. at a time; and in about an hour nearly all the sugar is in the form of a sacclarate with an excess of lime.
3d. Purification of the Saccharate.-The cooling apparatus is duplicate in form; one vessel being emptied by an exbaust and force pump, at a pressure of one to two atmospheres, into filter presses, the other being filled in the mean time. From the filter presses runs a liquor containing 4 to 5 per cent sugar. This is not used, however, but emptied into the waste pipe. The liquor which subsequently comes from the presses is used, as already explained, for diluting the molasses to be mixed with the caustic lime. The saccharate remaining in the filter presses is white, and of great purity.
The Method of Using the Saccharate.-The saccharate contains 100 parts of sugar to 130 of lime. If the molasses to be worked represents about 5 per cent of the weight of the beets, the saccluarate obtained is mixed with the beet juice. In cases where the molasses is to be worked at once for its sugar, it is found desirable to eliminate from the saccharate the excess of lime. This is accomplished by mixing the saccharate with weak juices. The tri-basic saccharate is transformed into a calcic-mono-basic and hydrated lime, and this latter is easily separated by suitable filter presses. The liquor from the latter apparatus cotains all the sugar and only 30 parts of lime to 100 of sugar. The residuum is then washed, and from it is usually obtained 4 per cent of sugar.

## The Possibilities of Speed.

In a recent article on the limits of speed of ocean steamers the Boston Herald took the ground, substantially, that their enlargement depended upon improvements-and decided im-provements-in the generation and application of power. It is not a little curious, however, that, as to at least one of the cardinal factors in locomotion, the possibilities of speed should be so much greater on water than on land, since both the average and highest speed made on the railway leave those of the ocean steamer far back in the dislance. We mean what is commonly called friction.
This signifies the rubbing of the moving body upon or against the ground or water, as the case may be, when in motion. It results from the action of gravity pressing vertically down upon the body, and thus causing it to adhere to whatever it rests upon. And since gravity also enables the moving body on land to exert its own force against itself, and thus to move from place to place, it bas passed into a trite saying that gravity is at once the main
impediment and the indispeusable auxiliary to locomotion.
impediment add the indispeusable auxiliary to locomotion.
Now, the degree or potency of friction depends always on the weight of the moving body; then, on land, on the manner of its adbesion to the ground and the smoothness and grade of the ground. Hence, a smooth, level, straight steel railway, and well oiled freely moving rolling gear of car, reduce friction to the minimum. On water, depth and placidity and proper shape of vessel do the same.

Now, to determine the relative potency of friction between water and land locomotion, the common incidents of canal navigation and railway freight car propulsion by horses furnish at once accurate and conclusive data.
Two horses tow all day a loaded caual boat, of a total weight of as much as 300 tons, at a speed of two miles an hour. An equal load transferred on the railway would make up a freight train of 15 loaded cars, car and load weighing ten tons each. Now, those two horses pulling ou that train with the same force which they exerted in start ing and towing that canal boat, so far from propelling it at the above speed of two miles an hour, would not move it at all. But load, power, and application of power being the same in both instances, the difference in the result is evidently due to the difference in the degree of potency of ad-
hesion of the load, which is thus proved to be greater on hesion of the load, which is thus proved to be greater on land than on water, therefore requiring a greater force to be overcome. Now, assuming that the ratio of increase of
power with increase of speed is the same on water that it is on land, since it takes so much less power at low speed to move a load on water than it does on land, always pro-
vided the application of power is the same in both cases, it follows that the iucrease of power demanded by the in crease of speed must remain within the same original proportions, and always be much less on water than on land And this being so, it follows that friction must also be equally less on water than on land. As to this importan factor, therefore, the ocean steamer
of speed than the rail way express.
The idea of relative friction is well taken by the Herald writer, but the reasoning is fallacious in the fact of drawing a deduction relative to high speeds from the comparison of the friction of a body moving in water at a low speed and the power required to overcome the static friction of a train.
These bear no relation to the relative power required to maintain a high speed of a given weight upon rail and water.
The displacement of water by a moving body is the prime factor in the advancement of marine speed, while the displacement of air and safety are the prime factors in the advancement of railway speed.

An Improved quarantine System.
In a recent address before the representatives of the various exchanges of New Orleans, Dr. Joseph Holt, Presiden of the Board of Health of that city, made the following sug gestions:
When a vessel arrives at the mouth of the Mississippi, she is either infected or she is healthy. If we know her to be infected, she is at once removed to the supplemental or lower station, for infected vessels only, where she will be actually cleansed, actually disinfected and fumigated ber sick removed to the local hospital.
She is an exceptional case, and will be dealt with excep ionally.
She will certainly not be allowed to endanger healthy If asels by mooriug in their vicinity.
If at any time she wishes to put back to sea, she is at liberty to do so; but if she desires to come to our port, she will be detained until the board can safely venture uponallowing her up.
We will understand better the particulars of treatment when we have described the course of a sailing ship through quarantine-no record of sickness on the voyage; a cargo of
30,000 bags of coffee; yellow fever epidemic in Rio, from whence she has cleared. She is brought alongside the wharf at the upper quarantine station, where she finds every arrangement for the rapid discbarging and reloading of cargo. The crew with all their effects is at once taken ashore, where, in a room provided, everything they carry apparel and baggage, is subjected to powerful disinfection. Their clothing exchanged for other clothing already treated, and this, in turn, disinfected. They are then received at a commodious boarding house, comfortably prepared for them, there to undergo the prescribed detention. If one should fall ill, he is instantly removed to the hospital as distant as can be located.
Hospital experience proves that yellow fever is conveyed through the medium, not of persons, but of things. Yellow regular march of an epidemic. In the mean time a full corps of acclimated stevedores are busily engaged in breaking out the cargo and transferring it to the warehouse, already built by the United States Government for that accommodation, or directly iuto barges, there to undergo
fumigation. As soon as compactly emptied, or at leust sufficiently so to permit of thorough cleansing and fumigation, the quarantine tug, a compactly built small vessel somewhat
after the fashion of a fire tug for harbor protection, is run alongside the ship. A hose attached to a powerful forcing pump aboard the tug is let through the forward hatcliway down into the hold.
In order to flush the bilge quickly, it might be necessary to take up the limber plank, as a better examiuation could be had and the real condition ascertained. But whether this is done or not, or the ship be in ballast or not, sle can be speedily and thoroughly washed. The pump is started and the washing begins, while the ship's pumps are set to
discharging the foul bilge water. This continues until she is washed clean, not only in the limbers and floors of the hold, but the ceiling and every available part. She is now pumped out, the hose removed, and then begins the disinfection and fumigation. Another large hose attached to a powerful exhaust fan is lowered into the same position as the first. The hatches and every other outlet are closely
battened. with the exception of a small ventiating batchway, either at the bow or stern. A quantity of sulphur is put into the furnace connected with the fan, and ignited. volume and with tremendous furce is driven into the limber and air stakes, into every crevice and part of that ship until she is completely filled. We go through her with au atmosphere, as it were, of fire.
In doing this we displace the mephitic and dangerous at mosphere closed in her when she started from Rio, and which, if allowed, would have been set free at our leveethe infected atmosphere of Rio to commingle with the atmosphere of New Orleans, deadly ripe, perlaps, for its reception.
We have displaced this not only with a non-infected at mosphere, but with one intensely germicidal-one that destroys organic elements in the air or on exposed surfaces with instant greediness. As for the fumigating agent to be
acid gas, chlorine, or the nitric acid fumes produced by pouring nitric acid upon copper filings, of which Dr. Wiblin, of Southampton, says that all the goods may be safely and satisfactorily disinfected by this agent. The fumes so produced are so powerful that no avimalcules can exist in them for more than two seconds, and the portholes being closed for twelve bours, the process cannot failto be effective. For my own part, I believe that the sulphurous acid is all that we can desire.
After a few hours the hatches are removed, and pure air is driven in to facilitate clearing the ship of the fumes. She is reloaded, or ber freight already sent by barge, and with her captain on board proceeds at once to the city, there to be discharged only by an acclimated gang. Her export freigbts must be ready. She is at once reloaded, and starts on her voyage. If the term of detention of her crew has not already expired, she touches at quarantine to tilke on such as have engaged to reship, and puts to sea, with no more deteution than was required to cleanse her, with the utmost expedition, which alone was worth the trouble.
This method having once been enforced, we may boldly proclaim that for the first time in the history of our quarantine a ship has been actually cleansed and disinfected, purged of her suspicion.

## Burning of Barns

It is noticeable that a larger number of the burnings of barns is mentioned by the periodical press in the summe than at any otber time. Some of the fires are undoubtedly caused by lightning, the moist vapor from the uncured hay making a favorable conductor for the electric fluid. But there are barn fires which cannot be attributed to lightning to lighting of matches, to light from lanterns, nor to the invasions of careless tramps. It may be that the spontaneous combustion of hay is as possible as the spontaneous firing of cotton waste. All fibrous material, when moist, and compressed, and defended from the cooling influences of the outward air, is subjected to a heating similar to that of fermentation; and in some instances the degree of heat is sufficient to cause actual, visible combustion. In the case of recently "cured" hay this danger is as great as, in similar circumstances, other materials may be. Frequently the grass is cut in the early morning, while wet with dew; is turned twice during the day, and gathered and packed in the "mow" or the "bay" before nightfall, with perbaps a sparse sprinkling of salt. Sucb a compressed mass of fibrous, moist matter will heat. How far the heat will go toward generating a combustion may be inferred from a foolish trick which the writer witnessed several years ago. A large meadow of hay bad been cut, cured, and cocked, previous to removal. A shower threatening, the cocks were covered with caps of canvas and left for the night. While getting the hay in, the next day, one of the workmen dropped an unlighted match from his pocket into a cock of hay, and in a few minutes it was ablaze. It afterward was ascertained that he had spoken of the warmth of the hay as be lifted it on his fork, when a companion remarked that it might be hot enough to light a match, on which he put a match into a rick, and before they had passed on five minutes the rick was on fire.
Everybody conversant with farm life, where hay is a permanent and important crop, knows that for weeks after getting in the hay the baru is warm when the doors are opened in the morning. There is an amount of heat that is absolutely unpleasant when the thermometer outside registers $60^{\circ}$, but which is quite welcome with the outside temperature at $40^{\circ}$. This barn heat is undoubtedly from the moist hay, compacted and iuclosed. The cure for the possible danger of possible spontaneous baru burning would seem to be the thorough curing-drying-of the hay before it is housed. We dry all our herbs and some of our vegetables without injuring their peculiar and individual qualities. There is no reason why bay or other fodder material stored in large masses should not be rendered equally innoxious to the influences of heat by thorough drying.

The process of liquefying gases, such as oxy gen, has been recently advanced a considerable step by the labors of M. Cailletet, who has communicated to the Comptes Rendus a brief preliminary account of his successful use of marsh gas for this purpose. The author recounts that, by the use of boiling ethylene, MM. Wroblewski and Olszewski bave succeeded in obtaining the meniscus of liquid oxygen, which be has not himself been able to detect in any of bis previous experiments. It appeared to M. Cailletet, however, that if he could find liquid bodies boiling at a temperature below that of ethylene it would thereby be possible to liquefy oxygen without being compelled to use pneumatic machines for the purpose of lowering the boiling point of the refrigerating liquid. All the necessary conditions for this purpose are fulfilled by marsh gas. In effect, this gas, slightly compressed and cooled in ethylene boiling under the ordinary atmospberic pressure, produces a colorless, exceedingly mobile liquid, which in resuming the gaseous state causes a cold sufficient for the instant liquefaction of oxygen. U:ider these conditions the liquefaction of oxygen becomes one of the simplest laboratory operations. M. Cailletet announces this discovery at the earliest possible moment, in order to secure priority of date; reserving the description of lis methods and actual results until he has completed a course of experiments upon which he is at present engaged.

ENGINEERING INVENTIONS.
A traction cable grip has been patented by Mr. William Martin, of San Francisco, Cal. The in vention provides for a frame with grooves in which
planks are fitted to slide, rollers mounted on the planks, brakes for the rollers, and means for forcin the rollers upon a cable, and the brakes upon the rollers, with various novel features, so that the running
cable will be taken hold of gradually without wear cable will be taken hold of
thereto or shiock on the car.
A balanced slide valve has been patented by Mr. Daniel A. Woodbury, of Rochester, N. Y. Thi invention provides for such .construction as relieves
the sliding faces of both the main and cut-off valves to any desired extent, a relief plate being so adjustable as to bear the entire pressure of the steam, by means under the control of the engineer, and so contrived as to accomplish the same by one movement of the adjust ing device
A car seal has been patented by Mr. Thos. P. Wentworth, of Elroy, Wis. The car having a vertical slot for receiving a seal key, a grooved block is
held on the inner surface of the car and a latch held to held on the inner surface of the car and a latch held t
slide in the groove, the latch adapted to engage and slide in the groove, the latch adapted to engage and having one beveled end and a head on the opposit end, making a simple and effective car door seal, the seal key having to be broken or destroyed to be re moved from the outside.

## MECHANICAL INVENTIONS

A plowshare tongs has been patented by Mr. George M. Sebastian, of Arkansas City, Kansas The tongs are composed of three members pivoted to-
gether, with a brace clamp adapted to be attached to gether, with a brace clamp adapted to be attached to
the tongs and to the object held therein, the jaws and handles being arranged to grasp both the plowshare and the bar, holding the edges thereof to be welded to gether in ciose contact, so that a true and perfec weld may always be effected.

## AGRICULTURAL INVENTIONS.

A soil pulverizer has been patented by Mr. Benjamin Deem, of Spring Hill, Kansas. In this infitted wilh a core upon the axle of the carrying frame the drum having a series of rows of slots, combined with segmental cutters, and their inner surfaces havin

A plow has been patented by Mr. William L. Quick, of Molino, Tenn. The invention provide
for such construction that plows can be readily adjust ed for various kinds of plowing; a sma!! plow cau be attached to one end of the foot for cultivating close $t$ rows of plants, and a larger plow attached to the othe
end for opening the furrow between the rows, etc.

A hand corn husker has been patented by Mr. Robert C. McMinn, of Golden City, Mo. The in vention consists of a metal plate forked at the oute
end in the form of hollow bent cla ws, and in means fo adjusting the strap to suit different sized hands, or to of corn, and the husker is made to act more efficiently and with greater ease.

## miscellaneous inventiuns.

A fastener for knob spindles has been patented by Mr. Le Grand Terry, of Horseheads, N. Y
This invention consists in a novel construction and ar rangement of parts of knob stank, notched escu tcheon,
etc., making a door knob which can be locked so it etc., making a door knob which can be cannot be turned, thus locking the door
A neck yoke has been patented by Mr. Cyrus R. Furey, of Logansport, Ind. This invention
provides a new and improved attachment for neck provides a new and improved attachment for neck
yokes for holding the neck yoke ring and the martin yokes for holding the neck yoke ring and the martin
gale strap, and consists in a neck yoke having a spring snap at each end
A fireproof hanging ceiling has been patented by Mr. Louis Lafond, of New York city. This in
vention consists in a ceiling constructed with iron bar vention consists in a ceiling constructed with iron bar
placed edgewise on the flanges of the iron girders, an carrying the iron hangers that support the ceiling iiles
whereby the latter will be firmly supported.
ereby the latter will be firmly supported.
The art of treating cigars is the subject of a patent issued to Mr. James D. Culp, of San Felipe
Cal. The invention consists in applying to cigars coat or dressing of paraffine dissolved in naphtha, to improve both their flavor and burning quality, render the wrapper more fle
An inkstand has been patented by Mr. William O. Rastetter, of Dalton, Obio. It is surrounded by a remova ble casing, on which tubes are formed, in the lower ends of which are corks or other stoppers to
form feet, making a soft and yielding support for the inkstand, and preventing injury to the points of the
A fire escape has been patented by Mr. Eli Frazier, of North Lawrence, Kansas. This invention relates to that class of fire escapes in which an endess rope or chainis used forlowering persons, each
one descending by his own weight, the friction of the rope on pulleys preventing the descent from being to

A cash carrier has been patented by Mr George H. Spring, of Le Mars, Iowa. This invention relates to devices used in large stores for carrying the
cash from the counters of the clerks to the cashier aud returning the change, and involves the use of a car on a horizontal wire, being designed to simplify t
tem of cash carriers and expedite their action.
A cream can gauge has been patented by Mr Charles E. De Long, of Vermillion, Dakota Ter. Th can has a longitudinal slot with lateral notches at one
end, and a strip creased to form pockets along the side edges, into which pockets the side edges of the slot in the can are passed, whereby the creased slip is held in the slot, a strip of glass being beld in the creased stri
and numerals or other characters produced thereon.

A method of bardening or improving esins of all kinds has been patented by Mr. Albert Kissel, of Frankfort-on-the-Main, Germany. This in ams, resins, and their conversion of the acias in bal or other alkaline earths, into their respective salts, in order to harden the resins, resinous by-products, resin preparations
A wheel scraper has been patented by Mr John W. Whipp, of Van Alstyne, Texas. The inven tion consists in a frame adapted to partly embrace the
wheel and carrying longitudinal and transverse scraping wires, with means for adjusting their tension, th ransverse wire having means for adjusting it verti cally, and the frame being held adjustably on an arm or bar on the axle.
A door knob has been patented by Mr. dwin A. Johnson, of Allegheny City, Pa. This in which a serrated spindle is engaged by the edge of sey inserted through an aperture in the knob shank, nd its object is to facilitate the adjustment and secur ng of a door knob on the
An oil lamp feeder has been patented by Mr. William H. Dillon, of Glasgow, Ky. This inven ion consists of a special construction and combina-
tion of parts having for its object to use oil conducted like gas in pipes, to raise the lamp wick and to open the valve which admits oil thereto at the same move ment; also
the valve.
A bow hook for neck ties has been patentd by Mr. Julius Schlesinger, of Hoboken, N.J. It is self-adjusting, formed of a piece of wire bent to form prong, from the upper end of which two parts are in
cined downward and outward on opposite sides, thes arts having hooks ou their free ends for receiving th shield of the bow, and the prong having a bend at it per end.
A lock joint for fishing rods has been pa tented by Mr. Justice Webb, of Georgetown, Ky. With
a sleeve having an annular ridge or collar and two sleeve having an annular ridge or collar and two
studs is an additional sleeve fitting on the front end carrying a sliding sleeve with two L-shaped slots for proved lock joint for firmly holding together the sec tions of a fishing rod.

## 

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Electrical Alarms, Bells, Batteries. See Workshop For Sole-Patent For Sale,-Patent Self-ventilating Funnel. Best thing
ut for making money. G. M. Wickliffe, Brook Neal, Va.


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some answers require not a litte research, and,
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or mail each must take his turn.
 such service without renuneration.
Scientific American Supplents referred
Minemy be had at the officu. Price 10 cents each senf for examination should be distinctly
marked or labeled.
(1) S. B. G. asks the rule to find the do minical letter for any year in any century. A. Rule:
Divide the number of centuries and the years of the Divide the number of centuries and the years of the
given century each by 4, and the years again by 7 ; given century each by 4, and the years again by dd together the three prole sum mainder will be the ordinal number of the dominical letter required. If 0 remain, it will be the 7 th, or $G$
In bissextile years two dominical letters are used. ExIn bissextile
ample: 1884.
$18=4$ and $2 \mathrm{rem} 2 \times 2=$.4
$8:=21$ and $0 \mathrm{rem} .0 \times 2=0$
$8: 5$
$8=21$ and $0 \mathrm{rem} 0 \times 2=$.0
$\mathrm{~s}=12$ and $0 \mathrm{rem} .0 \times 4=0$
which, being less than 7 , is the ordinal number for E t being a bissextile year, $F$ precedes $E$ until the 1st of arch, the order of the lette
(2) E. H. -The disintegrating propertie steam heat at 60 pounds pressure are well known to used except as outside covering for low pressure stea pes, and then only as a makeshift.
(3) A. S.-You are right. Brakes should never he strongly applied to a movingtrain on a bridge
of any size, and the best railroads prohibit such pracice; when necessary to reduce speed in crossing, th rakes are applied before reaching the bridge and the released when crossing. Very likely many bridge
have had their lives much shortened, and many acci dents have happened, from neglect of this rule.
(4) P. B. asks how large a carbureter, o
ow many feet of evaporating surface, with gasolin nough for eight burners of five feet an hour each. A About 12 square feet. Less will do when the car-
bureter is freshly charged. 2 . Suppose a ball of 25 bureter is freshly charged. 2. Suppose a ball of 25 of the fullmoon, would it not appear to be a spot on the of the fullmoon, would it not appear to be a sporcely be ble to discern a spot or shadow of a ball 25 miles tance named with the unaided eye. A telescope would
easily show it.
(5) E. J. R. asks for a receipt of a cheap common gray or brown ware. A A brown cottag glaze consists of litharge 60 parts, fint 32 parts, brown slip 8 parts. This must be used of about the same con sistency as cream color glaze, and will stand the highsee also PLEMENT, No. 313
(6) D. J. P. asks how the birch beer sold in saloons is made. A. A very excellent sparkling beer from 8 to 10 per cent of its weight of sugar and 0.2 to 0.3 per cent of tartaric acid. According to another
authority, the best product is made by adding to 100
pounds of the sap about 6 ounces of tartaric cid and 8 pounds of the sap about 6 ounces of tartaric scid and 8
to 10 (or if a stronger product is wanted .6 to 24 ) pounds of sugarand 3 ounces of a strong almond milk. The misture is fermented in the usual manner, put in bottles with a little more sugar, and securely sealed. Scientific American SuppleMENT, No. 270.
(7) W. R. wishes to know what is the right temperature to raise family bread at. A. The
 be from $400^{\circ}$ to $440^{\circ} \mathrm{F}$. We suggest as interesting in this connection, Mr. George M. Whitaker's article on Theory and Practice of Bread Making, in Scientifio American Supplement, No. 170, and also Dr. Graham's
paper on the Chemistry of Bread Making, in Scientific american Supplement,No. 222.
(8) L. H. F. asks: 1. What is the modus operandi to cook raw meats, especially corned beef,
economically und with the least shrinkage, looking to its preservation? A. Each packer has his own special eneral way the meat is first cooked in the ordinary way, then put into the can and sealed, boiled in this condition for some time longer, when it is removed and a vent opened in the can in order to allow all gases, etc., to escape, again hermetically sealed, boiled for a few minutesandl the operation is completed. 2. Why cannot cooked corned beef and animal soups be kept from becoming rancid after being put up in air tight (so how causedand how prevented. A. By the foregoing process all deleterious gases aredriven off, and once ased the articles remain good for years. Deletriou access to the air.
(9) F. P. H. desires to know how alumi num is taken from the ground. A. The aluminum in treated soas to form the double chloride of aluminum nd sodium. The latter is then decomposed by heating it with metallic sodium, fluorspar or cryolite being dded as a flux. Scientific American Supplement, No. 50 , gives in more detail the method of manufacure. Recently improved methods have been introduced, but they are essentially the same as the fore-
going outline.
(10) H. M. B. asks how to make cup grease for lubricating machinery, something light colored. A.
In a small boiler dissolve from 56 to 60 pounds of soda in about 3 gallons of water. In a 60 gallon boiler melt tallow, and to it and palm oil, each in quantity accordqrs.: palm oil, 1 cwt. 1 qr. In winter, tallow, 1 cwt. 1 qr.; palm oil 1 cwt. 3 qrs. In spring or
autumn, tallow, 1 cwt. 2 qrs., palm oil, a similar quantity. As soon as the mixture boils, put out the fire and let the mixture cool down gradually, frequently stirring while cooling. When reduced to blood soda, stirring tt well to insure a perfect mixture of the
(11) S. G. writes: I keep a boarding house omake a living. For several years $I$ have put up my own jellies and preserves, and in order to make them
cheap have used apple juice to make jelly; but find it will ferment in a few weeks' time. Can you tell me of au anti-ferment that will stop fermentation, and in what proportion is it used to a gallon of juice? A. $1 / 4$ to $1 / 2$ per cent of formic acid is said to possess powerful preservative properties and to be particularly suita-
ble for adding to fruit juices. Add it to the boiling ble for adding to fruit juices. Add it to the boiling
(12) D. D. L. desires to obtain, at a moderate cost, a compound by mixing two or more ingredi-
ents which will harden in a few minutes after being nited. To answer the purpose it should become quite firm. A. If equal parts of common calcined plaster of
Paris and of potassium sulphate be mixed together, Paris and of potassium sulphate be mixed together,
they will hardeh in a moment with less than an equivalent weight of water; so much so indeed that the mixture cannot be poured out of the vessel. The rapidity of hardening therefore can be made to vary with the percentage of water, the mass solidifying even if 6 parts of water be used.
(13) M. B. T. writes: 1. Pure water at $60^{\circ}$ temperature has specific gravity of 1. What is its spe-
cific gravity at $70^{\circ}, 80^{\circ}$, and $90^{\circ} 9$ A. At $70^{\circ}$ the specific gravity would be 0.99897 , at $80^{\circ} 099768$, at $90^{\circ} 0 \cdot 99599$. 2 Is the expansion of waterregular from freezing to boiling? A. The expansion is not regular. It frrst con-
tracts up to $39 \cdot 2^{\circ}$ Fah., and then expands. 3. Would racts up to $39 \cdot 2^{\circ}$ Fah., and then expands. 3. Would
sirup or honey having specific gravity of $1 \cdot 4$ at $60^{\circ}$ exsirup or honey having specific gravity of $1 \cdot 4$ at $60^{\circ}$ ex-
pand thesame as water with each additional $10^{\circ}$ or $20^{\circ}$ pand thesame as water with each additional whe or no
of heat? A. It is not likely that it would; we have no of heat? A. It is not likely that it would; we have no
information on this subject, however. 4. What per cent of sweet has sirup that has a specific gravity of $1 \cdot 4$ A. About 865 per cent of sugar.
(14) E. J. G. asks for a recipe to prepare paper for the "blue process" of copying. A. Use wo separate solutions of:
Iron and ammonium citrate................. 1 oz.
Water................................. 4 oz
Potassium ferricyanid
Water........................................ 1 az oz
For use, mix equal quantities and float paper for two
(15) J. B. H. asks the ingredients impregnating the "indelible copyable rinbon "used on type
writers. A. The ink which has generally been used for writers. A. The ink whic
he ribbons consists of:
ribbons consists.
Aniline black...
Pure alcohol.
Concentrated
Concentrated glycerine.................... 15 "
Dissolve the aniline black in alcohol and add the giycerine. Recently however an ink has been prepared by
using printing ink and diluting it with boiled linseed oil and adding an iron salt. We cannot vouch for
used: 16 parts of boiled linseed oil varnish, 6 parts o
the finest lampblack, and 2 to 5 parts of iron proto the finest lampblack, and 2 to 5 parts of iron proto-
chloride, prepared by dissolving the iron perchloride in absolute alcohol, and adding sufficient pulverized me tallic iron to resuce it to the protochloride.
(16) W. L. S.-To make very black drawings with India ink, a correspondent suggests that the
pigment be cracked into small pieces and soaked in dilute ammonia water, when with an occasional shak ing it will dissolve in two days; but if
(17) P. E. McD.-The limit of expansion of air has never been determined.
tions are too indefinite for reply here
(18) M. J. S.-Oars are better than a screw with shaft, etc., for driving a small boat where you
have only muscle power. How to build small boats o have only muscle power. How to build small boats o
various kinds is fully described in back numbers of our Surplement.
(19) A. H. T. \& S.-Stereotypes or electro types which show newspaper pages, pictures, etc., in
reduced or enlarged sizes are made by some of the photo-engraving processes. Such printing is also done to a considerable extent by photolithography
(20) V. J. desires information as to how to get rid of roaches. A. Pulverized borax sprinkled
around the infested places will cause them to flee.
(21) F. S. B. writes: Will you inform me what will harden tar for covering roofs. Have used resin and sulphur, but the sun makes it run. Is ther
anylhing besides asbestos that will harden it? A. You anythiug besides asbestos that will harden it? A. You
can boil the tar down as far as possible, and then cover the roof with gravel stones of a quarter to talf an inch in size; or perhaps a more satisfactory method would be
to mix the tar with hydraulic cement. We understand that this compound forms a very acceptable roofling
(22) J. L. R. asks: What chemicals will prevent the fermentation of malt soil, as it invariably,
during the summer months, bursts the barrels containing it? A. Use either copperas or zinc clloride in the proportion of about one pound dissolved in one gallon
(23) H. G. W. asks with what he can put a polish on soft gypsum. A. If it is in the rough condishore grass and water, then afterward with a paste
formed of finely powdered and sifted slaked lime and water. The rough palish thus produced is finished by friction with finely powdered talc or French chalk until a satiny luster is produced.
(24) G. B. L. says: I have two tape wooden cones 6 inches diameter at one end, 3 inches at
the other, respectively, on shafts 3 feet apart, and driven by a $11 /$ inchech leather belt; this belt slips. What
can I do to produce an even speed on the driven cone? The weight to drive can be turned by a 10 inch crank A. Rub a litule good beeswax upon the inside of the belt. If it does not drive the work at the proper ten-
sion, it is an indication that the pulleys are too small. sion, it is an indication that the pulleys are too small
Cone pulleys areuot equal in power to straight ones
with a given helt, and from their peculiarshape cannot with a given helt, and from
properly carry wide belts.
(25) A. M. asks bow he can get or make
|ver thimbles white when they are tarnished. A silver thimbles white when they are tarnished. A
Either dip them into a dilute solution of nitric acia Either dip them into a dlute solution of nitric acid
(aqua fortis) or else silver plate them. For description (aqua fortis) or eise silver plate them. For description
of the latter process see ScIENTIFIC American Suple MENT, No. 310, under head of ele ctrometallurgy.
(26) T. T. asks how to prepare the com pound used by wood engravers to make $a$ transfer
from a printon to a type metal block. A. One ounce caustic potash to half pint alcohol should be made into a solution, with which the print is wetted for a few minutes; the type metal block is then brushed
over thinly with Canada balsam, the picture put on over thinly with Canada balsam, the pictur
face down, and the two run between rollers.
(27) P. S. asks: Can soluble glass (water glass) be used for inside painting? Will it mix with dry colors or mixed paints? How high a temperature dampness, or by change of temperature, etc.? A. Soluble glass can be used for inside painting. It form
the basis of the silica paints. It is quite permanent the basis of the silica paints. It is quite permanent.
and is not easily decomposed. It will effloresce and tend todissolve by dampness, and is soluble in water A good description of its properties is given on page
5061 of the Scientifio American Supplement, No. 5061
317.
(28) N. F. W. says: I have an upright tubular boilerof wrought iron 2 feet high and 1 foot diameter; the body is riveted from top to bottom with 16 rivets, I think $1 / 4 /$ inch rivets, the thickness of the
boiler is about $1 / 3$ inch. Should like to know about how much steam wonld be safe to put on it; should like to carry 80 pounds if safe. A. It would be safe at 80
pounds, if of good material and well made. We advise pounds, if of good material and well made. We advise
you to have it tested by water pressure to at least 120 pounds before using it under steam pressure.
(29) L. W. asks: Can you tell me what causes wrigglers in wells, and what will prevent or de-
stroy them? A. These pests only occur where the
well is foul; the well should be cleaned out
(30) A. C. A. writes: 1. Could I not make my own rubber cement, with your kind assistance? It
must stand hot and cold water. A. Rubber cement must stand hot and cold water. A. Rubber cement
consists of one part raw rubber diesolved in four parts naphtha. 2. How could I vulcanize the soles of a pair
of boots after being cemented on? It is necessary, for the edges will give. A. It will be impossible for you to vulcanize the soles of a pair of boots after they are cemented on. A full description of the vulcanizing
process is given in back numbers of the Scientifio American Supplement. We do not know what you mean by rubber
thing as the cement.
(31) J. F. N. desires to know whether hydrogen peroxide would be desirable to use in bleaching resin soap, and if not, what can be used? A. We would
hardly recommend hydrogen peroxide for bleaching

Sesin. See Supplement, No. 319, for a description o
this agent. Watt in his recent work gives the following: "When roap is made from dark colored goods,
considerable improvement may be made by adding a oderate quanity of solution of chloride of soda afte he first operation of saponfication is complete." Th colored resin, and is generally yellow or green. In the latter case indigo is added. We would recommend you
to consult Mr. Watt's book. It is entitled The Art of Soap Making, and is worth about $\$$.
(32) J. G. R. asks if there is any formula for removing stains from a marble slab, caused by the acid from lemon juice. A. We should think that any
stains caused by lemon juice would be easily removed stains caused by lemon juice would be easily removed
by the application of cold water. The following howby the application of cold water. The following how ver is strongly recommended as suitable for removing
stains from marble: Take two parts common soda, one stains from marble: Take two parts common soda, one
part of pumice stone, and one part of finely powdered hen rub it well all over the marbie, and the stains will be removed; then wash the marble all over with soa and water, and it will be clean as it was at first.
(33) F. K. McC. writes, asking dir ections how glass is stained permanently. A. Glass staining may be done at home by the follo wing process: Sprea
ver the glass a strong gum water, and when dry lay it over the paper on which the design is sketched, and trace with a fine hair pencil all the outlines. Dip the
tube-like pencils in the colors, and let them flow out tube-like pencils in the colors, and let them flow out
upon the glass; have a care, and not touch the pencil to upon the glass; have a care, and not touch the pencil to riety of ways; one of the easiest, and especially to be
inners, is to take a goose quill cut in the shape of pen, wi thout the shit, and with it carefully take out th ights by lines and little dots. This part of glass staining is the most exacting and difficult, as much of the
effect depends upon the shading. The glass is then effect depends upo
ready for the kiln.
(34) A. W. M.-Full information about aaking lager beer, with details, and proper amounts o the ingredients to be used, will be found in Scientifio
AMERIICAN SUPPLEMENT, No. 217. Potatoes mix only is, by ordinary means by whichother plants mix; tha flowers. Potatoes never "mix" in the hills; new va rieties are produced from the seed bulbs.
(35) P. H. L.-The pitch of a roof is meas n a quarter of the horizontal nie from pea.k to eaves the width from the plumb line of the peak to theeaveres.
A whole pitch would be as high as wide, and equal $45^{\circ}$.
(36) F. W. C. C. writes: Can you inform e whether there are in the United States or Canada any institutions where the theory and practice of a
mechanical engineer can be learned? If you know of any, or could put me in the way of acquiring the in-
formation, I would be much obliged to you. I am at formation, I would be much obliged to you. I am a ing East in the fall. Any information sent to the in closed will find me during the summer, and will be
most gratefully received. A. Write to the Stevens In most gratefully received. A. Write to the Stevens In-
stitute, Hoboken, N. J., an admirable institution for

## (37) J

(37) J. C. H.-To make Berlin bronze, clean themetal by first dipping for a moment in nitric acid,
then rinse quickly in running water, and rub with sawdust. For the dip, to 1 gallon hot water add half a pound each of perchloride of iron and perchloride o copper. Let the articles remain in this solution no longer than for the required color, riuse well, dry, and polish with warm sawdust or a rag wheel. Copper iron
by cleaning and dipping in a solution made with by cleaning and dipping in a solution made with 3
ounces sulphate of copper, 3 ounces sulphuric acid, to onces sulphate o
(38) H. T. asks: Is crude petroleum of $55^{\circ}$ specifc gravity much more dangerous to havdle tha the refined coal oils in general use for lighting? I do
not want to use the crude article for lighting, but to run an engine-gas being too expensive at $\$ 4$ per
thousand cubic feet here, and thepower required befn mainly intermittent, and therefore steam power un available. A. Crude petroleum is used for generating
steam,but cannot be trusted to burn with a wick. It is blown from a blow pipe with air or steam. Yo will find interesting articles upon petroleum as fuelin
Scientific American Supplement, Nos. 331 and 404.
(39) A. J. McI.-On slight exposure to the air a colorless solution of barium peroxide forms the whitish barium carbonate by taking up the carbonic
acid in the air. Naturally the reaction is faclititated by the artificial introduction of carbonic acid into th
surrounding atmosphere. There is also a so-called "ground glass varnish," sold by dealers in photo graphic supplies, which when poured on glass will rapidly dry, forming an opaque surface. Certain rare organic chemical compounds are said to possess a
great sensitiveness to light, but they are not easily progreat sensitiveness to lig
curable in this country.
(40) F. L. L.-You will require for a horse power boiler about 45 square feet of heating sur-
face. The form that you have sketched we do not approve of. A bent coil around the fire chamber is bette Multiply the
for surface.
(41) L. B. C. asks: Will you be kind nough to tell me a cheap and harmless but efficien
remedy for the falling off of the hair, and aloo an article to promote a healthy and abundant growth? A
The falling out of the hair may be due to many caus The falling out of the hair may be due to many causes, Read The Hair, its Use and its Care, by Dr. J. V Shoemaker, in Scientific Amprican Supplement, No
388. Morfit recommends the following. Scald black te 2 ounces, with 1 gallon boiling water; strain, and add 3 ounces glycerine; tincture cantharides $1 / 2$ ounce; and
bay rum 1 quart. Mix well by shaking, and then perbay rum 1 quart. Mix well by shaking, and then per
fume. An excess of alum in bay rum is also recommended. The growth of the hair is dependent largel preparation can be counted as snre for this purpose,
although thereare many formulas such as the foregoing in existence purporting to accomplish their object.
(42) J. S. writes: Would you pleast let me know what the ingredients of sperm candles are, also the quantity of each ingredient? A. Melt together
over a water bath 100 parts stearic acid, and 10 to 11 over a water bath 100 parts stearic acid, and 10 to 11
parts of bleached beeswax; but to insure success, the nixture must remain over the bath from 20 to 30 minutes, without being stirred or agitated. At the end allowed to cool until a slight pellicle is formed on the urface, when it is cast direct into the moulds, previously heated to the same temperature, with the precaution of avoiding stirring the mixture, which would
(43) H. S. asks (1) for an inexpensive eans of magnetizing ordinary printing type. A. Or dinary type cannot be magnetized. 2. I want to con struct a battery io experiment with. Will you direct
me how to do it? A. Consult Supplement, Nos. 157 me how to do it? A. Consult Suppleme
158 , and 159 , for information on batteries.
(44) D. B. asks: 1 . What is the ratio of ai ordinary pressure ( 30 inches) to a ir reduced to liquid? (I do not expect more than an approximation.) A. W oxygen and nitrogen have. 2. What would be the ris ng speed of a body propelled in opposition to gravity by a constant force double that of gravity, and what the speed, raising force being four times gravity? A. caused by gravity, and 3 times that. 3 Is there an ombination of lenses that would magnify 1 squa m. 625 umes ( 25 times lineally preserving a uniform positions? A. A combination of two plano-cent enses,as in a Ramsden eye piece, will be nearly aplan399. 4ee Scientifio American Supplement, No power for very minute objects? A. 2,000 to 3,000 diame ers. 5. What is angular aperture of microscopes? A
ngular aperture is the extreme angle of the light that Angular aperture is the extreme angle of the light that
(45) M. M. asks for a good and effective method of destroying the caterpillars on a grape vine also a method of preventing them from coming on. A grape, and of these, seven or eight assume the cater pillar form at some stage of their development. If the ruit has not been formed, they may as a general thing destroyed by spring ng the vines with a solutio ing tablespoonful of the former to two gallons of the latter. The vines may be dusted with a mixture of the poisons and plaster or flour, in the proportion of mulsion sprinkled on the vines would be destructiv o the pests without endangering human life. Tak bout four pounds of common yellow bar soap, one gal ver the stove, stirring it till it forms a hick yellowish liquid, then remove the mixture from the stove and continue the stirring until it becomes cool. This should be largely diluted with warm sof
vater, and it will be permanent. Pyrethrum powde ixed with pill be permanent. Pyrethrum powder on the vines.
(46) R. B. writes: I am manufacturing liquid in which I use 5 per cent of acetic acid: the only
difficulty I have is the smell retained by the acid. What an I use or add to overcome this? A. It is impossible overcome the odor of acetic acid except by adding ther or some soluble acetate, s ch as the sodium or the potassium salt, might be used. There are various romatic vinegars such as the following, that may be suggestive: Take of camphor 1 ounce avoirdupois; oil of cloves, 1 drachm; oil of cedrat and lavender, of
each 40 grains; oil of bergamot and thyme, of each 20 grains; oil of cinnamon, 10 grains; glacial acetic acid, bottle and agik
(47) O. C. R. says: I have an acoustic tele whone a quarter of a mile long, using No 18 iron wire
with 9 inch diaphragm made of photographer's f loud speaking; would No. 20 copper wire or a differ nt diaphragm produce better resulte? A. If you will ryy a heavier diaphragm and use a wire cable cord, you will succeed better. You will find a thin wooden diaphragm very effective. 2. What would the materials
cost forthe construction of the dynamo machine decribed in your Supplement, and are there no manuimilar makines are for sale by ours A. $\$ 8$. $\$ 1$
crical supplie
(48) E. H. T.-Porous cups are merely un glazed earthenware. We cannot say just what the dif erence in Porce would be by using cups that were no is porous throughout. There in favor of the cup whic ening electrodes to the carbons. One is to cast a lea cap directly on the carbon, the other is to make an elec deposit of copper on the end of the carbon and the peferred, however; they are for sale by all dealers in lectrical goods.
(49) O. B. S. asks for a number one re cipe for cementing leather together. A. Take of comhem in a glue pot, and add water sufficient to jus whole to a boiling heat, and add pure tannin until the whole becomes ropy or appears like the white of eggs
Apply itwarm. Buff the grain of the leather where it to be cemented; rub the joint surfaces solidy to ether, let it dry a few bours, and it will be ready fo use; and if properly put together, it will not need rivet use; a
ing.
(50) W. D. F. asks (1) information as t ny powder or combination of powders that when mixed fine gloss. A. The glazing of paper is generall effected during the process of manufacture. Coating the paper with a dilute solution of gum water might
accomplish your purpose. 2. Do you know in what
branches the United States Civil Service Board examine applicants, in making application for a position in the
United States Treasury Department? A. $a$, OrthoUnited States Treasury Department? A. a, Ortho-
graphy, penmanship, and copying. b, Arithmetic, graphy, penmanship, and copying. $\quad b$, Arithmetic,
fundamental rules, fractions, and percentage. $c$, Interest, discount, and elements of bookkeeping and accounts. $d$, Elements of the English language, letten Elements of the geography, history, and government of the United States. 3. I saw men on the stretu selling a
fluid in bottles, that when put on brass or copper will fluid in bottles, that when put on brass or copper will
make it look as if it was silver plated; could you tell me make it look as if it was silver plated; could you tell me what it is? A. A good silvering solution consists of a solution of 1 part potassium cyanide in 6 parts water;
add to this a concentrated aqueous solution of silvernitrate (free from acid) until the precipitate is redissolved. Mix this solution with fine chalk, and apply after cleaning the objects.
(51) G. W. W.-1. Malleable castings are worth about 12 cents per pound. 2. Gasoline is a proof about $95^{\circ}$ B. to $80^{\circ} \mathrm{B}$. $\mathrm{I} t$ is worth from 18 to 35 cents per pallon in bulk, according to its quality. 3. The iridiumpointed fountain pens seem most popular. 4.
Mutilated silver coin can be sold at the United States Treasury or in quantity at the United States Assay and bas a value of about $\$ 1.20$ per ounc
(5) M. N. B asks what ingredients are necessary to make a hektograph. A. The composition is follows:
Good ordinary glue................... 100 parts.
Glycerine..........................
Barium sulphate (finely powdered) or
the same amount of kaolin...... 25
Water..................................
First dissolve the glue in water, heat it, add then the
lycerine.
(53) A. F. O. asks how the water in bottles is frozen. A. By placing the bottles of water in the
brine bath of a refrigerating machine or in a mixture (54) H. F. says: I (54) H. F. says: I have a call for a machine machine, and where I could get one? A. You will need only a polishing lathe with a fine emery wheel
on one end of the spindle and a buff upon the other
(55) P. R. asks what steam pressure it would be safe to use in a boiler made of three thirty-seconds
iron, 4 feet long, 15 inches diameter, with 121 inch flues. I want to run a cylinder $2 x 5$ inches. Is the boiler arge enough for such an engine? $\Lambda$. 30 pounds pressure if the seams are
enough for the engine
(56) G. H. J. asks to be informed what process is used to cause the bones in canned fish to lose A. The large bones are removed; otherwise nothing is one to affect in any way the bony portion of the fish. (57) M. \& W. ask what infusorial earth is. . Iufusorial earth is diatomaceous silica or the sili-
ious portions of the remains of microscopic life. Its A portions or the remans of
(58) W. B. E.-For steaming logs for veneering, any box thatcan be made so tight as not to
waste steam will answer. Exhaust steam from the engine is much used for such purposes. The principal the heat of boiling water will make it cut freely. There is no necessity for pressure in the steam box. (59) E. F. N. -There are a number of re ceipts for browning gun barrels. The following one of antimony, dip it into olive oil, and rub the barrel over. In 48 hours it will be covered with a fine coat of rush , ind rush, and wipe with a rag dipped in boiled linseed
oil. Very complete directions for browning gun rels and oher peful hints mar be obteined from rels and other useful hints may be obtained
vook, "Shooting on the Wing," by John Phin.

## INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted
August 12, 1884,
AND EACH BEARING THAT DATE
[See note at end of list about copies of these patents.]

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